

PRINT ISSN : 2395-6011
ONLINE ISSN : 2395-602X

**INTERNATIONAL JOURNAL OF SCIENTIFIC
RESEARCH IN
SCIENCE & TECHNOLOGY**

VOLUME 9, ISSUE 1, JANUARY-FEBRUARY-2022



Web Site : www.ijsrst.com

Email : editor@ijsrst.com



International Journal of Scientific Research in Science and Technology

Print ISSN: 2395-6011 Online ISSN : 2395-602X

Volume 9, Issue 1, January-February-2022

International Peer Reviewed, Open Access Journal
Bimonthly Publication

Published By
Technoscience Academy



Website URL : www.technoscienceacademy.com

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Physico-Chemical Properties and DFT Calculations of 2-Methoxy - 4 - (Prop-1-En-1-Yl) Phenol (ISOEUGENOL) Using Gaussian Basis Set

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Article Info

Volume 9, Issue 1

Page Number: 521-529

Publication Issue

January-February-2022

Article History

Accepted: 01 Jan 2022

Published: 09 Jan 2022

ABSTRACT

Physico-chemical properties plays an important role in determining toxicity of a material hence were calculated using acclab/chemsketch and the data predicted is generated using ACD/Labs Percepta Platform - PhysChem Module. Gaussian 09, RevisionA.01, software package was used for the theoretical quantum chemical calculations of 2-methoxy -4-(prop-1-en-1-yl) phenol commonly called Isoeugenol. DFT/B3LYP/6-311G (d, p) basis was used to perform geometric optimization and vibrational frequency determination of the molecule. The statistical thermochemical calculations of the molecule were done at DFT/B3LYP/6-311G (d, p) basis set to calculate the standard thermodynamic functions: heat capacity (C_v), entropy (S) and Enthalpy (E). DFT/B3LYP/6-311G (d, p) basis set was used to calculate the various NLO properties like dipole moment (μ), mean linear polarizability (α), anisotropic polarizability ($\Delta\alpha$), first order hyperpolarizability (β), second order hyperpolarizability (γ) in terms of x, y, z components for Isoeugenol (2-methoxy -4-(prop-1-en-1-yl) phenol. Same basis set was used to carry out Mulliken population analysis. UV-Visible absorption spectra, ECD spectra, electronic transitions, vertical excitation energies and oscillator strengths of Isoeugenol (2-methoxy -4-(prop-1-en-1-yl) phenol) were computed by Time Dependent DFT (TD-DFT) method using the same basis set. FMO analysis, Molecular electrostatic potential study was also done using the same basis set.

Keywords: Physico-chemical property, acclab /chemsketch, DFT, FMO, Mulliken population analysis, TD-DFT, NLO properties, ECD, Global reactive descriptors.

I. INTRODUCTION

Isoeugenol also known as propenyl guaiacol, belongs to the class of organic compounds known as methoxyphenols. Methoxyphenols are compounds containing a methoxy group attached to the benzene ring of a phenol moiety. Chemical name of isoeugenol

is 2-methoxy -4-(prop-1-en-1-yl) phenol in accordance with International Union of Pure and Applied Chemistry (IUPAC), Other names by which Isoeugenol is known are 4-Hydroxy-3-methoxy-1-propenylbenzene, 2-methoxy-4-propenylphenol and 4-Propenylguaiacol. Isoeugenol can exist as either the cis (Z) or trans (E) isomer. Structural formula of both

cis (*Z*) and trans (*E*) the isomers of Isoeugenol are depicted in Figure -1(a) and 1 (b) respectively.

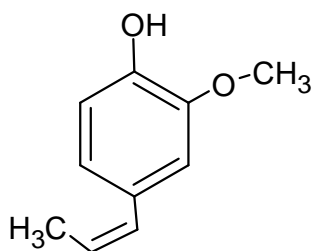


Figure-1a Structural formula of 2-methoxy-4-[(1*Z*)-prop-1-en-1-yl] phenol (Isoeugenol)

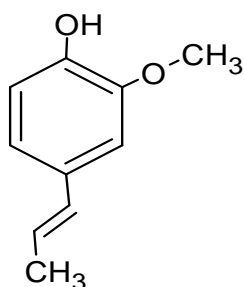


Figure-1b Structural formula of 2-methoxy-4-[(1*E*)-prop-1-en-1-yl] phenol (Isoeugenol)

Isoeugenol is a clear to pale yellow oily liquid with a spicy, sweet, carnation like odour [1] and taste of sweet spice and clove [2]. Isoeugenol has a molecular formula $C_{10}H_{12}O_2$, formula mass 164.2g/mol, $pK_a = 9.88$ at $25^\circ C$ i.e., weakly acidic, very slightly soluble in water and soluble in organic solvents [3]. Isoeugenol is a fragrant essential oil found in many different plants. It has been extracted, admixed with eugenol and other plant volatiles, from calamus, savory, basil, ylang-ylang, clove, tuberose, jonquil, nutmeg, tobacco, sandalwood, dill seed, mace, gardenia, petunia, and other flowers [4-7]. Due to sweet, floral fragrance isoeugenol is incorporated into various household cleaning agents and personal hygiene products, including perfumes, cream lotions, soaps and detergents [8]. Isoeugenol finds use in food products and in medicine as an antioxidant, local antiseptic, analgesic anti-inflammatory, potential anticancer, anti-fungal etc [9-17]. It is known to have anti-arthritic activity also [18]. Tasting like anise or licoricey isoeugenol is added to non-alcoholic drinks, baked foods, candy, and chewing gums. Moreover,

recent studies show that microbes readily convert isoeugenol to vanilla in up to 71% yield [19] by an epoxide/epoxide-diol pathway [20-22] hence it is also used in the manufacture of vanillin. Isoeugenol has found a wide range of uses in many areas of life due to its numerous properties and due to the growing interest in traditional and unconventional medicines that contain natural ingredients, Isoeugenol is an element of scientific research for its use as potential constituent for various medicinal and food products. Quantitative structure-activity relationship of a molecule has been studied to predict its biological activity [23]. Growing interest of researchers in this molecule motivated us to calculate physico-chemical properties and carry out quantum chemical calculations (computational study) of Isoeugenol. The computation of physico-chemical properties, geometry and electronic properties of this compound will clarify the structure – activity relationship of this compound.

II. METHODS AND MATERIAL

Calculation of the physico-chemical properties of 2-methoxy-4-[(1*E*)-prop-1-en-1-yl] phenol (Isoeugenol) is done using acclab/chemsketch [24] and the predicted data is generated using the ACD/Labs Percepta Platform - PhysChem Module. Quantum chemical calculation of 2-methoxy-4-[(1*E*)-prop-1-en-1-yl] phenol (Isoeugenol) has been performed using personal laptop using Gaussian 09, Revision A, 01 software package [25] and Gauss View 6.0.16 programme. Density Functional Density (DFT), and the Becke three -parameter exchange functions in combination with the LYP correlation function of the Lee, Yang and Parr (B3LYP) method was used to carry out theoretical study of 2-methoxy-4-[(1*Z*)-prop-1-en-1-yl] phenol (Isoeugenol). DFT/B3LYP/6-311G (d, p) basis set was used to optimise geometry, determine vibrational frequency, thermochemical calculations etc. UV-Visible spectra, electronic transitions, oscillator strengths, vertical excitation

energies, of 2-methoxy-4-[(1*Z*)-prop-1-en-1-yl] phenol (Isoeugenol) were computed using Time Dependent DFT (TD-DFT) method using the same basis set.

III. RESULTS AND DISCUSSION

Physical and chemical Properties of 2-Methoxy-4-(1-propen-1-yl)phenol (Isoeugenol)

Various physical and chemical properties of a substance determine the environmental behaviour. These include the solubility in water, vapour pressure, octanol/water partition coefficient etc. This compels the researchers to evaluate the role of these properties in determining associated environmental behaviour including toxicity. The physical and chemical properties of Isoeugenol were calculated using acdlab/chemsketch [24] and the predicted data is generated using the ACD/Labs Percepta Platform - PhysChem Module and are tabulated in Table-1.

Table-1 Physical and chemical properties of 2-Methoxy-4-(1-propen-1-yl) phenol (Isoeugenol)

1	Molecular Formula	C ₁₀ H ₁₂ O ₂
2	Formula Weight	164.20108
3	Composition	C (73.15%) H (7.37%) O (19.49%)
4	Molar Refractivity	50.70 ± 0.3 cm ³
5	Molar Volume	152.8 ± 3.0 cm ³
6	Parachor	381.9 ± 4.0 cm ³
7	Index of Refraction	1.577 ± 0.02
8	Surface Tension	38.9 ± 3.0 dyne/cm
9	Density	1.074 ± 0.06 g/cm ³
10	Boiling Point:	266.6±20.0°C at760 mmHg
11	Vapour Pressure:	0.0±0.6 mmHg at 25°C
12	Enthalpy of Vaporization:	52.5±3.0 kJ/mol
13	Flash Point:	122.9±6.7 °C
14	#H bond acceptors:	2
15	#H bond donors:	1
16	#Freely Rotating	2

	Bonds:	
17	#Rule of 5 Violations:	0
18	Dielectric Constant	Not available
19	Polar Surface Area:	29 Å ²
20	Polarizability	20.10 ± 0.5 10 ⁻²⁴ cm ³
21	RDBE	5
22	Monoisotopic Mass	164.08373 Da
23	Nominal Mass	164 Da
24	Average Mass	164.2011 Da
25	M+	164.083181 Da
26	M-	164.084278 Da
27	[M+H] ⁺	165.091006 Da
28	[M+H] ⁻	165.092103 Da
29	[M-H] ⁺	163.075356 Da
30	[M-H] ⁻	163.076453 Da
31	ACD/LogP:	2.45
32	ACD/LogD(pH 5.5):	2.55
33	ACD/BCF (pH 5.5):	51.21
34	ACD/KOC (pH 5.5):	582.31
35	ACD/LogD(pH 7.4):	2.55
36	ACD/BCF (pH 7.4):	51.11
37	ACD/KOC (pH 7.4):	581.18

High solubility in water and low partition coefficient of isoeugenol suggests low potential for bioaccumulation and moderate concerns for the environment i.e., is environmentally friendly and hence can be used to produce other aromatic flavourings and fragrances.

A. Geometrical Analysis

The molecular structure of 2-Methoxy-4-(1-propen-1-yl) phenol (Isoeugenol) having Molecular formula C₁₀H₁₂O₂ Molecular mass: 164.08373 amu, is an asymmetric top type of molecule with 66 degrees of freedom. Gaussian 09, Revision A.01, and Gauss View 6.0.16 programme [25] was used for the optimisation of molecular structure of Isoeugenol and the obtained optimised molecular structure along with the atom numbering scheme is shown in Figure 2.

Figure -2 Optimised Geometrical structure of 2-Methoxy-4-(1-propen-1-yl) phenol (Isoeugenol)



Geometrical parameters i.e., Bond Length, Bond Angle, Dihedral Angle of 2-Methoxy-4-(1-propen-1-yl) phenol (Isoeugenol) after optimisation as calculated by DFT/ B3LYP/6-311G (d, p) level basis set are listed in Table 2.

Table 2: Optimised geometrical parameters (bond length, bond angle, dihedral angle) of 2-Methoxy-4-(1-propen-1-yl) phenol (Isoeugenol) as calculated by DFT/B3LYP/6-311G (d, p) level basis set

S.NO.	Bond between Atoms	Bond Length (Å)	Bond Angle between Atoms	Bond Angle (°)	Dihedral Angle between Atoms	Dihedral Angle (°)
1	R(1,2)	1.4058	A(2,1,6)	119.1283	D(6,1,2,3)	-0.0006
2	R(1,6)	1.3892	A(2,1,10)	120.4458	D(6,1,2,12)	179.9974
3	R(1,10)	1.3607	A(6,1,10)	120.4258	D(10,1,2,3)	-179.9985
4	R(2,3)	1.3874	A(1,2,3)	120.2778	D(10,1,2,12)	-0.0005
5	R(2,12)	1.3752	A(1,2,12)	113.6557	D(2,1,6,5)	0.0007
6	R(3,4)	1.4088	A(3,2,12)	126.0665	D(2,1,6,9)	-179.9985
7	R(3,7)	1.0829	A(2,3,4)	120.9913	D(10,1,6,5)	179.9986
8	R(4,5)	1.4007	A(2,3,7)	120.1537	D(10,1,6,9)	-0.0005
9	R(4,17)	1.4698	A(4,3,7)	118.855	D(2,1,10,11)	-0.0095
10	R(5,6)	1.391	A(3,4,5)	117.909	D(6,1,10,11)	-180.0074
11	R(5,8)	1.083	A(3,4,17)	118.3583	D(1,2,3,4)	-0.0015
12	R(6,9)	1.0835	A(5,4,17)	123.7327	D(1,2,3,7)	180.0026
13	R(10,11)	0.9666	A(4,5,6)	121.2149	D(12,2,3,4)	180.0007
14	R(12,13)	1.4208	A(4,5,8)	120.1124	D(12,2,3,7)	0.0048
15	R(13,14)	1.0953	A(6,5,8)	118.6727	D(1,2,12,13)	179.9602
16	R(13,15)	1.0888	A(1,6,5)	120.4787	D(3,2,12,13)	-0.0419
17	R(13,16)	1.0953	A(1,6,9)	118.3325	D(2,3,4,5)	0.0035
18	R(17,18)	1.0896	A(5,6,9)	121.1888	D(2,3,4,17)	-179.9991
19	R(17,19)	1.3378	A(1,10,11)	107.0896	D(7,3,4,5)	-180.0006
20	R(19,20)	1.0878	A(2,12,13)	118.4986	D(7,3,4,17)	-0.0031
21	R(19,21)	1.4992	A(12,13,14)	111.2334	D(3,4,5,6)	-0.0034
22	R(21,22)	1.0964	A(12,13,15)	106.0714	D(3,4,5,8)	179.9946
23	R(21,23)	1.0964	A(12,13,16)	111.2331	D(17,4,5,6)	179.9993
24	R(21,24)	1.0928	A(14,13,15)	109.3768	D(17,4,5,8)	-0.0027
25			A(14,13,16)	109.468	D(3,4,17,18)	-0.0222
26			A(15,13,16)	109.3828	D(3,4,17,19)	179.981

27			A(4,17,18)	114.5597	D(5,4,17,18)	179.9751
28			A(4,17,19)	128.0017	D(5,4,17,19)	-0.0218
29			A(18,17,19)	117.4386	D(4,5,6,1)	0.0014
30			A(17,19,20)	119.6909	D(4,5,6,9)	180.0005
31			A(17,19,21)	124.5645	D(8,5,6,1)	-179.9967
32			A(20,19,21)	115.7446	D(8,5,6,9)	0.0025
33			A(19,21,22)	111.2774	D(2,12,13,14)	61.1769
34			A(19,21,23)	111.2767	D(2,12,13,15)	-179.9836
35			A(19,21,24)	111.5813	D(2,12,13,16)	-61.1371
36			A(22,21,23)	106.4606	D(4,17,19,20)	-0.0024
37			A(22,21,24)	108.0137	D(4,17,19,21)	179.9951
38			A(23,21,24)	108.0109	D(18,17,19,20)	180.0008
39					D(18,17,19,21)	-0.0017
40					D(17,19,21,22)	120.7353
41					D(17,19,21,23)	-120.7114
42					D(17,19,21,24)	0.0099
43					D(20,19,21,22)	-59.267
44					D(20,19,21,23)	59.2862
45					D(20,19,21,24)	-179.9924

A. Vibrational Assignments

For a non-linear molecule with N atoms, the number of fundamental vibrations is equal to $(3N-6)$. This also includes three translational and three rotational degrees of freedom [26,27]. **2-Methoxy-4-(1-propen-1-yl) phenol** (Isoeugenol), the molecule under consideration, has an asymmetric top group symmetry and 24 atoms; hence 66 normal modes vibrations are possible. As already been stated DFT/B3LY/6-311 G (d, p) level basis set has been used to study the vibrational properties of **2-Methoxy-4-(1-propen-1-yl) phenol** (Isoeugenol) molecule and the theoretical IR spectra and Raman spectra so obtained are shown in Figure 3 and 4 respectively while frequencies (scaled and unscaled), Reduced mass, Force constant, Intensities, and corresponding vibrational assignment for the theoretical IR spectra of **2-Methoxy-4-(1-propen-1-yl) phenol** (Isoeugenol) are tabulated in Table 3. Vibrational frequencies have been assigned

by visual inspection of modes animated by using the Gauss View 6.0.16 programme and the standard values reported [26]. A comprehensive account of the characteristic group absorptions and their relationship to molecular structure is discussed below.

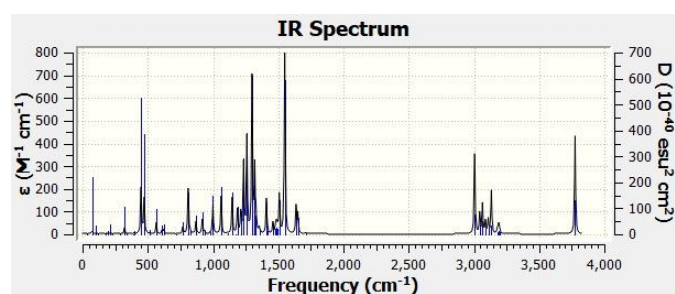


Figure 3: Theoretical IR spectra of **2-Methoxy-4-(1-propen-1-yl) phenol** (Isoeugenol)

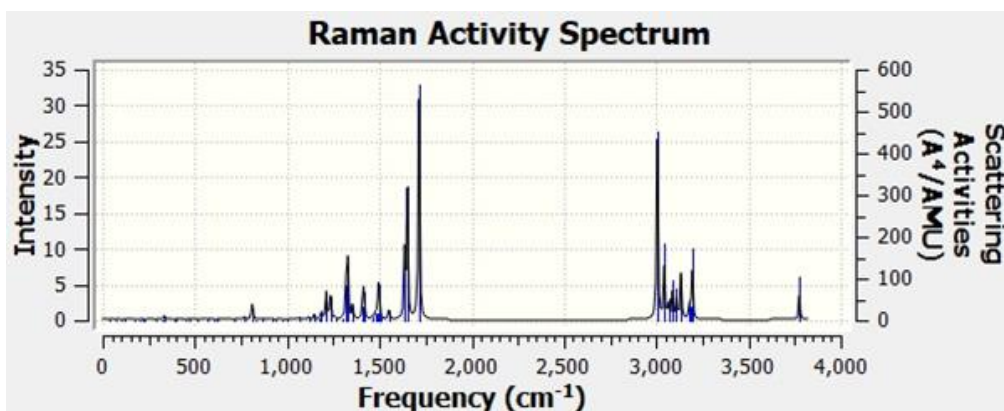


Figure 4: Theoretical Raman spectra of 2-Methoxy-4-(1-propen-1-yl) phenol (Isoeugenol)

Table 3: frequencies (scaled and unscaled), Reduced mass, Force constant, Intensities, and corresponding vibrational assignment for the theoretical IR spectra of 2-Methoxy-4-(1-propen-1-yl) phenol (Isoeugenol)

MODE	Frequency	Reduced Mass	Force Constant	Infrared	Raman Activity	Depolar-P	Depolar-U
1	35.10	2.3000	0.0017	0.0283	1.5209	0.7500	0.8571
2	71.98	3.0758	0.0094	3.9864	1.1281	0.7500	0.8571
3	103.48	2.3084	0.0146	0.8913	1.2103	0.7500	0.8571
4	119.34	3.4558	0.0290	0.0804	2.0702	0.7235	0.8396
5	175.28	2.7622	0.0500	0.1723	1.1601	0.7500	0.8571
6	196.16	1.2674	0.0287	0.6361	1.8693	0.7500	0.8571
7	214.79	3.4898	0.0949	2.0529	2.9016	0.3454	0.5134
8	228.76	1.4332	0.0442	0.0025	0.2080	0.7500	0.8571
9	288.75	2.5730	0.1264	0.3465	0.2695	0.7500	0.8571
10	321.93	4.3072	0.2630	8.5415	0.9972	0.2704	0.4257
11	335.33	4.7518	0.3148	0.2393	8.1201	0.1671	0.2863
12	385.49	4.2294	0.3703	0.1731	1.4495	0.7500	0.8571
13	397.00	3.7529	0.3485	1.0946	2.2526	0.7443	0.8534
14	448.18	1.6356	0.1936	59.1557	0.2917	0.7500	0.8571
15	472.13	1.5900	0.2088	45.4766	3.1363	0.7500	0.8571
16	515.50	5.3180	0.8326	1.9644	0.9504	0.7436	0.8529
17	565.16	4.9394	0.9295	13.9290	3.9650	0.3995	0.5709
18	608.97	3.3170	0.7247	5.1031	0.1569	0.7500	0.8571
19	622.01	5.2611	1.1993	6.1108	2.9431	0.3126	0.4763
20	713.09	4.7064	1.4100	0.0887	0.0297	0.7499	0.8571
21	769.22	4.6251	1.6124	9.3755	7.6186	0.6000	0.7500
22	808.50	1.4335	0.5521	29.2321	9.8007	0.7500	0.8571
23	810.63	4.7395	1.8349	32.8119	26.0650	0.1293	0.2290
24	828.65	1.5222	0.6158	3.2564	1.7247	0.7500	0.8571
25	869.37	1.6069	0.7156	16.1587	3.9740	0.7500	0.8571

26	917.50	2.6417	1.3102	19.1878	3.7830	0.0538	0.1021
27	935.90	1.2972	0.6694	3.4511	0.7870	0.7500	0.8571
28	978.94	2.1584	1.2187	1.7728	1.9722	0.4304	0.6018
29	999.31	1.0940	0.6437	37.0426	0.0773	0.7498	0.8570
30	1062.20	4.1973	2.7902	48.6484	4.4956	0.3030	0.4651
31	1063.57	1.5251	1.0164	0.0772	2.1081	0.7500	0.8571
32	1115.53	2.2839	1.6745	1.6067	7.5904	0.6029	0.7523
33	1146.55	1.6222	1.2564	46.1954	13.0620	0.1975	0.3298
34	1171.77	1.2699	1.0273	0.5562	2.8189	0.7500	0.8571
35	1186.28	1.7017	1.4110	31.3611	17.8181	0.3633	0.5330
36	1212.66	1.6330	1.4149	27.0608	64.0755	0.3158	0.4800
37	1234.60	1.3996	1.2569	90.0304	54.7331	0.2935	0.4538
38	1259.83	3.0105	2.8153	122.7136	6.3239	0.6730	0.8046
39	1298.96	3.0942	3.0760	199.5975	4.6139	0.6499	0.7878
40	1319.75	2.0378	2.0912	83.1938	85.6312	0.2469	0.3960
41	1328.96	1.5128	1.5742	24.5777	136.0845	0.2739	0.4300
42	1354.56	1.3847	1.4969	7.7477	30.7470	0.3593	0.5286
43	1409.48	2.1384	2.5030	43.0656	33.8548	0.1960	0.3278
44	1414.63	1.2659	1.4926	4.3700	67.1264	0.4121	0.5837
45	1459.12	2.6695	3.3485	14.6445	8.4889	0.2194	0.3599
46	1479.00	1.0445	1.3461	7.1810	14.7097	0.7500	0.8571
47	1484.65	1.2452	1.6171	9.5090	4.7440	0.6820	0.8109
48	1490.14	1.0452	1.3674	8.4302	17.1547	0.7500	0.8571
49	1495.80	1.1198	1.4761	4.9616	84.1192	0.4144	0.5860
50	1508.01	1.0656	1.4277	49.8771	8.2961	0.7043	0.8265
51	1549.87	3.2275	4.5677	230.5725	23.8384	0.6117	0.7591
52	1636.52	5.6196	8.8674	35.8611	163.6012	0.3803	0.5511
53	1650.28	6.3366	10.1675	26.3890	318.4674	0.4494	0.6201
54	1714.03	5.4909	9.5045	1.5377	562.6702	0.3139	0.4779
55	3005.36	1.0373	5.5200	58.1626	451.7891	0.1424	0.2493
56	3006.55	1.0341	5.5077	47.9687	194.2679	0.0140	0.0276
57	3044.38	1.0992	6.0022	26.7739	184.0977	0.7500	0.8571
58	3065.93	1.1066	6.1285	38.5587	52.0952	0.7500	0.8571
59	3088.52	1.0985	6.1736	16.1145	94.4199	0.7457	0.8543
60	3109.84	1.0881	6.1999	18.8693	74.3343	0.2392	0.3861
61	3134.13	1.0984	6.3569	27.8043	103.1793	0.5344	0.6966
62	3134.17	1.0890	6.3025	27.6319	63.4495	0.2901	0.4497
63	3180.15	1.0869	6.4765	6.7812	47.2364	0.7162	0.8346
64	3189.26	1.0892	6.5273	10.8547	33.3541	0.3538	0.5227
65	3195.75	1.0942	6.5842	7.5080	170.8143	0.2253	0.3677
66	3775.81	1.0648	8.9445	125.3302	105.1243	0.2322	0.3769

1) Alkenes C=C stretching vibrations

C=C stretching mode of unconjugated alkenes usually shows moderate to weak absorption at 1667-1640 cm^{-1} . Monosubstituted alkenes i.e. vinyl group absorbs near 1640 cm^{-1} with moderate intensity.

2) Alkene C-H stretching vibrations

In general, any C-H stretching bands above 3000 cm^{-1} result from aromatic, alkyne, or alkene C-H stretching. The frequency and intensity of alkene C-H stretching absorption are influenced by the pattern of substitution. Vinyl group produces three closely spaced C-H stretching bands, two of which result from symmetrical and asymmetrical stretching of the terminal C-H groups, and the third one from the stretching of the remaining single C-H group.

3) Alkene C-H bending vibrations

Alkene C-H bonds can undergo bending either in the same plane as the C=C bond or perpendicular to it; the bending vibrations can be either in phase or out of phase with respect to each other. The vinyl group absorbs near 1416 cm^{-1} because of a scissoring vibration of the terminal methylene. The most characteristic vibrational modes of alkene are the out-of-plane C-H bending vibrations between 1000 and 650 cm^{-1} . These bands are usually the strongest in the spectra of alkenes.

4) Alkanes C-H Stretching Vibrations

Absorption arising from C-H stretching in alkanes occur in the general region of 3000-2840 cm^{-1} . In case of methyl group two distinct bands occur at 2962 cm^{-1} & 2872 cm^{-1} . Band at 2962 cm^{-1} results from the asymmetrical (as) stretching mode in which two C-H bonds of methyl group are extending while the third one is contracting (CH_3). Band at 2872 cm^{-1} arises from symmetrical (s) stretching (CH_3) in which all three of C-H bonds extend and contract in phase. In case of methylene groups, the asymmetrical stretching (CH_2) and symmetrical stretching (CH_2) occur near 2926 and 2853 cm^{-1} respectively. C-H stretching vibrations due to isopropyl group is very weak and usually lost in other aliphatic C-H absorption and is observed near 2890 cm^{-1} .

5) Alkane C-H Bending Vibrations

Two bending vibrations can occur in methyl group-symmetrical bending vibration involving in-phase bending and asymmetrical bending vibration involving out-of-phase bending of C-H bonds. The symmetrical bending vibration (CH_3) occurs near 1375 cm^{-1} , the asymmetrical bending vibration (CH_3) near 1450 cm^{-1} . The four bending vibrations are referred to as scissoring, rocking, wagging, and twisting. The band resulting from methylene rocking vibration (CH_2), appears near 720 cm^{-1} . Configuration in which two methyl groups are attached to the same carbon atoms exhibits distinctive absorption in the C-H bending region.

6) Mononuclear Aromatic Hydrocarbon

In the spectra of aromatic compounds most prominent and informative bands occur in the frequency region between 900-675 cm^{-1} . These strong absorption bands are the result of out-of-plane ("oop") bending C-H bonds of the ring. In the 1300-1000 cm^{-1} region in-plane bending bands are observed. Skeletal vibrations, involving stretching of carbon-carbon bonds within the benzene ring, absorb in the 1600-1585 and 1500-1400 cm^{-1} regions. The skeletal bands frequently appear as doublets and depends on the nature of the ring substituents. Aromatic C-H stretching bands occur between 3100 and 3000 cm^{-1} . Weak combination and overtone bands appear in the 2000-1650 cm^{-1} range.

The in-phase and out-of-plane bending of a ring hydrogen atom is strongly coupled to adjacent hydrogen atoms. The position of absorption of the out-of-plane bending bands is therefore characteristic of the number of adjacent hydrogen atoms on the ring. The bands are frequently intense and appear at 900-675 cm^{-1} .

7) Phenol

The characteristic bands due to O-H stretching and C-O stretching observed in the spectra of phenols are sensitive to hydrogen bonding. H stretching vibrations of non-hydrogen bonded or free hydroxyl group of phenol absorbs strongly in the 3700-3584

cm^{-1} region. Due to intermolecular hydrogen bonding additional bands appear at lower frequency, 3550-3200 cm^{-1} . C-O stretching vibrations in alcohols and phenols produce a strong band in the 1260-1000 cm^{-1} region of the spectrum. Phenols absorb at 1390-1330 and 1260-1180 cm^{-1} . These bands apparently result from interaction between O-H bending and C-O stretching.

8) O-H Bending vibrations

The O-H in-plane bending vibrations occur in the general region of 1420-1330 cm^{-1} . Phenols show a broad absorption band in the 769-650 cm^{-1} region because of out-of-plane bending of the bonded O-H group.

9) C-O Stretching vibrations in ethers

The characteristic response of ethers in IR is associated with the stretching vibration of the C-O-C systems. Since vibrations involving oxygen atoms result in greater change in dipole moments than those involving carbon atoms, hence more intense bands are observed for ethers. The C-O-C stretching bands of ethers, as is the case of C-O stretching bands of alcohols, involve coupling with other vibrations within the molecule. The spectra of aryl-alkyl ethers display an asymmetrical C-O-C stretching band at 1275-1200 cm^{-1} with a symmetrical stretching band near 1075-1020 cm^{-1} . Resonance, which results in the strengthening of the C-O bond, is responsible for the shift in the asymmetrical absorption band of aryl-alkyl ethers.

B. Thermochemical properties

Thermodynamic properties help to understand energetics, structural and reactivity properties of a molecule. Frequency calculations were used to compute the zero-point energies, thermal correction to internal energy and entropy as well as heat capacity for Isoeugenol molecule and are compiled in Table 4. The statistical thermochemical analysis of Isoeugenol (2-methoxy-4-(1-propen-1-yl) phenol) is carried out by assuming the molecule under

consideration to be at room temperature of 300K and one atmospheric pressure. The standard thermodynamic functions: heat capacity (C_v), enthalpy (E), entropy (S) have been obtained at B3LYP/6-311G (d, p) level basis set and are tabulated in Table 5. These functions describe the thermodynamic stability of the system at the given conditions of temperature and pressure.

Table 4: thermodynamic functions of Isoeugenol as computed by frequency calculations

Thermodynamic Functions	Value
Zero-point correction	0.197547 (Hartree/Particle)
Thermal correction to Energy	0.209665
Thermal correction to Enthalpy	0.210609
Thermal correction to Gibbs Free Energy	0.158868
Sum of electronic and zero-point Energies	-538.657406
Sum of electronic and thermal Energies	-538.645289
Sum of electronic and thermal Enthalpies	-538.644344
Sum of electronic and thermal Free Energies	-538.696085

Table 5: Thermodynamic properties of Isoeugenol as calculated by DFT/B3LYP/6-311 G (d, p) level basis set

	E (Thermal) KCal/Mol	C_v Cal/Mol- Kelvin	S Cal/Mol- Kelvin
Total	131.567	45.197	108.898
Electronic	0.000	0.000	0.000
Translational	0.889	2.981	41.194
Rotational	0.889	2.981	31.226
Vibrational	129.789	39.236	36.477
Vibration 1	0.594	1.982	5.518
Vibration 2	0.598	1.967	4.099
Vibration 3	0.605	1.946	3.388

Vibration 4	0.609	1.933	3.111
Vibration 5	0.627	1.873	2.378
Vibration 6	0.636	1.845	2.169
Vibration 7	0.645	1.818	2.003
Vibration 8	0.651	1.797	1.889
Vibration 9	0.685	1.695	1.481
Vibration 10	0.707	1.632	1.300
Vibration 11	0.716	1.605	1.234
Vibration 12	0.754	1.501	1.018
Vibration 13	0.764	1.477	0.974
Vibration 14	0.807	1.365	0.801
Vibration 15	0.829	1.312	0.732
Vibration 16	0.871	1.216	0.620
Vibration 17	0.921	1.107	0.514
Vibration 18	0.968	1.013	0.434

A. Nonlinear optical properties of Isoeugenol

Molecular NLO properties of active compounds can be predicted with the help of quantum chemical calculations [28,29]. The relationship between the nonlinear optical properties and the molecular structure can be better understood with the help of Hyperpolarizability [30-31]. DFT/B3LYP/6-311 G (d, p) has been used to compute the electronic properties like total dipole moment(μ), mean linear polarizability (α), anisotropic polarizability ($\Delta\alpha$), first-order hyperpolarizability (β) and second order hyperpolarizability (γ) in terms of x, y, z components by Gaussian 09, Revision A.01 package and Gauss View 6.0.16 programme for Isoeugenol molecule. Calculation of above mentioned NLO properties have been executed using equation-1 to equation-5[32-33] and the results are summarised in Table 6.

$$\mu = (\mu^2_x + \mu^2_y + \mu^2_z) \tag{1}$$

$$\alpha = \frac{\alpha_{xx} + \alpha_{yy} + \alpha_{zz}}{3} \tag{2}$$

$$\Delta\alpha = \frac{1}{\sqrt{2}}[(\alpha_{xx} - \alpha_{yy})^2 + (\alpha_{yy} - \alpha_{zz})^2 + (\alpha_{zz} - \alpha_{xx})^2 + 6(\alpha_{xy}^2 + \alpha_{yz}^2 + \alpha_{zx}^2)]^{1/2} \tag{3}$$

$$\beta = (\beta^2_x + \beta^2_y + \beta^2_z)^{1/2} \tag{4}$$

where $\beta_x = \beta_{xxx} + \beta_{xyy} + \beta_{xzz}$, $\beta_y = \beta_{yyy} + \beta_{yxx} + \beta_{yzz}$ and $\beta_z = \beta_{zzz} + \beta_{zxy} + \beta_{zxx}$

$$\gamma = \frac{1}{5}(\gamma_{xxxx} + \gamma_{yyyy} + \gamma_{zzzz} + 2\gamma_{xxyy} + 2\gamma_{xxzz} + 2\gamma_{yyzz}) \tag{5}$$

The conversion factor of α , β and γ in atomic unit are
 For α 1 atomic unit (a.u.) = 0.1482×10^{-24} electrostatic unit (esu),

For β 1 a.u. = 8.6393×10^{-33} esu and

For γ 1a.u. = 5.0367×10^{-40} esu.

As mentioned above DFT/B3LYP/6-311G (d, p) method, based on field-independent basis is used to compute the nonlinear optical components of Isoeugenol. Urea is one of the prototype molecule which is used as a threshold value for comparative purpose hence is used to study the NLO properties of a molecular system. The computed electric dipole moment (μ) of Isoeugenol molecule ($\mu = 2.6222$ D) was calculated to be 1.1049 times that of the standard reference material of prototypical molecule urea ($\mu = 2.3732$ D) and first-order hyperpolarizability (β) of Isoeugenol molecule ($\beta = 5.1851 \times 10^{-31}$ esu) is about 1.3909 times the first order hyperpolarizability of urea (β of urea = 3.728×10^{-31} esu) indicating that isoeugenol has considerable nonlinear optical property hence it is recommended to use Isoeugenol molecule as a prospective building block for nonlinear optical material.

Table 6: nonlinear optical components of Isoeugenol as calculated by DFT/B3LYP/6-311 G (d, p) level basis set

Dipole moment (μ) In Debye		Mean Linear Polarizability (α) in a.u		First-order Hyperpolarizability (β) in a.u.		Second order Hyperpolarizability (γ) in a.u	
μ_x	-0.0380	α_{xx}	-64.6560	β_{xxx}	-27.5035	γ_{xxxx}	-2618.7766
μ_y	2.6219	α_{yy}	-64.8757	β_{yyy}	15.7507	γ_{yyyy}	-783.7295
μ_z	0.0008	α_{zz}	-75.7584	β_{zzz}	0.0011	γ_{zzzz}	-94.3136
Total μ	2.6222	α_{xy}	-8.2013	β_{xyy}	-8.6368	γ_{xxxxy}	-69.9238
		α_{xz}	-0.0026	β_{xxy}	18.3993	γ_{xxxz}	-0.0139
		α_{yz}	-0.0002	β_{xxz}	0.0098	γ_{yyyx}	-57.8955
		α	-68.43003 a.u	β_{xzz}	-11.3589	γ_{yyyz}	-0.0069
			$-10.14133 \times 10^{-24}$ esu	β_{yzz}	2.5362	γ_{zzzx}	0.0017
		$\Delta\alpha$	12.42992 a.u	β_{yyz}	0.0013	γ_{zzzy}	0.0024
				β_{xyz}	-0.0074	γ_{xxyy}	-596.2700
				β	60.0171 au	γ_{xxzz}	-495.8275
					5.1851×10^{-31} esu	γ_{yyzz}	-163.5812
						γ_{xxyz}	0.0023
						γ_{yyxz}	-0.0087
						γ_{zzxy}	-2.4027
						γ	-1201.6542 au
							-6.0524×10^{-37} esu

A. Mulliken population Analysis: Mulliken Atomic Charges.

Atomic charges, an important concept in chemistry which gives a simple picture of distribution of electron density within a molecule. Many properties of a molecule like dipole moments, electric potentials, NMR chemical shifts, reactivities, and electromagnetic spectra can be correlated to atomic charges in a molecule, and many structure-property theories of molecule are based on the idea of atomic charges [34]. Atomic Polar tensor (APT) charge is derived using quantum mechanically calculated dipole moment. DFT/B3LYP/6-311 G (d, p) level basis

set was used to calculate the Mulliken atomic charges, APT atomic charges, and Natural atomic charges. Calculated values of Mulliken, APT, Natural atomic charges are given in Table 7 and plotted in Figure 5. Atomic charge distribution is different due to the presence of polar -OH group on Carbon atom -1 and -OCH₃ group on carbon atom-2. Oxygen atom -12 has more negative charge than Oxygen atom-10 due to the presence of methyl group which has +I effect. Carbon atoms 1, 2 and 13 have positive charge as they are directly attached to electronegative oxygen atom hydrogen atom -11 has more positive charge because it is attached to oxygen atom of phenolic group.

Table 7: Mulliken, APT and Natural Atomic Charges on each of the constituent atom of Isoeugenol molecule as calculated by DFT/B3LYP/6-311 G (d, p) level basis set.

Atom No.	Natural Charge	Apt charge	Mulliken charge
C 1	0.30244	0.517260	0.151631
C 2	0.26080	0.450485	0.146602
C 3	-0.26558	-0.077965	-0.092515
C 4	-0.07262	-0.028416	-0.074996
C 5	-0.19020	-0.048879	-0.055026
C 6	-0.24007	-0.081379	-0.090106
H 7	0.20544	0.054056	0.095767
H 8	0.19904	0.038561	0.082918
H 9	0.21395	0.044186	0.099747
O 10	-0.66885	-0.820055	-0.359342
H 11	0.47626	0.339929	0.254512
O 12	-0.55928	-0.886803	-0.406252
C 13	-0.19056	0.523966	-0.122324
H 14	0.16683	-0.033234	0.116122
H 15	0.18452	-0.004064	0.128619
H 16	0.16685	-0.033211	0.116134
C 17	-0.20739	0.083523	-0.073277
H 18	0.18250	-0.001592	0.074043
C 19	-0.15263	-0.008135	-0.141841
H 20	0.17862	0.009584	0.089854
C 21	-0.58912	0.076911	-0.272021
H 22	0.20203	-0.047596	0.114474
H 23	0.20203	-0.047618	0.114478
H 24	0.19499	-0.019514	0.102798

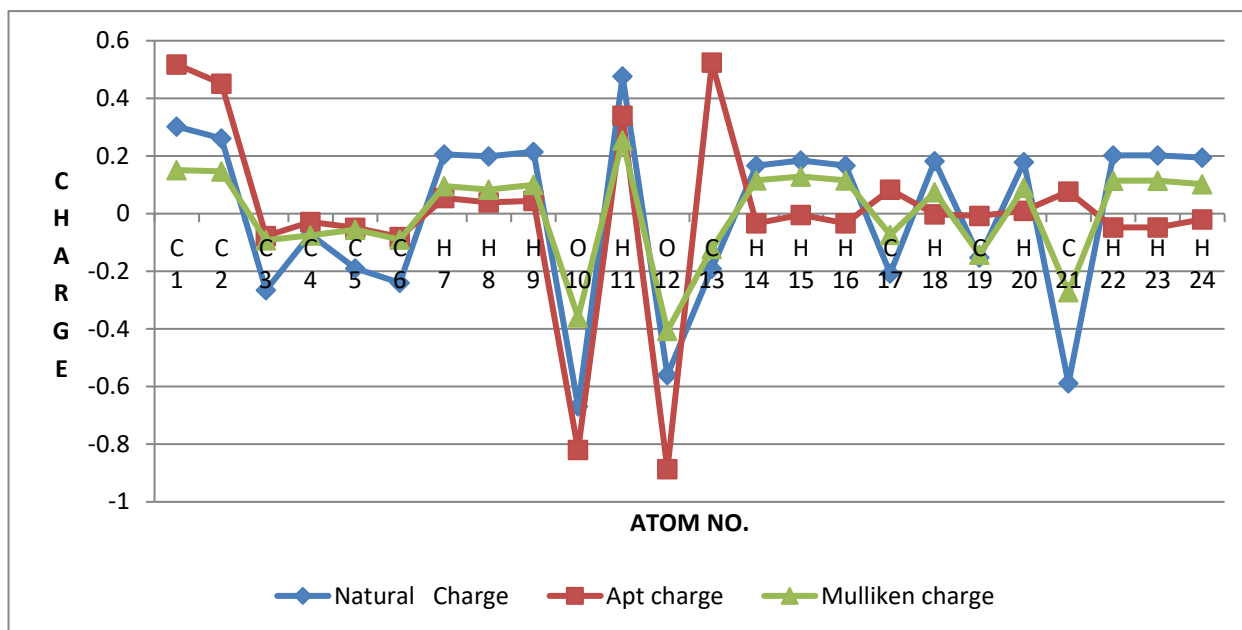


Figure 5: Mulliken, Apt, and Natural Charges on each of the constituent atom of Isoeugenol.

A. UV-VISIBLE Spectral Studies and Electronic Properties

TD-DFT calculations facilitates quantum chemists in better understanding of observed electronic absorption spectrum in terms of Excitation energies (E), absorption wavelength (λ), oscillator strengths (f), molecular orbitals undergoing transitions, transition energy, electronic transitions etc [35-36]. Molecular orbitals undergoing excitation transition, transition energy and excitation energy, absorption wavelength etc have been gathered in Table 8 and the UV –Visible spectra of Isoeugenol compound as obtained from TD-DFT calculations is shown in Figure 6.

Table 8: UV-Visible spectral results (excitation energy, absorption wavelength, oscillator strength, transition energy) of Isoeugenol molecule as calculated by TD-DFT/ B3LYP/6-311g (d, p) basis set.

Excited state	Excitation Energy (E)	Absorption Wavelength (λ)	Oscillator Strength (f)	Excitation Transition (MO)	Transition Energy (MO) Singlet A
1	4.7958 eV	258.52 nm	f=0.1113	43 -> 45 43 -> 46 44 -> 45 44 -> 46	0.29607 -0.14431 0.50973 0.34256
2	5.1129 eV	242.49 nm	f=0.2672	43 -> 45 44 -> 45 44 -> 46	-0.28254 0.46586 -0.43657
3	5.5365 eV	223.94 nm	f=0.1613	42 -> 45 42 -> 46 43 -> 45 44 -> 46 44 -> 47	0.15346 0.13338 0.53112 -0.36484 -0.16985

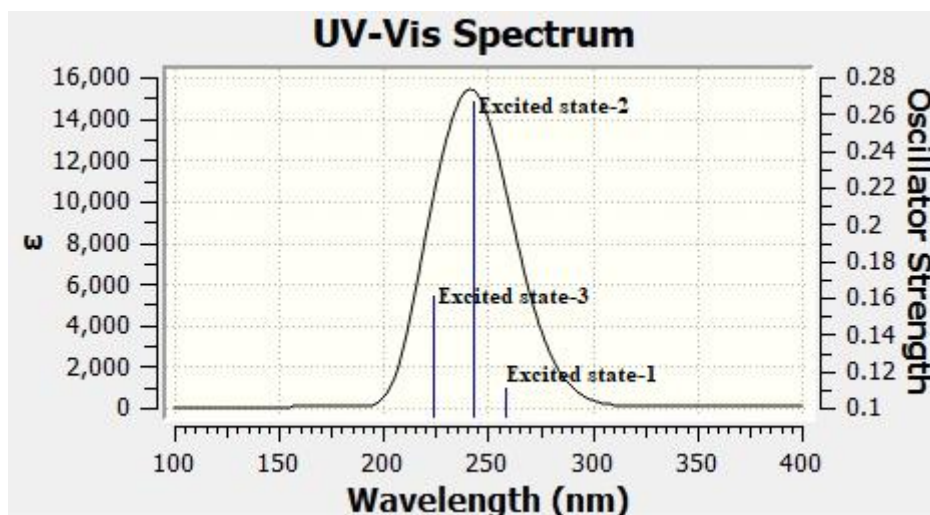


Figure 6: Theoretical UV-Visible spectra of Isoeugenol

G. Electronic Circular Dichroism (ECD) spectroscopy

ECD (Electronic circular dichroism) has been found to be a powerful chiroptical tool for the determination of absolute configuration (AC) or conformation of natural products containing chromophores since 1960s [37-38]. CD is defined as the differential absorption of left and right circularly polarised electromagnetic radiation by a sample. The difference of the absorption is the measure of the magnitude of CD, which is expressed by the differential molar extinction coefficients as $\Delta\epsilon = \epsilon_l - \epsilon_r$ ($L \text{ mol}^{-1} \text{ cm}^{-1}$) [39]. TD-DFT method allows the simulation of the ECD spectrum of a medium size molecule on a desktop or PC in a reasonable time [40-41]. ECD spectra of Isoeugenol was studied using B3LYP/TD-DFT/6-311G (d, p) level and the results are presented in Table-9 and spectra in Fig. 7. In Isoeugenol molecule common chromophore and auxochrome groups are an aromatic ring, a phenolic, a methoxy group and an alkene group. The absorption bands are due to aromatic $\pi - \pi^*$ and $n - \pi^*$ transitions. A negative CE at 258.52 nm and 223.94 nm $R_{vel} < 100$ corresponds to S-configuration while slightly positive CE at 242.49 nm corresponds to R-configuration.

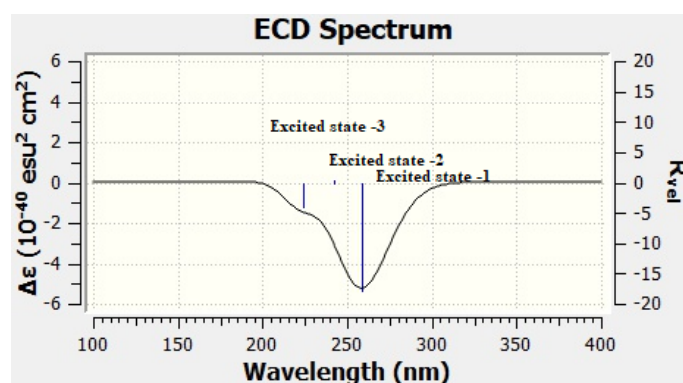


Figure 7- Theoretical ECD spectra of Isoeugenol

Table 9: ECD spectral results of Isoeugenol

Excited State	Wavelength (nm)	R_{vel}	$\Delta\epsilon$ ($10^{-40} \text{ esu}^2 \text{ cm}^2$)
1	258.524392	-17.89126734	≈ -5.2
2	242.4912143	0.3740610138	$\approx +1.3$
3	223.9415427	-4.002235682	≈ -1.3

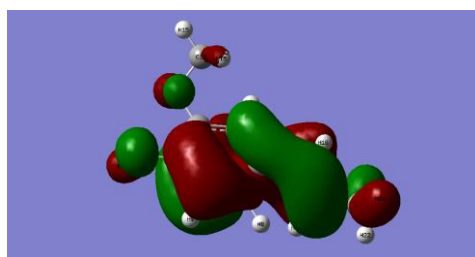
A. Frontier Molecular orbital analysis (FMO analysis)

Interaction of two atomic orbitals with each other produces two new orbitals called molecular orbitals – bonding molecular orbital and antibonding molecular orbitals. The bonding molecular orbital has lower energy and is occupied by a pair of electrons (a Lewis

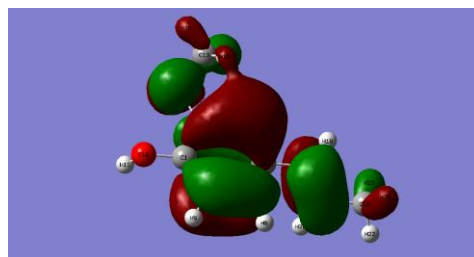
base) and is called Highest Occupied Molecular Orbital (HOMO) while antibonding molecular orbital has lower energy and does not contain electrons (a Lewis acid) and is called Lowest Unoccupied Molecular Orbital (LUMO) of the compound. HOMO and LUMO are a pair of orbitals which interact most strongly. They together are called Frontier Molecular Orbital (FMO) because they are present at the outermost boundaries of the electrons of a compound. The FMO analysis for Isoeugenol has been carried out using B3LYP/6-311G (d, p) basis set at DFT with structure of the molecule in singlet excited state and has been shown in Figure 8. In Table 10 energies of molecular orbitals undergoing major transitions and their energy gap (ΔE) have been presented.

Table 10 : Energy Gap (ΔE) of major electronic transitions

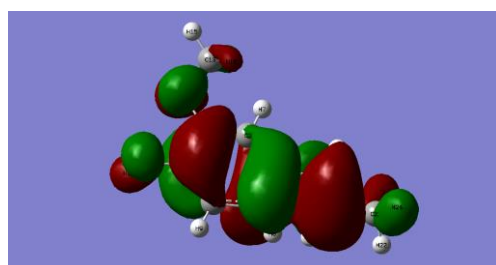
LUMO Energy (E_{LUMO})	HOMO Energy (E_{HOMO})	Energy gap (ΔE) ($E_{\text{LUMO}} - E_{\text{HOMO}}$)
45 (-0.02970)	44 (-0.22865)	0.19895
46 (-0.01422)	44 (-0.22865)	0.21443
47 (0.02160)	44 (-0.22865)	0.25025
45 (-0.02970)	43 (-0.24869)	0.21899
46 (-0.01422)	43 (-0.24869)	0.23447
45 (-0.02970)	42 (-0.27919)	0.24949
46 (-0.01422)	42 (-0.27919)	0.26497



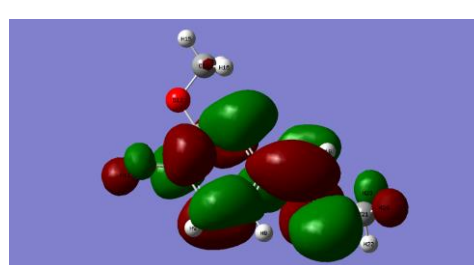
MO-42 E = -0.27919



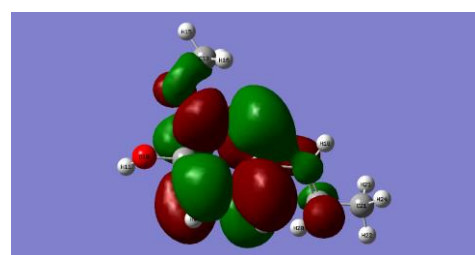
MO-43 E = -0.24869



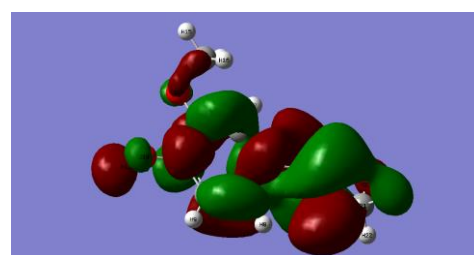
MO-44 E = -0.22865



MO-45 E = -0.02970



MO-46 E = -0.01422



MO-47 E = 0.02160

Figure -8 – Frontier Molecular orbitals with Molecular Orbital No. and its energy indicated below each Molecular Orbital

I. Global and Local Reactivity Descriptors

Global chemical reactivity descriptors of a compound like absolute hardness, softness, chemical potential, electronegativity, electrophilicity index as well as local reactivity descriptors have been defined [42-46]. Robert Parr and others [42] defined Electrophilicity index and suggested that it can be calculated using chemical potential and absolute hardness. According to this definition electrophilicity index measures the susceptibility of chemical species to accept electrons. Thus, low value of it suggests a good nucleophile while higher value indicates the presences of good electrophile. Electronegativity, an atomic parameter, has long been known to be of great use in chemistry. Electronegativity has been defined by Pauling and Mulliken [48] as the average value of the ionization potential and electron affinity. Robert G Parr and others [45] scrutinized the concept of electronegativity from the point of view of Density Functional Theory of Hohenberg and Kohn [48]. In the Hohenberg and Kohn density functional theory of the ground state negative of electronegativity is chemical potential. They observed that electronegativity is the same for all orbitals in an atom or molecule in its ground state. They also demonstrated how electronegativity differences between valence states drive electron transfers between atoms on molecule formation. Hardness refers to resistance to deformation or change and mathematically is half the difference of ionization potential and electron affinity. The minimum value of hardness is zero. Softness is defined as the reciprocal of hardness thus zero hardness constitutes maximum softness [45-46]. Hence, we can say that different global reactive descriptors and energy gap of major electronic transitions are helpful to describe the stability and reactivity of a molecule. The calculated values of various reactive descriptors are presented in Table 11. A low value of hardness indicates that Isoeugenol is soft and can be easily deformed but a negative value of chemical potential shows that it is quite stable and does not undergo decomposition.

Table 11 : Calculated values of Global and Local Reactivity Descriptors of Isoeugenol

Parameter	Relation	Calculated Value
Ionization Energy(I)	$-E_{\text{HOMO}}$	0.22865
Electron Affinity (A)	$-E_{\text{LUMO}}$	0.02970
Chemical Potential(ϕ)	$-\frac{(I + A)}{2}$	-0.129175
Absolute hardness(η)	$\frac{(I - A)}{2}$	0.099475
Softness(S)	$\frac{1}{\eta}$	10.052778
Electronegativity (χ)	$\frac{(I + A)}{2}$	0.129175
Electrophilicity index (ω)	$\frac{\phi^2}{2\eta}$	0.083871
Electron donating capability(ω^-)	$\frac{(3I + A)2}{16(I - A)}$	0.160893
Electron accepting capability (ω^+)	$\frac{(I + 3A)2}{16(I - A)}$	0.031718

C. Electrostatic potential and electron density surfaces

Molecular Electrostatic Potential (ESP) is the potential that a unit positive charge would experience at any point surrounding the molecule due to the electron density distribution in a molecule and is correlated with dipole moment, electronegativity, partial charge, and chemical reactivity of the molecule. With the help of electrostatic potential chemical reactivity of a molecule can be predicted because regions of negative potential are expected to be sites of protonation i.e. site of nucleophilic attack, while regions of positive potential may indicate electrophilic sites. The different values of electrostatic potential are represented by different colours-red represents region of most negative electrostatic potential, blue represents the region of the most positive electrostatic potential and green represents the region of zero potential. Potential increases in the order red < orange < yellow < green < blue.

The electron density surfaces and electrostatic potential for Isoeugenol was computed using B3LYP/6-311G (d, p) basis set at DFT and are shown in Figure 9 and Figure 10 respectively.

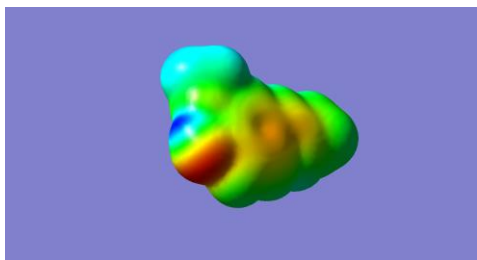


Figure 9: electron density of Isoeugenol from total scf density (isoval = 0.0004; mapped with esp)

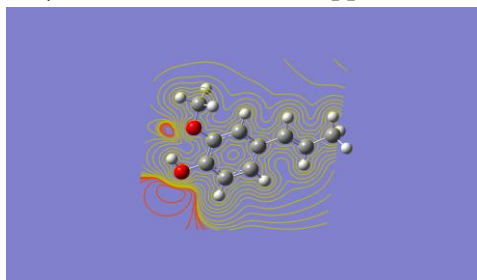


Figure-10: electrostatic potential from total scf density (red- negative charge -yellow-green -blue positive charge)

IV. CONCLUSIONS

An attempt was made to calculate various physico-chemical properties of Isoeugenol using acdlab/chemsketch as these properties influence the toxic manifestations of a material. Further efforts were made to study the geometry, dipole moment, molecular electrostatic potential (ESP), atomic charge distribution, polarizability, hyperpolarizability etc. Reactivity descriptors like chemical reactivity, electrophilicity, chemical potential, absolute hardness, chemical softness etc for Isoeugenol were discussed by analysing HOMO and LUMO calculated using B3LYP/6-311 G (d, p) basis set. The values of dipole moment (μ), hyperpolarizability (β) of Isoeugenol were calculated and were observed to be comparable to the values of standard reference material of prototype molecule urea hence this molecule is recommended for its use as a perspective building block for NLO material and a negative value of chemical potential indicates that Isoeugenol is quite stable and does not undergo decomposition readily. High solubility in water and low partition coefficient of isoeugenol suggests low potential for

bioaccumulation and moderate concerns for the environment i.e., is environmentally friendly.

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Cite this article as :

Raksha Gupta, Sachin Kumar, "Physico-Chemical Properties and DFT Calculations of 2-Methoxy – 4 - (Prop-1-En-1-Yl) Phenol (ISOEUGENOL) Using Gausssian Basis Set", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 2, pp. 01-20, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST22914> Journal URL : <https://ijsrst.com/IJSRST22914>

Accelerate The Implementation of Village SDGs Through a Children-Worth Village

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Article Info

Volume 9, Issue 1

Page Number : 21-29

Publication Issue

January-February-2022

Article History

Accepted : 01 Jan 2022

Published : 09 Jan 2022

ABSTRACT

The Government of Indonesia through Presidential Regulation Number 25 of 2021 concerning Child-friendly District/City Policies again emphasizes that districts/cities throughout Indonesia become KLA and the fulfillment of children's rights and special protection. Sumbawa Regency is one of the regencies in West Nusa Tenggara Province that has been committed to realizing KLA since 2017. However, until now Sumbawa Regency has not been able to get the KLA predicate, either Nindya, Madya or Pratama. Through the initiation of the Child Friendly Poto Village, the local government together with the Samawa Center tried to implement a bottom-up approach in KLA. For this reason, this study aims to determine the design, implementation and initiation process of child-friendly villages in Poto Village, District, as well as the challenges and obstacles. This study uses a PAR approach based on the concept of rights-based community development popularized by Ife and Tesoriero (2000). The result of this research is that the design of the implementation of DLA is adjusted to the conditions of the local community where it begins with the common perception and preparation of the DLA action plan. The challenges and obstacles lie in the commitment of the members of the task force and the village government. This is because the DLA issue is still considered new and not very familiar so that understanding is not yet complete.

Keywords: Child Friendly Village, Village SDGs, Sumbawa

I. INTRODUCTION

Indonesia is one of the countries that have ratified the Convention on the Rights of the Child in 1989 through Presidential Decree No.

36/1990.¹ Furthermore, in 2005, the State Ministry for Women's Empowerment for the first time introduced the term Child Friendly City through the Child

¹Zendy Wulan Ayu Widhy Prameswari. 2017. Ratification of the Convention on Children's Rights in the Legislation System in Indonesia. *Juridika Journal*, Faculty of Law, Air Langga University. Vol 32 No 1 January 2017

Friendly City/Kabupaten Policy (KLA). It aims to district/city governments to accelerate the implementation of the Convention on the Rights of the Child (CRC) from the legal framework into definitions, strategies, and development interventions such as child-friendly policies, institutions and programs.²

In order to support the acceleration of the realization of KLA, the Indonesian government through Presidential Regulation Number 25 of 2021 on the Policy for Child-friendly Districts/Cities, again emphasizes that districts/cities throughout Indonesia become KLAs and the fulfillment of children's rights and special protection. Because in 2030 Indonesia is targeted to become an Indonesia Suitable for Children (IDOLA) and create a golden Indonesian generation in 2045.

Sumbawa Regency is one of the regencies in West Nusa Tenggara Province that has been committed to realizing KLA since 2017. Realizing a Eligible Sumbawa Regency has been mandated in the Medium Term Development Plan Region (RPJMD) 2021-2026, which is the embodiment of the government's fourth mission, namely to make Sumbawa Safe and Cultured.

In the context of accelerating the implementation of KLA in Sumbawa Regency, various efforts have been made, including the establishment of a KLA task force, and the initiation of the issuance of Regional Regulation Number 7 of 2017 concerning the Implementation of Child Protection by the P2KBP3A Service. Under the coordination of the P2KBP3A Service, the achievement of KLA fulfillment indicators was 83.33. Meanwhile, referring to the 2016-2021 RPJMD document, the achievement of KLA implementation is 100.40% of the RMD target. Even though the achievement is 100 percent, in reality Sumbawa Regency has not been able to get the

KLA predicate either Nindya, Madya or Pratama. Therefore, in order to accelerate the implementation of KLA in accordance with Presidential Regulation Number 25 of 2021, it is necessary to implement KLA with a combination of top down and bottom up mixed methods.

The Bottom up method in KLA starts with developing Child Friendly Villages/Kelurahan (DEKELANA). The development of DEKELANA is very important considering that the Village/Kelurahan is the spearhead of the government which is in direct contact with the community. The fulfillment of children's rights starting from the smallest institution, namely the family, can be monitored and controlled properly. With the realization of child-friendly villages/kelurahan, it will contribute to the realization of child-friendly districts/cities, child-friendly provinces, child-friendly Indonesia, and subsequently becoming a child-friendly world. On the other hand, the commitment to realizing DEKELANA has in fact contributed to accelerating the implementation of the Village SDGs. In which several indicators regarding the fulfillment of the rights of children and women as required by the Village SDGs can be achieved through DEKELANA.

Poto Village is the first and only village in Sumbawa Regency that has initiated a Child Friendly Village. This initiation was accompanied by the Samawa Center and the Sumbawa Regency Bappeda. In an effort to make Poto Village a Child Friendly Village, various strategies have been carried out. For this reason, this participatory action research aims to find out how to (1) design the implementation and initiation process of child-friendly villages in Poto Village, Sumbawa Regency; (2) what are the challenges and obstacles in the process of initiating child-friendly villages.

²Hamid Patilima. Child Friendly City. 2017. Accessed at <https://www.kla.id/kota-layak-anak/>

II. THEORITICAL FRAMEWORK AND METHODOLOGI

Right is fundamental to community development. As Ife (2006) stated that human rights are a vital component of community development, so the basic principles emphasize human rights, enable people to realize and implement their human rights, and are protected from human rights violations. As for the relationship between human rights and society; (a) rights and responsibilities go hand in hand, (b) when having rights, there is an obligation to support, encourage and exercise those rights which require participation, (c) in the implementation process requires working with those who are marginalized, whose voices are not heard. so that claims to rights can be heard and dealt with, thereby shaping the nature of community development, (d) community development requires rights because it provides a moral scaffolding that enables society's tasks to work. Therefore, in the context of fulfilling children's rights in child-friendly villages, the rights approach in community development is important to be used as a basis. Thus, the acceleration of implementation can be encouraged by all elements in society with a full level of participation.

In addition to the rights-based approach, there are three main approaches that are used as models in the development of Child Friendly Villages, which consist of: (a) bottom-up, (b) top-down, (c) combination. Bottom-up approach starting from individual/family initiatives and then developing at the RT/RW level that is appropriate for children. Community initiatives in an RT/RW area can be developed into other RT/RW which eventually becomes a community movement of a village/kelurahan to realize a "Child-friendly Village/Kelurahan". From these village/kelurahan community movements, it can encourage the realization of a "Child-friendly Sub-district". Finally,

a collection of child-friendly sub-districts can be the initiative of the district/city concerned to realize it.

Top-down approach starting from the government at the national level by facilitating, socializing, advocating or it can be in the form of forming a "sample" in several provinces or in all provinces. Furthermore, these provinces provide facilitation and socialization or can also choose a "sample" in several districts/cities or in all districts/cities to realize KLA development, so that KLA development initiatives will be realized at the district/city level.

Combination Approach between the bottom-up and top-down approaches is the ideal approach in accelerating the realization of KLA in the districts/cities. A community movement to create a decent environment for children starting at the family level, or RT/RW, or at the village/kelurahan or sub-district level would be ideal if combined with a strong commitment from the Provincial and Regency/City Governments. In addition, each region can also take the initiative to prepare KLA development in its area.

This research is a qualitative research, using a Participatory Action Research (PAR) approach. Based on the writings of the Institute of Development Studies, Participatory Action Research (PAR) is an inquiry approach that has been used since the 1940s. It involves researchers and participants working together to understand a problem situation and change it for the better. There are many definitions of approach, which share some elements in common. PAR focuses on social change that promotes democracy and challenges inequality; context specific, often targeted at the needs of specific groups; is an iterative cycle of research, action and reflection; and often seek to 'liberate'

This research was conducted from July to October 2021, and took place in Poto Village, Moyo Hilir

District, Sumbawa Regency, NTB. The data used were primary and secondary, with data collection techniques, namely participatory observation, in-depth interviews and FGDs.

Data analysis, Creswell (2010) in qualitative research, namely: (1) preparing data for analysis, (2) building a general sense of the information obtained, (3) coding data, (4) categorizing data, (5) description and these themes will be restated in the narrative/qualitative report, (6) interpreting or interpreting the data.

III.RESULTS AND DISCUSSION

A. General Condition of Poto Village

Poto village is located in the western part of Sumbawa sub-district, at an altitude of 225 meters above sea level. This village has an area of 1,367.00 Ha/m² with lowland contours with a total slope of 15-40 degrees. Land use in general consists of settlements covering an area of 40.00 Ha/m², rice fields 670.00 Ha/m² (using irrigation technical 100.00 Ha/m² and rain-fed 20.00 Ha/m²), plantations 448.00 Ha/ m², graves 50.40 Ha/m², offices 12.00 Ha/m², public infrastructure 128.60 Ha/m², yard 28.00 Ha/m², fields or fields 470 Ha/m². Administratively, Poto Village is bordered by Sebewe Village in the north, then in the east by Berare Village, in the south by Moyo Village and in the west by Seketeng Village.

Poto village has a population of 2652 people, consisting of 1,219 male residents and 1,343 female residents. There were 697 children aged 0-18 years, consisting of 357 boys and 340 girls. Meanwhile, there are 473 school-age children 7-18 years old, 235 boys and 238 girls. The majority of people are farmers, as many as 1,223 people and livestock as many as 265 people. There are 15 migrant workers, 66 civil servants, 26 traveling merchants, 1 mechanic, 9 private midwives, 1 POLRI, 19 retired civil servants/TNI/POLRI, 4 trained village

shamans, private lecturers 3 people, and 19 employees of private companies.

The population of Poto Village The majority graduated from elementary school with a total of 466 people, graduated from junior high school as many as 220 people, completed high school as many as 284 people, graduated from Diploma as many as 46 people and graduated from Bachelors and Masters as many as 105 people. In addition to formal education, Poto village is also supported by non-formal education, such as the Permata Art Studio, the Cinde Bulaeng Art Studio and the Matano Art Studio.

There are trained maternity workers, midwives, and nurses. The number of health workers in Poto Village in 2021 is 7 people. Health service infrastructure in Poto Village consists of sub-health centers, polyclinics/medicine centers, posyandu, and maternity homes. Malnutrition status of toddlers in Poto Village can be said to be in the safe zone because the number of well-nourished toddlers is 189 toddlers out of 200 toddlers. Meanwhile, the other 11 toddlers were categorized as undernourished. The number of people with mental and physical disabilities recorded in Poto Village are 20 people with physical disabilities and 6 people with mental disabilities.

B. DLA Preparation Design

Child-friendly villages are a form of bottom-up approach in implementing Child-friendly Districts. The stages of implementing Child Friendly Villages have been regulated and compiled by the Ministry of PPA through the DLA development module. In the DLA development guide, there are several stages that must be carried out starting from: a) preparation, b) planning, and c) implementation.

In the context of DLA initiation in Poto Village, the stages developed in the DLA module are not fully adopted in the field. This is due to several factors: The village government and the local community have never heard of or received any socialization about child-friendly districts, so DLA is considered a new issue.

The Village Government and local communities need time to understand and form a common understanding of the importance of Child Friendly Villages. The lack of a common understanding of DLA has resulted in the identification of resources or potential supporters of DLA not yet possible to implement. The selection of areas (hamlets) that serve as pilot initiations cannot be carried out, considering that Poto Village has seven hamlets with different typologies. It is feared that social jealousy will arise if the DLA pilot is carried out in one of the hamlets. There are limited time and funding sources in the DLA initiation process. Given that DLA is not included in the village government's work plan, there is no budget available to support DLA implementation.

These influential factors led to a re-design of the DLA initiation preparation plan in Poto Village. This re-design was carried out by considering: (a) the typology and characteristics of the area, (b) the opportunity or time available to the village government and local communities, (c) the capacity needed in developing DLA from both village officials and local communities, and (d) commitment from the local community. all parties in the village.

DLA is a new issue for village officials and the people of Poto Village. Thus, the DLA preparation stage is one of the basic and most important things, considering that at this stage the DLA concept and indicators are constructed in the understanding of all parties. There are four main agendas in the preparation stage for the Poto Village DLA Initiation;

- Coordination, becomes the gateway before entering the DLA process. In the coordination process, it begins with informing the top leadership/village heads regarding policies/rules from the central to regional levels regarding the urgency of implementing DLA. At the next meeting, the village head and staff were introduced to the concepts and indicators that must be met to achieve DLA. This process aims to introduce and create mutual understanding with village heads, BPD members, hamlet heads, to the RT/RW.
- Assessment, carried out when there is a mutual understanding and need to initiate DLA incision. In this process, identification of resources that can support DLA is carried out, including: initial information on educational facilities, health, art studios, posyandu cadres, child protection cadres, children's organizations or associations, as well as values or norms related to the protection and fulfillment of children's rights. Identification is carried out with the village head and BPD members.
- Identification of Stakeholders, aims to identify parties outside the village government and local communities, who are related to DLA issues and have the capacity to support implementation. The stakeholders that have been identified and coordinated are: Bappeda, P2KBP3A Service, Diskominfotik and Sandi, Moyo Hilir District Government, Faculty of Communication Sciences and Faculty of Psychology, University of Technology Sumbawa.
- Preparation for the formation of the DLA Task Force (GT) is the final stage in the DLA preparation process. The formation of this GT can only be done if the village government, BPD, Kadus, and RT/RW already have a common understanding and agree to initiate DLA. GT is the spearhead in the implementation of DLA, because it plays an

active role and socializes, facilitates, and bridges all parties involved or actively involved with DLA. On this basis, GT members must come from representatives of all elements in society, such as: the head of the hamlet, the head of the posyandu, the head of the PKK village, teachers, youth leaders, community leaders and other elements deemed important.

In every agenda, of course, there are obstacles and challenges. This also happened in the Poto Village DLA planning, where internal challenges & obstacles caused the process of creating a common understanding to take longer than the set target time. The obstacles and challenges are as follows:

- Lack of active participation from the village government, Kadus, RT/RW, and BPD when the introduction of the DLA concept was carried out. The presence of village officials is very important, to bridge information and to help in the initial socialization process to the community. considering that DLA is a new issue and not yet familiar to the local community. This then has implications for the lack of parties who know and understand about DLA, so that socialization to the Poto Village community can be said to be not running.
- The village government has also not taken the initiative to disseminate DLA information through its communication channels, such as village social media.
- The village government and its staff have limited time, considering that DLA is not a priority agenda for the village. So that DLA activities are carried out when the village government has free time.
- Lack of active participation of village government when coordinating with stakeholders who can support the implementation of DLA

- The timing of the DLA initiation coincides with the implementation of socio-cultural activities in the community

C. Child Friendly Village Planning Design in Poto Village

The formation of the DLA Task Force is a sign that Poto Village is ready and committed to planning and implementing children's rights. The Task Force was confirmed through a Village Head Decree. The inauguration process was attended by various parties, namely from the Moyo Hilir district government, the Poto village government, community leaders, representatives of the Moyo Hilir health center, and other elements deemed important by the village government.

TABLE I
STAGES OF DLA PLANNING

Agenda	Tujuan	Output	Temuan
Pengukuhan GT DLA dan Penyamaan Persepsi	Pemaparan kondisi eksisting dan indikator KLA	Terbentuknya GT KLA	Tidak semua GTA mampu berkomitmen
Penyusunan rencana aksi	Sosialisasi peran klaster dan penyusunan skenario	GTA memahami peran/fungsi dan tanggung jawab	GTA belum sepenuhnya memahami tanggung jawab dan peran

Dissemination and equalization of perceptions were also carried out at the time of the inauguration of the Task Force so that the parties present gained a comprehensive understanding of Child Friendly Villages, both from the indicators, potential supporters, to the existing condition of Poto Village which allows for the implementation of DLA.

The task force that has been confirmed is divided into 5 clusters, according to the KLA cluster. Referring to the results of the DLA evaluation conducted by the Sumbawa Regency P2KBP3A Office, only 4 clusters of children's rights were fulfilled starting from the village level. However, considering the high number of cases of violence against children in Sumbawa Regency, the Task Force feels it is very important to prepare a special protection scenario at the village level.

A. Preparation and Implementation of Child Friendly Villages in Poto Village

The implementation of children's rights to realize DLA begins with the preparation of a Village Action Plan (RAD) by the Task Force. In the process of preparing this RAD, it was carried out by means of focus group discussions based on clusters, in which each cluster was accompanied by an external facilitator (Samawa Center). In the cluster discussion, each person is asked to write down the current condition of each indicator, identify potential supports, and propose an implementation plan.

Focus group discussions in the preparation of the RAD were conducted 3 times in each cluster. There are 14 indicators that will be compiled by RAD in the initiation of DLA in Poto Village. The 14 indicators were chosen with various considerations, including the availability of time, the opportunity to be formed/achieved, the availability of tools/materials, and the capacity of the GT. After a 10-week process, some of the achievements of the compiled RAD can be implemented, as presented in the following table

Klaster	Indikator	Capaian
Kelembagaan	GT DLA Perdes Perlindungan anak	Terbentuk GT DLA melalui SK Kades Inisiatif untuk

		penyusunan Predes
I	Forum Anak Anak berperan 2 P Profil anak	Terbentuk Forum Anak melalui SK Kedes Pendampingan FA untuk menuju 2P Data Profil Anak
II	Data perkawinan Kelompok konsultasi keluarga	Terbentuk nya K 3 yang terlatih
III	Data gizi buruk Kawasan bebas asap rokok	Tidak ada gizi buruk Rencana perdes KBAR
IV	Data pendidikan formal ILA Paud HI RBA	Pendataan sarpras pendidikan ILA disekolah Belum terdapat paud HI Recana RBA di gedung seni
V	Kekerasan terhadap anak	Adanya isu-isu perlindungan anak yang akan diatur

		dalam perdes
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B. Challenges of Implementing Child Friendly Village

The implementation of children's rights in Poto Village certainly has its own challenges and opportunities. Moreover, the DLA issue is still something that is considered new and is not used to being questioned or discussed in the local community. The challenges and opportunities in the implementation of DLA in Poto Village are summarized in the following table. All hypertext links and section bookmarks will be removed from papers during the processing of papers for publication. If you need to refer to an Internet email address or URL in your paper, you must type out the address or URL fully in Regular font.

Klaster	Indikator	tantangan	peluang
KLB G	GT DLA Perdes Perlindungan anak	Komitmen GT Tidak ada tenaga terlatih dalam penyusunan perdes	Tingginya kesadaran perlindungan anak dan pemenuhan hak anak, serta tersedia SDM potensial desa
I	Forum Anak Anak berperan 2 P Profil anak	Sulit menemukan anak yang mau terlibat, dan tidak semua data anak tersedia	Adanya dukungan dari orang tua dan lingkungan

II	Data perkawinan Kelompok konsultasi keluarga	Sulit mendapatkan data KUA, serta masyarakat belum mengenal lembaga konsultasi keluarga	Memasih memegang teguh nilai-nilai lokal. GT bersemangat menjadi konselor keluarga
III	Data gizi buruk Kawasan bebas asap rokok	Kurangnya informasi pendidikan non formal serta infrastruktur yang masih terbatas	Adanya dukungan pemdes dan masyarakat, serta antusiasme anak
IV	Data pendidikan formal ILA Paud HI RBA	Perlindungan anak dari sebagai bentuk kekerasan	Tingginya kesadaran masyarakat
V	Kekerasan terhadap anak		

IV. CONCLUSION

Referring to the Child Friendly Village Evaluation indicator at the P2KBP3A Office, there are 14 indicators for child-friendly villages. Of the 14 indicators, 4 indicators of child-friendly villages that have been successfully implemented are: (a) GT DLA, (b) Children's Forum, (c) Family and Peer Counselors, and (d) Children's nutritional status. In addition, 6 indicators are in the process with 60 percent progress consisting of: (a) village regulation on child protection, (b) involvement of children's forums, (c) marriage data, (d) ILA, (e) smoke-free public spaces, (f) child-

friendly playroom. Meanwhile, the 4 indicators that have not progressed consist of; (a) child profile, (b) child education data, (c) HI PAUD, and (d) PKA

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Cite this article as :

Fahrnunisa, Ayuning Atmasari, Lalu Ahmad Taubih, Apriadi, "Accelerate The Implementation of Village SDGs Through a Children-Worth Village", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 2, pp. 21-29, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST22915>
Journal URL : <https://ijsrst.com/IJSRST22915>

Geophysical Resistivity Survey (VES) for Selection of Artificial Recharge of Appropriate Artificial recharge for Augmentation of Ground Water Resources In Paithankheda Village, M. S. India

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ABSTRACT

In this study the data generated while conducting electrical resistivity surveys through Vertical Electrical Sounding (VES) at 22 sites in different location along with a available geological & hydro-geological information of Paithan Kheda village were analyzed. The objective are (i) to understand the nature and extent of aquifer (ii) to find out the location and thickness of unsaturated zones and (iii) to evaluate and extent of appropriate artificial recharge structures at suitable locations across the village.

Interpretation of the top sounding curves indicates presence of three to four subsurface geo-electric layers across the study area. The top soil layer has range of resistivity values from 2 to 30-ohm m & lithology comprise clay with kankar, lateritic sand. This is followed by the weathered and jointed Basalt layers with resistivity values 100 300-ohm m could be identified below the depth of 45m. At some places, doleritic dykes were also observed with resistivity values >300-ohms.

The interpretation of VES data when correlated with the available litholog data indicates a prominent water bearing zone between 30 and 45 mbgl. The underlying hard and compact Basalt has very little possibility of occurrence of groundwater. The top unsaturated and unconfined granular zone up to a depth of 30mts could therefore be easily recharged artificially through rainwater harvesting measures thereby augmenting the groundwater resources of the existing aquifers. Site specific artificial recharge measures from amongst counter banding, gully plugs, check dams, percolation tank. Recharge shafts subsurface dikes have been identified across the village for effective recharge of the aquifer especially in its north eastern & southern block regions. Considering the deteriorating groundwater situation, these initiatives would be significant in catering the needs of future generations.

Keywords : rainwater harvesting. Artificial recharge (AR) Vertical Electrical Sounding (VES) well sitting Teremeter SAS300, litholog Morar shales Schlumberger Configuration.

Article Info

Volume 9, Issue 1

Page Number : 30-34

Publication Issue

January-February-2022

Article History

Accepted : 01 Jan 2022

Published : 09 Jan 2022

I. INTRODUCTION

1.1 Electrical resistivity Method

Electrical resistivity methods are of foremost importance in groundwater exploration, in water quality evaluation and groundwater pollution studies because the resistivity of rock is very sensitive to its water content. Although several methods can be enumerated under the geophysical methods. The electrical resistivity method has been used in the present investigation. Some of the common sedimentary rocks being more porous possess higher water content; hence they normally have a lower resistivity values. Wet and clay soils normally have a lower resistivity than sandy soils. Resistivity of each rock depends on certain characters such as porosity, degree of water saturation and concentration of dissolved salts (Kearey and Brooks 1988).

1.2 Geophysical investigations

Geophysical investigations were carried out by electrical resistivity methods, using the instrument named ABEM Terrameter –SAS 300. The methods for investigation are vertical electrical sounding (VES) by Schlumberger configuration. By way of conducting such soundings at different litho layers beneath the ground were probed to understand the thickness and apparent resistivity of each litho-layer and its capacity to bear water.

Appropriate no of soundings is done at the project location for getting litho logical characteristics variation with depth.

1.3 Analysis of VES data

The obtained readings in the field are plotted in the bi-logarithmic graph sheet and geoelectric field curve were interpreted and correlated with standard two layers master curves (Orellana and Mooney) by partial curve matching techniques to ascertain the water bearing strata beneath the earth. The same was also cross-checked with computer software IPI2WIN.

1.4 Suggestion and recommendation

Finally, the recommendation and suggestion are made on based on the hydrological investigation of the area and subsequent geophysical data interpretation which clearly indicates the layer resistivity p_1 , p_2 , p_3 , & p_4 and its thickness.

1.5 Geophysical Survey (VES) Conducted for the study

For the study, Vertical electrical soundings (VES) surveys had been carried out at 19 locations for structure I and 4 locations for structure II using Schlumberger electrical resistivity techniques to ascertain the nature of bedrock below the soil cover, and to delineate the layer thickness of different formations and resistivity contrast of different layers. The obtained data from the field were analyzed and interpreted to ascertain the water bearing strata beneath the earth. The analyzed data parameters from the different selected locations are given Table-2.

Table 2: Analyzed Data parameter

Apparent				Thickness (m)			
p1	p2	p3	p4	h1	h2	h3	h4
1. Mr Bhau Rotge land at Paithankheda (Near Kesapuri village) Paithan Kheda Block (Nearly 22Km from Aurangabad –Shegoan Road)							

13.1	40	1.33	452	1.01	2.18	2.91	-
2. Janabai Krmarkar Land at Paithenkhedha (Nearly 22Km from Aurangabad –Shegoan Road)							
22.54	2.623	16.24	28.59	1.08	2.79	6.04	-
3. Ashokh Ghundre land at Paithankhedha (Along the Nala)							

Electrical parameters hydrological significance

Sr.No.	Resistivity (Ohm-m)	Thickness (M)	Infered Lithology	Hydrological Significance
1	20-30	2-40	predominantly clay/clay with kankar Blackcotton soil	Generally, lies in unsaturated zone aquifer at good upper leve, & poor at depth
2	30-100	5-50	Highly wheathered Basalt	First Principal aquifer of the aera
3	100-300	0-48	Highly weathered & fractured Basalt	Second Principal aquifer of the aera
4	>300	Bottom Layer	Hard and Compect Basalt	Very poor aquifer, acts as brrier for grounwater movement

Where,

ρ_a Apparent Resistivity of each litho layer in ohm-m

$h_1 - h_4$ Thickness of each layer in m from the survey data analysis, majorly K and KHK types of curves were found in the area indicating the presence of multilayered inhomogeneous formation (Refer Table). Top

(1) In addition to new bore wells, defunct bore wells and dry wells in the surrounding area could be used for rainwater Collection.

(2) Rooftop and paved rainwater harvesting should be Compulsorily (legislation) done for large department / Institutional buildings of the Village. i.e Grampanchyat Building ZP school Buildings & Buildings like Samaj Mandirs etc.

(3) The rainwater collected should be put to desiltation and Filtration prior to transporting down the earth through existing or newly

constructed later harvesting structures like dug wells, Bore wells, shafts, trenches etc.

(4) A detailed water management plan for the entire Village is

Required to be prepared for utilizing the maximum quantity of The available surface (rainwater) resource which is currently Going to waste. From the carried studies the broad description of the groundwater development and management plan Envisaged for Paithankhedha is as under:

II. RESULTS AND DISCUSSION

The analyses of sounding curves obtained from Geophysical survey data over the areas have brought out three To four subsurface geo-electric patterns. The top layer (depth Range- 2 to 20 m) consists predominantly of clay / clay with

kankar/ Black cotton Soil followed in respective order by Highly weathered & jointed Basalt (depth range- 20-55 m) and Hard & compact Basalt (depth below 55 m) which at depth (>300) Major parts of the investigated area are potential zones for ground water exploration and exploitation purposes and for long term sustainability these areas have sufficient scope for artificial recharge predominantly through the construction various appropriate water harvesting structures.

III. CONCLUSION AND RECOMMENDATIONS

As discussed above, it is concluded that field geo-electrical Survey is very rapid and reliable method to explore an area for finding out the prospect of groundwater occurrence. It helps to delineate the area precious for groundwater Development and management. Based on the above field Survey and subsurface aquifer conditions, most of the areas need artificial recharge of the aquifers by adopting appropriate measures.

Following suggestions or recommendations have been proposed for groundwater development in the city. A well-planned recharge scheme for the entire city should developed for the construction of various artificial recharge structures such as injection wells, recharge shafts, storage Ponds and tanks etc. at suitable locations.

IV. GROUNDWATER DEVELOPMENT AND MANAGEMENT PLAN

The number of water harvesting structures should be distributed dividing balance resources equally for dug wells and tube wells and taking consideration of 100 % development of net

groundwater availability in the block. Therefore, it is suggested that a scientific study at every five years' period is a must to check the impact of groundwater development on groundwater regime and accordingly number of structures should be modified. By considering these points, there are many ways to adopt this practice but the structures which are feasible in the study area & almost across Paithankheda are: contour bundings, gully plugs, check dam, percolation tank, recharge shafts & subsurface dykes. Broadly, the area for artificial recharge have to be divided into two categories i.e. overexploited and safe to semi-critical area where long term trends of groundwater level is declining. It is observed that gully plugs and contour bunds may be constructed on the upper reaches of streams. Percolation Tanks can be considered in areas which provide sufficient Spread. In locations where streams are of 5-6 m wide and have sufficient depth, a series of small check dams in the stream course may fulfill the objective of conservation of Groundwater. During rainy season, it should be mandated that the farmers use bunds in the area for storing the water in their fields. In areas where clay beds that prevent percolation of water to the unsaturated zone in the weathered Basalt and Highly Fractured Jointed Basalt, recharge shaft may prove good structures for artificial recharge of groundwater in the alluvial flat terrain areas, due to very poor drainage density the feasibility of percolation tanks is almost remote. In these areas where the phreatic aquifer has gone dried and the clay beds do not allow percolating the water in deeper level, recharge shaft is only means to be adopted to augment the groundwater.

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Cite this article as :

N. V. Sharma, I. S. Shaikh, "Geophysical Resistivity Survey (VES) for Selection of Artificial Recharge of Appropriate Artificial recharge for Augmentation of Ground Water Resources In Paithankheda Village, M. S. India", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 2, pp. 30-34, January-February 2022. Available at doi: <https://doi.org/10.32628/IJSRST22917>
Journal URL : <https://ijsrst.com/IJSRST22917>

Recent Advancements in Intrusion Detection in Software Defined Network Security

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ABSTRACT

In recent years, Software Defined Networking (SDN) has enabled total control over the network's data flow. SDN acts as a centralised point of administration for data and traffic management. Due to the fact that SDN is an open source software, it is more vulnerable to security concerns. Security policies must also be adhered to, since this would expose the controller to the greatest attacks. DDOS and DOS assaults are more prevalent in SDN controllers. DDOS is a damaging assault that disrupts the usual flow of communication and initiates an overflow of flooded packets, thereby shutting down the system. Machine Learning approaches assist in identifying the network's hidden and unexpected patterns, hence aiding in the analysis of the network's flow. All classified and unclassified approaches can assist in detecting hostile flows depending on specific factors such as packet flow, time length, precision, and accuracy rate. To identify DDOS assaults, researchers employed Bayesian Networks, Wavelets, Support Vector Machines, and KNN. According to the review, KNN offers superior results due to its increased accuracy and reduced false positive rate for detection. We explore the various strategies used in DDoS detection and examine new improvements in intrusion detection in software defined networks in this article.

Keywords : Software Defined Networking, Bayesian Networks, Wavelets, Support Vector Machines, DDoS

Article Info

Volume 9, Issue 1

Page Number : 35-42

Publication Issue

January-February-2022

Article History

Accepted : 01 Jan 2022

Published : 04 Jan 2022

I. INTRODUCTION

Intrusion detection and prevention systems (IDPS) are critical, particularly for enterprise networks. They

enable the defence of the internal network by monitoring network traffic, alerting the administrator when suspicious traffic is detected, and filtering or redirecting suspicious traffic as necessary. Fig. 1

depicts a straightforward network-based IDPS system. A network-based IDPS's typical components are an IDPS sensor, an

IDPS management server, and an IDPS console [1]. The IDPS sensor is in charge of monitoring and analysing network traffic. The management server is a centralised device that collects and handles data from sensors. A console is an application that acts as an interface for users and administrators of the IDPS. Additionally, the boundary switch must replicate each packet to the IDPS sensor. This may be accomplished by setting the standard switch's spanning port. This port has visibility into all network traffic that passes through the switch. The introduction of Software-Defined Networks (SDN)

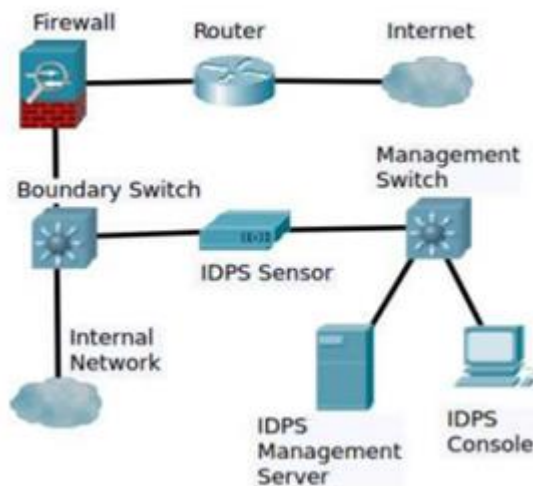


Figure 1: A Simple Network-Based IDPS System

[2] enables the implementation of intrusion detection systems.

SDN has garnered considerable research attention in recent years because to its capacity to solve the lack of programmability in traditional network architectures and to allow easier and quicker network innovation. SDN decouples the data plane from the control plane and enables networking applications to be implemented on top. As seen in Figure 2, the SDN architecture is composed of three levels.

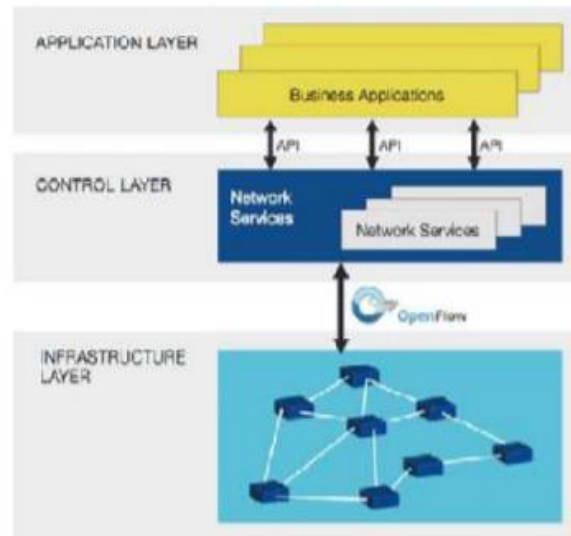


Figure 2: Architecture of a SDN

The infrastructure layer, also known as the data plane, is the most fundamental layer, and it is comprised of the forwarding network elements. Its primary functions include data transmission, local information monitoring, and the collection of statistical data. The control layer, also known as the control plane, is located in the centre of the hierarchy. It is in charge of programming and overseeing the operation of the forwarding plane. This layer, which is located on top of the architecture, comprises network-oriented applications.

The controller provides an abstracted and global view of the forwarding plane to the application layer, which may be used to make decisions. It then makes use of this information to offer suitable instructions to the control layer or to operate the network services. Follows: Section II describes the related work, Section III describes about existing in intrusion detection methods. Section IV talks about recent advancements in intrusion detection methods. Section V gives the conclusion.

II. SOFTWARE-DEFINED NETWORKS AND RELATED WORK

The networking paradigm of Software-Defined Networks (SDN) separates the control and forward planes [2]. The devices provide data flow switching capabilities, while the control plane is separated to create a new entity called the network controller. At the bottom of the stack is the forward plane, which contains hardware devices such as switches, routers, firewalls, and intrusion detection systems (IDS). The devices lack the necessary software intelligence to populate the forwarding tables. The network logic was transferred separately to the controller layer. The controller abstracts the devices and offers the resources necessary for low-level forwarding device programming. The controller, also known as the Network Operating System (NOS), delivers network state and topology information. Additionally, the controller communicates with the apps via northern and southbound APIs. The southbound API, on the other hand, is used to facilitate communication between the controller and forwarding devices. OpenFlow serves as the de facto southbound protocol for SDN [3]. On top of the SDN model stack is the application plane. Network programmability is a critical capability of the SDN paradigm, since it enables applications on the top plane to access physical devices via the controller. Programmability enables and accelerates innovation across a vast array of network applications, including monitoring, traffic engineering, security, and cloud computing. The SDN architecture is fundamentally centralised. A controller is a centralised entity that gives a comprehensive view of the whole network; it simplifies the process of managing and enforcing regulations. Additionally, it reduces the number of errors associated with creating and installing network policies. Centralization improves network resilience and interoperability; for example, many devices from disparate industrial sectors may be merged and abstracted into a single network. In typical

networking systems, security risks are a significant problem. The attacks are becoming more sophisticated in SDN networks. Numerous advantages of the paradigm are coupled with new risks that were not achievable in older networks. For the southbound Open Flow protocol, a security investigation revealed a variety of threats developed from the SDN standard protocol, such as denial of service attacks on flow tables and on the devices' control channels between the devices and controller (DoS). Conflicts between application privileges cascade to flow rules. The control channel between the controller and the switch is established using TCP, with the option of encrypting the channel using the Transport Layer Security (TLS) protocol. Without encryption, communication between the controller and forwarding devices is vulnerable to man-in-the-middle attacks. Kloti et al. examined the OF protocol's security [4]. According to the study, denial of service attacks have posed a danger to the flow tables and communication channels by flooding those components with OpenFlow rules and requests. Additionally, by installing rules from untrusted sources, tampering attacks have mostly targeted the flow tables on the devices. Kreutz et al. found that there are seven potential dangers to SDN [5]. Three dangers are inextricably tied to the controller:

- Attacks on the controller's communications with the data plane devices.
- Vulnerabilities in the controller
- Untrusted programmes were used to launch attacks on the controller

Intrusion Detection Systems (IDS) are software or hardware-based systems that monitor network traffic for potential security threats. The standard intrusion detection technique consists of three phases: gathering network data, processing it, and finally initiating a correct reaction if a danger is discovered. There are three methods for analysing collected traffic: signature-based analysis, anomaly detection

analysis, and specification-based analysis. To begin, signature-based, in which a system maintains a database of predetermined violation signatures and compares them to network activity signatures. Secondly, anomaly or outlier analysis is concerned with the system's ability to distinguish between normal and aberrant patterns. Normal activities are indicated for the system in a baseline profile that the system produces throughout the learning phase. Thirdly, stateful protocol analysis; in this technique, a preset pattern of protocol behaviour is constructed, network activity is compared to the expected behaviour described by protocols, and an alarm is raised in the event of profile violation. To optimise IDP performance, a mix of strategies is applied [6]. The signature-based technique has a key limitation in that it cannot identify new threats, whereas anomaly detection has a greater risk of false alarms. A mixed approach is used in the majority of commercial deployments [7]. Anomalies, sometimes referred to as outliers, are patterns that are unexpected. We presume that invasive or malicious activity is infrequent in the context of networking [8].

III. III. EXISTING INTRUSION DETECTION METHODS

Intrusion Detection Systems (IDS) continuously monitor the network for odd behaviour in order to detect whether or not it has been hacked. There is a difference between a host-based and a network-based identification system. A host-based intrusion detection system is a software application that operates on a single computer and analyses its own traffic for signs of assault. A network-based intrusion detection system is installed on a separate workstation that monitors the whole network's activities [3]. Intrusions can be detected in two ways: by detecting misuse and by detecting anomalous intrusions. Intrusion detection by misuse, or knowledge-based intrusion detection, is the most prevalent strategy, which compares network traffic to a database of

known assaults [4]. When an event fits the signature of an attack stored in the database, an alarm is triggered. Anomaly-based intrusion detection examines network traffic for any divergence from the system's usual or anticipated behaviour [3]. It then uses that knowledge to learn and adapt. Among the benefits of misuse intrusion detection is its precision and low false positive rate. When an intrusion detection system misinterprets regular communication as an attack, this is referred to as a false positive. The drawback of misuse intrusion detection is the ongoing maintenance required to keep the database current. The high rate of false positives is the system's primary downside. This is due to its capacity for change and adaptation throughout time. However, one of its advantages is its capacity to "identify efforts to exploit novel and unknown weaknesses," potentially resulting in the discovery of new attacks [4]. Numerous strategies are used to process the data that arrives the Intrusion Detection System. The following sections describe many of the most frequently used methodologies, including the neural network methodology employed in this study:

i. Expert Systems - data is compared against an audit trail based on a previously determined set of attack rules. Similar to expert systems, signature analysis converts the "semantic description of an assault into the proper audit trail format" [5]. This is a technique that is frequently employed in commercial systems such as Stalker, Real Security, and Cisco IDS.

ii. Colored Petri Nets - Using expert knowledge bases, Colored Petri Nets provides graphical representations of assaults. Statistical Analysis - the data's behaviour through time is compared to a variety of factors. These variables include, but are not limited to, user logon, storage space, RAM, and CPU utilisation.

iii. Data Mining - excels at obtaining "unknown but possibly relevant data from massive data repositories" [5]. Neural Networks — a learning method is used to compare the input and output vectors. For intrusion detection, multiple neural network-based techniques were used. Jake Ryan, Meng-Jang Lin, and

Risto Miikkilaine of The University of Texas at Austin demonstrated that their approach was 96 percent accurate in detecting unexpected network activity [12]. Another experiment led by Griffin University's Robert Birkely achieved a classification rate of 100% for normal, 92% for known attacks, and 80% for unknown assaults [13].

Additionally, Kohonen's Self-Organizing Map was employed to identify intrusions. In contrast to backpropagation, self-organising maps (SOM) are unsupervised learning networks with unknown outputs. Experiments with SOMs have also demonstrated a high degree of effectiveness in classifying regular traffic from harmful traffic. Within a distance of zero to three, Brandon Rhodes, James Mahaffey, and James Cannady were able to classify all regular traffic. Whereas assault sessions were categorised at a distance of eighty to six hundred thirty - suggesting a significant deviation from the usual [14].

IV. RECENT ADVANCEMENTS

A FLEXIBLE NETWORK-BASED INTRUSION DETECTION SYSTEM

With the ability of centralization in SDN environment, the problem of IDS will be easily overcome. The general architecture is given in Fig 4.

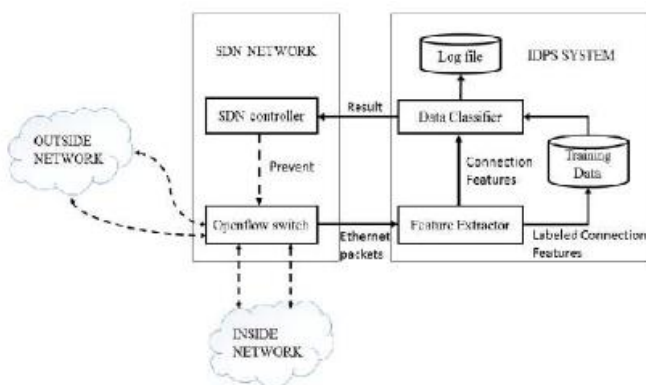


Figure 3 : IDS based on SDN Architecture

i. SDN controller: An OpenFlow controller is a software-defined networking (SDN) programme that controls flow control in an SDN context. The OpenFlow protocol is used to control SDN controllers. The SDN controller serves as the network's operating system (OS). The controller is the point of contact for all communications between applications and devices. The Open-Flow protocol establishes a connection between controller software and network devices, allowing server software to instruct switches on where to transmit packets. The controller configures network devices and determines the optimal routing for application traffic using the OpenFlow protocol.

ii. OpenFlow switch: OpenFlow is a protocol that enables the programming of the flow table in various switches and routers. Three components comprise an OpenFlow switch: a Flow Table, a Secure Channel, and the OpenFlow Protocol. One of the advantages of Openflow switches is their capacity to duplicate packets for the purpose of inspection. Additionally, the Openflow option functions as a firewall, preventing several assaults.

iii. Feature Extractor: Choosing an appropriate collection of features is difficult owing to the diversity of protocols present at the network layer and the number of features collected from each protocol. The current state of network intrusion detection research does not provide a comprehensive feature set capable of detecting all network-level intrusions [8], and our article focuses on a specific class of intrusions in terms of detection scope, DOS, and Probe. As a result, some elements are taken from the header dependent on the TCP connection. Additionally, depending on the mode selected, all extracted features are transmitted to the training module; alternatively, features are utilised to check for normal or bad connections.

iv. Data Classifier: Using machine learning, a classifier determines if this is an assault or not. Numerous models, such as decision trees and support vector machines, can be implemented. The classifier is trained using TCP and UDP flooding and then put to

the test using a real-world DDoS flooding assault. If the classifier detects any malicious traffic, the IDS instantly alerts the SDN controller.

v. Log Module: This module is capable of logging assaults and generating data for the training process.

B. BLOCK CHAIN BASED INTRUSION DETECTION

i. SDN Controller on Blockchain

Specifically, the research of blockchain-based distributed SDN control plane for secure information updating between controllers is connected to our work. For example, the proposal 15 uses a permissioned blockchain to keep track of system updates and time stamps in each controller. Despite using SPBFT consensus to broadcast messages/requests, the work lacks a consensus process to add new participants and ignores controller insider assaults. Our technique, however, addresses these.

ii. Multiple SDN Controllers

Using several controllers with collaborative detection communication, we attempt to decentralise the SDN control plane in this study. An AS managing numerous controllers that straddle geographical domains, or a single domain with multiple controllers/firewalls providing various networking inbound points. Using this criteria, we assume no external attacks are threatening controller coordination communication, and we focus on insider attacks that compromise controller nodes and exploit communications.

iii. Risk Model

We can now develop the danger model that encourages us to guard against, based on our strategy employing blockchain-based controllers P2P network with collaborative detection. Decentralized and coordinated controllers are studied and addressed to solve the first challenge, which is against the availability of traditional centralized intelligence

utilising a single SDN controller. An (inside) attacker can tamper with the sent information if the collaborative defensive communication between controllers is not protected. In the joint defensive communication, we use blockchain to protect the transactions (carrying the detection information). We think no outside attacker may get such inside defence information because we assume our collaborative defence communication will not cross the network barrier. There is no confidentiality issue because only insiders should have access to the material, however we must register all insiders/participants. So we utilise permissioned block chain to regulate who may participate in the coordinated defence. Inside attackers that utilise real identities or enrolled as lawful users at the participant registration stage are considered compromised controllers. To overcome this issue, we propose the PBFT consensus protocol, where every transaction carrying defensive information (i.e. detection signature) must be certified by a quorum of other participants.

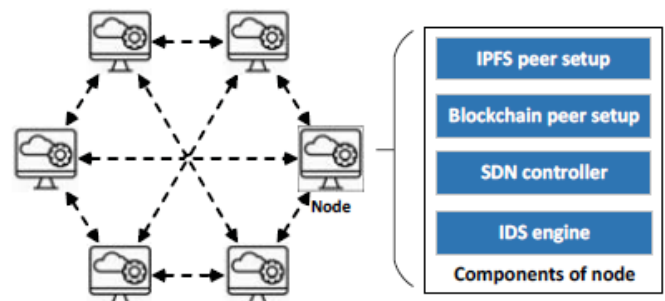


Figure 4 : Block chain-enabled SDN with four steps: Generate, Import, Fetch and Update

C. HYBRID APPROACH

According to the current discoveries, the architecture for identifying anomalous flows in an SDN context is based on the notion of transductive Confidence Machines. It is calculated using the detection point's confidence level and the probability p to determine whether the detection point can be recognised or not. To determine the detection point based on the p value, it is discovered that the higher the p value, the more probable the detection point exists on the controller.

This technique detects assaults by utilising a KNN algorithm strategy that takes strangeness and independence into account as parameters.

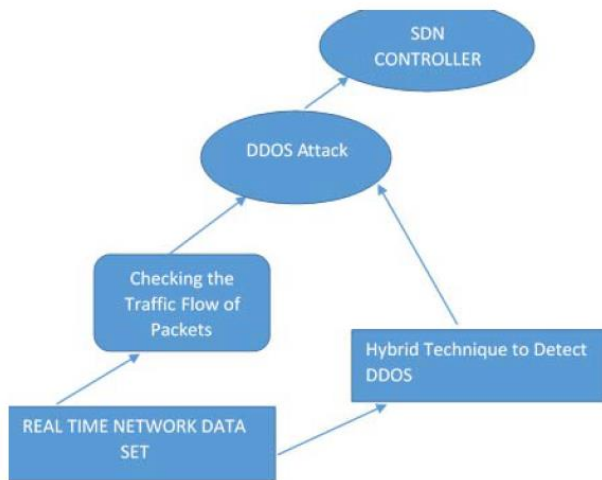


Figure 5 : Hybrid IDS

- i) Because the patterns of abnormal behaviour in traffic are so fast, a hybrid method enables detection and mitigation to occur more quickly and easily.
- ii) Because the KNN method computes the Euclidian distance and sorts the data sets based on that value, the detection rate is quite sluggish. After comprehending the outcome, a comparison of the result utilising an optimization strategy is performed.
- iii) Using noisy data and the duration of the packets' flow, the combined technique of SVM and ANN lengthens the testing period, leading in a greater accuracy rate and detection crucial.
- iv) By combining SVM and ANN approaches, the difficulty of finding an ideal technique for detection based on noisy data is increased as well.
- v) The experiments are conducted using the KDDCUP99 Datasets, which are also used to develop the algorithms. The data sets are a continuous real-time stream of data that significantly improves the realism of intrusion detection. This data collection contributes to the algorithm's increased detection precision.

V. CONCLUSION

SDN (software-defined networking) has become the industry standard for network management because it isolates the flow control logic from the data layer.

Specifically, in this paper, we investigated a block chain-enabled collaborative intrusion detection system in SDN networks, which provides trust management of the controllers as well as integrity of the detection signature sharing over the controllers in order to gain a coordinated defence and defend against insider attacks that are supported by n-compromise immunity. It was also examined in this research, as well as its limits and the advantages of utilising a hybrid strategy, which provides a greater accuracy rate while maintaining a lower precision value.

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Cite this article as :

Shridhar R Sharma, V. Mohan, B K Madhavi, S B Kishor, "Recent Advancements in Intrusion Detection in Software Defined Network Security", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 35-42, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST22913> Journal URL : <https://ijsrst.com/IJSRST22913>

Analysis of Hydro Magnetic Flow of Visco Elastic Fluid in a Vertical Channel

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ABSTRACT

In the present paper we have Analysis of hydro magnetic flow of visco elastic fluid. Hydro magnetic visco elastic fluid flow between two horizontal infinite parallel porous plates with time varying sinusoidal pressure gradient and magnetic field has been discussed in the present study. The visco elasticity in an effective approach to modeling the dissipative mechanism. Some interesting observations are low-frequency oscillating pressure gradient Prevents back flow, significant reduction in skin frictions is observed by embedding the channel in porous medium and magnetic field and elasticity decelerate the fluid flow and also in this paper a Theoretical Analysis is carried out of study the visco elastic effects on hydro magnetic heat & mass transfer in a vertical channel. The two vertical plates are in porous medium and non-uniform wall temperatures. A magnetic field of uniform strength is applied in the direction perpendicular to the plates.

The visco elastic fluid flow is characterized by second order fluid. The effects of different flow parameters on skin friction are analyzed and illustrated graphically.

Keywords : Visco Elastic, Skin-Frication, Heat & Mass Transfer Oscillatory Flow

Article Info

Volume 9, Issue 1

Page Number : 43-46

Publication Issue

January-February-2022

Article History

Accepted : 01 Jan 2022

Published : 20 Jan 2022

I. INTRODUCTION

Sugunamma et. al. [8] has analysed a fully developed free convective flow through a porous medium in a vertical channel using Brinkman's model taking into account of both viscous & Darcy dissipation using finite element method and some parameters of viscous flow e.g. velocity temperature & Nusselt numbers are calculated and the phenomenon of oscillatory flow along with heat and mass transfer of a conducting fluid has attracted the attention of many researchers due to its importance in many areas such as biological and industrial processes. Jain

Purushuttam & Singh [2] considered heat transfer in free convection flow of a viscous incompressible fluid through a vertical channel bounded by a naturally permeable material using Brinkman model & obtained important factors of fluid flow. Agarwal & Kishore [1] studied thermal mass diffusion of M.H.D. natural convection flow between infinite vertical moving & oscillating porous parallel plates, here we are interested in considering buoyancy effects of thermal & mass diffusion on elastic viscous fluids under magneto hydro dynamic effect confined between two vertical parallel plates moving in opposite direction. One plate is excluding oscillation

about a constant mean. Here we obtained terms of velocity, skin fraction etc.

In this study, an attempt has been made to extend the problem studied by Kumari et.al. [23] to the case of visco-elastic fluid characterized by second order fluid. The constitutive equation for the incompressible second-order fluid is of the form.

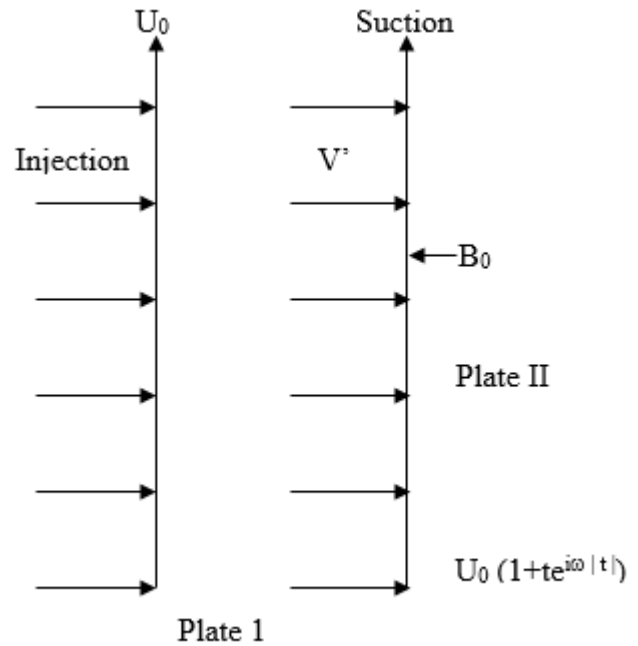
$$\sigma = -PI + \mu_1 A_1 + \mu_2 A_2 + \mu_3 (A_1)^2$$

Where, σ is the stress tensor. A_n ($n = 1, 2, 3$) are the Kinematics Rivlin - Ericlsen tensor; μ_1, μ_2, μ_3 are the material coefficients describing the visco-elasticity and cross viscosity respectively.

II. MATHEMATICAL FORMATION

Here we consider two Dimensional flows of an incompressible viscous fluid between two Porous parallel plate moving in opposites direction. Let X' axis chosen along an infinite flate plate moving vertically upwards & Y' axis normal to it, B_0 is

constant magnetic field in transverse direction. So that induced magnetic field is negligible.



III. MATHEMATICAL SOLUTION

The governing equations are as follows [1] & [6]:

$$3.1 \quad a) \frac{\partial u^l}{\partial t^l} + v^l \frac{\partial u^l}{\partial y^l} = g \beta^l (T^l - T^s) + g \beta^l (C^l - C^s) + \nu \frac{\partial^2 u^l}{\partial y^{l2}} - \frac{\sigma B_0^2 u^l}{\rho^l} - \frac{SV^2}{4V_0^2} \left(\frac{\partial^3 u^l}{\partial y^{l2} \partial t^l} - \frac{\partial^2 u^l}{\nu \partial y^{l2}} \right)$$

$$b) \frac{\partial v^l}{\partial t^l} = - \frac{\partial P^l}{\partial y^l}$$

$$c) \frac{\partial T^l}{\partial t^l} + v^l \frac{\partial T^l}{\partial y^l} = \frac{K}{\rho^l c_p^l} \frac{\partial^2 T^l}{\partial y^{l2}}$$

$$d) \frac{\partial c^l}{\partial t^l} + v^l \frac{\partial c^l}{\partial y^l} = D \frac{\partial^2 c^l}{\partial y^{l2}}$$

$$e) \frac{\partial v^l}{\partial y^l} = 0$$

The Boundary conditions are:

$$3.2 \quad a) u^l = U_0, v^l = v^l, T^l = T^l_\omega, C^l = C^l_\omega \text{ at } y^l = 0$$

$$b) u = -U(t) = -U_0(1 + t e^{i\omega|t|}), v^l = v^l$$

$$c) T^l = T^l_s, C^l = C^l_s \text{ at } y^l = d$$

Here the prime densities dimensional quantities & t is a very small perturbation parameter.

The continuity equation gives.

$$3.3 \quad v^l = v_0$$

Introducing non dimensional quantities defined as follows:

$$\eta = \frac{y^l v_0}{\nu}, \quad m = \frac{d v_0}{\nu}, \quad t = \frac{v_0^2 t^l}{4\nu}$$

$$\omega = \frac{4v\omega^l}{v_0^2}, \quad u = \frac{u^l}{U_0}, \quad v = \frac{v^l}{v_0},$$

$$\theta = \frac{T^l - T^l_s}{T^l_{\omega} - T^l_s}, \quad \theta^* = \frac{C^l - C^l_s}{C^l_{\omega} - C^l_s}, \quad Pr = \frac{\mu c_p^l}{k^l}$$

$$3.4 \quad Sc = \frac{\nu}{D} \quad E = \frac{U_0^l}{c_p^l (T^l_{\omega} - T^l_s)} \quad Gr = \frac{vg\beta^l (T^l_{\omega} - T^l_s)}{U_0 v_0^2}$$

$$G_c = \frac{vg\beta^l (C^l_{\omega} - C^l_s)}{U_0 v_0^2}, \quad M = \frac{\sigma B_0^2 \nu}{\rho^l v_0^2}, \quad S = \frac{4v_0^2}{v^2}$$

Using (3.4), Then we get non-dimensional eqⁿs as follows:

$$3.5 \quad a) \quad \frac{1}{4} \frac{\partial u}{\partial t} + \frac{\partial \mu}{\partial \eta} = Gr\theta + G_c\theta^l + \frac{\partial^2 u}{\partial \eta^2} - Mu - S \left(\frac{1}{4} \frac{\partial^3 u}{\partial n^2 \partial t} - \frac{\partial^2 u}{\partial \eta^2} \right)$$

$$b) \quad \frac{1}{4} Pr \frac{\partial \theta}{\partial t} + Pr \frac{\partial \theta}{\partial \eta} = \frac{\partial^2 \theta}{\partial \eta^2},$$

$$c) \quad \frac{Sc}{4} \frac{\partial \theta^l}{\partial t} + Sc \frac{\partial \theta^l}{\partial \eta} = \frac{\partial^2 \theta^l}{\partial \eta^2}$$

B.C's are gives by

$$3.6 \quad a) \quad u = 1, \quad \theta = 1, \quad \theta^l = 1, \quad \text{at } \eta = 0$$

$$b) \quad u = - (1 + te^{i\omega t}), \quad \theta = 0, \quad \theta^* = 0 \quad \text{at } \eta = m$$

If Let us take

$$3.7 \quad a) \quad u(\eta) = u_0(\eta) + t u_1(\eta) e^{i\omega t}$$

$$b) \quad \theta(\eta, t) = \theta_0(\eta) + t \theta_1(\eta) e^{i\omega t}$$

$$c) \quad \theta^*(\eta, t) = \theta_0^*(\eta) + t \theta_1^*(\eta) e^{i\omega t} \quad \text{from (3.5), (3.6) \& (3.7) we get -}$$

$$3.8 \quad \theta^* = \frac{e^{scn} - e^{scm}}{1 - e^{scm}}, \quad \theta = \frac{e^{Pr\eta} - e^{Prm}}{1 - e^{Prm}}$$

from 3.5(a) and 3.7(a), we get -

$$3.9 \quad \frac{d^2 u_0}{d\eta^2} (1 + S) - \frac{du_0}{d\eta} - Mu_0(\eta) = -Gr\theta_0(\eta) - G_c\theta_0^*(\eta)$$

$$3.10 \quad \frac{d^2 u_1}{d\eta^2} (1 + S - \frac{Si\omega}{4}) - \frac{du_1}{d\eta} - (M + \frac{i\omega}{4}) u_1(\eta) = 0$$

Solving above equations we get,

$$3.11 \quad u = C_1 e^{\frac{1 + \sqrt{1 + 4M(1+S)}}{2} \eta} + C_2 e^{\frac{1 - \sqrt{1 + 4M(1+S)}}{2} \eta} - \frac{Gr e^{SCm}}{(1 - e^{SCm})(S_c^2(1+S) - S_c - M)} - \frac{G_c e^{SCm}}{M(1 - e^{SCm})} - \frac{G_c e^{Pr\eta}}{(1 - e^{Prm})(P_r^2(1+S) - P_r - M)} - \frac{G_c e^{Prm}}{M(1 - e^{Prm})}$$

$$+ \in e^{i\omega t} \left\{ d_1 e^{\frac{1 + \sqrt{1 + 4(1+S - \frac{Si\omega}{4})(M + \frac{i\omega}{4})}}{2} \eta} + d_2 e^{\frac{1 - \sqrt{1 + 4(1+S - \frac{Si\omega}{4})(M + \frac{i\omega}{4})}}{2} \eta} \right\}$$

IV. CONCLUSION

If we draw graph for Mi against η than it we will find that Mi decreases with increase of M more rapidly where as if increases that first up to η = 0.6 & then decreases. We also solve u decrease with the increase in magnetic Graphop No: Gc. We see that Pr&s on skin friction causes a decrease in t.

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Cite this article as :

Dr. Anil Kumar Arya, "Analysis of Hydro Magnetic Flow of Visco Elastic Fluid in a Vertical Channel", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 43-46, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229110>
Journal URL : <https://ijsrst.com/IJSRST229110>

Study of Residence Time Distribution in Chemical Industry

A Review

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ABSTRACT

Article Info

Volume 9, Issue 1

Page Number : 47-55

Publication Issue

January-February-2022

Article History

Accepted : 05 Jan 2022

Published : 17 Jan 2022

The concept of residence time distribution (RTD) is an important tool for the analysis of industrial units and reactors. The RTD of fluid flow in process equipment analyses their performance and checks the feasibility of a reactor. RTD method has been widely used in industry to optimize processes, solve problems, improve product quality, save energy, and reduce pollution. The technical, economic, and environmental benefits have been well understood and recognized by various sectors such as industrial and environmental sectors. The petrochemical industries, mineral processing, and wastewater treatment sectors are identified as the most appropriate target beneficiaries. This review traces current applications of the residence time theory in various chemical industries. Besides reviewing recent experimental studies in the literature, some common modeling, tracer injection and detection technique, and different parameters are studied to understand RTD. **Keywords** : Residence time distribution, Modeling, Tracer injection, parameters.

I. INTRODUCTION

The residence time distribution can be termed as the probability distribution of time that solid, or fluid particle stays in that unit operations. It is mostly equivalent to the time taken to complete that unit operation. RTD has a crucial design. designs are very important and, need improvement, and scale-up of many manufacturing processes. Parameters such as Peclet number (Pe), Dispersion number (Nd), or several tanks in series (not) in junction with mean residence time (T_r) are used by the RTD models to

differentiate between CSTR and PFR reactors. Many chemical processes on large scale are based on continuous flow reactors, which include plug flow reactor and continuous stirred tank reactor in practice, no process is ideal and shows many differences from ideal behavior. Therefore, the behavior of the real system is in between CSTR and PFR. Improper design, operating conditions that are fluctuating, scale-up effect, different raw material sources, non-uniform heating cooling, etc. are many reasons for deviation of processes from ideal behavior. These are one of the processes which can lead to a decreased nonuniform

quality of the product. Fluid mechanics and residence time distribution are used to describe the flow irregular patterns and hydrodynamics of any continuous flow reactor. RTD theory is best suited to predict nonideal flow patterns. Also the probability distribution function of time can be said with the help of RTD a material flowing inside the process equipment. Also process efficiency, mixing time, passing, channeling, dead zone, etc. can be studied in the designing stage itself, the improper design of reactor vessel can be obtained by RTD.

II. TRACERS

Different types of tracers are used in different phases like solid, gaseous, liquid. Mainly a tracer of unique property is chosen. This property can be nuclear, physical, chemical, or biological. The amount of tracer used is very small. Tracer is injected with the flow, and it moves along the flow. Tracer cannot be used mostly at high temperatures and pressure. Also, it is quite impossible to take readings of RTD under such conditions and there are chances of tracer getting spoiled. We cannot take RTD readings at difficult sections. Therefore, it is impossible to study RTD complex structure. Dyes are used because of their coloring properties. These can be traced by the naked eye because of the color or by spectrophotometer. On the other hand, in many places, these are not used because of their coloring properties only. Also using a small amount of dye cannot give proper results. Ionic and molecular structure influence the selection of these dyes as a fluorescent dye in high concentration can be toxic. Also, by the process chemicals, the fluorescent dyes can be changed e.g., pH. Ions are also used as tracers in less quantity. The problem of ion being used as a tracer is that it is not detectable in less quantity and can be regarded in a porous medium. Some ions have less stability in polluted water such as nitrates. Because of its low cost and non-hazardous nature, lithium chloride and sodium chloride are used. The good point of electrolyte tracer is that it can be

detected even in a small amount. The drawback is that it may sometimes react with the fluid. Acids and bases are used only when any change in pH is not affected but the process.[14],[15].

III. MODELING

Synman, G. C., and Smith, S. W studied the next step to study hydrodynamics by models. Advantages of RTD Modelling are any technical error or missing data can be found out by RTD measurements. The basic information is given in the RTD experiment. Further treatment modeling for the process is essential. Modeling gives more idea about the performance of reactor through different parameters depending on models. A model can be classified depending on several parameters as being either a one-parameter model or a two-parameter model. The RTD, which is completely an experimental method, is used to evaluate the parameter(s) in the model.

1. Axial Dispersion Model

Synman, G. C., and Smith, S. W studied ADM is more generalized for non-ideal reactors. ADM is used generally in long pipes with laminar flow, turbulent flow, packed bed, etc. The dispersion coefficient is the parameter to find non-ideality. Although it is a combination of PFR and perfect mixers, ADM is also an ideal substitute to generate the concept of RTD for non-ideal reactors. Boundary Conditions for the closed-closed system, (Without dispersion), in the case of closed-closed vessels, we assume that there is no dispersion of radial variation in concentration either upstream (closed) or downstream (closed) of the reaction section; hence this is a closed-closed vessel. Boundary Condition for this is Open-open system, (With dispersion) In an open vessel, dispersion occurs both upstream (open) and downstream (open) of the reaction section; hence this is an open-open system.[19]

2. Tank-In-Series model

This model illustrates N number of tanks of equal volume linked in series, according to Synman, G. C., and Smith, S. W. Even a minor change in N can cause a massive change in the residence time distribution for a small value of N, yet for a high value of N, the large change is insignificant and the model acts as a plug flow. In other words, the degree of mixing reduced as the number of tanks increased.[19]

IV. PARAMETERS

Variance, mean residence time are the essential parameters to find from the experiment. In the Axial Dispersion Model, Peclet number and Dispersion number are found. The dimensionless group, Peclet number, which is the ratio of convective to dispersive flow, is used to quantify the amount of dispersion present in a particular reactor. The inverse of the Peclet Number is the Dispersive Number. The axial dispersion method uses the Peclet number, a dimensionless criterion, to characterize mixing. Peclet number for non-ideal reactor has an estimating range from 0.5 to 24, Dispersion Number for PFR is 0, for CSTR is 3-4. In the Tank-in-series model Number of tanks (N) is found from variance and mean residence time. There are several approaches for estimating parameters. The most widely utilized approaches are the moment's method and the least square curve fitting methods. The variance from the experimental response curve was used to calculate the parameters for ADM and TISM. To determine the ADM parameters for a minimal amount of dispersion. The sum of the squares of the difference between the model response and the empirically measured response was minimized using this technique. The parameters with the smallest sum of squares of the difference between experimental and model responses are the best-fit ones. [24]

V. TYPES OF REACTORS

The continuous stirred tank reactor and the plug flow reactor are the two types of chemical reactors. In terms of kinetic characteristics, a plug flow reactor is more efficient than a stirred tank reactor. The flowing nature of a plug flow reactor is one reason that renders the process unsuccessful. Reactants and reaction products flow at varying speeds throughout the cross-section of the tube when the reactor flow is not optimal. This is due to the reactor's hydraulic elements being overlooked. A chemical reaction takes place inside the reactor, changing the substance of distinct chemical molecules. Every industry relies on the efficiency of its reactors. This has an impact on the materials used in processing, the amount of energy required, and the process's dependability.[10]

PFR

Because of its narrow residence time distribution, high surface-to-volume ratio, and low wall strength, PFR is beneficial. As a popular way of obtaining that distribution, the pulse experiment relies on the tracer injection having a perfect pulse. Errors occur when there is a variation from a perfect pulse. This impact is measured in turbulent and laminar flow regimes using numerical analysis of experimental data, and the findings are compared to an analytical technique. The turbulent regime, which has the most technical significance, shows the most significant variations. The characterization of continuous reactors' residence time behavior is critical for their design. The residence time distribution of ideal PFRs is quite narrow (RTD). This means that a chemical's residence period in the reactor is precisely determined. A PFR has variations in residence time, described through the RTD function $E(t)$. [9]

CSTR

Short-circuiting, dead zones, and recirculation are

some of the key mixing parameters defining the degree of mixing in a CSTR. The degree of mixing significantly affects the conversion of reagents, as well as the molecular structure of the product. RTD provides an approach to characterize the non-ideal mixing in a reactor, thus allowing the process engineer to understand and analyze better mixing performance of the reactor. The RTD information can be used to design an appropriate reactor model system to reflect the actual mixing behavior in the tank. An appropriate reactor model, with accurate reaction kinetics, can provide accurate predictions of reactor performance and is useful in both process design and optimization. Numerous experimental studies on RTD in continuous stirred tanks have been carried out covering a wide range of tank sizes, impeller designs, baffle designs, and operating conditions. Continuous stirred-tank reactors (CSTR) are still widely used in polymerization processes. Viscosity changes rapidly during polymerization, and in general, a nonideal CSTR behavior is observed.[8]

VI. RTD IN INDUSTRIES

BIO-PROCESSING/BIOTECHNOLOGY

The impact of the hydraulics, the oxygenation, and the substrate composition at the manufacturing of lignin peroxidase (LIP) by *Phanerochaete chrysosporium* immobilized in polyurethane foam in a packed bed bioreactor was studied. The hydrodynamic behavior of the reactors was reformed by selecting various flow recycling ratios. The best results were when the bioreactor operated at plug flow with partial mixing. After deciding the best conditions, lignin peroxidase production in packed bed bioreactors operated at alternating growth-production cycles become accomplished for 25 days acquiring an average activity of 6136 U. The impact of bioreactor hydrodynamics on LIP synthesis by *P. chrysosporium* immobilized on polyurethane foam for successive growth-idiopathic phase cycles were observed in the experiments

corresponding to series of Packed bed bioreactors, were operated at three different recycling ratios. Their hydrodynamics were analyzed by residence time distribution experiments. The obtained data were adjusted to the tanks-in-series model. The bioreactor operated with partial mixing displayed the best performance since it shows the highest productivity, also relatively stable production. The LIP profiles concentration along each reactor closely agreed with the results obtained from the RTD experiments.[1]

Simultaneous bio-adsorption and biodegradation were discovered to be effective in removing fluoride ions from waste by TEJ PRATAP SINGH, JATIN BHATNAGAR, and C.B. MAJUMDER. In the bio-column reactor, bacteria from *Acinetobacter baumannii* were immobilized on the java plum seed. The bed depth service time design model and empty bed residence time were used to assess the bio-performance. In the columns on this simplified bio-column reactor design model, the effect of various operational parameters like flow rate, bed depth, and initial concentration was observed. A desorption experiment was carried out to see if the medium could be regenerated and reused.[2]

Luc De Backer & Gino Baron examined the liquid phase residence time distribution (RTD) in a packed bed bioreactor containing porous glass particles. A model including axially dispersed flow for the external fluid phase and an effective diffusivity that combines diffusion and convection, predicts experimental RTD data satisfactorily. There was immobilization of yeast cells on porous glass. High Biomass loading affected the mass transfer whereas low biomass loading didn't affect the mass transfer rates. Comparison of the RTD data from experiments performed in the presence and absence of cells in the external fluid phase revealed that the mass transfer rate is influenced by the cells immobilized inside the porous particles and not by the cells present in the external fluid phase. The presence of yeast cells only at a high biomass loading influenced

the RTD significantly. Also, at the high liquid flow rates, the decreased mass transfer rates are the strongest. The yeast cells which are immobilized inside the porous particles, and not the cells present in the interstitial spaces of the packed bed, are responsible for an increased intraparticle mass transfer resistance. The same mathematical model can be used for transport in porous particles with or without immobilized cells.[30]

PHARMACEUTICAL

Antoni Sanchez, Francisco Valero*, Javier Lafuente, Carles Sola studied using isooctane as solvent and butanol as esterification agent a study of the enantioselective resolution of ibuprofen by industrial *Rhizomucor miehei* lipase was been carried out The Residence-time distribution (RTD) technique which is a strong tool to observe the behavior of continuous reactors and to analyze possible deviation from ideality. RTD was carried out in the tubular packed reactor by pumping into the reactor a solution of N-butyl propionate, an inert compound, in pulse. This tracer was chosen because of the physical properties that are the same as those of the reacting mixture and it is easy to predict. [6]

MC. Martinetz, A-P. Karttunen, S. Sacher, P. Wahl, J. Ketolainen, J.G. Khinast, O. Korhonen researched that residence time refers to the time spent by a drug in the part of the body where it needs to be absorbed. The more the residence time, the more of it can be absorbed. If the drug is delivered in an oral form and destined for the upper intestines, it usually moves with food and its residence time is roughly that of the food. This generally allows 3 to 8 hours for absorption. If the drug is delivered through a mucous membrane in the mouth, the residence time is short because saliva washes it away. Strategies to increase this residence time include bio adhesive polymers, gums, lozenges, and dry powders.[5] A large class of drugs is enzyme inhibitors that bind to enzymes in the body and inhibit their

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activity. In this case, it is the drug-target residence time that is of interest. More the residence time of drugs more they are desirable because it is effective and hence can be used in lower doses. The residence time is determined by the kinetics of the interaction, such as how complementary the shape and charges of the target and drug are and whether outside solvent molecules are kept out of the binding site and are proportional to the half-life of the chemical dissociation. One way to measure the residence time is in a preincubation-dilution experiment where a target enzyme is incubated with the inhibitor, allowed to approach equilibrium, then rapidly diluted. The amount of product is measured and compared to a control in which no inhibitor is added. [5]

Aparajith Bhaskar1 & Ravendra Singh found the content uniformity of each tablet must be guaranteed before it can be released to the market. This work aimed to develop and analyze a strategy to change the non-confirming tablets in real-time and thereby assure drug concentration of final tablets. RTD-based strategy is proposed to be applied for real-time tablet diversion. For manufacturing equipment, the RTD is a characteristic of the mixing. Typical chemical engineering jargon differentiates the RTD at the definitional stage using a continuous stirred tank reactor (CSTR) and plugged flow reactor (PFR) where the former exhibits a thorough mixing characteristic and the latter introduces a time delay. For a system, the RTD may be derived by conducting tracer experiments. The increased involvement of RTD in the chemical engineering field has also led to the number of models. This work made use of the tank in the series model. In this work, an RTD-based control system was designed and implemented in silico. The developed system's application is directed mainly towards continuous pharmaceutical manufacturing processes where it can facilitate more production efficiency. However, does not restrict its use to a direct compaction continuous pharmaceutical line. It can be adapted and used in any continuous process. The future work includes the

implementation of an RTD-based control strategy into the pilot plant facility.[4]

FERTILIZER INDUSTRY

Abellon et al. studied that the procedure for phosphate treatment is extremely complicated: it has many inlets, and each inlet has its flow rate, which is not very steady. As a result, we chose to inject at the granulated phosphate rock inlet was a more accessible in-site inlet. The Inlet of phosphate to the central unit of the reactor has an open side, which allows us to practice radiotracer injection. Because the flow rate of that inlet fluctuates a lot (sometimes up to 20%), a precise radiotracer injection with the same behavior as the phosphate flow isn't as important in our scenario. The intake, as visible on the right side of Fig. 5, has reinforced concrete thick walls that act as a barrier between the device's radiotracer and the operator's body. Following the fast injection of the radiotracer, data gathering of the RTD curve vs time begins for at least 6 hours. Treatment and interpretation of data Subtracting the background level should be the first step in the RTD curve data handling. Then, if the acquisition was successful, to repair an error that occurred during the reactor's transient-state run, a mathematical interpolation approach should be used. Sections of the RTD curve have been disrupted. When the acquisition time is insufficient to return count rates to an exponential decline with a linear behavior towards zero at the end of the experiment, a mathematical extrapolation of the RTD curve is required. Engineers may use this technique to figure out why phosphate treatment plants aren't performing as they should. as well as to achieve precise flow rate, inventories, and mixing efficiency measurements. For phosphate, however, a chemical reaction can't take place in a vacuum. complete the task to the nth degree. As the % completion rises, the pace of reaction slows until it reaches a plateau. Our long-term aim for radiotracer applications in the phosphatic sector, as well as for radiation safety concerns, is to maximize the

quantity of information collected using radiotracers while using the least amount of radioactivity possible.[31]

OIL AND GAS INDUSTRY

Abellon et al. (1997) conducted research that was utilized to calculate the circulation rate in FCCU. In a cold four-cell environment fluidized bed reactor with interconnecting a bead of glass, MRT was utilized to analyze solid particles. The findings were tracked using the radioisotope ^{24}Na . An IR radiotracer was used on molten glass in such a way that the density of the glass bead did not change. It was ensured that the MRT would not be hampered. The radiotracer's size has an effect. The liquefied bed appeared to be mixed, and static electricity altered the existence of the residence time distribution. Button on the inside of the bed. Catalyst dynamics in fluid catalytic cracking. Two separate refineries' fuel cell control units (FCCUs) were evaluated. Samples of catalysts Instrumental neutrons were used to activate them. analysis of activation twelve distinct components makes up Although the catalyst had been activated, the radioactivity of high levels of lanthanum and sodium was discovered. in comparison to the other components on the page catalyst. It was also discovered that lanthanum had a negative charge. Higher levels of Lantium (^{140}La) and sodium (^{24}Na) were found. Concentration compared to other components The impetus fluid dynamics These samples had been irradiated. Used as a natural radiotracer to determine. In the FCCU, MRT of the catalyst and axial mixing is performed. The radial distribution in the riser and stripper was determined using the radiotracer concentration curve obtained from detectors positioned across the diameter of the column at various axial points. This sort of measurement is only possible using the radiotracer approach. The ADM was used to replicate the experimental results, and the riser had a lot of axial mixing, which was problematic.

Pant et al. (2009) investigated how coal particles migrate in a coal gasifier with a fluidized bed. The radiotracers ^{140}La and ^{198}Au deposited on the surface of coal particles were used as independent tracers. The gamma function model, which is an extension of TISM, is used to simulate. The value of N in the function model is in the gamma range (number of tanks). It's possible to have a fractional value. This model can interpret the little departure from a well-mixed state ($N=1$); however, it is not physically interpretable. In sieves, the radiotracer method was also employed. Using a plate extraction column to calculate the axial distance. In the laboratory, mixing, liquid holdup, and slide velocity are all factors to consider. An ADM with unrestricted access to replicate the situation, an open boundary condition was employed data from an experiment It was discovered that the brief Radiotracers with a half-life of less than a year are great instruments for studying the environment. According to the generated curve, the flow rate of water was faster than crude oil due to friction between the layers of the two fluids. Because water has a larger density than crude oil, it dominates the system.[29]

WASTEWATER TREATMENT

Abellon et al. found RTD testing useful for determining whether the system is nearing any of the targets. Whether or if the behavior is ideal. There are no conventional procedures for evaluation in the literature of continuous-operation systems' mixing performance. There are no conventional methods for evaluating the mixing performance of continuous systems in the literature. As a result, stimulus-response methods are used to assess RTD. A tracer pulse input injected abruptly, or a step input supplied continuously at a steady rate can be utilized as the stimulus. The RTD parameters calculated can be used to investigate flow and mixing parameters in continuously operating systems. The RTD parameters are calculated using the concentration vs. time data from the stimulus-response tests. The closed-vessel boundary condition was used

for pulse tracer studies, starting with mixing-cup measurements. This differs from the open vessel boundary condition, which uses through-the-wall measurements at the outflow to determine the boundary condition. The axial dispersion, mixing condition, and segregated flow are investigated using a dispersion model. For modeling purposes, the computed dispersion coefficient is utilized. The dimensionless group termed dispersion number, which is used to measure axial dispersion was introduced by RTD research. The smaller the dispersion number, the less dispersion, and the possibility of plug flow in the column. The higher the value, the greater the dispersion and the likelihood of a mixed flow. As a result, RTD investigations were used in the current study to determine non-ideal flow behavior it was completed the tests were carried out in a column containing lantana Camara adsorbent utilizing sodium chloride as a tracer at various phenol flow rates. [29]

VII.CONCLUSION

The concept of RTD is spreading through many areas from solid processing used in continuous manufacturing of chemicals, plastics, polymers, food, catalysts, and pharmaceutical products, to hydrodynamic modeling of real. Tracer technology shortens the diagnosis time and provides the data quickly. Tracer technology has many applications outside the traditional chemical engineering and extensions of the traditional RTD have appeared, and still experimental improvements are reported. The recent push of continuous flow chemistry in the pharmaceutical industry and the development of milli- and microreactors renewed the interest in RTD for the characterization of the flow behavior in such devices. The best way to improve the design of the reactor is to understand what is happening internally and RTD has proved to be the most efficient to check the feasibility of the reactor.[10]

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Cite this article as :

Shivani Kaustubh Chitale, Pranjal Nitin Jadhav, Snehal Suresh Dhoble, Dr. Mrs. Sonali Dhokpande, Prashant Ingole, " Study of Residence Time Distribution in Chemical Industry - A Review", *International Journal of Scientific Research in Science and Technology(IJSRST)*, Print ISSN : 2395-6011, Online ISSN : 2395-602X, Volume 9, Issue 1, pp.47-55, January-February-2022. Available at
doi : <https://doi.org/10.32628/IJSRST22919>
Journal URL : <https://ijsrst.com/IJSRST22919>

Introduction To Scientific Writing A Review

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ABSTRACT

Scientific writing is a technical form of writing that is designed to communicate scientific information to other scientists. Scientific writing is predicated on the rigors of scientific inquiry; therefore, it must reflect the same precision as that demanded in the research process. Successful scientific writing depends on the individual writer's projection of a shared professional context. Writers seek to embed their writing in a particular social world which they reflect and conjure up through approved discourses. The objective of scientific writing is to record data and all ideas which must be supported by evidence, with appropriate citations of the source of the evidence. This paper therefore looks at introduction to scientific writing, types of scientific writing and their styles. This is underscored by the fact that without a written record of the findings and observations of researchers, no proof exists that any research was conducted. Scientific writing should build on and extend prior research. Becoming familiar with existing scientific literature is a crucial first step in planning. In fine understanding the criteria of doing good scientific research is key for communicating your findings in a clear and interesting fashion focusing on the subject matter.

Keywords : Scientific Writing Types, Writing Styles

Article Info

Volume 9, Issue 1

Page Number : 56-63

Publication Issue

January-February-2022

Article History

Accepted : 10 Jan 2022

Published : 20 Jan 2022

I. INTRODUCTION

Scientific writing is a technical form of writing that is designed to communicate scientific information to other scientists, (Joseph Mugah ,2019). Scientific writing is predicated on the rigors of scientific inquiry, therefore it must reflect the same precision as that demanded in the research process. All ideas must be supported by evidence, with appropriate citations of the source of the evidence, (Angelika Hofmann, 2017). Scientific writing represents an original work of scientific research or study. It can be an addition to

the ongoing study in a field, ground breaking, or a comparative study between different approaches. This distinction is important because the writer is communicating highly technical information to others who might, or might not, be as knowledgeable; they may be from a different discipline; they may, or may not, be a native speaker of the language used, (Golebiowski, 2017). Many journals have international audiences, so precise communication helps prevent misunderstandings and mistranslations in other contexts. Communicating facts, figures, and methods used in research as well as the description of

the result has to be precise and exact. The research question, hypotheses, methods, analysis, and conclusions must be stated clearly and simply, (Astuti, Mohammed, & Zars, 2019).

Successful academic writing depends on the individual writer's projection of a shared professional context. Writers seek to embed their writing in a particular social world which they reflect and conjure up through approved discourses. As a result, the genres of the academy have attracted increasing attention as they offer a rich source of information about the social practices of academics for example, (Gupta & Kasugap, 2019) argues that discourses are systematically organized sets of statements which give expression to the meanings and values of an institution.

Besides communication of a finalized piece of research, the written work is the basis for further opinions, views and critiques from fellow professionals and academics separated by time and distance. Most importantly, it represents the only permanent record of scientific work that has been completed. Writing equips us with communication and thinking skills. Writing expresses who we are as people, makes our thinking and learning visible and permanent. It also fosters our ability to explain and refine our ideas to others and ourselves, (Ahmad & U.K, 2016). The main objective of scientific writing is to record data. Without a written record of the findings and observations of researchers, no proof exists that any research was conducted and valuable information obtained after a lot of effort may be lost. A goal of scientific writing is to communicate scientific information clearly and concisely. Flowery, ambiguous, wordy, and redundant language run counter the purpose of scientific writing, (Mouton & Yakhontova, 2017).

Why is Scientific writing Important?

Scientific writing is both a testing device and a teaching device. When handled correctly, it empowers one to: Learn and read an assignment carefully, research the nuances of set topic, refine focus to a strong, offer arguable thesis and select the best evidence to prove the analysis of dissertation, (Bartholomae, 2015).

II. LITERATURE REVIEW

2.1 TYPES OF SCIENTIFIC WRITING

Different types of writing have their own particular tone or style. In scientific writing, the tone is generally formal, objective and informative. Examples of scientific writing include lab reports, journal article summaries, and research proposals and grant applications. The four main types of academic writing are descriptive, analytical, persuasive and critical. Each of these types of writing has specific language features and purposes, (Blyer & Thralls, 2014).

2.1.1 Descriptive scientific writing

The simplest type of academic writing is descriptive. Its purpose is to provide facts or information. An example would be a summary of an article or a report of the results of an experiment. The kinds of instructions for a purely descriptive assignment include: identify, report, record, summarize and define. Its purpose is to provide facts or information. i.e. Summary of an article or a report of results of an experiment, (Polychronounce & Alnomoun, 2015). Descriptive scientific writing is guided by terminologies such as: identify, report, record, summarise. It requires one to develop writing style and perhaps think more deeply about what has been read or experienced, in order to make more meaningful conclusions.

2.1.2 Analytic scientific writing

Analytical writing style involves reviewing what has been read in light of other evidence. It shows the thought processes one has gone through to arrive at a given conclusion and discusses the implications of this, (Swales & Ventola, 2018). Most academic writing is also analytical. Analytical writing includes descriptive writing, but also requires one to re-organize the facts and information described into categories, groups, parts, types or relationships. The Analytical Writing measure assesses critical thinking and analytical writing capabilities. It evaluates ability to communicate, support complicated ideas, design test arguments, engage in a clear and intelligible discussion of an issue. It doesn't assess how much one knows about a specific topic.

2.1.3 Persuasive Academic writing

Academic persuasive writing is research-based articles intended to encourage others to see your point of view on a topic of interest or discussion. It is the way of creating a persuasive argument by evoking an emotional response in the audience/reader, (Salager & Meyer, 2014). *Persuasive writing* is used to convince or persuade a reader that the writer's opinion of a topic or cause is correct. This research-based article intends to encourage others to see the researcher's point of view on a topic of interest or discussion. The reader must be convinced that the author is an authority and merits attention. Adverts and newspaper columns are good examples of persuasive writing. Though there are many techniques to write persuasively, most persuasive texts include a central argument, evidence to support the point and a conclusion, to summarize the text, (Mouton & Yakhontova, 2017). Persuasive writing has to sway your reader intellectually and emotionally. Persuasive techniques include:

- Establishing trust and develop credibility. In scientific research, the author must establish credibility as a rigorous and expert researcher, (Stephen Heard,2017).
- Understanding the reader's purpose and align your own.
- Paying attention to language.
- Considering tone.
- Using rhetoric and repetition.

2.1.4 Critical writing

Critical writing analyses and evaluates information, usually from multiple sources, in order to develop an argument. It is an appeal to logic and reason. It is used to persuade an audience by logical thought, fact and rationality, (Bazerman, 2016). It identifies, questions and assessing deeply held assumptions about knowledge, the way we perceive events and issues, beliefs, feelings, and actions, (Angelika Hofmann, 2017). It identifies questions and assessing our deeply held assumptions about our knowledge, the way we perceive events and issues, our beliefs, feelings, and actions. Critical writing can be split into three parts: Description, Interpretation and Outcome. A mistake many beginning writers make is to assume that everything they read is true and that they should agree with it, since it has been published in an academic text or journal. Stages of writing an excellent critical essay are:

1. De-code the essay title.
2. Plan your essay.
3. Research your subject.
4. Structure your essay.
5. Develop your argument and introduce counter-arguments.
6. Use relevant evidence.
7. Develop your academic writing style.
8. Find out how to present your work.

2.2 WRITING STYLES

Three main writing styles are: descriptive, analytical and reflective. A *critical analysis* paper asks the *writer* to make an argument about a particular book, essay, movie, etc. The goal is twofold: one, identify and explain the argument that the author is making, and two, provide your own argument about that argument, (Bartholomae, 2015). Analytical writing style is often called for at university level. It involves reviewing what has been read in light of other evidence. Analytical writing shows the thought processes through which one arrives at a given conclusion and discusses the implications of this. A *Critical Reflection* (also called a *reflective* essay) is a process of identifying, questioning, and assessing our deeply-held assumptions about our knowledge, the way we perceive events, issues, our beliefs, feelings, and actions. Basic reflective writing can be split into three parts: Description, Interpretation and Outcome. The stages of the scientific method are often incorporated into sections of scientific reports. These are: -

Title: A title should be of the fewest words possible, accurately describing the content of the paper. Is the title clear and informative, and does it reflect the contents of the report or paper?

Abstract: A well-defined abstract allows the reader to identify the basic content of your paper quickly and accurately, to determine its relevance, and decide whether to read it in its entirety. The abstract briefly states the principal, scope, and objectives of the research. Does your abstract describe the background for your study, clearly state the research problem, briefly describe the methods used to investigate the problem, state the results obtained, summarize conclusions and link these back to the study context? In a nutshell, the abstract should say what your study is about and explain why it matters. Different disciplines may expect abstracts to be written in a particular style, (Blyer & Thralls, 2014).

Introduction: The introduction discusses the issue studied and discloses the hypothesis tested in the experiment. This is usually structured as a literature

review in a paper or larger report. In an undergraduate science report, you should explain the motivation for your current experiment or study and reference relevant background readings or articles. You should also provide a clear statement of the research questions and describe how this link to the study background or context. An overview of what is included in the report including a brief overview of the methods used and the expected results, (Mouton & Yakhontova, 2017).

Methods: This section is the 'recipe'. The step-by-step procedure, notable observations, and relevant data collected are all included in methods and results. It describes what has been done and how it was done. For the report to be a practical, useful document and for the results to be reproducible, a trained person should read the report to replicate the study from the information provided and accurately and fully describe experimental procedure, (Hamby, 2015).

Results: Results display findings, figures, and tables of study. It represents the data, condensed, and digested with important trends that are extracted while researching. Since the results hold new knowledge, it is important that data is simple and clearly stated. In this section you report what you found in your investigation. Check correctly formatted, labeled and captioned all tables and figures, Check lab manual for specific instructions but refer to the introduction to tables and figures in the next section for general advice. Correctly check reported descriptive, inferential statistics and used tables and/or graphs to support clear communication of results. Ensure that tables and figures are located soon after the text in which they are introduced, (Mouton & Yakhontova, 2017).

Discussion: The discussion section consists of the author's analysis and interpretations of the data. Additionally, the author may choose to discuss any discrepancies with the experiment that could have altered the results. This is where discussion and interpretation of results, comment on whether the research supports original hypotheses or answers your

research questions is done. If results do not fully answer original questions, or fail to support a hypothesis, it's important to explain why this might be the case, (Gosden, 2016). Acknowledge any limitations to the study design in this section. Speculate on future research that may be helpful to answer unresolved issues, or point out new research questions that have arisen out of research. Finally, link findings back to the original context or motivation for the study or experiment. It may be a very small contribution but it is important to explain how your study adds to or supports, existing knowledge.

The conclusion summarizes the experiment and will make inferences about the outcomes. The paper will typically end with an acknowledgments section, giving proper attribution to any other contributors besides the main author(s), (Astuti, Mohammed, & Zars, 2019).

Reference and Appendices: A list of references presented alphabetically by author's surname, or number, based on the publication, must be provided at the end of scientific paper. The reference list must contain all references cited in the text. Include author details such as the title of the article, year of publication, name of journal or book or volume, and page numbers with each reference. Specific details to check include: Double-checking that all references used in the body of the text and that citations and references match, (Joseph, Alan, & Gross, 15 May 2007). As a general rule keep direct quotations to a minimum. Describe the work of others in your own words and reference your sources. This will also help to better understand the science that others have carried out. Make sure you have applied the appropriate referencing style correctly and consistently. Check any online references to ensure they are accessible. Characteristics of good scientific writing include:

- **It must be set within the context of other published work.** Because science builds on and corrects itself over time, scientific writing must

be situated in and reference the findings of previous work, (Mouton & Yakhontova, 2017). This context serves variously as motivation for new work being proposed or the paper being written, as points of departure or congruence for new findings and interpretations, and as evidence of the authors' knowledge and expertise in the field.

- **Concise and precise.** A goal of scientific writing is to communicate scientific information clearly and concisely. Flowery, ambiguous, wordy, and redundant language run counter to the purpose of the writing.
- Clear - it avoids unnecessary detail.
- Simple - it uses direct language, avoiding vague or complicated sentences.
- Impartial - it avoids making assumptions (Everyone knows that) and unproven statements (It can never be proved that)
- Structured logically- ideas and processes are expressed in a logical order. The text is divided into sections with clear headings;
- Accurate - it avoids vague and ambiguous language such as about, approximately, almost;
- Objective - statements and ideas are supported by appropriate evidence that demonstrates how conclusions have been drawn as well as acknowledging the work of others.
- Neutral - It avoids making assumptions and unproven statements.
- It represents how and where data were collected and supports its conclusion with evidence.
- Avoids Technical terms and Jargon are used only when they are necessary for accuracy.

Different fields have different conventions for writing style, and individual journals within a field usually have their own style guides. Some issues of scientific writing style include: Some style guides for scientific writing recommend against use of the passive voice,

while some encourage it. In the mathematical sciences, it is customary to report in the present tense, (Swales & Ventola, 2018). Some journals prefer using "we" rather than "I" as personal pronoun or a first-person pronoun. The word "we" can sometimes include the reader, for example in mathematical deductions. The acceptability of passive voice in scientific writing is inconsistent. It is not always wanted, but is sometimes encouraged. One reason that passive voice is used in scientific writing is that it is beneficial in avoiding first-person pronouns, which are not formally accepted in science. In practice, scientific writing is much more complex and shifts of tense and person reflect subtle changes in the section of the scientific journal article. Additionally, the use of passive voice allows the writer to focus. In order to get published, papers must go through peer review by experts with significant knowledge in the field. During this process, papers may get rejected or edited with adequate justification.

Identify the point: Unlike other writing styles, scientific writing needs to have a clear point. It needs to be obvious to the reader what they get out of reading your work, answering the question, "what's in it for me?" A 'point' has three elements: a problem, a gap in our understanding of that problem, and a contribution towards filling in that gap, (Golebiowski, 2017) The 'problem' should be one that many other people care about (especially if you want it to be cited). Identifying the 'gap' is synonymous with conducting a thorough literature review. And you should be able to clearly state the contribution in a handful of sentences. Not only do you need to identify the point, but you need to weave it throughout your work so that the reader can follow, without losing hope that they will arrive at the promised destination.

Empathize with your readers: Remember, the whole point of writing is for people to read what you have written. It doesn't matter how great your research is if you confuse your reader or put them to sleep on

page two, (Mouton & Yakhontova, 2017). You need to identify your target audience and write for them. In many ways, you are the worst possible reader for your work because you already understand everything. To write well, you have to put yourself into a novice's shoes and ask yourself, "if I knew little or nothing, would I understand or care about this?"

Start writing early: Start writing very early, long before the research. This accomplishes a few things. Firstly, it provides a check on understanding of the subject matter (it's hard to write about something if you don't understand it). Conduct a thorough literature review (you can't write a good introduction unless you are aware of what has already been done). And it helps one to determine what research direction will provide the most cogent manuscript. This is important because often a manuscript is the primary output of research, so the research should be guided by the manuscript needs, to some extent, (Polychronou & Alnomoun, 2015).

2.3 Figures

Figures illustrate a trend in your data or a feature of your data. Graphs, photographs or illustrations follow the convention for a figure. Key points for figure presentation include: Figure caption goes below the figure. Use normal case not title case for the caption. Number the figure followed by the caption. Refer to the figure by number in the text. For graphs, you usually plot the independent variable on the x axis, (Gupta & Kasugap, 2019).

2.4 Tables

Use tables when you need to present or group data in a logical way. Key points for table presentation include: Table caption that goes above the table. Use normal case not title case for the caption. Number the table followed by the caption. Refer to the table by number in the text. Horizontal lines are used only to separate headings from data. Avoid vertical lines to separate columns. Use figures to illustrate a trend in

your data or a feature of your data. Graphs, photographs or illustrations follow the convention for a figure, (Bazerman, 2016).

The first time you use a technical term, make sure you define it. In some disciplines it is usual to bold the term the first time you use it and thereafter use a normal typeface. Similarly, define acronyms or abbreviations the first time you use them and thereafter just use the acronym (Blyer & Thralls, 2014).

2.5 Terms

The first time you use a technical term, make sure you define it. In some disciplines it is usual to bold the term the first time you use it and thereafter use a normal typeface, (Joseph Mughah ,2019). Similarly, define acronyms or abbreviations the first time you use them and thereafter just use the acronym.

2.6 References

In the end reference, separate information about author(s), date, title, edition and publication as follows: Author(s), Date, Title, Edition, Place of Publication, Publisher, Extent, Notes, Extend include pagination of number of volumes; Notes provide information about location such as URL for online works, (Blyer & Thralls, 2014).

III. CONCLUSION

Good research is meaningless unless you can communicate your findings in a clear and interesting fashion by providing a check on understanding of the subject matter. Sentences and paragraphs should be in a logical order so that the reader can easily follow the argument and reach the same conclusion as the researcher. Each paragraph should be able to stand on its own and be internally cohesive. Scientific writing needs to have a clear point. The whole point of writing is for people to read what has been written. Writing should start very early, long before the research.

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Cite this article as :

Rose Khamusali Okwemba, "Introduction To Scientific Writing A Review ", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 56-63, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST218631>
Journal URL : <https://ijsrst.com/IJSRST218631>

Role of Gender in Biodiversity Conservation and Management : A Study in the Context of Agriculture in Alibaug Maharashtra

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ABSTRACT

The study is focused on the role of gender in conservation and management in crop diversity and varieties and reported on the findings of the study in four villages of Alibaug Maharashtra. 25-25 respondents for men and women had been surveyed with questionnaire and interviewed in-depth followed by focus groups conducted for men and women which provided the means of cross checking responses. The results indicated that food crop diversity and variety management is mainly done by women while men have great influence over cash crops. Women are responsible for selection, processing and storage as well as home garden practices. Hence, we concluded that role of gender in crop seed diversity and varieties in selection, processing and storage contribute significantly to the human and put a great impact for the cultural and socioeconomic management and conservation of agro biodiversity.

Keywords : Conservation, Crop, Seed Diversity, Gender Relation, Socioeconomic, Food Crop.

Article Info

Volume 9, Issue 1

Page Number : 64-69

Publication Issue

January-February-2022

Article History

Accepted : 05 Jan 2022

Published : 16 Jan 2022

I. INTRODUCTION

Through with the contrastive activities and management practices, men and women have frequently developed a different expertness and knowledge about the localized environment, plant and animal species and their products and uses. These gender distinguished local anesthetic knowledge systems play a crucial role in the in situ conservation, management and betterment of genetic resources for food and agriculture. It is fact that the decision about to conserve depends on the knowledge and perceptual experience of what is most useful to the household and local community. knowledge and perception of

what is most useful to the household and local assemblage. Women's and men's specific knowledge of the measure and diverse use of domestic crop species and varieties extends to wild plants that are used as food in times of requirement or as medicines and sources of income. This local knowledge is highly refined and is traditionally shared and handed down between generations. Through experience, innovation and experimentation, sustainable practice session are developed to protect soil, water, natural vegetation and biological diversity. This has important implications for the conservation of plant genetic resources.

Across the world specially in tropical areas abundance of biodiversity in villages areas, on farms, in homesteads, forests common pastures, field and borders, gender plays an important role in management of the most of the biological resources what are used by humans beings.

In smallholder cultivation, women farmers are more responsible for the selection, betterment and modification of plant varieties. In many regions, women are also responsible for the management of small livestock, including their reproduction. Women often have a more highly specialized knowledge of wild plants used for food, fodder and medicine than men. Haward (2003) emphasizes the culinary traditions and preferences, generally maintained by women have major influences on knowledge, selection, use and conservation of biological resources.

In 1995 [Dianne E. Rocheleau](#) had published a paper on current gender imbalance between rights and responsibilities in biological resource management and its effect on rural peoples' abilities to maintain diverse livelihoods and complex landscapes and to protect the distinct ecosystems on which they and many other current gender imbalance between rights and responsibilities in resource management and its effect on rural peoples' abilities to maintain diverse livelihoods and complex landscapes and to protect the distinct ecosystems on which they and many other species depend. JH Momsen (2007) studied about influence of gender on food and medicines play a major role in biodiversity conservation.

K. Shrinath has reported in 2009 that Conservation of biodiversity can be achieved by the use of technological innovations integrated with development schemes and linking them with self-help groups of women and men. Sustainability issues like the struggle between paddy and shrimp farming, disease in coconuts, drinking water scarceness and pollution have led to deterioration of coastal zone bio-resources and pose challenges to elementary household food security as perceived by both women

and men. Biodiversity intercession help to maintain bio-resources, stipulate various occupations and to make sure about food security for the rural poor.

Both men and women practical knowledge and skills in biodiversity management is not static, but influenced by locally specific social and ecological changes and new sources of information that might be informed by global trends such as improved availability and increased variety. So the study has focused on gender role in management crop diversity and variety with objective to increase the visibility of gender based knowledge of management for agrobiodiversity and food security.

II. Method and Methodology

The study was conducted in western ghat region Alibaug Maharashtra which is situated [Lat:18° 39' 23.9544"- Long: 72° 52' 47.5248" E] in the coast of Arabian sea. Four villages namely Mapgaon, Kihim, Sogaon and Satirje had been selected for study were comparatively more rural and remote and agricultural based. The total number of 100 Respondents (women and men respectively) had been selected for random sampling in which some of the respondents had also taken part in-depth interviews. A pre-tested on few different females and appropriately modified closed questionnaire were used for sampling at the home of the respondents only and descriptive field observation were also recorded. Each has been taken about 45-60 minutes on an average.

There were (3-3) respondents from those four villages) 12 respondents (from survey participants) had been carried out for semi-structured in-depth interview was focused on selection criteria, processing and storage techniques of crop diversity and perception of gender roles in seed work. Throughout the villages respondents were invited (men and women) for interviews and inclusion was based exclusively on their availability and interest. The focus group one with men and other with women were conducted in each villages, in each case hosted by key informants

and five to ten people from each villages were attended by host groups (from sample and non sample and non sample households) ranging in age from 15 to 50 years and above. Variation in responses were resolved through consensual agreement, a process of conflicting of facts and differences of opinion. For the purpose of the questionnaire, activities for agricultural diversity were divided on order to obtain a higher resolution analysis of gendered domains in biodiversity management and conservation.

For role of gender determination process relative participation of agricultural activities both in cash and food crops as well as in home gardens, individual men and women had been asked to measure their own level of participation for each and every task. The described work always performed separately at all time; always female specified work used to performed by respondents with family members as like daughter, mother, mother/daughter-in-law etc. By women members only while listed works generally helped by the women respondents to the men in the family while doing the some portion of work like seed work.

III. Results

The study is showing a clear differences in men and women's duties and responsibilities with respect to crop and seed. Women were more involved in production seeds of subsistence food crops like as beans, potatoes, grains, finger millet, vegetables etc. than men who were concerned with production of seeds for cash crops. Though both genders are working together in production of Rice because of its dual role as both as household food and cash crops. There were home gardens also included in the questionnaire and the result was socking. Most of the women showed higher involvement in the home garden works and used to grow seasonal vegetables, spices, fruit trees etc. is for self consumption and extras sold in the local market which is surplus income. During the study it was found that people were doing fish farming at small level in home garden in a netted small tank that is a good concern towards

conservation practices and socioeconomic status. The detailed data from villages also indicated that involvement of women in field activities like as nursery activities, planting, weeding, harvesting, storage and preservation which completely covers the fact that these works are mostly done by men.

Nursery activities

Nursery practices are primary activities of agriculture. Seed processing is the series of procedures by which raw grains are treated for planting in the respective season. Respondents were asked to describe the different phases of seed cleaning and drying for several crops. Involvement of women were more in seed processing than men because of their habitual skills in winnowing, wind and in sieving or grading and drying had made learn by their mother at early stage of household learning. Each and every crops are usually have their unique processing steps like as ash used to applied for the removal of vegetable seeds to help them out from the fruit and remove sticking and control the pests.

Gender tests for seed dryness checking in those villages by following methods: For paddy crops sounds of seeds hitting against each other in the hand palm or throw in the air by the winnowing weight feeling and husk comes off. Seeds rolled against one another for millet husk to make out. For vegetable or fruits just open the seeds to get well-formed cotyledons or sounds of seeds rubbing against each other. The study also revealed that the minor crops which grows in the home garden can easily available without any labour intensive during staple crop shortage.

Farm Practices:

As far as the farming practices are concern most of the respondents were agreed with equal role of gender. They both use to go for all types of activities like planting, watering, weeding, harvesting etc. Other types of farm works like spray of insecticide and pesticides types of work usually done by men.

The women were equally participating in agricultural farm as well as domestic and house work. harvesting of crops, removing of fruits, fodder, etc. Selling in the local market mostly done by women but the matter of sorrow is that women were working more than men but paying less. If we talk about farming in coastal region we can't leave the fishes which is main food of the Konkan. During the study it was found that people were doing fish farming at small level in home garden in a small netted tank that is a good concern towards conservation practices and socioeconomic status. The careful procedure for selection of different traits is largely responsible for the difference in performance and appearance of the breed from its wild progenitor, as well as from other breeds of the species.

The study also reveals about the livestock rearing during the discussion/ interview mostly women are responsible for the feed, fodder and water for newborn or or sick animals while men use to do milking ewes and other household works were performed by married or young girls who were trained by their mother as lively hood.

Seed storage and management:

The role of gender in seed storage and management vary with the different crops grown. Men use to take important role in storage and maintenance of cash crops and food crops. Respondents have their different-different types of storage like one of the storage unit was raised platform made up of wooden walls which prevents from dampness of the mud. Other type of storage units were different type of container can be made with metal, clay, plastic etc. The containers must be closed air tightly to prevent by insect/pest, fungus, light, water etc. The mud containers were tightly closed with cow dung and mud mixture generally done by women. During survey and interview respondents were asked first that who is responsible for seed management and why? Most of the men answered that it is women

task as they are having good knowledge of house work and habit. Hence, families are mostly dependent on the women rather than men for seed storage and management.

IV. Discussion

Men and women have different knowledge about seed and crop diversity and their preference also be different like women generally prefer food crop seeds, meal quality, taste, can be also including cooking time, should be resistance to pest or disease and should be easy of collection, processing, preservation and storage. Men are more likely to consider yield sustainability for a range of soil type and easy of storage. Women also had a broader set of seed selection criteria than men because they use plant material in different ways like paddy not only provide food but it is also used for thatching mat-making, fodder, and also used as husk for fuel. Women try to make sure that varieties are in line with culinary traditions, are palatable and nutritious and meet processing and storage requirement.

There are several studies has been done in this field which shows that wherever women do not produce crops directly but then also men use to take preferences and criteria for selecting and preserving varieties. However, the researchers mostly used to neglect these criteria based claims because they are not directly related to agroecological field condition. Women are also responsible for seed storage, preservation, exchange and also takes part in seed and crop management activities which is often explained by the close relation with agricultural and domestic work Assumption of cultivation method, crop breeding varietal diversity, Plant uses are not informed by both men's and women's contribution do not adequately trace or conserve local knowledge and can lead to the marginalization of agro biodiversity. Crop management should be included within the discussion on agro biodiversity and recognition of men and women destructive roles (Kothari;2003).

There are limited researches has been done on women's role in crop management contributed by three major factors in which first and major factor is to exclude out the women from assumption based data collection, because women are not easily accessible to the male researchers Second is failure to identify the sex of participants cannot discriminate properly the basis of gendered division of labour. The third factor is partiality by researchers to label the essential task of processing, storage and exchange as domestic rather than agricultural work activities. Women shows a great responsibility in nutrition and health needs as they are highly knowledgeable about crop diversity and variety, their culinary, nutritional and curative properties with agronomy and environmental characteristics. Hence, women need to get preferences with empowerment and capacity building under a strategy. Understanding gender roles would better help in conservation of agro biodiversity for food security.

V. Conclusion

Agricultural diversity of crops and varieties cannot addressed without all considering of role of gender in diversity management and conservation. Furthermore, the significance of gender role in biodiversity is not only has implication on agrobiodiversity conservation, but it is also essential to other difficulties such as health, food security, poverty, trade and technology development etc. Positive steps to ensures gender roles specially women's contribution in agricultural biodiversity management and conservation are to be taken into account and that their reliance on plant genetic resources for their livelihood status and welfare are recognized through use of diverse crop biodiversity, thus promoting its use and transmission in all appropriate spheres including formal and informal education, training and extension. Hence, we can say that women are users, preservers and managers of agrobiodiversity.

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Cite this article as :

Prerana Prakhar, Dr. R. K. Agarwal , "Role of Gender in Biodiversity Conservation and Management : A Study in the Context of Agriculture in Alibaug Maharashtra", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 64-69, January-February 2022. Journal URL : <https://ijsrst.com/IJSRST1207573>

Job Satisfaction Levels of Field Employees in Indian Pharmaceutical Industries

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ABSTRACT

Article Info

Volume 9, Issue 1

Page Number : 70-78

Publication Issue

January-February-2022

Article History

Accepted : 06 Jan 2022

Published : 20 Jan 2022

The Pharmaceutical sector plays a vital role in underpinning the economic development of a country. This study attempts to evaluate job satisfaction of employees in different pharmaceutical companies. It focuses on the relative importance of job satisfaction factors and their impacts on the overall job satisfaction of employees. It also investigates the impacts of pharmaceutical type, work experience, age, and sex differences on the attitudes toward job Satisfaction. The result shows that salary, efficiency in work, fringe supervision, and co-worker relation are the most important factors contributing to job satisfaction. The overall job satisfaction of the employees in pharmaceutical sector is at the positive level. The nature of business operation, the work culture and the level of job satisfaction have undergone sea change for the pharmaceutical companies. As a business proposition initiated huge investment whereas majority of their stocks is going down bringing a high level of apprehension related to job security among its employees. This research paper highlights some of these problems and presents a picture of level of job satisfaction among employees of pharmaceutical companies. It also identifies unique issues of job satisfaction in the companies. Pharmaceuticals Companies are selected for the research because they are currently undergoing continued expansion. In order to gain competitive advantage and adapt to the dramatic changing environment, it is important for them to achieve management efficiency by increasing employee satisfaction in the organization. Hence this research was mainly undertaken to investigate on the significance of factors such as working conditions, pay and promotion, job security, fairness, relationship with co-workers and supervisors in affecting the job satisfaction. This paper presents a comprehensive diagnosis of job satisfaction indices of pharmaceutical business, the factors causing the dissatisfaction & suggestions to improve them.

Keywords : Pharmaceutical Industries, Promotion, Job Security, Fairness

I. INTRODUCTION

Job satisfaction describes how content an individual is with his or her job. It is a relatively recent term since in previous centuries the jobs available to a particular person were often predetermined by the occupation of that person's parent. There are a variety of factors that can influence a person's level of job satisfaction. Some of these factors include the level of pay and benefits, the perceived fairness of the promotion system within a company, the quality of the working conditions, leadership and social relationships, the job itself (the variety of tasks involved, the interest and challenge the job generates, and the clarity of the job description/requirements).

The happier people are within their job, the more satisfied they are said to be. Job satisfaction is not the same as motivation, although it is clearly linked. Job design aims to enhance job satisfaction and performance methods include job rotation, job enlargement and job enrichment. Other influences on satisfaction include the management style and culture, employee involvement, empowerment and autonomous workgroups. Job satisfaction is a very important attribute which is frequently measured by organizations. The most common way of measurement is the use of rating scales where employees report their reactions to their jobs. Questions relate to relate of pay, work responsibilities, variety of tasks, promotional opportunities the work itself and co-workers.

Some questioners ask yes or no questions while others ask to rate satisfaction on 1 – 5 scale where 1 represents “not all satisfied” and 5 represents “extremely satisfied”.

1.1 Background of the Study

People management is an important aspect of organizational processes. This emanated from the recognition that the human resources of an organization and the organization itself are synonymous. A well-managed business organization normally considers the average employees as the primary source of productivity gains. These organizations consider employees rather than capital as the core foundation of the business and contributors to firm development. To ensure the achievement of firm goals, the organization creates an atmosphere of commitment and cooperation for its employees through policies that facilitate employee satisfaction.

Satisfaction of human resource finds close links to highly motivated employees. Motivated employees then develop loyalty or commitment to the firm resulting to greater productivity and lower turnover rates. However, even with the widespread recognition of the importance of facilitating the relationship between job satisfaction and motivation in facilitating organizational commitment, there are varying perspectives on the means of doing this. The earliest strategy is to use wage increases to link job satisfaction and motivation to organizational commitment (Hill & Wiens-Tuers 2002). With the recognition that this is not enough to bring about motivation expressed in job satisfaction, other perspectives emerged giving particular importance to the training and skills development of employees (Woodruff 2000) applied through the underlying principle of continuous organizational learning. Since this covers only an aspect of human resource management, a holistic approach emerged that targets the development of a certain quality of employment life (Champion-Hughes

2001) that covers fair wages, benefits, other employment conditions, and career development to support the facilitation of motivation and job satisfaction directed towards organizational commitment.

This means that achieving motivation and job satisfaction to develop organizational commitment is not simple or easy and works according to the context of individual firms. Although, there are best practices within industries, it is up to the individual organizations to determine which human resource strategies meet its needs and objectives. To determine the manner that individual industries develop and achieve organizational commitment through job satisfaction and motivation, the study will investigate in-depth the human resource strategies of Incepta Pharmaceuticals Limited, Apex Pharma & Beximco Pharmaceuticals Limited.

1.2 Objective of the study

The objective of the study is as follows:

- To assess the satisfaction level of employees in Pharmaceutical industry
- To identify the factors which influence the job satisfaction of employees
- To identify the factor which improves the satisfaction level of employees

1.3 Scope of the study

This study emphasis in the following scope:

- To identify the employees level of satisfaction upon that job.
- This study is helpful to that organization for conducting further research.
- It is helpful to identify the employer's level of satisfaction towards welfare measure.
- This study is helpful to the organization for identifying the area of dissatisfaction of job of the employees.
- This study helps to make a managerial decision to the company.

1.3 Limitations of the study

- The survey is subjected to the bias and prejudices of the respondents. Hence 100% accuracy can't be assured.
- The researcher was carried out in a short span of time, where in the researcher could not widen the study.
- The study could not be generalized due to the fact that researcher adapted personal interview method.

1.4 Methodology

A descriptive research design with survey method is applied in the study. The researcher has used both the Primary and the secondary data for the purpose of this study. Secondary data were collected from available books, publications, research studies, articles and websites.

A closed-ended interview-schedule was designed to collect primary data. Lupin, Mankind & Dr. Reddy. Pharma are selected to collect primary data and the researcher visited each pharmaceutical to talk informally with pharmaceutical officials for collecting information regarding job satisfaction. After collecting all necessary data, data have been analyzed and tabulated descriptively. And, this tabulated information used to measure perceived satisfaction and dissatisfaction level of the employees. To measure the satisfaction level a 5 point scale has been used which is denoted by 1=SD, 2=D, 3=N, 4=A, and 5=SA

II. REVIEW OF LITERATURE

The study of job satisfaction is a topic of wide interest to both people who work in organizations and people who study them. Job satisfaction has been closely related with many organizational phenomena such as motivation, performance, leadership, attitude, conflict, moral etc. Researchers have attempted to identify the various components of job satisfaction, measure the relative importance of each component of job satisfaction and examine what effects these components have on employees' productivity.

Spector (1997) refers to job satisfaction in terms of how people feel about their jobs and different aspects of their jobs. Ellickson and Logsdon (2002) support this view by defining job satisfaction as the extent to which employees like their work. Schermerhorn (1993) defines job satisfaction as an affective or emotional response towards various aspects of an employee's work. C.R.Reilly(1991) defines job satisfaction as the feeling that a worker has about his job or a general attitude towards work or a job and it is influenced by the perception of one's job. J.P. Wanous and E.E. Lawler (1972) refers job satisfaction is the sum of job facet satisfaction across all facets of a job. Abraham Maslow (1954) suggested that human needs from a five-level hierarchy ranging from physiological needs, safety, belongingness and love, esteem to self-actualization. Based on Maslow's theory, job satisfaction has been approached by some researchers from the perspective of need fulfillment (Kuhlen, 1963; Worf, 1970; Conrad et al., 1985)

Job satisfaction and dissatisfaction not only depends on the nature of the job, it also depend on the expectation what's the job supply to an employee (Hussami, 2008). Lower convenience costs, higher organizational and social and intrinsic reward will increase job satisfaction (Mulinge and Mullier, 1998; Willem et al., 2007). Job satisfaction is complex phenomenon with multi facets (Fisher and Locke, 1992; Xie and Johns, 2000); it is influenced by the factors like salary, working environment, autonomy, communication, and organizational commitment (Lane, Esser, Holte and Anne, 2010; Vidal, Valle and Aragón, 2007; Fisher and Locke, 1992; Xie and Johns, 2000).

Different people interpret compensation differently. In this paper compensation, reward, recognition, and wages are terms used in different situations (Zobal, 1998). The compensation is defined by American Association is "cash and non-cash remuneration provided by the employer for services rendered" (ACA, p. 9). Salary was found to be the prime factor for the motivation and job satisfaction of salaried

employees of the automobile industry from the results of the survey by Kathawala, Moore and Elmuti (1990). The survey tried to asses the various job characteristics and the way the employees ranked them as motivators and satisfiers. The results showed that compensation was ranked as the number one job element for job satisfaction and increase in salary for performance was ranked as the number one job element for motivation. Compensation is very valuable tool for retention and turnover. It is also a motivator for an employee in commitment with the organization which in result enhances attraction and retention (Zobal, 1998; Moncarz et al., 2009; Chiu et al., 2002). It also works as communicator when it is given to employee against his services which shows how much an employee is valuable for its organization (Zobal, 1998).

The mentoring is used for development-orientation (Scandura and Williams, 2004). When a supervisor provides mentoring, the relationship affects the protégés skill development and intentions to remain with the employer (McManus and Russell, 1997). On the other hand non-supervisory mentor may increase mentee's confidence by providing access to outside organization (Scanduraa and Williams, 2004). The immediate supervisor support is very important in organizational change. Although the support of supervisor is not very crucial in satisfaction but it has positive impact on satisfaction (Griffin, Patterson and West, 2001). According to Chakrabarty, Oubre, and Brown (2008) "perhaps the finest way in which supervisors can portray himself as a role model is to personally demonstrate proper techniques so that employee could understand how job should be done." J.D. Politis (2001) has examined the roles played by leadership in the process of knowledge acquisition and a survey was carried out on 227 persons who have been engaged in knowledge acquisition activities to examine the relationship between leadership styles and knowledge acquisition attributes. The results showed that the leadership styles that involve human interaction and encourage participative decision-

making are related positively to the skills essential knowledge acquisition.

According to the study conducted by Friedlander and Margulies (1969), it was discovered that management & friendly staff relationships contribute to the level of job satisfaction. However, this result contradicts with view of Herzberg (1966) who supported the view that supervision is irrelevant to the level of job satisfaction. According to Frame (2004) work conditions are defined as an employee's work place, work instruments, the work itself, organization policy, and organizational rules. Arnold and Feldman (1996), promoted factors such as temperature, lighting, ventilation, hygiene, noise, working hours, and resources as part of working conditions.

The worker would rather desire working conditions that will result in greater physical comfort and convenience.

The absence of such working conditions, amongst other things, can impact poorly on the worker's mental and physical well-being (Baron and Greenberg, 2003). Robbins (2001) advocates that working conditions will influence job satisfaction, as employees are concerned with a comfortable physical work environment. In turn this will render a more positive level of job satisfaction. Arnold and Feldman (1996) shows that factors such as temperature, lighting, ventilation, hygiene, noise, working hours, and resources are all part of working conditions. Employees may feel that poor working conditions will only provoke negative performance, since their jobs are mentally and physically demanding.

According to James Brown (2007), he defines fairness as equal treatment, receiving the same services and benefits as other people. Fairness means different things to different people, and our view of whether or not something is fair often depends on the circumstances (Klesh, J. 1979). Competent employees are essential to the success of any organization. An important factor driving satisfaction in the service environment is service quality. One school of thought refers to service quality as a global assessment about a

service category or a particular organization (PZB, 1988). Recently, it has been argued that satisfaction is generally viewed as a broader concept and service quality is a component of satisfaction (Zeithaml & Bitner, 2003). This is because satisfaction derives from various sources, such as service encounter satisfaction and overall satisfaction. In other words, a little satisfaction from each service encounter leads to overall satisfaction with the service. Various studies discussed shows that job satisfaction has been studied with relevance to co-worker behavior supervisor behavior, pay and promotion, organizational factors and other work related factors. In some studies the employees were highly satisfied or otherwise. The aim of this study is to determine the factors affecting employee job satisfaction in pharmaceuticals Companies.

III. PHARMACEUTICAL INDUSTRY IN INDIA

India is a prominent and rapidly growing presence in the global pharmaceuticals industry. It is the largest provider of generic medicines globally, occupying a 20% share in global supply by volume, and also supplies 62% of global demand for vaccines. India ranks 3rd worldwide for production by volume and 14th by value. India has the highest number of US-FDA compliant Pharma plants outside of USA and is home to more than 3,000 pharma companies with a strong network of over 10,500 manufacturing facilities

The pharmaceutical industry in India offers 60,000 generic brands across 60 therapeutic categories. The API industry is the third world's largest, and it has 57% of APIs on the WHO.

Table 1: Pharmaceutical sector growth rate

Year	Growth Rate
2010	22.46%
2011	10.18%
2012	5.90%

2013	8.60%
2014	17.50%
2015	4.08%
2016	15.80%
2017	18.91%
2018	20.80%
2019	21.10%
2020	26.88%

IV. ANALYSIS AND INTERPRETATION

The data after collection is to be processed and analyzed in accordance with the outline and down for the purpose at the time of developing research plan. Technically speaking, processing implies editing, coding, classification and tabulation of collected data so that they are amenable to analysis. The term analysis refers to the computation of certain measures along with searching for pattern groups. Thus in the process of analysis, relationship or difference should be subjected to statistical tests of significance to determine with what validity data can be said to indicate any conclusions.

The analysis of data in a general way involves a number of closely related operations, which are performed with the purpose of summarizing the collected data and organizing them in such a manner that they answer the research questions. In this study the researcher followed above process carefully and it is presented in this chapter

4.1 Findings

This section will try to highlight and discuss the results and the findings based on the analysis done on the data collected from respondents. This research focuses on the factors affecting employee job satisfaction in selected pharmaceuticals company. The discussion then will try to accomplish all the objectives of the study. In this instance, for simplicity of analysis and findings, this part focuses on the levels of employee job satisfaction in Pharmaceuticals Company and discussion. Pharmaceuticals company survey responses are the frequencies that simply refer to the number of times

various subcategories of certain factors occur (in this study, the demographic factors) from which the percentage and the cumulative percentage of their occurrence can be easily calculated. The descriptive statistics will present the feel of the data that gives preliminary ideas how good the scales are, how well the coding and entering of data has been done, and the central tendency of the research variables.

4.2 Employees Job Satisfaction in Pharmaceuticals Company

This part discusses the respondents' overall perception of employee job satisfaction in Pharmaceuticals Company and sub-dimensions such as pay and promotion, job security, work conditions, fairness and Relationship with co-workers and management. The findings are presented in frequencies and percentages.

4.2.1 Employee Satisfaction in Pharmaceuticals Company

Factors influencing job satisfaction	Mean
Working Condition	62%
Pay and Promotion	60.4%
Fairness	60.4%
Job Security	61%
Relation with Co-workers	66%
Relation with Supervisor	56.2%
Average	61%

In terms of working conditions, pay and promotion, job security and relationship with co-workers the study found that the level of employee job satisfaction is "neither happy nor unhappy" and in terms of relationship with immediate supervisor the level of employee job satisfaction is "somewhat unhappy". Overall level of employee satisfaction in pharmaceutical companies, the study found that the average mean is 61%, so the overall level of employee job satisfaction is "neither happy nor unhappy".

4.3 Descriptive Statics

4.3.1 Level on work conditions.

In terms of level on work conditions in pharmaceuticals companies, the study found that 44 respondent's

Perceived atmosphere to be "Neutral". About 29 respondents perceived the work conditions to be "happy", while 15 respondents perceived work conditions as "unhappy". A few, 7 respondents rated the work conditions as "very unhappy" and "very happy" 5. At last, the mean score is 3.01, so the work conditions are "neither happy nor unhappy". Looking at the mean score of 3.10, we can see that work conditions influence job satisfaction in pharmaceuticals companies. (See, Appendix-02)

4.3.2 Level on Pay and Promotion

In terms of level on pay back in pharmaceuticals companies, the study found that 49 respondents perceived pay and promotion to be "neither happy or unhappy", 21 of the respondents perceived the pay and promotion to be "somewhat happy" and 21 respondents perceived pay and promotion to be "somewhat unhappy". Only a few 4 and 5 of the respondents rated the pay and promotion as "very unhappy" and "very happy". At last, the mean score is 3.02, so the pay and promotion is "somewhat unhappy". According to a mean score of 3.02, we can see that pay and promotion influences job satisfaction in pharmaceuticals companies. (See, Appendix-03)

4.3.3 Level on Fairness

In terms of level about fairness in pharmaceuticals companies, the study found that 51 respondents perceived fairness to be "neither happy nor unhappy", 24 respondents perceived the fairness to be "somewhat happy", while 16 respondents perceived fairness as "somewhat unhappy". A few 6 respondents rated the fairness as "very unhappy" and 3 respondents are "very happy". Finally, the mean score is 3.02, so the fairness is "neither happy nor unhappy". According to the mean score of 3.02, we can see that

fairness influences job satisfaction in pharmaceuticals companies. (See, Appendix-04)

4.3.4 Level on Job Security

In terms of level on job security in pharmaceuticals companies, the study found that 50 respondents perceived job security in pharmaceuticals companies to be "neither happy nor unhappy", 24 respondents perceived job security in pharmaceuticals companies to be "somewhat happy", while 17 respondents perceived job security in pharmaceuticals companies as "somewhat unhappy". 5 respondents rated job security as "very unhappy" and 4 respondents were "very happy". Finally, the mean score is 3.08, so job security in pharmaceuticals companies is "neither happy nor unhappy". According to the mean score of 3.05, we can see that job security influences job satisfaction in pharmaceuticals companies. (See, Appendix-05)

4.3.5 Level on Relationship with co-workers

In terms of level on relationship with co-workers in pharmaceuticals companies, the study found that 42 respondents perceived relationship with co-workers to be "neither happy or unhappy", 25 respondents perceived the relationship with co-workers to be "somewhat happy" and 19 respondents "somewhat unhappy". Only 1 respondent rated the relationship with co-workers "very unhappy" and 13 respondents were "very happy". At last, the mean score is 3.30, so the relationship with co-workers is "somewhat unhappy". According to a mean score of 3.30, we can see that relationship with co-workers influences job satisfaction in pharmaceuticals companies. (See, Appendix-06)

4.3.6 Level on Relationship with immediate supervisor

In terms of level on relationship with immediate supervisor in pharmaceuticals companies, the study found that 49 respondents perceived relationship with immediate supervisor in pharmaceuticals

companies to be “neither happy or unhappy” 14 respondents perceived relationship with immediate supervisor as in pharmaceuticals companies to be “somewhat happy”, while 25 respondents perceived relationship with immediate supervisor in pharmaceuticals companies as “somewhat unhappy”. 8 respondents rated relationship with immediate supervisor as “very unhappy” and 4 rated it as “very happy”. Finally, the mean score is 2.81, so relationship with immediate supervisor in pharmaceuticals companies is “somewhat unhappy”. According to the mean score of 2.81, we can see that relationship with immediate supervisor influences job satisfaction in pharmaceuticals companies. (See, Appendix-07)

4.4 Conclusion

Employee job satisfaction can improve service quality and increase employee satisfaction. In this circumstance, policy makers and managers have turned their attention to provide different kinds of facilities to their employees in order to satisfy their employees. This study tested factors affecting job satisfaction for pharmaceuticals companies. The results suggest that the factors had satisfactorily explained job satisfaction and that the policy makers and managers should focus on the factors that affect employee job satisfaction, if they want to enhance their businesses. Based on the results for the standardized values, we are able to see that work conditions, fairness, promotion, and pay, are key factors affecting pharmaceuticals companies employees' job satisfaction.

Money is a good motivator, actually all employees' work for money, employees need the money, a good salary and good compensations are key factors in satisfying the employee. We can increase the employee salary and compensation to motivate the employee, the good pay back can be one of the key factors affecting job satisfaction, also in this way one can increase the service quality and organizational performance. The factor of work conditions is also

proven to have significant influence over the pharmaceuticals companies. The physical design of the place does have certain impacts on job satisfaction. Because the work conditions in the pharmaceuticals companies include the employee relationships and work environment, all these factors relate to employee job satisfaction. A good work environment and good work conditions can increase employee job satisfaction and the employees will try to give their best which can increase the employee work performance.

The importance and the need is therefore describing or defining the physical environment by identifying those elements or dimensions that make up the physical environment. Therefore, in the questionnaires several elements have been defined such as cleanliness, lighting, noise, and furniture arrangements. These elements are the determinant of whether it affects employee's satisfaction. In pharmaceuticals companies, the employees hope they all receive equal treatment with respect to pay or promotion. If pharmaceuticals companies create a fair competitive environment, like fair treatment, fair compensation, fair work hours, these will improve employee job attitudes; fairness can also motivate employees to be hard working. After this consideration, we can see that fairness can increase employee job satisfaction; satisfied employees offer good services for the organization. This can increase organizational performance, so fairness is a key factor affecting job satisfaction in pharmaceuticals companies. In pharmaceuticals companies' job security as an aspect of job satisfaction was more important to male employees than to female employees. Employees from medium- and large-staff-sized

Organizations, compared with those from small staff-sized organizations, were more likely to cite job security as a very important contributor to their job satisfaction.

4.5 Recommendation

Opportunities for future study have emerged as a result of this study. In addition to overcoming the limitations of data gathering, additional research is needed to observe the relationships between job satisfaction and work conditions, pay and promotion, fairness, job security, relationship with supervisor and co-workers. The limitations have contributed to the lack of arriving at many strongly statistically proven findings and conclusions. For future research the following suggestions should be considered:

- 1) It is suggested that for future research a proportionate stratified random sample be used to compare several public sector institutions using a larger sample.
- 2) The research is needed to further investigate the potential relationships and affects these variables and other extraneous variables, such as role ambiguity, job level, contingent rewards and co-work have on job satisfaction.
- 3) Qualitative investigators must conduct research regarding the job satisfaction of pharmaceuticals companies. This research method will provide a different perspective of employees, job satisfaction and contribute a more in-depth understanding of how employees view their job.

Based on this study, and analysis of factors affecting pharmaceuticals companies' employee's job satisfaction, this paper makes the following recommendations to the policy makers and managers of the pharmaceuticals companies:

- 1) Create favorable work conditions for the company. Guide the employee to communicate effectively, build a good interpersonal environment within the company, in order to create good work conditions.
- 2) To improve the pay treatment of pharmaceuticals companies employees. Pharmaceuticals companies should improve the overall salary packages of employees; on the other hand, two shifts or three shifts is a way to reduce the workload of employees.

- 3) To improve fairness in pharmaceuticals companies, create a scientific performance appraisal system in the organization. Utilize the other developed countries' scientific performance systems, and use these systems to evaluate employee work performance and evaluate employee service quality.
- 4) Ensure rightsizing strategy within the organization where have shortage of employees and train-up them appropriately for future positions.

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Cite this article as :

Dr. R. Shridhar, Tabish Turabi , "Job Satisfaction Levels of Field Employees in Indian Pharmaceutical Industries", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 70-78, January-February 2022. Journal URL : <https://ijsrst.com/IJSRST229117>

Recent Trends in Human Resource Practice in Pharmaceuticals Industries

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ABSTRACT

Article Info

Volume 9, Issue 1

Page Number : 79-87

Publication Issue

January-February-2022

Article History

Accepted : 06 Jan 2022

Published : 20 Jan 2022

The Pharmaceutical part accepts an irreplaceable part in supporting the budgetary change of a country. This study tries to evaluate HRD Trends of delegates' in particular pharmaceutical associations. It focuses on the relative essentialness of occupation satisfaction components and their impacts on the general occupation satisfaction of specialists. It is like manner examines the impacts of pharmaceutical sort, work experience, age, and sex contrasts on the miens toward vocation Satisfaction. The method for business operation, the work society and the level of livelihood satisfaction have encountered sea change for the pharmaceutical associations. As a business recommendation began huge endeavor while overwhelming a portion of their stocks is going down bringing a strange condition of trepidation related to boss security among its laborers. This examination paper highlights some of these issues and presents a photograph of level of occupation satisfaction among delegates of pharmaceutical associations. It moreover perceives unique issues of occupation satisfaction in the associations.

Keywords : HRD Trends, Pharmaceuticals Industries, Pharmaceutical Associations

I. INTRODUCTION

Among the different variables of creation, which are utilized as a part of an association, human asset is the most vital. This is on the grounds that the effective utilization of physical assets (i.e., land, apparatus, and materials) at last relies on upon how the human components are put to great use on different operations. The most effective hardware on the planet

won't deliver at the ideal level unless the general population who work the apparatus know how to make it perform getting it done and above all, are roused to make their gear proficiently. In the event that the aptitude and the will of Human Resource legitimately connected, they help in changing the life less considers of creation valuable items. They are fit for expansion i.e. fit for creating and yield that is more noteworthy than the entirety of inputs. When

they get enlivened even standard individuals can convey exceptional results. They can assist an association with achieving results rapidly, proficiently and adequately.

In India, the birthplace of human asset administration can be followed in the 1970s; sympathy toward welfare moved towards higher proficiency, an adjustment in expert estimations of human asset supervisors was noticeable. Amid the 1980s because of new innovation and other ecological changes, Human Resource Development (HRD) turned into a noteworthy issue. Amid the 1990s, the staggering part of human component in industry has been figured it out. Developing mindfulness about the essentialness of human side of association has prompted the advancement of human asset administration as an unmistakable order. Concentrate on human qualities and a philosophical methodology, are prone to give this order the status of a calling. In this way, the human asset capacity in India has become through a few stages, e.g., work welfare, mechanical relations, work organization, staff administration lastly to human asset administration and human relations and human asset advancement. HRM has made some amazing progress from being only a bolster, cleanliness related capacity to a vital capacity. Enrollment and choice is the procedure of pulling in people on an opportune premise, in adequate numbers and with fitting capabilities. The determination procedure changes from association to association, occupation to employment, and nation to nation.

Preparing and advancement programs lacks in workers. Preparing makes the workers adaptable in operations.

All-rounder can be exchanged to any employment. Adaptability is thusly guaranteed. Development demonstrates flourishing, which is reflected in expanded benefits from year to year. The strategy

must have a reasonable, reasonable and straightforward procedure that applies to all representatives inside of the association. An exchange obliges representatives to change the work gathering, working environment or unit. The exchange may be to move the representative to an alternate geographic locale. Unsettling influence in contemplations, emotions and observations that has an immediate influence in everyday working. Emotional instability influences considering, state of mind and conduct; this is connected with pain as well as practical hindrance with indications differing from mellow to serious.

Industrial Relations (IR) is the relationship which exists in the middle of businesses and representatives. It is most imperative that this relationship is great. The significance of Good IR decreases the mechanical question, at a same time it's enhance the confidence of the representatives. Representatives work with the immense enthusiasm. The primary object of IR is a finished mental unrest of specialists and representatives. Work fulfillment is the inclination a representative land when the position he does satisfies every one of his desires. While assurance alludes to the disposition of the representatives of an association and is a gathering idea, work fulfillment is the sentiment an individual worker. Job satisfaction has been characterized as a 'pleasurable or positive enthusiastic state coming about because of the evaluation of one's occupation or employment encounters'. It communicates the measure of understanding between one's desire of the employment and the prizes that the occupation gives. The way of one's surroundings of employment is an essential piece of life as Job Satisfaction impacts one's general life fulfillment. Work Satisfaction, in this way, is the consequence of different states of mind controlled by a representative. In a slender sense, these states of mind are identified with the occupation under condition with such particular components, for example, compensation. Chiefs of

occupation, states of work, social connection at work, brief settlement of grievances and reasonable treatment by business.

Nonetheless, more far reaching methodology requires that numerous elements are to be incorporated before a complete Comprehension of employment fulfillment can be acquired.

II. REVIEW OF LITERATURE

Research into the role and effect of HRD Practices and its Relationship with Job Satisfaction in organizations is opening up a new and exciting area of study. Guest, (2002) identified that job satisfaction as a key variable mediating or intervening any positive link between human resources (HR) practices and organizational performance. Green, (2006) studied that in disparity, researchers suggested that in UK, the implementation of human resources practices has been related with higher levels of job intensity resultantly lowered the levels of job satisfaction

Appelbaum, (2002) noted that human resource practices adopted as part of a high-performance work system were not mainly premeditated to increase job satisfaction, in practice, they might or might not have such effect. It might be the case that human resource practices impact on job satisfaction such as satisfaction with sense of achievement or satisfaction with salary. Hence, future research is required to assess the actual effects of human resource practices on individual's job satisfaction and overall job satisfaction. Financially healthy organizations are likely to bethose which are successful in maintaining and retaining a workforce characterized by good physical, psychological, and mental health. This impact on employee health and well-being, and so determine the financial health and profitability of the organization. It also addresses the efficacy of various intervention strategies in reducing employee stress,

and their implications for organizational practices and human resource policies. (Cooper et al., 1994)

The basic purpose of performance appraisal has been to prepare a useful feedback to personals so that they can develop their performance. It has eight suitable methods: Personal appraisal, 360 degree appraisal, self-appraisal, Competence assessment, objective setting, and performance related to pay, Coaching, Personal improving plan (Peretz, 2008).

Rewards management is the one of processes in the human resources that is developed, underpinned practically, academically and known as a "Soft Variant" for human nature in the subject (Ekaterini Galanou, 2011)

Ali and Ahmed (2009) confirmed that there is a statistically significant relationship between reward and recognition respectively, also motivation and satisfaction. Eunmai, (2005), HR Practices, have been extensively examined, the effects of employees' overall perception of HR effectiveness have rarely been studied. One Human Resource function that aids in changing employee behavior is that off support from employer for personal development, it leads to employees positive responses as being engaged and committed (Maurer and Lippstreu, 2008). Job Satisfaction as Related to Organization Climate and occupational Stress: A case Study of Indian Oil found the results of the study also confirmed the assumption that high age group managers as well as high age group engineers were equally satisfied with their jobs and the study revealed the same findings when low age group mangers and low age group engineers were compared on their job satisfaction level by Jain, et al., (2007). Edwina Pio, (2007) reported that A Review and Avenues for Future Research in this study he pointed out integrates and discusses research on HRM in India with a focus primarily on the past fifteen years. It is within this complexity that research on India and its workforce is presented by illuminating HRM as embedded in the Indian environment with its intricate epistemologies and transitions in a period

of dynamic change. Shruti Gupta, (2008), examined that “The Indian and Japanese HRM Practices: Similarities and Differences with Analysis of Automobile Sector in India”. This exploratory study found that the key HRM factors of significant differences in Recruitment and Selection, Training and Development, Performance Appraisal, Compensation Practices and Job Design amongst the two countries.

Alina Ileana Petrescu et al., (2008), postulate that “Human resource management practices and workers’ job satisfaction”, the purpose of this study is to investigate the relationship between several HRM practices and workers’ overall job satisfaction and their satisfaction with pay. The findings of the study it was concluded that A pay structure that is perceived to be unequal is associated with a substantial reduction in both non-union members’ overall job satisfaction and their satisfaction with pay. “The Effect of Biographical Variables on the Job Satisfaction of a Group Human Resource Management Employees working in a Municipality” in this study, result indicated that employees are uncertain about the job satisfaction components: company policies and practices, remuneration, promotion, security, acknowledge for good performance, status, supervisor skills, working conditions, equipment and facilities discussed by Markham et al., (2008).

Arngrim Hunnes (2009), “Internal wage dispersion and firm performance: White-collar evidence’. The purpose of this study is to investigate the net relationship between internal wage dispersion and firm performance. The study contributes to the relatively sparse empirical literature on internal wage dispersion and firm performance. In fact, the study aims to narrow down the research gap due to prior literature focusing either on the impact of employee incentives on individual effort and employee incentives on firm performance, thus leaving the effect of employee incentives on firm- level

performance with little attention. Secondly, as Bryson & Freeman (2010) argue, firms are found to frequently switch between different employee compensation schemes. This signals that organizations have difficulties in structuring optimal schemes. Therefore, knowing that PBC plans for employees are getting more popular, it is essential for practitioners to know which type of compensation plans work best and for whom

A notable share of prior literature focuses on blue-collar work although in today’s economy white-collar work is of considerable importance (Hopp et al., 2009). There is some research that touches upon blue-collar employee incentives but less evidence regarding the effects of white-collar worker incentives on firm performance. Yet, job design, requirements and responsibilities of all three groups, executives, white-collar and blue-collar workers, are different and this should be reflected in compensation schemes (Kauhanen & Napari, 2012). The Employee attitudes typically reflect the moral of the company. Every Organization should develop strategies that strengthen the work environment and increase the employee’s morale and satisfaction to enhance employee performance and productivity. Job satisfaction represents one of the most complex areas facing today’s managers when it comes to managing their employees. Policy makers and managers have turned their attention to provide different kinds of facilities to their employees in order to satisfy their employees. A good work environment and conditions can increase employee job satisfaction and the employees will try to give their best which can increase the employee work performance (Jitendra et al., 2013)

III. OBJECTIVE OF THE STUDY

To know the demographic profile of employees in the study unit.

To identify the relationship between HRD factors and demographic variables.

IV. METHODOLOGY

Application of appropriate methods and adoption of scientific procedure is a *sin-quo-non* - systematic enquiry. This has an important bearing on the collection of reliable and accurate information as well as on the outcome of the study.

Sampling

A sample of 120 Investors has been taken at stratified random sampling covering all categories viz. Executives, Managers, and other middle level management. The sample was distributed among three selected companies viz. Dr. Reddy’s and Biological Events Pharma

Hypothesis

H0: -There is no significant relation between factors affecting HRD practices and demographic factors of employees.

H1: -There is a significant relation between factors affecting HRD practices and demographic factors of employees.

Demographic Profile of Employees

In view of the importance of the employees and their perception on factors that influence job satisfaction, it would be fruitful to examine and understands their socio-economic characteristics that influence, their behavior and performance in a large measure. Therefore, an attempt is made in this section to present the socio-economic profile of selected employees of selected companies.

- Working conditions
- Quality of supervision
- Company policies and administration
- Inter personal relations

- Promotion and growth in the organization
- Personal or company loyalty to employees
- Good work-life balance
- Learning and career development
- Sympathetic help with personal problems
- Recruitment & Selection
- Addressing grievances

ANOVA				
	Age	Education	Designation	Annual Income
Working conditions	.010	.004	.000	.000
Quality of supervision	.006	.000	.000.	.000
Company policies and administration	0.20	.012	.000	.000
Inter personal relations	.662	.146	.003	.003
Promotion and growth in the organization	0.10	.000	.000	.000
Personal or company loyalty to employees	.007	.000	.000	.000
Good work life balance	.169	.005	.000	.000
Learning and career development	.001	.039	.001	.001
Sympathetic help with personal problems	.030	.085	.095	.095
Recruitment & Selection	.555	.427	.026	.026
Addressing Grievances	.430	.285	.047	.047

Company Policies and Administration

It can be inferred from the above statistical survey and the mean table with respect to Age below that

majority of the respondents are below 35 years expressed that there is no significant relationship between company policies & administration and Age (Demographic factor) in the pharmaceutical sector. In respect of education of the employees in the pharmaceutical sector, there is no significant relationship between company policies & administration and Employee

Education, reasons for such factor is majority of respondents are Graduates only. Availability of statistical survey of pharmaceutical employee responses, there is a significant relationship between company policies & administration and

Designation (Demographic factor) here reason is majority of the favorable respondents are executives only. In respect of Annual income of the employees in the Pharmaceutical sector, there is a significant relationship between company policies & administration and Annual income the reason is majority of favorable respondent's Annual income is below 3 lakhs only based on the statistical data.

Inter Personal Relations

It can be inferred from the above statistical survey and the mean table with respect to Age below that majority of the respondents are in between 35 to 50 years expressed that there is no significant relationship between employee inter personal relations and Age (Demographic factor) in the pharmaceutical sector. In respect of Education of the employees in the pharmaceutical sector, there is no significant relationship between employee inter personal relations and Education the reason is majority of favorable respondents are qualified SSC / Intermediate here. Availability of statistical survey of pharmaceutical employee responses, there is a significant relationship between employee inter personal relations and

Designation (Demographic factor) here reason is majority of the favorable respondents are senior executives only.

Availability of statistical survey of Pharmaceutical employee responses, there is a significant relationship

between employee inter personal relations and annual income here reason is majority of the favorable respondent's annual income in between 3 lakhs to 6 lakhs here.

Promotion and Growth in the Organization

It can be inferred from the above statistical survey and the mean table with respect to Age below that majority of the respondents are below 35 years expressed that there is no significant relationship between Promotion and Growth in the organization and Age in the pharmaceutical sector. In respect of education of the employees in the pharmaceutical sector, there is a significant relationship between Promotion and Growth in the organization and Employee Education, reasons for such factor as per availability of statistical survey majority of respondents are Graduates only. Availability of statistical survey of pharmaceutical employee responses, there is a significant relationship between Promotion and Growth in the organization and Designation (Demographic factor) here reason is majority of the favorable respondents are executives here. In respect of Annual income of the employees in the Pharmaceutical sector, there is a significant relationship between Promotion and Growth in the organization and Annual income the reason is majority of favorable respondent's Annual income is below 3 lakhs only based on the statistical data.

Personal or Company Loyalty to Employees

It can be inferred from the above statistical survey and the mean table with respect to Age below that majority of the respondents are age of below 35 years expressed that there is no significant relationship between Personal or company loyalty to employees and Age (Demographic factor) in the pharmaceutical sector. In respect of Education of the employees in the pharmaceutical sector, there is a significant relationship between Personal or company loyalty to employees and

Education the reason is majority of favorable respondents are qualified SSC / Intermediate here.

Availability of statistical survey of pharmaceutical

employee responses, there is a significant relationship between Personal or company loyalty to employees and Designation (Demographic factor) here reason is majority of the favorable respondents are executives only.

In respect of Annual income of the employees in the Pharmaceutical sector, there is a significant relationship between Personal or company loyalty to employees and Annual income the reason is majority of favorable respondent's Annual income is below 3 lakhs only based on the statistical data.

Learning and Career Development

It can be inferred from the above statistical survey and the mean table with respect to Age below that majority of the respondents are below 35 years expressed that there is a significant relationship between employee Learning and Career development and Age of the employee in the pharmaceutical sector. In respect of education of the employees in the pharmaceutical sector, there is no significant relationship between employee learning and Career development and Employee Education, reasons for such factor as per availability of statistical survey majority of respondents are Graduates here. Availability of statistical survey of pharmaceutical employee responses, there is a significant relationship between employee learning and Career development and Designation (Demographic factor) here reason is majority of the favorable respondents are executives here. In respect of Annual income of the employees in the Pharmaceutical sector, there is a significant relationship between employee learning and Career development and Annual income the reason is majority of favorable respondent's Annual income is below 3 lakhs only based on the statistical data.

Sympathetic help with Personal Problems

It can be inferred from the above statistical survey and the mean table with respect to Age below that majority of

the respondents are age of below 35 years expressed that there is no significant relationship between Sympathetic help with personal problems and Age of the employee (Demographic factor) in the pharmaceutical sector. In respect of education of the employees in the pharmaceutical sector, there is no significant relationship between Sympathetic help with personal problems and Employee Education, reasons for such factor as per availability of statistical survey majority of respondents are Graduates here. Availability of statistical survey of pharmaceutical employee responses, there is no significant relationship between Sympathetic help with personal problems and Designation (Demographic factor) here reason is majority of the favorable respondents are executives here. In respect of Annual income of the employees in the Pharmaceutical sector, there is no significant relationship between Good work-life balance and Annual income the reason is majority of favorable respondent's Annual income is below 3 lakhs only based on the statistical data.

Recruitment and Selection

It can be inferred from the above statistical survey and the mean table with respect to Age below that majority of the respondents are age of below 35 years expressed that there is no significant relationship between Recruitment & Selection and Age of the employee (Demographic factor) in the pharmaceutical sector. In respect of Education of the employees in the pharmaceutical sector, there is no significant relationship between Recruitment & Selection and Education the reason is majority of favorable respondents are qualified SSC / Intermediate here. Availability of statistical survey of pharmaceutical employee responses, there is no significant relationship between Recruitment & Selection and Designation (Demographic factor) here reason is majority of the favorable respondents are executives here. In respect of Annual income of the employees in the Pharmaceutical sector, there is no significant relationship between Recruitment & Selection and

Annual income the reason is majority of favorable respondent's Annual income is below 3 lakhs only based on the statistical data.

Addressing Grievances

It can be inferred from the above statistical survey and the mean table with respect to Age below that majority of the respondents are age of below 35 years expressed that there is no significant relationship between Addressing grievances and Age of the employee (Demographic factor) in the pharmaceutical sector. In respect of education of the employees in the pharmaceutical sector, there is no significant relationship between Addressing grievances and Employee Education, reasons for such factor as per availability of statistical survey majority of respondents are qualified SSC / Intermediate here. Availability of statistical survey of pharmaceutical employee responses, there is no significant relationship between Addressing grievances and Designation (Demographic factor) here reason is majority of the favorable respondents are executives here. In respect of Annual income of the employees in the Pharmaceutical sector, there is no significant relationship between Addressing grievances and Annual income the reason is majority of favorable respondent's Annual income is below 3 lakhs only based on the statistical data.

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Cite this article as :

Dr. R. Shridhar, Tabish Turabi , "Recent Trends in Human Resource Practice in Pharmaceuticals Industries", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 79-87, January-February 2022. Journal URL : <https://ijsrst.com/IJSRST229116>

The Fundamentals of Epoxy Composites with Filler for Different Applications: A Review

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ABSTRACT

Abstract Composites or composite materials are engineered materials that consist of two or more constituent materials with wide discrepancies in their physical, chemical, and mechanical properties. The characteristic properties of these composite are as a result of the individual properties of their constituent parts and their respective volume fractions and arrangements in the material system. Depending on the intended application, composites can be designed to satisfy specific geometrical, structural, mechanical, chemical, and sometimes aesthetic requirements. Areas of application of these synthetic materials includes construction such as in buildings and bridges, automotive industry such as in car bodies, aeronautic, naval (e.g., ships and boats), and in the biomedical fields. Therefore, the main purpose of this paper is to introduce composite materials, epoxy resins their additives, fillers and discuss their current and potential use in coatings, electronic materials, adhesives, and matrices for fiber reinforced composites because of their outstanding mechanical properties, high adhesion strength, good heat resistance, and high electrical resistance.

Keywords: Composites, Epoxy Resins, Additive, Fillers, Application Of Epoxy Resins

Article Info

Volume9, Issue 1

Page Number: 88-100

Publication Issue

January-February-2022

Article History

Accepted : 15Jan2022

Published :25Jan2022

I. INTRODUCTION

Overview on Composite

In the innovatively propelled engineering system, there is a developing interest for cost-effective and new materials for different applications. Superior materials and processes have an expanding role in accomplishments for environmental protection, advancement of infrastructure, modern and consistent development in the transportation system. The

accessibility of natural wealth and man-made materials are conveying down accessibility today. This has brought about the requirement for research, selection of new choices, and suitable materials. Therefore, there was an interest for robust and lightweight materials thus composite materials were developed.

Composite materials or composites are designed materials comprised of at least two constituent

materials, with altogether extraordinary physical or chemical properties that keep them independent and appreciable levels among the completed structure. The properties of composite materials attained by joining the different constituent materials can't be accomplished by any of the individual components used alone.

Composite materials are typically manufactured by three different materials like metals, ceramics, and polymers. A large portion of the composite materials is created to enhance the mechanical properties, for example, stiffness, toughness, and hardness. Composites moreover have predominant alternative properties like high strength, lightweight, wear, and corrosion resistance.

The two basic constituents in the composite are reinforcement and a matrix. The strength and stiffness properties are offered by the reinforcement phase. Normally the reinforcement phase is stronger, stiffer, and harder. Generally, the reinforcement is available in the form of fiber or particulate. Fiber has a length that is significantly more prominent than its diameter. The length to diameter (l/d) ratio is known as the aspect ratio and can change enormously. Long fibers have more aspect ratio and preferred orientation while short fibers have minimum aspect ratio and are randomly oriented in nature.

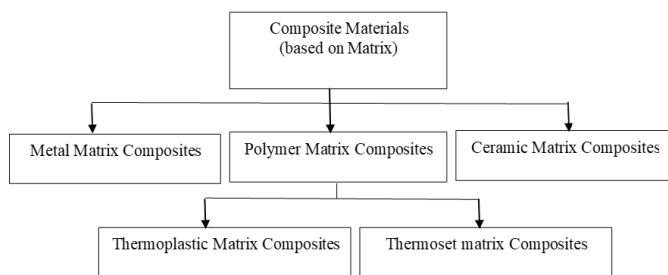


Figure 1.1 Types of composites

The dimensions of particulate composites have equal in all directions. They might be spherical, platelets, or some other consistent or unpredictable geometry. Particulate composites tend to be significantly weaker and less stiff than long fiber composites, however, they are typically considerably less costly. Particulate

strengthened composites generally contain minimum reinforcement because of difficulty in processing.

The matrix is a continuous phase in composites. The matrix plays a major role to perform several functions like keeping up the fibers in the proper orientation, spacing furthermore and protecting them from abrasion and deterioration. In polymer matrix composites form a strong bond between the fiber and the matrix. It transmits the load to the fiber through shear at the interface.

Due to an extensive lifetime, the effectiveness of materials, and the simple manufacturing procedure of composites the usage of these composites is unavoidable. The composite materials are having great financial advantages and societal utilize due to their promptly available nature.

1.1 Elements of Composite

Composites are a mixture of two materials in which one of the materials called the reinforcement phase (dispersed phase) is in the form of fibers, particles, or sheets, and is surrounded by the other materials called the matrix phase (continuous phase). The reinforcement material and the matrix material can be metal, polymer, or ceramic. It can provide greater strength and rigidity than is found in any of the separate components while being as light as could be expected under the circumstances. The matrix phase supports and surrounds the reinforcement phase by keeping their relative position.

The reinforcements impart their excellent mechanical and physical properties to improve the matrix properties. A combination between the matrix and reinforcement creates the properties which are inaccessible from the individual constituent materials. The wide range of matrix and reinforcement materials allows the researcher to choose an optimum ratio between them.

The matrix material is placed into the reinforcement previously or after the reinforcement material is introduced into the mould. The matrix material

encounters a blending occasion, after which the part shape is set. Depending upon the characteristic of the matrix material, this combination will happen from various perspectives such as polymerization or curing of the liquid state.

1.2 REINFORCEMENT MATERIAL

The function of the reinforcement in a composite material is one of improving the mechanical properties of the neat resin system. There are different fibers used in composites that have dissimilar properties thus influencing the properties of the composite in various ways.

Nevertheless, singular fiber or bunch of fibers can be used for manufacturing composites and some other applications, the reinforcements should be arranged into some sort of sheet, known as fabric for easy handling. A different form of assembling fibers into sheets and different varieties of fiber orientations are to be followed for fabricating the sheets and every one of them has its characteristics.

Advanced composite materials are generally characterized by high-strength fibers with high stiffness compared to other materials while embedded together by weaker matrix. The high-strength fibers are additionally low density while possessing a large fraction of the volume.

These composites exhibit good physical and chemical properties that include lightweight, high stiffness, and strength along the direction of the reinforcing fiber, dimensional stability, temperature, and chemical resistance, and generally easy handling. Nowadays advanced composites are replacing metal parts, especially in the aerospace industry. The common fibers commercially used are glass fiber, carbon fiber, and aramid fibers.

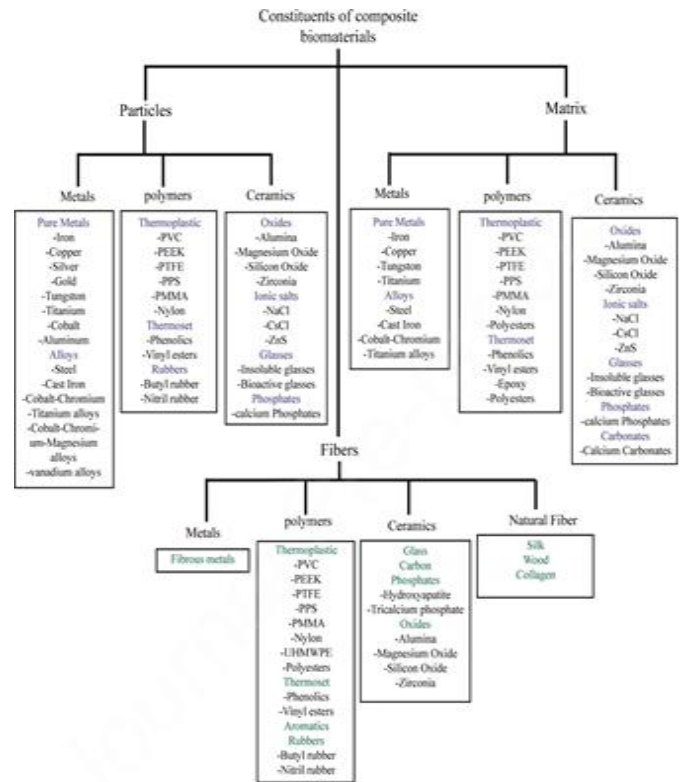


Figure 1.2 Constituents of composite biomaterial [1]

1.3 FIBER-REINFORCED PLASTICS (FRP)

FRP is a composite material that utilization of natural or synthetic fibers embedded in the polymer matrix to increase strength and stiffness. FRPs used to strengthen and reinforce the structures are greatly stronger than typical steel. Fiber-reinforced polymer composites (FRPs) are classified into:

- i. Carbon Fiber Reinforced Polymer Composites (CFRPs)
- ii. Glass Fiber Reinforced Polymer Composites (GFRPs)
- iii. Aramid Fiber Reinforced Polymer Composites (AFRPs)

1.3.1 Merits of FRPS Composites

The achievement of fiber-reinforced polymer composites in the competitive environment is basically because of their outstanding performance

contrasted with different materials. The benefits include:

- High strength to weight ratio
- Dimensionally stable
- Resistant to corrosion and abrasion
- Good thermal and electrical resistance
- Enhanced impact, fatigue, and compression strength
- Lower shrinkage rate

1.3.2 Demerits of FRPS Composites

- High initial cost.
- Weakness to mechanical damage
- Less flexibility
- Minimum shear strength
- Lack of ductility

1.4 SYNTHETIC FIBERS

Synthetic fibers are manmade fibers by the chemical synthesis process. In general, synthetic fibers are manufactured by extruding fiber through the form die into air and water. These fibers are high-performance fibers that possess high tensile strength, stiffness, and thermal stability than those of the traditional fibers. The performance of a fiber-reinforced composite is estimated by its length, shape, arrangement of the fibers, and the mechanical properties of the matrix material.

1.5 Glass Fibers

More than 95% of the fibers utilized as a part of strengthened plastics are glass fibers, as they are low cost, simple to fabricate, and have high strength and stiffness compared to the plastics, with which they are reinforced. Their low densities, corrosion resistance, and high fatigue life are advantages of the glass fiber.

Generally, glass fibers are available as discontinuous and continuous fibers, cloths, mats, tapes, and yarns. The addition of different mineral oxides to silica sand gives the resulting product having different types. Based on the chemical composition and its application, glass fibers can be classified into various types. The most commonly used glass fibers are E-glass (fiberglass) also S-glass. The E-glass fibers are high electrical resistive glass made with alumina calcium borosilicate. It is also used for general purposes due to its good mechanical properties. The S-glass fiber remains for the higher substance of silica. It maintains its strength at high temperatures when compared with E-glass and has higher fatigue strength. It is utilized mostly in aerospace applications. Another kind of fiber is C-glass (corrosive resistant glass) used in corrosive environments. D glass (dielectric glass) is used for applications requiring low dielectric constants. R glass (reinforcement glass) is used in high strength and construction applications and A-glass (alkali glass) is used to enhance surface appearance. Figure 1.3 shows the different forms of glass fiber[1,2].



(a) Chopped fiber (b) roving



(c) Woven roving

Figure 1.5 (a-c) different forms of glass fiber

1.6 Carbon Fibers

Carbon fibers also called graphite fibers are about 5 – 10 micrometers in diameter and mostly composed of

carbon molecules. 90 percent of manufacturing carbon fiber is the oxidation and thermal pyrolysis of polyacrylonitrile (PAN) material and 10 percentage are made from rayon or petroleum pitch. These materials are natural polymers, characterized by long series of molecules bound together by carbon atoms. The advantages of these fibers are high strength and modulus, low thermal expansion, and high fatigue strength. The disadvantages include high cost, high electrical conductivity, and low impact strength. These fibers are reinforcement for composite materials used in aircraft components, High-performance vehicles, sports items, wind blades, and other high-performance applications.

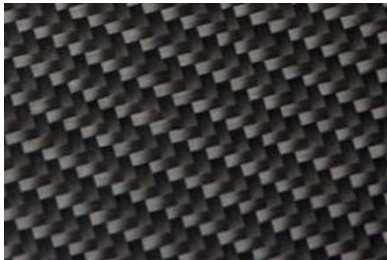


Figure 1.6 Carbon fiber

1.7 Aramid Fibers

Aramid fibers are synthetic fibers, with molecules that are described by moderately rigid polymer chains. These molecules are linked by solid hydrogen bonds that transmit mechanical stress proficiently and making it feasible to utilize chains of relatively low molecular weight.

The characteristics of aramid fibers are

- Good resistance to abrasion and corrosion
- Good resistance to organic solvents
- Non-conductive
- No melting point
- Low flammability
- Good fabric integrity at elevated temperatures
- High strength

They are used in aerospace and military applications, for ballistic rated body armor fabric and ballistic composites, marine cordage, marine hull reinforcement, and as an asbestos substitute. Though the high cost of the material, the intricate manufacturing process and preparing of the composite material has constrained their popularity when compared with glass fiber or carbon fiber.

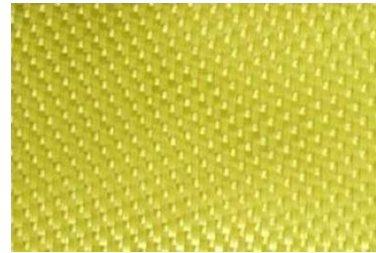


Figure 1.5 Kevlar fiber

Mechanical properties of various synthetic fiber shown in Table 1.1.

Table 1.1 Mechanical properties of synthetic fibers [2]

Fiber	Density (g/cm ³)	Elongation (%)	Tensile strength (MPa)	Elastic modulus (GPA)
E-Glass	2.5	0.5	2000-3500	70
S-Glass	2.5	2.8	4570	86
Carbon	1.4	1.4-1.8	4000	230-240
Aramid	1.4	3.3-3.7	3000-3150	63.0-67.0

1.8 Polymer Matrix Material

In polymer matrix composites, the matrix material performs two important functions. They are binding the reinforcement material in the respective place and distribute the mechanical stress to the reinforcement under an applied force. Polymers are the perfect materials as they are handled effortlessly, have lightweight, desirable mechanical properties. The two different types of polymers are thermosets and thermoplastics.

The characteristics of thermosets have limited three-dimensional atomic structure after curing. Whereas, thermoplastics have may be single or two-dimensional atomic structures. Thermoplastics tend to lose their property at elevated temperatures.

Nowadays thermoset polymers are used as superior composite matrix materials. The thermoset materials (i.e., epoxy, polyester, vinyl ester, polyimide) are changing phase from liquid to solid by an irreversible process, finally, we get a cross-linked chain. After the cross-linking process is done, they can't be liquefied again. The advantages of using a thermoset are a liquid stage

at room temperature and during processing only low or medium pressure are required and they are low-cost materials.

Epoxy resins are most extensively used in polymer matrix composites and are suitable for the compression moulding process. They are sensibly steady to chemical contacts and are outstanding adherents having minimum shrinkage during the curing process and no discharge of unpredictable gases. Generally epoxy resins are low molecular weight organic fluids containing various epoxide groups, which are three-part rings with one oxygen and two carbon atoms. The chemical structure of epoxy resin is shown in Figure 1.6. Polyepoxides, epoxy, epoxy resins, epoxides (Europe), epoxy or 1,2-epoxy represent a special class of highly reactive pre-polymers or polymers that contain epoxide groups in their molecular structures. The term epoxy represents any basic or cured end products of ERs [1, 2]. An epoxy is reacted with a hardener (curing agent), they set to a hard material and it does not melt or dissolve in solvents. The important properties of epoxy resins are viscosity, molecular weight and epoxide equivalent weight.

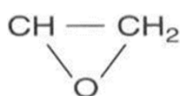


Figure 1.6 Structure of epoxy resin

1.8.1 Types of Epoxy Resin

There are two principle classifications of epoxy resins, to be specific the glycidyl epoxy and non-glycidyl epoxy resins. The glycidyl epoxies are further divided into glycidyl-ether, glycidyl-ester and glycidyl-amine. The non-glycidyl epoxies are either aliphatic or cycloaliphatic epoxy tars. Glycidyl epoxies are manufactured through a condensation process of proper dihydroxy compound, dibasic acid or a diamine and epichlorohydrin.

Merits of epoxy resin

Epoxy resins are commonly used matrix material due to the advantages of high strength, low viscosity, low shrinkage rate, resistance to fatigue and creep, good chemical and electrical resistance.

Demerits of epoxy resin

Epoxy resins also have few inherent disadvantages like toxic in nature, moisture absorption resulting into change in dimensions and physical properties, high degree of thermal coefficient of expansion, high degree of smoke release in a fire.

II. CURING OF EPOXY RESINS

The curing practice is a chemical reaction in which the epoxide groups in epoxy resin reacts with a curing catalyst (hardener) to shape a very cross linked, three-dimensional system. So as to change over epoxy resins into a hard, infusible, and inflexible material, it is important to cure the resin with hardener. Epoxy resins cure rapidly and effectively at any temperature from 5-150 °C depending upon the choice of curing agent. The large varieties of curing agent for epoxy resins are available depending on the manufacturing process and properties required. The generally available curing agents for epoxies include amines, polyamides, phenolic resins, anhydrides, polymercaptans and isocyanates. The phenolic and amine-based curing agents are generally used for curing of epoxy resins. These co-reactants are

commonly called curatives or hardeners and the cross-linking reaction is often called to as curing. Generally, curing of epoxides makes them brittle in nature because of high degree of cross-linking [3]. Curing of ERs also results in the formation of thermosetting polymers with high mechanical strength and excellent thermal and chemical stability [4,5].

III. APPLICATIONS OF ER'S

The unique thing about composite materials in general is the fact that they can be tailored to suit specific applications. Typical products include automobile panels, roof, life gates, battery trays, fenders, hoods, bumpers, spoilers, air deflectors, furniture, kitchen bowls and trays, large containers, recreational vehicle body panels, medical equipments.

Application fields

3.1 Paints and coatings

Epoxy resins are widely used as heavy-duty anticorrosion coatings because of their exceptional properties, such as easy processing, high safety, excellent solvent and chemical resistance, toughness, low shrinkage on cure, mechanical and corrosion resistance, and excellent adhesion to many substrates. Metal cans and containers are often coated with epoxy resins to prevent rusting, especially when packaging acidic foods like tomatoes. Epoxy resins are also used for high performance and decorative flooring applications such as terrazzo, chip, and colored aggregate flooring [7,14].

3.2 Adhesives

Epoxy adhesives are a major part of the class of adhesives called "structural adhesives". These high-performance adhesives are used in the construction of aircraft, automobiles, bicycles, boats, golf clubs, skis, snowboards, and other applications where high

strength bonds are required. When used as adhesives in cryogenic engineering applications, it is necessary to optimize the epoxy shear strength at both cryogenic and room temperatures. Commercial epoxy adhesives are engineered for optimal toughness by incorporating phase-separated thermoplastics, rubber particles, or rigid inorganic particles into the matrix. Typically, the adhesives are cured at elevated temperatures to increase their strength and activate chemical bonding at the substrate/adhesive interface [15-17].

3.3 Industrial tooling

Epoxy systems are used in industrial tooling applications to produce molds, master models, laminates, castings, fixtures, and other industrial production aids. This "plastic tooling" replaces metal, wood, and other traditional materials, and generally improves the process efficiency while either lowering the overall cost or shortening the lead-time for many industrial processes. Fiber-reinforced epoxy composites have proven effective in repairing metallic components and tubular pipes. The composites also act as load-bearing units in hydrogen storage cylinders [18-19]. Aerospace industry Epoxy resins have been extensively used for structural adhesive applications in the aerospace industry because of their high adhesive properties and low cost. Epoxy resins reinforced with high strength glass, carbon, Kevlar, or boron fibers have the greatest potential for use in the aerospace industry [20].

3.4 Electronic materials

Epoxy resin formulations are important in the electronics industry, and are employed in motors, generators, transformers, switchgear, bushings, and insulators. Epoxy resins are excellent electrical insulators and protect electrical components from short circuiting, dust, and moisture. Metal-filled polymers are extensively used for electromagnetic interference shielding [21]. Epoxy molding compounds (EMCs) are popularly used as

encapsulation materials for semiconductor devices protect the integrated circuit devices from moisture, mobile-ion contaminants, and adverse environmental conditions such as temperature, radiation, humidity, and mechanical and physical damage [22,23]. Epoxy composites containing particulate fillers, such as fused silica, glass powder, and mineral silica have been used as substrate materials in electronic packaging applications [24,25].

3.5 Biomedical systems

The biomedical industry has taken advantage of this multi-component material in the design and manufacture of biomaterials that can be used for the repair or the complete replacement of different human tissues or organs [8]. [9] proposed wearable modules have been constructed on reinforcement epoxy material and fabricated on textile woven using the hand block printing method, these delivered results in the textile cotton and polyester materials. A 3.91 GHz have been offered the both the wearable woven materials. [11] the Epoxy/ Yahyali Stone composites can be suggested as a radiation shielding material for the low energetic gamma rays utilized in nuclear medicine applications.

epoxy (EP)/binary spherical alumina (S-Al₂O₃) composites with a high loading of 50 vol% were fabricated by incorporating different sizes of S-Al₂O₃ into EP to increase the thermal conductivity and yet retain the flowability of the composites. binary composites possessed superior electrical insulation, high thermal stability, significantly reduced thermal expansion coefficient and good mechanical properties. These combined desirable properties indicate that binary S-Al₂O₃ mixtures with an optimized size distribution and maximum packing volume are best candidates to develop high performance epoxy-based underfill materials which would improve the flip-chip reliability [12]. a new CF/flax/epoxy composite material developed; CF/flax/epoxy composite has the potential to be used in orthopedic fracture fixation [13].

IV. ADDITIVES AND FILLERS

A variety of additives can be used to modify composite properties, performance, and appearance, including catalysts, inhibitors, colorants, release agents, flame retardants and ultraviolet absorbers. Smart use of additives will bring up new functionalities and savings in material use.

Fillers have specifically different properties to polymers, and by their sensible choice one can produce composite materials with improved properties for a given use and it is essential to recognize that while promoting a few properties. These materials are added into polymer matrix for the following reasons.

- Improve the Mechanical property
- Flame retardancy
- Enhance the Electrical and magnetic property
- Improve Surface property
- Improve processing aids
- Better abrasion and tear resistance
- Reduces cost
- Reduces shrinkage

Additionally, it may include improve degradability, antiaging characteristics, bioactivity, radiation absorption, warpage minimization etc.

The most commonly used fillers for thermoset resins are calcium carbonate, Kaolinite and alumina hydrate. Other commonly used fillers include clay, mica, silica, glass microspheres, glass whisker, and micro rubber balloon. The calcium carbonate of often used filler in unsaturated polyester and vinyl ester resins to reduce the cost as well as the mould shrinkage.

4.1 Epoxy with Additive

the challenges of joining composite materials together and the advantages that adhesives and tapes have over

traditional metal fasteners. The report explore advice on choosing the right adhesive to use and what parameters to consider as well as comparing some of the new adhesives that are being used to bond composite materials, whilst evaluating the advantages some chemistries have over others. two recent Case Studies where Techsil has worked with manufacturers using carbon fiber composite parts in their product assemblies to overcome challenges in bonding their parts together are studied [10].

4.2 Epoxy with Filler

The addition of fillers in epoxy depends on the shape, size, colour, density, modulus and various studies of fillers are used to improve stiffness and heat deflection temperatures, crystallization, decrease shrinkage, voids and good appearance of the composites. One of the known fillers is glass fibre. Because of its good strength and stiffness, the size and volume fraction play an important role in mechanical and wear properties [4]. Processing of fillers with epoxy can be done by casting, in which a liquid material is usually poured into a mould. Particulate filled epoxy is a preferred choice for non-structural application such as polymer bearings, seals, tools etc. The reinforcing fillers range from particulates of metals, oxides, nitrides, carbides.

Effect of fillers on various sizes on mechanical Characterization

N. Saba et al. [26] noted the effect of nano oil palm empty fruit bunch fillers on natural fiber kenaf in the non-woven mat form with epoxy composite. The experimental results shows that addition of nano oil palm empty fruit bunch filler with kenaf epoxy composite improves the tensile strength in comparison to kenaf epoxy composite due to minimizing the free spaces by the nano fillers. The impact strength of nano filler hybrid composite is increased by 28.3%. K. Mohan et al. [27] observed the effect of multi wall carbon nano tubes on the hybrid composite of glass- flax fiber. Glass and flax fiber hybrid reinforced composites by epoxy resin with

muti walled carbon nano tubes were fabricated using compression moulding technique. MWCNT are added in epoxy resin by using ultra sonic probe sonicator. The maximum tensile strength was raised upto 28.26% with incorporation of 1% MWCNT whereas compressive strength is increased with 1% of MWCNT by weight. The SEM images represent the uniform dispersion of MWCNT in the epoxy resin. Ahmer Hussain Shah et al. Wang et al. [28] inserted the nano TiO₂ in unidirectional fiber of flax by method of immersion in nano TiO₂, KH560 suspension through sonification. The quantity of inserted nano TiO₂ is 0.89% by weight to 7.14% by weight, depends on the concentration of suspension. The drastic change in increase of 23.1% of tensile strength and 40.5 % of interfacial shear strength by the optimizes contents of nano TiO₂ (2.34% by weight) was observed. Foruzanmehr et al. [29] studied flax fibers grafted with TiO₂ were used to create Ploylactic acid (PLA) composites. The TiO₂ film was inserted on the flax fiber by a technique of sol-gel-dip method and also the fibers were oxidized for the purpose to enhance the interfacial adhesion between the flex fibers & TiO₂ film. The impact resistance of the composite of TiO₂ grafted flax fibers was increased by three times as compared to pure poly lactic acid (PLA). The hygroscopic behavior was also observed and amount of moisture absorption was decreased by 18% in the composites of flax fiber grafted with modified TiO₂. Mahesha et al. [30] investigated the mechanical and tribological behavior of Basalt fiber reinforced composites with Epoxy matrix with insertion of nano TiO₂ alone as well as combination of nano TiO₂ with nano clay by the method of vacuum assisted resin infusion technique (VARI). The experimental observations show s that tensile strength and dimensional stability of the basalt- Epoxy composite was increased with the fillers of nao Tio₂. Wear test shows that minor increase in coefficient of friction in basalt-Epoxy with nano clay and decrease in coefficient of friction for basalt Epoxy with nano TiO₂ and TiO₂/clay. Prasob P.A. et al. [31]

noted the increase in tensile strength by 30.79% and increase in compressive strength by 34.03% for composite with fillers of TiO₂, 4% by weight in quantity. Nayak et al. [32] counted the effect of addition of nano TiO₂ 0.1% by weight on glass fiber reinforced polymer composites (GFRP) and found that 9% water diffusion coefficient has reduced, residual flexural strength increased by 19%, residual interlaminar shear strength increased by 18%. The effect of nano OPEFB, MMT and OMMT to kenaf epoxy shows the significant increase in storage modulus, loss modulus, tan delta and glass transition temperature. Mechanical, moisture absorption properties and thermal behaviour was studied by added the nano TiO₂ to the flax fiber reinforced epoxy composites fabricated by compression moulding technique. The best performance was obtained at 0.7% in the variation of 0.5, 0.7 and 0.9 nano TiO₂ in the matrix. Moisture absorption tendency is also decreased by addition of nano TiO₂. The diffusion coefficient is decreased by 31.66% for nano TiO₂ added to flax fibre epoxy composite when compared to flax fibre epoxy composite without nano TiO₂ addition. G. Seshanandan et al. [33] made the hybrid composites by taking jute and glass with different weight ratios of nano TiO₂ by hand lay up method. They noted the drastic increase in tensile strength, flexural strength and shear strength. The insertion of TiO₂ nano particles in FRP resulted in improved strength due to crack deflection and crack pinning toughening, crack-tip blunting mechanisms. Graphene oxide (GO) has been induced into the poly (p-phenylene benzobisoxazole) (PBO) fiber surfaces uniformly with a silane coupling agent (KH-540), improving largely the interfacial shear strength by 61.6%. Gujjala Raghavendra et al. [34] introduced the nano composites by inserting nano alumina (Al₂O₃) into a hybrid composite of natural fibers of Jute and glass fiber. The tensile and flexural strength found to be increased by the insertion of alumina nano particles. The maximum erosion takes place at 90

degree, therefore the composite shows the brittle behavior as the increases in alumina contents.

V. CONCLUSION

In this paper, we have reviewed various epoxy resins. The properties of cured epoxy resins depend on the type of epoxy resin, curing agent, and curing process used. The toughness of epoxy resins can be improved by incorporating thermoplastic components, inorganics, carbon fibers, clay, and carbon nanotubes. Epoxy resins have a wide range of application including coatings, aerospace industry, electronic materials, and biomedical systems.

Its mechanical characterization affected by the parameters like dispersion of fillers, interfacial bonding between filler and polymer matrix and distribution of fillers. Bulk literature is available related to use of fillers in metal matrix composites and synthetic polymers but in this paper an attempt is made to review the use of different fillers with natural fiber hybrid composites and their response on mechanical properties. The various fillers like Titanium Oxide (TiO₂), Aluminum Oxide (Al₂O₃), Silicon carbide (SiC), Zinc Oxide (ZnO), Zirconium Oxide (ZrO₂), Calcium Carbonate (CaCO₃) in varying ratios improves mechanical characters of natural fiber composites.

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Cite this article as :

Monika Shankarrao Satpute, Rajeshkumar U. Sambhe, "The Fundamentals of Epoxy Composites with Filler for Different Applications : A Review", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 88-100, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229113> Journal URL : <https://ijsrst.com/IJSRST229113>

Comparative Study of MnO₂ and Polypyrrole for Supercapacitor Application.

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ABSTRACT

This paper is related to comparative study of MnO₂ and polypyrrole, MnO₂ and polypyrrole are separately deposited on two different stainless steel substrate using electrodeposition method, we have studied their super capacitance behaviour using cyclic voltammetry technique and charge discharging curve. We got maximum capacitance value equal to 184.42 F/gm and 29.72 F/gm For MnO₂ and Polypyrrole so MnO₂ shows better performance than polypyrrole.

Keywords : - Voltammetry, Polypyrrole, Charging Discharging Curve

Article Info

Volume 9, Issue 1

Page Number : 101-105

Publication Issue

January-February-2022

Article History

Accepted : 15 Jan 2022

Published : 28 Jan 2022

I. INTRODUCTION

Super capacitors are widely used in an energy storage system. there are two type of supercapacitor ,Activated carbons, for example, have surface areas in excess of 1000m²/g, and the production of EDL (electrical double layers) in these materials provides the basis for the first method. In order to enhance the working potential of the devices, activated carbon capacitors based on carbon materials were manufactured without the utilization of aqueous electrolytes. Second, a faradaic charge exchange procedure is used to provide electrochemical capacitance that permits electrons and ions to go into the electrode material. [1]. Since it exhibits capacitive performance instead of the distinctively peaked redox behaviour that is closely correlated with intercalation, this is referred to as pseudo capacitance.

The several metal oxide and polymer have been studied extensively for high power super capacitance. Manganese dioxide is one of the metal oxide which is used for study of supercapacitor behaviour. Manganese oxide is low cost ,low toxic, high stability material as compared to RuO₂ so many researcher mostly use MnO₂ for supercapacitor study.

Manganese dioxide gives the very low capacitance as compared to RuO₂ so to improve its capacitive behaviour many of researcher have used electrodeposition method. Similarly, some polymer are used to study supercapacitor because they have high conductivity. Polypyrrole is one of the polymer which is used for study of super capacitor as it has high specific capacitance, high conductivity. In the presence of a strong oxidant, pyrrole solution may be used to create conductive polymer films, which have high durability and conductivity. Conductive polymer

films can be made by chemical oxidation in the presence of a strong oxidant, for example FeCl_3 [2, 4, 5], or by electrochemical oxidation from a pyrrole solution in the presence of a supporting salt, the nature of the salt strongly affects the conductivity of the film [2,3]. The electrodeposition technique is more convenient for the synthesis of materials since it has several benefits, such as its simplicity, the quickness of the reaction, and the ability to precisely regulate the experimental conditions.

The aim of our investigation is using electrodeposition method to prepare MnO_2 and Polypyrrole thin film separately and study their electro chemical properties. In this paper we have synthesized MnO_2 and Polypyrrole film separately by Potentiostatically electrodeposition method and we have studied their morphological structure along with their super capacitive behaviour, and observed that the both thin films are charged–discharged in Na_2SO_4 electrolyte separately.

II. EXPERIMENTAL METHOD

We first prepared MnO_2 thin film by potentiostatic electrodeposition method. For electrodeposition of MnO_2 we have used 0.1 M MnSO_4 and added KOH (0.05M) for adjusting ph. 6.5, then applied 0.95 V voltage for 20 min. A three-electrode electrodeposition approach was used in this study using stainless steel as the working electrode, saturated calomel as the reference electrode, and graphite as the counter electrode. After electro deposition, film was annealed for 200°C , similarly preparation of Polypyrrole thin film was done using potentiostatic electrodeposition method. For electrodeposition of polypyrrole, we used 0.1M Pyrrole and added 5 sulphosalicylic acid for adjusting ph. 2.2, we have applied 0.7 V for electrodeposition for 25 min at room temperature. In this investigation, we found that MnO_2 and Polypyrrole are electrodeposited on two different stainless steel substrate.

A zero grade polish paper was used to prepare the stainless steel substrate prior to electrodeposition, and the surface was then ultrasonically washed with acetone along with ethyl acetate and then etched substrate for few sec in HNO_3 and again ultrasonically cleaned with distilled water. Electrodeposited films are electrochemically characterized by Cyclic Voltammetry, galvanostatic charge discharge technique in 0.5M Na_2SO_4 using autolab Metrohm potentiostat 204.

III. RESULT AND DISCUSSION

a. XRD:

figure1a and 1b shows xrd pattern of MnO_2 and Polypyrrole. Both figures shows almost amorphous structure of material, peak are found due to stainless steel which is indexed by square. MnO_2 amorphous structure and polypyrrole is more feasible for supercapacitor behaviour.

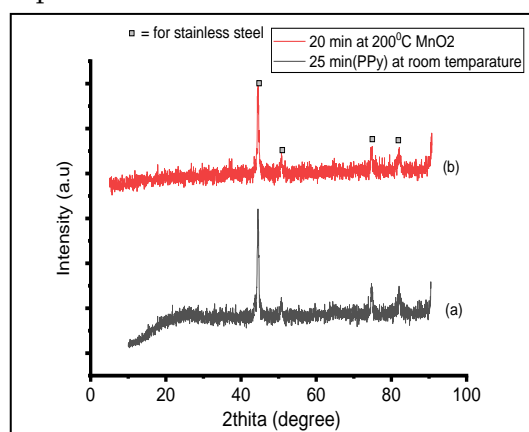


Figure 1 : XRD for a) Polypyrrole b) MnO_2

b. FTIR:

FTIR is one of the technique which is used for confirmation of material, the ftir is studied at range 400 to 4000 cm^{-1} , for MnO_2 (figure 2) 3407 cm^{-1} , 2924 cm^{-1} , 2855 cm^{-1} peaks are obtained due to stretching of water molecule. Peak at 1625 cm^{-1} is attributed for bending of water molecule. 558 cm^{-1} attributes Mn-O vibration so from FTIR of MnO_2 graph, it gives the confirmation of MnO_2 . similarly for Polypyrrole in figure 2 absorption peak obtained at 3442 cm^{-1} , 2924

cm⁻¹ in room temperature is because of O-H and C-H stretches. absorption peak at 1456 cm⁻¹ shows stretching of C=C while 1635 cm⁻¹ and 1372 cm⁻¹ demonstrates stretching of C=N and C-N bond, peaks at 1034 cm⁻¹, 456.83 cm⁻¹ and 607 cm⁻¹ are obtained because of C-H in plane vibration and pyrrole ring vibrations, it confirmed that formation of polypyrrole.

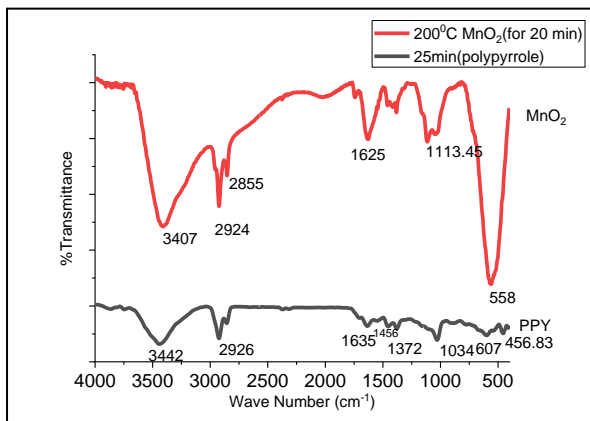


Figure 2 FTIR for Polypyrrole and MnO₂

c. Surface Morphology:

Surface morphology of Polypyrrole and MnO₂ were studied using SEM technique. figure 3a shows surface morphology of polypyrrole, it looks like cauliflower structure and it shows polypyrrole uniformly deposited on substrate, similarly figure 3b shows SEM image for MnO₂ it look like granular structure and high Porous.

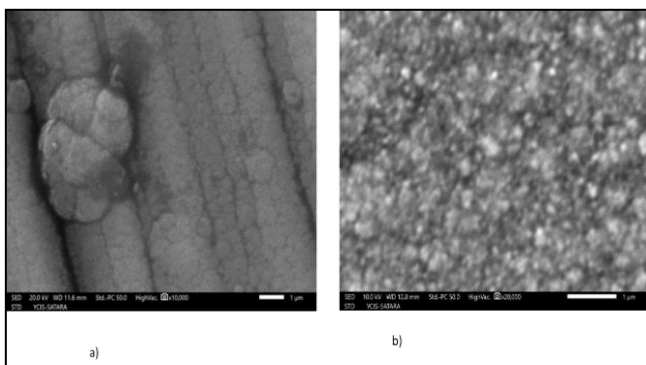


Figure 3 : SEM image for a) Polypyrrole b) MnO₂

d. Electro chemical Characterization:

Electrochemical performance can be studied by Cyclic Voltammetry, galvanostatics charging

discharging curve technique using 1M MnSO₄ for MnO₂ and 0.5 M For polypyrrole.

d.1 Cyclic Voltammetry: Figure 4a and 4b shows the cyclic voltammetry of mno2 and polypyrrole. Figure4a is cyclic voltammetry of polypyrrole for Scan rate 10 mV/sec at Voltage range -0.5 to 0.4 V and figure 4b is cyclic voltammetry of MnO₂ at voltage range 0 to 1 V for scan rate 10 mV/sec. from this figure area under the curve of polypyrrole is large as compared to MnO₂, But it gives poor capacitance performance due to Na⁺ ion can reach outer part of electrode layer and cannot enter the interior pores of the nano particles matrix and anionic dopant like 5 sulfosalicylic acid oxidize on the surface of stainless steel [8] and hence capacitance for polypyrrole at 10 mV/sec is 29.82F/gm which is calculated using following equation

$$C_{sp} = \frac{\int I dv}{2mV} \dots\dots\dots 1)$$

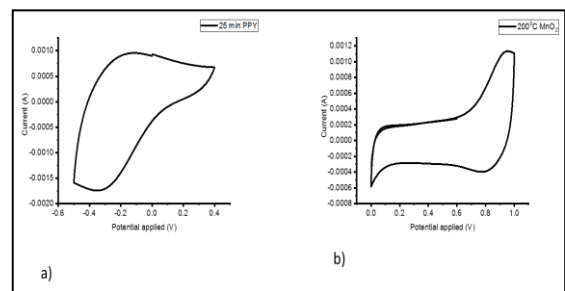


Figure 4. Cyclic Voltammetry for a) Polypyrrole in 0.5 M Na₂SO₄ b) MnO₂ in 1 M Na₂SO₄

Where $\int I dv$, is defined as average charge deduced from CV, active material' mass is represented by m that is deposited on working electrode. Similarly supercapacitance of Mno2 were measured using cyclic voltammetry technique. Fig 4b shows cyclic voltammetry curve of MnO₂ for scan rate 10 mV/sec at voltage range 0 to 1 volt. Its area under the curve is lower than PPY, it shows better performance as compared to PPY because at 10 mV/sec the Na⁺ diffusion from the electrolyte may access to the almost all interior of the nanoparticles matrix, leading to a complete insertion reaction and therefore this

provides a reduction procedure but PPY does not give any reduction process. The maximum supercapacitance calculated using equation 1 is 184.42 F/gm.

In this synthesis, MnO₂ shows maximum supercapacitance as compared to Polypyrrole.

d.2 Galvanostatic charging and discharging curve:

Figure 5 shows that charging curve for MnO₂ and polypyrrole shows asymmetric nature of curve and MnO₂ shows slightly symmetric nature of polypyrrole. Initially both curves slightly drop Voltage before discharge curve, it confirmed that both electrodes have low resistance. So supercapacitance for polypyrrole and MnO₂ can be calculated using following equation

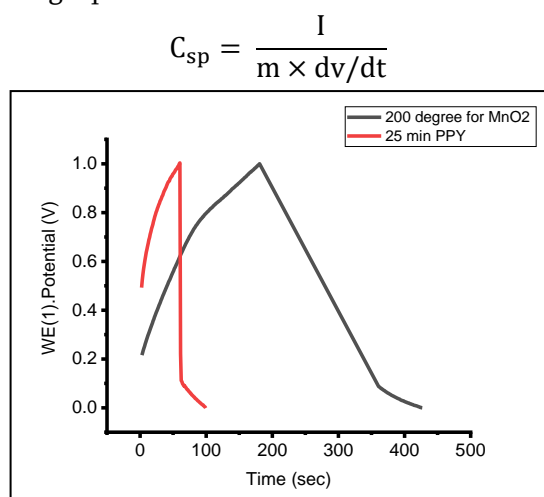


Figure 5. Charging discharging curve for MnO₂ and Polypyrrole

Here, I represent the applied current, deposited material's mass is given by m, and dv/dt is the discharge time calculated from the slope of the galvanostatic charge discharge curve. Maximum capacitance for polypyrrole is 15.96F/gm and for MnO₂ 203.92.F/gm at 0.5 ma Current. So capacitance for MnO₂ is greater than polypyrrole. It is possible to compute the energy density of a super capacitor using the following equation:

$$E = \frac{1}{2} C V^2$$

Energy density for MnO₂ is 103.045 (wh/kg) and Polypyrrole is 8.019 (wh/kg), so both electrodes show pseudocapacitive behaviour.

IV. CONCLUSION

We have successfully synthesized MnO₂ and polypyrrole. From experimental observations, we came to the conclusion that the specific capacitance of MnO₂ using cyclic Voltammetry 184.42 g/gm for 10 mV/sec and using galvanostatic charging discharging curve 203.92 F/gm for 0.5 mA current while for Polypyrrole we got specific capacitance is 29.82 F/gm for 10 mv/sec scan rate using cyclic Voltammetry technique and Charging discharging we got 15.96 F/gm at 0.5 mv over all MnO₂ shows better specific capacitance as compared to polypyrrole. Ideally polypyrrole has high conductivity but in our research it shows poor performance. The polypyrrole electrode's low capacitance is because of the high impedance along with low capacitance oxide layer formed at the film-substrate interface by anodic oxidation of stainless steel. So, if researcher used milled steel substrate performance may be improved.

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Cite this article as :

Priti Nana Jadhav, Dr. K. V. Sukhatankar, "Comparative Study of MnO₂ and Polypyrrole for Supercapacitor Application", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 101-105, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229119>
Journal URL : <https://ijsrst.com/IJSRST229119>

Brain Gate Technology

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ABSTRACT

Article Info

Volume 9, Issue 1

Page Number : 106-113

Publication Issue

January-February-2022

Article History

Accepted : 15 Jan 2022

Published : 28 Jan 2022

Brain Gate overpasses the gap between the brain and the computer. It is a mind-to-movement system that allows a quadriplegic person to command a computer using only his/her thoughts. Brain computer interface technology, used in Brain gate technology, is a brain implant system that came into existence by bio tech company called cyberkinetics in conjunction with the Department of Neuroscience at Brown University. It is found that people with long established, severe paralysis can generate signals in the area of the brain responsible for voluntary movement and these signals can be detected, recorded, routed out of the brain to a computer and transformed into actions enabling a paralyzed patient to perform basic tasks. It is none less than a scientific triumph that brain these signals can be reconnected, thereby allowing the patient to make movements of their limbs just by thinking about it. A fascinating goal which motivates one to work upon this technology is to enable naturally controlled movements of paralyzed limbs. The research done on Brain Gate is yet very limited as the system is still under trial and hence, this paper gathers information through several contributions provided and assembles them to form a single point of reference.

Keywords: Brain Gate, Cyberkinetics, Brain computer Interface and neuroscience

I. INTRODUCTION

Our brain is responsible for all the thoughts produced, but some of us don't have the capability to deliver these thoughts to others. The evolution of the brain gate system is to entitle those with severe paralysis and other neurological conditions to live more productively and to be all by one's self. The Brain Gate System is an investigational medical device

which deliberately decodes neural signals, normally associated with movement commands, in order to permit a disabled individual to control a computer interface. A computer chip that's embedded into the brain, observes brain activity and then interprets the target of the user into computer commands. Presently, the chip makes use of about 100 hair-thin electrodes that recognize the electro-magnetic signature of neurons firing in particular areas of the brain. The

task particularly thought is interpreted into electrically charged signals which is then sent and decoded with the help of a program, which can move any prosthetic device like a robotic arm.

Dr. Donald Humphrey of Emory University is the reason behind the discovery of the revolution of Brain Gate. He invented a method for brain-computer interfaces in the late 90's, which became the basis for a liberal and diverse patent. Following that, a Brown University spin-off known as Cyberkinetics was created to turn a set of laboratory tests into a regulatory accepted set of clinical trials for the first-generation neural interface system, which resulted into Brain Gate Neural Interface System. Subsequently in 2004, the first of two Investigational Device Exemptions was received by Cyberkinetics from the U.S. Food and Drug Administration to perform this research. This was a 12 month, protensive, feasibility clinical study carried out on the Brain Gate system. The study was designed to gather exploratory safety and efficacy data on the possibility of motor impaired patients using Brain Gate System to control a computer with thoughts. Subsequently in 2004, the first of two Investigational Device Exemptions was received by Cyberkinetics from the U.S. Food and Drug Administration to perform this particular research. This was a 12 month, protensive, feasibility clinical study carried out on the Brain Gate system. The study was designed to gather exploratory safety and efficacy data on the possibility of motor impaired patients using Brain Gate System to control a computer with thoughts.

II. BRAIN COMPUTER INTERFACE

Brain-computer interface uses electrophysical signals to control any prosthetic device. BCI is one of the most popular and assuring technologies as it helps in improving communication/control of quadriplegic people. It consists of electrodes which are applied to the scalp of the patient, the signals are then picked up

by these electrodes and carried into amplifier. The signals are then amplified around ten thousand times and then passed through an analog to digital converter to a computer. The computer then processes the EEG signals, which will then help in performing tasks. This technology has applications in many sectors, including medicine, education, and psychology which helps in solving many health-related issues like cognitive deficits, slowness in processing speed, and movement capability decline among elderly people.

There are three types of BCI based on the electrodes used for measuring the brain activity: 1) *Non-invasive BCI*, where the electrodes are placed on the scalp (e.g., EEG based BCI), 2) *Invasive BCI*, where the electrodes are directly attached on human brain (e.g., ECoG based BCI), 3) *Partially Invasive BCI*, where the electrodes are positioned on the exposed surface of brain so that they measure electrical activity coming from the cerebral cortex. To construct a BCI system, five or six components are normally required: signal acquisition during a specific experimental paradigm, pre-processing, feature extraction, classification, translation of the classification result to commands and user feedback.

III. PRINCIPLE

The ultimate goal of Brain gate is to turn one's thoughts into actions. The principle of Brain Gate Technology is to produce neural signals even though these signals are not sent to the limbs. The signals produced with whole brain function is understood by the system. It can be an astounding invention for many.

IV. COMPONENTS USED IN BRAIN GATE

Brain Gate mainly consists of four hardware components:

1) The chip: This chip is a 4mm silicon chip, which is square in shape, and it is studded with 100 hair thin

microelectrodes. This chip is implanted in the primary motor cortex of the brain. Motor cortex of the brain is accountable for the control of movements.

2)The connector: Connector is responsible for passing the signals which it has received from the chip to the convertor. This connector is stanchioned firmly to the patient's skull.

3)The converter: The signal proceeds through an amplifier. Here it is transformed to digital data and then flinched by fiber-optic cable to a computer. This amplifier is shoebox sized.

4)The computer: Brain Gate gains an understanding to assist motive of brain movement with imagination movements. These movements like up, down, left, right is then connected to a cursor.

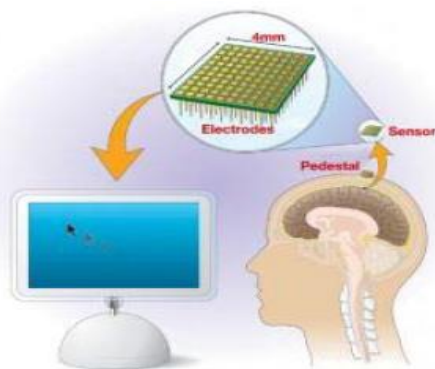


Fig. 1 : The sensor/chip used in Brain Gate

Brain Gate system uses various algorithms and pattern-matching techniques to smooth communication. The algorithms used in Brain Gate are written in C, Java, and MATLAB. The electrical activity of neurons is inspected by software algorithms that process signals and these signals are then translated into control signals for use in various computer-based applications.

V. WORKING

Brains are pervaded with neurons, which are connected to each another by dendrites and axons. Whenever we think, do any activity, or memorize something, our neurons are at work. Then at the speed of approximately 250 mph , small electric

signals race from neuron to neuron. These signals are then provoked by differences in electric potential carried by ions on the membrane of each neuron. Few of these electric signals escape even though the paths, signals taken are insulated by something called myelin. Scientists have the ability to detect these escaped signals and explicate what they mean and use them to conduct some kind of device.

The Brain Gate neural interface system is a patent, investigational Brain-Computer Interface which contains an internal sensor. It identifies brain cell activities and external processors that convert these signals into a computerized output under the person's own control. Sensor/Chip is implanted on the motor cortex. Electrical signals are picked up from the electrodes which invade about 1mm into the surface of the brain, this is called neural spiking.

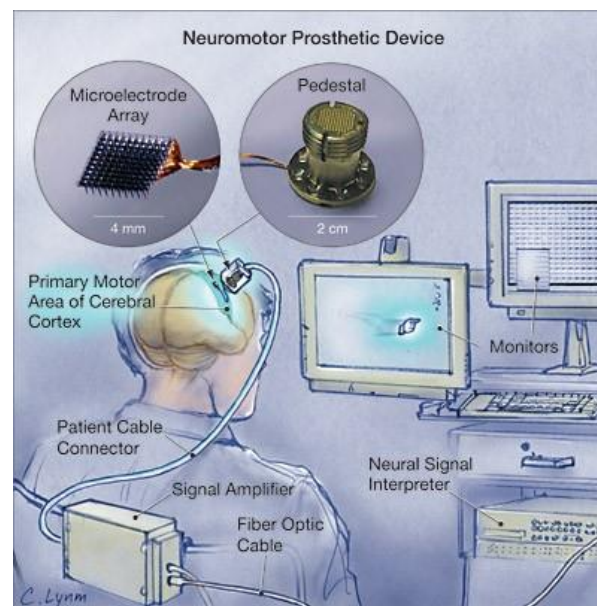


Fig. 2 : Structure of Brain Gate System

The brain gate system is a neuromotor prosthetic device. A Neuromotor prosthetic device is a type of brain-computer interface which extracts signals from central nervous system and thereafter deliver them to control various devices. These devices can be replacement for motor, sensory or cognitive functions that have been impaired due to neurological disorders. The device consists of an array of 100 silicon hair-like

thin microelectrodes in which each electrode is 1mm long. The sensor is of the size of a contact lens. The electrodes are organized less than half a mm apart in the array. The electrolyte and the electrodes form a capacitor which have very high capacitance per area consequently granting voltage-sensitive sites for the entire surface in a spatial arrangement.

When we think about any particular action, electrodes on the silicon chip detect neural activity from an array of neural impulses in our brain's motor cortex. The impulses transfer from the chip and transmit them through thin gold wires to a titanium pedestal that protrudes about an inch above our scalp. These EEG signals produced are obtained from the brain through invasive or non-invasive methods.

It is compulsory to clean the signals once they are obtained. Only once the signals are cleaned, they will be processed. Hence, the pedestal first filters out unwanted signals or noise and then sends the signal to an amplifier. An external cable, which is 13 cm long, connects the pedestal to computers, signal processors, and monitors. The signal is grabbed by the acquisition system and is sent through a fiber optic cable to a computer. The computer then classifies the signals and then using a suitable algorithm, translates the signal into an action, resulting into the desired action/movement.

Brain Gate is able to sense the electrical activity of numerous individual neurons at one time, the data is transmitted from the neurons to computer, where it is analyzed, and the thoughts are then used to control any prosthetic device.



Fig. 3 : Thoughts of a man being analyzed by the computer

The whole process requires two surgeries, one is to implant the Brain gate, and another is to remove it. Before the surgery, several precautions are taken to prevent infections; patients need to bath daily using antimicrobial soap and consume antibiotics, even MRI scans are done in order to find the exact place for the sensor in the brain. In aseptic condition and under general anesthesia, the surgeon drills a small hole in the skull and implants the sensor. Post-operative care is extremely required, which also includes a CT scan, blood tests, and care of wound in the hospital for about a week. Even After the implantation, regular medical checkups are required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions. Authors are strongly encouraged not to call out multiple figures or tables in the conclusion—these should be referenced in the body of the paper.

VI. PROMINENT RESEARCH SUCCESSES

It all started in the year 1995, when Dr. Donald R. Humphrey along with Dr. Leigh R. Hochberg studied 'INTRACORTICAL RECORDING OF BRAIN ACTIVITY FOR CONTROL OF LIMB PROSTHESES'. This research was done to find the evidence that whether the signals derived directly from the motor cortex of the brain can be used for controlling prosthetic devices or not. The study cleared the way for two areas which required more research, for brain imaging studies of candidates for a neural prosthesis and for finding stable neural signals for prosthesis control.

Later, in the year 1997, D. R. Humphrey and L. R. Hochberg along with M. Burrow, J. Dugger and D. J. Reed conducted research where a Time Delay Neural Network was used for cortical control of robot. The

research acquired success as a robot arm could track the actual wrist position of a monkey when it was given corresponding neurological signals from the animal's motor cortex. This was a green signal for further research and several studies were done and finally in the year 2003, Brain Gate was found by Cyberkinetics in combination with the Brown University.

Clinical trials On Brain Gate system began in the year 2004 and continued till 2006 where 4 patients with tetraplegia were studied. The very first patient, a 25-year-old patient, Matthew Nagle, had spinal cord injury and was paralysed down from the neck since the year 2001. Then after taking part in the clinical trial of this system, he was able to open emails, switch tv channels and even move a prosthetic arm using his wheelchair. This was the first time that neural signals were recorded and decoded in a human with paralysis. After conduction of these trials, it was observed that the participant had immediately gained control of a computer interface, could operate the cursor while performing other voluntary motor tasks and required no special training. It was also observed that modulation of neural activity is possible in motor impaired patients.



Fig. 4 : Clinical trial being performed on Matthew Nagle

Thereafter in 2009, Brain gate earned the rights and virtues from this technology and intellectual property from Cyberkinetics. In July 2009, clinical trials began under the name 'BrainGate2 Neural Interface System'

and has been continued since then. In November 2009, Toyota launched its wheelchair which worked on thoughts. Toyota teamed up with Japanese research foundation RIKEN for the development of this mind-controlled wheelchair. This is the very first use of EEG signals. EEG(Electroencephalography) is an efficient modality which helps to acquire brain signals corresponds to various states from the scalp surface area.

Subsequently in the year 2012, a research teams of neuroengineers performed a clinical trial where two people who had lost the use of their limbs were able to move a robotic arm just by thinking about it. Using this technology, for the first time in 15 years a participant was able to raise a bottle to her mouth and take a sip.



Fig. 5 : The woman who was able to raise a bottle using Brain Gate

The main disadvantage of this system was that the wires coming out of the patient's brain attached to the cables. The research for making the device wireless went on for a long duration. Making the device wireless, it involved too many complexities and there were even chances of patient being infected. The aim was to make the device completely user controlled so that almost all the requisite requirements of the paralysed would be solved.

Finally in April 2021, Brain Gate became the first technology to transmit wireless commands from a human brain to a computer. This proved to be a milestone for Brain Gate technology.

VII. WIRELESS BRAIN GATE SYSTEM

The size of the wireless device is about 2 inches and weight is about 1.5 ounces. The significance of this is that the device is attached to the computer wirelessly. So we still have the micro electrode array which is now attached to the bandwidth pedestal mounted wireless transmitter. This bandwidth has a wireless receiver which receives the signals from the patient's brain. The information then goes to a digital hub and that is then delivered by a fiber optic cable to the neural signal processor. The information is then decoded, and it is used to control the computer system used by the patient.

With this wireless transmitter we have about a 36-hour battery life, so the data could be recorded for 24 hours. Soon this could become a more prominent treatment option for patients dealing with difficult neurological disorders.

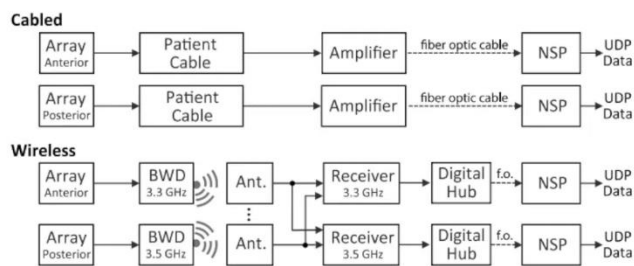


Fig. 6 : Components of cabled and wireless systems for dual-array recording. Ant.: Antenna, f.o.: fiber optic

From the study, scientists concluded that the wireless brain computer interface was as efficient and as effective as the wired brain computer interface. They both are comparable in terms of decoding the neural signals and even in terms of the bit rate they both have a similar speed of processing. From the recordings of a single electrode in the brain computer interface, scientists concluded that both the systems have similar amplitudes and so the signal strength is just as strong in the wireless and the wired system.

VIII. ADVANTAGES

1. Brain Gate can be used in an interactive environment as the user's ability to operate the system is not affected by their speech, noise or eye movements.
2. The chip can safely be implanted in the brain for at least two years and later, it can even be removed safely.
3. Tetraplegic patients get the ability to easily control external devices, user can easily learn to control a cursor with basic training as the system is not complex and makes it easy to interact with computer.
4. The speed, accuracy, and precision are comparable to a person with no disabilities.
5. Patients using Brain Gate system can communicate by thinking of what they want to say, their thoughts are then translated through text or a robotic voice and this works almost every time.
6. The system uses an invasive method where active potentials of every single neuron are recorded more accurately compared to other non-invasive methods.

IX. DISADVANTAGES

1. Currently, it is essential to recalibrate the device before every use by the patient. Scientists are working on automated calibration to allow more independence to the patient.
2. The chip needs to be surgically implanted in the brain which is a very risky process as it requires a surgery and can be dangerous even though the chip is extremely small.
3. The device is not yet available in the market and is very complex and highly expensive as it uses advanced technology. Scientists estimate that the technology might cost hundreds of thousands of dollars.

4. The system still takes a lot of time as one must think of each letter individually which will then be translated into text or voice.
5. As brain is exceedingly complex, there are approximately 100 billion neurons in a human brain and each neuron continuously sends and receives signals through a complex web of connections. Chemical processes are also involved and hence EEGs obviously can't understand everything.

X. FUTURE SCOPE

Brain Gate system is still an investigational device and thus indicates what is likely to be possible in future. Currently the focus is to improvise the basic process of converting thoughts to computerized actions. Once this is done, the potential uses for this technology are almost limitless for instance, a robotic hand could be placed by robotic braces which would help in joining individual's own limbs, thereby allowing them to move and directly interact with the environment. If this led to a positive outcome then the gates would be open for more advance uses, like, things could be accomplished in a way where there's no need of a robotic part. Signals could be sent to the appropriate motor control nerves in the hands, bypassing a damaged section of the spinal cord and allowing actual movement of the subject's own hands.

Brain Gate system has allowed individuals to control wheelchair or operate a robotic hand. The system will connect the brain gate sensor with functional electrical stimulation (FES) system. FES system uses electrical impulses to trigger muscle and limb movement. The initial version will allow one to perform simple actions such as eating or drinking using their own arms and under the natural control of their own brains. Later versions, however, won't require supports and will allow users to do more efficient activities, such as using cell phones or remote controls.

We can highly expect that soon, Brain Gate System could be even used by those users who have less severe injuries. There's a high chance that the next generation products could be able to provide one with the ability to control devices that allow breathing, bladder, and bowel movements but currently, the system is still in its early ages and is not yet approved for sale.

XI. CONCLUSION

The wickedness of the deficits caused due to paralysis is a very strong motivation to go after Brain-Machine Interface solutions. The research is still on its way to gradually increase the adaptability of the algorithm, like to read more characters per minute even in the absence of software using statistics of English language. The aim is to replace the robotic with user's own arms where electrical wires will replace the damaged nerves. The sole purpose of brain gate still being under research is to make the device faster, reliable, completely user controlled. This would solve almost all the crucial needs of the paralysed. The idea to move robotic devices not by manual control, but by mere thinking has been a fascinating approach.

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Cite this article as :

Kashish Rajiv Kumar , "Brain Gate Technology", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 106-113, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229120>
Journal URL : <https://ijsrst.com/IJSRST229120>

Artificial Neural Network and Open CV - Surpassing Expectations!!

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ABSTRACT

The paper describes some surpassing expectations and recent developments in neural networks and open CV. The paper mentions a new architecture, the pulsed neural network, considered the next generation of neural networks. The paper also explores the use of memristors in the development of a brain-like computer called the Moneta. A new model, multi/infinite-dimensional neural networks, is a recent development in advanced neural networks. The paper concludes that the need for neural networks to develop human-like technology is essential and may be non-expendable for it.

Keywords : Neural Network, Pi Camera, Python, Pulsed Neural Network, Neuro-fuzzy Computing, MoNETA.

Article Info

Volume 9, Issue 1

Page Number : 114-116

Publication Issue

January-February-2022

Article History

Accepted : 06 Jan 2022

Published : 20 Jan 2022

I. INTRODUCTION

Neural networks can handle many problems to deal with enormous quantities of data. They are better suited than the traditional computer model to address issues humans are naturally good at and which computers cannot solve very well. For example, clustering, pattern recognition, generalizing, etc., are problems humans hold better than computers, and so do neural networks. Research is also focused on developing new models of neural networks that are better at solving these problems.

IMPROVEMENT OF EXISTING TECHNOLOGIES

Neural Network technologies rapidly will improved upon in the future. some of the main things are handwriting, speech recognition to stock market

prediction, and Automatic car driving will become more sophisticated as researchers develop better training methods and network architectures. Neural Networks might, in the future, allow:

1. Robots that can see, feel, and predict the world around them
2. Improved stock prediction
3. Typical usage of self-driving cars
4. Composition of music
5. Handwritten documents to be automatically transformed into formatted word processing documents
6. Trends found in the human genome to aid in the understanding of the data compiled by the HumanGenome Project
7. Medical Image Analysis.

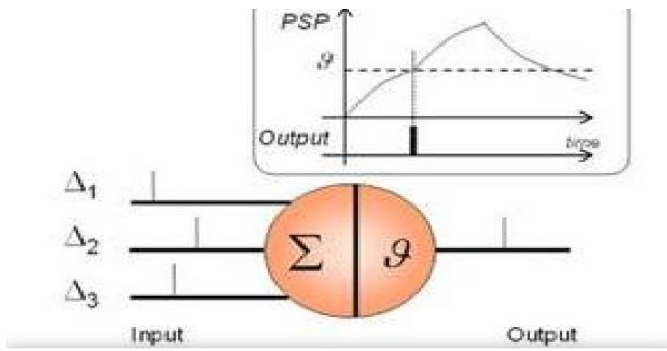


Fig 1. Basic model of a Pulsed Neuron, The future of Neural Network

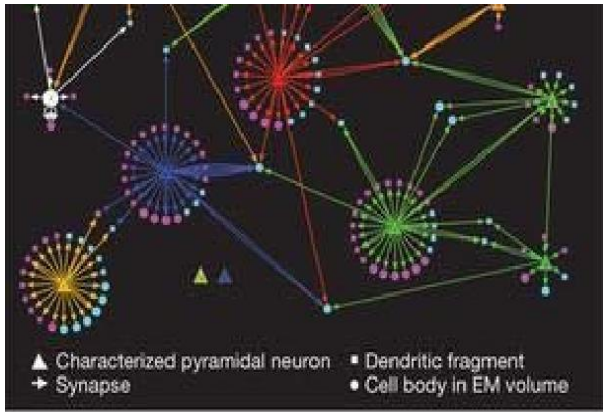


Fig 2.3-Dimensional Neural Network from the human brain

The following are the neural network projects currently underway

1. Artificial Neural Network based Self-Driving Car

Autonomous Vehicles are the fast-growing technology in the field of Automobiles with advanced features. These vehicles can sense the environment, navigating and fulfilling human capabilities without any human interference. The paper touches on building a three-wheel vehicular prototype that will detect the obstacles and, in turn, avoid collision and moves safely towards the destination. This paper explains how the Artificial Neural Network aims to control the vehicle without any human intervention. Images from extensive data, which is the only input to the prototype. The captured images undergo an Image processing technique that will calculate the frame's dimensions or moving objects and detect them.

2. Lesion Extraction using Open Computer Vision

Endometriosis is caused by the endometriotic tissue that streaks the uterus from the outside. 6% of women under childbearing age are affected by endometriosis disorder. The presence of the issue can be identified through MRI, Transvaginal Ultra Sound Scan (TVUS), Laparoscopic images and pathological slides. Image-based applications are processed using Image Pre-processing, Image Segmentation, Image Enhancement and Feature Extraction Techniques. Open Computer Vision (Open CV) extracts the features from Laparoscopic Endometriosis Images (LPI). This paper proposed a method to identify the endometriotic tissue using LPI images. The proposed method uses several image processing techniques of OpenCV includes Adaptive Threshold, Contour Mask, to extract the lesion area from the Laparoscopic images. The designed algorithm has experimented with, and the results yielded 53.5 % mean value intensity in identifying the lesion area.

3. Flow counter and estimation using deep learning

A flow counter and estimation in real-time using deep learning is an essential part of security and entertainment, completed this technology as a game-altering and even better human identification and counting part in terms of accurateness. This paper focuses on one of the advanced deep learning tools in people depending to achieve higher efficiency. Also, focus on Open C V, NN, and machine learning to count the number I/O a defined place using NN. Here, the system is trained by artificial neural networks and computer vision. Real-time people flow estimation is fundamental for several applications like security, business, tourism, and other fields where people flow surveillance is required.

A WORD OF AWARENESS

Although NN seems to solve many problems, they are not simple; overconfidence in neural networks can

result in costly mistakes. As an example the Pentagon, USA, required that the tanks in the US army be made harder to attack. The research team decided to fit each tank with a digital camera hooked up to a computer as part of this attempt. The system would continually scan the outside, for example, an enemy tank hiding behind a tree, and alert the tank crew to anything suspicious. Computers are good at doing repetitive tasks without taking a break, but they generally interpret images. The solution to solve the problem was to employ a neural network.

II. FUTURE SCOPE

An understanding of the future of neural networks and their applications will help researchers to appreciate the importance and essentiality of their role in the development of a human-like artificial brain. Artificial Intelligence research is directed towards the development of artificial life, which is not possible

III. CONCLUSION

Artificial neural networks and Open CV are going very rapidly in IT for different applications and new embedded systems. The integration is already delivering good results towards more effective and efficient solutions to problems otherwise better handled by human beings. Current research seems to be moving in the right direction towards the ultimate goal of all artificial intelligence.

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Cite this article as :

Eldhose PU, "Artificial Neural Network and Open CV - Surpassing Expectations!!", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 114-116, January-February 2022.

Journal URL : <https://ijsrst.com/IJSRST229132>

Machine Learning Based Theft Detection Using Yolo Object Detection

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ABSTRACT

Theft is a common criminal activity that is prevailing over the years and is increasing day by day. To tackle this problem many surveillance systems have been introduced in the market. Some are simply based on video surveillance monitored by a human while some are AI-based capable of detecting suspicious activity and raising an alarm. However, none of them are intelligent enough to identify what kind of suspicious activity is being carried out and what kind of protective measures should be taken in real-time. This blog presents the design of an effective surveillance system using machine learning techniques.

Keywords : Machine learning, Image Processing, Yolo, Tensor Flow.

Article Info

Volume 9, Issue 1

Page Number : 117-120

Publication Issue

January-February-2022

Article History

Accepted : 06 Jan 2022

Published : 20 Jan 2022

I. INTRODUCTION

Theft is the most common crime committed across the world. According to the National Crime Records Bureau (NCRB), ~80% of the criminal cases are related to theft [1] as shown in figure 1. Increasing theft rates cause people to suffer both financially and emotionally. Therefore, there is a need to develop a more deterrent surveillance system, which is convenient to use, free from false alarms, minimize human interference, and cost-effective.

Machine Learning (ML) techniques prove to be fruitful in developing efficient surveillance systems. This blog aims to design a theft detection and monitoring system, which would be capable to detect theft using a motion-sensing camera using ML and

alarm the owner with an alert message along with the captured image of that instance of motion.

The major contributions are:

- To detect and activate motion in the still place according to requirements
- To recognize facial expressions and detect people wearing the mask using the ML model
- To detect the suspiciousness in the surrounding for any kind of weapon and raise alert messages

II. METHODOLOGY

1. Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class (such as

humans, buildings, or cars) in digital images and video methods for object detection generally fall into either machine learning-based approaches or deep learning based approaches.

2. Here, we are using deep learning-based approach via YOLO (You only look once). Starting the concept, first the camera will work as an i/p for the system, then after taking in the image it will initialize and start capturing device.
3. Then condition applies if object isn't detected then system will say no object found from specified list, if detected is a yes, then check if found object is available in specified list, if in list then save the list of detected object and compare the saved object list with specified object list, if match found then system will display no object missing and if match not found then system will show alert on display and buzzer will ring

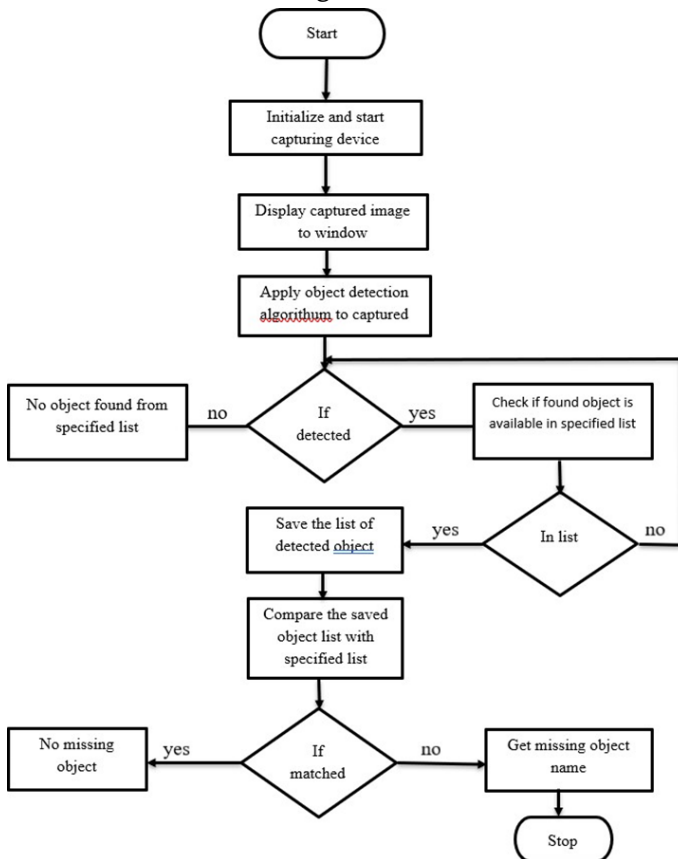


Fig.1: flow Chart of Methodology

III. HARDWARE COMPONENT

- 1) **Arduino Nano:** The Arduino Nano is another popular Arduino development board very much similar to the Arduino UNO. They use the same Processor (Atmega328p) and hence they both can share the same program.

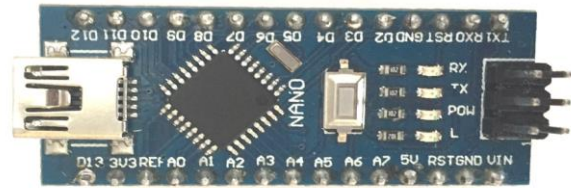


Fig.2 Arduino Nano

There are total 14 digital Pins and 8 Analog pins on your Nano board. The digital pins can be used to interface sensors by using them as input pins or drive loads by using them as output pins. A simple function like pin Mode() and digitalWrite() can be used to control their operation. The operating voltage is 0V and 5V for digital pins. The analog pins can measure analog voltage from 0V to 5V using any of the 8 Analog pins using a simple function like analog Read().

LCD Module:

- Operating Voltage is 4.7V to 5.3V Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 5x8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters

- Available in Green and Blue Backlight



Fig.3 16x2 LCD Module

16x2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8x1, 8x2, 10x2, 16x1, etc. but the most used one is the 16x2 LCD. So, it will have (16x2=32) 32 characters in total and each character will be made of 5x8 Pixel Dots.

Buzzer:

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

There are two types of buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customised with help of other circuits to fit easily in our application.

This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V

battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval.



Fig.4 buzzer

III. SOFTWARE

1) Tensor Flow

Tensor flow allows developers to create a graph of computations to perform. Each node in the graph represents a mathematical operation and each connection represents data. Hence, instead of dealing with low-details like figuring out proper ways to hitch the output of one function to the input of another, the developer can focus on the overall logic of the application.

2) YOLO

YOLO which stands for “You only look once” is a single shot detection algorithm which was introduced by Joseph Redmon in May 2016. Although the name of the algorithm may sound strange, it gives a perfect description of this algorithm as it predicts classes and bounding boxes for the whole image in one run of the algorithm.

IV. CONCLUSION

In machine learning based theft detection using yolo object detection Designed machine learning based theft detection system that used in various CCTV camera, Surveillance camera for identification of theft. It used in various application for monitoring theft in home, various mall, museum, etc

In this system we used YOLO (You Only Look Once) Real time object detection system. For object detection once detecting the object we can add importance to that device and if that object is missed we got alert through buzzer also our system tell which object is missed.

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Cite this article as :

Swati Khadse, Babli Nandanwar, Ashwini Kirme, Taiksha Bagde, Vijaya Kamble, "Machine Learning Based Theft Detection Using Yolo Object Detection", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 117-120, January-February 2022.
Journal URL : <https://ijsrst.com/IJSRST1229118>

Elastic, Mechanical and Thermophysical Properties of HMo₂ (H= Zr and Hf) Laves Phase Compounds

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ABSTRACT

Using the Lennard - Jones many body interactions potential technique, the elastic, mechanical, thermophysical, and ultrasonic characteristics of HMo₂ (H= Zr and Hf) laves phase compounds were investigated. Other ultrasonic parameters are calculated using second-order elastic constants. Mechanical constants such as Young's modulus, bulk modulus, shear modulus, Poisson's ration, ductility, and anisotropy factor have also been calculated. Laves phase compounds satisfy the Born Criterion for mechanical stability since their Pugh's ratio (the ratio of bulk modulus to shear modulus) is smaller than 1.75, indicating that they are brittle. These ZrMo₂ and HfMo₂ ultrasonic velocities and thermal relaxation times are calculated using calculated elastic constants and lattice parameters under the same physical conditions. For the evaluation of anisotropic behaviour and thermophysical parameters, the orientation dependent ultrasonic velocities and thermal relaxation time were also examined. The obtained results are evaluated in order to understand more about the properties of laves phase compounds.

Keywords : Laves Phase Compounds, Ultrasonic Properties, Elastic Properties

Article Info

Volume 9, Issue 1

Page Number : 121-130

Publication Issue

January-February-2022

Article History

Accepted : 20 Jan 2022

Published : 31 Jan 2022

I. INTRODUCTION

The laves phases of intermetallic compounds have been given a lot of thought because of their excellent physical and chemical features, [1–2]. Laves phases have been investigated for a variety of applications, including high-temperature structural materials with excellent corrosion and oxidation resistance, hydrogen storage materials and superconducting materials, and resistance superconducting materials [3–5] because of its refractory character, molybdenum (MO) and related alloys are widely utilised in a

variety of applications where severe environment resistance is required, such as in caustic chemicals. Zirconium is primarily utilised as a container for nuclear fuel in light water reactors in the nuclear power sector, owing to its low neutron absorption crosssection [6]. Mo alloys are intermetallic compounds in general. Since the discovery of intermetallic compounds with intriguing properties such as polymorphism and unusual magnetic and electrical properties, the leaves phase has been a popular topic of discussion [7–9]. Magnetostrictiv materials and high temperature structural materials

are significant for applications in hydrogen storage materials; superconducting materials and enormous are related to magnetostrictiv materials. At high temperatures, the phases usually exhibit particular magnetic properties as well as high strength and oxidation resistance. ZrMo₂ is an another Zr-compound that is an important nuclear structural material and cladding material for reactor nuclear fuels [10, 11].

We worked very hard in this research work to establish relationship between thermophysical and microstructural properties for HMo₂(Hf and Zr)

compounds, which will aid in understanding the mechanical behaviour of hexagonally structured HMo₂ (X = Hf and Zr) compounds and play an important role in the diagram of a manufacturing apparatus with useful physical properties under moderate working conditions. Thermal relaxation time and ultrasonic velocity for hexagonally structured HMo₂ (X = Hf and Zr) compounds were considered for it though. For hexagonally structured HMo₂ (X = Hf and Zr) compounds, the bulk modulus (B), shear modulus (G), Young's modulus (Y), Pugh's ratio (B / G), and Poisson's ratio were computed and discussed.

II. METHODS AND MATERIAL

The Lenard Jones interaction potential methods will be used for the evaluation of SOECs and TOECs in this investigation. The partial derivatives of the thermodynamic potential of the medium constrained to finite deformation, as well as mathematically expressed by subsequent expression such [12, 13], are a generalised characterization of the n th order elastic coefficient.

The partial derivatives of the medium constrained finite deformation's thermodynamic potential, as well as following expressions like are a universal description of the nth order elastic constant. [25, 26],

$$C_{ijklmn\dots} = \frac{\partial^n F}{\partial \eta_{ij} \partial \eta_{kl} \partial \eta_{mn} \dots} \tag{1}$$

F refers for free energy density, whereas η_{ij} stands for Lagrangian strain component tensor. Taylor series expansion η can be used to extend F in terms of strain:

$$F = \sum_{n=0}^{\infty} F_n = \sum_{n=0}^{\infty} \frac{1}{n!} \left(\frac{\partial^n F}{\partial \eta_{ij} \partial \eta_{kl} \partial \eta_{mn} \dots} \right) \eta_{ij} \eta_{kl} \eta_{mn} \dots \tag{2}$$

As a function, the free energy density is represented as:

$$F_2 + F_3 = \frac{1}{2!} C_{ijkl} \eta_{ij} \eta_{kl} + \frac{1}{3!} C_{ijklmn} \eta_{ij} \eta_{kl} \eta_{mn} \tag{3}$$

The basis vectors are $a_1 = a \left(\frac{\sqrt{3}}{2}, \frac{1}{2}, 0 \right)$, $a_2 = a(0,1,0)$ and $a_3 = a(0,0,c)$ in cartesian coordinates axis are

used to make hexagonal compounds. The unit cell lattice parameters are a and c. The unit cell of an HCP compound is made of two non-equivalent atoms: six in the basal plane and three in the upper and lower planes. As a result, both the first and second neighborhood have six atoms. The location vectors among those two types of atoms are $r_1 = a(0,0,0)$ and $r_2 = \left(\frac{a}{2\sqrt{3}}, \frac{a}{2}, \frac{c}{2} \right)$.

$$\varphi(r) = -\frac{a_0}{r^m} + \frac{b_0}{r^n} \tag{4}$$

Where a_0 and b_0 are constants, m and n are integers, and r is the atom distance. Our earlier studies used the interaction potential model to compute six SOECs and ten TOECs of the hexagonal compound, as well as formulations of elastic constants.

Voigt and Reuss' techniques [14, 15] were used to compute the bulk and shear moduli. The Voigt and Reuss techniques, respectively, used unchanging stress and unchangeable strain computations. Furthermore, the average values of both approaches were utilised to determine the resulting values of B and G [16] using Hill's techniques. The Young's modulus and Poisson's ratio are calculated using bulk and shear modulus values, respectively [17, 18]. For the evaluation of Y , B , and G , the following expressions were performed.

$$\left. \begin{aligned} M &= C_{11} + C_{12} + 2C_{33} - 4C_{13}; C^2 = (C_{11} + C_{12})C_{33} - 4C_{13} + C_{13}^2; \\ B_R &= \frac{C^2}{M}; B_V = \frac{2(C_{11}+C_{12})+4C_{13}+C_{33}}{9}; \\ G_V &= \frac{M+12(C_{44}+C_{66})}{30}; G_R = \frac{5C^2C_{44}C_{66}}{2[3B_V C_{44}C_{66} + C^2(C_{44}+C_{66})]}; \\ Y &= \frac{9GB}{G+3B}; \quad B = \frac{B_V+B_R}{2}; \quad G = \frac{G_V+G_R}{2}; \quad \sigma = \frac{3B-2G}{2(3B+G)} \end{aligned} \right\} \quad (5)$$

Because the velocity of ultrasonic waves is primarily determined by SOECs and density, the anisotropic and mechanical properties of hcp structured materials are highly associated with ultrasonic velocity. In a hexagonal structured compound, there are three types of ultrasonic velocities based on the mode of vibration. Wave velocities of the first longitudinal V_L and second shear (V_{S1}, V_{S2}) waves.[19,20] The following equations describe ultrasonic velocities for hexagonal structured compounds based on the angle between the direction of propagation and the z -axis:

$$V_L = \sqrt{\frac{C_{33}}{\rho}} \quad (6)$$

$$V_S = \sqrt{\frac{C_{44}}{\rho}} \quad (7)$$

where, V_L, V_s are the longitudinal, quasi-shear, and shear wave velocities, respectively.

$$V_D = \left[\frac{1}{3} \left(\frac{1}{V_L^3} + \frac{1}{V_{S1}^3} + \frac{1}{V_{S2}^3} \right) \right]^{-1/3} \quad (8)$$

At low temperatures (less than 100K), the electron-phonon interaction dominates ultrasonic wave attenuation mechanisms. The mean free path of electrons is the same as the mean free path of acoustical phonons at this temperature regime. As a result, there is a significant probability of interaction between free electrons and acoustic phonons [20]. The following is the mathematical formula for ultrasonic attenuation for longitudinal ($\dot{\alpha}$)_{Long} and shear waves ($\dot{\alpha}$)_{Shear} caused by energy loss due to electron-phonon interaction:

$$\alpha_{long} = \frac{2\pi^2 f^2}{\rho V_l^3} \left(\frac{4}{3} \eta_e + \chi \right) \quad (9)$$

$$\alpha_{shear} = \frac{2\pi^2 f^2}{\rho V_s^3} \eta_e \quad (10)$$

where ‘ρ’ is the density of nanostructured compound, ‘f’ is the frequency of the ultrasonic wave, ‘η_e’ is the electron viscosity and ‘χ’ is the compressional viscosity (which is zero in present case),

At higher temperatures, the two dominant processes are p-p interaction (Akhieser's type loss) and thermoelastic loss, both of which are significant for ultrasonic wave attenuation. The following equation describes the attenuation due to Akhieser's loss:

$$(\alpha/f^2)_{Akh} = \frac{4\pi^2\tau E_0(D/3)}{2\rho V^3} \tag{11}$$

Here, *f* represents the frequency of the ultrasonic wave; *E*₀ is the thermal energy density.

. The thermoelastic loss $(\alpha/f^2)_{Th}$ is considered by the subsequent equation:

$$(\alpha/f^2)_{Th} = 4\pi^2 \langle \gamma_i^j \rangle^2 \frac{kT}{2\rho V_L^3} \tag{12}$$

The total attenuation is specified by the subsequent equation as:

$$(\alpha/f^2)_{Total} = (\alpha/f^2)_{Th} + (\alpha/f^2)_L + (\alpha/f^2)_S \tag{13}$$

Wherever $(\alpha/f^2)_{Th}$ is the thermoelastic loss, $(\alpha/f^2)_L$ and $(\alpha/f^2)_S$ are the ultrasonic attenuation coefficient for the longitudinal wave and shear wave correspondingly.

III. RESULTS AND DISCUSSION

3.1 Higher order elastic constants

We used an interaction potential approach to calculate the elastic constants (six SOECs and ten TOECs) in this study. For HfMo₂ and ZrMo₂, the lattice parameters 'a' (basal plane parameter) and 'p' (axial ratio) are 5.417, 5.373 and 1.591, 1.599, respectively [21]. For the leaves phase compound, the chosen values of m and n are 6 and 7. For HfMo₂ and ZrMo₂ compounds, b₀ values are 4.62x10⁻⁶² erg cm⁷ and 4.66x10⁻⁶² erg cm⁷, respectively. Table 1 shows the SOECs and TOECs estimated for various leaves phase compounds at room temperature.

Table1. SOECs, TOECs and bulk modulus (inGPa) at room temperature.

	C ₁₁	C ₁₂	C ₁₃	C ₃₃	C ₄₄	C ₆₆	B
HfMo ₂	302	74	61	284	74	118	142
HfMo ₂ ^[16]	301.3	154.4	157.9	297.9	46.3	73.4	---
ZrMo ₂	281	69	56	259	68	110	131
ZrMo ₂ ^[16]	281.2	150.5	153.7	269.1	37.7	65.6	---

	C ₁₁₁	C ₁₁₂	C ₁₁₃	C ₁₂₃	C ₁₃₃	C ₃₄₄	C ₁₄₄	C ₁₅₅	C ₂₂₂	C ₃₃₃
HfMo ₂	-4933	-782	-158	-201	-960	-900	-234	-156	-3903	-3452
ZrMo ₂	-4589	-727	-145	-185	-875	-820	-216	-144	-3613	-3116

HfMo₂ and ZrMo₂ had the higher elastic constant values, which are important for the material, as these are associated with the stiffness parameter. SOECs are used to determine the associated parameters. Evidently, for steady of the hexagonal compound, they would satisfy the renowned Born- Huang's stability norms [19, 20] i.e. $C_{11} - |C_{12}| > 0$, $(C_{11} + C_{12}) C_{33} - 2C_{13}^2 > 0$, $C_{11} > 0$ and $C_{44} > 0$. In Table 1, It is evident that the values of above elastic constant are positive too satisfies Born-Huang's mechanical stability criteria and therefore totally these compounds are mechanically stable. The evaluated coefficients of C₁₂, C₁₃ and C₆₆ are some differ than other results of theoretical [21] for HfMo₂ and ZrMo₂ compound. Essentially Turkdal, et al. [21] has been theoretically evaluated by DFT investigations, which is rather differ from reported method. While found order of SOECs are of the similar as specified in Table 1[21]. Comparative magnitude of elastic constant C₁₁, C₃₃, and C₄₄ are well obtainable by our approach. Thus, there is respectable agreement between the presented and the informed values which is correlated with elastic constants. Therefore, our theoretical methodology is well justified for the evaluation of SOECs of hexagonal arranged compounds. We present the calculated values of TOECs in table 1. The negative values of TOECs indicate a negative strain in the solid. Negative TOECs appear in the previous paper on hexagonal structure material. Therefore, this applied theory for valuation of higher order elastic constants is justified [22, 23]. Hence, the applied theory for the valuation of the elastic constants is justified.

Table 2. Voigt–Reuss constants (M and C²), Bulk modulus ($\times 10^{10} \text{Nm}^{-2}$), Shear Modulus ($\times 10^{10} \text{Nm}^{-2}$), Young's Modulus ($\times 10^{10} \text{Nm}^{-2}$), Poisson's Ratio, Pugh's Ratio for HfMo₂ and ZrMo₂ compound.

	M	C ²	Br	Bv	Gr	Gv	Y	B/G	G/B	σ
HfMo ₂	700	110261	158	142	97	100	242	1.52	0.65	0.231
ZrMo ₂	644	93562	145	131	105	93	239	1.40	0.71	0.211

It is found that the value of B, Y, and G of ZrMo₂ leaves phase compound are smaller than HfMo₂ leaves phase compound. Thus ZrMo₂ have little Stiffness and bonding with respect to HfMo₂ leaves phase compound. B/G and ' σ ' are the measure of brittleness and ductility of solid. If $\sigma = \leq 0.26$ and $B/G = \leq 1.75$, the solid is generally brittle, otherwise it is ductile in nature [16, 24] . Our finding of lower values of B/G and σ compared to their critical values indicates that HfMo₂ and ZrMo₂ is brittle in nature at room temperature. It is well known that for stable and elastic material the value of σ should be less than 0.5. The values of ' σ ' evaluated for HfMo₂ and ZrMo₂ are smaller than its critical value. It indicates that HfMo₂ and ZrMo₂ is stable corresponding to shear. The compressibility, hardness, ductility, toughness, brittleness and bonding nature of the leaves phase compounds are too well connected with the SOECs.

3.2 Ultrasonic Velocity and Ultrasonic allied parameters

In present analysis, we have correlated the mechanical and isotropic behavior of the hexagonal compound with ultrasonic velocity. We have calculated V_L , V_S , V_D and τ for leaves phase compounds. The angular dependence Figures 1-4. The angles are measured form the z-axis of the crystal. Form figs. 1 and 2 velocities V_L and V_S1 of HfMo₂ and ZrMo₂ have minima and maxima at 450 respectively. In Figure 3, we find that V_S2 increases with angle form the z- axis. The irregular behavior of orientation dependent velocity is due to combined effect of SOECs and density. The nature of the orientation dependent velocity curves in this work is similar to nature of

orientation dependent velocity curve found for other hexagonal type's material [22, 23]. Thus, the angle dependence of the velocities in leaves phase compounds is justified.

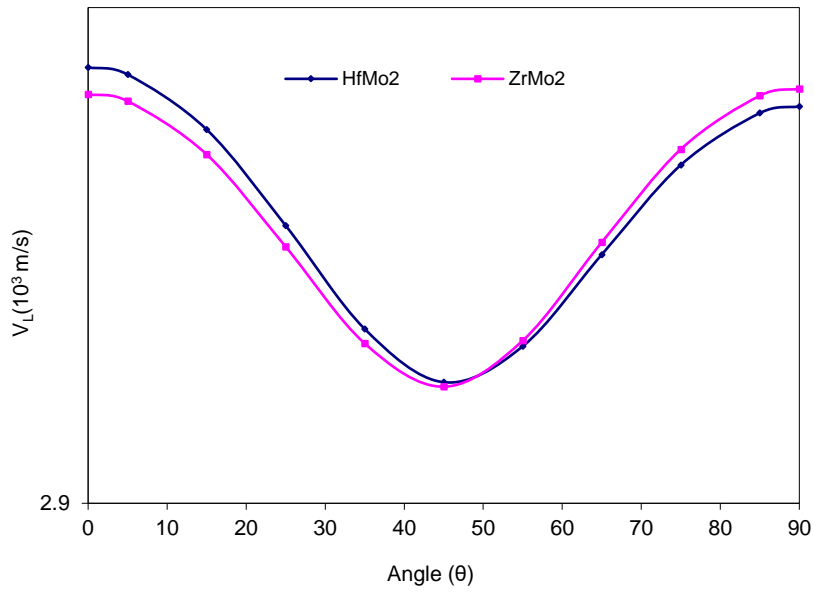


Fig. 1. V_L vs Theta with unique axis of crystal

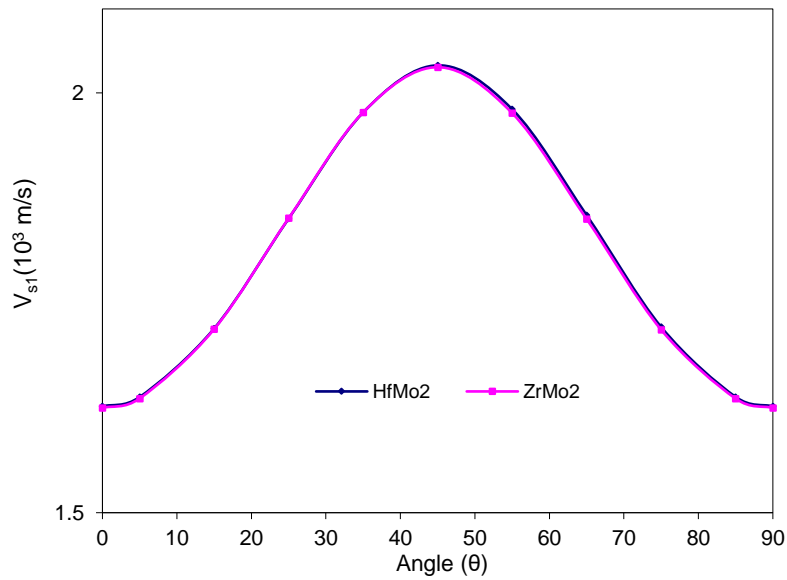


Fig. 2. V_{S1} vs Theta with unique axis of crystal

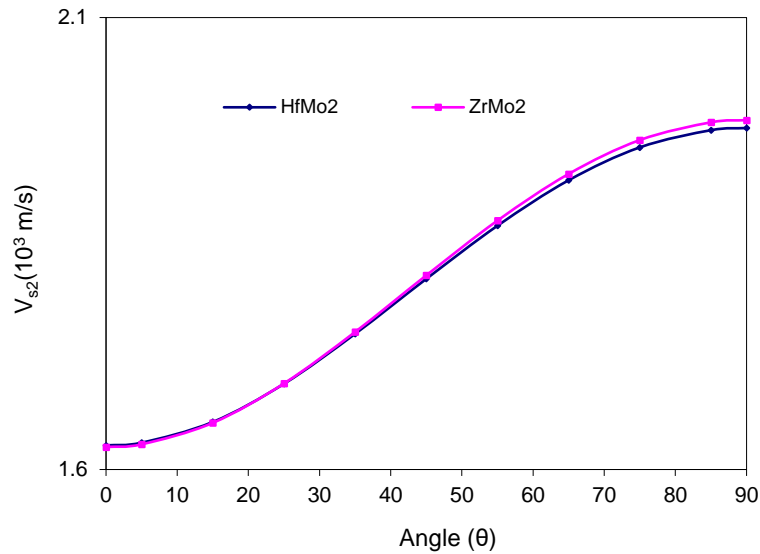


Fig. 3. V_{s2} vs Theta with unique axis of crystal

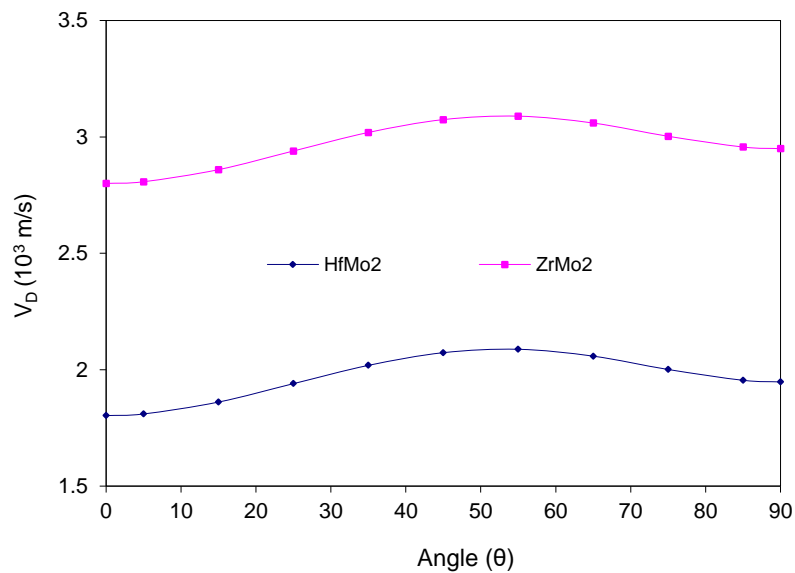


Fig. 4. V_D vs Theta with unique axis of crystal

Figure 4 shows the variation of Debye average velocity (V_D) with the angle made with the z- axis of the crystal. It is clear that V_D increases with the angle and reaches maximum at 55° for both transition metal disilicides. As the calculation of V_D involves the velocities V_L , V_{S1} and V_{S2} [25, 26], It is understandable that the variation of Debye average velocity is affected by the fundamental ultrasonic velocities. Maximum value of V_D at 55° is due to a significant increase in pure shear and longitudinal wave velocities and a decrease in quasi-shear wave velocity. It may be determined that the average sound wave velocity is a maximum when a sound wave travels at 55° angles with the z- axis of this crystal.

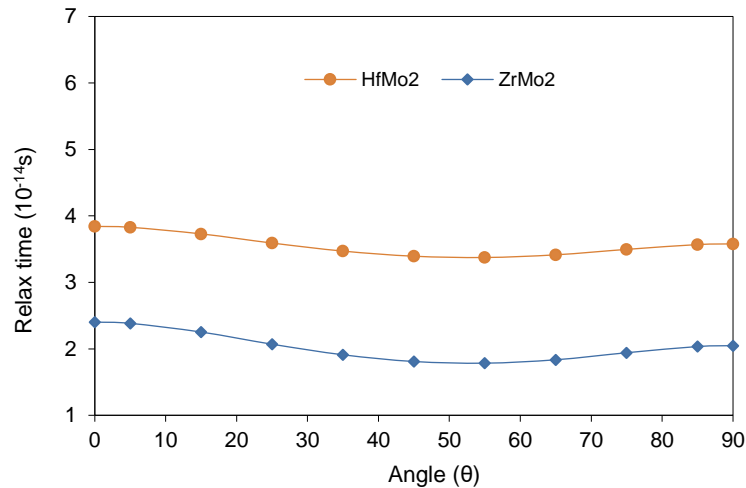


Fig. 5. Relaxation time vs Theta with unique axis of crystal axis

Figures 5 show a plot of the calculated thermal relaxation time ' τ ' with the orientation dependent. Angle dependent ' τ ' curves track the reciprocal nature of V_D as $\tau \propto 3K / C_V V_D^2$. It is clear that thermal relaxation time for leaves phase compounds is mainly affected by ' k '. Thermal relaxation time for hexagonal structured material is of order at picoseconds [22, 27]. Therefore, the calculated ' τ ' explains the hexagonal structure of leaves phase compounds. The lowest value of τ at $\theta = 55^\circ$ denotes that the re-establishment time for equilibrium phonon distribution for wave propagation along ' τ ' distribution of thermal phonons will be minimum for propagation of wave along this direction.

IV. CONCLUSIONS

Based on the discussion above, it is important to note that the notion of using a simple interaction potential technique to calculate higher-order elastic coefficients for hexagonally organised leaves phase compounds remains valid. The elastic constants must satisfy the well-known Born's stability criterion for superconducting leaves phase compounds to be stable. The ductile nature of superconducting compounds is confirmed by the Pugh's ratio. The ' τ ' is determined to be of the order of picoseconds for HfMo2 and ZrMo2 leaves phase complexes, depending their hexagonal structure. Because ' τ ' has the smallest value along $\theta = 55^\circ$ at all temperatures, the duration required for the re-establishment of phonon symmetry spreading will be the shortest for wave propagation in this direction. HfMo2 leaves phase compound has a better mechanical behaviour than ZrMo2 leaves phase compound.

Processing and non-destructive characterisation of leaves phase compounds could benefit from this research. These findings will serve as a foundation for further research into the major thermophysical features of additional leaves phase compounds.

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Cite this article as :

Khan Ahmad Anas, Mohd.Imran Aziz, "Elastic, Mechanical and Thermophysical Properties of HMo₂ (H= Zr and Hf) Laves Phase Compounds", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 121-130, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229121>
Journal URL : <https://ijsrst.com/IJSRST229121>

Socio-Economic Effect of Covid-19 Lock-Down and Its Associated Factors Among College Students

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ABSTRACT

The aim of this study was to analyze the socio-economic effect of COVID-19 lockdown and its associated factors among college students. A survey study was conducted through social media in the age group of 18-25, in which 41% males and 59 % were females, out of which 13% male and 07% female students felt depression, 75% faced financial crises, 73% faced financial difficulties within family, 70% worried about parents' earnings and 52% felt changes in employment activity, 84% unable to control the important things in life, 75% dealt successfully with irritating life hassles, 51% felt things were going their way, 61% felt nervous, 81% confident about ability to handle personal problems, 82% able to control irritations in life and only 20% felt moderate to severe depression, 54% said need to reduce the amount of food, 49% said financial issue being an obstacle for getting food, 35% experienced increased snacking, 15% decreased appetite and 38% inconsistent eating, 18% increase in quarrel or fight, 16% in domestic violence in the family as well as 37% experienced reduced interactions with people, 03% fill great positive and 08% fill negative effects on social relationships. The statistically significant association is observed in depression with gender, financial crises, nervousness, financial issue for getting food and increase in domestic violence. Thus, it is concluded that COVID-19 lock-down and its associated factors are building socio-economic problems among college students. Therefore, various measures should be encouraged to prevent such emotional distress.

Keywords :Socio-economic, COVID-19, Students

Article Info

Volume 9, Issue 1

Page Number:131-138

Publication Issue

January-February-2022

Article History

Accepted :20 Jan2022

Published :31 Jan2022

I. INTRODUCTION

COVID-19, caused by a new strain of coronavirus, risen out of Wuhan city of China in December 2019 and its outbreak has affected millions of people worldwide and was declared a pandemic by the

World Health Organization on 11th March 2020 (WHO 2020). Confirmed cases and deaths grew rapidly, on 5th April 2020 there were more than 1,200,000 confirmed cases worldwide and more than 68,000 people had died from it (Johns Hopkins University & Medicine 2020). On that time India is

also one of country in the world with the most people affected by this pandemic.

On 24th March 2020, Indian government announced a lock-down period of 21 days in response to the seriousness of the pandemic and enforced Section 144 of Cr PC all over the country (Sengupta 2020). But even after the 21 days of lock-down period, the infection is not contained and hence the lockdown is prolonged further (Dutta 2020), following this, the peoples social lives are severely affected. It is not just a health crisis; it is the economic and humanitarian crisis and called a black swan by many economists (Aneja and Ahuja 2021). Such isolation strategy in an attempt to contain the pandemic, could also lead to development of psychological distress, loneliness, anxiety, depression, panic states, economic troubles and extreme mental stress (Hawryluck et al, 2004; Buheji et al, 2020; Reynolds et al, 2008). The societal impacts are dire too with job losses, mental illness, increased domestic violence, and so forth (Aneja and Ahuja 2021).

Although the overall impact on education and mental health of the university environment is still unknown, it is expected to be very considerable (Araújo et al, 2020; Sahu, 2020). "Considering the usual high incidence of emotional disorders in university students, it can be expected that the current situation may cause a notable impact on this population" (Auerbach et al, 2016; Bruffaerts et al, 2018 and Hunt and Eisenberg 2010). The continuous spread of COVID-19 and the circumstances of the situation creates various problems in students life because college students, are one of the groups that are vulnerable to distress due to active social life. Hence studying the effect of lock-down on the social and mental health of this group of people is needed. Therefore, this study aims to show the socio-economic effect of covid-19 lock-down and its associated factors among college students of some rural areas of Gadchiroli District, Maharashtra, India.

II. MATERIALS AND METHODS

Study population

A community based survey study was conducted in the some rural areas of Gadchiroli district, Maharashtra, India. All university undergraduate science students living in study area who were willing to participate, who had access to internet and social media and who were able to understand English was eligible for participation in this study.

Survey instrument and Statistical analysis

A web-based anonymous survey was conducted in the month of May to June, 2021 by Google form through social media like Whatsapp, first to the groups containing college students in our contact and the participants were encouraged to share it to other students they knew of. It was an internet-based survey and consent was obtained from the participants. It composed of 23 multiple-choice questions which included questions referred to participants' demographic characteristics, financial crises, negative emotional states, food habits, domestic violence and social life. Data entry and analysis was done using SPSS Statistical software. The associations between different variables assessed using chi square test and p value was calculated.

III. RESULTS

The survey study on socio-economic impact of COVID-19 outbreak and its associated factors among college students was completed by a total of 100 college going students belonged to the Science field and are thus the sample considered in this study. Out of 100 study subjects, 41% males and 59 % were females. All the participants were in the age group of 18-25 years. The demographic characteristics of the final survey respondents are summarized in Table 1.

In the present survey study more number of male students 13% and only 7% female students felt depression and gender is significantly associated with

depression ($p < 0.05$) as well as majority of participants 75% faced financial crises, 73% faced financial difficulties within family, 70% worried about parents' earnings and 52% felt changes in employment activity during second wave of COVID-19. The statistically significant association is observed between depression with financial crises ($p < 0.01$) and non-significant with worries about parents' earnings (Table 2 and 4).

In this period of lock-down during COVID-19 second wave the various negative emotional states shows that majority 84% participants felt that they were unable to control the important things in life, 75% dealt successfully with irritating life hassles, 51% felt that things were going their way, 61% felt nervous, 81% felt confident about ability to handle personal problems, 82% able to control irritations in life and only 20% felt moderate to severe depression. The statistically significant association is observed between depression and nervousness ($p < 0.05$) (Table 2, 3 and 4).

The present study on food pattern and habits during second wave of COVID-19 shows that majority 54% said need to reduce the amount of food and 49% said financial issue being an obstacle for getting food is the probable reason as well as 35% experienced increased snacking, 15% decreased appetite and 38% experienced inconsistent eating. The statistically significant association is observed between depression with financial issue for getting food ($p < 0.05$) and non-significant with need to reduce the amount of food (Table 2, 3 and 4).

In our study on domestic violence, out of the total participants only 18% experienced increase in quarrel or fight and 16% in domestic violence in the family as well as the survey study on the status of social relation or social isolation in COVID-19 reported that majority 37% participants experienced reduced interactions with people however, only 03% fill great positive and 08% fill negative effects on social relationships. The statistically significant association is observed between depression with increase in domestic violence ($p < 0.01$) (Table 3 and 4).

IV. DISCUSSION

The COVID-19 pandemic being one such pandemic which has terrifically affected the lives of people. As a way to control the spread of the virus most countries opt for social distancing and lock-downs which brings loss to human lives also bring many adverse impacts on the society specially college going students therefore this study aimed at assessing the socio-economic impact of COVID-19 outbreak and its associated factors among college students, who are known to have an active social life. To our knowledge, this study is the first one from study area that analyzes the impact of COVID-19 outbreak among college students from science field.

The present survey study revealed that depression is higher in males than female and gender is significantly associated with depression. Similarly, Kazmi et al, (2020) reported the depression and stress levels were higher in males as compare to females and Aylie et al, (2020) revealed that sex is significantly associated with depression in their respective studies. But Ravichandran et al, (2020) reported contradictory findings where no association between gender and the negative emotional states was observed. Our study on financial crises show that majority of participants 75% faced financial crises which is statistically significant with depression. This is supported with a study done in Ethiopia among university students (Aylie et al, 2020) and in China among college students (Cao et al, 2020).

Furthermore, this study showed that the prevalence of nervousness is 61% and the statistically significant association is observed between depression and nervousness as well as the prevalence of depression is 20% which is supported with a review of existing literature reported by Ayeli et al, (2020) in Ethiopia (21.3%) and Rajkumar et al, (2020) (16–28%) but lower than studies conducted by Salman et al, (2020) in Pakistan (45%) and Odriozola-gonzalez et al, (2020) in Spain (34.1%) and higher than study conducted by Rehman et al, (2020) in India (13.97%).

In the period of lock-down food being an important need and getting food was a major issue. The present study on food pattern and habits revealed that majority 54% students said need to reduce the amount of food and 49% said financial issue being an obstacle for getting food is the probable reason as well as 35% experienced increased snacking, 15% decreased appetite and 38% experienced inconsistent eating. The statistically significant association is observed between depression and financial issue for getting food. The findings is in agreement with study reported by Christodoulou et al, (2013) where 16.6% said that their financial situations are stopping them from getting food and this was found to have a strong association with anxiety as well as Acard et al, (2003) also reported, over-eating was found to be associated with negative psychological experiences and Ravichandran et al, (2020) reported that the frequency of food intake has increased by 41.8% and 48.3% said they feel a need to reduce the food intake in the lock-down, but these weren't associated with the negative emotional states in their studies.

In our study on domestic violence, out of the total participants only 18% experienced increase in quarrel or fight and 16% in domestic violence as well as majority 37% participants experienced reduced interactions with people however, only 03% fill great positive effects and 08% fill negative effects on social relationships. The statistically significant association is observed between depression with increase in domestic violence. Similarly Ravichandran et al, (2020) reported that 20.9% increased in quarrels and fights but no associations were found with the negative emotional states and 5% increase in domestic violence which was associated with the anxiety and stress among the participants within family in this lock-down. Jones and Isham (2020) also suggested that in such periods of lock-down, domestic violence cases would increase in their study on the consequences of COVID-19 on domestic violence.

The possible reasons for the difference between the earlier studies and present study may be

the age group of students have analyzed is different from that of the other study, a significantly smaller sample size in the study and could be because of a care-free attitude of college students.

V. CONCLUSION

COVID-19 pandemic has incurred social and economic problems which affects the students life and creates various problems like depression, financial crises, worries and irritations, nervousness, change in food habits, quarrel or fight, domestic violence, reduced interactions with people, positive as well as negative effects on social relationships. Thus, it is concluded that COVID-19 outbreak and the lock-down are building distress among college students. Therefore, measures to prevent such distress should be encouraged. During lockdown everyone must be involved in their hobbies, physical activities and exercise, share emotion with parents and friends, it could make this time productive and happy instead of getting stress.

VI. LIMITATION OF THE STUDY

The outcomes of this study cannot be generalized to other population because the study involved only the age group of 18-25 years and an educated group. Since the data were collected by internet, the respondents may not provide accurate information for the study, which may have an effect on the findings of this study. The study could not be superior to a professional psychiatrist's assessment.

CONFLICT OF INTEREST: No conflict of interest

Table 1 Demographic characteristics of survey respondents

SN	Particulars	Category	Percentage (%)
1	Age	18-25 years	100
2	Gender	Male	41
		Female	59
3	Class	UG - I	23
		UG - II	48
		UG - III	29

Table 2 Characteristics of the survey respondents related to the situation

SN	Particulars	Percentage (%)	
		Yes	No
1	Have you faced Financial crises in COVID pandemic?	75	25
2	Have you faced Financial difficulties within family in COVID pandemic?	73	27
3	Have you Worried About Parents' Earnings in COVID pandemic?	70	30
4	Have you felt any Changes in employment activity in COVID pandemic?	52	48
5	In the COVID pandemic, how often have you felt that you were unable to control the important things in your life?	84	16
6	In the COVID pandemic, how often have you dealt successfully with irritating life hassles?	75	25
7	In the COVID pandemic, how often have you felt that things were going your way?	51	49
8	In the COVID pandemic, how often have you felt nervous?	61	39
9	In the COVID pandemic, how often have you felt confident about your ability to handle your personal problems?	81	19
10	In the COVID pandemic, how often have you been able to control irritations in your life?	82	18
11	Need to reduce the amount of food?	54	46
12	Financial issue being an obstacle for getting food?	49	51

Table 3 Characteristics of the survey respondents related to the situation

SN	Particulars	Percentage (%)			
		None	Mild	Moderate	Severe
1	Have you felt Depression in COVID pandemic?	67	13	14	06
2	What was your eating pattern during second wave of COVID?	No change	Increased snacking	Decreased appetite	Inconsistent eating
		12	35	15	38
3	Have you faced Quarrel and Fight in family during COVID pandemic?	None	Increased	Decreased	Same as before
		53	18	08	21
4	Have you faced Domestic violence in COVID pandemic?	59	16	08	17
		No change	Restricted outdoor activities	Reduced interactions with people	Problems with parents
5	What is the status of your Social relation/social isolation in COVID?	34	20	37	09

		None	Little	Some	Great
6	Fill any Positive effects on social relationships.	58	24	15	03
7	Fill any Negative effects on social relationships.	58	19	15	08

Table 4 Associations between various negative emotional states

SN	Particulars	Number	Depression Number	P value
1	Gender			
	Male	41	13	0.048*
	Female	59	07	
2	Faced financial crises			
	Yes	75	06	0.008**
	No	25	14	
3	Worried about parents' earnings			
	Yes	70	15	0.653
	No	30	05	
4	Felt nervous			
	Yes	61	17	0.039*
	No	39	03	
5	Financial issue being an obstacle for getting food			
	Yes	49	16	0.011*
	No	51	04	
6	Need to reduce the amount of food			
	Yes	54	12	0.622
	No	46	08	
7	Increased domestic violence			
	Yes	16	09	0.003**
	No	84	11	

* p < 0.05, **p<0.01

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Cite this article as :

Sonali Dhawas, "Socio-Economic Effect of Covid-19 Lock-Down and Its Associated Factors Among College Students", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 131-138, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229128>
Journal URL : <https://ijsrst.com/IJSRST229128>

Effluents and Waste Water Treatment by Physical, Chemical and Biological Method

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ABSTRACT

During the last 30 years, the prompt population increment, the environmental issues as the result of urbanization of the cities and development of industries in large scale. Among the other pollutants: water pollution is one of the important issues. Such pollution not only affects human health but also harmful agriculture and the earth. Drinking safe and clean water is one of the rising problems around the world. This review article highlight conventional waste water treatment consists of physical, chemical and biological method to remove insoluble particles and soluble contaminants from effluents.

Keywords : Effluents, Waste Water Treatment Physical, Chemical, Biological Method.

Article Info

Volume 9, Issue 1

Page Number : 139-144

Publication Issue

January-February-2022

Article History

Accepted : 20 Jan 2022

Published : 31 Jan 2022

I. INTRODUCTION

Effluent is considered to be water pollution is such as outflow from the sewage treatment facilities or waste water discharge from industries. Effluent is defined by the United States Environmental Protection Agency as “wastewater- treated or untreated- that flows out of a treatment plant, sewer, or industrial outfall. It generally refers to wastes discharged into surface waters”.

The Compact Oxford English Dictionary defines effluent as “liquid waste or sewage discharged into a river or the sea”. Thus an effluent is something that flows out; a stream flowing out of a lake, reservoir, etc; the outflow of a sewer, septic tank, etc; sewage that has been treated in a septic tank or sewage treatment plant; sewage or other liquid waste that is discharged

into a body of water, a discharge of liquid waste, as from a factory or nuclear plant.

In spite of having an efficient design and technology, some waste generation is inevitable in any manufacturing processes. Managing the waste by reuses, recycle or otherwise recover and dispose is the responsibility of the industry itself. The waste may be solid, liquid, or a gas, but the old system of leaving it to the open environment, is a barbaric act against the interest of mankind and nature. Disposal of effluent and waste in a safe, efficient and effective manner is the remedy to avoid adverse environmental effects.

Poor management of waste treatment and effluent disposal systems, results in potential public health risk. Variable factors including prevailing and seasonal weather conditions, topography, separation distances

from residences and public facilities, the quantity, concentration and the type of effluent and the nature of the receiving water environment are factors that are to be assessed when designing a waste treatment and effluent disposal system. No nuisance from odour or danger to public health and safety is to be caused by waste and effluent disposal systems.

II. CHARACTERISTICS OF EFFLUENTS

The characteristics of effluents are depending on the source and type of it. For example, an effluent like municipal waste water will be having different characteristics from that of a factory, or from that of a shrimp farm, or from that at a mine. Each of the effluent has to be analyzed and studied for its characteristics.

For example, municipal wastewater is mainly comprised of water (99.9%) together with relatively small concentrations of suspended and dissolved organic and inorganic solids. Among the organic substances present in sewage are carbohydrates, lignin, fats, soaps, synthetic detergents, proteins and their decomposition products, as well as various natural and synthetic organic chemicals from the process industries.

Municipal wastewater also contains a variety of inorganic substances from domestic industrial sources including a number of potentially toxic elements such as arsenic, cadmium, chromium, copper, lead, mercury, zinc, etc. Even if toxic materials are not present concentrations likely to affect humans, they might well be at phototoxic levels, which would limit their agricultural use. However, from the point of view of health, a very important consideration in agricultural use of wastewater, the contaminants of greatest concern are the pathogenic micro- and macro-organisms.

Wastewater discharged from an industrial plant contains various types of impurities depending on the type of dyes, chemicals, auxiliaries and process used. Some of these impurities are considered toxic while some are not. Of course, the toxicity or harmfulness also depends on the amount present in a certain amount of wastewater and its potential use. For example water is used for drinking purposes. irrigation in the fields, in various types of textile, chemical, food processing. leather processing and pharmaceutical industries, and also to maintain the aquatic life in the canals and rivers. In all these cases different level of purity in terms of toxicity and harmfulness is required.

Of the many variable characteristics often studied and most critical in an industrial effluent are pH, suspended solids, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total suspended solids (TSS), Total dissolved solids (TDS), Total Organic Carbon (TOC), oil and grease content, Total Phosphorous, Total Nitrogen, Ammonia, and physical characteristics like colour, odour and temperature. The strength of the wastewater is often determined by measuring the amount of oxygen consumed by microorganism like bacteria in biodegrading the organic matter. BOD is not an accurate quantitative test, although it could be considered as an indication of the quality of a water source. The presence of radioactive substances, fecal bacteria, and heavy metals are also important.

III. METHODS FOR WASTE WATER TREATMENT

Wastewater treatment consists of applying known technology to improve or upgrade the quality of a wastewater. Usually wastewater treatment will involve collecting the wastewater in a central, segregated location (the Wastewater Treatment Plant) and subjecting the wastewater to various us treatment processes.

Its objective is to produce an environmentally-safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse (usually as farm fertilizer). Using advanced technology it is now possible to re-use sewage effluent for drinking water.

Wastewater treatment, however, can also be organized or categorized by the nature of the treatment process operation being used; for example, physical, chemical or biological.

A. Physical Method

Physical methods include processes where no gross chemical or biological changes are carried out and strictly physical phenomena are used to improve or treat the wastewater. Examples 'coarse screening' to remove larger object and sedimentation (or clarification). In the process of sedimentation, physical phenomena relating to the settling of solids by gravity are allowed to operate; Usually this consists of simply holding a wastewater for a short period of time in a tank under dormant conditions, allowing the heavier solids to settle, and removing the "clarified" effluent. Another physical treatment process consists of aeration - that is, physically adding air, usually to provide oxygen to the wastewater. Still other physical phenomena used in treatment consist of filtration. Here, wastewater is passed through a filter medium to separate solids. An example the use of sand filters to further remove entrained solids from a treated wastewater. Permitting greases or oils, for example, to float to the surface and skimming or physically removing them from the wastewaters is often carried out as part of the treatment process.

In certain industrial wastewater treatment processes strong or undesirable wastes are sometimes produced over short periods of time. Since such "slugs" or periodic inputs of such wastes would damage a biological treatment process, these wastes are sometimes held, mixed with other wastewaters, and gradually released, thus eliminating "shocks" to the

treatment plant. This is called equalization. Another type of "equalization" can be used to even out wide variations in flow rates. For example, the wet well of a pump station can receive widely varying amounts of wastewater and, in turn, pump the wastes onward at more uniform rates.

B. Chemical Method

Chlorination, Ozonation, Neutralization, Coagulation, Adsorption, and Ion Exchange are examples of chemical methods. Chemical treatment consists of using some chemical reaction or reactions to improve the water quality. The most commonly used chemical process is chlorination. Chlorine, a strong oxidizing chemical, is used to kill bacteria and to slow down the rate of decomposition of the wastewater. Another strong oxidizing agent that has also been used as an oxidizing disinfectant is ozone.

A chemical process commonly used in many industrial wastewater treatment operations is neutralization. Neutralization consists of the addition of acid or base to adjust pH levels back to neutrality. Since lime is a base it is sometimes used in the neutralization of acid wastes.

Coagulation consists of the addition of a chemical that, through a chemical reaction, forms an insoluble end product that serves to remove substances from the wastewater. Polyvalent metals are commonly used as coagulating chemicals in wastewater treatment and typical coagulants would include lime (that can also be used in neutralization), certain iron containing compounds (such as ferric chloride or ferric sulphate) and alum ($K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$).

Certain processes may actually be physical and chemical in nature. The use of activated carbon to "adsorb" or remove organics, for example, involves both chemical and physical processes.

C. Biological Method

Biological treatment methods use microorganisms, mostly bacteria, in the biochemical decomposition of wastewaters to stable end products. More microorganisms, or sludge are formed and a portion of the waste is converted to carbon dioxide, water and other end products. Generally, biological treatment methods can be divided into aerobic and anaerobic methods, based on availability of dissolved oxygen.

Aerobic methods include Activated Sludge Treatment Methods, Trickling Filters, Oxidation Ponds, Lagoons etc. Here oxidation of the organic matter takes place.

Anaerobic methods include Anaerobic Digestion, Septic Tanks, and Lagoons where mostly reduction of carbon in organic compounds into hydrocarbons takes place.

The solids which are removed are primarily organic but may also include inorganic solids. Treatment must also be provided for the solids and liquids which are removed as sludge. Finally, treatment to control odours, to retard biological activity, or to destroy pathogenic organisms may also be needed.

Wastewater may contain high levels of the nutrients nitrogen and phosphorus. Excessive release to the environment can lead to a buildup of nutrients, called eutrophication, which can in turn encourage the overgrowth of weeds, algae, and cyanobacteria (blue-green algae). This may cause an algal bloom, a rapid growth in the population of algae. The algae numbers are unsustainable and eventually most of them die. The decomposition of the algae by bacteria uses up so much of oxygen in the water that most or all the animals die, which creates more organic matter for the bacteria to decompose. In addition to causing a deoxygenating condition, some algal species produce toxins that contaminate drinking water supplies. Different treatment processes are required to remove nitrogen and phosphorus.

D. Some examples of Biological Methods are Nitrogen Removal

The removal of nitrogen is effected through the biological oxidation of nitrogen from ammonia to nitrate (nitrification), followed by denitrification, the reduction of nitrate to nitrogen gas. Nitrogen gas is released to the atmosphere and thus removed from the water.

Nitrification itself is a two-step aerobic process, each step facilitated by a different type of bacteria. The oxidation of ammonia (NH_3) to nitrite (NO_2^-) is most often facilitated by *Nitrosomonas*; while the nitrite oxidation to nitrate (NO_3^-), is facilitated by *Nitrobacter*.

Denitrification requires anoxic conditions to encourage the appropriate biological communities to form. It is facilitated by a wide diversity of bacteria. Sand filters, lagooning can all be used to reduce nitrogen, but the activated sludge process can do the job the most easily.

Phosphorus Removal

Phosphorus removal is important as it is a nutrient for algae growth in many fresh water systems. Phosphorus can be removed biologically in a process called enhanced biological phosphorus removal. In this process, specified bacteria, called Polyphosphate Accumulating Organisms (PAOs), are selectively enriched and accumulate large quantities of phosphorus within their cells. When the biomass enriched in this bacteria is separated from the treated water, these bio-solids have a high fertilizer value.

Phosphorus removal can also be achieved by chemical precipitation, usually with salts of iron (e.g. ferric chloride), aluminium (e.g., alum), or lime. This may lead to excessive sludge production as hydroxides precipitates and the added chemicals can be expensive. Chemical phosphorus removal requires significantly smaller equipment than biological removal and it is easier to operate and is often more reliable than biological phosphorus removal. Once removed,

phosphorus, in the form of a phosphate-rich sludge, may be stored in a land fill or resold for use in fertilizer.

Disinfection

The purpose of disinfection in the treatment of waste water is to substantially reduce the number of microorganisms in the water to be discharged back into the environment. The effectiveness of disinfection depends on the quality of the water being treated (e.g., cloudiness, pH, etc.). the type of disinfection being used, the disinfectant dosage (concentration and time), and other environmental variables. Common methods of disinfection include ozone, chlorine, ultraviolet light, sodium hypochlorite and Chloramines.

Chlorination remains the most common form of waste water disinfection due to its low cost and long-term history of effectiveness. One disadvantage is that chlorination of residual organic material can generate chlorinated-organic compounds that may be carcinogenic and harmful to the environment. Further, because residual chlorine is toxic to aquatic species, the treated effluent must also be chemically de-chlorinated, adding to the complexity and cost of treatment.

Ultraviolet (UV) light can be used instead of chlorine, iodine, or other chemicals. Because no chemicals are used, the treated water has no adverse effect on organisms that later consume it. UV radiation causes damage to the genetic structure of bacteria, viruses, and other pathogens, making them incapable of reproduction.

IV. CONCLUSION

Throughout the years, the water is polluted because of urbanization, industrialization and unskilled utilization of natural water resources. There are numerous methods of removing effluents from the

sewage water and treating the waste water for reuse. The scarcity of the shortage of water globally, various studies has been carried to solve this problem and in this connection, waste water treatment is among the one. In this review article, a brief and detailed introduction of the waste water has been highlighted. One the basis of reviewed literature in this article, following are the some concluded remarks-

- The advanced new green technical methods are being used to overwhelm the conventional techniques of wastewater treatment.
- Some techniques covenant with decrease of heavy metals where other techniques compact with lessening of Phosphorus and Nitrogen.
- The biological method particularly fungi and bacteria for wastewater treatment, specifically for colored compounds in the molasses found distilleries wastes.

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Cite this article as :

Dr. Arun Kumar, "Effluents and Waste Water Treatment by Physical, Chemical and Biological Method", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 139-144, January-February 2022. Journal URL : <https://ijsrst.com/IJSRST229133>

A State-of-the-Art Review on Soil-Structure Interaction

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ABSTRACT

This paper provides an insight and the role of the dynamics soil structure interaction analysis depending upon the past studies. As a result of population boom and scarcity of land, buildings are constructed very close to each other. This is the major issue especially in the case of developing country where housing colonies are developing in the big cities as well as in the countryside, making the study of soil-structure interaction as an essential part of structural design process. The effect of soil, on which the structures stands, especially in the highly seismic zones, the dynamic behaviour of soil as well structure should be well known by the designer. The effects of structures standing in a close vicinity to each other is the main issue of soil-structure interactions as well as structure-soil-structure interactions. In this paper, various methods of soil-structure interactions carried out by various researchers in various region are reviewed.

Keywords : - Population boom, Countryside, Soil-Structure Interaction, Seismic Zones

Article Info

Volume 9, Issue 1

Page Number : 145-151

Publication Issue

January-February-2022

Article History

Accepted : 01 Jan 2022

Published : 09 Jan 2022

I. INTRODUCTION

Civil engineering structures generally require some type of structural element which is in direct contact with soil. In order to estimate the accurate response of the superstructure it is necessary to consider the response of the soil supporting structure, and is well explained by the soil structure interaction (SSI) analysis. Various attempts have been made by various researchers to model the SSI problem analytically; however the soil nonlinearity, foundation interfaces

and boundary conditions make the problem more complex and computationally costlier.

Most efficient and accurate modeling of the unbounded soil medium has been of long-standing interest in the mind of researchers for the dynamic soil structure interaction (SSI) problems. The methods available for the analysis of SSI problems can be classified into two groups: i.e. direct method and substructure method. In the direct method of SSI analysis, the artificial boundary has to be placed

sufficiently far from the soil-structure interface because approximate or local boundary conditions are imposed on this boundary. This leads to an increase in the number of degrees of freedom (DOF) and the computational effort, although the direct method itself is computationally efficient because the interaction force - displacement relationship involved is local in time and space. On the contrary, in the substructure method, the boundary conditions imposed on the interaction horizon are rigorous, making the force-displacement relationship global both spatially and temporally. A large amount of data also need to be processed, which results in expensive computations, especially for large-scale problems.

II. REVIEW OF AVAILABLE LITERATURES

Jonathan et al. (1999) proposed the well-defined procedures for simulating the inertial soil structure interaction effects with respect to seismic structural response. Their analysis procedure and data's are similar to that of provisions provided in standard building codes along with the consideration of the site influence conditions, foundation embedment, flexibility, and shape of the foundation impedance. The process of implementing their analysis procedures and techniques is well illustrated using the data of Northridge earthquake (1994). Their analyses empirically evaluate SSI effects using available strong motion data from a broad range of sites conditions.

Zhang et al. (1999) developed a three-dimensional dynamic SSI analysis program (DSSIA-3D) for SSI analysis in the time domain. DSSIA-3D is based on the substructure method, wherein the unbounded media is modelled by the SBFEM. Approximation schemes in both time and space were implemented for computational efficiency in calculating the unit-impulse response matrix with no major loss of accuracy. Also, in order to calculate the interaction forces using convolution integrals an efficient scheme has been implemented. DSSIA-3D can be used for SSI

analysis considering seismic waves as well as externally applied dynamic loading.

Wegner and Zhang (2001) proposed a procedure using FEM-SBFEM coupling for the free-vibration analysis of a soil-structure system. Using inverse iteration for solving the nonlinear eigenvalue problem, the fundamental frequency of the soil structure system and the corresponding mode shapes as well as the radiation-damping ratio are calculated.

Genes M. C. and Kocak S. (2005) presented a computational model for dynamic response of soil-structure interaction analysis using the FE-BE-SBFEM coupled model. In their analysis they first developed and tested the FE-BEM and FE-SBFEM models and later, the FE-BE-SBFEM model is implemented in analysis. In their proposed model, the finite region, which might be considered as the structure, is modelled by the FEM. On the soil-structure interface, the boundary at the bottom of the finite medium, which is extending to infinity in vertical direction, is modelled by the BEM, and the vertical boundary of the layers, which is extending to infinity in horizontal direction, is modelled by the SBFEM. This coupled model combines the three methods by using them whenever they are advantageous; for example, the use of SBFEM on the vertical boundary eliminates the need for discretization of free surfaces, and SBFEM represents the layered medium on the vertical boundary more efficiently than the BEM. SBFEM satisfies the boundary conditions on free, fixed and inter-material surfaces without discretization. Also, there are no singular integrals to be evaluated as in BEM.

Their analyses are conducted in frequency space. Dynamic stiffness matrices pertaining to related regions of the SSI system are calculated by three methods and combined by using sub structuring method. In the SBFEM, for the dynamic stiffness matrix calculations Bulirsch-Stoer integration algorithm is used to integrate the resulting ODE. Since Bulirsch-Stoer integration algorithm dictates

the frequencies at which dynamic stiffness matrix is calculated, related dynamic stiffness calculations are conducted by BEM and FEM at corresponding frequencies. Their finding shows that the coupled FE–BE–SBFEM model can be used in SSI analyses efficiently and accurately. Their results also demonstrated the importance of using coupled models for analysing complex structures and non-homogeneous unbounded mediums.

Julio A. G. (2008) proposed that the influence of soil-structure interaction in the dynamic behaviour of the structure is reflected in an increase in the vibration period as well as an increase in system damping compared to the fixed base model. He observed that the increase in vibration period is about 7.6% as compared with the fixed-base model. He also observed that the increase in the system damping is 166% as compared to the fixed-base model.

His observation shows that the influence of soil-structure interaction in the seismic design of the structure is reflected in a decrease in the horizontal values of spectral acceleration and reduction in the acceleration values for the fundamental period of the structure is 29.6% as compared with the fixed base model. He recommended to reduce the spectral acceleration of the structure corresponding to the fundamental period by 20% over the acceleration value for the fixed base model. He observed that the inclusion of the soil in the structural analysis provides results, stresses and deformations, closest to the actual behaviour of the structure, in comparison with those provided by the analysis of a fixed-base structure. He also suggested that, mechanisms such as rocking can be investigated by including the stiffness parameters of foundation and subsoil. His finding suggests that the increase in system damping is associated with a reduction in the elastic deformation of the structure due to the energy dissipated in the soil-foundation system. Besides, more economic designs are obtained by including the soil in the structural analysis and design, due to the reduction in seismic loads.

Sanaz et al. (2011) worked on coupled scaled boundary finite element-finite element model to examine the dynamic response of the structure considering soil-structure interaction. They used substructure method to analyse the soil-structure interaction problem. Their analysis is performed in time domain where material behaviour of soil and structure is assumed to be linear. They used scaled boundary finite element method to calculate the dynamic stiffness of the soil, and the finite element method to analyse the dynamic behaviour of the structure. 2D frames have been analysed by them using their proposed model and results were compared with those obtained by cone model. In analysis they observed that, consideration of SSI effect leads to reduction in displacement and base shear. It was also observed that when the soil structure system was subjected to an earthquake whose predominant period is close to natural period of the structure, considering SSI effects leads to more significant reduction, and the dynamic response of the structure was more affected. From their analysis it was observed that considering SSI effects results in more effective design without decreasing safety margin.

Syed, N. M. and Maheshwari, B. K. (2012) presented the work on coupled FEM-SBFEM approach for the nonlinear dynamic SSI analysis. In their study the nonlinearity of soil is modelled using HiSS constitutive model. After verification of developed algorithm, an axisymmetric problem of an elastic half-space under dynamic load was addressed by them. Their results highlighted the importance of radiation damping in the SSI analysis. They suggested that their approach can be used in the dynamic SSI analysis of highly nonlinear problems, since the full Newton-Raphson iteration is considered in the nonlinear HHT- α method of integration. They also stressed that, their algorithm can be extended to deal with soil liquefaction.

Chen, X., Birk C. and Song, C. (2013). They developed a new algorithm which will be useful for the solution

of dynamic soil-structure interaction problems in the time domain. The traditional SBFEM is based on approximating the acceleration unit-impulse response by a piece-wise constant function. Two essential improvements proposed by them are: (1) the displacement unit-impulse response is calculated instead of the acceleration unit-impulse response based on a piece-wise linear approximation; (2) the convolution integral in the soil-structure interaction force vector is truncated after a few steps. This leads to a significant reduction of computational effort. The accuracy and computational efficiency of the proposed algorithm have been verified by them using various numerical examples.

Syed, N. M. and Maheshwari, B. K. (2014). The FEM-SBFEM approach was compared by them with the direct method of the SSI analysis using viscous dashpots. They found that the FEM-SBFEM approach is computationally efficient compared with viscous dashpots, which uses large FEM mesh (increasing computation) and still gives approximate results. In their study free-field amplification factors were calculated using the FEM-SBFEM approach and compared with those calculated using viscous boundary and Kelvin elements. The results of the dynamic SSI analysis of a building with unbounded domain modeled using the SBFEM verified a well-established fact that the response of the structure depends conjointly on the dynamic characteristics of the structure and the supporting soil.

Badry P, Satyam N (2016). has observed that the effect of introducing interaction effect deviates the system response. The deviation so observed was less for the bottom floor and increases as the storey height increases. The response was about 15 - 20 % on an average in the case of SSI analysis than the fixed base analysis. Thus, it signifies that the effect of interaction plays important role in superstructure response. They have also observed that, the asymmetrical building response at all points located at the same level is not same and clearly shows that the asymmetrical building has different movement at different location

on the same vertical level. This deviation is found to be within the range of 2-4 % for different corners which indicates the effect the structure.

Lu, Yang (2016). Developed simplified nonlinear sway-rocking model to capture the coupled sway-rocking behaviour of shallow mat foundations supporting heavily-loaded buildings under earthquake ground motions. Their spring-type model utilised a single normalised backbone curve for each of the swaying and rocking degrees of freedom. They also developed normalised backbone curves depending upon their results of a series of static displacement-control finite-difference analyses which was carried out using the FLAC^{3D} program. The effect of soil non-homogeneity on the stiffness and capacity of the soil-foundation system was also considered in their analysis.

The effectiveness and efficiency of their proposed model were validated against results from dynamic analyses performed using a FLAC^{3D} model by utilising two artificial input motions and one real earthquake acceleration record. The simplified model was capable of efficiently capturing the foundation load-displacement behaviour, including the maximum and residual displacements, with good accuracy.

Although their proposed simplified model has some limitations, though their model able to provide parameters necessary for preliminary design of buildings on weak soil while achieving a good balance between simplicity and accuracy. In addition, the concept of the model allows engineers to select appropriate model properties in accordance with specific site conditions.

Kwag, S., Ju, B and Jung, W. (2018) explored the SSI effect on the overall risk of a PWR containment building structure with respect to two failure modes: strength and displacement. Such an exploration is based on the current SPRA framework which integrates seismic hazard and fragility information. For the fragility analysis purpose, the factor of the safety method and the MLE-based statistical approach are employed by them. The seismic responses of the

containment structure supported on the three soil conditions: fixed, hard, and soft, are obtained by using site response analyses and inelastic time-history analyses, and results are then utilized for basic information in the fragility quantification. The discrete seismic hazard information in the site of

interest and the log-log linear approximation are utilized for the conservative risk assessment. Finally, the seismic fragility and risk results in the three different soil conditions are compared for each failure mod.

A summary of SSI researches through analytical, experimental and numerical studies

Researcher	Year	Contribution	Foundation	Analysis
Analytical Studies				
Lin and Miranda	2009	4-story asymmetrical building	Springs and dashpot	Arithmetic sum method
Olariu and Movila	2014	2-story asymmetrical building	Springs and dashpot	Spectral acceleration method
Experimental studies				
Todorvska	2002	45m Hollywood storage building	Pile	Ambient vibration test
Mason, Trombetta, Chen, Bray, Hutchinson and Kuttar	2013	Asymmetrical group of symmetrical building	Isolated	Scale down model, Centrifuge testing
Numerical studies				
Venkatesh, Gupta and Pandit	2012	Asymmetrical loading	Raft	and 2 3-D nonlinear analysis of soil -D analysis for structure
Tehrani and Khoshnoudian	2014	Planar asymmetry. 5 to 15 story buildings	Shallow	Pushover analysis
Sharma and punit	2014	Different shear wall configuration in tall asymmetrical building	Shallow	3-D nonlinear dynamic analysis

Isbilioğlu and Taborda	2014	Group of asymmetrical small structure	Isolated	3-D nonlinear analysis
Yigti	2013	Asymmetrical cluster of buildings	Shallow	3-D dynamic nonlinear analysis
Irfan, Sunandan Reddy and Mythili	2014	Soft story effect including interaction	Isolated	3-D dynamic non

III. CONCLUSION

From the literature review, author wants to conclude that it is very important to direct research towards the ways of examining the effects of SSI on the structure and figure out the conditions that produce adverse effects on SSI. This review article will provide a good understanding of the origin and development related to the various problems that existed in the context of soil structure interaction. It is apparent that great deal of work has been done to understand the effects of dynamic SSI. It has been hypothesized that in many cases SSI can be considered beneficial for multi-purpose residential and / or commercial buildings and other types of civil engineering structures. Many investigators have shown that this hypothesis is flawed in different contexts. Numerous evidence is available that demonstrates the effects of soil structure interactions on the structural response and highlighted the important contributions due to SSI. In addition, ground motion amplification plays a major role in the structural response. There are various ways to evaluate the effects of seismic SSI and each method has its own usefulness and scope. Various issues related to soil modelling and foundation interaction have been discussed and it is considered that a limited amount of research has been done on nonlinear modelling of soil and foundation interaction for seismic soil structure interaction studies. The natural period of the structure plays a major role in the structural response for seismic SSI studies. It has been observed that the validity of the fixed base for flexible bases is limited to the stiff soil foundation systems. The behaviour of low-rise and high-rise structures are different from each other. In

the same way, the behaviour of moment resisting framed structures is different from those of the wall frame structure where the rocking plays an important role. The type of foundation plays a major role in determining the response of the superstructure. The behaviour of structures supported on shallow foundation is different than that supported on the piles. Site features and ground motion have a significant impact and produces a destructive response to the structures during an earthquake. It is understood that there are many issues involved with dynamism and that need to be known for a better understanding of the seismic SSI.

From this review article, it is clear that many studies have carried out which give idea about the effects of SSI. However, studies that focus on the application of different approaches to a particular issue is limited. Such studies should be developed to understand local effects and specific effects of SSI which will be useful in understanding the realistic scenarios or causes that may arise due to SSI.

IV. ACKNOWLEDGEMENTS

The resources provided by Department of Civil Engineering, North Eastern Regional Institute of Science and Technology (NERIST) Nirjuli, is gratefully acknowledged by the author.

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Advances in Civil Engineering, Volume 2018, Article ID 2698319.

Cite this article as :

Talkeshwar Ray, Sukumar Baishya, Dipika Devi, "A State-of-the-Art Review on Soil-Structure Interaction", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 2, pp. 145-151, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST22911>
Journal URL : <https://ijsrst.com/IJSRST22911>

Analysis of Inventory Management of Agro-based Industries using EOQ and EPQ Model with Profit Maximization

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ABSTRACT

Due to the perishable nature of agricultural product the Inventory management of Agro-based industry is a challenging task. EOQ model and EPQ model has its importance & role for proper management of this category of Inventory. The success of many industries is related to their ability to provide goods and services at right time and in right place. Different organization adopt different inventory control methods to manage their inventory to avoid stock-out and overstock. This paper analyses possible parameters of existing literature, concentration, description of characteristics and of EOQ inventory control model and EPQ model that have been developed and can solve the Problem in this field & will provide maximum profit with the customer satisfaction.

Keywords : EOQ, EPQ, Inventory management, Holding cost, Ordering cost, production cost

Article Info

Volume 9, Issue 1

Page Number : 152-159

Publication Issue

January-February-2022

Article History

Accepted : 06 Jan 2022

Published : 20 Jan 2022

I. INTRODUCTION

Industries that have agricultural produce as raw materials are known as Agro-based Industries. These are consumer-based industries. Food Processing Industries are based on agricultural raw materials as it needs all kind of agricultural raw material for its products. All branches of Agro-based industry are very important because they increase industrial products, provide employment, earn foreign exchange, increase income level and also provide employment to women and provide base for development for backward areas.

The most important factor in organization and the proportion of inventories to total asset is inventory

management. Inventory management system has mainly two concerns, one is level of customer service i.e., to have right goods, in right place and at right time and other is cost of ordering and carrying inventories. Inventory management was not proper in this industry which is situated in Odisha. In this paper it is named as AK Industry because the identity of this market complex is protected. This industry is a M.S.M.E. This type of industry was facing many problems when overstock or stock out occurs in the market warehouse. To overcome these problems various methods can be used like JIT (Just in Time), Value stream mapping, EOQ and EPQ etc. In this paper an EOQ and EPQ method is selected for research work.

Bill Roach 2005 [1], explains how the origin of the Economic Order Quantity started in his article, "Origin of the Economic Order Quantity formula; transcription or transformation?" published in 2005. Roach explains that the Economic Order Quantity (EOQ) has been a well-known formula that calculates the optimal economic order quantity. He also mentions how Ford W. Harris contribution to the EOQ formula was significant. He wrote formula of EOQ in 1915, when he was still an undergraduate student. The formula of EOQ is used in business, also in engineering.

India as an agriculture base economy has its requirement for agriculture growth through the establishment & development of Agro-based industry which can be held & possible through successful business of agricultural products whereas success of any business is related to their ability to provide the satisfaction towards the customers and maximum selling of its product, has the required goods and services in the right place & time or proper/effective inventory management. An effective inventory management should maintain sufficient finished goods inventory for smooth sales operation, efficient customer services, minimization of the carrying cost and time, control investment in inventories, keep it at an optimum level, permits a better utilization for available stocks by facilitating interdepartmental transfers with a company. Effective inventory management for manufactured products is with the application of various models whereas Agriculture products with its inventory is big issue today need more attention because, it is difficult task to manage the agriculture products and its inventory due to their unique features such as the perishable nature, limited and unpredictable supply, prices and decision of how much to sell. This is the real case in the Odisha market.

In this case characterization of the optimal inventory (selling) policies has to be developed for variety of cost functions, Here the author has taken the linear

cost which may be functioned & if will be relevant in practice, can derive closed form expressions for the optimal policies and the optimal discount profits with the help of EOQ model as a tool for its implementation and effective inventory management. Here the product is Tomato Sauce and Chilli Sauce.

Here the available data is taken for the analysis with the development of calculated cost, estimates to compare business and the recommended EOQ model to the business to implement & increase stocks and reduce reorder. Regardless of all other theory, applying this, EOQ theory to practice, it is possible to make selling decisions judiciously & can significantly make outer form of the prevailing practice of selling. EOQ is an inventory model which is for the fixed order size inventory and is a formula for determining the optimal order size that minimizes the sum of carrying costs and ordering cost which has the requirement of the demand forecasting of the particular region or by taking the usage of a particular product and its past data is available.

Economic Order Quantity (EOQ) and Economic Production Quantity (EPQ) both are widely and successfully used models of inventory management. Economic order quantity is the optimum order size that should be placed with a vendor to minimize blockage of funds and holding and ordering costs. At the same time, it is that adequate quantity of a product or part that will ensure unstopped production or sales activity in an organization. On the other hand, economic production quantity is the optimum lot size that is to be manufactured in a production unit to avoid unnecessary blockage of funds and excess storage costs. This production quantity is adequate to ensure uninterrupted work. Both models aim to minimize costs in an organization by keeping control of inventory. The target is to optimize inventory utilization so that money does not block in excess inventory. Also, the company should not face a shortage of inventory due to which production and

other processes get hampered. An optimum mix of major costs related to inventory like holding cost and ordering cost is worked out to keep costs under control.

Organization's inventory is an important component and its management is vital to the success and cost reduction of the firm's expenditure. In this field of effective inventory management, a number of scholars have done the research and with their suggestions & findings.

L. Bournee & D.H.T Walker (1977) Company performance depend upon many variables, either depends on sales marketing good human resource or the less production cost. Wee H M. (1999) Domestic and international research shows that the agricultural products are perishable products, and their inventory model is based on the study of perishable products. And the core elements in the perishable products are: 1) demand, 2) freshness, 3) loss rate J. W Toomy (2000), The role of inventory management is to maintain a desired stock level for every specific product item, where the systems that plan and control inventory must be based in the product, customer and the process of product that available in the inventory.

Prasad & TATA (2000) Batching of inventory helps NGOS to save on their transport cost which will eventually save on their total supply chain with total cost Wild (2002) recommends, proper warehousing of inventory so that when goods are ordered, they are held at the warehouse or the least item possible minimizing holding cost of inventory Kavalya (2004). Total cost model needs to be balanced by ensuring purchase costs, ordering cost and holding costs are minimized so that the firm can reap good profits and maintains its budgetary allocation for nongovernmental organization. Beamon and Kotleba (2006) explain that reorder level (ROL) is critical for human terrain organizations to achieve optimal efficiency and to be effective. They need to have two reorder levels one that is normal where as a second one that is for emergency cases in case of disaster.

This improves performance and customer satisfaction. Lai & Chang (2009) it was found out that keeping moderate inventory is good and it enables an organization operate minimal expenses of holding and setup costs; eliminate unwanted lead time produce goods as per customer order. This enables and organization achieve total quality control as efficient and effective supply chain management are implemented in a firm's value chain. T. Lwika & P. B Ojera (2013), Inventory management is a crucial part of a firm because mismanagement of inventory threatens a firm's viability such as too much inventory consumes physical space, creates financial burden and increases the possibilities of damage, spoilage, and loss. A. Swain, D. Samal, A. Kalam (2018), explain the inventory of potato in Odisha market to prevent the loss and farmer's suicide. D. Samal, A. Kalam (2021), explain the inventory of Ghee in RKL market to prevent the loss and customer satisfaction. Anantadjaya, S. P., Nawangwulan, I. M., Irhamsyah, M., & Carmelita, P. W. (2021). discussed about Supply Chain management, inventory management & financial performance: evidence from manufacturing firms.

II. ASSUMPTIONS & NOTATION

Constant Demand and Easy Restocking

Both models assume the demand to be constant over the year. The EOQ model assumes that the product is easily available in the open market. Its replenishment will happen as soon as it reaches the minimum threshold level. Similarly, the EPQ model assumes that the production capacity aligns with the requirements. And the product can happen as the stock goes down below a minimum level. It will ensure no stock-out situation. And, also successfully took care of all demand.

Constant Price

Both models assume the price of the product to be constant all through the year. While making a

purchase under EOQ or producing the product under EPQ, the price does not vary. Also, no discounts are on offer on quantity or value.

Constant Quality

Both models assume that the quality of the products purchased or produced remains the same all year-round. There is no variation in it due to which the demand also does not change.

1) Holding and Ordering Costs remain Unchanged. Holding the cost of inventory is the cost of stocking and maintaining inventory. It can be in the form of rentals for the storage area, salaries of personnel looking after the inventory, electricity bills, repairs, maintenance, etc. Ordering costs are the costs at the time of placing an order for the inventory. These can be in the form of freight, packing and forwarding charges, etc.

Both models have the assumption that these costs will remain unchanged throughout the year. Besides, the EPQ model assumes that the set-up costs of production also remain constant throughout the year. And this set-up cost will not change with the production length.

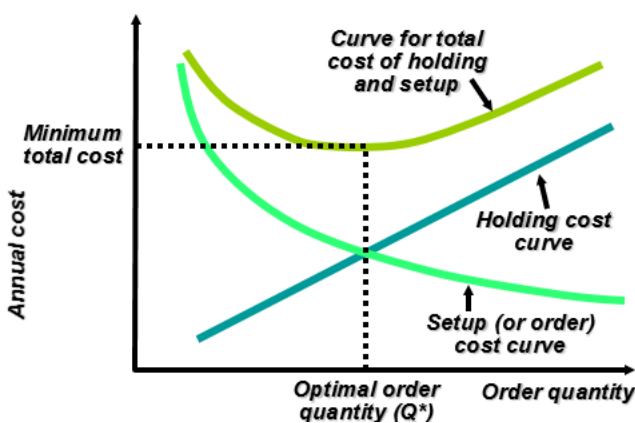


Figure 1: EOQ Model

$$EOQ = \sqrt{\frac{2D.O}{H}}$$

Q= The EOQ order quantity. this is the variable we want to optimize. All the other variables are fixed quantities.

D = the annual demand of product in quantity /unit time.

O = the product order cost. This is the flat fee charged for making any order is independent of Q.

C= Unit cost

H = Holding cost/unit

A = Demand for the year

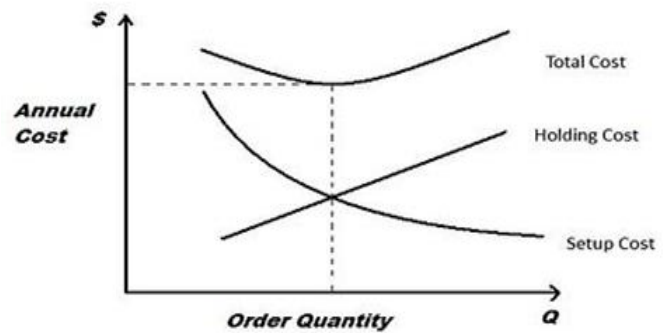


Figure 2: EPQ Model

$$EPQ = \sqrt{\frac{2D.O}{H(1-x)}}$$

Here, x= D/ P where P= Production rate.

Limitations of EOQ and EPQ Model:

Unrealistic Assumptions:

The most significant limitation of both models is that the assumptions are unrealistic.

- Both models assume the holding cost, ordering cost, demand, price, quality, etc. of the product or part to be constant throughout the year. It is not realistic in the real world.
- Holding and ordering costs may vary due to change in rentals, salaries of personnel, and other overhead expenses.
- Constant demand, as well as the price of a product, can hardly be constant. They fluctuate a lot in the real world.
- Consumer income, tastes, and preferences, prices of inputs and raw materials, seasonal variation in demand, etc. are key factors that will affect demand as well as price.

Similarly, the assumption of the constant quality of the product is not realistic, especially under the EPQ model. The quality of the product generally changes with every production batch. The production process also does not remain constant because of factors like an interruption in power supply, breakages, and repairs in plant and machinery, overheating, change in the quality of inputs and raw materials, etc. Also, the model does not consider wastages or damages in the production process due to which the product quality may go wrong, directly impacting the demand for the product.

Differentiation Table

Both models aim to minimize costs in an organization by keeping control of inventory. The target is to optimize inventory utilization so that money does not block in excess inventory. Also, the company should not face a shortage of inventory due to which production and other processes get hampered. An optimum mix of major costs related to inventory like holding cost and ordering cost is worked out to keep costs under control.

	consideration	consideration
Lead Time	The presence of constant lead time is assumed	There is no such assumption

III. CALCULATION OF EOQ

It determines the optimal amount of those cost that affected both by the amount of inventories held and the number of orders made. Ordering in bulk at the same time will increase the costs of maintaining a small business, because that will increase the number of stocks in the warehouse, while ordering costs will be lowered. Increasing the number of orders reduces holding costs but increases the costs of ordering. EOQ model minimizes the amount of these costs, which found a formula that shows the connections between the costs of maintaining and ordering and annual demand for the material. Here the authors have taken the data of AK industry who produce Tomato and Chilli Sauce and sell. Significant costs affecting the determination of the optimal inventory levels are holding costs and ordering costs. Significant holding costs are only those that differ with respect to inventory levels. This includes the opportunity cost of the holding funds, invested in stocks, which is reflected by the cost of wanted return from investing in stocks compared with any other investment alternative. For the firm the required return is 25%. In other holding costs, it is included storage and security and electricity and the cost of electricity goes to 12000 for 12 months. In ordering costs there are included costs for transportation which relate to the number of units ordered. Society makes a supply once in every week and the charge is 10000.

Economic order Quantity (EOQ) can be determined by reflecting the total costs for different amounts of orders through the formula. For the EOQ'S determination, we need the annual demand data, the cost of ordering and cost of holding. In this paper for

Basis	EOQ	EPQ
Meaning	Economic order quantity is the optimum order size that should be placed with a vendor to minimize blockage of funds and holding and ordering costs	Economic production quantity is the optimum lot size that is to be manufactured in a production unit to avoid unnecessary blockage of funds and excess storage costs
Formula	$EOQ = \sqrt{\frac{2D.O}{H}}$	$EPQ = \sqrt{\frac{2D.O}{H(1-x)}}$
Production	The company itself is not producing the item under	The company is the producer itself of the product or the part under

experiment we supposed to calculate EOQ for the Tomato Sauce and Chilli Sauce which is sold.

Monthly Demand (Raw Materials)

Material	Amount
Type-I	12 quintal
Type-II	7.5 quintal
Type-III	3 quintal

The AK industry calculates demand for Tomato Sauce and Chilli Sauce based on average monthly turnover. It works 365 days a year. So the annual demand for the Tomato Sauce and Chilli Sauce are

$$D_1 = 12 \text{ quintals/one month} \times 12 = 144 \text{ quintals.}$$

holding cost=0.3 per unit per year

The purchase price for 1 k.g. is Rs 30/- i.e, C₁=Rs 30/- per k.g.

$$D_2 = 7.5 \text{ quintals/one month} \times 12 = 90 \text{ quintals.}$$

holding cost=0.3 per unit per year

The purchase price for 1 k.g. is Rs 20/- i.e, C₂=Rs 20/- per k.g.

$$D_3 = 3 \text{ quintals/one month} \times 12 = 36 \text{ quintals.}$$

holding cost=0.3 per unit per year

The purchase price for 1 k.g. is Rs 50/- i.e, C₃=Rs 50/- per k.g.

$$C = (C_1 + C_2 + C_3) / 3 = 100 / 3$$

$$H = h * C$$

$$D = D_1 + D_2 + D_3$$

According to the data, they order one time in a month and the total charge is Rs. 66000/- Ordering cost It includes the cost of transportation cost, it orders once in a month a truck of raw materials charge Rs 6000.

So, the price excluding transportation cost is

$$66000 - 6000 = 60000$$

Therefore, raw material purchased

$$\frac{60000}{(100 / 3)} = 1800 \text{ k.g}$$

$$\text{Ordering cost per k.g.} = \frac{6000 \times 12}{1800} = 40$$

$$\text{So EOQ} = \sqrt{\frac{2 \times 21600 \times 40}{0.3 \times (100 / 3)}} = 415.69 \text{ k.g}$$

So, the economic order for the raw materials is approximately 4.15 quintals per order to minimize the cost.

$$D_1 = 45 \text{ quintals/one month} \times 12 = 540 \text{ quintals.}$$

Holding cost=0.03 per unit per year

The Selling price for 1 k.g. is Rs 70/- i.e, C=Rs 70/- per k.g.

$$D_2 = 63 \text{ quintals/one month} \times 12 = 756 \text{ quintals.}$$

$$D = D_1 + D_2$$

Holding cost=0.3 per unit per year

The Selling price for 1 k.g. is Rs 60/- i.e, C=Rs 60/- per k.g.

Therefore, total order for 10800

$$\text{Ordering cost per k.g.} = \frac{58500 \times 12}{10800} = 65 \text{ Average}$$

$$EPQ = \sqrt{\frac{2D.O}{H(1-x)}}$$

Here, x= D/ P, where P= Production rate

$$EPQ = \sqrt{\frac{2 \times 10800 \times 65}{0.3 \times (0.1)}} = 6841.05 \text{ k.g.}$$

So, the economic production quantity is approximately 68.41 quintals per order to minimize the cost.

IV. RESULT ANALYSIS

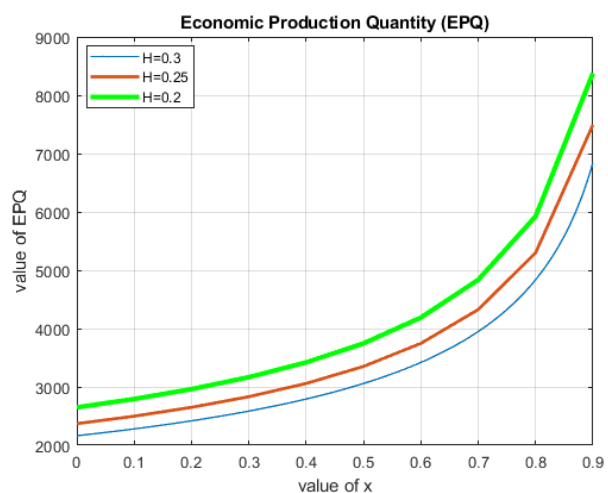


Figure 3

From the Figure 3, it reveals that EOQ is directly proportional to ordering cost and inversely proportional to holding cost.

Similarly, from the Figure 4 and 5, we got the result that EPQ is directly proportional to ordering cost and directly proportional to the demand and production ratio.

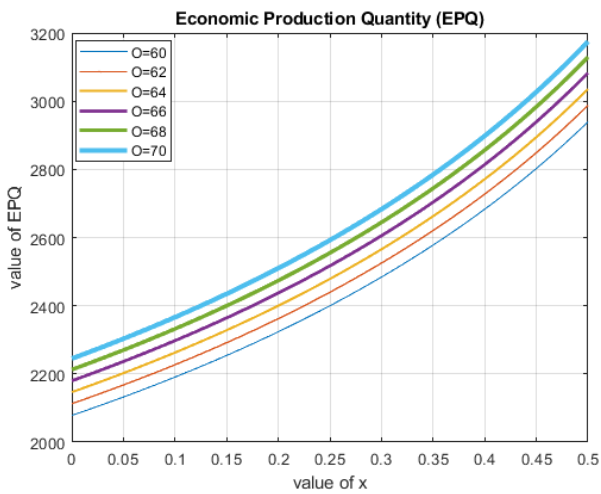


Figure 4

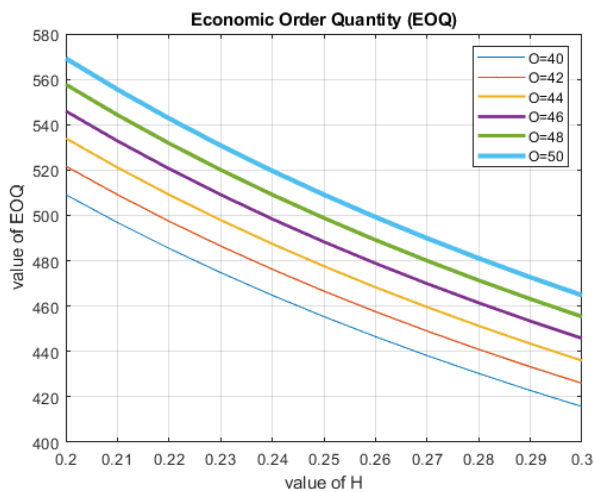


Figure 5

V. CONCLUSION

For profit maximization of the industry Economic order quantity (EOQ) inventory model is effective in inventory management by the reduction of ordering, carrying and total cost, is considered as promotional effort for customer satisfaction and developmental pricing strategy. Here demand is estimated by taking the previous data available and price fixation for a particular product throughout the year, will help the retailer sell the product according to their estimation though production is constant. Inventory order

calculation and implication helps to reduce the risk of the retailer. Retailer will get the fixed price from the customer, though it is constant throughout the year. By this effective inventory management, a seller or retailer can not only give the customer satisfaction, profit maximization but also can do the responsibility towards society.

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Cite this article as :

Debasmita Samal, Manas Ranjan Mishra, Abdul Kalam, "Analysis of Inventory Management of Agro-based Industries using EOQ and EPQ Model with Profit Maximization", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 152-159, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229127>
Journal URL : <https://ijsrst.com/IJSRST229127>

Treatment of Effluents by Plants, Animals and Microorganisms

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Article Info

Volume 9, Issue 1
Page Number : 160-163

Publication Issue

January-February-2022

Article History

Accepted : 25 Jan 2022
Published : 02 Feb 2022

ABSTRACT

This review article provides useful information for understanding the role of plants, animals and microorganism in the pollutants removal. The current literature is collected and organize to provide and insight into the specific roles of microorganisms toward plants and pollutants. Water hyacinth removes arsenic from arsenic contaminated drinking water, Peace Lily remove dangerous effects of toluene, xylene and benzene. The algae adsorbing heavy toxic metals. Microorganisms used for converting alkene into alkene oxide by the process known as bioaugmentation.

Keywords : Effluents, Phytoremediation, Bioaugmentation, Bioremediation.

I. INTRODUCTION

The abiotic environment includes water, air and soil while the biotic environment consists of all living organisms - plants, animals and microorganisms. It is the biotic community that are affected by environmental pollution in its abiotic environment to a great extent. For example water pollution makes the aquatic life tough and unhealthy. Similarly the growth of certain microorganisms indicates the presence of pollution (algal bloom).

The cost of cleaning up tens of thousands of toxic sites on factory grounds, farms, and military installations is staggering. However, recent research, found that hundreds of species of plants, along with the fungi and bacteria that inhabit the ecosystem around their roots, seek out and often break down chemical molecules that can harm most other life. For example, there are sunflowers that capture uranium, ferns that thrive on arsenic, clovers that eat oil, and poplar trees that destroy dry-cleaning solvents. Research into

using plants as pollution sponges must continue, but early reports of their helping to clean up pollution were promising.

II. TREATMENT OF EFFLUENTS BY PLANTS (PHYTOREMEDIATION)

It is the process where plants are introduced into an environment to remove contaminants from it and clean the environment. There have even been studies where these plants have turned the contaminant into a harmless substance and then once harvested can be used for mulch (decaying plant material used for improving the soil), animal feed, paper, etc. In some instances (especially if trees are being used) the plants are left in the environment and allowed to grow and mature as normal.

Phytoremediation has been used to clean up *metals, pesticides, solvents, explosives, crude oil, polyaromatic hydrocarbons, land fill leachates, agricultural runoff, acid mine drainage, and*

radioactive contamination. Phytoremediation has been used in many different locations. It is being used in *Chernobyl with sunflowers to remove cesium-137 and strontium-90*. *Hybrid poplars have been used in Whitewood Creek in South Dakota to absorb arsenic from mine wastes* and in Aberdeen, Maryland to remove trichloroethylene and polycyclic aromatic compounds from groundwater.

Water hyacinth removes arsenic from arsenic contaminated drinking water. The plant is extremely tolerant of, and has a high capacity for, the uptake of heavy metals, including Cd, Cr, Co, Ni, Pb and Hg, which could make it suitable for the bio cleaning of industrial wastewater. In addition to heavy metals, it can also remove other toxins, such as cyanide, which is environmentally beneficial in areas that have endured gold mining operations.

Some natural plants which can fight pollution inside the house are *Devil's ivy* (Golden Pothos - scientific name is *Epipremnum Aureum*) that controls common air pollutants like the benzene, carbon monoxide and formaldehyde; another plant *Peace Lily* (*Spathiphyllum*) removes the dangerous effects of toluene, xylene and benzene. These are easily found in the nail polish removers, paints used at home, solvent solutions and adhesives which we frequently use harmful things. Many indoor plants play an essential role in indoor air pollution control system by removing high concentrations of pollutants such as cigarette smoke and organic solvents.

Even before awareness of indoor air pollution increased in the early 1980s, NASA had funded research on using plants to biologically treat waste water. Biological waste water treatment technology proved effective and is used at small- to medium-scale municipal sewage treatment plants and to reclaim water for irrigation.

It is well known fact that the oxygen is restored by plants and trees and they absorb CO₂ during photosynthesis. Thus the quality of the air can be greatly influenced by plants. They stop the movement of dust and pollutants. Through the intake of carbon

dioxide, plants can also lessen the greenhouse effect caused from the burning of fossil fuels like coal.

A diverse cover of plants aids in 'maintaining healthy watersheds, streams, and lakes by holding soil in place, controlling stream flows, and filtering sediments from water. Regional climates are impacted by the amount and type of plant cover. Forest and marshes, for example, can cool local climates. Natural disasters, such as drought, have been blamed on the destruction of forests and other critically important plant communities.

The pollution is mostly resulting from human activity. But the smaller entities in the animal kingdom play their own role in cleaning pollutants. Many aquatic animals including muscles, oysters, and shell fishes absorb heavy metals like Cd, Cr, Ni, Cu, Zn and Hg. These are used as indicators of heavy metal pollution in a water body, and researches are going on using them to clean the heavy metal pollution by growing them.

Household waste and municipal waste can be processed by using worms in *vermiculture* and convert the organic waste into useful vermicompost that can be used as a fertilizer. Many birds act as natural scavengers of organic waste by eating it.

The use of dangerous pesticides in agriculture can be avoided if friendly pets and bugs are used to drive away the pests that attack the farm.

Microorganisms are known natural scavengers; so the microbial preparations (both natural as well as genetically engineered) can be used to clean up the environmental hazards. Many of the effluent treatment systems like activated sludge treatment, lagooning, trickling filtration etc uses microorganisms.

III. TREATMENT OF EFFLUENTS BY MICRO ORGANISMS (BIOREMEDIATION)

Bioremediation is the process of using microorganisms to remove the environmental pollutants where microbes serve as scavengers. The other names/terms used for bioremediation are *biotreatment*, *bioreclamation*, and *biorestitution*.

Unnatural and synthetic chemicals such as pesticides, herbicides, refrigerants, solvents and other organic compounds undergo microbial degradation, reducing the environmental pollution.

Sewage that mainly contains organic and inorganic compounds, toxic substances, heavy metals and pathogenic organisms are treated to biodegradation by microorganisms. The biodegradation involves the degradation of organic matter to smaller molecules (CO_2 , NH_3 , PO_4 etc.) and requires constant supply of oxygen. The process of supplying oxygen is expensive, tedious, and requires a lot of expertise and manpower. These problems are overcome by growing microalgae in the ponds and tanks where sewage treatment is carried out. The algae release the O_2 while carrying out the photosynthesis which ensures a continuous supply of oxygen for biodegradation. The algae are also capable of adsorbing certain heavy toxic metals due to the negative charges on the algal cell surface which can take up the positively charged metals. The algal treatment of sewage also supports fish growth as algae are a good source of food for fishes. The algae used for sewage treatment are *Chlorella*, *Euglena*, *Chlamydomonas*, *Scenedesmus*, *Ulothrix*, *Thribonima* etc.

Another purpose of biological treatment is for nitrification/denitrification. Nitrification is an aerobic process in which bacteria oxidize reduced forms of nitrogen (Ammonium to oxides of Nitrogen). Denitrification is an anaerobic process by which oxidized forms of nitrogen are reduced to gaseous forms (N_2), which can then escape into the atmosphere. This helps to minimise eutrophication.

Some microalgae like *Chlorella pyrenoidosa*, are known to be more efficient than higher plants in utilizing atmospheric CO_2 for photosynthesis and generate more O_2 . The growing of these microalgae near the industries and power plants (where the CO_2 emission into atmosphere is very high) will help in the reduction of polluting effects of CO_2 .

IV. TREATMENT OF EFFLUENTS BY ANIMALS (BIOLOGICAL CALCIFICATION)

Certain deep sea organisms like corals, green and red algae store CO_2 through a process of biological calcification. As the CaCO_3 gets precipitated, more and more atmospheric CO_2 can be utilized for its formation.

Biotechnology is used to create new microorganisms that are more efficient towards specific effluent treatment. The problem of pollution can also be minimized by controlling pollution occurring at different stages of the manufacture (like secondary treatment of effluent). Biotechnology plays an important role in this in paper, leather and tannery industries.

In Plastic industry, the conventional technologies use oil based raw materials to extract ethylene and propylene which are converted to alkene oxides and then polymerized to form plastics such as polypropylene and polyethylene. There is always the risk of these raw materials escaping into the atmosphere thereby causing pollution. Using biotechnology, safer raw materials like sugars (glucose) are being used, which through the direct of microbes are converted into alkene oxides; e.g., *Methylococcus capsulatus* has been used for converting alkene into alkene oxides.

It is possible to increase biodegradation through manipulation of genes i.e., using genetically engineered microorganisms and by using a range of microorganisms in biodegradation reaction. (This is known as bioaugmentation). Use of genetic engineering and genetic manipulations is nowadays developed for more efficient bioremediation.

Example of Biotechnological method is to reduce atmospheric carbon dioxide (CO_2). Biotechnological methods have been used to reduce the atmospheric CO_2 content at two levels-

(1) The fast growing plants utilize the CO_2 more efficiently for photosynthesis. The techniques of micro-propagation and synthetic seeds should be used

to increase the propagation of such fast growing plants.

(2) Further, the CO₂ utilization can be increased by enhancing the rate of photosynthesis. The enzyme ribulose biphosphate carboxylase (RUBP-case) is closely linked with CO₂ fixation. The attempts are being made to genetically manipulate this enzyme so that the photosynthetic efficiency is increased.

V. CONCLUSION

The advancement of wastewater treatment technology not with standing, treated sewage may still contain some harmful substances. There is a wide range of microbial pathogen types which occur in wastewater with the type and number present being highly dependent on the socioeconomic conditions. In order to purpose an efficient way to treating waste water, there is need to under stand the negative environmental impacts posed by the untreated or inadequately treated wastewater entering the nearby ecosystems, especially on the lives that depend on the ecosystem for substances. To safeguards ecosystems and public health, there is the need to treat waste water effluents before discharge. The remediation of waste water can be achieved by various treatment processes such as pyto remediation, microbial remediation process. Although there treatment process play vital role in wastewater remediation.

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Cite this article as :

Dr. Arun Kumar, "Treatment of Effluents by Plants, Animals and Microorganisms", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 160-163, January-February 2022. Journal URL : <https://ijsrst.com/IJSRST229135>

Feynman Kernel in Fractional Quantum Systems

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Article Info

Volume 9, Issue 1

Page Number : 164-168

Publication Issue

January-February-2022

Article History

Accepted : 25 Jan 2022

Published : 03 Feb 2022

ABSTRACT

In this paper, we have sketched what is to be known as fractional path integral representation in quantum mechanics. We will begin with fractional Schrödinger's equation in the framework of Caputo fractional derivatives. Furthermore, Feynman kernel for derived path integrals is established.

Keywords : Fractional Quantum Mechanics, Feynman Kernel, Caputo Derivative

I. INTRODUCTION

Nearly a decade ago, a group of researchers proposed the fractional form of Schrödinger's equation in the framework of both Riemann-Liouville (RL) and Caputo fractional derivatives [1]. The aim of this short paper is to establish the path integral formulation using the fractional form of Schrödinger's equation in the framework of Caputo derivative. The main reason why we have chosen to work on Caputo derivative instead of Riemann-Liouville derivative is because it makes more physical sense in the terms of both applications and understanding of the subject. The fractional differential equations that are formulated in the framework of Caputo derivatives require only boundary conditions; this coincides with the needs of

boundary conditions in quantum mechanics. Whereas, on the other hand, Riemann-Liouville derivative needs initial condition. Many other types of Schrödinger's equation are also established depending on the framework of different kinds of fractional derivative, for more information, refer to references [2]-[4].

Consider a function depending on n variables x_1, x_2, \dots, x_n over the domain $\Omega = [a_1, b_1] \times \dots \times [a_n, b_n]$, then for $0 < \alpha_k < 1$, where α_k is the order of the derivative, we define left and right partial Riemann-Liouville (RL) and Caputo fractional derivatives as follows [1]:

$$({}_+ \partial_k^\alpha f)(x) = \frac{1}{\Gamma(1-\alpha_k)} \partial x_k \int_{a_k}^{x_k} \frac{f(x_1, \dots, x_{k-1}, u, x_{k+1}, \dots, x_n)}{(x_k - u)^{\alpha_k}} du, \quad 1.1$$

$$({}_- \partial_k^\alpha f)(x) = \frac{-1}{\Gamma(1-\alpha_k)} \partial_{x_k} \int_{x_k}^{b_k} \frac{f(x_1, \dots, x_{k-1}, u, x_{k+1}, \dots, x_n)}{(u-x_k)^{\alpha_k}} du, \tag{1.2}$$

$$({}_+^C \partial_k^\alpha f)(x) = \frac{1}{\Gamma(1-\alpha_k)} \int_{a_k}^{x_k} \frac{\partial_u f(x_1, \dots, x_{k-1}, u, x_{k+1}, \dots, x_n)}{(x_k-u)^{\alpha_k}} du, \tag{1.3}$$

and

$$({}_-^C \partial_k^\alpha f)(x) = \frac{-1}{\Gamma(1-\alpha_k)} \int_{x_k}^{b_k} \frac{\partial_u f(x_1, \dots, x_{k-1}, u, x_{k+1}, \dots, x_n)}{(u-x_k)^{\alpha_k}} du, \tag{1.4}$$

respectively. Here, ∂_{x_k} denotes the partial derivative with respect to x_k , The subscript k and the superscript α indicate that the derivative is taken with respect to x_k and it is of order α_k ($\alpha_k = \alpha$).

II. FRACTIONAL SCHRODINGER'S EQUATION A TIME EVOLUTION OPERATOR

From [1], Eqn. (13), we have the following fractional Schrödinger's equation

$$i\hbar^\alpha ({}_+^C \partial_0^\alpha) \Psi = \frac{-\hbar^{2\alpha}}{2m^\alpha} ({}_+^C \partial_k^\alpha) ({}_+^C \partial_k^\alpha) \Psi + V\Psi \tag{2.1}$$

where the subscript 0 in $({}_+^C \partial_0^\alpha)$ denotes that fractional Caputo derivative has been taken with respect to time, and similarly, the subscript k in $({}_+^C \partial_k^\alpha)$ denotes that the derivative has been taken with respect to the spatial dimensions. Eqn. (2.1) can be written into the following form for any arbitrary state $|\Psi(t)\rangle$.

$$i\hbar^\alpha ({}_+^C \partial_0^\alpha) |\Psi(t)\rangle = \hat{H} |\Psi(t)\rangle \tag{2.2}$$

with

$$\hat{H} = \frac{-\hbar^{2\alpha}}{2m^\alpha} ({}_+^C \partial_k^\alpha) ({}_+^C \partial_k^\alpha) + V. \tag{2.3}$$

With the above definitions in mind, authors in [5] have provided a time evolution of the solution for Eqn. 2.2 as

$$|\Psi(t)\rangle = U(t, t_0) |\Psi(t_0)\rangle \tag{2.4}$$

with

$$i\hbar^\alpha ({}_+^C \partial_0^\alpha) U(t, t_0) = \hat{H} U(t, t_0) \tag{2.5}$$

where the time evolution operator is defined as

$$U(t, t_0) = E_\alpha \left(-\frac{i}{\hbar^\alpha} \hat{H} \Delta t^\alpha \right), \tag{2.6}$$

and $E_\alpha(z)$ is the Mittag-Leffler function

$$E_\alpha(z) = \sum_{n=0}^{\infty} \frac{z^n}{\Gamma(\alpha n + 1)}. \tag{2.7}$$

One can note that the evolution operator that we have written here is slightly different from what authors have proposed in [5], this is because authors in [5] haven't raised their reduced Plank's constant to the power of

the order of derivative in their Schrödinger's equation, whereas, in our equations, we have used \hbar^α instead of only \hbar . Since we know that for any time evolution operator satisfies the property

$$U(t_2, t_1)U(t_1, t_0) = U(t_2, t_0), \tag{2.8}$$

$$U(t_0 + \Delta t, t_0) = I - \frac{i}{\hbar^\alpha} \hat{H}(t_1) \Delta t^\alpha + O((\Delta t^\alpha)^2) \tag{2.9}$$

where I is the unit operator and $t_1 = t_0 + \Delta t$, yielding

$$U(t, t_0) = \lim_{N \rightarrow \infty} \left(I - \frac{i}{\hbar^\alpha} \hat{H}(t \equiv t_N) \Delta t^\alpha \right) \left(I - \frac{i}{\hbar^\alpha} \hat{H}(t \equiv t_{N-1}) \Delta t^\alpha \right) \times \dots \times \left(I - \frac{i}{\hbar^\alpha} \hat{H}(t \equiv t_1) \Delta t^\alpha \right) \tag{2.10}$$

where the infinitesimal time interval Δt^α is given by

$$\Delta t^\alpha = \frac{(t - t_0)^\alpha}{N}. \tag{2.11}$$

For time independent Hamiltonian, we have

$$U(t, t_0) = \lim_{N \rightarrow \infty} \left(I - \frac{i}{\hbar^\alpha} \hat{H} \Delta t^\alpha \right)^N = e^{-\frac{i}{\hbar^\alpha} \hat{H} (t - t_0)^\alpha}, \tag{2.12}$$

from this, we can get the Trotter's formula if the Hamiltonian can be written as $H = A + B$, which is

$$e^{-\frac{i}{\hbar^\alpha} (t - t_0)^\alpha (A + B)} = \lim_{N \rightarrow \infty} \left(e^{-\frac{i}{\hbar^\alpha} \Delta t^\alpha A} e^{-\frac{i}{\hbar^\alpha} \Delta t^\alpha B} \right)^N, \tag{2.13}$$

usually, A and B are kinetic and potential energy of the system respectively.

III.FEYNMAN KERNEL

We know from the definition of Hamiltonian that in order for our system to work mathematically, Hamiltonian must be momentum and position dependent both in Heisenberg's and Schrödinger's picture. Therefore, we define our fractional momentum operator and position operator as follows

$$\hat{P}_\alpha^k |\Psi\rangle = p |\Psi\rangle, \tag{3.1}$$

$$\hat{X} |\Psi\rangle = x |\Psi\rangle, \tag{3.2}$$

where

$$\hat{P}_\alpha^k = -i\hbar^\alpha ({}^C_+ \partial_k^\alpha). \tag{3.3}$$

Taking into account the following completeness conditions

$$[\hat{X}, \hat{P}_\alpha^k] = i\hbar^\alpha \frac{x^{1-\alpha}}{\Gamma(2-\alpha)}, \tag{3.4}$$

$$[\hat{X}, \hat{X}] = [\hat{P}_\alpha^k, \hat{P}_\alpha^k] = 0, \tag{3.5}$$

$$\begin{aligned} \hat{P}_\alpha^k |p\rangle &= p |p\rangle, & \langle p | \hat{P}_\alpha^k &= \langle p | p, \\ \hat{X} |x\rangle &= x |x\rangle, & \langle x | \hat{X} &= \langle x | x, \end{aligned} \tag{3.6}$$

$$\langle x | p \rangle = \frac{e^{ipx/\hbar^\alpha}}{\sqrt{2\pi\hbar^\alpha}} \quad \langle p | x \rangle = \frac{e^{-ipx/\hbar^\alpha}}{\sqrt{2\pi\hbar^\alpha}} \tag{3.7}$$

$$\int_{-\infty}^{+\infty} |p\rangle\langle p| dp = I, \tag{3.8}$$

$$\int_{-\infty}^{+\infty} |x\rangle\langle x| dx = I, \tag{3.9}$$

we can now write our Hamiltonian as

$$H(t) = H(\hat{P}_\alpha^k, \hat{X}, t). \tag{3.10}$$

Insert Eqn. (3.8) into (2.10) successively to find

$$U(t, t_0) = \lim_{N \rightarrow \infty} \prod_{j=0}^N \left(\int_{-\infty}^{+\infty} dx_j \right) |x_N\rangle\langle x_0| \prod_{j=1}^N \langle x_j | I - \frac{i}{\hbar^\alpha} H_j(\hat{P}_\alpha^k, \hat{X}) \Delta t^\alpha | x_{j-1} \rangle \tag{3.11}$$

where

$$H_j(\hat{P}_\alpha^k, \hat{X}) = H(\hat{P}_\alpha^k, \hat{X}, t_j) \tag{3.12}$$

and the quantity

$$K(x_j, t_j, x_{j-1}, t_{j-1}) = \langle x_j | I - \frac{i}{\hbar^\alpha} H_j(\hat{P}_\alpha^k, \hat{X}) \Delta t^\alpha | x_{j-1} \rangle \tag{3.13}$$

which appears in Eqn. (3.11) is known as the Feynman kernel. If Hamiltonian has the form

$$H(\hat{P}_\alpha^k, \hat{X}; t) = \sum_{m,n} a_{m,n}(t) (\hat{P}_\alpha^k)^m \hat{X}^n \tag{3.14}$$

then, insert Eqn. (3.8) on the left hand side of

$$\langle x_j | I - \frac{i}{\hbar^\alpha} H_j(\hat{P}_\alpha^k, \hat{X}) \Delta t^\alpha | x_{j-1} \rangle \tag{3.15}$$

in Eqn. (3.11) and then use relation (3.7) to get a valid representation of Feynman kernel. Therefore, we get

$$K^{(\hat{P}_\alpha^k, \hat{X})}(x_j, t_j, x_{j-1}, t_{j-1}) = \int_{-\infty}^{+\infty} \frac{dx_j}{2\pi\hbar^\alpha} e^{ip_j(x_j-x_{j-1})/\hbar^\alpha} \left(I - \frac{i}{\hbar^\alpha} H_j(p_j, q_{j-1}) \Delta t^\alpha \right) \tag{3.16}$$

where the sub-script on K represents operator ordering. We need to take into account the issue of operator ordering because it changes the argument below position in the Hamiltonian. Therefore, if the Hamiltonian has the form

$$H(\hat{P}_\alpha^k, \hat{X}; t) = \sum_{m,n} b_{m,n}(t) \hat{X}^m (\hat{P}_\alpha^k)^n \tag{3.17}$$

then, this in turn assembles Feynman kernel into the following form

$$K^{(\hat{X}, \hat{P}_\alpha^k)}(x_j, t_j, x_{j-1}, t_{j-1}) = \int_{-\infty}^{+\infty} \frac{dx_j}{2\pi\hbar^\alpha} e^{ip_j(x_j-x_{j-1})/\hbar^\alpha} \left(I - \frac{i}{\hbar^\alpha} H_j(p_j, q_j) \Delta t^\alpha \right). \tag{3.18}$$

IV. CONCLUSION

In this paper, we have provided an expression for Feynman kernel for fractional quantum mechanical systems in the framework of Caputo fractional derivative. We have begun by stating the completeness conditions and then developing the

time evolution operator to finally get in the expression for Feynman kernel. There has been an increasing interest in fractional quantum mechanics since last few decades and many fractional quantum mechanical systems are established since then [6]. The completeness conditions and the expression for Feynman kernel that we have derived can be useful in

deriving the path integral formulation of fractional quantum mechanical systems. Thus, the result can therefore be applied to deriving the trace formula, coherent states, fermionic path integrals etc. in fractional quantum mechanical systems.

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Cite this article as :

Omprakash Atale, "Feynman Kernel in Fractional Quantum Systems", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 164-168, January-February 2022. Available at

doi : <https://doi.org/10.32628/IJSRST229124>

Journal URL : <https://ijsrst.com/IJSRST229124>

A Critical Review on Design of RCC Cantilever Retaining Wall

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Article Info

Volume 9, Issue 1

Page Number : 169-177

Publication Issue

January-February-2022

Article History

Accepted : 25 Jan 2022

Published : 03 Feb 2022

ABSTRACT

This paper provides an innermost and the dynamics role of the RCC Cantilever Retaining Wall in soil strata of different region especially on hilly and mountainous area of Himalayan range, analysis depending upon the previous research paper done by using different software. As we live on 21st century a result of population boom and new technology of different engineering properties developed day to day life. This is the major issue especially in the case of developing country where lot of earthwork is being carryout. Highway Bridges, flyover, Tunnel, Dams, Reservoirs and Cannels are constructed and developing rapidly in the big cities as well as in the countryside, making the study of RCC Cantilever Retaining Wall as an essential part of structural design process to Control flood, landslide of backfilling and natural Phenomena and for the economic purpose. The effect, on which the structures stands, especially in the highly seismic zones, the dynamic behavior of soil as well as retaining structure, should be well known by the designer. The effects of structures standing in a steep slope to each other are the main issue of cantilever retaining structure, as well as by-soil-structure interactions. In this paper, various methods of RCC Cantilever Retaining structure are carried out by various researchers in different software.

Keywords :- RCC Cantilever Retaining Wall, Developing Country, Highway, Bridges

I. INTRODUCTION

Various attempts have been made by different researchers to model the cantilever retaining wall problem analytically by different software such as AutoCAD, Staad-Pro, SAFE, RISA, 3D environmental, Naviswork, ETABS, RIVET, MATLAB etc; however

the nonlinearity, foundation interfaces and certain boundary conditions of software make the problem more complex, and computationally uneconomical. Also the rapid evolution of material such as cement of different characteristic strength, quality, Plasticizer and manufacturing of reinforcement with different Grade such as (250,450,500,550) etc and with

diameter of (8, 12, 16, 20, 25 and so on) also lead to diverse situation in design and construction of retaining wall.

II. REVIEW OF AVAILABLE LITERATURES

Prachi S. Bhojar1, Dr. G. D. Awachat:-This paper presents the Static analysis and Design of retaining wall with and without shelves. Cantilever retaining wall with pressure relief shelves is considered as a special type of retaining wall. The concept of providing pressure relief shelves on the backfill side of a R.C.C retaining wall reduces the total earth pressure on the wall, which results in a reduced thickness of the wall and ultimately in an economic design of a cantilever wall. The conclusions in this thesis drawn based on the discussion and results obtained analytically and using Staad-Pro. model study. The pressure distribution diagram changes much due to addition of shelves. The pressure relief shelves have been extend up to the failure plane to achieve the stability of the structure. In practice, there is limitation of using more number of shelves, but up to three shelf may be used economically for high retaining walls. It is also observed that, the average saving in cost of construction is 15% to 25% by the provision of relief shelves over the conventional cantilever retaining wall. Analytical results of active earth pressure, nodal reactions, and bending moments with pressure relief shelves have been close agreement with the Staad-Pro. Software result.

Rajesh D. Padhye, Prabhuling B. Ulagaddi (2010): They used active earth pressure and lever arm in their study and found reduction of shelf and there by considerable reduction the moment about the base slab.

Dr. D. N. Shinde, Mr, Rohan R. Watve (2015):This paper concerned with the analysis of cantilever retaining wall using Finite Element method. The retaining wall with and without shelves is analysed

by using Stadd-pro model and results for various parameters was compared and found satisfactory.

Basudhar et al. (2006):- investigated the efficient cost design of cantilever retaining walls of a particular height that satisfies the constraints of some structural and geotechnical designs. Seven design variables were taken into consideration, which are base width, toe width, thickness of stem, thickness of base, minimum width of embedment, reinforced rod diameter and top width of stem. The method of sequential unconstrained minimization along with Powell's algorithm for multidimensional searches and the method of quadratic interpolation for one dimensional search were adopted. It was noticed that by increasing the top of the stem from 10 to 30cm, the cost was increased by 9% to 15%.

Robert F. Bruner, Harry M. Coyle, and Richard E. Bartoskewitz :-In this paper currently available retaining wall design procedures were summarized with emphasis on the prediction of lateral earth pressures using the Coulomb and Rankine earth pressure theories, and the equivalent fluid pressure method. The information presented in their report was obtained during the last three years of a five year study on "Determination of Earth Pressures for Use in Cantilever Retaining Wall Design". Measured pressures and movements along with results of geotechnical tests of the foundation and backfill soils are presented in detail. The test wall design based on the District 12 TSDHPT design standard is outlined and compared with results from the field performance study. Significant modifications were made in the areas of the use of cohesive soil in the backfill, the computation of lateral earth pressures, and the computation of stability against overturning. This objective has been accomplished and the proposed modifications in design procedure are based on measured earth pressures, measured wall movements, and measured geotechnical properties of the soils adjacent to the wall. The measured earth pressures on the heel (back) side of the wall were greater than those predicted by current design procedures. A

proposed uniform pressure of 2 psi and an earth pressure coefficient of unity are indicated for use in the proposed design modifications. The measured earth pressure on the toe (front) was 3.5 times greater than the pressure measured on the heel (back) at the same depth. Also, significant earth pressure was measured on the front of the key. These pressures contribute to the stability of the wall against sliding and overturning. The measured pressures along the base of the footing were nearly uniform because of foundation soil resistance which contributes to stability against overturning. This contribution is included in the proposed design modifications. Total horizontal movement measurements indicated that most of the movement occurred during the construction backfilling process. Vertical movement and tilt measurements were relatively small because of the stiff clay foundation soil. The undrained shear strength is recommended in the modified design procedure because it is the appropriate strength parameter during construction. The proposed modification in design procedure should be verified by additional field performance studies. These studies should include walls with different proportions that are founded on and backfilled with different soil types. This report contains recommendations for instrumentation on future field studies.

D.R. Dhamdhere¹, Dr. V. R. Rathi², Dr. P. K. Kolase:
-This paper consist of analysis and design of cantilever and relieving platform retaining wall with varying height from 3m to 10m and SBC 160KN/m². It also shows comparative study such as cost, economy, bending moment, stability against overturning & sliding between both the retaining wall. The comparative study is carried out along with the cost and optimum or least cost estimate is chosen as the best option. In this paper it is also shown that the relieving platform retaining wall is economical, more stable than cantilever retaining wall and it also relieves the bending moment of heel portion.

Poursha et al. (2011):- studied the optimum cost of the reinforced cantilever retaining wall of satisfying a number of geotechnical and structural constraints using harmony search algorithms. The design variables were the stem thickness at the top, the stem thickness at the bottom, toe width, heel width, stem height, base slab thickness and key depth. The object function was to minimize total cost of the design and construction according to ACI 318-05. The procedure of optimum design was divided into two stages. Firstly, checking for stability, which included overturning, sliding and bearing capacity failures? Secondly, checking each part of the cantilever wall for the strength and required steel. The same process of Athens Journal of Technology and Engineering September 2018 279 optimization was repeated for two types of backfill using MATLAB, and the mathematical results showed that the solution of improved harmony search algorithm was better, when compared to a traditional harmony search method.

Pei and Xia (2012):- followed heuristic optimization algorithms to design a reinforced cantilever retaining wall. The main goal of this investigation was to design the wall with minimum cost of the retaining wall which comprises the cost of concrete and reinforcements per meter length of the wall. The costs of labours, framework, steel fixing and losses of material were neglected for sake of simplicity. Three types of heuristic algorithms were approached for solving the constrained model of optimization including Genetic Algorithm (GA), Particle Swarm Optimization (PSO) and Simulated Annealing (SA). The main outcome was that the application of heuristic optimization algorithms is very effective in the design of a reinforced cantilever retaining wall with minimum cost. It was recommended that the particle swarm optimization was the most effective and efficient among the three methods used. With regard to cost, it was found that the design gained by the method of heuristic optimization algorithms was half as expensive as the traditional design method.

Dr. P. D. Hiwase Mr. Shashank Bisen Mr. Pratik Surana:- this paper, want to make an attempt to use programming languages to make calculations of the design of retaining wall much more easy and swift. Retaining walls are used to retain earth or other loose material. These walls are commonly constructed in the places namely construction of building basement, as wing wall or abutment in bridge construction and in the construction of embankment. All these types of construction works require intricate calculations with accuracy and precision. So to make these calculations much easy and appropriate, the use of a programming language known as Python is used here. The earth retaining wall is the most important structure in various construction projects of civil engineering. It involves intricate design work and the manual calculations can sometimes become tedious and time taking. Also the accuracy and precision of the design becomes very important when it comes to big structures such as bridges and dams. Therefore, a lot of companies and construction firms have started using various user friendly software.

Ali Kaveh1, Kiarash Biabani Hamedani, Taha Bakhshpoori :-In this paper, optimum design of reinforced concrete cantilever retaining walls is performed under static and dynamic loading conditions utilizing eleven population-based meta-heuristic algorithms. These algorithms consist of Artificial Bee Colony algorithm, Big Bang-Big Crunch algorithm, Teaching-Learning-Based Optimization algorithm, Imperialist Competitive Algorithm, Cuckoo Search algorithm, Charged System Search algorithm, Ray Optimization algorithm, Tug of War Optimization algorithm, Water Evaporation Optimization algorithm, Vibrating Particles System algorithm, and Cyclical Parthenogenesis Algorithm. Two well-known methods consisting of the Rankine and Coulomb methods are used to determine lateral earth pressures acting on cantilever retaining wall under static loading condition. In addition, Mononobe-Okabe method is employed for dynamic loading condition. The design is based on ACI 318-05

and the goal of optimization is to minimize the cost function of the cantilever retaining wall. The performance of the utilized algorithms is investigated through an optimization example of cantilever retaining wall. In addition, convergence histories of the algorithms are provided for better understanding of their performance

Sheikholeslami et al. (2014):- In this paper, author developed a novel optimization technique known as hybrid firefly algorithm with harmony search technique (IFA-HS) in order to obtain the optimal cost of reinforced concrete retaining walls satisfying the stability criteria and design provisions of ACI 318-05. Some design examples were tested using this new method from which the results confirmed the validity of the proposed algorithm. The method demonstrated its efficiency and capability of finding least-cost design of retaining walls that satisfy safety, stability and material constraints.

Medhekar (1990) investigated the optimum design of free cantilever retaining walls. Two different types of foundation were assumed which are rigid and flexible. The objective was to minimize the total cost of the structure. The method of the interior penalty function was used to solve the problem of nonlinear optimum design. The requirement for the stability and structural strength were represented as constraints. The results showed that the minimum cost of a wall with a height varying from 3 to 6m for the rigid foundation was slightly higher than for a corresponding wall and flexible foundation. This means that the flexibility of the foundation has no significant effect on the cost of retaining walls.

Jyoti P. Bhusar & Rajashri S. Ghodke: - This paper presents the parametric study to recognize the effect of number of shelves, width of shelves and shelf position on the lateral earth pressure distribution, top wall movement and the maximum bending moment on the wall with shelves. Reduction in lateral thrust due to provision of relief shelf reduces the bending moment at the stem bottom. The present study reveals that the cantilever retaining wall with single

relief shelves can reduce bending moment at the bottom of stem up to 70%, compared to that of a retaining wall without relief shelf. The economic shelf location for cantilever retaining wall with single shelf is at 0.4h to 0.5h from top of the stem, where h is height of stem. The deflection of the stem is reduced by about 95% by providing shelf. Retaining wall with two shelves of 1.5 m and 2 m shelf widths positioned at 0.35h and 0.55h is recommended and it decreases bending moment at bottom of stem by about 65% and top node displacement by about 70%. Retaining wall with two shelves 2 m and 2.5 m shelf widths positioned at 0.35h and 0.65h shows better performance and it decreases bending moment by about 78% as well as decreases node displacement by about 90% along with nearly uniform earth pressure beneath the base slab.

Yaoyao Peia , Yuanyou Xia, a: -This paper aims at automatic design and cost minimization of reinforced cantilever retaining walls (RCRW). The design requirements and geometrical constraints are imposed as design constraints in the analysis. 9 parameters are selected to define the structure and 25 constraints are established. Three heuristic algorithms, including genetic algorithm (GA), particle swarm optimization (PSO) and simulated annealing (SA) are presented to solve the constrained optimization model. The computation programs have been developed and validated by taking an example design. Results show that heuristic optimization algorithms can be effectively applied to cost minimization design of RCRW. It is found that no single algorithm outperforms other methods. With respect to effectiveness and efficiency, PSO is recommended to be used.

Akshaykumar S. Chalakh, Prof. Sanjay Bhadke :- Investigating the presentation of earth holding structures under seismic conditions has been significant issue because of their wide applications in a few infrastructural applications and different structures. The issue of unsteadiness of dividers is predominantly identified with earth pressure

circulation on the divider and the reaction of divider against the earth pressure, particularly, under unique stacking condition. Soil – divider collaboration is a significant property which oversees the dynamic conduct of the divider. Much after an enormous number of studies, the dynamic conduct of soil-divider framework is as yet not totally explaining. The target of this examination is to contemplate the seismic conduct of L-Shape cantilever holding divider alongside the earth pressure dissemination of soil in seismic conditions. There are a few sorts of holding divider and the most widely recognized sorts utilized are gravity divider, cantilever divider, counter post dividers and buttressed divider. In this manner, a couple of parts should be utilized so as to get the goal. Thus, this framework can be utilized for the plan of a cantilever holding divider. In addition, it spares time in the plan with adequate format detail of the cantilever holding divider. Right now of L-Shape cantilever holding dividers includes strength checks for toppling, sliding and bearing.

Tamadher Abood1, Hatem E.Younis Eldawi, Faeza R. Elnaji Abdulrahim :- Retaining structures hold back soil or other loose material where an abrupt change in ground elevation occurs. The retained material or backfill exerts a push on the structure and thus tends to overturn or slide it, or both. The cantilever is the most common type of retaining wall and is used for walls in the range of 3to 6m in height. This study presents analyses and design of cantilever retaining wall which is made from an internal stem of steel-reinforced, cast-in-place concrete (often in the shape of an inverted T). In this work a detailed analyses and design for this type of walls which include estimation of primary dimensions of the wall, then these dimensions were checked. The factor of safety against sliding, overturning and bearing were calculated the shear resistance for the base, the tension stresses in the stem and the tension stresses for the base were checked. Calculation of reinforcement for each part of the wall was done. All analysis and design are based on the ACI cod

Russell A. Green & C. Guney Olgun & Wanda I.

Cameron: - A series of nonlinear, explicit finite difference analyses were performed to determine the dynamic response of a cantilever retaining wall subjected to earthquake motions. This article outlines the calibration and validation of the numerical model used in the analyses and comparisons are presented between the results from the finite difference analyses and results from simplified techniques for computing dynamic earth pressures and permanent wall displacement (i.e., Mononobe-Okabe and Newmark sliding block methods). It was found that at very low levels of acceleration, the induced pressures were in general agreement with those predicted by the Mononobe-Okabe method. However, as the accelerations increased to those expected in regions of moderate seismicity, the induced pressures are larger than those predicted by the Mononobe-Okabe method. This deviation is attributed to the flexibility of the retaining wall system and to the observation that the driving soil wedge does not respond monolithically, but rather responds as several wedges. It was found that the critical load case for the structural design of the wall differed from that for the global stability of the wall, contrary to the common assumption made in practice that the two load cases are the same.

Parishad Rahbari, Nadarajah Ravichandran, and C.

Hsein Juang:- Seismic geotechnical design of retaining walls should consider the uncertainties not only in soil properties such as friction angle of the backfill but also in earthquake load such as peak ground acceleration (PGA). When the uncertainties are incorporated in the design, the robustness which is a measure of sensitivity of a design to uncertain parameters must be considered and evaluated for obtaining suitable design and corresponding construction cost. This paper presents a response surface-based robust geotechnical design approach for cantilever retaining wall subjected to earthquake load. First, the upper and lower bounds of the design variables were determined through dynamic retaining

wall design using Mononobe-Okabe method for possible variations in the uncertain parameters. Then, dynamic finite element analyses were performed on a subset of designs by applying El Centro earthquake motions with varying PGA for computing the maximum wall tip deflection which is considered as the serviceability indicator. A response surface for the wall deflection was developed as a function of uncertain and design variables and validated. Finally, a design optimization was performed considering cost and robustness index as the objectives. Two robustness indices, standard deviation of the response and signal to noise ratio were used in this study and the results were compared. The optimization yielded a set of preferred designs, known as Pareto front, and the knee point concept was used to select the final optimal design.

Dr. S.S Patil and A.A.R.Bagban:- As we know that, retaining wall is one of the most important types of retaining structures. It is extensively used in variety of situations such as highway engineering, railway engineering, bridge engineering and irrigation engineering. Reinforced concrete retaining walls have a vertical or inclined stem cast with base slab. These are considered suitable up to a height of 6m. It resists lateral earth pressure by cantilever action of stem, toe slab and heel slab. The tendency of wall to slide forward due to lateral earth pressure should be investigated and a factor of safety of 1.5 shall be provided against sliding. Cantilever retaining walls are found best up to a height of 6m. For greater heights earth pressure due to retained fill will be higher due to lever arm effect, higher moments are produced at base, which leads to higher section for stability design as well as structural design. This proves to be an uneconomical design. As an alternative to this, one may go for counterfort retaining wall, which demands greater base area as well as steel. As a solution to this difficulty, a new approach that is to minimize effect of forces coming from retained fill, short reinforced concrete members in the form of cantilever steps are cast along the stem

on the retaining face. Addition of these steps would counterbalance the locally appearing forces and will result into lesser moment and shear forces along the stem. Also it will reduce the bending action that is pressure below the base. The objectives of the study are To reduce the stresses on the retaining face of the cantilever retaining wall, it is proposed to introduce reinforced concrete steps along the stem. 2) Decide the most economical location of step along length and also along height of wall from number of trials. 3) Decide cross section of the R. C. step as per the stresses due to frictional forces in step. 4) Stability analysis of Cantilever retaining wall with steps for unit width will be done. Check for minimum and maximum stresses will be observed. 5) Cost comparison shall be carried out for these three different alternatives to give most economical retaining wall type.

III. CONCLUSION

From the literature review, author wants to forecast that it is very important to directly examine the effect of RCC Cantilever Retaining wall and figure out the conditions that produce adverse effectiveness methods to automate the human work involved in performing the individual tasks of the construction planning of a reinforced concrete cantilever retaining wall with the help of python programming software. The systems consist of a central database that is interconnected with components that perform the design tasks very economical and analyze and design the modal accurately. Python is a user friendly software & ease of working. Yet even the ability to manage data in an orderly fashion is an improvement over the common present design The optimum design of reinforced concrete cantilever retaining wall can be regarded as rather complicated when compared with other conventional concrete structures. This is due to rigorous checking requirement for overall external stability and internal strength at critical sections practice in which the stages and the software

of design are disjointed. Some software has been developed to produce master models and KBE systems. They still depend on programming procedures and a comprehensive understanding of the system structure. The development of such systems for practical use will require to be thoroughly planned. Computers continue to become more powerful and research into the automation methods advances. New software is written and existing software is improved. From an end users perspective off-the-shelf programmed that A BIM already functions somewhat alike to a master model, holding much structural data. The development of software may result in more programmers having capacities for structural design as well as modelling. A change in the professional culture of the construction industry is also possible, all data concerning a structure can be integrated into the model can also extend beyond the planning stage.

This article will provide a good understanding of the origin and development related to the various problems that existed in the context of retaining of soil structure in different region. It is apparent that great deal of work has been done to understand the effects of RCC Cantilever retaining wall. It has been hypothesized that in many cases this structural design can be considered beneficial for multi-purpose residential and / or commercial buildings and other types of civil engineering structures. Numerous evidence is available that demonstrates the effects of RCC Cantilever Retaining Wall on the structural response and highlighted the important contributions. There are various ways to evaluate the effects and each method has its own usefulness and scope of soil retaining and foundation cantilever retaining structure studies. The behaviour of low-rise and high-rise wall structures are different from each other. In the same way the type of retaining wall structure plays a major role in determining the response of the superstructure. From this review article, it is clear that many studies have carried out which give idea.

IV. ACKNOWLEDGEMENTS

The resources and material provided by Civil Engineering Department of Himalayan University Itanagar are greatly appreciated by the author.

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Cite this article as :

Taring Sanjay, Talkeshwar Ray, "A Critical Review on Design of RCC Cantilever Retaining Wall ", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 169-177, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229126> Journal URL : <https://ijsrst.com/IJSRST229126>

Logistic Regression Modeling for Maternal Determinants of Low Birth Weight

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ABSTRACT

Low birth weight is a major public health issue in India. Low birth weight leads to an impaired growth of the infant resulting in a higher mortality rate and increased morbidity. In India, nearly 20% of new borns have Low birth weight. Males have less frequency of Low birth weight than females. This study emphasizes the need for improving maternal health, weight gain during pregnancies, prevention and proper management of risk factors along with improving socioeconomic and educational status of mothers. Logistic regression is a statistical model for analyzing a dataset in which one or more independent variables that determine an outcome. The main objective of this paper is to identify the predictors of low birth weight through simple logistic regression model.

Keywords : Logistic regression, Low birth weight, Wald Test, Omnibus Test and Case control study.

Article Info

Volume 9, Issue 1

Page Number : 178-182

Publication Issue

January-February-2022

Article History

Accepted : 25 Jan 2022

Published : 03 Feb 2022

I. INTRODUCTION

Indian has made progress in economic, social, demographic and health fields has been defined by WHO as weight at birth of less than 2.5 kg. By international agreement, Low birth weight (LBW) has been defined as a birth weight of less than 2500 grams, with the measurement being taken preferably within the first hour of life, before significant postnatal weight loss has occurred. It contributes substantially to neonatal, infant, and childhood mortality and morbidity. Across the world, neonatal mortality is 20 times more likely for LBW babies compared to NBW babies (>2.5 kg). It is now a well-recognized fact that birth weight is not Only a critical determinant of child survival, growth, and development, but also a

valuable indicator of maternal health, nutrition, and quality of life. The main objective of this study to assess the maternal and socio demographic factors associated with LBW babies in rural area of Madurai. Low birth weight has costs to the individual and family but also to society. In the short-run, low birth weight babies faced increased mortality risks and larger health costs.

Biswas et al., (2008) have discussed the community based epidemiological study on birth weight of newborns in the rural domain of a backward district of West Bengal. Dharmalingam et al., (2010): have examined mother's nutritional status and socio-biological aspects in determining the birth weight. And the mothers' BMI impacts were more pervasive

across India than the impact of other factors on birth weight. Choudhary et al., (2013) have conducted community based cohort study on birth weight of newborns among pregnant women of an urban slum in Bhupal, India. They concluded that mother occupation, daily calorie intake and duration of day-time rest taken by pregnant women were found in significant association.

Chaman et al., (2013) have used univariate and multivariate logistic regression methods to evaluate the LBW risk factors in LBWs compared to normal weight infants. They found prematurity and high risk pregnancy were the most important risk factors for LBW. Ravi Kumar Bhaskar et al., (2015) have suggested interventions such as delay age at first pregnancy, improving maternal education and nutrition, and iron and calcium supplementation can prevent LBW. Shashikantha et al., (2017) have found that the prevalence of low birth weight was 18% aged below 19 years married females. Ahankari et al., (2017) have discussed the preterm delivery and low birth weight in India and they found that preterm

delivery and LBW were much higher in mothers less than 22 years of age in this rural Indian population.

II. METHODS AND MATERIAL

This is hospital based case control study, 139 comprised of histologically control 139 data were collected from Tirunelveli Government Hospital, Tamilnadu in October 2018 to June 2019. The data were analyzed with logistic regression by use of the Survival package in R software.

2.1 Logistic Regression

Logistic regression is to find the best fitting model to describe the relationship between the dichotomous characteristic of interest and a set of predictor variables. Logistic regression generates the coefficients of a formula to predict a logit transformation of the probability of presence of the characteristic of interest.

$$\text{Logit}(p) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_k X_k \quad (1)$$

where p is the probability of presence of the characteristic of interest. The logit transformation is defined as the logged odds.

$$\text{Odds} = \frac{p}{1-p} = \frac{\text{probability of presence of characteristic}}{\text{probability of absence of characteristic}} \quad (2)$$

and

$$\text{logit}(p) = \ln\left(\frac{p}{1-p}\right) \quad (3)$$

Rather than choosing parameters that minimize the sum of squared errors (like in ordinary regression). Estimation is logistic regression chooses parameters that maximize the likelihood of observing the sample values. Logistic model describes the expected value of Y ((u) E (y)) in terms of the following logistic formula

$$E(y) = \frac{1}{1 + \exp\left[-\left(\beta_0 + \sum_{j=1}^k \beta_j X_j\right)\right]} \quad (4)$$

For (0, 1) random variables such as y , it follows from basic statistical principles about expected values that $E(y)$ is equal to the probability $\Pr(y = 1)$; so the formula for the logistic model can be written in a form that describes the probability of occurrence of one of two possible outcomes of y , as follows

$$\Pr(y = 1) = \frac{1}{1 + \exp\left[-\left(\beta_0 + \sum_{j=1}^k \beta_j X_j\right)\right]} \quad (5)$$

The logistic model is useful in many important practical situations where the response variables can take one of two possible values. For example, a study of the development of a particular disease in some human population could employ a logistic model to describe in the study group will ($y = 1$) or will not ($y = 0$) develop the disease in question during a follow up period of interest. The first step in logistic regression analysis is to postulate (based on knowledge about, and experience with the process under study) a mathematical model describing the mean of y as a function of the X_j and the β_j values.

The model is then fitted to the data by maximum likelihood, and eventually appropriate statistical inferences are made after the model's adequacy of fit is verified, including consideration of relevant regression diagnostic indices. It is used to investigate the factors affecting incidence of LBW, Associations between independent variables and low birth weight were analyzed using simple logistic regression and odds ratios and 95% confidence intervals were calculated.

Wald and Omnibus Test

In logistic regression, the Wald test is the common t-test for testing the significance of a particular regression coefficient. The formula for the Wald statistic is

$$Z_j = \frac{b_j}{S_{b_j}}$$

where S_{b_j} is an estimate of the standard error of b provided by the square root of b_j the corresponding diagonal element of the covariance matrix, $V(\hat{\beta})$.

With large sample sizes, the distribution of Z_j is closely approximated by the normal distribution. With small and moderate sample sizes, the normal approximation is described as 'adequate.' The Wald test is used to test the statistical significance of individual regression coefficients. And omnibus tests are used to test whether the explained variance in a set of data is significantly greater than the overall unexplained variance through Omnibus test.

III. RESULT AND DISCUSSIONS

The problem of low birth weight is multidimensional and integrated approach is necessary which includes medical, social, economic and educational measures.

Table 1: Omnibus Tests of Model Coefficients

		Chi-Square	Df	Sig. Value
Step 1	Step	124.834	7	0.000
	Block	124.834	7	0.000
	Model	124.834	7	0.000

Table 1 show that omnibus tests of model coefficients results which are used to verify that the new model is an improvement over the baseline model. The chi-square values are the same for step, block and model. The chi-square test is used to check if there is a significant difference between the Log likelihoods of the baseline model and the new model. Since the chi-square value is highly significant (chi square=124.834, df = 7, p < 0.000) so our fitted model is significantly better.

Table 2: Model Summary

Step	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R Square
1	67.861	0.593	0.790

Table 2 shows that the R² values tell us approximately how much variation in the outcome is explained by the regression model. We prefer to use the Nagelkerke's R² which suggests that the model explains roughly 80% of the variation in the outcome.

Table 3: Classification Table

Observed	Predicted		
	Low Birth Baby	Normal Baby	Percentage Correct
Low Birth Baby	2	12	14.3
Normal Baby	1	124	99.2

Table 4: Logistic regression values of Low Birth Weight

Step 1	β	S. E	Wald	df	Sig. Value	Exp (β)	95% C.I. for Exp(β)	
							Lower	Upper
Sex	0.076	0.666	0.013	1	0.909	1.079	0.292	3.982
Mother Qualification	2.732	0.900	9.208	1	0.002	15.367	2.631	89.748
Father qualification	-0.865	0.706	1.502	1	0.220	0.421	0.106	1.679
Mother age at marriage	-0.098	0.107	0.831	1	0.013	0.907	0.735	1.119
Mother age at time of delivery	-0.074	0.098	0.568	1	0.451	0.928	0.766	1.126
Order of Child	1.126	0.873	1.662	1	0.197	3.083	0.557	17.082
Pregnancy period on weeks days	0.143	0.060	5.652	1	0.017	1.153	1.025	1.298

Table 4 provides the regression coefficient (β), the Wald statistic and the Odds Ratio (Exp (β)) for each variable. From the results mother qualification highly significant from the overall effect (Wald = 9.208, df = 1, $p < 0.002$). Mother age at marriage, pregnancy period on week's days also associated between low birth weights.

The fitted logistic regression model for LBW expressed in terms of the variables used in below equation

$$\text{Log}(p/1-p) = +2.732 * \text{Mother qualification} + 0.098 * \text{Mother age at marriage} + 0.143 * \text{Pregnancy period on weeks days}$$

IV. CONCLUSION

This study suggests that the low birth weight was found to be higher with the maternal factors associated with LBW, it has concluded LBW was found to be affected by rural place of residence. Preference nutritionally poor food items and miss timing of nutritious foods during pregnancy and child birth was prominent accentuating the occurrence of low birth weight. The mother's age at time of delivery, parent's education and occupations are major factors associated with low birth weight in new borns. Thus, the findings of this study emphasize the need for improving maternal health, weight gain during pregnancies, prevention and proper management of risk factors along with improving socioeconomic and educational status of mothers.

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Cite this article as :

S. Sundarabalan, S. Raguraman, "Logistic Regression Modeling for Maternal Determinants of Low Birth Weight ", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 178-182, January-February 2022. Available at
doi : <https://doi.org/10.32628/IJSRST229131>
Journal URL : <https://ijsrst.com/IJSRST229131>

Spatial - Temporal variability of Land Use Land Cover at Mount Merapi, Indonesia

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ABSTRACT

One of the most active volcanoes in the island of Java is Merapi mount which was experienced the last major eruption peak on October 26th, 2010. This volcanic eruption was effusive eruption type where magmatic gas pressure in the crater was not too strong and magma eruption was just flown out past the slopes of the Merapi mount area. However, magmatic gas pressure and magma volume still result in deformation changes that have a direct impact on residential areas throughout the Merapi mount area. Residential areas were obtained through supervised classification process from Landsat 7 and 8-satellite imagery in the 2009, 2011 and 2019 acquisition year. The reason of observation year selection was based on pre and post eruption concept to get pattern of Merapi's mountain body change through deformation analysis. The work focuses on spatial-temporal variability of land use land cover analysis at Mount Merapi pre and post 2010 eruption event considered here. The technique is based on NDVI (Normalized Difference Vegetation Index), Maximum Likelihood Classification (MLC) and False Colour Composite methodology. Based on change in number of pixels it was analysed. Actually, some portion of land was covered with clouds and its shadows. From the results it was observed that, water body, barren and built up features were miss classified. So finally False Colour Composite (FCC) images are used to identify the misclassified classes.

Keywords : NDVI, MLC, False Colour Composite (FCC), Mount Merapi Volcano, Landsat 7 & Landsat 8.

Article Info

Volume 9, Issue 1

Page Number : 183-192

Publication Issue

January-February-2022

Article History

Accepted : 25 Jan 2022

Published : 03 Feb 2022

I. INTRODUCTION

The social and economic development of a society is completely dependent on its expansion. This is the primary motivation for conducting socioeconomic

surveys. Both spatial and non-spatial datasets are included in this type of survey. At the local, regional and national levels, LULC maps play a critical role in programme design, management, and monitoring. On the one hand, this type of information aids in the

understanding of land use issues, and on the other, it aids in the formulation of policies and programmes necessary for development planning. It is vital to monitor the ongoing process of land use land cover pattern throughout time in order to ensure sustainable development. To accomplish sustainable urban development and to prevent haphazard expansion of towns and cities, authorities involved in urban development must establish planning models that allow every available piece of land to be used in the most reasonable and optimal way possible. So it is necessary to have information about the existing and former land use land cover data of the area. LULC maps also aid in the investigation of changes in our ecology and surroundings. The precise information regarding the research unit's Land Use Land Cover [1], will be helpful to formulate regulations and implement programmes to protect our ecosystem.

The Earth is in a perpetual state of flux. Some of this transformation happens slowly over millennia, while others happen quickly over decades. Volcanoes, continental shifts, mountain building and erosion, reorganisation of oceans, appearance and disappearance of deserts and marshlands, advances and retreats of great ice sheets, rise and fall of sea and lake levels, and the evolution and extinction of vast numbers of species are all caused by major natural forces. Volcanic eruptions are also monitored by using thermal remote sensing by estimating Land Surface temperature values [5, 10, and 11].

Mount Merapi is one of the most active volcanos in Indonesia, which is located in central Java. It has a lengthy history of major eruptive episodes. Activity has included lava flows, pyroclastic flows, lahars, Plinian explosions with heavy ash-fall, incandescent block avalanches, block-and-ash flows, and dome growth and destruction. Fatalities from these events were reported in 1994, 2006, and in 2010 when hundreds of thousands of people were evacuated. The impact of active volcano activity will be felt in the

densely populated area where the island of Java became one of the islands with the largest residential area in Indonesia.

The organization of this document is as follows. Section 2 presents a literature review of the existing methods used to detect Land Use Land Cover change. Section 3 which discuss about materials methodology i.e. study area and input images for the study purpose and proposed method for detecting changes. Results and discussions were presented in the section 4. Finally section 5 states the conclusions and future scope.

II. LITERATURE REVIEW

Halah Qahtan Hamdy (2018) et.al. Digital change detection method applied to find LU/LC change detection using maximum likelihood estimation. And also NDVI (Normalized difference Vegetation Index) used to classify two classes vegetation and no-vegetation. NDWI (Normalized Difference Water Index) used to identify water and no-water areas [2]. NDBI (normalized Difference Built-up Index) used to classify urban area and no-urban area. Number of indices is used for better identification of each individual class. But there is no comparison between maximum likelihood estimation and indices based estimation.

Zubair Saing (2021) et.al. LULC change detection done for the area South Sulawesi Province, Indonesia for the two years 2005 and 2019[7,3]. Here classification had done using ISO cluster classification which is unsupervised [13]. Training samples considered based on ISO cluster and topographical map of Indonesia. Then finally maximum likelihood classifier [14] applied and results validation had done using random point and field check. Accuracy achieved was 82% and 86% for June 2005 and March 2019 respectively.

Anjan Roy (2019) et.al. used Integrated hybrid classification technique, which comprises of unsupervised and supervised classification techniques, was applied combined human knowledge. NDVI and NDWI [6] maps are used for cross verification of the results. The confusion matrix-based accuracy assessment and Kappa coefficient were considered for assessing the performance of the classification system. The results showed an overall accuracy of 91.36% and kappa index of agreement value of 0.91.

Sophia S. Rwanga, (2017) et.al [8] proposed supervised classification algorithm for Land Use Land Cover classified map generation. Finally classified image accuracy assessment was done using error matrix (Confusion matrix) by comparing with ground truth data. The overall classification accuracy of 81.7% and kappa coefficient of 0.722 observed. Name of the applied supervised classification algorithm was not mentioned.

Md. Inzamal Haque (2017) et.al. Proposed pre-classification approach with CVA (Change Vector

Analysis), NDVI and NDWI analysis were implemented to assess the change scenario [9]. Maximum likelihood supervised classification technique was performed to create the signature class of significant land cover category (deep water, shallow water, vegetation, and settlement). The evaluation of accuracy was not taken into account.

III. MATERIALS AND METHODOLOGY

Study Area:

Mount Merapi, Gunung Merapi (Fire Mountain) It is the most active volcano in Indonesia and has erupted regularly since 1548. It is located approximately 28 kilometres (17 mi) north of Yogyakarta city which has a population of 2.4 million, and thousands of people live on the flanks of the volcano, with villages as high as 1,700 meters (5,577 ft) above sea level. For geographical area of research lies in latitude position 110°14'60" E- 110°32'30" E and in longitude position 7°29'47" S-7°47'53" S and can be seen clearly in Figure

1.

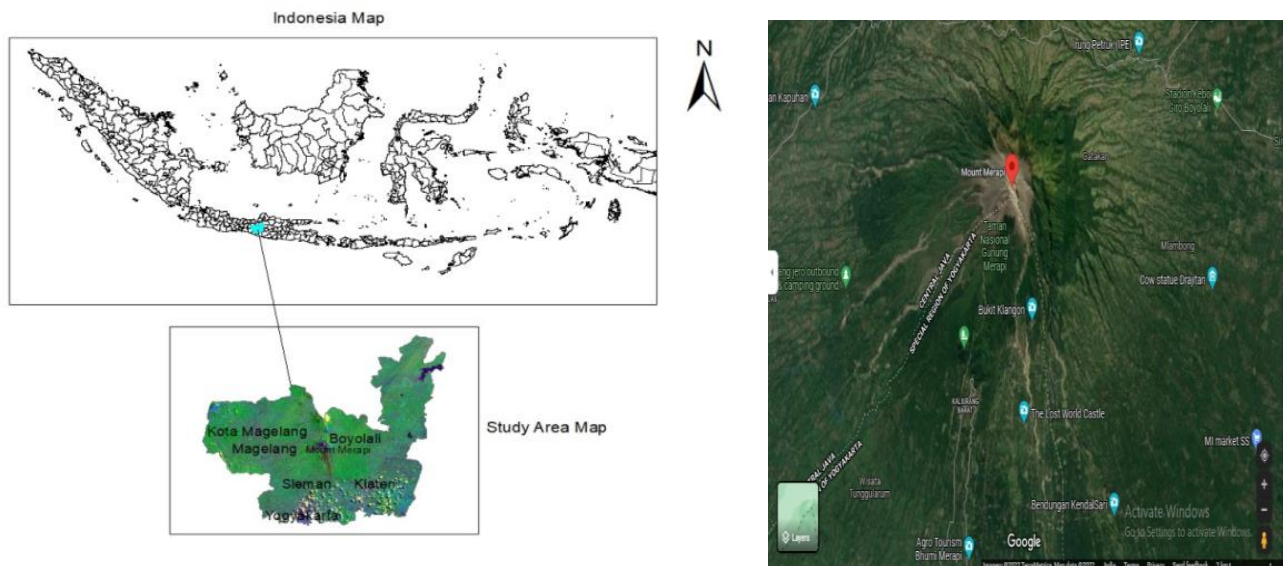


Figure 1. Study area of Mount merapi and its surrounding districts

Mount Merapi rises to roughly 2,930 metres above sea level. On the 26th of October, 2010, Mount Merapi erupted. The Merapi volcanic eruption is a kind of effusive eruption characterised by lava melts and low

magmatic gas pressure. For the magma to flow out of the cavity, it must pass through the top of the mountain's slopes. Despite being a type effusive eruption, this one produces significant physical,

environmental, and economic damage. The lava flow will change the land cover in the area, therefore there will be changes in land cover before and after Mount Merapi erupts. Prior to the eruption, this results in substantial deforestation (deformation). Volcanic deformation is caused by volcanic activity in the form of magma movements beneath the surface, which effect pressure changes in the magma pocket. Submarine motion is a precursor to eruption and a rise in pressure, both of which will cause ground deformation. This study will look at the deformation pattern that happened on Mount Merapi before and after the eruption. It also includes a study of the effects on land cover land use changes in the study area.

Materials:

Multispectral band pictures of Landsat8 Level 1 OLI / TIRS C1 Level 1 & Landsat 7 (ETM+) were used to detect spatiotemporal changes in land use/land cover at Mount Merapi, 2010 pre and post eruption. WGS84 is the reference datum. Landsat image path-120 and row-65 of the study area were considered. Landsat 7 has a pixel spatial resolution of 28.5 meters and Landsat 8 has a pixel spatial resolution of 30 meters. The satellite image acquisition dates are June 21, 2009, May 10, 2011 from landsat7 and June 25, 2019 from landsat8. Satellite data is shown in Table 1. Images courtesy of <https://earthexplorer.usgs.gov>. This study considered images having <10% cloud coverage for attaining best classification as well as change detection results. For the development of LULC change detection maps GIS software used is ArcGIS 10.3.

Table 1. Spatial Image Sources

Data source	Sensor	Date	Spatial resolution	Bands
LAND SAT 7	ETM+	21-06-2009	28.5 meters	3,4&5
		10-05-2011		
LAND SAT 8	OLI /TIRS	25-06-2019	30 meters	4,5 &6

Methods:

The methods utilized to detect changes at Mount Merapi volcano before and after the huge eruption on October 26, 2010 are depicted in Figure 2 in the form of flow diagram. The entire procedure is divided into four sections. 1)Pre-processing of images 2) Classification based on NDVI thresholds 3)Classification based on maximum likelihood 4) Change detection using statistical analysis 5)Comparison using FCC image.

Image pre-processing:

The initial step in picture pre-processing is to use the landsat toolbox to remove scan-lines errors from Landsat7 band images. Mount Merapi surrounding areas were selected by using Area Of Interest (AOI) selection process using map clipping process. For subsequent processing, an AOI map is clipped from the needed band images. All the selected images were projected onto a UTM (universal Transverse Mercator) coordinate system, datum WGS84 in the north zone 49N (WGS_1984_UTM_Zone_49N).

NDVI Threshold based Classification:

The Normalized Difference Vegetation Index is a prominent vegetation index that is used by remote sensing to analyse vegetation health and land use land cover [5,6]. The mathematical formula for estimating the NDVI using RED band and NearInfraRed (NIR) band images is given below.

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

$$Landsat 7 - NDVI = \frac{Band4 - Band3}{Band4 + Band3}$$

$$Landsat 8 - NDVI = \frac{Band5 - Band4}{Band5 + Band4}$$

NDVI values ranges from -1 to +1. The classification was done based on NDVI threshold values. It was divided into five classes a) Water bodies b) Barren

Land c) Built up d) Low density vegetation e) High density vegetation.

Maximum Likelihood Classification:

Maximum likelihood classification determines the probability that a given pixel belongs to a specific class based on the statistics for each class in each band being normally distributed. All pixels are categorised unless a probability threshold is set. It was chosen because of its ability to appropriately classify items. This is the most widely using algorithm for creating land use and land cover classification maps and detecting changes based on them. Signature files, which can be constructed from NDVI threshold classified image [4]. It was used as base for maximum likelihood classification.

Change detection using statistical analysis:

Change detection requires understanding the changes in land use land cover that happened as a result of such a huge volcanic eruption [12]. Here, pixel-based variations were calculated to quantify the changes in distinct LULC classes. Images from 2009, 2011 and 2019 were used in this study, which were taken before and after Mount Merapi's massive volcanic eruption in 2010.

Comparison with FCC: Finally comparison between Maximum likelihood classified images with False Colour Composite (FCC) image of that study area was done. By visual interpretation of the FCC image with classified images results were presented.

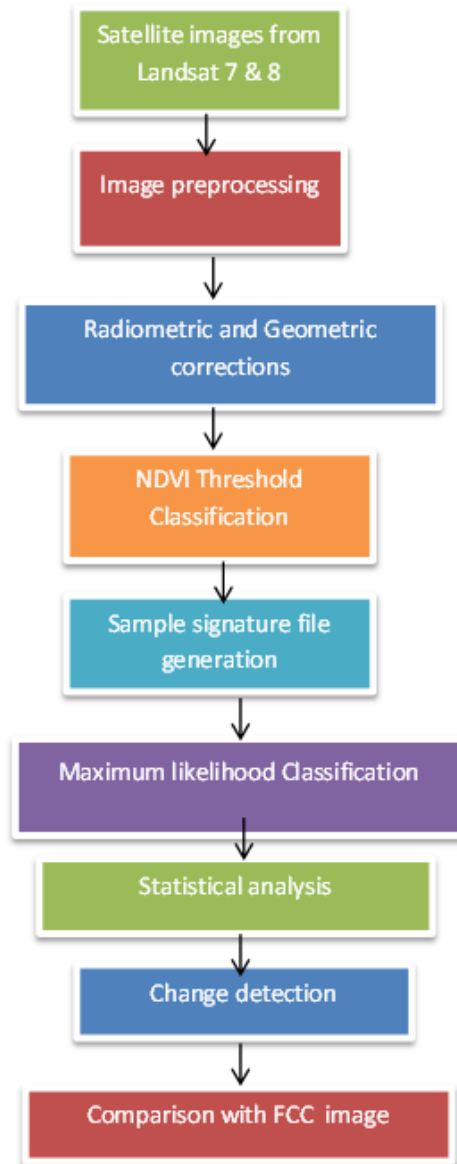


Figure 2. Change detection methodology flow diagram

IV. RESULTS AND DISCUSSION

The goal of this study was to determine how land use and land cover were before and after the 2010 volcanic eruption. This data is required by the government officials to take appropriate action plan in response to the observed changes. They will be able to rebuild and recreate the essential facilities as a result of this. To compensate those who have been affected. Normalized Difference Vegetation Index images for the years 2009, 2011 and 2019 are shown in the figures 3(a), 4(a) and 5(a) respectively. Maximum Likelihood Classified (MLC) images are

shown in the figures 3(b), 4(b) and 5(b) for the years 2009, 2011 and 2019 respectively. False Colour Composite (FCC) images for the years 2009, 2011 and 2019 are shown in the figures 3(c), 4(c) and 5(c)

respectively. Basically Composite band images are used for visual interpretation of the changes in Land use and Land cover. This composite band image was generated using 3bands.

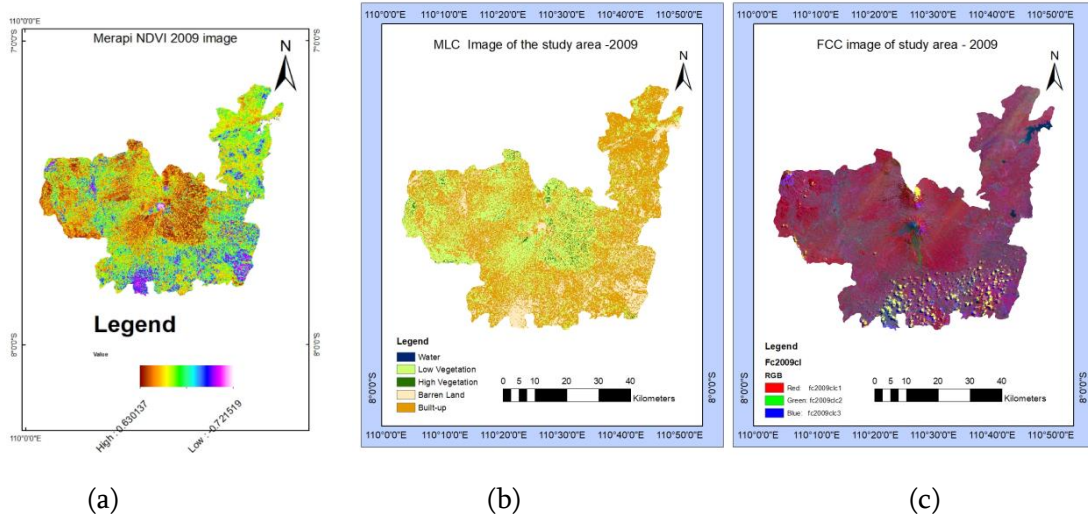


Figure 3. Study area (a) NDVI Threshold (b) MLC image (c) False Color Composite image for the year 2009

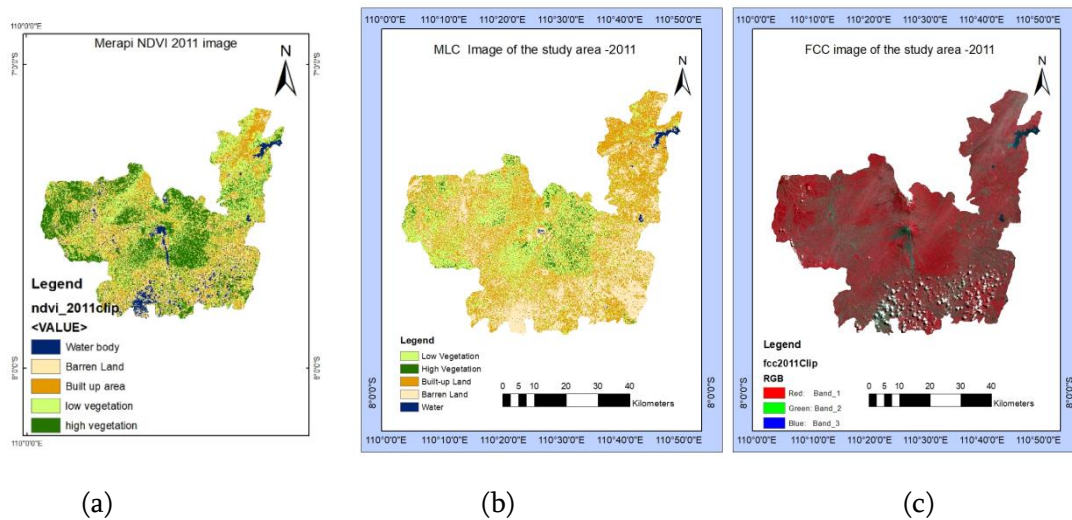


Figure 4. Study area (a) NDVI Threshold (b) MLC image (c) False Color Composite image for the year 2011

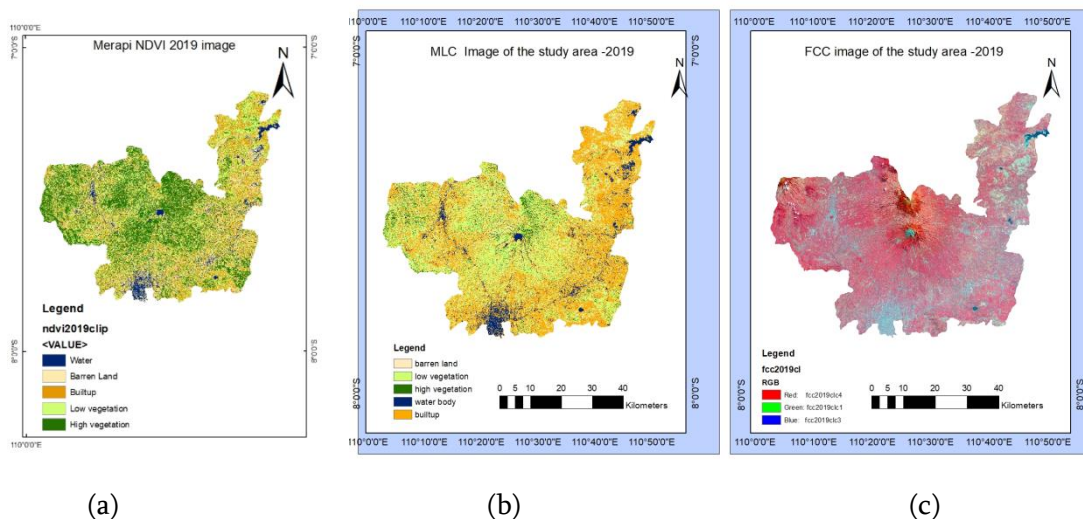


Figure 5. Study area (a) NDVI Threshold (b) MLC image (c) False Color Composite image for the year 2019

Table 2: Classified parameters in terms of no. of pixels count, Area (%) and differences

Land use Land cover parameter	No. of Pixels	Area (%) 2009	No. of Pixels	Area (%) 2011	No. of Pixels	Area (%) 2019	Difference between 2011 & 2009	Difference between 2019 & 2009
Barren land	584879	15.0429	1179577	30.34	619042	15.92	15.2971	0.8771
Low vegetation	1340772	34.4843	1126659	28.98	1212421	31.18	-5.5043	-3.3043
High vegetation	75228	1.9348	136442	3.51	173903	4.47	1.5752	2.5352
Water body	226	0.0058	22933	0.59	262547	6.75	0.5842	6.7442
Built- up	1886964	48.5322	1422458	36.59	1620156	41.67	-11.9422	-6.8622

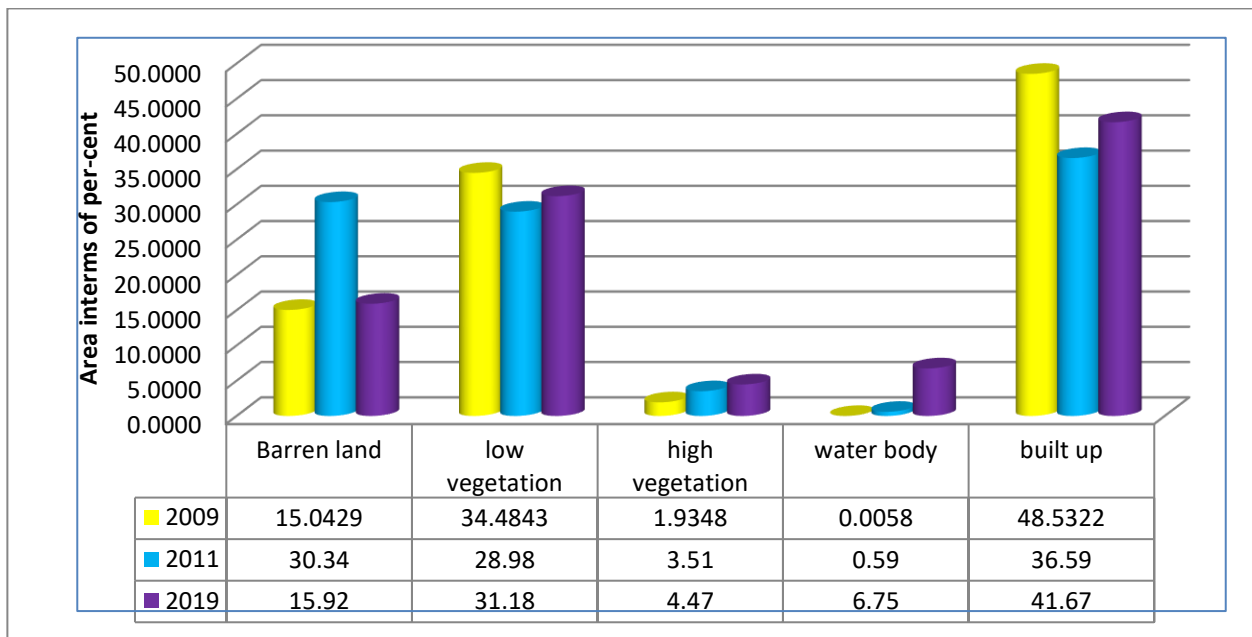


Figure 6. LULC parameters for the years 2009, 2011 and 2019 in terms of Area (%)

From the above results it was observed that, due to clouds and its corresponding shadows some of classes are misclassified. Which can be clearly observed in False Colour Composite (FCC) images shown figures 3 (c), 4 (c) and 5 (c). The study area was classified into 5 classes i) Water body ii) Barren Land iii) Built-up area

iv) Low vegetation and v) High vegetation. Table 2 presents the land use land cover parameters change in-terms of number pixel count per year, parameter wise area (%) occupancy and difference between 2011 & 2009 and 2019 & 2009. LULC parameters and its quantification using area wise (%) occupancy

presented in the figure 6 for the three years data. After quantifying the results it was observed that, water bodies were very less in the year 2009, due to cloud masking over that area. In the year 2019 built-up was about to 41.67 % actually it was more than that. In the year 2011 barren land was approximately double to 2009 and 2019. All these observations are made by comparing the NDVI and MLC classified images with FCC images. So, finally for achieving better classification results it requires cloud free images.

V. CONCLUSION

Mount Merapi volcano and its surrounded places are classified for finding change detection before and after occurrence of massive eruption in the year 2010. After the eruption major change occurred in vegetation areas and barren and built-up land. For the analysis of change in land use land cover, June 2009, May 2011 and June 2019 images were classified using two stage processes. First step to apply NDVI threshold and then Maximum likelihood classifier for better classification was done. The advantage of FCC images clouds and its shadows are identified. Whereas in NDVI based classification it considers clouds and shadow feature as water body so misclassification chances are there. From the above results it was observed that cloud areas are wrongly classified. From this study it can be concluded that, with cloud free images maximum classification accuracy can be achieved. Here the observations are made by comparing the classified images of NDVI and MLC with False Colour Composite images. FCC images can able to present clouds and its shadows. After quantifying the results it was observed that, water bodies were very less in the year 2009, due to cloud masking over that area. In the year 2019 built-up was about to 41.67 % actually it was more than that. In the year 2011 barren land was approximately double to 2009 and 2019. All these observations were made

by comparing the NDVI and MLC classified images with FCC images.

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Cite this article as :

A. Rajani, Dr. S. Varadarajan, "Spatial - Temporal variability of Land Use Land Cover at Mount Merapi, Indonesia", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 183-192, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229129>
Journal URL : <https://ijsrst.com/IJSRST229129>

QR Codes in Education : A Review

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Article Info

Volume 9, Issue 1

Page Number : 193-205

Publication Issue

January-February-2022

Article History

Accepted : 25 Jan 2022

Published : 05 Feb 2022

ABSTRACT

Mechanical advances carried utilizations of developments to schooling. Ordinary schooling progressively prospers with new advancements joined by more student dynamic conditions. In this continuum, there are students favoring self-learning. Customary learning materials yield alluring, spurring and innovatively improved learning materials. The QR (Quick Response) Codes are one of these advancements. The point of this review is to overhaul an illustration unit upheld with QR Codes and to get the student sees about the upgraded material. For this reason, the overhauled example unit was conveyed to 15 students in Balikesir University in the scholastic year of 2013-2014. The students were approached to concentrate on the material. The students who had advanced mobile phones and Internet access were picked for the review. To give sectional variety, three gatherings were made. The gathering students were from Faculty of Education, Faculty of Science and Literature and Faculty of Engineering. Later the semi-organized meetings were held, the students were gotten some information about their pre-information about QR Codes, QR Codes' commitment to learning, hardships with utilizing QR Codes about and configuration issues. Spellbinding information examination was utilized in the review. The discoveries were deciphered based on Theory of Diffusion of Innovations and Theory of Uses and Gratifications. Later the exploration, the subjects found were attention to QR Code, kinds of QR Codes and applications, commitments to learning, and expansion of QR Codes. By and large, the students taking part in the review detailed that they knew about QR Codes; that they could utilize the QR Codes; and that involving QR Codes in schooling was valuable. They likewise communicated that such elements as visual components, allure and direct steering emphatically affected learning. What's more, they for the most part referenced that they didn't have any trouble utilizing QR Codes; that they enjoyed the plan; and that the substance ought to incorporate both shallow and inside and out data.

Keywords: Mobile learning, QR Code, Communication, Distance education

I. INTRODUCTION

It is feasible to say that more extensive utilization of the Internet and the abatement in the costs of cell phones has expanded the utilization of these gadgets. Individuals can work with next to no limitation of spot and utilize these gadgets for various purposes. As indicated by Al-Khalifa (2011), perhaps the main parts of cell phone is their capacity to get to the Internet anyplace, which makes it conceivable to arrive at the data whenever they need. Versatile, in particular pervasive learning is reshaping the learning climate. From SMSs to Smart Phones, it has changed the method of cooperation among students and the learning materials. Students can arrive at learning objects (video, text, sound and so on) quicker than at any other time. Since correspondence learning, printed version materials (course books) are the base materials of learning for open and distance learning courses at Anadolu University ("Acikogretim Sistemi - Tarihsesi," 2012).

As indicated by ABI research (2013), there were 1.4 billion PDAs in the World. A raport about the utilization of advanced mobile phones, which was distributed in 2014, shows that the number had reached to 1.75 billion (eMarketer, 2014). Another review uncovered that 89% of the advanced mobile phones are utilized the entire day (Smartphone clients all over the Planet, 2012).

Figure 1 presents the purposes behind utilization of PDAs in the last part of 2011 all over the Planet. As indicated by the information introduced in the Table, PDA proprietors use their telephones for gaming, which is trailed by interpersonal organizations, music and news. Involving PDAs for instructive designs is around 11%.

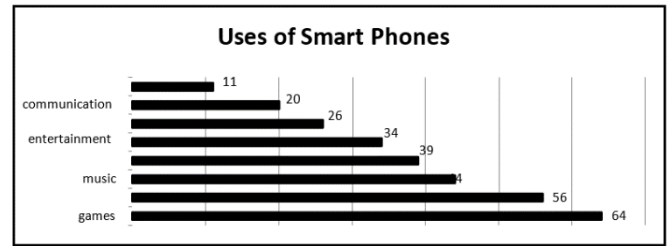


Figure 1 : Uses of Smart Phones

Figure 2 presents the month to month information use for 2013 and 2014. As per the information, there was an increment of 69% in a year. Figure 3 shows the complete Internet traffic information in 2000 and versatile Internet traffic information in 2014. As indicated by Figure 3, versatile traffic information in 2014 were multiple times more than the all out Internet traffic information in 2000.

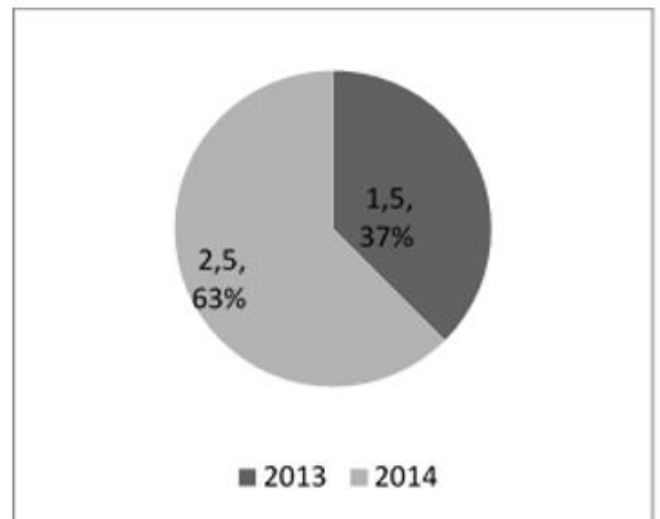


Figure2: Monthly data use in Exabytes (Cisco, 2015)

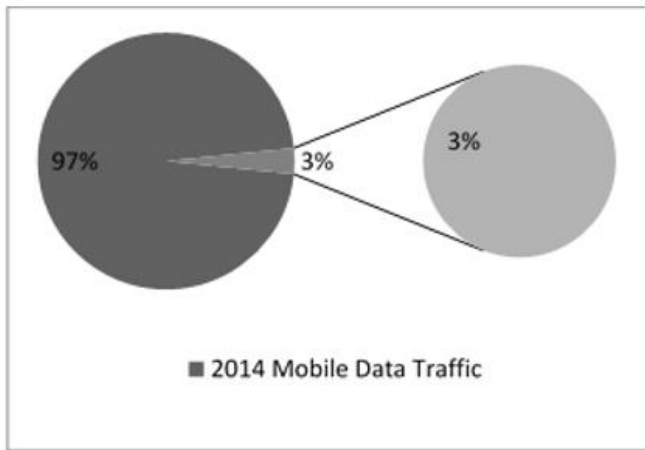


Figure 3: Year 2014 Mobile and year 2000 Total Internet Traffics by percentage (Cisco, 2015)

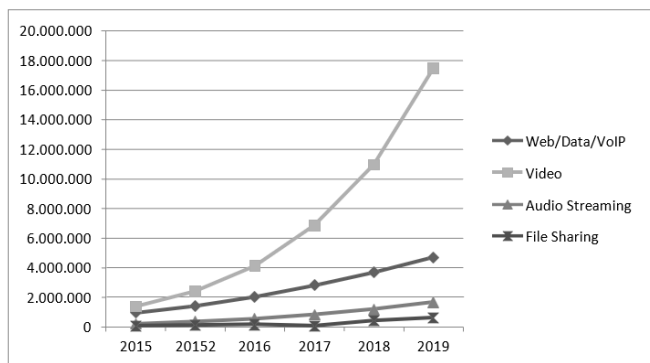


Figure 4. 2015 – 2019 Mobile data traffic by application TB by month (Cisco, 2015)

When the graph in Figure 4 is examined, it is seen that two-third of the mobile data traffic will be of videos.

II. THEORETICAL BACKGROUND

This review is grounded upon the Theory of Diffusion of Innovations and Theory of Uses and Gratifications. The information in this review were deciphered based on these speculations.

Hypothesis of Diffusion of Innovations

The Theory of Diffusion of Innovations set forward by Rogers depends on four variables: advancement correspondence channel, time and social framework. As per Rogers (2003), this dissemination is a course of correspondence by means of specific channels

between the individuals from the social framework with respect to the "new".

In his hypothesis, Rogers characterized 'advancement' as a thought, an application or an item viewed as new by an individual or association. An advancement doesn't need to be an idea or a plan that is certainly obscure. It is enough that the individual or association has not utilized it previously (Berger, 2005). There are five stages in Roger's model: Knowledge, influence, choice, execution and affirmation.

- ✓ Information: The individual gets educated with regards to the advancement and its utilization.
- ✓ Influence: The individual assesses the positive and negative parts of the advancement and shapes his/her mentalities likewise.
- ✓ Choice: In this stage, the individual chooses to acknowledge or dismiss the advancement.
- ✓ Execution: This stage exists assuming the choice stage is finished emphatically.
- ✓ Affirmation: The Individual certifies and reinforces the reception choice.

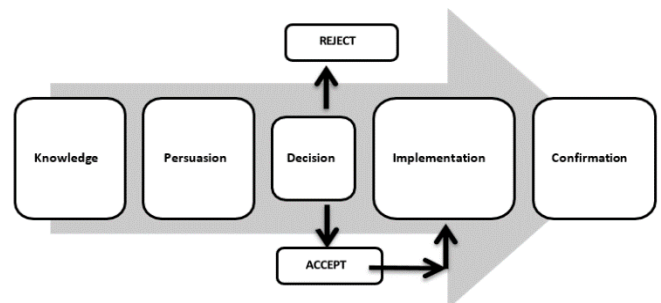


Figure : 5. The innovation-decision process (Rogers, 1995)

Theory of Uses and Gratifications

The hypothesis of Uses and Gratifications was first declared by Elihu Katz. As per Katz, research on correspondence consistently centered around the subject of 'How does media help individuals?' however the genuine inquiry ought to definitely be 'How individuals manage media?' (McQuail and Windahl, 2010, p.167).

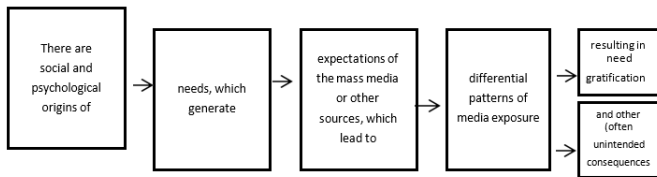


Figure 6. The Uses and Gratifications approach (McQuail & Windahl, 2010, p.168)

In many examinations dependent on the hypothesis of Uses and Gratifications, delights acquired were seen as inspirations essential for specific web exercises. Studies in related writing showed that delights for the most part included looking for data, diversion, observation, correspondence between people, character, obtaining status and gains (Charney and Greenberg, 2001; LaRose, Mastro and Eastin, 2001; Papacharissi and Rubin, 2000).

QR CODES

QR Codes comprise of dark modules organized in a square example on a white foundation. They are intended to translate the information rapidly. It is very simple to make and utilize these codes (Pons, 2011).

Involving QR Codes for schooling is one more method of utilizing the Internet. Speedy Response (QR) codes are flexible. A piece of long multilingual text, a connected URL, a computerized SMS message, a business card or practically any data can be implanted into the two-layered standardized identification. With moderate prepared cell phones, QR Codes can interface clients to the data rapidly and effectively (LAW, SO, and 蘇永華, 2010).

Beginning around 2011, utilizing QR codes has been utilized in various structures. As indicated by comScore MobiLens (2011), 1 out of 5 PDA proprietors in U.S. examined QR codes. Canada and Germany both saw close 16% of advanced cell proprietors filtering QR codes in a month, while the UK and Spain (home to the most entered PDA markets) saw only 12% of their members checking

QR codes. (Source: comScore MobiLens, 3 mon. avg. finishing Dec-2011)

QR codes are utilized in a wide scope of regions like media, road flags, all spots prompting sites, music, video and interpersonal organizations (Arslan, 2011). As per Walsh and Andrew (2011), a portion of the gainful employments of QR Codes incorporate crossing over printed materials to electronic materials, arriving at voiced materials, opening inserted recordings, furnishing libraries with outside assets and arriving at proper assistance.

QR Codes in Education

It very well may be expressed that reviews on utilization of QR Codes in training were for the most part directed in the field of portable learning. Survey of the connected writing uncovered that cell phones were utilized while utilizing QR Codes. As per So (2008), the main part of portable learning is the trilogy of 'area freedom', 'time autonomy' and 'significant substance'. These three essential highlights are among qualities of portable learning, and they vary from e-learning and electronic learning because of these elements (Law and So, 2010).

The rising pace of versatile innovation is expanding and infiltrating all parts of human existence. Hence, this innovation assumes an imperative part in learning various components of data. Today, a reasonable shift from instructor focused figuring out how to understudy focused learning makes understudies find innovation more viable and fascinating than any time in recent memory (Miangah, 2012).

In a trial review directed on the utilization of QR codes in instruction (Rikala and Kankaanranta, 2012), the perspectives on 76 students and of their instructors from four distinctive level not set in stone. The consequences of the review uncovered that the students were excited and persuaded to utilize the QR

codes. With respect to the their instructors, they drew nearer mindfully to the utilization of QR codes in schooling and referenced the probability of different hardships to be knowledgeable about connection to the arrangement of example units and time. Moreover, in the review, it was observed that QR codes could spur students and cause them to notice class since these codes support learning and give openings both to autonomous learning and for helpful learning.

In one more review did by McCabe and Tedesco (2012), QR codes were utilized by means of advanced cells for direct association with the subjects inside the extent of the course of science. In the review led with 14 students, every one of the students revealed positive perspectives about the QR codes ready for the course of science. In such a course interaction, 83% of the students expressed that they arranged for the accompanying illustration better and got their work done all the more beneficially, and 67% of them expressed that there was an increment in their course stamps and that they thought that it is not difficult to utilize QR codes. Furthermore, as uncovered by the main finding acquired in the review, 83% of the student experienced less pressure when they read up for the examples with the assistance of QR codes. As per the students, the explanation was that it was quickly conceivable to get to the fundamental data through QR codes without asking their friends or educators.

Hernández-Julián and Peters (2012), in their review led to contrast doing schoolwork on the web and doing schoolwork on paper, observed that an electronic climate could make it simpler to get to an educational material and that it didn't altogether impact learning.

Al-Khalifa (2011) fostered a Mobile Snapshot Response framework with QR Codes. The framework pointed toward working on the correspondence among educators and their understudies. Streams

(2010) planned an undertaking based QR Code framework for English language instructing. In the review, the scientist clarified how the framework was created, applied and tried. It was viewed as in

the review that the students appreciated and profited from the framework while utilizing it to do the course exercises. Liu, Tan and Chu (2007), in their review, fostered a learning framework to further develop students' English language levels with the assistance of QR Codes. The review uncovered that the QR Code framework learned English.

Chen, Teng, Lee and Kinshuk (2011) led a review to permit admittance to computerized materials through QR Codes in paper-based understanding errands. The outcomes proposed that immediate admittance to computerized assets utilizing QR codes doesn't altogether impact understudies' understanding appreciation.

In their review, Ozcelik and Acarturk (2011) pointed toward diminishing the spatial space among printed and online assets utilizing QR Codes. In this observational review did with 44 college understudies, the understudies were partitioned into two gatherings (paper + cell phone and paper + PC). In the review, it was inferred that gratitude to QR codes found in course books, cell phones add to learning since it is effectively conceivable to get to data on the web.

Bread cook (2010) involved QR Codes in his review named "Making Physical Objects Clickable: Using Mobile Tags to Enhance Library Displays". The specialist detailed that libraries ought to contain both physical and electronic media and that the versatile naming innovation between these two conditions will give a strong premise to new age libraries.

Hwang, Wu, Tseng and Huang (2011) fostered a learning stage utilizing QR codes through phones which are low-valued and which have a camera and

web association. This exact review showed that the students involving the stage exhibited significant enhancements as far as learning proficiency and learning accomplishment.

Planning a Lesson Unit Supported with QR Codes

In this review, QR Codes were added to an illustration unit of Computer-101 course book for Anadolu University Open Education Faculty. As should be visible on figure 7, we made a twitter account, a Facebook support page and QR connects to the computerized type of the course book. As Bolter and Grusin (2000) referenced, hypermedia targets tending to various and various feelings of human. Utilization of more faculties for hearing, seeing, smelling and contacting, learning expands learning. Rather than the medium, the informative techniques cause the learning (Clark and Mayer, 2008), yet utilizing various media gives capacity to utilize various methodologies.



Figure: 4. Cover page showing Twitter and Facebook Support pages

In Figure 8, there are two different QR Codes from the lesson unit? The upper one leads to a video about the subject, and the other leads to a Wikipedia page.

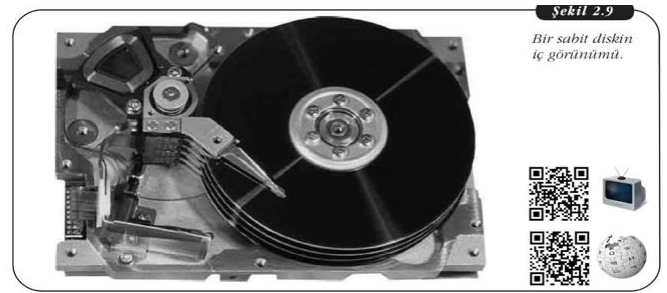


Figure 8. Using QR Codes in the lesson unit

In Figure 9, the QR Codes link to Google images and Flash videos.

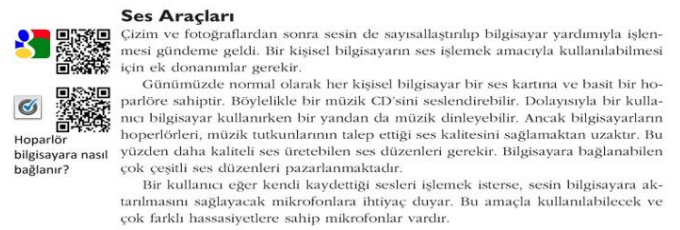


Figure : 9 Google images and Flash videos

III. METHODOLOGY

The current review was planned as a contextual analysis. As indicated by Creswell (2009), contextual analysis is a subjective methodology where the examiner investigates a limited framework (a case) or different limited frameworks (cases) after some time through point by point, top to bottom information assortment including numerous wellsprings of data (e.g., perceptions, interviews, varying media material, archives and reports) and reports a case portrayal and case-based topics.

In this review, the scientists updated an illustration unit of the course book by adding QR codes. The QR codes connected the student to sites, applications and informal organizations connected with the subject to be instructed.

Members

The members in the review were 15 understudies from Faculty of Education, Faculty of Science and Literature and Engineering Faculty of Balıkesir University in the scholastic year of 2013-2014. In the

review, the deliberate inspecting technique was utilized. In this technique, the specialist chooses whom to remember for the review and picks the members generally fitting to the reason for the examination (Balci, 2004).

The understudies who were picked for the review met the models of having a "savvy" telephone and approaching the Internet utilizing their telephones. These understudies were isolated in three gatherings:

- ✓ Bunch 1: Second-grade understudies from the Department of Computer and Instructional Technologies in Necatibey Education Faculty
- ✓ Bunch 2: Third-grade understudies from the Department of Mechanical Engineering in of Engineering Faculty
- ✓ Bunch 3: Students from the branches of Physics, Chemistry and Biology in Faculty of Science and Literature

The reason for picking these gatherings was to break down alternate points of view of understudies from various offices.

Information Collection

In this review, the scientists pointed toward deciding the students' perspectives about the example unit upheld with QR Codes. For this reason, semi-organized inquiries questions were ready. As indicated by Ozguven (2004), semi-organized meetings give a chance to roll out certain improvements during the meeting for unusual circumstances.

The most common way of setting up the inquiries questions started with draft questions and proceeded by hearing master point of view. Later well-qualified sentiments, the vital changes were made, and the inquiries questions were applied to three understudies as a pilot study. The reason for the pilot study was to comprehend assuming the inquiries were clear, open-finished and steady with the point of the review.

In accordance with the motivation behind the review, there are six inquiries:

- ✓ What was your level of information about the subject before the review? Later this illustration unit, what do you think your level of current information about the subject is?
- ✓ Did the QR Code upheld example unit have positive effect on your learning? How viable it was on your learning?
- ✓ What should the substance of QR Codes be? (Text, Links to recordings, texts, sounds or pictures)
- ✓ What issues did you encounter while utilizing the QR Codes?
- ✓ What is your take on the plan of QR Codes on pages? What are your ideas?
- ✓ Should QR Codes be utilized for subtleties or for improvement? (Improvement; with same trouble however with alternate points of view, similar to a basic video, itemizing; additional data for whom it might concern)

Information Collection Process

Interviews were held in one of the analyst room in Necatibey Education Faculty fundamental grounds. Complete of 15 understudies took part the review. In the main stage, the members were educated with regards to point of the examination. During the gathering, definite data was given to the members about the motivation behind the review and about the examination technique. The members were additionally educated with regards to such subjects as establishment regarding the vital programming, connection to the help page and contact data. The understudies were requested their assent and informed that the meeting would be recorded and the accounts will not be utilized for some other reason.

Following the main gathering, the course material (the PC course example unit upheld with QR Code) was given to the members, and they were approached to read up the material for a long time. What's more, a gathering was framed on an interpersonal

organization site, and the understudies joined to this gathering. The point of the gathering was to offer specialized help for the students experiencing difficulty with QR Code application.

Following fourteen days, the appropriate setting for the still up in the air as per the members' decisions. Each meeting required around five minutes. Later the meetings, the sound records were deciphered. As per the pre-arranged coding draft, the inquiries and the understudies' responses were dissected and inspected.

Information Analysis

For the examination of the information, inductive coding and graphic investigation were utilized. Inductive coding was utilized to uncover the ideas from the information and the associations between the ideas. In elucidating examination, the information are summed up as indicated by beforehand set topics. To underscore the perspectives, direct citations are every now and again utilized. The discoveries got are deciphered dependent on the circumstances and logical results relations (Yildirim and Simsek, 2008).

The scientists, without rolling out any improvements on the records, changed over them into composed texts. For legitimacy issues, a specialist was requested his viewpoint. As indicated by Yildirim and Simsek (2008), in the event that more than one scientist breaks down the information together, coding unwavering quality should be considered. It is an absolute necessity to reach .70 or higher for the dependability of the information.

The specialists and the master autonomously coded the information into proper topics. The codings were thought about, and it was observed that since the dependability esteem was higher than .70. Along these lines, the coding was seen as solid. The information, which were put by the meeting graph, were characterized, and the outcomes got were upheld with direct citations.

Discoveries

Later the investigation, the information were coded, and the topics were made. The discoveries were deciphered by the hypotheses of Diffusion of Innovations and Uses and Gratifications. The discoveries acquired by means of the examination questions were as per the following: Awareness of QR Code advancements, types and points of utilizing QR Codes, QR Code commitment to learning, and expansion of QR Codes.

Consciousness of QR Code Technologies

At the point when the members were gotten some information about their consciousness of QR Code innovation, the accompanying discoveries were acquired :

Table: 1 Awareness of QR Code

Themes	Frequency (f)
No knowledge	6
Awareness	
Advertisements	3
Medicine Boxes	5
Posters	3
TV – Internet	2

Types and Aims of Using QR Codes

According to participants' answers about their preferences of using QR Codes and about what their contents should be, the following findings were obtained:

Table : 2. Types and Aims of Using QR Codes

Themes	Frequency (f)
Preferences of use	
Video	14
Image	5
Leading to social networks	7
Audio files	4
Download links	5
Preferences to content	
Surface information	3
Deep information	1
Surface and deep information	11

At the point when the members' perspectives about utilizing of QR Code were dissected, it was observed that practically each of the understudies settled on video coordinating. Different thoughts were connecting to pictures, informal communities, sound documents and download joins.

QR Code Contribution to Learning

The members were gotten some information about in the event that involving QR Codes for schooling had beneficial outcome on their learning. Provided that this is true, which elements of QR Codes were adding to their learning? The discoveries are introduced in the Table underneath.

Table : 3. QR Code Contribution to Learning

Themes	Frequency
No positive effect on learning	-
Positive effect on learning	15
Visuals	9
Ease of use	5
Direct leading	8
Attractiveness	9
Updatable information resource	5

With regards to the reasons and constructive outcomes on learning, each of the members had the very thought that QR Code upheld illustration unit effectsly affected learning. At the point when the reasons were examined, the accompanying subjects were found: constructive outcome of visuals, convenience, direct driving, engaging quality, and updatable data asset. An understudy named Mansur said:

"Obviously it effectsly affects learning. It is more fascinating than a customary book, so we can invest more energy. Also, there is a more straightforward and updatable substance. It is rapidly updatable. I think I lean toward somebody training me to perusing. That is the reason I thought that it is helpful".

Multiplication of QR Codes

The members were requested their thoughts regarding multiplication of QR Codes to look at whether or not they would utilize QR codes; regardless of whether utilizing QR Codes were powerful; which variables would be the causes and which elements would control the utilization. The Table shows the discoveries acquired.

Table : 4 Proliferation of QR Codes

Themes	Frequency
The factors that would restrain the use	
Difficulties and technical problems in the process of transition to new technologies	5
Lack of academic staff who know how to use QR Codes	10
Preference of different technologies	2
Lack of necessary equipment	9
Need for technological knowledge	14
It will be effective to use QR codes	
Boredom with course books can be avoided	8
Direct links reduce the loss of motivation	7
Using multiple media together enriches the content	11

What's more, the members recorded the purposes behind not involving this innovation as follows: absence of instructors/scholastic staff who know how to utilize the innovation; other accessible advancements to like, absence of fundamental gear to utilize the innovation, and provided that this is true, there is a requirement for mechanical information.

At the point when the issues with respect to the utilization of QR Codes in the illustration unit were inspected, it was seen that as the vast majority of the students didn't encounter any issue. The people who had issues revealed that they encountered issues with respect to fixing the cam point, goal and association issues. The members leaning toward the utilization of

QR Codes announced that QR Codes behaved like media and that they could in this way help decrease the routinized design of books. What's more, as per the students, they encountered less inspiration misfortune, and improved substance would have beneficial outcome on learning. One understudy, Alper, communicated his thoughts as follows: "... at the point when I become an instructor, I am wanting to utilize QR codes. They assist with making learning more significant. Direct connecting to the assets doesn't cause any deficiency of time helps arrive at where you need to We don't lose time looking on the net Furthermore, recordings and sounds accessible are extremely useful." Mansur said "I believe it's great. Youngsters might get exhausted while understanding books, I suspect as much, and I lean toward this technique."

IV. DISCUSSION

This review pointed toward distinguishing the perspectives on the members about the QR Code upheld example unit. The outcomes uncovered that the members accomplished an agreement on the constructive outcomes of QR Code on learning. They expressed that they would involve QR Codes later on. This outcome could be clarified with the hypothesis of dispersion of advancements. As per the hypothesis of advancements, through five phases of the hypothesis understudies got educated with regards to QR Codes on the off chance that they haven't previously, created uplifting perspectives, acknowledged the development, implemented by utilizing the QR Code application and affirmed the would like use it later on. Furthermore, the finding got is corresponding to those announced in different examinations directed by Susono and Shimomuro (2006), Liu, Tun and Chu (2007), Hwang, Wu and Huang (2011) and Law and So (2010). As indicated by the discoveries, members track down QR Codes successful as far as visuals, convenience direct connecting, appeal and updatable data sources. Furthermore the consequences of different

investigations completed by Miangah (2012), Rivers (2010) and Law and So (2010) additionally support the outcomes acquired in the current review.

It was seen that as a large portion of the members knew about QR Codes. Utilization of QR Codes in instruction was viewed as an advancement. This outcome shows comparability with the %65-reaction of 'YES' to the topic of "Have you at any point seen a QR Code" coordinated in a review named QR Code Usage and Interest Survey directed by MGH (2011). The members' reactions were recorded as advertisements, medication boxes and TV-web. This outcome is additionally steady with the discoveries detailed by MGH (2011).

The members concurred that the QR Code innovation ought to be utilized for the spread of QR Codes. This finding is predictable with those gotten in different investigations completed by Ozelik and Acarturk (2011) and by Rikala and Kankaanranta, (2012). In this specific circumstance, the members' assumptions and satisfaction of these assumptions were compelling.

The principle factor forestalling the utilization of QR Codes is the requirement for enough innovative information to introduce and utilize the application. Different elements can be summed up as challenges experiencing significant change to another innovation, absence of scholastic staff who knows how to utilize QR Codes, learners' preferencing different advancements, and absence of vital equipment. Cell phones and enhancements in Internet, both as far as speed and content, have positive impact on dissemination of QR Codes.

Comparative discoveries were additionally acquired in a review completed by Rikala and Kankaanranta, (2012). The distinction from the this review is Rikala and Kankaanranta (2012) referenced the plausible challenges to be knowledgeable about planning QR code substance and called attention to that such

applications were probably going to take a ton of time and that there was a requirement for additional models in regards to its utilization.

The members for the most part had a similar thought regarding utilizing the QR Codes detailing that they liked to get to the recordings. Likewise, the members additionally preferred the component of being coordinated towards interpersonal organizations that drives students to collaborate. Contingent upon this assertion, it very well may be expressed that the components of correspondence and participation are important for learning. The elements of correspondence (Al-Khalifa, 2011) and collaboration (De pretro and Frontera, 2012) are discoveries gotten in investigations led on the utilization of QR codes in instruction. When considered according to the viewpoint of organizations, it very well may be expressed based on Uses and Gratifications Theory that the members were happy with simple admittance to the learning content, direct connecting and getting to rich substance utilizing QR Codes.

The dissemination of development hypothesis has five stages specifically information, influence, choice, execution and affirmation (Rogers, 1995). In the information stage, the students were generally acquainted with QR Codes. In spite of the fact that they referenced that they had never seen QR Codes in the field of schooling. The members and the analyst talked about whether or not involving QR Codes for schooling would be compelling. Every one of the understudies expressed that there will be beneficial outcome on learning. This can be named as influence stage.. At the choice stage, the members were requested the reasons that made them utilize course material upheld with QR Codes. It was tracked down that rich media, high inspiration, convenience and direct connection impacted their decision of utilization. The discoveries got in this stage were like those announced in different investigations directed by Law and So (2010) and Rikala and Kankaanranta,

(2012) (simple use and inspiration). During the fourteen day survey of the illustration unit, each of the students utilized every one of the QR Codes. There is a period contrast between clients, some did it in a quicker than the others. At the affirmation stage, the members were coordinated inquiries concerning whether they were considering involving QR Codes later on. Each of the understudies addressed responded to that if conceivable they could involve QR Codes later on. The meetings uncovered that involving QR Codes for instruction would be advantageous and alluring. That would have constructive outcome on learning. This outcome is steady with the view announced by Rikala and Kankaanranta (2012) that students need to re-experience QR code-helped learning and that such applications should be utilized for training.

It is feasible to say that the students who had surveyed the QR Code upheld illustration unit encountered the affirmation stage. The members recently knew about what the QR Code is, the thing that is it utilized for and how it very well may be useful for learning. They offered positive viewpoints about expanding QR Code use for instructive purposes. Furthermore, it is likewise conceivable to say that QR Codes finished its dissemination among the students who assessed the example unit.

V. CONCLUSION

Its' feasible to contend that expanded reality applications offer novel interations among human and climate utilizing cell phones. The pervasiveness of data frameworks weakens the limits of electronic and non-electronic devices, gadgets and conditions. The period of data social orders requires handling, communicating and putting away more information and data in an expanding pattern. QR Codes can contain more data when contrasted with a customary standardized identification. Computerized supplies like camera prepared cell phones and related

applications lead the multiplication of QR Codes. Then again the printed or the paper-based materials are as yet fundamental for organization of data like books, papers, research papers, letters and so on Utilizing QR Codes on printed materials like course books might improve the appealing and elucidative parts of pieces of literature.

Albeit relatively few related examinations have been directed in the field of training, they are for the most part utilized for strong purposes. The examination on QR Codes shows that they were inclined toward on account of direct connecting, blending rich substance and making them more charming. Inspiration is one of the vital variables of learning for open and distance-learning students. QR Code upheld pleasant learning conditions might assist students with keeping up with their inspiration. QR Codes particularly utilized in libraries are turning out to be more normal worldwide by utilizations and satisfaction (of QR innovation?). It goes about as a scaffold connecting the actual climate to the virtual climate. As in the remainder of the World, as far as Turkey, it is for the most part utilized in wellbeing related conditions, advertisements and announcements.

Despite the fact that it is more straightforward to utilize QR Codes, it is beyond the realm of possibilities to expect to utilize them without mechanical necessities. It is likewise conceivable to contend that being familiar with an innovation might make the new innovation more straightforward to learn and utilize. In this viewpoint the utilization of QR Codes would increment in accordance with the expansion in the connected advancements like PDAs and tablets.

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Cite this article as :

Anita Sondhi, Dr. Ravindra Kumar, "QR Codes in Education : A Review", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 193-205, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229118> Journal URL : <https://ijsrst.com/IJSRST229118>

Quantization of $R \times S^3$ Topological Klein-Gordon Scalar Field

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Article Info

Volume 9, Issue 1

Page Number : 206-217

Publication Issue

January-February-2022

Article History

Accepted : 01 Feb 2022

Published : 11 Feb 2022

ABSTRACT

In this paper, we have portrayed scalar and complex Klein-Gordon field theory on $R \times S^3$ topological space. The corresponding Klein-Gordon equation was established by M. Carmeli in October 1983. The field theory is formulated using differential operators defined on S^3 topology instead of ordinary Cartesian operators. Furthermore, we have quantized the theory and commutation relations along with the Hamiltonian for the theory are derived.

Keywords: Klein-Gordon scalar field, Quantization, $R \times S^3$ topology.

I. INTRODUCTION

Klein-Gordon field theory has been of grave importance in modern particle physics for describing the dynamics of spin zero particles. A successful attempt of describing field theories on $R \times S^3$ topology was done by M. Carmeli and A. Malka in a series of 6 papers [1]-[6]. The $R \times S^3$ topological Klein-Gordon equation was first introduced in [1] and a more general solution using group theoretic method

was established by authors. However, a rigorous and applicable treatment in the framework of quantum field theory for those equations using the plane wave solution haven't been yet formulated on $R \times S^3$ topology. The main aim of this paper is to establish Klein-Gordon field theory on $R \times S^3$ topology where we have sketched a classic formulation and its applications in quantum field theory. From [1], we have the following form of Klein-Gordon equation on $R \times S^3$ topology.

$$\left(L^2 - \frac{1}{\gamma^2} \frac{\partial^2}{\partial t^2} \right) \phi(t, \theta) = \left(\frac{I_0 \gamma}{\hbar} \right)^2 \phi(t, \theta). \quad (1.1)$$

Here, $\theta = (\theta^1, \theta^2, \theta^3)$ are three rotational angles such as Euler angles and $L = (L_1, L_2, L_3) = (L_x, L_y, L_z)$ is the corresponding differential operator given by

$$L_1 = \frac{-\sin\theta^3}{\sin\theta^2} \frac{\partial}{\partial \theta^1} - \cos\theta^3 \frac{\partial}{\partial \theta^2} + \cot\theta^3 \sin\theta^3 \frac{\partial}{\partial \theta^3}, \quad (1.2)$$

$$L_2 = \frac{-\cos\theta^3}{\sin\theta^2} \frac{\partial}{\partial \theta^1} - \sin\theta^3 \frac{\partial}{\partial \theta^2} + \cot\theta^3 \cos\theta^3 \frac{\partial}{\partial \theta^3}, \quad (1.3)$$

$$L_3 = -\frac{\partial}{\partial \theta^3}. \quad (1.4)$$

The operator $L^2 = L_1^2 + L_2^2 + L_3^2 = L_x^2 + L_y^2 + L_z^2$ is then give by

$$L^2 = \frac{1}{\sin^2\theta^2} \frac{\partial}{\partial\theta^2} \left(\sin\theta^2 \frac{\partial}{\partial\theta^2} \right) + \frac{1}{\sin^2\theta^2} \left(\frac{\partial^2}{\partial\theta^{1^2}} - 2\cos\theta^2 \frac{\partial^2}{\partial\theta^1 \partial\theta^3} + \frac{\partial^2}{\partial\theta^{3^2}} \right). \tag{1.5}$$

Plane wave solution of Eqn. (1.1) is given by

$$\phi(\theta) = e^{(i/\hbar)(Et - J\cdot\theta)} \tag{1.6}$$

where $\theta^\alpha = (\theta^0, \theta^1, \theta^2, \theta^3)$, $\theta^0 = ct$ and

$$J^\alpha = (J^0, J^k) = (E, \gamma J), \tag{1.7}$$

$$J_\alpha = (J_0, J_k) = (E, -\gamma J) \tag{1.8}$$

is the angular momentum four vector with $J = (J_x, J_y, J_z)$ and $J_k = i\hbar\gamma L_k$. Furthermore, using the definition of J^α , J_α and $\gamma = c(m_0/I_0)^{1/2}$ we can conclude the following relation:

$$E_J = J^0 = J_0 = \pm(\gamma^2 J^2 + I_0^2 \gamma^4)^{1/2}, \tag{1.9}$$

$$J^\alpha J_\alpha = E_J^2 - \gamma^2 J^2 = I_0^2 \gamma^4. \tag{1.10}$$

Here, m_0 and I_0 are rest mass and moment of inertia respectively. Another more general solution of Eqn. (1.1) using group theoretic methods can be found in [1].

II. FIELD THEORY AND QUANTIZATION

Let

$$L^\mu = \frac{\partial}{\partial\theta_\mu} = \left(\frac{1}{\gamma} \frac{\partial}{\partial t}, -L \right), \tag{2.1}$$

$$L_\mu = \frac{\partial}{\partial\theta^\mu} = \left(\frac{1}{\gamma} \frac{\partial}{\partial t}, L \right), \tag{2.2}$$

and

$$L^\mu L_\mu = \frac{1}{\gamma^2} \frac{\partial^2}{\partial t^2} - L^2. \tag{2.3}$$

Now, we can construct a Lagrangian for $R \times S^3$ topological Klein-Gordon equation as

$$\mathcal{L} = \frac{1}{2} L_\mu \phi L^\mu \phi - \frac{m_0^2}{2} \phi^2 \tag{2.4}$$

where we have employed $\hbar = c = 1$. For constructing a variational principle on $R \times S^3$ topology, we first assume that our Lagrangian depends on fields ϕ and their derivatives $L_\mu \phi$. Hence, $\mathcal{L} = \mathcal{L}(\phi, L_\mu \phi)$ and the action has the form

$$S(\Omega) = \int_\Omega L(\phi, L_\mu \phi) d^4\theta \tag{2.5}$$

whose variation $\delta S(\Omega) = 0$ would lead us to the following Euler-Lagrange's equation:

$$\frac{\partial L}{\partial \phi} - L_\mu \left(\frac{\partial L}{\partial (L_\mu \phi)} \right) = 0. \tag{2.6}$$

A detailed derivation of the above equation can be found in [6]. We can now plugin Eqn. (2.4) in (2.6) to get the following form of Klein-Gordon equation:

$$(L_{\mu}L^{\mu} + m_0^2)\phi(\theta) = 0 \tag{2.7}$$

The process for quantization of $R \times S^3$ topological Klein-Gordon field theory will be similar to that of quantization in classical mechanics. First, we define canonically conjugate momentum to construct Hamiltonian and then solve corresponding commutation relations.

Define a momentum canonically conjugate to the field variable $\phi(\theta)$ as follows:

$$\Pi(\theta) = \frac{\partial \mathcal{L}}{\partial \dot{\phi}(\theta)} \tag{2.8}$$

from which we can construct a Hamiltonian density as

$$\mathcal{H} = \Pi(\theta)\dot{\phi}(\theta) - \mathcal{L} \tag{2.9}$$

which yields a Hamiltonian of the form

$$H = \int d^3\theta \mathcal{H} = \int d^3\theta (\Pi(\theta)\dot{\phi}(\theta) - \mathcal{L}). \tag{2.10}$$

Note that Lagrangian density (2.4) can be written as

$$\mathcal{L} = \frac{1}{2}\dot{\phi}^2 - \frac{1}{2}L\phi.L\phi - \frac{m_0^2}{2}\phi^2. \tag{2.11}$$

This leads us to the following Hamiltonian density for the system

$$\mathcal{H} = \Pi(\theta)\dot{\phi}(\theta) - \mathcal{L} \tag{2.12}$$

$$= \Pi(\theta)\dot{\phi}(\theta) - \frac{1}{2}\dot{\phi}^2 + \frac{1}{2}L\phi.L\phi + \frac{m_0^2}{2}\phi^2 \tag{2.13}$$

$$= \Pi(\theta)\Pi(\theta) - \frac{1}{2}\Pi(\theta)^2 + \frac{1}{2}L\phi.L\phi + \frac{m_0^2}{2}\phi^2 \tag{2.14}$$

$$= \frac{1}{2}\Pi(\theta)^2 + \frac{1}{2}L\phi.L\phi + \frac{m_0^2}{2}\phi^2. \tag{2.15}$$

Therefore, using Eqn. (2.10), we get a Hamiltonian for our theory as

$$H = \int d^3\theta \left(\frac{1}{2}\Pi(\theta)^2 + \frac{1}{2}L\phi.L\phi + \frac{m_0^2}{2}\phi^2 \right). \tag{2.16}$$

Assuming equal time canonical Poisson brackets relations between $\Pi(\theta)$ and $\phi(\theta)$ to be

$$\{\phi(\theta), \phi(\tilde{\theta})\}_{\theta^0=\tilde{\theta}^0} = \{\Pi(\theta), \Pi(\tilde{\theta})\}_{\theta^0=\tilde{\theta}^0} = 0 \tag{2.17}$$

$$\{\phi(\theta), \Pi(\tilde{\theta})\}_{\theta^0=\tilde{\theta}^0} = \delta^3(\theta - \tilde{\theta}) \tag{2.18}$$

then, we can easily show that the dynamical equations of first order in the Hamiltonian form can be written as

$$\dot{\phi}(\theta) = \{\phi(\theta), H\} \tag{2.19}$$

$$\dot{\Pi}(\theta) = \{\Pi(\theta), H\} \tag{2.20}$$

These relations can explicitly be formulated as follows. Recall the definition of Hamiltonian from Eqn. (2.6) and then using Eqn. (2.19), we can write

$$\dot{\phi}(\theta) = \{\phi(\theta), H\}$$

$$\begin{aligned}
 &= \left\{ \phi(\theta), \int d^3\tilde{\theta} \left(\frac{1}{2} \Pi^2(\tilde{\theta}) + \frac{1}{2} L_{\tilde{\theta}}\phi \cdot L_{\tilde{\theta}}\phi + \frac{m_0^2}{2} \phi^2(\tilde{\theta}) \right) \right\}_{\theta^0=\tilde{\theta}^0} \tag{2.21} \\
 &= \frac{1}{2} \int d^3\tilde{\theta} \{ \phi(\theta), \Pi^2(\tilde{\theta}) \}_{\theta^0=\tilde{\theta}^0} = \Pi(\theta). \tag{2.22}
 \end{aligned}$$

Similarly,

$$\dot{\Pi}(\theta) = \{ \Pi(\theta), H \} \tag{2.23}$$

$$\begin{aligned}
 &= \left\{ \Pi(\theta), \int d^3\tilde{\theta} \left(\frac{1}{2} \Pi^2(\tilde{\theta}) + \frac{1}{2} L_{\tilde{\theta}}\phi \cdot L_{\tilde{\theta}}\phi + \frac{m_0^2}{2} \phi^2(\tilde{\theta}) \right) \right\}_{\theta^0=\tilde{\theta}^0} \tag{2.24} \\
 &= \int d^3\tilde{\theta} [L_{\tilde{\theta}}\phi(\tilde{\theta}) \cdot \{ \Pi(\theta), L_{\tilde{\theta}}\phi(\tilde{\theta}) \} + m_0^2 \phi(\tilde{\theta}) \{ \Pi(\theta), \phi(\tilde{\theta}) \}]_{\theta^0=\tilde{\theta}^0} \tag{2.25} \\
 &= L \cdot L\phi(\theta) - m_0^2 \phi(\theta). \tag{2.26}
 \end{aligned}$$

Therefore, we get

$$\dot{\phi}(\theta) = \Pi(\theta) \tag{2.27}$$

and

$$\dot{\Pi}(\theta) = L^2\phi(\theta) - m_0^2\phi(\theta). \tag{2.28}$$

Taking both sides derivative of Eqn. (2.29) and using Eqn. (2.30) we obtain what is known as second order equation which eventually gives Klein-Gordon equation in its original form on $R \times S^3$ topology, that is, Eqn. (2.7).

III.SOLUTION AND CREATION-ANNIHILATION OPERATORS

We know that plane wave solution to $R \times S^3$ topological equation is given by Eq. (1.6). Therefore, using this information, we can construct a corresponding general solution in terms of the corresponding plane wave solution as

$$\phi(\theta) = \int \frac{d^3J}{\sqrt{(2\pi)^3 2J^0}} \left(e^{-ij \cdot \theta} a(J) + e^{ij \cdot \theta} a^\dagger(J) \right) \tag{3.1}$$

where

$$a(J) = \frac{a(J)}{\sqrt{2J^0}} \tag{3.2}$$

and

$$a^\dagger(J) = \frac{a^\dagger(J)}{\sqrt{2J^0}} \tag{3.3}$$

are functions that later act annihilation and creation operators later. Therefore, as now we have constructed our general solution, using Eqn. (2.29) we can get the conjugate momentum as follows:

$$\Pi(\theta) = \dot{\phi}(\theta) = -i \int d^3J \sqrt{\frac{J^0}{2(2\pi)^3}} \left(e^{-ij \cdot \theta} a(J) - e^{ij \cdot \theta} a^\dagger(J) \right). \tag{3.4}$$

Since definition (3.1) and (3.4) are invertible, we can construct the following representation of functions (3.2) and (3.3):

$$a(J) = \frac{1}{\sqrt{(2\pi)^3 2J^0}} \int d^3\theta e^{ij\cdot\theta} (J^0\phi(\theta) + i\Pi(\theta)) \tag{3.5}$$

$$= \frac{1}{\sqrt{(2\pi)^3 2J^0}} \int d^3\theta e^{ij\cdot\theta} \leftrightarrow \partial_t\phi(\theta). \tag{3.6}$$

$$a^\dagger(J) = \frac{1}{\sqrt{(2\pi)^3 2J^0}} \int d^3\theta e^{-ij\cdot\theta} (J^0\phi(\theta) - i\Pi(\theta)) \tag{3.7}$$

$$= \frac{-1}{\sqrt{(2\pi)^3 2J^0}} \int d^3\theta e^{-ij\cdot\theta} \leftrightarrow \partial_t\phi(\theta). \tag{3.8}$$

Since now we have obtained a reasonable representation for solution and operators, we can now apply this to quantize our theory. Therefore, the commutation relations for (3.1) and (3.4) reads:

$$[\phi(\theta), \phi(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} \tag{3.9}$$

$$= \int \int \frac{d^3J}{\sqrt{(2\pi)^3 2J^0}} \frac{d^3J'}{\sqrt{(2\pi)^3 2J'^0}} \times (e^{-ij\cdot\theta - ij'\cdot\theta'} [a(J), a(J')] + e^{-ij\cdot\theta + ij'\cdot\theta'} [a(J), a^\dagger(J')] + e^{ij\cdot\theta - ij'\cdot\theta'} [a^\dagger(J), a(J')] + e^{ij\cdot\theta + ij'\cdot\theta'} [a^\dagger(J), a^\dagger(J')]) = 0$$

$$[\Pi(\theta), \Pi(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} \tag{3.10}$$

$$= - \int \int d^3J d^3J' \frac{\sqrt{J^0 J'^0}}{2(2\pi)^3} \times (e^{-ij\cdot\theta - ij'\cdot\theta'} [a(J), a(J')] - e^{-ij\cdot\theta + ij'\cdot\theta'} [a(J), a^\dagger(J')] - e^{ij\cdot\theta - ij'\cdot\theta'} [a^\dagger(J), a(J')] + e^{ij\cdot\theta + ij'\cdot\theta'} [a^\dagger(J), a^\dagger(J')]) = 0$$

and

$$[\phi(\theta), \Pi(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} \tag{3.11}$$

$$= - \frac{i}{(2\pi)^3} \int \int d^3J d^3J' \sqrt{\frac{J'^0}{4J^0}} \times (e^{-ij\cdot\theta - ij'\cdot\theta'} [a(J), a(J')] - e^{-ij\cdot\theta + ij'\cdot\theta'} [a(J), a^\dagger(J')] + e^{ij\cdot\theta - ij'\cdot\theta'} [a^\dagger(J), a(J')] - e^{ij\cdot\theta + ij'\cdot\theta'} [a^\dagger(J), a^\dagger(J')]) = i\delta^3(\theta - \tilde{\theta}).$$

In a similar manner, through a process of long and pain full calculations, we can derive similar commutation relations for operators (3.2) and (3.3) using relation (3.5) and (3.7). Therefore, we get

$$[a(J), a(J')] = [a^\dagger(J), a^\dagger(J')] = 0 \tag{3.12}$$

$$[a(J), a^\dagger(J')] = \delta^3(J - J') \tag{3.13}$$

To understand the physical meaning of this operators and their working, let us take a look at the Hamiltonian of our system. Therefore, from Eqn.(2.12), we have

$$H = \frac{1}{2} \int d^3\theta (\Pi^2(\theta) + L\phi \cdot L\phi + m_0^2\phi^2(\theta)). \tag{3.14}$$

We can break our Hamiltonian into three pieces in order to simplify calculations as follows:

$$H_1 = \frac{1}{2} \int d^3\theta \Pi^2(\theta)$$

$$(3.15)$$

$$H_2 = \frac{1}{2} \int d^3\theta L\phi \cdot L\phi \tag{3.16}$$

$$H_3 = \frac{1}{2} \int d^3\theta m_0^2 \phi^2(\theta). \tag{3.17}$$

Using definition (3.1) and (3.4), we get the following values of H_1, H_2 and H_3

$$H_1 = -\frac{1}{2} \int d^3J J^0 (e^{-2ij^0\theta^0} a(J)a(-J) - a(J)a^\dagger(J) - a^\dagger(J)a(J) + e^{2ij^0\theta^0} a^\dagger(J)a^\dagger(-J)) \tag{3.18}$$

$$H_2 = -\frac{1}{2} \int d^3J \frac{J^2}{J^0} (-e^{-2ij^0\theta^0} a(J)a(-J) - a(J)a^\dagger(J) - a^\dagger(J)a(J) - e^{2ij^0\theta^0} a^\dagger(J)a^\dagger(-J)) \tag{3.19}$$

$$H_3 = \frac{1}{2} \int d^3J \frac{1}{J^0} (e^{-2ij^0x^0} a(J)a(-J) + a(J)a^\dagger(J) + a^\dagger(J)a(J) + e^{-2ij^0x^0} a^\dagger(J)a^\dagger(-J)) \tag{3.20}$$

respectively. Therefore, adding those terms we get

$$H = \frac{1}{2} \int d^3J J^0 (a(J)a^\dagger(J) + a^\dagger(J)a(J)). \tag{3.21}$$

Using relation (1.9), we can write the above Hamiltonian as

$$H = \int d^3J \frac{E_J}{2} (a(J)a^\dagger(J) + a^\dagger(J)a(J)). \tag{3.22}$$

It follows now that

$$[a(J), H] = E a(J) \tag{3.23}$$

$$[a^\dagger(J), H] = -E a^\dagger(J) \tag{3.24}$$

which shows that operators $a(J)$ and $a^\dagger(J)$ annihilate and create a quantum of energy.

IV. NORMAL ORDERING AND NUMBER OPERATOR

We know since the study of quantum mechanics that the ordering of the operators is ambiguous and it affects calculations. To remove this ambiguity, we define normal ordering where creation operators stand to the left of annihilation operators. Thus, if we normal order our Hamiltonian, we get

$$H^{N.O} = \int d^3J E_J a^\dagger(J)a(J) = \int d^3J E_J N(J) \tag{4.1}$$

where $N(J) = a^\dagger(J)a(J)$ is the number operator. From this, the total number operator for the system can be defined as

$$N = \int d^3J N(J) = \int d^3J a^\dagger(J)a(J). \tag{4.2}$$

It now follows from the definition of number operator that

$$[a(J), N(J')] = [a(J), a^\dagger(J')a(J')] \tag{4.3}$$

$$= [a(J), a^\dagger(J')]a(J') \tag{4.4}$$

$$= a(J')\delta^3(J - J') \tag{4.5}$$

and

$$[a^\dagger(J), N(J')] = [a^\dagger(J), a^\dagger(J')a(J')] \tag{4.6}$$

$$= a^\dagger(J')[a^\dagger(J), a(J')] \tag{4.7}$$

$$= -a^\dagger(J')\delta^3(J - J'). \tag{4.8}$$

Thus,

$$[a(J), N] = \left[a(J), \int d^3J' N(J') \right] \tag{4.9}$$

$$= \int d^3J' (a(J')\delta^3(J - J')) \tag{4.10}$$

$$= a(J) \tag{4.11}$$

and

$$[a^\dagger(J), N] = \left[a^\dagger(J), \int d^3J' N(J') \right] \tag{4.12}$$

$$= \int d^3J' (-a^\dagger(J')\delta^3(J - J')) \tag{4.13}$$

$$= -a^\dagger(J). \tag{4.14}$$

The above calculation is just another way to show that $a^\dagger(J)$ and $a(J)$ raise and lower the number of quanta by one unit.

V. ENERGY EIGENSTATES

Consider the normal ordered Hamiltonian

$$H = \int d^3J E_J a^\dagger(J)a(J). \tag{5.1}$$

The energy eigenstates of this Hamiltonian is

$$H|E\rangle = E|E\rangle. \tag{5.2}$$

Thus,

$$E = \langle E|H|E\rangle \tag{5.3}$$

$$= \langle E| \int d^3J E_J a^\dagger(J)a(J) |E\rangle \tag{5.3}$$

$$= \int d^3J E_J \langle E|a^\dagger(J)a(J)|E\rangle \geq 0. \tag{5.5}$$

This yields that $E \geq 0$ and we do not have to worry about negative energy states. Using relation (3.26) and (3.27), we have

$$[a(J), H]|E\rangle = E_J a(J)|E\rangle \tag{5.6}$$

$$a(J)H|E\rangle - Ha(J)|E\rangle = E_J a(J)|E\rangle \tag{5.7}$$

$$H\{a(J)|E\rangle\} = (E - E_J)\{a(J)|E\rangle\}. \tag{5.8}$$

In a similar manner, we get

$$H\{a^\dagger(J)|E\rangle\} = (E + E_J)\{a^\dagger(J)|E\rangle\}. \tag{5.9}$$

Since $a(J)$ acts as an annihilation operator, there must exist a state with minimum energy due to relation (5.6). Thus

$$a(J)|E_{\min}\rangle = 0. \tag{5.10}$$

Beyond this, we cannot lower our energy states further. This minimum energy state is known as vacuum state and can also be denoted by $|0\rangle$.

VI. GREEN'S FUNCTION

Green's function is fundamental in quantum field theory in studying the solutions of inhomogeneous differential equations where interaction between fields or particles takes place. The simplest case of Klein-Gordon field with an external source $J(\theta)$ is

$$(L_\mu L^\mu + m_0^2)\phi(\theta) = J(\theta) \tag{6.1}$$

and the corresponding Lagrangian is given by

$$\mathcal{L} = \frac{1}{2}L_\mu\phi L^\mu\phi - \frac{m_0^2}{2}\phi^2 + J\phi. \tag{6.2}$$

The Green's function for a given inhomogeneous equation is defined as the solution of the equation with a delta source. Therefore, for Klein-Gordon equation, we have

$$(L_\mu L^\mu + m_0^2)G(\theta - \tilde{\theta}) = -\delta^4(\theta - \tilde{\theta}). \tag{6.3}$$

If $G(\theta - \tilde{\theta})$ is known, then we can write the solution of Eqn. (6.1) as

$$\phi(\theta) = - \int d^4\tilde{\theta} G(\theta - \tilde{\theta})J(\tilde{\theta}) \tag{6.4}$$

then

$$(L_\mu L^\mu + m_0^2)\phi(\theta) = - \int d^4\tilde{\theta} (L_{\theta\mu}L^\mu_{\tilde{\theta}} + m_0^2)G(\theta - \tilde{\theta})J(\tilde{\theta}) \tag{6.5}$$

$$\begin{aligned} &= - \int d^4\tilde{\theta} (-\delta^4(\theta - \tilde{\theta}))J(\tilde{\theta}) \\ &= J(\theta). \end{aligned} \tag{6.6}$$

$$(6.7)$$

If we Fourier transform the functions, it would turn the above partial differential equation into an algebraic equation. Therefore, define

$$\delta^4(\theta - \tilde{\theta}) = \frac{1}{(2\pi)^4} \int d^4J e^{-iJ(\theta - \tilde{\theta})} \tag{6.8}$$

and

$$G(\theta - \tilde{\theta}) = \frac{d^4J}{(2\pi)^4} \int e^{-iJ(\theta - \tilde{\theta})} \hat{G}(J). \tag{6.9}$$

Substituting above values in Eqn. (6.3), we get

$$\hat{G}(J) = \frac{1}{J^2 - m_0^2}. \tag{6.10}$$

Thus

$$G(\theta - \tilde{\theta}) = \frac{d^4J}{(2\pi)^4} \int \frac{e^{-iJ(\theta - \tilde{\theta})}}{J^2 - m_0^2}. \tag{6.11}$$

Note that the above Green's function has poles at $J^0 = \pm E_J$. This poles can be removed using advanced Green's function. We would not go into details as it is not the aim of our paper, although, readers can refer to [8] (pg. 194) to make themselves familiarise with the advanced Green's function corresponding to the Cartesian Klein-Gordon equation

VII. COMPLEX KLEIN-GORDON FIELD EQUATION

In complex Klein-Gordon field theory on $R \times S^3$ topology, we have

$$(L_\mu L^\mu + m_0^2)\phi(\theta) = 0 \tag{7.1}$$

$$(L_\mu L^\mu + m_0^2)\phi^\dagger(\theta) = 0 \tag{7.2}$$

where $\phi(\theta) \neq \phi^\dagger(\theta)$. We can express $\phi(\theta)$ and $\phi^\dagger(\theta)$ in terms of two distinct spin zero scalar fields $\phi_1(\theta)$ and $\phi_2(\theta)$ which are hermitian. Thus

$$\phi(\theta) = \frac{1}{\sqrt{2}}(\phi_1(\theta) + i\phi_2(\theta)) \tag{7.3}$$

$$\phi^\dagger(\theta) = \frac{1}{\sqrt{2}}(\phi_1(\theta) - i\phi_2(\theta)). \tag{7.4}$$

Inverting the above relations yields

$$\phi_1(\theta) = \frac{1}{\sqrt{2}}(\phi(\theta) + \phi^\dagger(\theta)) \tag{7.5}$$

$$\phi_2(\theta) = \frac{-i}{\sqrt{2}}(\phi(\theta) - \phi^\dagger(\theta)). \tag{7.6}$$

We can now express Eqn. (7.1) and (7.2) in terms of $\phi_1(\theta)$ and $\phi_2(\theta)$ to get

$$(L_\mu L^\mu + m_0^2)\phi_1(\theta) = 0 \tag{7.7}$$

$$(L_\mu L^\mu + m_0^2)\phi_2(\theta) = 0. \tag{7.8}$$

Corresponding Lagrangian from which we can derive the above equations of motion is

$$\mathcal{L} = \frac{1}{2}L_\mu\phi_1L^\mu\phi_1 + \frac{1}{2}L_\mu\phi_2L^\mu\phi_2 - \frac{m_0^2}{2}(\phi_1^2 + \phi_2^2) \tag{7.9}$$

$$= \frac{1}{2}L_\mu\phi^\dagger L^\mu\phi - m_0^2\phi^\dagger\phi. \tag{7.10}$$

If we write solutions in terms of $\phi_1(\theta)$ and $\phi_2(\theta)$ the we can define the conjugate momenta as

$$\Pi_i(\theta) = \frac{\partial\mathcal{L}}{\partial\dot{\phi}_i(\theta)} = \dot{\phi}_i(\theta) \tag{7.11}$$

where $i = 1, 2$. Commutation relations can be given by

$$\{\phi_i(\theta), \phi_j(\tilde{\theta})\}_{\theta^0=\tilde{\theta}^0} = \{\Pi_i(\theta), \Pi_j(\tilde{\theta})\}_{\theta^0=\tilde{\theta}^0} = 0 \tag{7.12}$$

$$\{\phi_i(\theta), \Pi_j(\tilde{\theta})\}_{\theta^0=\tilde{\theta}^0} = i\delta_{ij}\delta^3(\theta - \tilde{\theta}). \tag{7.13}$$

And finally, the Hamiltonian can be given by

$$\mathcal{H} = \sum_i (\Pi_i\phi_i) - \mathcal{L} \tag{7.14}$$

$$= \sum_i \left(\frac{1}{2}\Pi_i^2 + \frac{1}{2}L_\mu\phi_i \cdot L_\mu\phi_i + \frac{m_0^2}{2}\phi_i^2 \right). \tag{7.15}$$

Now, on the other hand, if we write our solution in terms of ϕ and ϕ^\dagger , we can define conjugate momenta as follow:

$$\Pi(\theta) = \frac{\partial\mathcal{L}}{\partial\dot{\phi}^\dagger(\theta)} = \dot{\phi}(\theta) = \frac{1}{\sqrt{2}}(\dot{\phi}_1(\theta) + i\dot{\phi}_2(\theta)) = \frac{1}{\sqrt{2}}(\Pi_1(\theta) + i\Pi_2(\theta)) \tag{7.16}$$

$$\Pi^\dagger(\theta) = \frac{\partial\mathcal{L}}{\partial\dot{\phi}(\theta)} = \dot{\phi}^\dagger(\theta) = \frac{1}{\sqrt{2}}(\dot{\phi}_1(\theta) - i\dot{\phi}_2(\theta)) = \frac{1}{\sqrt{2}}(\Pi_1(\theta) - i\Pi_2(\theta)). \tag{7.17}$$

Equal time commutation relations are given by

$$[\phi(\theta), \phi(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} = [\phi(\theta), \phi^\dagger(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} = [\phi^\dagger(\theta), \phi^\dagger(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} = 0 \tag{7.18}$$

$$[\Pi(\theta), \Pi(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} = [\Pi(\theta), \Pi^\dagger(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} = [\Pi^\dagger(\theta), \Pi^\dagger(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} = 0 \tag{7.19}$$

$$[\phi(\theta), \Pi^\dagger(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} = [\phi^\dagger(\theta), \Pi(\tilde{\theta})]_{\theta^0=\tilde{\theta}^0} = i\delta^3(\theta - \tilde{\theta}). \tag{7.20}$$

Using (7.10), we can write the Hamiltonian density as

$$\mathcal{H} = \Pi\dot{\phi}^\dagger + \Pi^\dagger\dot{\phi} - \mathcal{L} \tag{7.21}$$

$$= \Pi^\dagger\Pi + L_\mu\phi^\dagger \cdot L_\mu\phi + m_0^2\phi^\dagger\phi \tag{7.22}$$

and thus

$$H = \int d^3\theta (\Pi^\dagger\Pi + L_\mu\phi^\dagger \cdot L_\mu\phi + m_0^2\phi^\dagger\phi) \tag{7.23}$$

Solutions of Eqn. (7.1) and (7.2) can be given as

$$\phi_i(\theta) = \int \frac{d^3J}{\sqrt{(2\pi)^3 2J^0}} \left(e^{-ij.\theta} a_i(J) + e^{ij.\theta} a_i^\dagger(J) \right). \tag{7.24}$$

Similarly, the solutions of Eqn. (7.1) and (7.2) can be given by

$$\phi(\theta) = \int \frac{d^3J}{\sqrt{(2\pi)^3 2J^0}} \left(e^{-ij.\theta} a(J) + e^{ij.\theta} b^\dagger(J) \right) \tag{7.25}$$

$$\phi^\dagger(\theta) = \int \frac{d^3J}{\sqrt{(2\pi)^3 2J^0}} \left(e^{-ij.\theta} b(J) + e^{ij.\theta} a^\dagger(J) \right) \tag{7.26}$$

where

$$a(J) = \frac{1}{\sqrt{2}} (a_1(J) + ia_2(J)) \tag{7.27}$$

$$b(J) = \frac{1}{\sqrt{2}} (a_1(J) - ia_2(J)) \tag{7.28}$$

Commutation relations for annihilation and creation operators can be given as

$$[a_i(J), a_j^\dagger(J')] = \delta_{ij} \delta^3(J - J') \tag{7.29}$$

$$[a(J), a^\dagger(J')] = [b(J), b^\dagger(J')] = \delta^3(J - J'). \tag{7.30}$$

All other commutation relations are zero.

VIII. CONCLUSION

In this paper, we have established $R \times S^3$ Klein-Gordon field theory for both complex and scalar fields. Furthermore, corresponding Hamiltonian and commutation relations within operators are derived. This approach to Klein-Gordon field theory will be important in the problems with angular dependence instead of Mikowskian distance. An example of such problem with angular dependence can be found in the beginning of [7].

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Cite this article as :

Omprakash Atale, "Quantization of $R \times S^3$ Topological Klein-Gordon Field Theory", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 206-217, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229136> Journal URL : <https://ijsrst.com/IJSRST229136>

Review on MRR in Spark Erosion Machining (SEM) Through ANN

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ABSTRACT

EDM is a modern machining technology used to machine hard material pieces that are difficult to produce using traditional machining methods. This article aims to optimize process factors to obtain maximum MRR and high surface integrity in the end cut. Using artificial neural networks, this research proposes a technique for automatically determining and optimizing processing parameters in the EDM sinking process (ANN). The availability of machining data in the industrial tool room survey is the primary issue regarding adjusted process parameters for precision machining. Experiments are conducted to investigate the effect of pulse current, pulse on time, electrode area, and gap voltage on MRR response.

Keywords : Electricity fluctuation, operation, profitability, SMEs, Ghana.

Article Info

Volume 9, Issue 1

Page Number : 218-237

Publication Issue

January-February-2022

Article History

Accepted : 05 Feb 2022

Published : 11 Feb 2022

I. INTRODUCTION

Manufacturing industries are facing challenges from advanced difficult-to-machine materials, such as superalloys, ceramics, and composites, as well as stringent design requirements (high surface quality, high precision, high strength, complex shapes, high bending stiffness, good damping capacity, low thermal expansion, and better fatigue characteristics) and machining costs in this technological era. In recent years, there has been a rising tendency toward the usage of lightweight and compact mechanical components; as a result, there has been an increased interest in advanced materials in modern-day industries. Electric discharge machining is a novel manufacturing technique based on the electrothermal phenomena of material degradation. In the presence of dielectric fluid, a succession of discrete sparks between the tool electrode and the workpiece

removes the material. Because the tool does not contact the workpiece, the surface texture is devoid of tensions and cutting force imprints. EDM is ideal for machining forging dies, injection molds, and automotive components.

The solution may be avoided, and the training pace can be increased. The experiment demonstrated that using mirror processing conditions provided by the above approach will result in good small-area mirror processing outcomes and the necessary processing precision and efficiency. Trias Andromeda, AzliYahya, Nor Hisham, Kamal Khalil, and Ade Erawan present a prediction of Material Removal Rate (MRR) in Electrical Discharge Machining (EDM) using Artificial Neural Network for High Igap current in their research paper Predicting Material Removal Rate of Electrical Discharge Machining (EDM) using Artificial Neural Network for High Igap current (ANN). Die sinking EDM process data for copper-

electrode, and steel workpieces were collected. The goal is to create a behavioral model based on an input-output pattern of raw data from the EDM process trial. The behavioral model is used to forecast MRR, compared to the actual MRR number. The results demonstrate a high degree of agreement in forecasting MRR.

Markopoulos, Angelos P. In this study, Artificial Neural Networks (ANNs) models for predicting surface roughness in Electrical Discharge Machining are developed (EDM). Two well-known programs, Matlab with accompanying toolboxes and Netlab, were used for this purpose. The models were trained using data from many EDM tests on steel grades; the suggested models employ the pulse current, pulse length, and processed material as input parameters. The findings show that the proposed ANNs models can accurately predict surface roughness in EDM. Furthermore, they might be essential instruments for EDM Machining process planning. The ability to create complicated geometries and detailed designs with great precision, particularly when combined with CNC, makes it more precise and superior to any other machining technology. Despite all of these advantages, the EDM machine has certain disadvantages. One of the most prevalent difficulties that waste time is the removal or erosion of electrode material from the electrode. As we all know, the EDM process works by eroding the material or workpiece caused by the spark formed between the electrode's surface and the workpiece. Thus, the MRR is defined as the ratio of the weight difference between the workpiece before and after machining to the machining time and material density. The material removal rate impacts both the machining rate and the rate of tool electrode wear. MRR is the better-the-higher performance metric. The goal of this research is to acquire and analyze optimum parameters such as pulse on current (I_p), pulse on time (T_{on}), and gap voltage (V_o) that determine the output parameter Metal Removal Rate (MRR), and

therefore perform screening using Artificial Neural Networks. The following goals are given below -

- To simulate the material removal rate of the EDM machining process under optimal conditions.
- Research of a contemporary mathematical tool, the Artificial Neural Network.
- Machine parameters to provide a carbon-free surface. MRR optimization in relation to the depth of cut. Suggest an ANN model for process optimization and validation.

The new manufacturing model employs unconventional energy sources such as sound, light, mechanical, chemical, electrical, electrons, and ions. The machining techniques are unconventional because they do not use standard metal removal tools and instead rely on alternative types of energy. EDM has been utilised to create sophisticated materials with the desired form, size, and precision in recent years. EDM is a non-traditional machining technology that uses carefully controlled sparks between an electrode and a workpiece in the presence of dielectric fluid to manufacture electrically conductive materials. It employs thermoelectric energy sources to machine exceedingly poor machinability materials; its unique features include sophisticated intrinsic-extrinsic shaped tasks independent of hardness. One of the primary benefits of the EDM method is the ability to machine any electrically conductive material, regardless of hardness, using heat energy. EDM eliminates mechanical strains, chatter, and vibration difficulties during machining since it does not make direct contact (an inter-electrode gap is maintained throughout the operation) between the electrode and the workpiece. There are other types of EDM processes available. Still, this article is concerned with die Sinking (also called ram) type EDM machines. Numerous input machining parameters can be wide-ranging in the EDM process and have diverse impacts on the EDM performance characteristics. EDM has gradually replaced traditional machining techniques

and is now a well-established machining solution in many manufacturing industries worldwide. Modern EDM, which was created in the late 1940s, is now widely acknowledged as a standard production method worldwide. Sir Joseph Priestley, an English scientist, uncovered the history of EDM methods. It took more than a century to put some practical applications to use. In the previous sixty years, the popularity of this machining has expanded by leaps and bounds.

1.1 Types of EDM

There are three different types of EDM

- Die Sinking EDM
- Micro Electro Discharge Machining (MEDM)
- Wire Electro Discharge Machining (WEDM)

a. **Die Sinking EDM:** The most fundamental is EDM, a non-contact machining method in which metal is removed by a sequence of regular electrical discharges between a tool-workpiece submerged in an insulating liquid and coupled to a suitable power source. Figure 1.1 depicts a schematic representation of such a machine. For cutting poor machinability materials, it employs thermoelectric energy sources.

b. **WEDM:** It employs a thin single-strand metal wire (diameter 0.1 mm, often made of steel, brass, or copper) that cuts the workpiece during the operation. Deionized water is utilized as a dielectric, immediately pumped around the wire while filters and de-ionizer devices regulate its resistivity and other electrical characteristics. As a result, WEDM is frequently employed when minimal residual stresses are sought. In WEDM applications, the wire functions nearly like an electrical saw, with the ability to achieve very narrowly cutting angles. The machining quality, i.e., accuracy and surface rugosity, is closely connected to the discharge parameters (current, voltage, discharge time, polarity) and dielectric

cleanliness. Sparks with low current form little craters: the surface rugosity is modest, but so is the clearance rate.

- c. **MEDM** is a powerful bulk micromachining method that produces complex 3-D features with high-precision positioning steps. It applies to all metals and alloys and any electrical conductor. MEDM's distinct characteristics and large material base have led to the technique used in industrial applications such as micro-mechanical tooling, ink-jet nozzle fabrication, and micro-machining of magnetic heads for digital VCRs. MEDM was initially used to create microscopic holes in metal foils, but it is now employed in various applications.

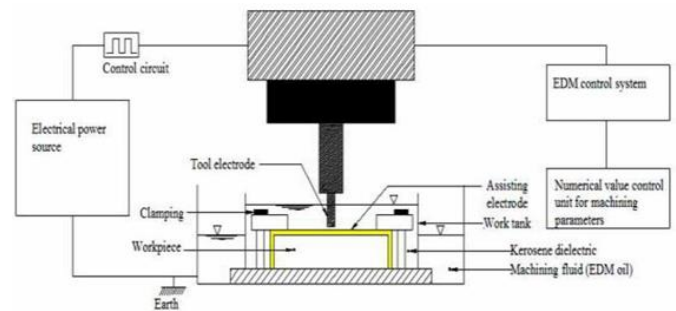


Figure 1.1 : EDM Schematic

1.2 Equipment of EDM

- **Dielectric system:** Dielectric fluid, delivery device, pumps, and filters comprise the dielectric system. Material removal in EDM is primarily caused by thermal evaporation and melting, which must be performed without oxygen to regulate the process and avoid oxidation. As a result, the dielectric system must provide an oxygen-free machining environment.
- **Electrode:** It is the instrument that determines the geometry of the created cavity. The material and design determine it. Selection criteria include: being widely accessible, easily machinable, having minimal wear, being electrically conductive, and having a good surface quality. The following electrode materials are frequently used in industry:

- Graphite
- Electrolytic oxygen-free copper
- Tellurium copper 99% Cu + 0.5% tellurium
- Brass

iii. Servo System: It is commanded by signals from the gap voltage sensor system in the power supply and regulates the electrode or workpiece in-feed to match material removal.

iv. Power Supply converts the alternating current from the main utility electrical supply to the pulse D.C. needed to generate spark discharges at the machining gap.

1.3 Working Principle of EDM

Figure 1.2: (a) Pre-breakdown phase (b) Breakdown phase (c) Discharge phase (d) End of the discharge and (e) Post-discharge phase

The essence of the EDM process is the conversion of electrical energy into heat energy via a succession of discrete sparks that occur between the tool electrode and a conductive workpiece submerged in a dielectric medium and separated by a tiny gap. Short-duration discharges are created in a liquid dielectric gap that separates the tool and the workpiece. Electrical energy is required to develop the electrical spark, and heat energy is used to remove the material in this process. The electrode is brought closer to the workpiece until the gap is narrow enough to ionize the dielectric. The dielectric flush eroded particles from the gap, and it is critical to keep this flushing going indefinitely. Because the workpiece is held in position by the fixture arrangement, the tool aids in concentrating the discharge or intensity of produced heat at the location of shape disclosure. Heat elevates the temperature of the workpiece in the region of tool position, melting and evaporating the metal. The machining process eliminates tiny quantities of workpiece material through the mechanism of melting and vaporization during a discharge. The erosion process in EDM is commonly divided into the following phases, depicted in Fig. 1.2.

i. Pre-breakdown: During this phase, the electrodes are kept at a small distance apart, with the electrode moving close to the workpiece and a large potential difference applied between the electrodes.

ii. Breakdown: The dielectric breakdown occurs when the applied voltage exceeds the strength limit of the utilized dielectric fluid. The breakdown site is usually between the electrode and the workpiece, but it can also be caused by conductive particles or debris in the gap. When a breakdown occurs, the voltage drops, and the current rapidly increases. During this phase, the dielectric becomes ionized, resulting in a plasma channel between the electrodes.

iii. Discharge: During this phase, the discharge current is kept constant to allow for a continuous attack of ions and electrons on the electrodes, resulting in high heating of the workpiece material and a temperature rise of between 8,000 C and 12,000 C. This quickly leads to the formation of a tiny molten metal puddle at the surface of the electrodes. Due to the great heat, a small amount of metal is also instantaneously evaporated. The plasma channel extends during this phase; hence the radius of the molten metal pool grows with time. Throughout the discharge process, the Inter Electrode Gap is a critical metric.

iv. End of the discharge: During this phase, the current and voltage supplies are turned off, causing the plasma to collapse under the pressure exerted by the surrounding dielectric.

v. Post-discharge: There will be no plasma during this period. Because the plasma is contracting and cooling, a little part of the metal will be machined, and a slight thin coating (white layer) will be deposited. As a result, the molten metal pool is sucked up into the dielectric, leaving a small crater on the workpiece surface.

Finally, the machining process eliminates tiny volumes of workpiece material that become molten or vaporized after a discharge and is taken away from the inter-electrode gap in the form of debris by the

dielectric flow. After material removal at the point of spark, the gap widens, and the position of the next spark changes to a new location on the workpiece surface where the gap is lowest. According to the inter-electrode gap, thousands of sparks erupt at different locations throughout the whole surface of the workpiece. As a result, a workpiece duplicate of the tool surface form is created.

1.4 EDM Process Parameters

Because of the differences in design, each EDM machine has a unique set of parameters. It is necessary to identify essential process factors that determine the reactions listed below to execute effective machining. The machine defines the entire collection of settings. The machining parameters are classified as follows: Input /process parameters: Voltage (V), discharge current (I_p), pulse-on time (T_{on}), pulse-off time (T_{off}), duty factor (τ), flushing pressure (F_p), workpiece material, tool material, inter-electrode gap (IEG), Lift Time (T_{up}), Work Time (T_w), and polarity (p) are the parameters that affect the machining process's performance.

- i. Gap Voltage: The voltage of applied pulses that determines the spark energy is specified by open-circuit voltage. Before current flow, this deionizes the dielectric medium, dependent on the electrode gap and dielectric strength.
- ii. Pulse-on time: The amount of time that real machining takes place or the amount of time that electricity is permitted to flow every cycle. The longer the pulse length, the greater the spark energy, which causes broader and deeper crevices. This is because the amount of material removed is proportional to the amount of energy delivered on time. The gap state determines the lengths of the ignition delay and discharge duration during pulse duration. Pulse duration and discharge current assess the energy created during a single electrical discharge.
- iii. Discharge current: The current rises until it reaches a certain level, denoted as discharge current.

The number of power units connected parallel to the gap is generally determined by the discharge current on static pulse generators. The higher the power intensity during electrical discharge, the greater the discharge current. It is the essential EDM machining characteristic related to power consumption when milling.

- iv. The effective area of electrode: The effective tool area is the area eroded by the tool surface comparable to the tool area of the blind cavity. The tool area's influence is inversely proportional to the MRR. As a result, a cavity with a smaller electrode area will result in a greater depth of cut.
- v. Duty cycle: It is the proportion of on-time to total pulse period. With a higher duty cycle, the spark energy is delivered for a longer length of the pulse period, resulting in greater machining efficiency.
- vi. Pulse-off time: The amount of time between sparks during which the supply voltage is switched off, causing the discharge current to drop to zero. During this period, the molten material solidifies and is washed out of the arc gap. This is setting influences the cut's speed and stability. As a result, if the cut-off period is too short, it will result in unsteady sparks.
- vii. Polarity: It describes the potential of the workpiece concerning the tool; depending on the application, the polarity might be either positive or negative. Carbide, Titanium, and copper are commonly cut using a negative polarity.
- viii. Inter Electrode Gap: The distance between the electrode and the component is during the EDM process. It's also known as a spark gap. It is one of the most critical needs for spark stability and flushing. The average gap voltage can estimate gap width, which is not directly measured. The tool servo mechanism is in charge of keeping the working gap at a constant value.
- ix. Dielectric fluid: The dielectric fluid serves as an electrical insulator in the EDM for the most critical reasons. Paraffin, deionized water, light transformer oil, and kerosene are the most utilized dielectric fluids. It cools the electrodes, creates a high plasma pressure

and a strong removal force on the molten metal, and aids in flushing these eroded particles away.

x. Flushing pressure: Flushing is the process of introducing clean, filtered dielectric fluid into the machining zone in EDM. If the cavity is deeper, the flushing becomes more difficult; ineffective flushing may cause arcing and the formation of undesired cavities, which can ruin the workpiece. There are numerous ways for flushing the gap that is often used: injection flushing, suction flushing, side-flushing, motion flushing, and impulse flushing. The typical pressure range is between 0.1 and 0.4 kg/cm².

xi. Lift time: It is the time when the tool is lifted, and the Inter Electrode Gap is flushed.

II. METHODOLOGY

2.1 Procedural Steps

- Referring research paper to know the most influential parameters of EDM.
- Understanding and forming optimal sets and combinations of input parameters.
- Collecting experimental data for developing neural network model.
- Understanding and developing ANN model with the best suitable algorithm.
- Collecting experimental data for validation and prediction purposes for the developed ANN model.

Figure 2.1: Procedural Steps

2.2 APPLICATION OF ARTIFICIAL NEURAL NETWORK TO PREDICT MRR OF EDM

In the past two decades, neural networks have been highly flexible modeling tools to learn the mathematical mapping between input and output variables for nonlinear systems. An artificial Neural Network (ANN) is an algorithm that imitates human beings' biological nervous systems. It has certain performance characteristics in common with biological neural networks. It comprises a huge

number of highly linked processing components (neurons) that work together to solve issues. ANNs, like humans, learn by doing. An ANN is trained for a specific application through a learning process, such as pattern recognition or data categorization. In biological systems, learning entails changes to the synaptic connections between neurons. The main objective is to model the EDM process for optimum operation representing a particular problem in the manufacturing environment where defining the optimization objective function using a smooth, continuous mathematical formula is impossible.

2.3 TRAINING THE EXPERIMENTAL DATA FOR ANN

Experiments were conducted to gather data for training or learning for neural network purposes. The training data set includes many cases, each containing values for a range of input and output variables. The first decisions will be needed: which variables to use and how many (and which) cases to gather. The choice of variables (at least initially) is guided by intuition. The researcher's expertise in the problem domain will give some ideas of which input variables are likely to be influential. The EDM process was conducted using copper electrode and steel workpiece materials. Experimental results of the material removal rate were recorded and presented in tabular form. The gap voltage V_{gap} falls to about 30V, 35V, 40V, and 45V, and the gap current rises to a selected constant value. The gap currents were selected at 3A, 5A, 7A, and 10A. A value for the material removal rate constant has been identified based on the empirical Analysis carried out on the experimental data and compared with the simulation result from the model using the Matlab software tool.

2.4 Collecting experimental data for validation and prediction purposes for the developed ANN model.

Although, the network successfully derived the complex relationship between the input values and MRR of the EDM process. After successful network training, it is expected to have mapped the desired relationship between the various input and output parameters. The network should also generalize this relationship for its application for new problems. The validation can be concluded that there is good agreement between network predicted and experimental results. Hence, it can be concluded that this ANN model serves as a good model for predicting MRR.



Figure 2.2: Flow Chart of ANN Architecture

III. EXPERIMENTAL SETUP

This chapter discusses the project's experimental setup. In this chapter, light is thrown on various aspects such as the machines used, their specifications, materials used for the experimentation, the laboratory

used, etc. This chapter gives the importance of the various machines used and their applications. This chapter also enlightens the composition and various properties of the material used in the experimentation. Besides the main experimental setup, other machines and tools were used to complete the experiment.

3.1 Laboratory used

Table 3.1: List of the laboratory and machines used

Sr. no Laboratory Machine

1. Workshop Electric Discharge Machine Automatic hack saw Grinder
2. Metallurgy lab Rockwell Hardness tester

3.2 Machines used

The various machines used in this project are as follows

3.2.1 Electric discharge machine

This machine is the soul of this project. All the experimentation of the project is carried out on this machine. It works on the principle of spark erosion, as discussed earlier. Figure 6.1 shows the actual setup of the electric discharge machine (EDM).

The specifications of the electric discharge machine (EDM) are given in table 6.2. The EDM machine is a non-conventional type of machine which finds its applications in mold-making industries.

Table No. 3.2:EDM Machine Technical Specification:

Size of Machine	Length X Width X Height	1250 X 1800 X 1100 mm
Work Head	Travel of the Quill	150 mm
Technical Data		
Co-ordinate Table	Mounting Surface(Length x Width)	400 X 250 mm
	Maximum Workpiece Height :	200mm
	Maximum Workpiece Weight:	200Kg
	Longitudinal Travel (X-Axis)	240mm
	Transverse Travel (Y-Axis)	150mm
	Maximum Table-Z-slide spindle distance universal axis:	325mm
	Minimum Table-Z-slide spindle distance universal axis	150mm
Work tank size	Length X Width X Height	685 X 445 X 290mm
	Motor Specification	0.5HP, 0.37KW,
		415V, 3 Ph, 50 Hz

3.3.1 Workpiece material

D2 steel is a high-carbon, high-chromium tool steel that hardens in the air. It is very worn and abrasion-resistant. It is heat treatable, with a hardness range of 55-62 HRC, and is machinable in the annealed state.

When adequately hardened, D2 steel exhibits low deformation. Because of its high chromium content, D2 steel has mild corrosion resistance when hardened.

Table No. 6.3: Thermal Properties for Cu.

Sr. No.	Properties	Values
1	Thermal conductivity	386 (W/m K)
2	Specific Heat	0.383 (J/gm K)
3	Latent heat of Melting	133 (J/gm)
4	Latent heat of Vaporization	5066 (J/gm)
5	Melting Temp.	1063(°C)
6	Boiling Temp.	2562(°C)

6.3.2 Tool electrode material

Copper is the most commonly used EDM tool material against En31 as workpiece material. Copper is selected as the tool material. A square tool was taken for experiments. Figure 6.3 shows the actual tool electrode with their cross-section, and table 6.4 consists of properties and dimensions of the copper electrode, respectively.



Figure 6.3 : Square Tool

6.3.3 Dielectric Fluid

In EDM, the dielectric fluid provides three essential functions.

- To insulate the gap between the inter-electrodes.
- To remove debris from the machined area.
- Serves as a coolant to aid in heat conduction between the electrodes

Table No. 6.5 : Properties of EDM Oil.

Sr. No.	Property	Value
1	Viscosity	15.4*10 ⁻⁶ (m ² /s)
2	Thermal Diffusivity	70.7*10 ⁻⁹ (m ² /s)
3	Thermal Conductivity	0.110 (W/m K)

EDM EXPERIMENTATION -

A. The trials were carried out using a die-sinking EDM machine of Electronica E-20 with a pulse generator. Under jet flushing, the dielectric fluid pressure is 3.1kgf/cm². The experimental workpiece material is AISI D2 alloy steel, employed in the inner core and parts of cold-work dies and molds. Furthermore, the copper tool is chosen in a prismatic shape with a transverse area of 15mm 15mm and a height of 50mm. As tool electrodes, copper rods with 98 percent purity and 8.94 g/cc density were machined with an excellent surface polish and accurate dimensions. Copper electrodes and workpieces were meticulously honed to ensure stable machining conditions throughout the EDM process.

B. Design of Experiments –

A sequential incremental design method was used. The type of variation in response to a given factor aids in determining the factor's levels. Though there are many parameters involved in the EDM process, the level of the generator current pulse intensity (Ip), pulse time (Ton), and gap voltage (Vg) have been taken into account as design elements in this study. Table 1 shows the parameter levels that correspond to each other.

Table 1: Machining parameters with levels

Symbol	EDM machining parameters and levels	Levels			
		1	2	3	4
Ip	Pulse Current (amps)	3	5	7	10
Ton	Pulse-on Time (sec)	0.11	0.17	0.29	0.38
Vg	Gap Voltage (volt)	130	135	140	145
Ae	Gap Voltage (volt)	L10 x W10	L15 x W15	L17 x W17	L20 x W20

C. Response Variable –

MRR The content MRR is defined as the ratio of the weight difference between the workpiece before and after machining to the machining time and material density. The material removal rate impacts both the machining rate and the rate of tool electrode wear. MRR is the better-the-higher performance metric. It is commonly represented in millimeters of water per minute (mm³/min).

D. Artificial Neural Network (ANN)

An artificial network comprises a collection of small processing units that communicate with one another by delivering signals via a large number of weighted links. Using the program MATLAB, a variety of ANN models were trained to simulate the performance characteristics of the EDM process. ANN designs, learning/training procedures, and the number of hidden neurons are frequently modified to produce an improved prediction model, but the adjustments are performed at random. So, a sequential incremental design was used for the experiment design to attain the best of the above for modeling and solution. The data collection is separated into three sections in the ratio 1/2: 1/4: 1/4. With 1/2 of the data used for training, 1/4 for testing, and 1/4 for validation of the network

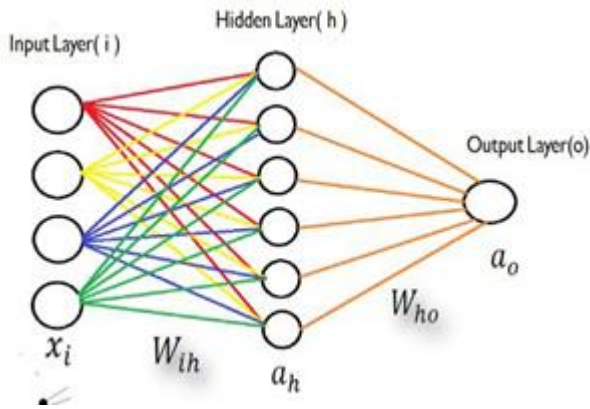
chosen at random by MATLAB's nntool. In this paper, Md. Ashikur Rahman Khana discusses how modeling may aid in the development of a better knowledge of such complicated processes, reduce machining time, and make the process more cost-effective. As a result, the current study focuses on creating an artificial neural network (ANN) model.

IV. RESULTS AND ANALYSIS

Table 2 displays the experimental data for surface roughness in finish cut machining for AISI D2. The factors studied in the tests include current intensity (I_p), pulse on time (T_{on}), and gap voltage (V_g), and the behavior of each parameter has a substantial impact on surface roughness. Table 2 shows the results of the experiment

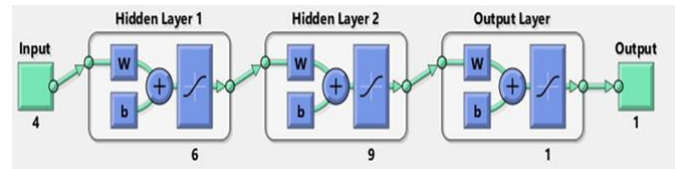
Table 2: Experimental Output

S. No.	I_p (amp)	T_{on} (sec)	V_g (volt)	A_e (mm ²)	MRR (mm ³ /min)
1	3	0.11	130	L10x W10	5.1948
2	3	0.17	135	L15x W15	7.4458
3	3	0.29	140	L17x W17	4.2424
4	3	0.38	145	L20x W20	6.0317
5	5	0.11	135	L17x W17	6.9062
6	5	0.17	130	L20x W20	4.2343
7	5	0.29	145	L10x W10	8.8311
8	5	0.38	140	L15x W15	10.505
9	7	0.11	140	L20x W20	3.3697
10	7	0.17	145	L17x W17	2.7705
11	7	0.29	130	L15x W15	1.6161
12	7	0.38	135	L10x W10	10.851
13	10	0.11	145	L15x W15	13.823
14	10	0.17	140	L10x W10	13.391
15	10	0.29	135	L20x W20	2.7417
16	10	0.38	130	L17x W17	6.5800



A. Training Neural Network Using Matlab

The sequential incremental technique was used to choose the optimal process parameter setting for ANN modeling. Gradient Descent with Momentum and Adaptive Learning Rate (GDX) training technique, 6 hidden neurons in first hidden layer, 9 neurons in the second hidden layer, and MLP neural architecture were chosen as ideal process parameters. Because this run's weights and bias matrix had the lowest MSE and highest R-value, they were used to simulate MRR. As a result, the architecture 4-6-9-1 was chosen and trained in Matlab using nntool.



B. The Analysis of MRR

Table 3 contains the values of the ANN output data for validation and comparison. R=0.96753 was discovered to be the correlation factor for all of the data. Figure 5 depicts the variation of MSE of training, validation, and testing data sets with respect to the epoch. The validation data set is used to halt the training process early to provide improved generalization. Figure 7.6 indicates that at epoch 453, the validation error is at its lowest.

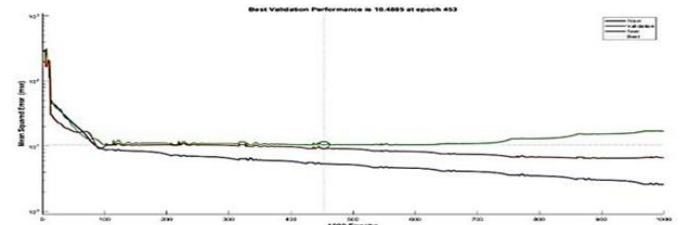


Figure 5: Variation of MSE w.r.t. epoch

Table 3: Experimental Output

S. No.	Ip amp	Ton sec	Vgvolt	Ae mm ²	MRR (mm ³ /min)
1	3	0.11	130	L10 x W10	5.16388 7
2	3	0.17	135	L15 x W15	7.42318 3
3	3	0.29	140	L17 x W17	6.97982 5
4	3	0.38	145	L20 X W20	5.03532
5	5	0.11	135	L17 X W17	7.88635 6
6	5	0.17	130	L20 x W20	5.61709 5
7	5	0.29	145	L10 x W10	8.70742 3

8	5	0.38	140	L15 x W15	9.67214 8
9	7	0.11	140	L20 x W20	2.74172 9
10	7	0.17	145	L17 x W17	2.74172 9
11	7	0.29	130	L15 x W15	3.52270 3
12	7	0.38	135	L10 x W10	12.9675 4
13	10	0.11	145	L15 x W15	18.9827 5
14	10	0.17	140	L10 x W10	16.2699 2
15	10	0.29	135	L20 x W20	4.17157 5
16	10	0.38	130	L17 x W17	8.59945 2

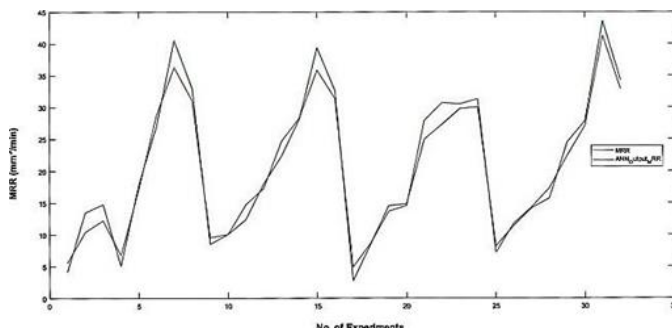


Figure 6: Comparison of Experimental output to ANN output

L20 x W20 and I_p for 3A to 4.5A (4-5) describes the fine cut machining region. The region enclosed for 5A till 7.5A (7-8) shows the transition from the fine machine cut to the rough cut machining. The cubic fitting polynomial has been used in the response surface plot of MRR, A_e , and I_p . The rough zone of the machining can be seen with the increase in current above 8A. Thus, a higher MRR can be obtained in the machine-prone region, compromising the surface finish of the work part.

A. Optimization and Comparison of MRR Responses

Cubic fit for MRR, A_e , and I_p

The surface plot (figure 6) for two variables simultaneously can be analyzed against MRR within the interval of finish cut to rough cut machining. The plot of MRR, A_e , and I_p the levels from L10 x W10 to

Cubic fit for MRR, I_p , and T_{on}

The surface plot (figure 7) for two variables simultaneously can be analyzed against MRR within the interval of finish cut to rough cut machining. In the plot of MRR, I_p , and T_{on} , the levels from 3A to 4.5A (4- 5) describe the fine cut machining region. The region enclosed for 5A till 7.5A (7-8) shows the transition from the fine

machine cut to the rough cut machining. The cubic fitting polynomial has been used in the response surface plot of MRR, I_p , and T_{on} . The variation of T_{on} as that compared to current is negligible. Thus, I_p is a dominant affecting MRR. The rough zone of the machining can be seen in the bright yellow zone with the increase in T_{on} above 290 μs and higher current values. Thus, a higher MRR can be achieved with an increase in T_{on} and increasing current in the machine-prone region, compromising the work part's surface finish.

Cubic fit for MRR, V_g , and T_{on}

The surface plot (figure 8) for two variables simultaneously can be analyzed against MRR within the interval of finish cut to rough cut machining. An inverse relationship between V_g and T_{on} in the plot of MRR, V_g , and T_{on} , an inverse relationship between V_g and T_{on} can be seen. Thus, the distinct observation for MRR keeping T_{on} as 110 μs can observe that with an increase in V_g , the steady transition from fine cut machining to rough machining zone. In contrast, for a higher value of T_{on} 380 μs (here), the transition from rough machining to a finish cut can be seen over the V_g range. The fine-cut zone of the machining can be seen in the dark blue region.

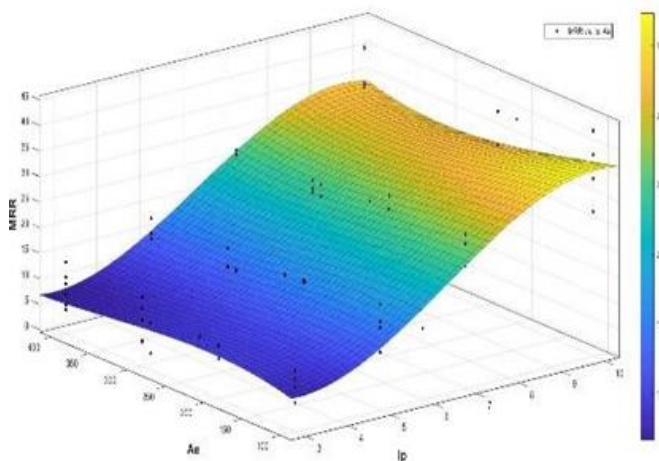


Figure 6: Cubic fit for MRR, I_p , and T_{on}

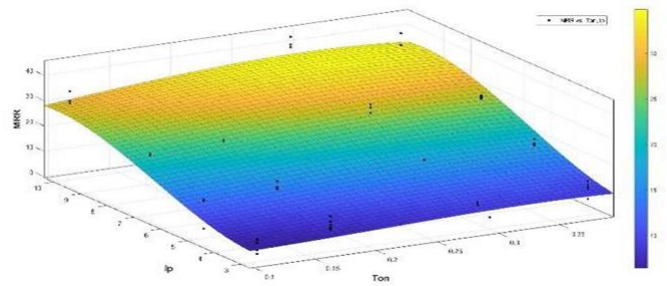


Figure 7: Cubic fit for MRR, I_p , and T_{on}

Figure 8: Cubic fit for MRR, V_g , and T_{on}

SURFACE TOPOGRAPHY

Surface topography is the study of geometrical features and spatial interactions and how component elements are interconnected or structured. Scanning electronic microscopy of the machined surface is used to analyze the surface topography of various samples. This chapter depicts the surface topography of the machined surface created on a D2 tool steel workpiece during EDM with a positive copper electrode for different discharge energies.

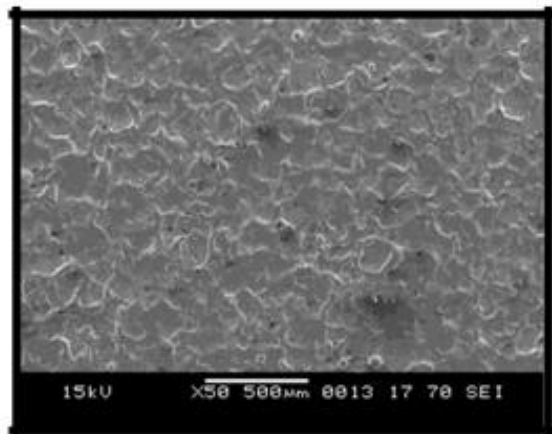
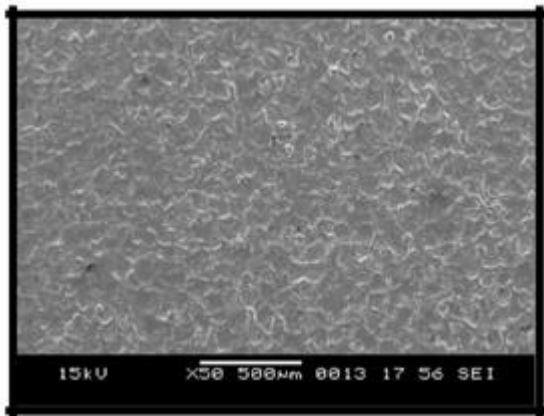
These figures show globules, craters, fissures, and tiny debris on the machined surface. The spark produced by the high-temperature plasma melts and vaporizes a tiny region of the workpiece surface, resulting in the formation of craters. The size of the crater is determined by the peak current and the discharge energy. At low peak current, small craters form. Less peak current and high frequency are associated with low material erosion, resulting in smaller craters.

Scanning electronic micrographs indicate the existence of fissures caused by the recast layer's solidification and/or quick cooling. Cracking is initiated by several surface defects in the recast layer created by the EDM process. The dielectric fluid rapidly cools the surface layer after the discharge and creates residual tensile tension. Cracks emerge when the residual tensile stress in the surface exceeds the material's ultimate tensile

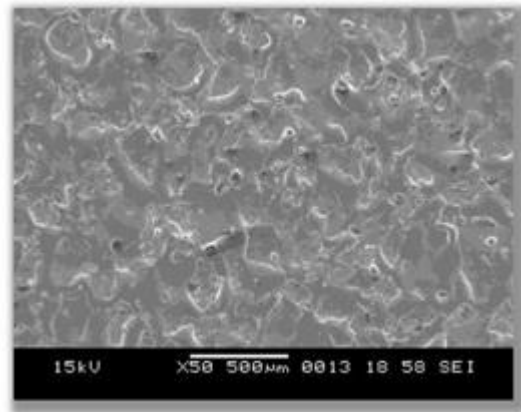
strength. Cracks do not form easily inside a thin recast layer because it dissipates heat quickly.

As a result, lesser discharge energy causes micro-cracks. Although most of the melted and vaporized material is flushed away by the dielectric after the pulse-on period, a tiny quantity of molten material is not ejected. After being rapidly cooled by the dielectric fluid, the unrepelled molten material resolidifies and produces globules of debris.

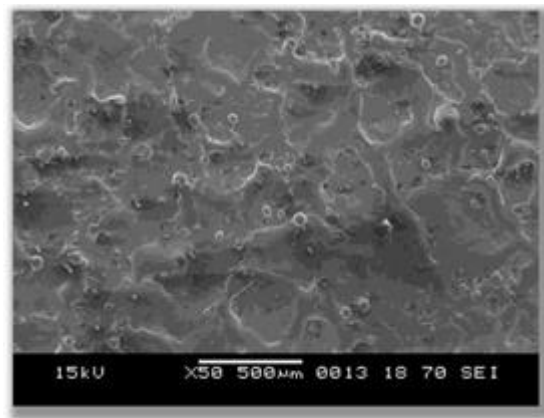
9.1 Variation of surface integrity concerning I_p (Images at x50 and 500 μm)



Low-Level Parameters



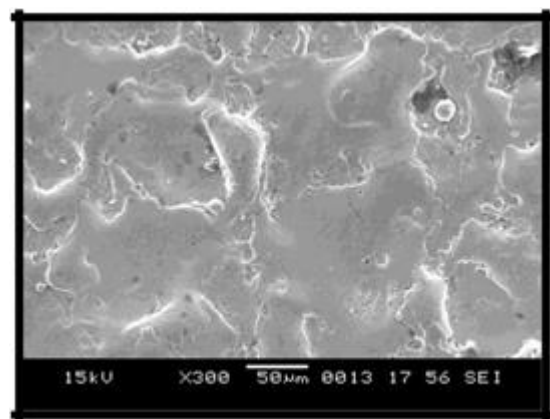
Img 9.1.13A

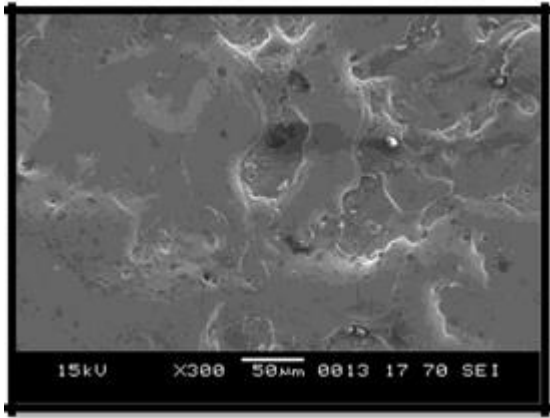


Img 9.1.2 5A

High-Level Parameters

Image 9.1.3 5A





Img 9.1.4 7A

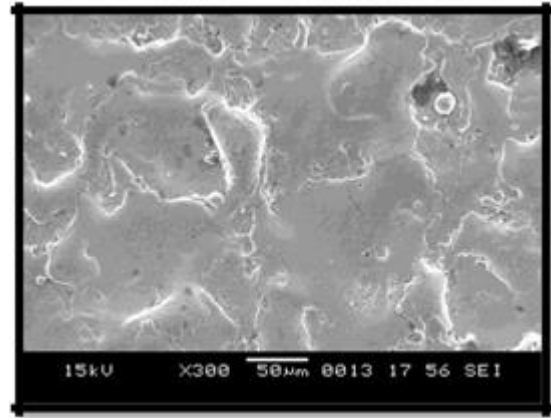
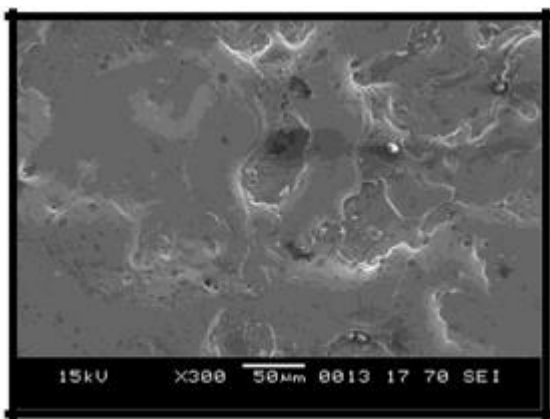
Discussion: As I_p increases, so does the discharge energy, which facilitates melting and vaporization of the workpiece material and creates larger and deeper craters, increasing surface roughness. The crater size grows larger with increasing current, and the surface texture gets rougher.

9.3 Variations of Cracks, Craters, and globules for different I_p and Ton

(Images at x300 and 50µm)

Low-Level Parameters

Img 9.3.1 3A



Img9.3.2. 5A

High-Level Parameters

Image 9.3.3. 5A

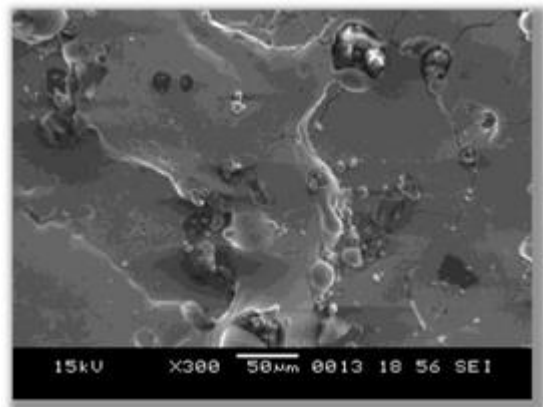
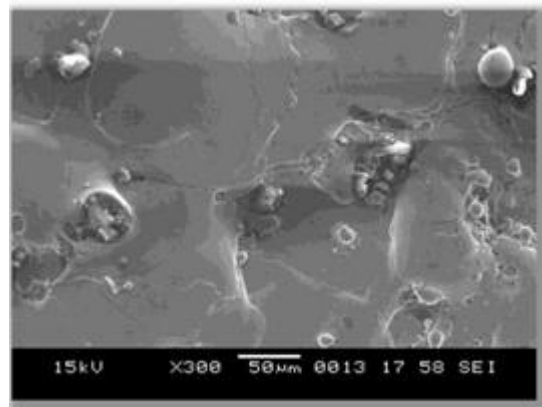


Image 9.3.4. 7A



Discussion: The discharge energy rises as the Ton increases. More craters are formed due to the increased discharge energy, which accelerates material degradation. As a result, as the Ton increases, the surface roughness does. However, a too-long Ton generates arcing and minimizes material erosion. Because of the expansion of the

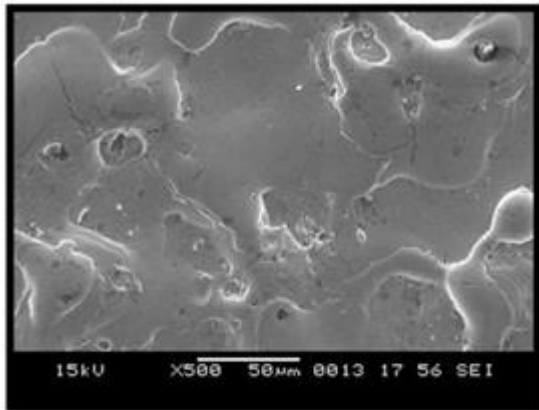
discharge column at a longer Ton, the energy density inside the discharge point is lowered. As a result, tiny craters are formed at too long Ton. As a result, a decreasing propensity to overly long Ton (about 290–380 s) is visible

9.4 Study of Cracks for different Ip Values

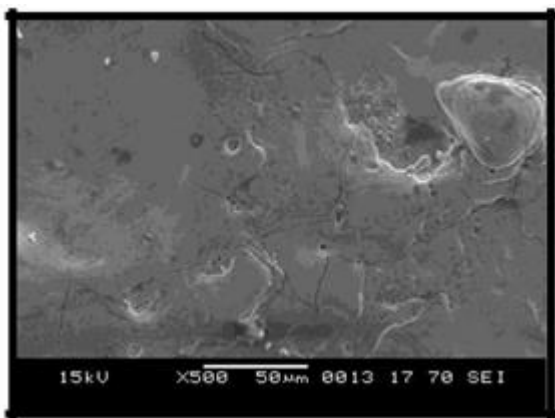
(Images at x500 and 50µm)

Low-Level Parameters

Img 9.4.1 3A



Img9.4.2. 5A



High-Level Parameters

Image 9.4.3. 5A

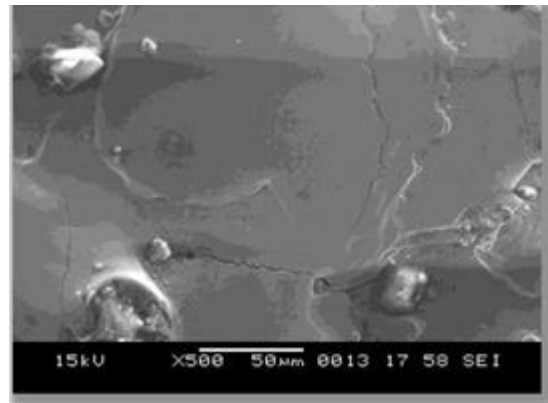
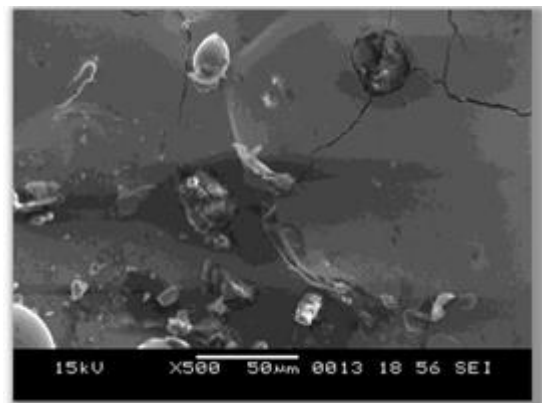


Image 9.4.4. 7A



Discussion: When only one of the subject materials' cracks and EDM parameters are evaluated, it is discovered that, for a constant pulse current, the surface crack density rises as the pulse-on time grows. If the pulse-on time is kept constant, the surface fracture density falls as the pulse current increases. When the pulse current increases, the thickness deviation steadily increases, as does the thickness ratio of the thick to the thin white layer.

V. CONCLUSION

The size of the craters rises as the discharge energy level increases, according to the SEM photos in Figures. It is discovered that when the energy level rises, the number of globules decreases. Furthermore, when the discharge energy increases, so does the degree of cracking. The high discharge energy generates intense sparks, an impulsive force that impact the surface. As a result, the melting and

vaporization rates rise, resulting in higher material removal. This results in bigger and deeper craters on the workpiece's machined surface. Long Ton is responsible for bigger craters, but strong Ip is responsible for deep craters during high energy levels. As a result of the tremendous discharge energy, deeper and broader craters form, resulting in a rougher surface. Recast layer thickness and generated stress are two elements that contribute to a higher degree of fracture development.

Furthermore, a high gap voltage provides for a shorter cutting time. As a result, increasing Vg minimizes material erosion, resulting in smaller craters. As Sv increases, surface integrity diminishes, and a higher servo-voltage value results in a more uniform surface on the workpiece.

The thickness of the recast layer grows in proportion to the discharge energy. Ton increases the thickness of the white layer and the residual stress. At long Ton, a greater quantity of heat energy reaches the inside of the workpiece. The temperature of the workpiece surface quickly surpasses the melting point. Following quick cooling by the dielectric fluid, the molten material resolidifies, resulting in a thick recast layer. As a result, the increased energy level causes more fractures—the high discharge energy results in forming an inhibitor carbon layer on the electrode surface. The carbon deposited on the electrode surface grows significantly as Ton increases. This carbon layer reduces electrode wear. Because of the high discharge energy, a considerable impulsive force may remove more debris from the machining gap. As a result, the surface topography with high discharge energy lowers the number of globules.

Crack formation is related to the EDM parameters. An increased pulse-on duration will increase both the average white layer thickness and the induced stress. These two conditions tend to promote crack formation. When the pulse current is increased, the

increase in material removal rate causes a high deviation of the thickness of the white layer. Compared to a thin white layer, it is true to say that a thick white layer tends to crack more readily. However, the area occupied by the thick layer is less, so the density of surface cracking is broadly similar for both thin and thick layers.

VI. FUTURE SCOPE

The future scope of the present work as understood in due course of performance of the project is enumerated as under:

- Experiments with workpieces of different materials can be investigated.
- Experiments with varying materials of tool can be done, and the current experiments can be compared.
- The effect of other process parameters like pulse on time, pulse off time, the voltage on the material removal rate, and different surface roughness parameters can be investigated.
- Apart from back-propagation learning for the modeling of the artificial neural network, another algorithm can be used to know if at all there is any better ANN model exists or not.
- Optimization techniques like a genetic algorithm (G.A.) response surface methodology (RSM) can be applied for this model optimization.

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Cite this article as :

Rahul Shrinivasan, Tushar Bhakte "Review on MRR in Spark Erosion Machining (SEM) Through ANN", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 218-237, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229138> Journal URL : <https://ijsrst.com/IJSRST229138>

A Comparative Study on Traditional E-Commerce V/s Cloud based E-Commerce

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Article Info

Volume 9, Issue 1

Page Number : 238-244

Publication Issue

January-February-2022

Article History

Accepted : 01 Feb 2022

Published : 11 Feb 2022

ABSTRACT

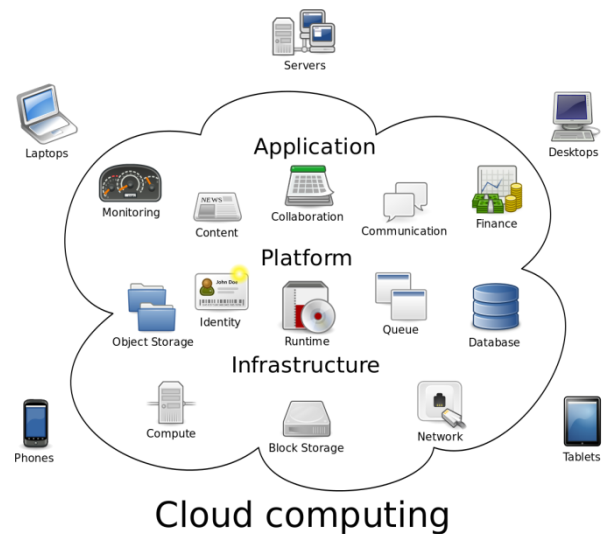
Now a day's Cloud computing is widely used and most popular topic on Information technology. It is use for resource sharing, software sharing, storage sharing and many more. Cloud computing is growing after proposed by Google in 2007. Due to providing internet resources and services it is also known as Internet computing. E-commerce has a growing business. If we merge cloud computing with E-commerce it will increase the market of E- Commerce. In this paper we discuss about Traditional E- Commerce v/s Cloud based Ecommerce.

Keywords: Cloud Computing, E-commerce, B2B, B2C, C2C.

I. INTRODUCTION

Cloud Computing

In the simplest terms, cloud computing means storing and accessing data and programs over the Internet instead of your computer's hard drive. Cloud computing is widely used and most popular topic on Information technology. It is More Popular and growing after Google proposed in 2007.



Cloud computing serves the users as “pay-as-service”, which supplies and delivers the end users with IT services based on their demand. It departs the IT service processes and transfers them to the cloud platform, which leads to the new service modes such

as IaaS (Infrastructure as a Service), PaaS (Platform as a Service) and SaaS (Software as a Service). As a new information means and mode, cloud computing is being applied to many industries creatively. E-commerce is a typical industry which is being influenced inevitably by the features of cloud computing. This paper discusses the impacts of cloud computing on the traditional E-commerce respectively from the perspective of technology, service and industry chain and presents the necessary suggestions on the development of E-commerce businesses in the cloud era.

E-Commerce

E-Commerce is a process for buying and selling product over electronic means such as by mobile applications and the Internet. Commerce refers to both online retail as well as electronic transactions. Ecommerce has hugely increased in popularity over the last decades, and in ways, it's replacing traditional brick and mortar stores.



While most people think of ecommerce as business to consumer (B2C), there are many other types of E-Commerce. These include online auction sites, internet banking, online ticketing and reservations, and business to business (B2B) transactions. Recently, the growth of ecommerce has expanded to sales using mobile devices, which is commonly known as 'm-commerce' and is simply a subset of ecommerce.

Definition of Traditional Commerce

Traditional Commerce or Commerce is a part of business, which encompasses all those activities that facilitate exchange. Two kinds of activities are included in commerce, i.e. trade and auxiliaries to

trade. The term trade refers to the buying and selling of goods and services for cash or kind and auxiliaries to trade, implies all those activities like banking, insurance, transportation, advertisement, insurance, packaging, and so on, that helps in the successful completion of exchange between parties.

In finer terms, commerce encompasses all those activities that simplify the exchange of goods and services, from manufacturer to the final consumer. When the goods are produced, it does not reach to the customer directly rather it has to pass from various activities, which are included under commerce. Its main function is to satisfy the wants of consumers by making goods available to them, at the right time and place.

Definition of e-Commerce

e-Commerce or electronic commerce refers to the exchange of goods and services, funds or information, between businesses and consumers using the electronic network, i.e. internet or online social network. e-Commerce means trading and providing assistance to trading activities, through the use of the electronic medium, i.e. all the activities like purchasing, selling, ordering and paying are performed over the internet. The scope of e-commerce is discussed in the following points:

- **B2B commerce:** When the business transaction takes place between two business houses, through the electronic channel, it is called B2B commerce.
- **B2C commerce:** When the exchange of goods and service takes place between the business entity and the customer, over the internet, then it is known as B2C commerce.
- **C2C commerce:** When the buying and selling of goods and services take place between customers using electronic medium, then it is called C2C commerce

- **Intra-B commerce:** When the exchange occurs within the firm or business house, with the use of electronic media, it is called as Intra B-commerce.

Why E-Commerce and Cloud? (Relationship between E-Commerce & Cloud)

The Tech-Flea Market

However, an industry cannot just go about the idea on a few measured illusions drawn from dream business stories of success. The understanding of pros and cons of the cloud computing business models helps in drawing quality business strategies. The trick is to first take a peep into your own requirements. This will help you zero in on the right model for your business needs. At a time when even Zombies are selling their fangs online, it is even more important today to expand the functionalities of the platform. The industry experts cite the latest fusion of the e-commerce industry and cloud computing as the new big thing in the technology world.

With the use of cloud computing technology, you can enhance your business with social media promotions without spending too many resources on upgrading the infrastructure. Cloud computing has turned out to be worth full business investment with its effective impact on your business. It is more cost-effective than your in-house server system.

Various technical and mobile services are providing cloud based applications and network frameworks to connect with e-commerce operations. Cloud computing applications impact your businesses in a very positive and innovative way. We take a look at a few reasons why introducing cloud computing to e-commerce industry is beneficial. So here we go:

Helpful in research and development

Research and development sections are two strong pillars behind a successful business. Effective research of the latest trend can lead your company to the new heights. In the modern era, fashion trends and

consumer preferences are changing very rapidly. It is very essential to understand these changes and produce innovative ideas to satisfy the consumer's need. Cloud computing is very helpful in the effective research and development of the company. Without understanding the market inclination growth of the company is not possible.

Enhance stability in the competitive market

A successful business survives in the market only when it is growing with the latest trends and technologies in the market. Cloud computing has become popular in a few years because of its efficiency. In this competitive world, you have to face a huge completion in every sector of life. For constantly surviving in this completion it is very necessary that you take the right decision at the right time. Everyone has limited resources in their business. It is very important to manage the resources in such a way that it is fully utilized in your business. Smart use of the technology is very helpful to last in the market. By using cloud computing technology, you can effectively manage your resources which will provide strength to your company.

Supportive in business enhancement

The proper use of cloud computing technology can take your business to a new height. Over a period of time, you will be able to spot a remarkable difference in your company's run. An industrialist must evaluate the market trends and take effective steps to capture the whole demand.

Cost Efficient

Cost efficiency is the most beneficial feature of cloud computing. As per the trend in the market you have to pay only for what you use. You can easily occupy the space you require according to the upward and downward demand in the business. On the other hand, if you are setting up a separate department to handle and maintain data, then it will be very expensive for you. So, there is no need to spend too

much money and time in organizing your data. Cloud computing is very effective in well organizing the recourses. As there is a service provider team to organize and sustain your data so you can without difficulty concentrate on the other resources of your business.

Evaluate New Market Opportunities

Cloud computing is very effective in understanding the latest market trends and demands. You can take effective changes in your production according to the market tendency. The IT leaders must be well aware about the cloud base approach and their impacts, so that they can choose the perfect solution for their business needs.

Security

Cloud based approaches are very secure and effective. Security issue is the major problem faced by the e-commerce industries. But the cloud technology develop very high-tech and protected path for the data management. Cloud service providers have security experts in their team, who manage the security option in the cloud applications. These professionals are more experienced than a normal IT staff of your company. So the cloud base technology is more trustworthy for data management than maintaining it yourself.

Adaptability

One of the best features of cloud computing is its flexibility. By using this technology you need not to block your resources and capital for purchasing and store a huge space for your data. You can easily boost or reduce the space according the customer's demand. For example, in festive season the customer demand increases, so you can easily scale up or down the resources to cope up with the high and low demand.

Speed

The speed of a site or its mobile app is the main differentiation between the successful and other e-commerce sites. It is very difficult to provide a fast site with millions of users accessing it at the same

time. Companies have to spend a lot of money to provide this kind of infrastructure. However, with the use of cloud, companies can save a huge amount of money and provide a very fast service to their users. Slow load time and down-time is the main issues of e-commerce industries, which can be reduced drastically by the help of cloud base technology. Data will be uploaded on the vendor's data center in the real time.

High Availability

In the past, people would rely on the physical availability of data. However, things have changed with cloud computing providing unlimited access to your data from anywhere in the world anytime. The high technology increases the accessibility of data. It is more reliable and efficient to access data with the help of the internet at any time and any place.

Smooth Resource Management

Cloud computing makes the resource management very easy and painless. As you are outsourcing this service by another IT companies, so you need not to do anything to manage your data. A well-prepared team is handling, maintaining, and upgrading your data. You just do not have to worry about the data management and improvement. You can spend your valuable time in managing the other resources of your business. It is very helpful in breaking down the obstacles of supply chain. Cloud computing develop the better interaction with the suppliers and customers.

Quick Response to New Market Challenges

Cloud based e-commerce applications allow you to quickly react on the new market challenges and opportunities. By understanding the customer's reviews you can accordingly deal with them. Continuous chasing the market trends polish your skill to predict the future developments.

Recovery Backups

In the e-commerce industry most activities are based on servers. Business actions are affected and bear

losses in case servers underperform. Interrupting power supply and some uncontrollable problems or any physical damage on the workplace can lead to data collapse and heavy revenue loss. However, if you are using cloud-based technology then just relax as all of your data is safe in the cloud. You can run your business in the usual manner.

Target the Premium Customers

Cloud computing is helpful in finding out the premium customers. By tracking the visits on the various products, you can find the perfect taste of your customers. You can make your products according to the requirement of the customers. It will provide very positive results to your business.

Increase in Revenue

Cloud computing provides incredible growth in revenue of the company. As it is very cost effective so the overall cost of your company will reduce drastically. There is no need to block the excess capital in maintaining the data. You can organize it in a very reasonable amount. In fact, you can utilise this amount in the other sectors. High speed and better accessibility will help in increasing more visits on the e-commerce sites so it will enhance the sales. It will help in increasing the overall profits of the company.

Globalize the Business

Cloud computing is very useful for the expansion of a business at global level. By using internet, you can easily target the worldwide customers. It is an effective and cheaper way of business development. Customers from any area of the world can easily access the cloud.

Collaboration Effectiveness

Cloud computing allows your business to share and communicate with your employees across the world. With this modern technology, you can monitor your projects without spending a huge amount. A common data, file or information can be accessed by various people on different locations at the same time. You can use cloud computing to share the information with your investors, suppliers, advisors, and accountants.

Automatic Updates

Cloud computing companies are using the latest and best technologies. If you are maintaining your data with this technology then your system will be updated automatically. You can use an updated version of the software.

Environment Benefits

If companies are using shared networks then it is good for the growth of our nation and industries. In the shared network paths resources are fully utilized. It will have less impact on the environment.

Infrastructure Support

Storing huge data is the biggest challenge for the e-Commerce industry. In E-Commerce analyzing the data is very important to understand the customer need. Millions of users search various items daily. Picking up the trend and interest of the user is a very difficult task. Cloud computing along with modern data analyzing techniques can easily solve this problem. Lot of data mining companies are working on this model and providing their services to the big e-commerce companies. Now e-commerce companies need not to invest a big chunk of their money in infrastructure. They can take the services of cloud service providers and save a lot of money.

Boon for Start-Ups

This is the era of start-ups and apps. Lots of apps are coming in the market to help the users with their day to day life. E-commerce is not just limited to the big retailers. It is moving to small businesses. Lot of ethnic designers and artists are selling their products on various e-Commerce sites. However, these start-ups do not have enough money to build and run their sites or apps. Cloud services are a boon for such start-ups. They can buy space in the cloud as much as they want. They can use software required to build software on the cloud. This is inspirational for young generation aspiring to find their ways to success.

It is very important to be innovative and updated at a time when technology changes at the blink of an eye. Running a business with old legacy systems is a pain in the back and the Cloud is proving to be the right

pain-relief spray. With the aforementioned reasons to go shopping in the Cloud, a business can easily attain success by achieving its target. The time has come when a business also has to adapt to the requirements of its customers. Cloud can make you understand you users and their needs. It is like drawing your business on the sky like a rainbow with the cloud

Benefits of Cloud Computing to E-commerce

E-commerce companies can avail various benefits by taking cloud computing SAAS.

- **Trust:** These days, cloud computing is already being used by large internet based MNCs like Amazon and Google. Businesses that work with these companies can leverage the existing cloud systems to reach out to more customers.
 - **Large Savings:** Cloud computing is extremely cost-effective; thanks to its metered approach and 'pay as you go' contracts. Virtualized servers can help companies save up to 80% of expenditure.
 - **Fast App Setup:** The speed at which e-commerce companies can make applications live on the cloud computing serve is five times faster than normal servers.
 - **Immense Company Growth:** When customers respond positively to apps that were created with the help of cloud computing, companies have an opportunity to grow their business at a much faster rate.
 - **Strong Security:** Cloud computing providers take strategic steps to ensure complete data protection. Many providers even go for ISO 27001 and various types of security audits to prove their worth to customers. Security measures can be implemented at all 3 levels– application, facility, and network.
 - **Organizational Improvement:** The use of cloud computing would open up many opportunities to improve internal organizational process. A few examples would be regulation of backend processes, more focus on core competencies, and enhancement of product development and service quality.
- The continual growth in cloud computing will result in more e-commerce communities on cloud networks.

This in turn will lead to a complete shift of working and service offering processes of e-commerce companies.

Challenges in Moving to the Cloud

Moving to the cloud can be a complex, time-consuming and costly process. Businesses should approach Cloud Consultants/Experts to avoid below pitfalls:

- Lack of Expertise and Technical Talent
- Time and Costs Required for Integrations and Customizations
- Vendor Lock-in

Relationship Between E-Commerce & Cloud

The long debated relationship between cloud computing and the e-commerce industry has gone deeper with time and, according to sources, it may surpass the magic once woven by Jack and Rose on the Titanic. Apparently, cloud computing plays a strong base for the e-commerce industry amid chaos of overnight business transformations. So considering several benefits of cloud computing on various platforms, IT industries from across the world are slowly waking up to the idea of using it in the industry effectively.

II. CONCLUSION

It is clear that cloud computing is essential for e-commerce industry as it provides numerous opportunities for e-commerce industry as we discussed in this paper. Cloud services are making it possible for the e-commerce companies to reach its goals and provide a customized experience to the customers. The companies which have embraced cloud have a competitive advantage over the ones who have not adopted it yet. In the near future, the e-commerce industry may be even more tightly integrated with cloud computing since many of the e-commerce businesses sustain their competitive edge due to the benefits of cloud computing.

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Cite this article as :

Manoj Chopra, Vijay Dhote, Dr. Pooja Bijlani, "A Comparative Study on Traditional E-Commerce V/s Cloud based E-Commerce", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 238-244, January-February 2022.
Journal URL : <https://ijsrst.com/IJSRST218638>

College Enquiry Chat Bot System with Text to Speech

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ABSTRACT

Chat bots are intelligent systems that interpret and react to users' questions in their native language. In a conversation, the chat bot reacts in the same way as a human would. It functions as a virtual assistant, and its accuracy is assessed by determining a correlation between user questions and chat bot responses. For a better user experience, the implemented Chat bot has two modes: text mode and audio mode. It provides an interactive approach of answering through voice messages when in audio mode. There is a long line at the inquiry window during the Institute's Academic Admission procedure. Even more challenging is the situation for parents who live in various cities, states, and nations. The purpose of this system is to give students and parents a place to ask questions and get answers via easy English language text messages or audio commands. Instead of queuing at an information desk to ask questions about the admissions process, students and parents will collaborate with a bot. Artificial intelligence (AI) and natural language processing (NLP) algorithms are used to create chatbots, which are intelligent systems. It effectively interacts with users and responds to their questions. Organizations, government groups, and non-profit associations are the most common users of dialogue/conversation operators. These conversational experts work for a wide range of businesses, from small start-ups to large corporations. There are a variety of code-based and interface-based chatbot development platforms available on the market.

Keywords – College Inquiry Bot, Classifier Algorithm, NLP, Chatterbox

Article Info

Volume 9, Issue 1

Page Number : 245-249

Publication Issue

January-February-2022

Article History

Accepted : 01 Feb 2022

Published : 11 Feb 2022

I. INTRODUCTION

Students will be admitted to engineering after completing their 12th grade or completing a diploma programme. They had a lot of issues prior to enrolling. Students and their parents are concerned about a

variety of admissions-related issues. When it comes to choosing a suitable engineering institution, students are often perplexed. They choose institutions based on a variety of factors, including prices and the previous year's admissions threshold. As a result, some students send me e-mails or call me on the

phone.. As a result, there is an unnecessarily large gathering of people waiting to be questioned. The admissions department frequently has trouble answering students' persistent questions. In addition, the college admissions department required additional people and funds to respond to all of the inquiries. The installed chatbot will answer users' questions, supply them with the information they need, increase the quality of service time, and make customers happy by offering clever solutions. It also boosts productivity by offering 24-hour support, reducing wait times at the help desk, and reducing human effort. Students can use their laptops or smartphones to communicate with the chatbot on the web. Students ask a variety of questions on admission specifics in plain language, and both can respond with correct answers. Customers can simply access the proposed application, and it responds to users at any moment. In order to improve the quality of service, the chatbot not only responds, but also self-learns and improves.

II. OBJECTIVE

A smart solution to resolve these questions, provide information as and when needed, enhance service and increase the number of customers will be created by a chat bot. It reduces individual variables included in the enterprise and can offer 24/7 hours of operation to improve efficiency. We plan to provide customers with a chat bot interface that can be accessible on the web and on any handheld computer.

III. RELATED WORK OR LITERATURE SURVEY

[1] Enhancing College Chat Bot Assistant with the Help of Richer Human Computer Interaction and Speech Recognition

Author: Sangeeta Kumari, Zaid Naikwadi, Akshay Akole

After preprocessing, they used stemming to remove terms that appeared at the beginning and end of the

sentence. Special characters and numerals are removed during preprocessing. Following stemming, the leftover words are matched with keywords stored in a dictionary..

[2] "Review on Implementation Techniques of Chatbot"

Author: Nithuna S and Laseena

They are frequently sent by financial institutions, such as banks and credit card companies, as well as organisations such as online retail outlets and new businesses. These conversational experts are used in a wide range of companies, from small start-ups to large partnerships. There are various code-based and interface-based chatbot development systems on the market.

[3] "Chabot Application on Crypto currency"

Author: Qitao Xie¹, Qingquan Zhang²

Many chatbots have been developed that provide a multitude of services through a wide range of methods. A chatbot is a brand-new conversational agent in the highspeed changing technology world. Secure and efficient system

[4] Preliminary Findings of using Chat-bots as a Course FAQ Tool

Author: Sue Inn Ch'ng Lee Seng Yeong

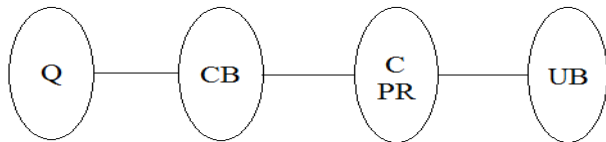
Students learn by asking questions and as instructors we encourage students to ask questions. However, not all questions are of equal importance . An advantage of bot platforms is that developers can also easily extend and integrate the conversational user interface into their program through the provided application programming interface

[5] Conversation to Automation in Banking Through Chatbot Using Artificial Machine Intelligence Language

Author: Sasha Fathima Suhel Vinod Kumar Shukla Ved Prakash Mishra

Chabot's are commonly used as tools for knowledge retrieval, such as product specifics extraction. Artificial Machine Intelligence is a very complicated topic. It involves creating machines that are capable of simulating knowledge.

IV. MATHEMATICAL MODELING



Where,

Q = User entered input

CB = preprocess

C = apply NLP chatterbot

PR = preprocess request evaluation

UB = chatbot response

Set Theory

1) Let S be as system which input image

$S = \{In, P, Op, \Phi\}$

2) Identify Input In as

$In = \{Q\}$

Where,

Q = User entered input(text)

Identify Process P as

$P = \{CB, C, PR\}$

Where,

CB = Preprocess

C = apply NLP chatterbot

PR = Preprocess request evaluation

4) Identify Output Op as

$Op = \{UB\}$

Where,

UB = Predict outcome

Φ = Failures and Success conditions.

Failures:

Huge database can lead to more time consumption to get the information.

Hardware failure.

Software failure.

Success:

Search the required information from available in Datasets.

User gets result very fast according to their needs.

Space Complexity:

The space complexity depends on Presentation and visualization of discovered patterns. More the storage of data more is the space complexity.

Time Complexity:

Check No. of patterns available in the datasets= n

If $(n > 1)$ then retrieving of information can be time consuming. So the time complexity of this algorithm is $O(n^n)$.

Above mathematical model is NP-Complete.

V. EXISTING SYSTEM AND DISADVANTAGES

In existing system there is no computerized system to identify the human query. Firstly, it is only suitable for the instance-level approaches that require an instance classifier, As we mentioned before, existing popular approaches of use with neural networks are treat separated instances as inputs, then use a deep neural network to transform them into embedding space.

Disadvantages:

It required internet connection must

VI. ADVANCED SYSTEM AND ADVANTAGES

The proposed system would help replicate the customer service experience with one difference that the customer would be interacting with a bot instead of a real person and yet get the queries attended and resolved.

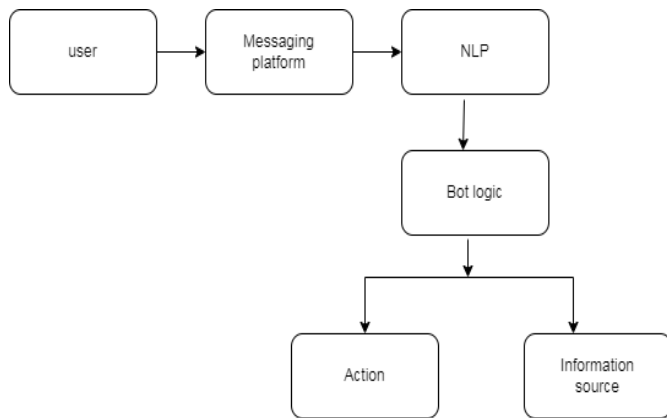


Figure : Advance System Architecture

Advantages:

- ✓ Confirming those infected is essential to manage and contain the virus successfully. Without reliable testing, it would be hard to determine the actual rates of cases. Thus, it is vital to identify what these available tests can and can't do to use them appropriately.
- ✓ Secure and efficient system.

VII. CONCLUSION

Any college or university can deploy a chat bot on their website to allow external stakeholders to ask questions at any time. And it would be quite beneficial to ease the admission process, as this chatbot can answer questions about state-by-state cutoffs, categories-by-category cutoffs, gender-by-gender cutoffs, and shift-by-shift cutoffs, among other things. Users can give feedback by tapping the like and dislike buttons in response to the responses to their queries. This information is saved in the backend and may be examined by the administrator to analyse the types of queries asked and, if necessary, enhance the answers. To test the chatbot's accuracy, the same query was posed in several different ways, each time modifying the wording of sentences and adding various exceptional characters and unrelated terms. The accuracy of BOT in detecting a specific

query for various settings in which the user is asking can be increased, giving the user a more genuine feeling of speaking with a human counsellor. This bot can be created in a local language and multilingual at a later time.

VIII. FUTURE WORK

Chat bots are a constantly growing area of study in the field of computer science. If there are any flaws in input owing to human spoken language, such as a grammatical or context issue, bots may still be unable to understand what is being asked. Misinterpretation of any commands, whether due to misspelling or otherwise, can be improved further using powerful Natural Language Processing NLP techniques. The BOT can be improved till it passes the Turing test.

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Cite this article as :

Pratiksha Chaudhari, Sonal Lokhande, Vaishnavi Ghule, Pruthviraj Kakade, Aniket Surkamble, Prof. Aparna Kulkarni, "College Enquiry Chat Bot System with Text to Speech", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 245-249, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229139>
Journal URL : <https://ijsrst.com/IJSRST229139>

Formulation of Healthy *Cucurbita maxima* seed incorporated Milkshake

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ABSTRACT

Cucurbita maxima is a popular vegetable and the seeds of *Cucurbita maxima* are generally considered a waste product but it is rich in bioactive compounds with nutraceutical properties. Diet rich in *Cucurbita maxima* seeds has been associated with a reduced risk of stomach breast, lung, prostate and colon Cancers. Seeds of *Cucurbita maxima* are consumed either roasted or raw and used in cooking and baking and incorporated into foods to increase the nutritional value in diets. Sensory evaluation is a combination of different senses of a perception coming into play in choosing and eating. The Objective of the study was to analyze the nutrient content of the *Cucurbita maxima* seed powder, to obtain a sensory evaluation of formulated products and to find out the acceptability of the product. The sample used in this study was *Cucurbita maxima* seed were cleaned with water to make the sample free from foreign materials, sundried and grind finely. The nutrients such as Protein, Carbohydrates, Crude fiber, Iron and Fat of the *Cucurbita maxima* seed powder were analyzed. Dried *Cucurbita maxima* powder was selected for the preparation of the milkshake. The milkshake was prepared using standard procedure. Sensory assessments were evaluated based on the quality description i.e, appearance, flavor, taste, color, texture and overall acceptability. The acceptability of the product was evaluated by a panel of 20 trained judges The data was subjected to statistical analysis such as Mean, Standard Division and Standard Error Mean. The result reveals that nutrients such as protein 6.256%, carbohydrate 23.645%, crude fiber 2.2%, Iron 0.298% and fat 49.8%. The sample *Cucurbita maxima* seed powder was taken to prepare the formulated product. Both the formulated products are evaluated by 20-panel members for the parameters such as appearance, taste, flavor, color, texture and overall

Article Info

Volume 9, Issue 1

Page Number : 250-255

Publication Issue

January-February-2022

Article History

Accepted : 08 Feb 2022

Published : 17 Feb 2022

accuracy. The appearance of formulated Cucurbita maxima seed milkshake has scored 97% in standard and 86% in the sample whereas the flavor of formulated Cucurbita maxima seed milkshake has scored 86% in standard and 96% in the sample. Taste of formulated Cucurbita maxima seed milkshake has scored 97% in standard and 98% in sample and Colour of formulated Cucurbita maxima seed milkshake has scored 92% in standard and 95% in the sample. The texture of formulated Cucurbita maxima seed milkshake has scored 92% in standard and 96% in sample respectively. Thus the present study concludes that incorporation of Cucurbita maxim seed powder in the milkshake will help to enhance the health benefit.

Keywords: Cucurbita maxima, Incorporation, Banana Milk Shake, Cucurbita maxima Milk Shake

I. INTRODUCTION

Cucurbita maxima is a popular vegetable in our country. The seeds of Cucurbita maxima are rich in oil and nutrients (Ahasan Habib et al., 2015). Cucurbita maxima seeds are generally considered a waste product but it is rich in bioactive compounds with nutraceutical properties (Montesano et al., 2018). Cucurbita maxima seed and seed oil are a rich natural sources of Phytosterols (Phillips, et al., 2005). Cucurbita maxima are one of the vegetables that meet the requirements of health Nutrition pumpkins are of local importance in traditional agricultural systems. They are cultivated throughout the world for food, seed oil and medicinal value (Kadam and Pati, 2014).

All groups of cucurbita seed were rich in oil, fiber and protein. Fatty acid is incorporated in foods to increase the nutritional value especially in diets that are deficient in nutrients (Karanjaet al., 2013).

The seeds of curcurbita maxima are rich in lipid 36.70%, protein 34.56% and crude fiber 2.9%. Therefore, it may be used as a potentially attractive source of lipid, protein and crude fiber. In addition, the seed is a good source of minerals like nitrogen, phosphorus, Sodium, calcium, copper, zinc,

magnesium, potassium, and iron that are important for our health. The seed may also be used as fertilizer since it contains 5.53% nitrogen. Cucurbita maxima seed yields 12%of oil (Habibet al., 2015).

Cucurbita maxima contain rich unsaturated Fatty acids, phytoestrogen and vitamins E in their seed that have potential pharmaceutical, nutraceutical and cosmetic properties. Cucurbita maxima seeds contain several types of unsaturated Fatty acids (Beni Lestari and Edy Meiyanto, 2018). Cucurbita maxima seeds are a good source of vitamins mostly vitamin B along with C, D, E, K besides, zinc, magnesium, manganese, phosphorous and phytosterol (Mythili and Kavitha, 2017).

Diet rich in Cucurbita maxima seeds has been associated with a reduced risk of stomach breast, lung, prostate and colon Cancers (Marianna et al., 2009). Seeds of Cucurbita maxima are consumed either roasted or raw and used in cooking and baking as an ingredient of cereals, bread, cakes and salads (Phillips et al., 2005). The Cucurbita maxima seed could be incorporated into foods to increase the nutritional value especially in diets that are deficient in the said nutrients (Karanjaet al., 2013).

Sensory evaluation is a combination of different senses of a perception coming into play in choosing

and eating food (Srilakshmi, 2007). A substance that produces flavor must be volatile and the molecules of the substance must come in contact with receptor in the epithelium of the olfactory organ (Srilakshmi 2009). Appearance encompasses the positive and negative aspects of the products (Pottor, 1996). Taste sensation which the taste buds near the tip of the tongue are more sensitive to sweet and salt and those on the sides to sour and there near the back to bitter (Srilakshmi 2007). The first impression of food is usually visual and a major part of our willingness to accept a food depends on its appearance. Appearance includes optical properties, Physical form and made of presentation (Shakuntala Mancy, 1999).

The Objective of the study was to analyze the nutrient content of the Cucurbita maxima seed powder, to obtain a sensory evaluation of formulated products and to find out the acceptability of the products.

II. METHODS AND MATERIAL

A. Collection and Processing of Cucurbita maxima seed powder

The sample used in this study was Cucurbita maxima seed. Cucurbita maxima seed and the other ingredients were purchased from the nearby Supermarket, Palliyadi, Kanyakumari District, Tamilnadu. The Cucurbita maxima seeds sample were cleaned with water to make the sample free from foreign materials. After washing the Cucurbita maxima seed are allowed to sundry for a particular period till it becomes dry. Then grind finely and the powdered Cucurbita maxima seed and other ingredients were measured using a weighing machine

B. Nutrient analysis of Cucurbita maxima seed powder

The nutrients such as Protein, Carbohydrates, Crude fiber, Iron and Fat of the Cucurbita maxima seed powder were analyzed.

C. Formulation of the product

Dried Cucurbita maxima powder was selected for the preparation of the milkshake. The milkshake was prepared using standard procedure. In the present study, banana milkshake and Cucurbita maxima powder incorporated milkshake were formulated.

Table – 1
Ingredients for the preparation of Milkshake

Ingredients	Banana Milk Shake	Cucurbita maxima seed powder Milk Shake
	Amount (g/l)	Amount (g/l)
Cow milk	¼ lit	¼ lit
Small size banana	20 gm	-
Cucurbita maxima powder	-	20 gm
Palm sugar	30 gm	30 gm

For the preparation of Banana milk shake, Take 20gm of banana, ¼ cup milk and 30gm palm sugar to the blend. Blend ingredients until mixture are smooth. Pour into frosted mugs. Keep it in Refrigerator for a particular period. For the preparation of Cucurbita maxima powder milk shake, instead of banana, 20 gm of Cucurbita maxima powder were incorporated.

D. Sensory evaluation for the formulated product
Sensory assessments were evaluated based on the quality description i.e, appearance, flavor, taste, color, texture and overall acceptability. This evaluation is a valuable tool in solving problems involving food acceptability products were evaluated by a panel of 20 trained judges from the Department of Nutrition and Dietetics, Muslim Arts College, Thiruvithancode. Kanyakumari District, TamilNadu.

E. Statistical Analysis

The primary data thus collected was consolidated and subjected to statistical analysis such as Mean, Standard Division and Standard Error Mean.

III. RESULTS AND DISCUSSION

A. Nutrient Analysis for Cucurbita maxima seed powder

The nutrient analysis result of the protein content of the Cucurbita maxima seed powder was 6.256g. The total carbohydrate content of the Cucurbita maxima seed powder was 23.645g. The crude fiber content of the Cucurbita maxima seed powder was 2.2%. The Iron content of Cucurbita maxima seed powder was 0.298mg. The fat content of Cucurbita maxima seed powder was 49.8%.

Table - 2

Nutrient analysis for the *Cucurbita maxima* seed powder

Nutrient	<i>Cucurbita maxima</i> seed powder
Protein	6.25 gm
Carbohydrate	23.64 gm
Crude fiber	2.2 %
Iron	0.298 mg
Fat	49.8 %

Ahsan Habib et al., 2015 states that the nutritional analysis, it was found that the seeds of Cucurbita maxima are rich in lipid 36.70%, protein 34.56% and crude fibre 2.91%. Therefore, it may be used as a potentially attractive source of lipid, protein and crude fiber.

The result of Qamar Abbas Syed et al., (2019) found that Cucurbita maxima seeds contained 41.59% oil,

25.4% protein, 5.2 % Moisture, 25.19% carbohydrates, 5.34% fiber, and 2.49% total ash.

The nutrient composition analysis of Cucurbita maxima seeds showed that these are very nutritious and provide many essential nutrients for health. However, the Cucurbita maxima seeds have been used for medicinal purposes and these possess also nutritional and therapeutic importance. The Cucurbita maxima seeds play a significant role in providing of micronutrients and also used in treatment and management of diabetes, inflammation, hyperlipidaemia, hypertension, cancer management and protect heart etc (Qamar Abbas Syed et al., 2019).

B. Sensory evaluation of formulated products

To enhance the nutrient content, in the present study, the banana milkshake and Cucurbita maxima seed powder were prepared using standard procedures. The sample Cucurbita maxima seed powder was taken to prepare the formulated products, Cucurbita maxima seed milkshake. Both the formulated products are evaluated by 20-panel members for the parameters such as appearance, taste, flavor, color, texture and overall accuracy.

The appearance of formulated Cucurbita maxima seed milkshake has scored 97% in standard and 86% in sample whereas the flavor of formulated Cucurbita maxima seed milkshake has scored 86% in standard and 96% in sample.

Table – 3

Sensory evaluation of formulated products

Scoring		Appearance	Flavour	Taste	Colour	Texture
Banana Milk Shake	Sensory	94%	86%	97%	92%	92%
	Mean ± SD	4.7 ± 0.31	4.3± 0.48	4.85± 0.26	4.6 ± 0.18	4.6± 0.16
	SEM	0.070	0.108	0.059	0.041	0.035
<i>Cucurbita maxima</i> seed Milk Shake	Sensory	97%	96%	98%	95%	96%
	Mean ± SD	4.85±0.12	4.8±0.16	4.3±0.40	4.75±0.24	4.8±0.33
	SEM	0.028	0.036	0.09	0.055	0.074

SD – Standard Deviation
SEM – Standard Error Mean

Taste of formulated Cucurbita maxima seed milkshake has scored 97% in standard and 98% in sample and Colour of formulated Cucurbita maxima seed milkshake has scored 92% in standard and 95% in sample. The texture of formulated Cucurbita maxima seed milkshake has scored 92% in standard and 96% in sample respectively. The study on Mule et al., (2014) concluded that blending of Fig (5%) with buffalo milk resulted in superior quality milk shake and was cost efficient.

Shinde et al., 2018 found that the Date milk shake prepared from 90 parts of buffalo milk and 10 parts of Date pulp was most acceptable and ranked is like very much. The addition of higher proportion of pulp in the blend scored towards lower side by a panel of judges.

IV. CONCLUSION

Thus the present study concludes that incorporation of Cucurbita maxim seed powder in the milkshake will help to enhance the health benefit. The study shows that the appearance, followed by colour, flavou and colour of the Cucurbita maxima seed powder incorporated product shows the best compared to the banana milkshake. So this study will be a key for future research.

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Cite this article as :

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Effect of Endosulfan on Intestine and Pancreas of frog *Rana tigrina*

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ABSTRACT

Article Info

Volume 9, Issue 1

Page Number : 256-260

Publication Issue

January-February-2022

Article History

Accepted : 08 Feb 2022

Published : 17 Feb 2022

Now a day's use of pesticides is the matter of great discussion for environmentalist to gain more relevant information on tolerance of organism to the pesticides. *Rana tigrina* were exposed to sub lethal concentration of Endosulfan (0.073 ml/lit) for 7 days regularly. The goblet cells of intestine was found to be swollen, enlargement of cells, cell shrinkage, damage of cell membrane, vacuoles formation and pancreas exocrine secretory acini cells was found to be damaged and connective tissue was loosely bounded also observed on exposure to Endosulfan.

Keywords : Endosulfan, Intestine, Pancreas.

I. INTRODUCTION

Now days the tremendous increase in environmental pollution is seen. Environmental pollution is due to the introduction of pollutants into natural environment that causes instability disorders, harms or discomfort the living organism in the ecosystem. Pollution can take the form of toxic chemical substance and contaminated water, soil, air which showed effect on the targeted and non- targeted organisms. It has been studied that acute toxicity of endosulfan on *Bufo bufo* gills & stream near sprayed agriculture field, after 24, 48, and 96 hours of exposure showed 50% mortality (LC 50) (Ilaria Bernabo *et.al.*, 2008). It has been found that exposure to natural and synthetic estrogenic chemicals may adversely affect wildlife and human health (Colborn

et al., 1993). There are various pesticides such as, Organochlorine (*Endosulfan*, *Endrin*) are used in fields and gardens. The environmental toxicological studies on vertebrates is rapidly expanding, fishes have become valuable indicator for the evaluation of the effects of toxic compounds (Khidr and Mekaway, 2008). Histology and histopathology can be used as biomonitoring tools for health in toxicity studies (Meyers and Hendricks, 1985). Histopathological alterations are biomarkers of effect exposure to environmental stressors, revealing alterations in physiological and biochemical function (Hinton *et.al.*, 1992). Histopathology, the study of lesions or abnormalities on cellular and tissue levels is useful tool for assessing the degree of pollution, particularly for sublethal and chronic effects (Bernet *et. al.*, 1999). There are various ways of spread of pesticidal

pollution in the environment such as rain water drained off from the pesticides spread field through which pesticides residues reach to environment and cause toxic effect on the aquatic and other organisms. In past several decades, decline in amphibian population has been occurring all over the world, for unexplained reasons which are thought to be varied but of which pesticides may be a part. Mixtures of multiple pesticides appear to have a cumulative toxic effect on frogs. Tadpoles from ponds with multiple pesticides present in the water lake longer period to metamorphosis into adult frogs, decreasing their ability to catch prey and to avoid predators. (Benoit *et.al.*, 2003) studied that the effect of cadmium , Endosulfan and atrazine on African frog (*Xenopus leavis*) and Bull frog *Rana catesbeiana* showed adverse impact on secretory capacity of adrenal cells of amphibians. Amphibians itself acts as a pest controlling organism plays a vital role in food web and are commonly found in agriculture fields, near ponds and rivers. When they came in contact with pesticides they absorb orally, cutaneously or by inhalation and get affected even though when they feed on the affected insects they get affected indirectly.

II. Material and Method

Adult frog (*Rana tigrina*) of both sexes were collected by net or hand from their spawning ponds at unpolluted and non-agriculture site. The collected frogs were transported to laboratory in covered baskets. Adult frogs of the same size and same weight (35-40 gm) were acclimatized in glass aquarium tank for the time period of 10 to 15 days in laboratory condition; frogs were feed twice a day alternatively by insects. Stock solutions of experimental dose were prepared by using Endosulfan and ethanol as a vehicle. From 0.073 ml stock solution is used as dose in per liter water after acclimatization of 10-15 days frogs has become divided into two groups:

GROUP I - Control

GROUP II – Experimental

Group I and Group II consist of six adult frogs respectively. Group I were placed in plane water glass aquarium. While Group II is treated with 0.073 ml/lit of dose of Endosulfan for 7 days. On eighth day frogs of both groups were sacrifice for further experimentation.

For Histopathological observation, after 7 days, frog of each group were removed and dissected. Small pieces of the intestine and pancreas were taken and immediately fixed in alcoholic bouin's fluid. Fixed tissues were processed routinely for paraffin embedding technique. Embedded tissues were sectioned at 5-7 μ in thickness and then stained with double staining method. Finally the sections were proceed for microscopic studies for observation and collect their respective photographs for observation.

III. Observations

Histopathological changes in intestine exposed to Endosulfan:

Frog *Rana tigrina* exposed to sub lethal concentration of Endosulfan showed the morphological changes. In the present investigation cells of intestine of treated frog showed flaccid and degenerative stage. Cells of intestine showed shrinkage, damaged and ruptured membrane of the cells, and space between the intestinal goblet cells was clearly observed.

Histopathological changes in pancreas exposed to Endosulfan:

Frog *Rana tigrina* exposed to sub lethal concentration of Endosulfan showed the morphological changes in the cells of pancreas. It showed the disruptor of the secretory acini cells and damage of the islets of langerhans cells of pancreas, as well as connective tissue was loosely bounded also observed.

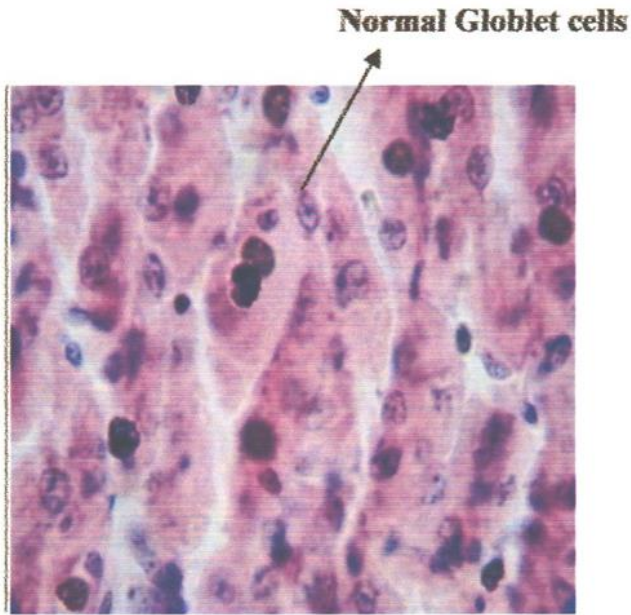


Fig no.1) Section of control frog intestine-Goblet cells of normal size are observed before treatment to endosulphan.

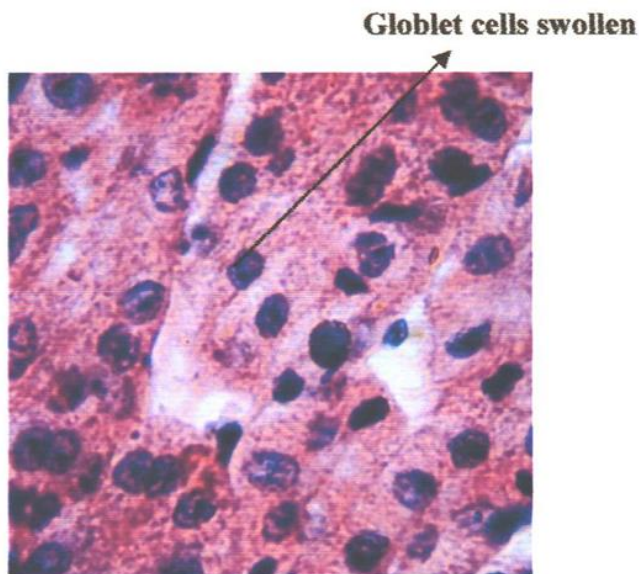


Fig. 1.1 Section of endosulfan treated intestine Goblet cells become swollen and enlarged after 7 days treatment of endosulfan

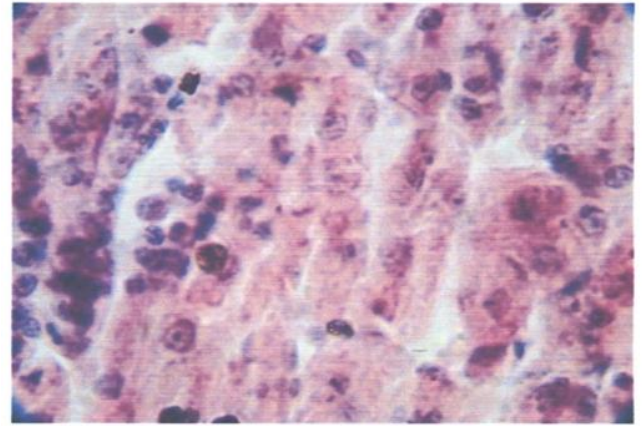


Fig.2) Section of Control frog intestine

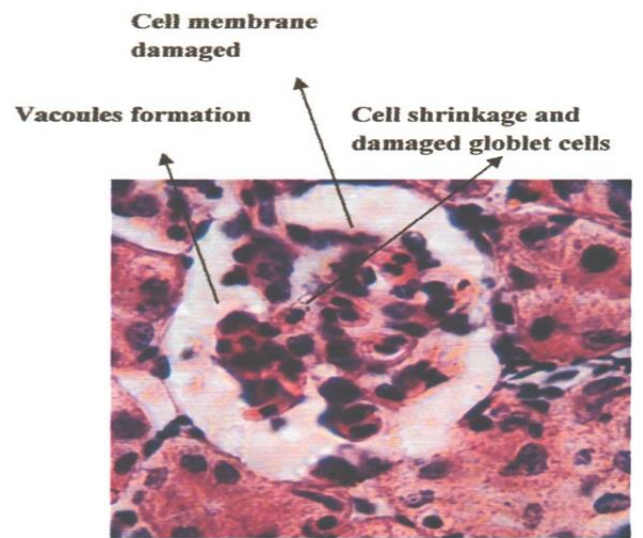


Fig.2.1) Section of Endosulfan treated frog intestine- Shows the endosulfan effects, goblet cells shrinkage, damage of cell membrane and vacoules formation.

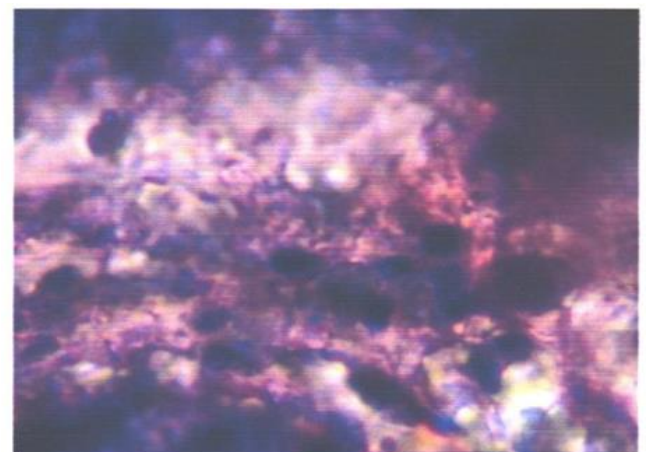


Fig. 3) Section of control frog Pancreas- Connective tissue and exocrine secretory normal of frog Rana tigrina

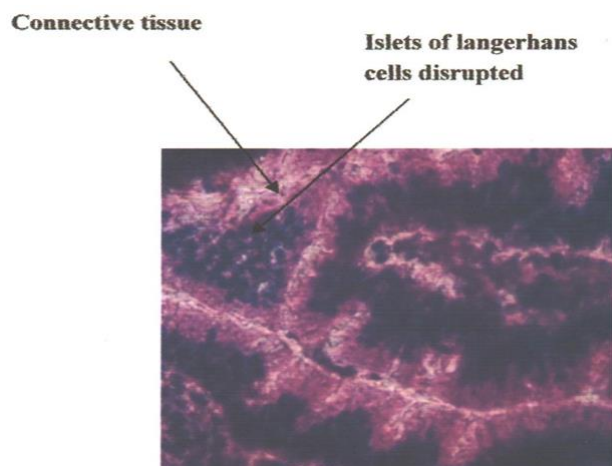


Fig. 3.1) Section of Endosulfan treated Pancreas- shows exocrine secretory acini cells suspended and islets of langerhans cells become disrupted.

IV. RESULTS AND DISCUSSION

Pesticides indirectly and directly affect on non-targeted organism and may interfere the physiological process of the living organism. A pesticide not only affects the physiochemical properties of the ecosystem but also affects the flora and fauna. The proper and safe use of pesticides will be ensuring only a good knowledge of their toxicological characteristics and behavior in biological media to be reviewed. Here we study the effect of Endosulphan on intestine and pancreas of frog *Rana tigrina* which shows morphological changes.

Histological changes in the Pancreas:

In the present investigation the effect of *endosulfan* shows the morphological changes in the intestinal cells the cell become swollen, cell membrane of intestinal cell was highly affected and disturbed, vascularization and degeneration of intestinal cell were also observed. Similar finding by **Chayya Roy Kundu et.al.,(2011)** observed the effect of malathion at sublethal concentration (0.006) on the intestine of cricket frog (*Fegarvarya limnocharis*) was observed for 24 hour to 240 hour of exposure and remarkable histopathological alteration were

observed it showed acute pathological condition in intestinal wall, due to toxicity the cytoplasm of cells disintegrated become empty and vacuolated, cell membrane was ruptured and degenerative villi of intestine also observed.

Similar finding also observed by **T. Braunbeck and S. Appelhum (1999)** on the exposure of endosulfan to carp *Cyprinus carpio* for 5 weeks it showed the liver alteration and enlargement of nucleolus, Golgi complex and rough endoplasmic reticulum and ultra structure of intestine shows complete lack of chylomicrons in epithelial lining which indicates disturbance of intestinal absorption.

Histological changes in the Pancreas:

In the present investigation toxicity of endosulfan showed impact on morphological changes in pancreatic cells .The cells of islets of langerhans secretory acini cells becomes ruptured and degeneration of pancreatic cells were observed. Similar Study were observed by **Ozlem Ozniem et.al.,(2010)** studied the exposure of endosulfan and vitamin C on rabbit pancreatic cells. It was showed remarkable degenerative changes and decrease in proinsulin-insulin and amylin secreting cells also slight decrease in glucagon secreting cells. From the present investigation it was suggested that endosulphan may show impact on the endocrine organs of frog, endosulfan is toxic to the amphibians and other organism so there is need to more research to develop a less toxic pesticides which will not harmful for targeted and non-targeted organism.

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Cite this article as :

Rathod S. H, N. R. Thorat, "Effect of Endosulfan on Intestine and Pancreas of frog *Rana tigrina*", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 256-260, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229145> Journal URL : <https://ijsrst.com/IJSRST229145>

Face Recognition Based Automated Attendance Management System

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ABSTRACT

At the beginning and end of each session, attendance is an important aspect of the daily classroom evaluation. When using traditional methods such as calling out roll calls or taking a student's signature, managing attendance can be a time-consuming task. The teacher normally checks it, although it's possible that a teacher will miss someone or some students' answers many times. Face recognition-based attendance system is a solution to the problem of recognizing faces for the purpose of collecting attendance by utilizing face recognition technology based on high-definition monitor video and other information technology. Instead of depending on time-consuming approaches, we present a real-time Face Recognition System for tracking student attendance in class in this work. The suggested method included identifying human faces from a webcam using the Viola-Jones technique, resizing the identified face to the desired size, and then processing the resized face using a basic Local Binary Patterns Histogram algorithm. After the recognition is completed, the attendance will be immediately updated in a SQLite database with the relevant information. Many institutions will profit greatly from this endeavor. As a result, the amount of time it takes and the number of human errors it makes are minimized, making it more efficient.

Keywords : Face Detection, Viola-Jones Algorithm, Face Recognition, Attendance, OpenCv.

Article Info

Volume 9, Issue 1

Page Number : 261-268

Publication Issue

January-February-2022

Article History

Accepted : 08 Feb 2022

Published : 17 Feb 2022

I. INTRODUCTION

Many scientific discoveries and technologies have occurred in this modern period of automation to save manpower, improve accuracy, and improve our lives. The breakthrough in the field [1] of automation replacing conventional attendance marking activities is known as an Automated Attendance System. Biometric, smart-card, and web-based Automated Attendance Systems are the most common types. These systems are frequently employed in a variety of businesses. When the strength is greater, the traditional method [2] of attendance marking becomes exceedingly time consuming and cumbersome. Automation of attendance systems has an advantage over traditional methods in that it saves time and can also be used for security [3]. This also aids in the prevention of bogus attendance. A facial recognition system is a computer programme that takes many images of a person and stores the data about that person's face so that when that person appears in front of the camera again, it can verify that person [4].

The face is the physical manifestation of one's individuality. As a result, we've developed a face-recognition-based automatic student attendance system. This technology has a lot of uses in everyday life, especially in security and surveillance systems. Facial recognition technology is a framework or programme that can authenticate an individual's identification by evaluating a photograph or video footage. The major goal of this research is to create an automatic attendance system based on face recognition [5]. To get better results, this project's test and training images are confined to frontal and upright facial photos [6], which only contain a single face. For humans, face recognition is an easy process. Hubel and Torsten Elie Wiesel demonstrated that we have specialized nerve cells for specific native features of a scene, such as lines and edges. Because humans don't perceive the earth as a collection of disparate

objects, our vision should combine the different sources of input into a meaningful and helpful pattern [7]. Automatic face identification entails extracting important options from a photograph, golfing stroke them into a useful representation, and performing some quiet categorization on them. Face recognition, three-dimensional reconstruction, and target recognition are all done with OpenCv, an open source module. This could be used to avoid using a proxy. The problem with this method is that it only catches one image of a student at a time once he enters the classroom.

The suggested system attempts to address the shortcomings of existing systems by including features such as face detection, feature extraction, feature detection, and analysis of student attendance. For feature detection, the system uses techniques such as image contrasts, integral pictures, color features, and a cascading classifier. Due to the usage of a large number of face features (Shape, Color, LBP, wavelet, Auto-Correlation), the method gives higher accuracy. Euclidean distance and k-nearest [8] neighbor techniques are used to recognize faces. Because the system considers the changes that occur in the face over time and utilizes appropriate learning algorithms, the findings are more accurate. The technology has been put through its paces in a variety of scenarios. For the aim of testing the system's accuracy, we consider a specific area such as classroom attendance. The percentage of recognized faces per total number of tested faces of the same person is the parameter used. The system is put to the test in a variety of lighting conditions, with diverse facial expressions, partial faces (in crowded classes), and the presence or absence of a beard and spectacles. In the majority of the cases studied, improved accuracy (almost 100 percent) is reached.

II. RELATED WORK

There are a number of existing systems that are closely analogous to the proposed idea of using official recognition techniques and algorithms to indicate attendance in a class. A literature survey of the proposed systems was conducted to analyse these systems. The proposed case study was built around a few key sources in the field of facial recognition and image processing. Using the other design methodologies, a descriptive framework was created [9]. This type of system makes [10] use of the RFID [11] technology and the SURF algorithm to create a student attendance control system. The SURF directly modifies the scale of box features to implement the scale space using box filter and integral image, similar to how SIFT produces a pyramid scale space and continually smooths the image with Gaussian and then sub samples the image. The authors presented a finger print-based attendance system in [12]. A portable fingerprint device has been developed that may be circulated among students to allow them to lay their finger on the sensor during lecture time without the intervention of the instructor. This technology ensures that attendance is recorded in an error-free manner. The author of [13] is dealt with by the system. The issue with this type of attendance system is that students may lose their ID cards for various reasons, and there will be another opportunity to collect the students' information. It's a lengthy procedure. In addition, when compared to other types of facial recognition algorithms, the algorithm processing is quite slow.

The authors of [14] suggested an Iris recognition system based on Daugman's algorithm. This system employs an iris recognition management system that captures, extracts, stores, and matches iris recognition images. However, laying transmission lines in areas with poor topography is a challenge. The authors of [15] proposed a system based on real-time facial recognition that is reliable, secure, and quick,

although it still has to be improved in varied lighting circumstances. The initiative places a greater emphasis on fingerprint scanning than on face recognition systems. The project will only recognise the student's face in one direction and record the student's attendance [16]. The author is experimenting with a new technology called fingerprint scanning, which comprises of a fingerprint scanner and a camera. The key benefit is that even if the camera does not recognise the student's face correctly after face registration, the student can be declared absent using this fingerprint scanner.

CNN (Convolutional Neural Networks [17]) was used by the authors to detect and extract information from the collected photos that contained the students' faces. They also used CNN to train their model and an SVM (Support Vector Machine) [18] classifier to classify the images after they were trained. They were able to reach a 95 percent accuracy rate [19]. The system implements the attendance system by employing the PCA (Principle Component Analysis) technique to recognise the faces of each and every student. It's a method for minimising the number of variables in face recognition [20]. Every image in the training set is represented by Eigen faces, which are a linear combination of weighted eigenvectors. The covariance matrix of a training image set yields these eigenvectors. When compared to other methods, this algorithm has a significant computational advantage.

III. EXISTING PROBLEM

This project is being carried out due to the concerns that have been highlighted on the methods which lectures use to take attendance during lectures. The use of clickers, ID cards swiping and manually writing down names on a sheet of paper as a method to track student attendants has prompted this project to be carried out. This is not in any way to criticize the various methods used for student attendance, but to build a system that will detect the number of faces present in a classroom as well as recognizing them.

Also, a teacher will be able to tell if a student was honest as these methods mentioned can be used by anyone for attendance records [21], but with the face detection and recognition system in place, it will be easy to tell if a student is actually present in the classroom or not. This system will not only improve classroom control during lectures, it will also possibly detect faces for student attendance purposes.

IV. Requirement

Python is a dynamic, interpreted (byte code-compiled) language. There are no type declarations of variables, parameters, functions, or methods in source code. This makes the code short and flexible, and you lose the compile-time type checking of the source code [22]. Python tracks the types of all values at runtime and flags code that does not make sense as it runs. Python comes with a large standard library that has some handy codes and functions which we can use while writing code in Python. An exception is an event that can occur during program execution and can disrupt the normal flow of program. Python supports exception handling which means we can write less error prone code and can test various scenarios that can cause an exception later on.

Web framework like Django and Flask are based on Python. They help you write server side code which helps you manage database, write backend programming logic, mapping urls etc. There are many machine learning applications written in Python [23]. Machine learning is a way to write logic so that a machine can learn and solve a particular problem on its own. For example, products recommendation in websites like Amazon, Flipkart, eBay etc. is a machine learning [24] algorithm that recognizes user's interest. Face recognition and Voice [25] recognition in your phone is another example of machine learning. Data analysis and data visualization in form of charts can also be developed using Python. Python integrates the Enterprise Application Integration that makes it

easy to develop Web services by invoking COM or COBRA components. It has powerful control capabilities as it calls directly through C, C++ or Java via Python [26]. The Python also processes XML and other markup languages as it can run on all modern operating systems through same byte code.

4.1 Open CV

OpenCV is a large open-source library for image processing, computer vision, and machine learning. Python, C++, Java, and other programming languages are supported by OpenCV.

It can analyse photos and videos to recognise items, faces, and even human handwriting. When it's paired with other libraries, like Numpy, a highly efficient library for numerical operations, the amount of weapons in your arsenal grows, as any operation that Numpy can be merged with OpenCV [27]. OpenCV is a cross-platform library that may be used to create real-time computer vision apps. It mainly focuses on image processing video capture [28] and analysis including features like face detection and object detection. This module covers the basic data structures such as Scalar, Point, Range, etc., that are used to build OpenCV applications. In addition to these, it also includes the multidimensional array Mat, which is used to store the images. In the Java library of OpenCV, this module is included as a package with the name org.opencv.core. This module covers various image processing operations such as image filtering, geometrical image transformations, color space conversion, histograms, etc. In the Java library of OpenCV, this module is included as a package with the name org.opencv.imgproc.

4.2 CSV

CSV (Comma Separated Values) is a simple file format used to store tabular data, such as a spread sheet or database. A CSV file stores tabular data (numbers and text) in plain text. Each line of the file is a data record.

Each record consists of one or more fields, separated by commas. The use of the comma as a field separator is the source of the name for this file format. A Comma Separated Values (CSV) file [29] is a plain text file that contains a list of data. These files are often used for exchanging data between different applications. For example, databases and contact managers often support CSV files. These files may sometimes be called Character Separated Values or Comma Delimited files. They mostly use the comma character to separate (or delimit) data, but sometimes use other characters, like semicolons. The idea is that you can export complex data from one application to a CSV file, and then import the data in that CSV file into another application. A CSV file has a fairly simple structure. It's a list of data separated by commas. For example, let's say you have a few contacts in a contact manager, and you export them as a CSV file [30].

V. System Design

This is a window application developed in Python technology, MySQL is a backend database. This application has two type of users one is Admin user who will upload the files to main storage with annotation details. Another is an end user who is a real beneficiary of this system who can able to search for the file by providing the query keyword. With this system end user can able to get most matching files in short time shown in figure 1. This system uses a Workload which is like a cache area with the help of the Workload space and Annotation technique this system help the end user to get his required file in short time.

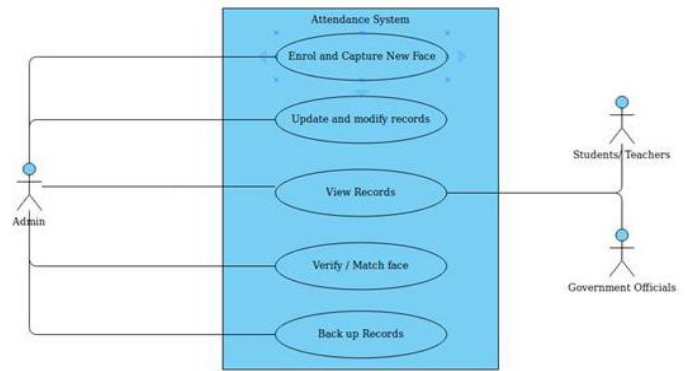


Figure 1 The Use case diagram

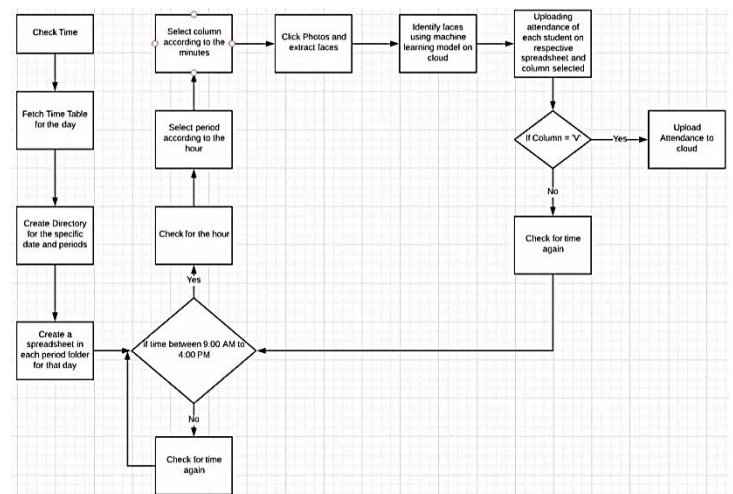


Figure 2 The System Architecture

The usage period of any venture advancement is the most essential stage as it yields the last arrangement, which takes care of the current issue. The usage stage includes the real emergence of the thoughts, which were communicated in the examination report and grew in the configuration stage shown in figure 2. Execution must be an impeccable mapping of the outline record in a suitable programming dialect with a specific end goal to accomplish important last item shown in figure 3. The item may be destroyed because of off base programming dialect decided for usage or unsatisfactory system for programming. The coding stage must be straightforwardly connected to the outline stage in the sense if the configuration is as far as item situated approach then usage ought to be ideally done in the article arranged way. Usage of any product framework is constantly gone before by

essential choice with respect to determination of stage, the dialect utilized and so forth shown in figure 4. These choices are regularly impact by a few variables, for example, environment in which the framework lives up to expectations, the rate that is needed, the security concerns, and other execution points of interest. The real execution choice that has been made before the usage of this venture is determination of the programming dialect for improvement of the application. The venture will be done in java, since it is an adaptable dialect. This dialect has been decided for the execution since it give obliged bundle to the security. The Project work is executed utilizing python. The IDE overshadowing is utilized, which streamlines the development of utilizations. Opencv is utilized to outline the all pages for sender and collector and Opencv code content the Python code at whatever point it obliged element conduct. The Python advancement unit is utilized to actualize all the obliged bundles. The accompanying depictions layout the outcomes or yields that we are going to get once regulated execution of th considerable number of modules of the framework.



Figure 3 The FRBAMS Window I



Figure 4 The FRBAMS Window II

VI. Conclusion

Attendance marking in a class room during a lecture is not only a onerous task but also a time consuming neat that. Due to an unusually high number of students present during the lecture there will always be a probability of proxy attendance. Automatic Face Recognition (AFR) has created a revolution in this changing world. It has ensured us with more safety of our data. Smart attendance using Face Recognition comes handy in day to day activities. It helps reducing the amount of paper and efforts for taking manual attendance. It is a process which uses students face to recognize them. It is done by using face biometrics and some other features of face. It is captured and been stored in the memory and it's been processed on to recognize the student by using various algorithms and techniques. In our attendance system, computer will be able to recognize the student whose data has been stored and it marks attendance of that student. Various algorithms and techniques have been used for improving the performance of face recognition. The concept we are using here is Open CV. We are also using Raspberry Pi and camera module to take image and storing them in database. This way the attendance will be automated. Student's attendance is used to be usually achieved by classical way this means record papers or more novel approaches by hardware tools such as

radio frequency identification (RFID), near field communication (NFC), biometric identification or combination of just presented. But in our proposed system does not require to carry any hardware device or to perform some kind of direct biometric identification. The proposed system an easy way for marking attendance where student is identified by camera, where the faces are matched to the one stored in the database after comparing the trained images. In this way students are automatically and indirectly monitored during classes and lectures, which is a better way for attendance system. Another area of future work is improving our neural network classifier. As mentioned in the previously, it is possible to construct the network to take its input directly from the image data rather from the vector that results from an images projection into face-space. Perhaps learning the face projection function could increase the accuracy of the neural network classifier. Additionally, more experiments are needed to see if there are other ways to tweak the network configuration to produce better results.

VII.Future Work

Face recognition is the most biological features recognition technology, according to the cognitive rule of human beings, its algorithm is ten times more complex than a fingerprint algorithm. The system will do its work even if one is not in touch with it or forget about it. Face recognition is featured by the following advantages compared to fingerprint: Using face recognition accurate and fast identification, industrial leading facial recognition algorithm matches more data than a fingerprint. High usability and security in this context failure to control and acquire rate is less than 0.0001%, fingerprint technology will have problems for enrolment with cold, wet, desquamation, elder, and around 5% people cannot get enrolled with a photo which is captured by the camera, there is no evidence with fingerprint

technology to track the incident and user friendly design.

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Cite this article as :

Aparna Trivedi, Chandan Mani Tripathi, Dr. Yusuf Perwej, Ashish Kumar Srivastava, Neha Kulshrestha, "Face Recognition Based Automated Attendance Management System ", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 261-268, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229147>
Journal URL : <https://ijsrst.com/IJSRST229147>

Comparative Study of Conventional Extraction and Microwave Assisted Extraction of *Chenopodium giganteum* Leaves

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ABSTRACT

Microwave assisted extraction is one of the advanced techniques under thought now a days. In MAE, microwave vitality is utilized to concentrate plant metabolites with the solvents. The present study shows an efficient microwave assisted extraction (MAE) method for taking out of secondary metabolites from the medicinal plant of *Chenopodium giganteum*. The dried powder samples were subjected to extraction process by Conventional method as well by microwave assisted extraction and the extracts were subjected to qualitative phytochemical screening. The phytochemical screening of both the extracts revealed the presence of proteins, carbohydrates, tannins, flavonoids, terpenoids, alkaloids, phenols, glycosides.

Keywords: Microwave assisted, Conventional, phytochemical, extracts.

Article Info

Volume 9, Issue 1

Page Number : 269-272

Publication Issue

January-February-2022

Article History

Accepted : 08 Feb 2022

Published : 17 Feb 2022

I. INTRODUCTION

Medicines from natural sources are the first choice for the prevention and treatment of all kind of diseases for thousands of years. These Natural medicinal products are prior sources for drug development. The drawback facing with in natural medicines are the quantity of bioactive substances which are comparatively less. So, Development of proper effective and selective methods for the extraction of those bioactive substances from the natural source is very important.

To separate the precise chemical ingredients from the herbal drug is the number one concept of extraction. There are special styles of Extraction strategies which

encompass solvent extraction, distillation method, urgent and sublimation consistent with the diverse idea of extraction.

Extraction entails isolating dissolvable substances from non-dissolvable residues using solvent(s); it may be in shape of liquid or solid There are categories of extraction which are traditional and contemporary; the former includes Soxhlet, soaking, maceration, extremely-sonication, rapid-rapid blending, and solvent permeation; the latter includes ultrasonic-assisted, subcritical, supercritical CO₂, enzyme-assisted, pressure-assisted, and microwave-assisted techniques.² The traditional methods are mainly associated with an extended time of extraction, destruction of heat-sensitive bioactive compounds,

and enormous consumption of solvents.³ It's far then critical to explore modern strategies of extraction to conquer the setbacks related to the traditional methods. Out of all of the current strategies of extraction, microwave-assisted extraction (MAE) has received the greatest attention because of its reduced consumption of solvent, shorter operation time, reproducibility, improved recovery yield, top selectivity, and reduced pattern manipulation ⁴. Gedye et al. And Giguere et al. Were groups that first described the usage of microwave power in 1986, it was hired in natural synthesis; microwave power become additionally hired in the extraction of biological samples for analysing natural compounds.

II. METHODS AND MATERIAL

Powder of *Chenopodium giganteum* were collected from Tirunelveli district, Tamilnadu. The plant was identified and authenticated by V. Chelladurai, Research officer – Botany, (Retired) Central council for research in Ayurveda & Siddha. The healthy leaves were shade dried and powdered using electric blender to get a coarse powder.

Conventional extraction:

10 gm of powder of both the drugs was subjected to successive solvent extraction using petroleum ether, chloroform, ethyl acetate and ethanol and Water. The

extract was concentrated and weighed to calculate % yield.

Microwave assisted extraction:

2 gm of powders of both the drugs were separately taken in 250 ml reaction flask and were subjected to microwave irradiation. the time set was 15 min and intensity 450 W but the extraction was stopped when vigorous boiling started. the extracts were concentrated and weighed to calculate % yield. The extracts obtained by conventional as well as microwave assisted extraction were subjected to preliminary phytochemical screening.⁵

Both above given extracts were subjected to Preliminary phytochemical screening by standard protocols.^{6,7}

III. RESULTS AND DISCUSSION

Powder of *Chenopodium giganteum* has been subjected to the extraction process by conventional method as well Microwave assisted extraction and the % yield and Color and Consistency of the extracts were compared and tabulated (Table 1). Both extracts are subjected to preliminary phytochemical screening and the results are given below Table.2.

Table 1: Comparative study of Conventional extraction and Microwave assisted extraction of *Chenopodium giganteum*

NO	SOLVENT	<i>Chenopodium giganteum</i>					
		CONVENTIONAL EXTRACTION			MICROWAVE ASSISTED EXTRACTION		
		COLOR AND CONSISTENCY	% YIELD	TIME (Hrs)	COLOR AND CONSISTENCY	% YIELD	TIME (Hrs)
2	Pet. ether	Yellowish green Semisolid	0.5%	2hrs	Yellowish green Semisolid	1%	10 Mins

		Consistency			Consistency		
	Chloroform	Greenish black Semisolid with oily mass	1.4%	3hrs	Greenish black Semisolid with oily mass	2%	15 Mins
	Ethyl acetate	Greenish black Semisolid with mass	0.7%	3.5hrs	Greenish black Semisolid with oily mass	2.5%	15 Mins
	Ethanol	Dark green Semisolid Consistency	0.4%	2.5hrs	Dark green Semisolid Consistency	3.5%	15 Mins
	Water	Dark Brown Semisolid Consistency	4.5%	2hrs	Brownish Black Semisolid Sticky Consistency	10%	15 Mins

Table 2: Preliminary phytochemical Screening of *Chenopodium giganteum* leaf extract prepared by Conventional extraction and Microwave assisted extraction

S.No	Chemical Constituents	CONVENTIONAL EXTRACTION	MICROWAVE ASSISTED EXTRACTION
1	Carbohydrates	+	+
2	Alkaloids	+	+
3	Steroids	+	+
4	Glycosides	+	+
5	Saponins	+	+
6	Flavanoids	+	+
7	Tannins	+	+
8	Phenolic Compounds	+	+
9	Proteins	+	+
10	Amino acids	+	+
11	Terpenoids	+	+

DISCUSSION

The color and consistency obtained in both the methods of extractions were same. The yield obtained was more in some of the cases in microwave assisted extraction than conventional extraction but time required for microwave assisted extraction was much less. Better results were obtained in microwave assisted extraction.

IV. CONCLUSION

The results were encouraging as better results were obtained with reference to % yield at medium intensity and more time. It was not clear whether the extraction in microwave was complete. Hence, it is necessary to carry out further study to evaluate completion of the process.

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Cite this article as :

Shailin Dkhar, Akila E, Dr. Narayanaswamy, Pruthvi N, "Comparative Study of Conventional Extraction and Microwave Assisted Extraction of *Chenopodium giganteum* Leaves", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 269-272, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229148>
Journal URL : <https://ijsrst.com/IJSRST229148>

QR Code as the Delivery of agent to Schools

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Article Info

Volume 9, Issue 1

Page Number : 273-276

Publication Issue

January-February-2022

Article History

Accepted : 08 Feb 2022

Published : 19 Feb 2022

ABSTRACT

Divider or magazine magazines are a method for conveying data on Schools grounds. In the conveyance of data, the magazine has been broadly spread in a few utilizations of Schools, iRan and GreenDoc. Be that as it may, this is as yet not ideal in light of the fact that the strategy utilized is as yet utilizing paper. And furthermore the absence of consciousness of understudies will peruse the data on the magazine. QR codes are a sort of two-layered grid code or scanner tag created by Denso Wave in 1994. With that, the type of data is decreased to a QR code that can store nitty gritty data showed on a screen accessible at a few vital corners of the grounds and output the code on the principle page of the internet based magazine site. The strategy utilized is the cascade technique, perception, and writing study and diary references as supporting recorded as a hard copy. This exploration was intended to make it more straightforward to get to data and draw in perusing interest to understudies of Schools.

Keywords : Wall magazine on the web, Information, QR Code, Waterfall

I. INTRODUCTION

Divider magazines, or frequently synchronized as mading, are probably the least complex sort of composed broad communications pointed toward dispersing data [4]. Mading is utilized by colleges, particularly Schools, which is currently the land for dispersing data. Data as inside, and outer data that has been chosen.

Advanced education Raharja the job of mading is vital for warning of data about the grounds. To add information and become the subject of enlightening and open data. Not just that, the magazine can work as the desires of understudies to offer their viewpoints,

works or different occasions in giving helpful data to perusers, particularly understudies of the grounds climate.

Mading is right now being executed, indeed the framework is now in awesome turn of events. Data on the magazine has been remembered for a few utilizations of Schools, iRan (I-Learning Ask and News) and Greendoc, however in the spread of data on the grounds climate has not been augmented. Furthermore 3 issues emerge, specifically, (1) Layout of paper sheets on sporadic mading (2) The data sheet becomes dull and harmed on the grounds that it isn't strong, (3) Lack of interest in perusing on mading. Internet mading with the QR Code helps issues in the

applied magazine, (1) Layout of data on the website making that is made more appealing (2) Online magazine doesn't need paper for data media, thusly there will be a screen that shows grounds data , (3) With alluring showcase on the screen while making it simpler to get to data by examining incorporated QR code.

With the presence of this framework, it is trusted that it can augment the conveyance of data on the Schools, expanding perusing interest in understudies, making it simpler to get to data and disseminate data that is valuable for the grounds climate.

II. RESEARCH METHOD

2.1 Literature Review

In this review, it has been founded on a few speculations that help this exploration, in particular:

- [1] Research led by Rayi Septipiani Agustina from Esa Unggul University in 2017 named "Rancang Bangun Majalah Online Berbasis Web (Studi Kasus : Smk Al-Chasanah)". This web shows news data, gives remarks, and can give input without any problem.
- [2] Research led by Sudarmaji, MM from the 2015 Indonusa Surakarta Polytechnic named "Rancang Bangun Majalah Kampus Online Berbasis Web". The web that has highlights in web based mading to work with news the board, gives offices to clients in looking for data and is allowed to peruse and interface with magazines on the web.
- [3] Research led by Wahyudi Firdaus from Sultan Syarif Kasim Riau Islamic University in 2016 named "Rancang Bangun Mading Online Berbasis Web (Studi Kasus:Program Studi Sistem Informasi Fakultas Sains Dan Teknologi Universitas Islam Negeri Sultan Syarif Kasim

Riau)". This web gives data about the aftereffects of understudy inventiveness, about divisions and conversation discussions.

2.2 Method

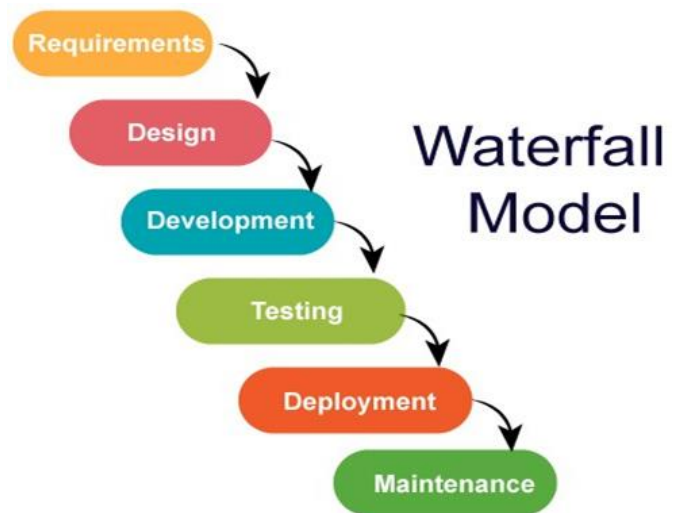


Figure 1. Waterfall

2.1.1 Requirement Analysis

In this review, an immediate overview will be led on the conveyance of data to Schools. In this review, an immediate overview will be led on the conveyance of data to Schools.

2.1.2 Data Collection

a. Observation

This exploration was led by direct perception at Schools.

b. Literature audit

This exploration in gathering information through searching for speculations that can be the premise of composing, for example, knowing the method for conveying data, QR Code, and a few existing diaries and analyzing to contrast hypothesis and the realities that exist in Schools.

c. System Requirements Analysis

At this stage, it will be done on the requirement for the method for conveying data as laid out on the accessible web-based magazine site QR code on the screen to work with admittance to data.

d. System Design

In the framework plan, the administrator is responsible for giving data, and choosing through the web-based magazine site that is associated with the screen is situated at the essential corner of the grounds. Understudies can filter the QR Code gave a short portrayal of data on the fundamental page of the showcase screen utilizing a cell phone gadget that approaches a QR

scanner, then, at that point, understudies can without much of a stretch get the data required exhaustively furnished with download and print elements to be perused anyplace whenever

It is clarified around 1 (one) framework that covers generally continuous exercises and 2 (two) entertainers who do exercises, in particular: understudies and administrator and afterward 7 (seven) usecases, to be specific: check QR Code, login, primary page, add articles, history articles, affirm accommodation of articles, select articles.

It is clarified around 2 Actors, specifically: Students and Admin and there are 6 Lifeline Procedures, specifically: QR Code/online page, login, make articles, article choice, article pages, and article screens and afterward there are 11 Message.

It is clarified around 4 swimlane to be specific: Student, Admin, System, and Monitor and there is 1 (one) introductory hub where the main item starts and afterward there is an activity that shows every type of effort streams, specifically: making articles, putting away articles, understudy

III. Finding

2.1 Problem

3.1.1 Analysis of System Requirements

Framework prerequisites examination is utilized to clarify what is required in planning the framework

and to portray it as indicated by the uprightness of the client, while dissecting the requirements for the QR Code for of conveying data on web based promoting for tertiary organizations, particularly Schools, specifically:

a. Functional Needs Analysis

The framework can be shown and access data about home, profile, exhibition, occasions, understudy articles.

b. Analysis of Non-Functional Needs

1) Software Specifications

The framework is worked with the accompanying programming: Microsoft Windows 8 working framework, XAMPP as a web server, Notepad ++ for its manager programming and PHP programming language as the primary content.

IV. 2. Conclusion

This framework is as yet in the model interaction so it is as yet a work in progress by the producer. Mading Online is wanted to work with understudies in giving data and creating imagination in conveying data. This framework is relied upon to work with admittance to data and further develop perusing interest in the grounds climate. Internet Mading with the assistance of the QR Code is normal that each understudy can get data successfully, modern and fascinating. Presently there are a great deal of differed and intriguing internet mading, so this framework needs further turn of events. It is trusted that this framework will be refreshed by the administrator or understudies to work on the nature of online magazine.

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Cite this article as :

Anita Sondhi, Dr. Ravindra Kumar, "QR Code as the Delivery of agent to Schools", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 273-276, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229144>
Journal URL : <https://ijsrst.com/IJSRST229144>

Environment Feature and Obstacle Position Prediction Using Long Short-Term Memory

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ABSTRACT

Congestion management and procedural knowledge require obstacle prediction of network based on large amounts of dataset. Traditional time series forecasting approaches struggle to create effective prediction models since time series analysis in prediction of network traffic is very unstable time parameter and is also non linear in nature, which may cause a very low forecast accuracy. Hence the define usage of LSTM ie. Long Short Term Memory Recurrent Neural Network has been developed as very important alternative for Neural Network (NN) efficiency. The paper proposed to develop an efficient method in combination with genetic algorithm (GA) and of Long Short Term Memory Recurrent Neural Network (LSTMs) in prediction of environment features and positions of obstacles. The combination of both will be comprises of two sections, one with LSTM which is used for feature extraction and GA is used to enhance hyper parameters extracted for the LSTMs networks. The method assumes the higher prediction accuracy as compared to previous research study with decrease in prediction of errors, with categorization of complex changes with considered data; this is done by comparing the ARIMA i.e. Auto Regressive Integrated Moving Average and LSMTs.

Keywords : Long short-term memory recurrent neural networks, Genetic algorithm, Network traffic prediction

Article Info

Volume 9, Issue 1

Page Number : 280-286

Publication Issue

January-February-2022

Article History

Accepted : 08 Feb 2022

Published : 17 Feb 2022

I. INTRODUCTION

In this era of massive knowledge, computing (AI) is maybe the foremost essential task of technology. AI has created plenty of progress, particularly in machine learning, data processing, laptop vision, skilled systems, tongue process, robotics, and doable technologies, since its origination fifty years ago[1].

Obstacle prediction is a very important space of motion planning. the utilization of a statistic analysis model may be a common theme in recent add this space. the foremost prevailing branch of AI is machine learning. Optimization algorithms, deep learning, artificial neural network systems, and scientific theory are number of the opposite forms of AI. The Environment feature and obstacle

prediction have been most prevalent areas in today research, especially in the field of prediction of motion and navigation. Major issue in LMS is that swapping into the convergence speed with tracking of traffic performance. One major issue with LMS is to make substitution between speed and its performance in tracking. While using LMS in prediction of traffic there is chance of conflict between prediction of errors and prediction of delays. The main phase or steps in size decreases the prediction delay but can emerge the problem in convergence, which will lead to increase in error prediction, on other side for lower step the decrease in size reduces the predictions of delay but the it may give rise to problem of convergence which cause to increase prediction errors. There are many models developed and proposed to explore the similar properties of network traffic categorization and prediction of network traffics. The current models like support vector machine (SVM) , auto regressive integrated moving average (ARIMA), are used as linear model in strong data, which cannot be explained or exploited, and encapsulating complicated non-linear connections [2].

The use of GA is based on to enhance the issues; the algorithms are not affected or disturbed by the presence of noise as compared to other AI algorithms. Genetic Algorithms are used in exploring of large spaces and multimodal spaces of applications [3]. The proposed system in this paper mainly focus on application of genetic algorithm along with LSTM for prediction of environment obstacles, we have observed from previous research that genetic algorithm can be used to enhance the parameter in hyper stages of LSTM method. We assume that the combination of two genetic algorithm and LSTM can be used to server mapping into input and output variable. The second pat applicable for genetic algorithm can used to optimize the hyper parameter used in model of LSTM. The environment data problem replacement is used to estimate

environment information at a certain intersection based on data from a nearby intersection. NN (Neural Network) based approach is applicable for predicting the motion. The main answer to resolve the problem of motion prediction can be done viva integrating multilayer perception(MLP) network or cascades deep learning network(DLN) , forward network(CFN), are mainly worn intended for checking the prediction performance[4].The paper mainly focus on the deep study of motion prediction analysis with problem identification using genetic algorithm and LSTM.

The different analyzed method for prediction of motion can be applied, we have observed that combining the GEO satellites and Auto Regressive Integrated Moving Average (ARIMA) model the motion calculation accuracy can be maintained .The method can also use grey model to analyze the prediction performance. Another method we learned was combination of ARIMA and grey model with different parameter weights can be used to analyze the network motion performance [5]. But these models require an high end expensive combination of GEO satellites for prediction of motion, therefore we analyze that combination of LSTMS and GA can reduce the motion errors and delays. The need of using GA-LSTMs for motion prediction is because pervious method are prone for problem of over fitting and it cannot be always efficient for prediction of motion performance in certain application[6].

II. Literature Review

Taking into account of network factors related to security, the best step to pervent network structure from anomalous situations or activities, we can monitor the motion for unwanted activities. The most reliable solution to monitor the motion is to analyze and detect the congestions, intrusive activities or attacks. Prediction of network motion

includes the evaluation of recurrent past network data flow which is used by collecting and storing of data, by analyzing the differentiated parameter in form of behavior and patterns included in various node of network. The vital role of studying the network motion for perdition of motion data is explain in [7] by the author. We have observed that LSTM procedure which is based on process of genetic steps of algorithm can be to analyze the network motion perdition along with its performance [8], the paper also explains about the experimental result of auto regression which can be integrated with ARIMA to achieve the higher accuracy of motion prediction .The paper[3] explains that the prediction of network motion can be important for network operations to analyze its efficiency and quality guarantee. Hence author here explains the improvised LMS prediction system for prediction of motion data.

The prediction of network motions focuses on approach for improved network motion based on analyzed of past motion input sets. This leads to the efficient method for network planning and management of task. The group of RNN i.e. recurrent neural network is generally considered in data modeling of time series which is based on objective of predicting the future implemented time series depending upon the past information with its different parameter like size. RNN have similar network like [9](GRU)Gate Recurrent Unit, (LSTM)Long Short Term Memory which is efficient for capturing the patterns , long dependencies and large arbitrary size.

Advanced communication networks, such as the Internet of Things (IoT) and mobile networks, generate enormous amounts of diverse motion information. Network infrastructure management practices for data collection and data analysis confront some obstacles and difficulties in such systems, including such precision and enhance

reliability analysis of massive data[10].We have studied the application of deep learning implemented in NTMA i.e obstacle Monitoring and Analysis.

Raw navigation data should be transformed into meaningful information using NTMA techniques in a series of phases. Using conventional methods for advanced analytics presents a number of obstacles and issues, involving reliability, elevated insights, and enhance reliability processing of large amounts of data is explain in[11]. Besides that, a large number of devices produce tremendous quantities of fresh data all day as a result of new paradigms like the Internet of Things (IoT) [12], so we need more process equipment to evaluate and analyze such massive amounts of raw data in a far more efficient direction in order of accessing space and time.

Moreover, Verma et al. [13] looked at true IoT data analysis. The authors reviewed the most recent network analytics techniques that are suitable for high IoT network machine learning in this paper. The foundation of real-time IoT analytics, application cases, and operating systems are also explored in that study.

Genetic Algorithms are dynamic meta heuristic methods derived from natural genetically principles. The primary premise of Genetic Algorithms is to imitate phenomena in natural systems that are required for evolution; particularly some of those who meet Charles Darwin's survival ideas is explain in [14]. Nowadays, computer internet navigation management is a hot study issue, as it aids in a variety of applications such as outlier detection, routing protocols, and symptom management. The goal in [15] is to make prediction on very small scales (just under 30 seconds). Because navigation is diverse, a functionality clustering approach is being used as the classification phase to group comparable time - series data together. According to the findings,

LSTM can be used to anticipate internet navigation with fewer errors.

In network design, reliable and actual campus internet navigation prediction is critical. The goal of this project is to conduct a vulnerability scanning of internet navigation as well as to solve prediction issues caused by the non - linearity and multidimensional dynamics of campus network navigation. For the investigation of surrounding users' network activities, an internet navigation prediction system related to the long memory (LSTM) model is provided in [16].

III. Proposed System

The path prediction through video grabs gain lots of attention by an researchers as it can be applied in various real time application like automated driving vehicles, camera based surveillance system analysis etc. In the method so many more information /data like real time environmental surroundings, direction of moving traffic, various states of target will be required. Hence most of the path prediction methods are basically based on computer vision task like living being movement detection, their various observation factors detection. However in path prediction method current information is available but future data is not hence the previous data and current data is used to predict the future estimated path for achieving the target. This path planning strategies should consider all the aspect like minimum required time for achieving the target, minimum shortest path to cover, minimum obstacles, and least energy requirement to move the target . The path prediction work is a most challenging task in the field of computer vision system. AN general method is shown in figure(1).

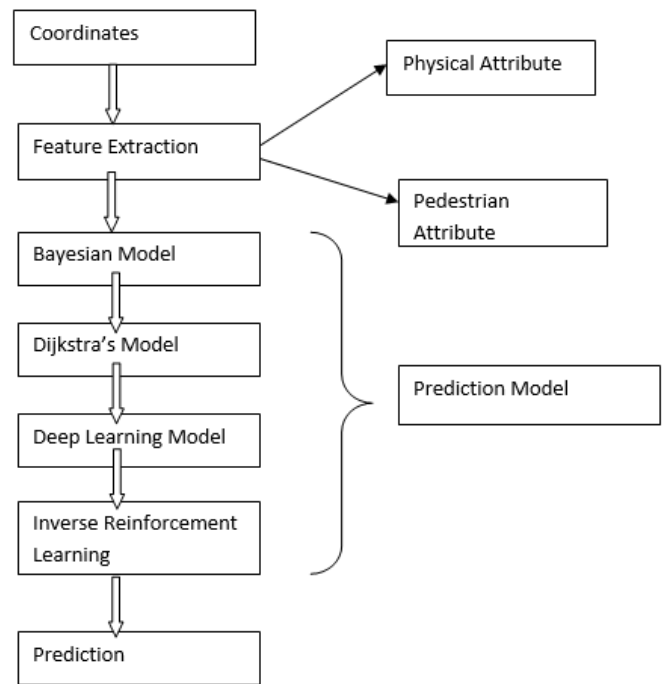


Figure 1. Depicts the Current States of Target Movement

IV. Feature Extraction Approach

In this a video is taken a input to system with some additional information like the current location of the source or the sequence of frames of an location of the source over the past frames of different timing in a seconds. Information useful for the path prediction is then extracted from the sequence of frames for future path prediction. Parameters taken into account to extract the features from the input video as shown in table(1).

Feature	Type
Enviroment	Scene Label
	Cost
	Global Scene Feature
Target	Location
	Direction
	Attribute
	Feature Vector

Table 1. Feature Extraction

It should be noted that the path selected by the human being is affected by so many factors of the environmental surroundings and the current mind state of the pedestrian. The path prediction can be improved when using the data that mostly decides how the human decides the way to go on in the current path. Hence when a video is taken from the location all the necessary data is extracted from the video for predicting the future path. This data is categorized in two ways:

- A) Environment
- B) Target

A) Environment:

In the heavy traffic flow normally every pedestrian does decide their own way & moves along a different path with considering all affect around their environmental surroundings.

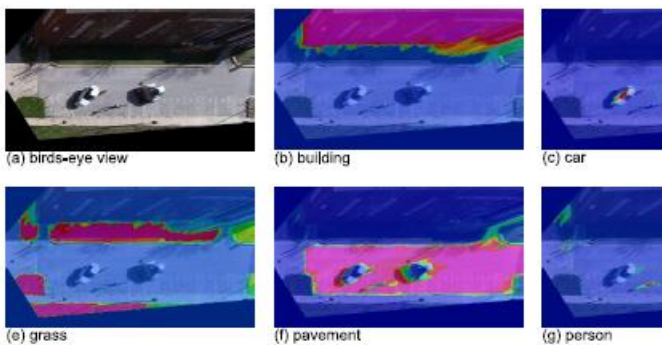


Figure 2. Environment Surrounding Feature Extraction

Consider an example, generally we walk in the side street for avoiding obstacles coming in our way of path (e.g., all parked vehicles & trees or dustbins kept a side in road) & we drive our own vehicles by using all the area of an path in a very common & social practice manner. All the movement of the body is dynamic in nature & affected by the environmental surrounding. Hence the various parameters (factors) is therefore can be used while predicting the future path of an target. Generally Feature vectors for creating feature maps of an

pedestrian is most widely used of path prediction. Here this feature extraction process of environment can be achieved by using “CONVOLUTION NNETWORK” for future path prediction.

1) Target

In addition to the environmental surrounding mostly affect the source while deciding future path, various internal observations of the target like different attributes namely age, gender, his/her internal demands are also plays an very important role for taking decision for selecting future path. Figure 3. A & B depicts the various body and head movement of pedestrian called as target features.

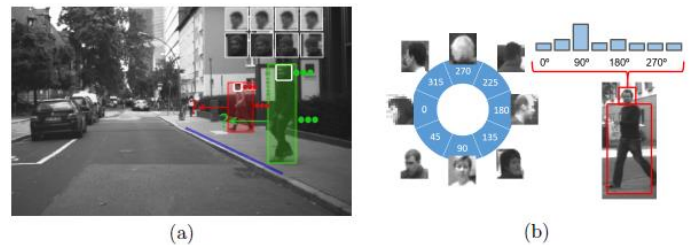


Figure 3. (a) Pedestrian body orientation. (b) Estimation of the orientation of the head in eight directions.

In [9] various techniques has been discussed for extracting target (source) features. Here the mostly used target feature attribute was a different orientation of the target body movement because this estimated orientation of the target can be used to predict that in which direction the target is going to move in future hence the prediction error in future process can be reduce in much extent.

Various techniques like histogram of oriented gradients (HOG) and support vector machine (SVM) has been used for this orientation. Similarly head direction is also a very important attribute for future path prediction as shown in fig (3.b) if the target head orientation is focused towards the camera of traffic light straight forward then it indicates he/she will stop on his position. Similarly its all different

orientation will indicate different future movements of the target that will definitely help to predict that in which direction the target is going to move in future.

V. Conclusion

Obstacle prediction and environment feature identification is a very important role in the motion planning and navigation. Artificial intelligence and machine learning are the technologies that help us for implementing the solutions for predicting the future change in the environment and that helps in predicting a obstacle types and their motion. In this work we have done the survey on various techniques available for the prediction. Long short term memory is used for the time series analysis and prediction of environment features and the obstacle class using the various parameters. In one of the section we have discussed the method along with the implementation steps and the intermediate steps considered during the simulating the system. We have found that the proposed long short term memory works efficiently in predicting the environment features and the obstacles classification in the environment under observation.

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Cite this article as :

Samir N. Ajani, Salim Y. Amdani, "Environment Feature and Obstacle Position Prediction Using Long Short-Term Memory ", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 280-286, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229151>
Journal URL : <https://ijsrst.com/IJSRST229151>

Comparison of Rhizospheric Soil Nutrients and Microbial Analysis with Two Different Weed Plants in Kalaburagi District, Karnataka

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ABSTRACT

Article Info

Volume 9, Issue 1

Page Number : 287-292

Publication Issue

January-February-2022

Article History

Accepted : 10 Feb 2022

Published : 20 Feb 2022

The important abiotic factor for the plants is soil. It which includes various nutrients and microorganisms for well adapting of plant to environment. The soil near to the face of a root of plant is called rhizosphere. Rhizosphere is a vital region of plant ecosystem, which includes various nutrients and microorganisms for well adapting of plant to environment. This study is aimed at assessing rhizospheric nutrient content cultural bacterial fungi and actinomycetes density in the rhizosphere of *Cassia sericea* and, which grow profusely in nutritionally-poor soils and environmentally-stress conditions as weed on road side, waste land and agricultural land. The rhizospheric soil of both the weeds are slightly alkaline. Both of the soil have rich organic content. Electric conductivity is more in .Nitrogen, Potassium, Zinc, Sulphur, are more in *Cassia sericea*. Hence *C. sericea* is more dominant than in *Parthenium hysterophorus*. Phosphorus and Iron content is more in *Parthenium hysterophorus*. In microbial analysis. *C. sericea* have much more bacterial colony and actinomycetes than *Parthenium hysterophorus*. But fungi are more in *Parthenium hysterophorus*. so both weed plants have comparatively rich in rhizospheric soil nutrition content and microbial density than normal soil this may be the one of the reason for their wide spread growth.

Keywords : Nutrients pH, soil, minerals, Organic carbon

I. INTRODUCTION

The activity of plant root surrounding area influences physiochemical and biological activity in the surrounding rhizosphere compartment, and vice versa. These processes are determining nutrient availability, cycling of nutrients and solubility of toxic elements

for plants and microorganisms, thereby creating the rhizosphere as a unique microecosystem. Plant developmental processes are controlled by internal signals that depend on the adequate supply of mineral nutrients by soil to root and root to shoot. Thus, the availability of plant nutrients can be a major constraint to plant growth in many environments.

Plants take up most of mineral nutrients through the rhizosphere where microorganisms interact with root exudates. Rhizospheric bacteria participate in the geochemical cycling of nutrients especially nitrogen, phosphorus and micro nutrient as iron, manganese, zinc, and copper, and determine their availability for plants and soil microbial community. Plant root exudates consists of a complex mixture of amino acids, purines, nucleoside organic acid anions, phyto siderophores, sugars, vitamins, inorganic ions (e.g. HCO_3^- , OH^- , H^+) [1], gaseous molecules (CO_2 , H_2), enzymes and root border cells which have major direct or indirect effects on the acquisition of mineral nutrients required for plant growth [2]. Rhizosphere was described for the first time by Lorenz Hiltner in 1904 [3]. It varies with the plant species and the soil, generally considered at 2 mm distance from the root surface known as rhizoplane. Researchers have shown that the influence can be up to 10 mm [4–6]. Rhizoplane affects the nutrient availability as well as microbial population. The micro-organism diversity is higher near to the rhizoplane. It decreases with an increase in distance from rhizoplane [7, 8]. The interaction between plant nutrients in soil and plant exudates modifies the micro climate of the rhizosphere [9]. The soil volume is affected by the root exudates. The microorganisms exert influence on plants. Thus the relationship between microbes and plants may be commensalic, mutualistic, or parasitic. In mineral nutrition, specific organisms are involved in the acquisition of nitrogen (N) (free living or symbiotic nitrogen fixers) and phosphorus (mycorrhizae) and their effects on plant development are well documented. Specific plant effects on the bacterial communities of rhizosphere have been observed in members of different plant species including *Chrysanthemum* [11], *Brassica solanum*, *Fragaria* [12], *Alopecurus*, *Anthoxanthum*, *Arrhenatherum*, *Holcus*, *Plantago* and *Geranium* [13] and *Camellia sinensis* [14]. The interaction of plant roots with soil microorganisms through rhizosphere has higher

levels of microbial biomass and activity than those in bulk soil. Rhizospheric microbial communities are influenced by the plant exudates, roots as mechanical support and competition for nutrients. Equally, plants are affected by rhizospheric microbial communities through their participation in fast soil nutrients cycle, water dependence and growth promoting metabolites, and high adaptable nature to extreme condition and their profuse growth. It is any plant species is a unique niche harboring diversified bacterial and fungal communities, which serve as potential resource for bio prospecting. The rhizosphere of plant species growing profusely under stress-conditions harbors novel microbes to meet their nitrogen requirement as observed in salt marsh grasses such as *Spartina alterniflora*, *Juncus roemerianus* [15]. Hence in this study two noxious weeds in region of Kalaburgi, *Parthenium hysterophorus* and *Cassia sericea* are selected to study the rhizosphere to know more about the weed plant. *Cassia sericea* annual herb and weed along railway lines and wastelands. road sides. This plant is a native of West India and south America. It is known to be widespread in Belgium and Dharwad districts of Karnataka. The present location is Kalaburagi of Karnataka is same as it. Ragweed (*Parthenium hysterophorus*) is an aggressive herbaceous weed of the Asteraceae with an almost worldwide occurrence (Towers et al. 1977). Both these plants are able to thrive well in adverse conditions, making these ecosystems as unique models for studying the diversity of a particular microbial community performing a certain geochemical function. Hence, it is hypothesized

That the two plants should harbor some rich microbes and nutrients in their rhizosphere irrespective of soil types for their N management. Study of these could be beneficial for weed management. The activity of plant root surrounding area influences physiochemical and biological activity in the surrounding rhizosphere compartment, and vice versa. These processes are determining nutrient availability,

cycling of nutrients and solubility of toxic elements for plants and microorganisms, thereby creating the rhizosphere as a unique micro ecosystem, which can exhibit completely different properties compared with the, soil science and soil microbiology strongly depend on the understanding of rhizosphere processes

II. MATERIAL AND METHODS

Rhizosphere soil sampling

Soil samples from rhizosphere soils of both *Cassia sericea* and *Parthenium hysterophorus* plants were collected from dry lands near the agricultural college Aland road Kalaburagi, Karnataka, India. The *Parthenium hysterophorus* and *cassia. sericea* were uprooted and rhizosphere soil samples were collected. All the samplings were triplicate and assessed separately to avoid sampling bias. *Cassia* and *Parthenium* soil samplings were done on same location and the microbiological analysis of the soil samples was carried out. After removing stones and stubbles, the powdered soils were packed in water-tight plastic bags and stored at 200 c for physio-chemical analysis. The physio-chemical properties of the soil samples were analyzed as per the standard procedures

Microbial Analysis

Colony forming units measure the viable bacterial fungal cells and actinomycetes. Microbiological analysis was performed by taking 1 gm of the soil in 10 ml of diluted sterile distilled water. 1ml of soil suspension was diluted serially and used for analysis of bacteria, fungi, actinomycetes. Nutrient agar, potato dextrose agar, starch casein was used for isolation of bacteria, fungi, actinomycetes respectively the soil suspension was prepared (according to serial dilution method) was shaken at RT using orbital shaker at 200 rpm for 1 hour. 200 micro litre of soil suspension was pipette and spread out over agar plates,

[pH7] a series of dilution of suspension from 10⁻² to 10⁻⁶ were used for plating. All the plates were incubated for a period 1 week. The experiment was carried out in duplicates. Colony forming units per gram of soil was determined.

III. Result And Discussion

Table I. depicts the results of Rhizospheric soil nutritional analysis sample of *parthenium* weed plant and *Cassia sericea* of Kalaburagi district.

The results of *parthenium* weed are observed as:- PH was found to be 8.2. organic carbon was 0.61. EC was found to be 0.61%. Nitrogen was 202 kg/hectare Phosphorus 25.0 kg/ hectare. Potassium was found to be 491 kg/ha. Sulphur 8.2 ppm. Zinc was found to be 0.259ppm. Iron was found to be 5.242 ppm. Copper ppm 1.126. Manganese 8.004ppm.

The results of *Cassia* are observed as:- PH was found to be 8.4. organic carbon was 0.14%. Ec was found to be 0.4. Nitrogen was 280 kg/hectare Phosphorus 15 kg/ hectare. Potassium was found to be 878 Kg/ha. Sulphur 9.8 ppm. Zinc was found to be 0.422ppm. Iron was found to be 5.139 ppm. Copper PPM 2.131. Manganese 8.245ppm.

The rhizospheric soil of both the weeds are slightly alkaline. Both of the soil have rich organic content. Electric conductivity is more in *C. sericea*. Nitrogen, Potassium, Zinc, Sculpture, are more in *Cassia sericea*. Hence *C. sericea* is more dominant than in *Parthenium hysterophorus*. Phosphorus and Iron content is more in *Parthenium hysterophorus*.

Colony forming units per gram of soil depicts the density of microbes isolated from rhizospheric soil. The bacteria was found to be higher in the rhizospheric soil compared to fungi. *Cassia sericea* has more number of bacteria than *Parthenium hysterophorus*. Fungi are more in number in

Parthenium hysterophorus than C.sericea. Soil contains lower number of actinomycetes in C.sericea as compared to P,hysterophorus. The presence of bacteria, fungi, and actinomycetes shows species richness in the soil.

Table.1. Dipict the results of comparison of rhizospheric soil analysis.

S. No.	Nutrients	Result	
		Parheniu mhystero phorus	Cassia sericea
1.	PH	8.3	8.4
2.	Organic carbon %	0.61%	0.14%
3.	EC (d.si/m)	0.2	0.4
4.	Nitrogen(kg /ha)	202	280
5.	Phosphorus (kg/ha)	25.0	15
6	Pottassium (kg/ha)	491	878
7.	Sulphur (ppm)	8.2	9.8
8.	Zinc (ppm)	0.259	0.422
9.	Iron (ppm)	5.242	5.139
10.	Copper (ppm)	1.126	2.131
11	Manganese (ppm)	8.004	8.245

Table -2 Microbiological analysis ; Of C.sericea and P.hysterophorus rhizosphere

Plant name	Parthenium			Cassia		
	I	II	Mea n	I	II	Mea n
Bacteria	28x 10 ⁶	12x 10 ⁶	15x 10 ⁶	38x 10 ⁶	40x1 0 ⁶	39x 10 ⁶
Fungi	53x 10 ⁴	65x 10 ⁴	59x 10 ⁴	21x 10 ⁴	36x1 0 ⁴	29x 10 ⁴
actinomy cetes	62x 10 ²	50x 10 ²	58x 10 ²	74x 10 ²	54x` 10 ²	64x 10 ²

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Cite this article as :

Vanamala G Sheri, Pratima Mathad, "Comparison of Rhizospheric Soil Nutrients and Microbial Analysis with Two Different Weed Plants in Kalaburagi District, Karnataka", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 287-292, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229112> Journal URL : <https://ijsrst.com/IJSRST229112>

Figures : STUDY OF MICRO ORGANISMS



Bacteria in rhizosphere of Cassia

bacteria in rhizosphere of parthenium



Fungi in rhizosphere of cassia



Fungi in Parthenium



Bacteria rhizosphere



Actionomycetes in parthenium c.sericea

Impact of Anthropogenic Activities on the Hydro Biogeochemistry of lake *Taal Ratoi* a Fresh Water Lake

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ABSTRACT

A fresh water lake the *Taal Ratoi* was chosen for present study situated near Fatehpur Mandaon village of Mau district in Eastern Uttar Pradesh. This lake having an area of 1837 hectare and connected with River Ghaghara. Being shallow water lake its hydro biogeochemistry was greatly affected by anthropogenic activities which include discharge of domestic waste, agricultural runoff, fisheries, boating, urbanization and use of recalcitrant materials. This results into eutrophication, acidification, siltation, and toxic contamination of the lake. For the present study physico-chemical properties of water analyzed from June to April 2019-2021 at ten sampling stations along the littoral and catchment area of lake. The statistical analysis of data revealed that the lake was eutrophic and the surface water contains high concentration of Nitrate 5.10mg/L and Phosphate 2.98mg/L. The mean value of pH 8.43, Electric conductivity 203.58 μ s/cm, Total Dissolve Solids 94.51mg/L, Dissolve oxygen 12.81mg/L, Salinity 212.74mg/L, and Total Dissolve Carbon 9.55mg/L were also analyzed. There were a positive correlation matrix found in between all physico-chemical parameters while a negative correlation was found between pH and Dissolve Oxygen. In this study a significant impact of anthropogenic activities were observed. It was found that the selected lake is being polluted and anoxic because of the high anthropogenic activities such as fisheries and agricultural activities are taking place in the area. It was also found that littoral zone of the lake is totally covered with the species *Eichhornia crassipes* and catchment area with *Hydrilla verticillata* and *Potamogeton crispus* [5].

Keywords- Anthropogenic activities, Fresh Water Lake, Eutrophication, Ecology, Littoral zone, Catchment area, Correlation matrix

Article Info

Volume 9, Issue 1

Page Number : 293-299

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022

Published : 21 Feb 2022

I. INTRODUCTION

The lake *Taal Ratoi* is a shallow fresh water lake connected with River Ghaghara and land mass spread over in its catchment area inhabiting a population of

about twenty five thousand people which influence the lake. Up to 1950s the water of this lake was very clean and was the only major source of fresh water of the area for agricultural and domestic circulation [5]. Now this lake was grossly polluted due to use of

recalcitrant materials, recent year urbanization, agricultural runoff and discharge of domestic sewage. As a result its water quality has been changed. Therefore, present study was carried out to assess the physico-chemical properties of water which are under stress of anthropogenic activities.

A. Physico-chemical properties- A great number of anthropogenic activities that have a negative impact on water quality and ecological state of the fresh water ecosystem [14]. These anthropogenic activities are discharge of domestic waste, agricultural activities, fisheries, urbanization, boating and use of recalcitrant materials which are the main cause of poor water quality in rivers, lakes, and wetland [2]. As the population and development of economy increases the anthropogenic activities progressively increases [24]. Agriculture and urban activities are major source of Phosphorous and Nitrogen in the aquatic ecosystem [3]. Nitrogen loads are likely to increase through population growth, expanded land development and increased agriculture [10]. Nitrate concentration indicates the level of micronutrients which support growth of phytoplankton [16] and organic load of water and bottom sediments release Phosphate content which help in growth of weeds [17]. In spite of this household detergent, domestic sewage, leaching of phosphate fertilizers also increases the level of phosphate. The lake ecosystems have been greatly affected in the recent years due to horrific development of industries and agriculture [22]. Due to increased industrial and agricultural activities surface and ground water being contaminated. This contaminated water contains large number of chemical elements [7] which influence characteristic of water body. As a result change in the quality of water influencing the biota [21]. Due to more deposition of domestic sewage dissolve oxygen fluctuated in lake [11] and it is an important indicator of ability of a water body to support aquatic life. Chemical fertilizers, pesticides, herbicides, insecticides and improper disposal of

sewage are source of major pollutants which cause to change the water quality. The productivity of water body determine by their physico-chemical parameters and change in this aspect, a water body bring about a corresponding change in the relative composition and abundance of the aquatic organisms [1]. Lakes in highly populated or intensively cultivated areas have experienced high nutrient loading, resulting in turbid water and loss of biodiversity [23]. Where lakes and reservoirs are used for drinking water purposes, eutrophication and the development of undesired phytoplankton blooms may create huge problems [4]. Sewages loading have markedly negative impacts on biota and Oxygen levels and have constituted a major problem in many parts of the world [8]. Sediment composition and structure of water body may also affected by shoreline development [13]. Large effort has been made to reduce the external loading of nutrients, such as Phosphorus and Nitrogen which is the main factor controlling primary productivity of lakes [6]. Most of the lake of urban and rural area became hypereutrophic due to the heavy population density and blusterous human activities. As the population density increases the reclamation of lake for agriculture increases. It brings few economical benefits but the morphology and function of lake changed. The health of a lake ecosystem directly or indirectly related to the each component of the ecosystem [18]. The lake *Taal Ratoi* remain connected with river Ghaghara throughout the year which allow the free mixing of stagnant and flowing water, therefore exhibit physico-chemical and biological characteristic which support flora and fauna [9]. The objective of the present study is to find out the impact of anthropogenic activities on hydro biogeochemistry of lake. This study would certainly be helpful for coming researchers to assess the aquatic health of water body to design a model for sustainable utilization of lake.

II. METHODS AND MATERIAL

A. Study area-The *Taal Ratoi* is the largest shallow freshwater investigations were made on monthly basis and the water lake having an area of 1837 hectares and an information was collected directly from the average depth of 200 cm. It is placed near Fatehpur inhabitants.

Mandao, a village of district Mau in Eastern Uttar Pradesh, India. The *Taal Ratoi* lies on North-East (26°09'46.6"N-83°44'16.8"E) Coast of India and connected with River Ghaghara. Lake is influenced by monsoon, winter and summer season. The south and east basins of lake are deeper while north and west basins are comparatively shallow. The East, West and South basins are more affected through anthropogenic activities because these basins are direct interacting to the inhabitant. For analysis of the physical and chemical properties of water total ten sites were selected in the lake. An overview, location and specific site are given in Figure-1 (A) and (B).

B. Sampling and Analysis of surface water- Samples were collected from all the sites on monthly basis in 2L polyethylene bottles during morning hours from 8:30 to 12:00 noon. Before sampling all the sample bottles were washed with Laboline and distilled water. Separate samples were taken in 250 ml airtight bottles for the analysis of Dissolve Oxygen. All the samples were carried out to the laboratory settled in Botany department of Shibli National College for refrigeration. The samples were analyzed in the laboratory within 48 hours for different physico-chemical parameters through standard methods. Concentration of hydrogen ions (pH) and Electric Conductivity (EC) were analyzed on site by Hanna digital meter (HI-98107 and HI-99300), TDS in laboratory by evaporation method at 180°C (APHA). Dissolve oxygen estimated in laboratory by Winkler titration method and Salinity by Mohr-Knudsen (1856) titration method. Nitrate and Phosphate measured Spectrophotometrically using Ascorbic acid and mixed reagent at 880 nm and Carbon analyzed by Carbon Analyzer, untreated sample used for total Carbon where as H₂O₂ treated sample used for Inorganic Carbon and the difference of both considered as Organic Carbon. For assessing the health and socio-economic status of the lake,



Fig-1:(A) Overview of Taal Ratoi

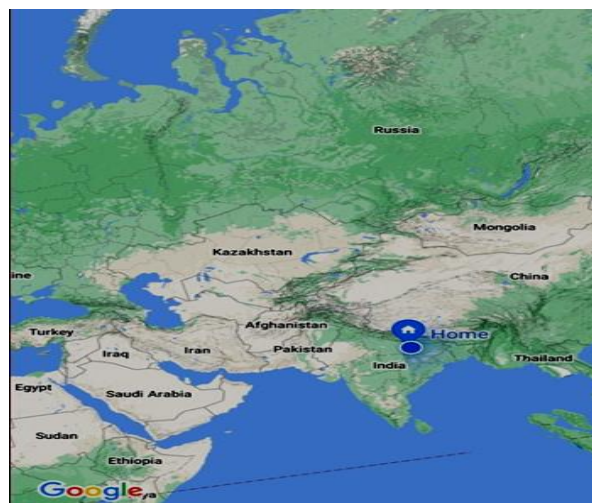




Fig-1:(B) Location and specific site of Taal Ratoi

III. RESULTS AND DISCUSSION

The *Taal Ratoi* is surrounded by many villages and about twenty five thousands of people inhabited around it. Through which lake has suffered numerous insults in the hand of man and as the results the lake is moving towards its definite end. Due to the ecological stresses from anthropogenic activities the lake is not only shrinking in surface but its water quality has deteriorated and the aquatic life is also badly affected. Large quantities of untreated sewage and garbage are received by lake from the villages as well as business establishment. Lakes usually become the recipient of waste water which severely pollutes their system and convey negative impacts on their physico-chemical parameters.

A. Effect on Physico-chemical properties- The physico-chemical properties of surface water of *Taal Ratoi* has been affected due to anthropogenic activities such as discharge of waste water, sewages and agricultural runoff. Eutrophication causes nutrient loading in water and sediments which influenced the water quality. From the present study and statistical analysis of data (Table-1) a significant changes have been found in the water chemistry. It was found that the lake is alkaline and during June to April pH value fluctuated from 7.61 to 8.97 with an average value 8.43. Maximum pH value (8.97) was

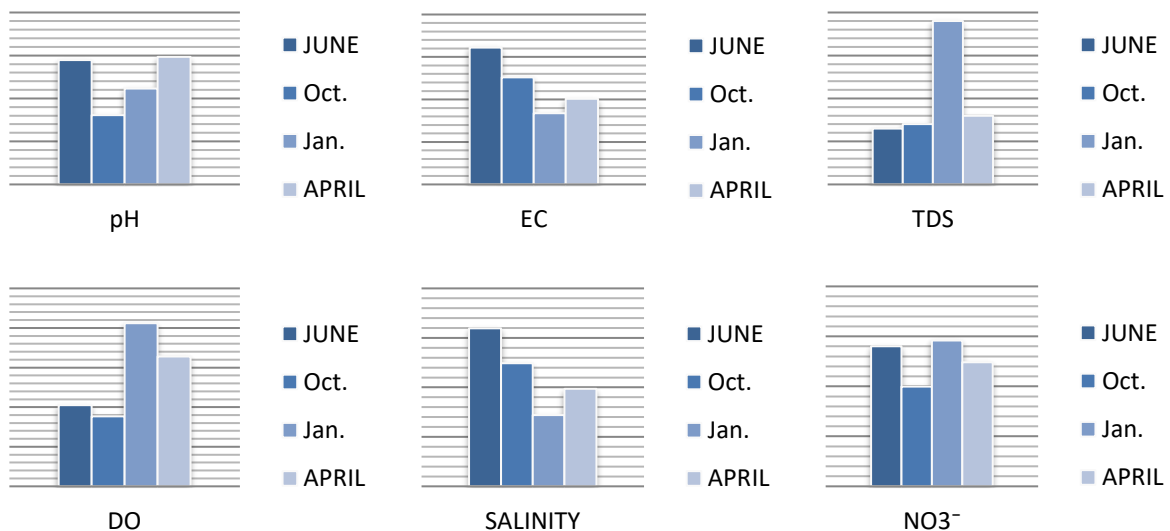
recorded in the month of April and minimum pH (7.61) in the month of October. Electric conductivity observed during June to April ranges between 196.75 to 212.23 μ s/cm. There was mean value of EC 203.58 μ s/cm while maximum Electric conductivity (212.23 μ s/cm) obtained in month of June in South and East basin of the lake whereas minimum Electric conductivity (196.75 μ s/cm) was estimated in month of January. An average value of Total dissolve solid was 94.51mg/L, ranged between 94.15 to 95.40mg/L during June to April. In month of January maximum TDS (95.40mg/L) and in June minimum TDS (94.15mg/L) was obtained. Maximum TDS was obtained at Fatehpur and Utrai sites in South-East basin of lake. Mean value of Dissolve oxygen 12.81mg/L fluctuated between 14.12 to 11.77mg/L during June to April. Maximum Dissolve Oxygen (14.12mg/L) obtained in month of January at Fatehpur site in southern basin and minimum Dissolve Oxygen (11.77mg/L) in month of October at Gangaupur site in northern basin. Salinity was estimated during June to April ranges between 204.40 to 221.95mg/L with average value 212.74mg/L. Maximum salinity (221.95mg/L) in the month of June while minimum salinity (204.40mg/L) was obtained in month of January. There was no significant change obtained in Salinity and Total Dissolve Solid (TDS). The mean value of Nitrate 5.10mg/L fluctuated between 3.99 to 5.83mg/L during month of June to April. Maximum Nitrate 5.83mg/L obtained in month of January at Fatehpur site in southern basin while minimum value of Nitrate 3.99mg/L in month of October at Doobari site in North-West basin of lake. Phosphate obtained during June to April fluctuated between 2.59 to 3.26mg/L with mean value 2.98mg/L. Maximum Phosphate 3.26mg/L was found in January at Fatehpur and Machariyahwa site in south-east basin while minimum Phosphate 2.59mg/L found in October at Gangaupur site in northern basin. Total Dissolve Carbon (Inorganic and Organic) during June to April ranged between 7.63 to 12.50mg/L with mean value 9.55mg/L. The maximum value of Total

Dissolve Carbon (12.50mg/L) analyzed in January at Fatehpur site in south basin but the minimum value (7.63mg/L) estimated in month of June at North basin of lake. There were a positive correlation matrix found in between Nitrate, Phosphate, Carbon, EC, TDS and Salinity. But a negative correlation matrix was found between pH and Dissolve Oxygen, as same correlation was also observed in Anchar Lake, Kashmir [19]. The Nitrate and Phosphate receive by the lake from household detergent, domestic sewage and fertilizers. The statistical analysis of data elucidated that the lake is eutrophic and being anoxic as well as the water is not in pristine condition.

Important observation of this study was that the Fatehpur, Machariyahwa, Maryadpur and Utrai sites in the South-East basin of lake was grossly polluted and insult with more anthropogenic activities because this basin direct interact to the inhabitant. In this study a significant impact of anthropogenic activities were observed. It was found that the selected lake is polluted because the high anthropogenic activities such as fisheries and agricultural activities are taking place in the area. The dissolution of pollutants in rainy season was also taking place because the lake connected with river Ghaghara.

Table-1: Analysis of physico-chemical parameters of surface water of Taal Ratoi in mg/L

PARAMETERS	JUNE	OCTOBER	JANUARY	APRIL	MEAN	SD	MAX	MIN.
pH	8.89	7.61	8.23	8.97	8.43	±0.6	8.97	7.61
EC(µs/cm)	212.23	205.21	196.75	200.14	203.58	±6.7	212.23	196.75
TDS	94.15	94.2	95.4	94.3	94.51	±0.5	95.4	94.15
DO	12.05	11.77	14.12	13.28	12.81	±1.0	14.12	11.77
SALINITY	221.95	214.9	204.4	209.7	212.7	±7.4	221.95	204.4
NO ₃ ⁻	5.61	3.99	5.83	4.97	5.1	±0.8	5.83	3.99
PO ₄ ⁻	3.11	2.59	3.26	2.96	2.98	±0.2	3.26	2.59
DOC	7.54	6.29	9.96	6.15	7.49	±1.7	9.96	6.15
DIC	2.10	2.14	2.54	1.48	2.07	±0.4	2.54	1.48
TDC	7.63	8.43	12.50	9.64	9.55	±2.1	12.50	7.63



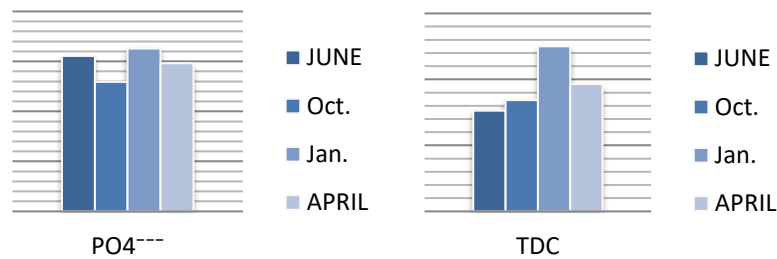


Fig-2: Graphical analysis of monthly basis value of physico-chemical parameters of *Taal Ratoi*

IV. CONCLUSION

In the present study it was observed that the lake is under stress of anthropogenic activities and suffered numerous insults in the hand of man and as the results the lake is moving towards its definite end. Due to the ecological stresses from anthropogenic activities the lake is not only shrinking in surface but its water quality has deteriorated and the aquatic life is also badly affected. The most striking observation was that the South-East basin of lake is grossly polluted because the high pH of the water due to the presence of Total Dissolve Carbon in the form of Carbonates and Bicarbonates while Nitrate was due to fertilizers used in agriculture. Due to the high population density, connection with river Ghaghara and intake of sewages from domestic wastage, the high organic pollution loading has been found. Presence of *Eichhornia species* confirmed that the lake is polluted and has high anthropogenic activities. There is a need to formulate proper ecologically benignant plan for the lake to embrace all the environmental components of the lake ecosystems and thus help to conserve the lake in a real ecological sense.

V. ACKNOWLEDGEMENTS

The authors are sincere thankful to Department of Botany, Shibli National College, Azamgarh Uttar Pradesh, India for providing necessary guidance, reform and research facilities.

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Cite this article as :

Mohammad Faizan, Abdullah, "Impact of Anthropogenic Activities on the Hydro Biogeochemistry of lake Taal Ratoi a Fresh Water Lake", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 293-299, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229146>
Journal URL : <https://ijsrst.com/IJSRST229146>

Study of All Available Strategies Integrated in Developing an Emergency Control Plan

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ABSTRACT

To maintain power balance, changes must be made on both the demand and supply sides. The power system's operating point will be less predictable as a result of these adjustments. Designing emergency controls offline via lengthy simulations has long been the norm. New sophisticated "wide-area emergency control algorithms" are needed since power system for the future is likely to vary more. The final line of defense for grid security and resilience is emergency control of the power system. This research offers and examines several strategies for under-voltage emergency protection. The solutions explored include LTC tap changes (locking, reversing, and blocking), distribution side voltage set point decrease, and eventually, load shedding. The study also discusses how some of the aforementioned strategies might be integrated into developing an emergency control plan. The ideas are shown in a small power system with three loads with encouraging results.

Keywords : Voltage stability, Emergency Control, Deep Reinforcement Learning, Transient Stability Dynamic Breaking, Load Shedding

Article Info

Volume 9, Issue 1

Page Number : 300-308

Publication Issue

January-February-2022

Article History

Accepted : 05 Feb 2022

Published : 15 Feb 2022

I. INTRODUCTION

In the literature, there are several examples of crises and preemptive management methods. It will be examined in this section which is the most crucial of all. The literature frequently makes use of one of two ways to choose remedial control measures. The first is sensitivity approaches, and the second is Optimal Power Flow (OPF) approaches. Emergency control measures are selected using sensitivity approaches, which are determined by the stability index's sensitivity when compared to the controls that are now accessible. This was the most common method described in the early literature on

emergency management. The OPF methodology is based on the discovery of corrective measures via the use of an optimization process that is subject to the power system's model. This has been the most extensively researched technique in the following literature because it may take into account the nonlinear nature of the issue.

II. SENSITIVITY APPROACH

To find control actions, several linear methods have been proposed. From a power system model, it is possible to calculate the sensitivities of distinct measures of stability about the available control

inputs, and then to implement these results to improve stability. These procedures are often extremely quick, which makes them excellent for use in emergencies. They are unsuitable for huge changes in configuration due to the failure of the linear assumption.

According to [21], voltage stability was improved by employing a control methodology that relied on descriptor load flow, Jacobian's least singular value. It relies on the sensitivity of reactive and active powers, and it is remedied utilizing a strategy that is based on the continuation of previous actions. As illustrated in [22], another method of improving voltage stability is to make utilization of energy functions. In this case, an index between the high-voltage and low-voltage solutions was being utilized to enhance the power stability by increasing the difference between the two solutions. The corrective action was determined by estimating the sensitivity of each variable concerning all of the controllable parameters.

Among the earliest results in the sensitivity of the load power margin (the margin of increase for a load before voltage instability emerges) were those reported in [23, 24], in which sensitivities were computed using the Jacobian's eigenvectors. Because of this, it has been common practice in the literature to use it. These results were further developed in [25, 26], where it was discovered which control direction was the most effective in the control space. The term "sensitivity" was used in [27], and it served as a framework for both identifying voltage stability and determining the number of corrective measures that would be required. Control sensitivities and linear approximations were used in conjunction with the rapid simulation of a contingency to achieve these results.

Because of this, OLTC blocking and load shedding was executed as preventative measures. [28] describes the implementation of yet another sensitivity strategy, this time corresponding to the load power margin. It was reported in [29] that this sensitivity technique has been used in close collaboration with preventive management, which

was managed to accomplish through the use of a contingency list.

Sensitivity analysis is utilized to develop an emergency control system for load-shedding for the Hellenic power system, which is discussed in [30]. In [31], the aperiodic angle stability index of [18], which had previously been published, was subjected to a sensitivity analysis. Considering that load-shedding was regarded as an emergency operation, the paper made extensive use of graph-theoretic approaches to reduce the number of control activities that had to be executed.

III. TIME POWER FLOW APPROACH

The OPF may be utilized to reveal adequate emergency controls for a given situation. When compared to the sensitivity method, which relies on a linearization of the system, the OPF may encompass the entire model and thus take into consideration the nonlinear effects. Several stability indices may be applied to the "OPF formulation" to accommodate stability margins to achieve the desired level of resistance to fluctuation resistance. This is why the sensitivity methodologies have been largely replaced by the OPF technique in the scientific literature. The OPF is utilized to confront the economic challenges associated with the operation of a power system [32]. Consequently, "OPF formulations" such as "security-constrained OPF (SC-OPF)," "Integrate Security against Eventualities," and "Security-Constrained OPF (SC-OPF)" is used. The SC-OPF is a computationally intensive device that is utilized to retain the power system operating in a normal state of operation. On the other hand, the OPF may also be utilized to restore the cohesion of a power system [33], if necessary. A set of stability constraints may be incorporated into the OPF to compute the corrective activity required to locate a new stable operating point.

This is a big non-convex problem that is extremely hard to simplify. Two considerations for emergency control must be made: which stability indices should be used to identify a robustly stable equilibrium; and

which optimization method should be used to simplify the OPF. Many different methodologies for problem-solving have been suggested in the literature. To discover local minima of the OPF, nonlinear solvers have been effectively utilized; see [32] for a bibliographic overview of the literature. In addition, meta-heuristic global solvers have been utilized widely in the literature to account for non-convexity, as shown in [34].

Significant research effort has been devoted in recent years to the implementation of convex relaxations to the OPF problem. That's massive because of the findings of Lavaei et al. [34], who demonstrated that a semi-definite relaxation can be used to achieve precision for a wide range of benchmark systems. When utilizing a convex relaxation of the OPF, it is possible to use convex optimization to find a solution to the problem at hand. Because any local minimum in a convex optimization problem must also be a global minimum, the convergence of the processes is no longer dependent on the initial estimate [35].

Using the interior-point technique to resolve the entire nonlinear OPF solution to restore solvability, became the first to do so. To restore equilibrium, control parameters such as transformer tap voltages, active power dispatching, generator terminal voltages, and load shedding were utilized. The goal was to minimize the amount of load shedding required to achieve this. Because it makes use of a conventional nonlinear solver to solve the problem, it makes no promises about the feasibility of optimality of the solution.

Particle Swarm Optimization and Genetic Algorithm techniques were implemented on an OPF with loading margin to determine required load shedding in the event of a crisis in [36], and the results showed that "Metaheuristic Global Solutions" were obtained. It was attempted to resolve the problem using the "Swarm-Based-Simulated Annealing Optimization approach" in [37], but the results were disappointing. [38] made use of a technique known as "Ant Colony Optimization." When the stability index of [18] is used in a pseudo-OPF formulation, the load flow equations are

satisfied, assuming that V/E_{th} endures constant all through the emergency action, as demonstrated in [39]. To obtain the answer, the method detects an algebraic solution and does not rely on any numerical techniques, which allows it to be extremely quick.

According to [40], a method for revamping a system to offer damping to prevent small-signal instability without amending the closed-loop power oscillation damping controllers has been discovered and implemented. Through an iterative process, the least dampened electromechanical mode was eliminated one at a time. This was accomplished by initially determining the least dampened mode and its sensitivity to the control variables of OPF. After that, the settings were tweaked over and over again to bring all modes below a threshold of damping. The same method is used in all subsequent articles that make use of local-solver. In [41], the topic of security against unforeseen events was also discussed. Because of the computational challenges involved, the OPF scheme for retaining small-signal stability is generally not adequate for emergency control in huge systems in general. This thesis represents a new approach to restructuring the closed-loop damping controls throughout the errors, which is described in detail.

There has been no previous research on "Convex Relaxations of Stability-Constrained OPF," and this is a new topic in the literature. A valuable tool in the creation of corrective activities may be provided by the conspicuous qualities of providing assurances (signifies as certificates) of infeasibility or global optimality, as well as the assertion that algorithms with global convergence exist.

"Convex relaxation of the stability-constrained OPF" is thus an intriguing issue that will be studied in the present thesis.

IV. OPERATIONAL ENVELOPE

When managing power systems, it is possible to use an operational envelope that is estimated off-line, like that explained in [42], which addresses voltage and temperature stability. It is possible to

implement emergency controls as controls that guide the operating point into the security region if the functional space of the power system has stability restrictions defined. In the literature, there has also been some discussion of an estimate of the operating envelope. A first-order approximation in the form of a hyperplane can be obtained using this method, and the stability boundary of the system can then be identified by using the hyperplane. With the help of specified contingencies, [43] developed a method for evaluating the boundaries of voltage, temperature, small-signal, and transient stability under specified conditions, and the results are displayed as a graph.

Accuracy may be improved by using higher-order approximations, which have been suggested. [44] shows that a second-order polynomial may be used to estimate the small-signal stability threshold. In [45], this is further improved by including second-order estimations of the thermal and voltage stability constraints, as well as security against particular situations, into the design.

Since the security areas must always be evaluated off-line for normal conditions, the operational envelope method is hard to utilize to recognize emergency controls. However, crises are exemplary by description, making them difficult to use.

In other emergency control systems, it is necessary to change or alter the underlying functioning of the existing controls. Using load shedding in conjunction with an alteration in the control strategy for secondary voltage regulation, it was possible to eliminate voltage instability, as described in [46]. It did not rely on any other metric of instability than voltage measurements, which was a flaw in the system. On-load tap-changers are critical in maintaining voltage stability. When a crisis occurs, emergency control solutions have been proposed that rely on rolling back the function of the tap-changers [47].

“Model predictive control (MPC)” has been used in the context of reducing overloads. [48] describes the design of an MPC system that reduces thermal overloads in a closed-loop manner.

V. OTHER LITERATURE

As a smart microgrid becomes smarter, so does the need to control the flow of power. Power systems' emergency control is often seen as the last safety net for grid resilience [1] because of its dynamic decision-making under uncertainty. Power system stability depends on various “adjustable power devices”, which theoretically is only the nonlinear equations' solution, because of power supply and demand complexity. The control of power flow has been the subject of previous studies. However, there is still a problem in implementing edge intelligence to the alteration of power flow.

Edge computing-based smart grids have recently seen an unprecedented increase, altering the idea of power management as we know it. “For smart grid applications, Trajano provides a dependable and low latency communication network” based on edge computing that allows for efficient end-to-end management of power [7]. This is different from numerous general edge computing solutions [3–4]. Barik uses an architecture that is hardware-implemented to embrace the notion of edge computing in smart grids, culminating in better performance metrics in storage demands, power consumption, and analytical capabilities [6]. Using a heuristic method, Huang presents an edge-determining framework for real-time tracking that may enhance frame rate and detection latency by a significant margin over the cloud framework [7]. Awadi, on the other hand, considers using dispersed devices cooperating through edge computing to discover aberrant samples in power consumption data in advance. An evaluation of the model's latency and network resiliency is done in this thesis. To analyze, assess, and save data on electricity use, With the use of IoT devices and mobile edge computing, Chen has developed a smart grid system capable of real-time analysis and processing huge amounts of data [9]. Edge computing may be deployed to smart grids using several architectures and frameworks described in the previous papers. However, they don't go into detail on how micro-grids might benefit from edge intelligence. For

power distribution, Albataineh presents a 2-level solution that integrates the benefits of edge identification and cloud computing, whereby an engine based on learning establishes the link between both. There may be improved power grid throughput and power consumption because of this engine's ability to load-balance between the edge and the cloud.

It's worth noting that this thesis uses edge intelligence to control distributed grids, but does not analyze power flow calculations between micro-grids. The "micro-grid framework" is enormously viewed as a hot challenge in modern smart grids, along with the rise in demand for electricity services from users. [10] Yang employs "deep reinforcement learning" to construct an online scheduling technique for managing energy deployments in micro-grids with unpredictable energy generation. An economic dispatch problem in micro-grids is examined by Fang, who proposes a "learning-based cooperative auction mechanism" that eliminates a single point of inability and increases scalability [11]. Rather than using an explicit model that relies on explanatory variables to "estimate stochastic variables" with uncertainty, Ji suggests a learning-dependent microgrid scheduling approach for the management of economic energy [12]. To improve power quality, electrical stability, power quality, and peak power demand, Etemad presents a learning-dependent charging approach for micro-grid batteries powered by renewable energy. A distributed scheduling problem in the micro-grid has been solved by Liu using a collaborative reinforcement learning approach, which lessens the coupling between nodes in the micro-grid and increases the "efficiency of distributed scheduling" [14]. Reinforcement learning is used by Brida to start generating optimal scheduling solutions for given system circumstances. Using a gated recurrent unit, Dabbaghjamesh proposes a deep learning approach for determining the optimal configuration for reconfigurable micro-grids. Reconfiguration decisions are made in real-time based on network topology factors that change over time [15]. It is shown that the use of "edge intelligence" to "micro-

grid management" may boost many achievement indicators in the following studies that multiple strategies and methodologies for economic energy management have been developed. They don't, however, go into detail on how microgrids are evolving.

Specifically, Ma investigates the application issues of DL in power flow computing, gives the network topology and skilling technique of a deep neural network, and discusses how to address the problem of over-fitting. Power flow determination in massive scale power grids is a problem that Wang addresses by "integrating professional knowledge with artificial intelligence" [16]. [16] An estimating method based on a learning-based distribution is presented by Zhu to evaluate the impact of wind speed correlation across diverse wind power plants [17]. To increase the pace of determination of "probabilistic power flow" concerns, Yang has devised a learning-based method. The differences in performance across "neural networks" with different topologies are examined, and three kinds of power bus systems are utilized as an assessment benchmark. The proposed approach may significantly improve "approximation accuracy and training speed" compared to the pure data-driven deep learning strategy [18]. According to Su, a "deep belief network" may be used to regulate the power system rather than relying only on current learning-based methodologies [19]. For complicated power systems, Huang has developed an adaptive emergency control method dependent on deep reinforcement learning's feature extraction and nonlinear generalization capabilities [20]. These works explain how to utilize deep learning to the problem of calculating how much electricity is flowing. However, research on the use of edge intelligence in "micro-grids" is still in its infancy.

In terms of published research, there aren't many studies looking at how micro-grids can employ edge intelligence to calculate power flow. Edge computing's local autonomy and the inadequacy of earlier ways to deal with them have contributed to system instability since they are not well adapted to the "edge computing framework." Based on "edge

computing and multi-agent learning,” our research presents a framework for power flow adjustment. Rather than attempting to address the issue of power flow synchronization, we propose a “learning-based distributed architecture” to address the problem.

As transmission systems in many countries are getting heavily loaded, voltage instability has emerged as a challenge to power systems planning and operation. To contain voltage instability or collapse, many utilities are actively considering effective, efficient, and economic solutions such as reactive support, generation rescheduling, LTC control, and, as a last resort, load shedding. In particular, under-voltage protection can serve as a safety net for stressed systems, as it is common that a period of several minutes with low voltages precedes the actual voltage collapse [1, 2]. Thus, if something unpredictable happens, or some control function fails to lead the system towards instability and collapse, Undervoltage emergency controls can save the system minimizing the impact of the instability.

Undervoltage load shedding (UVLS) is a control action, which stabilizes in most cases an unstable power system by sacrificing a relatively small percentage of customer loads. In previous publications, this protective action has been contemplated in either a static or dynamic framework. Early approaches were based on a static power flow algorithm to alleviate line [3] or equipment [4] overloads. Some practical concepts of UVLS implementation using conventional under-voltage relays are explained in [5]. Some other implemented UVLS schemes are presented in [6], where attention is given to the influence of other protection devices. Two criteria for UVLS, namely “soft” and “firm”, were proposed in [7]. Further discussion by the same authors of the influence of the load models can be found in [6].

VI. CONCLUSION

Emergency control strategies that have a direct or indirect influence on power consumption are the focus of this study. When it comes to LTC control

activities, there is a number to evaluate and compare. They have a significant impact on the performance of a voltage collapse protection control system, even if they do not permanently restore equilibrium. As long as the LTC is operating within its control range, tap-reversing has been determined to be the most effective LTC emergency control method. Another possible control action is to lower the voltage setpoint on the distribution lines. The LTC now has a new, lower voltage dead band as a result of this activity. As a result, the LTC's workload is lightened (at least temporarily). It is impossible to reestablish long-term homeostasis if load self-restoration is present. It is possible, however, to minimize the amount of load shedding beyond the crucial period corresponding to the theoretical minimum amount to be shed by using voltage reduction or other combinations of countermeasures. On an 8-bus power system with three loads, a combination of voltage setpoint reduction and tap-reversing is illustrated. According to the study findings, it is conceivable to create coordinated protection strategies against voltage breakdown to minimize the quantity of Undervoltage load shedding if more research is done.

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Cite this article as :

Alok Kumar Sriwastawa, Virendra Pratap Yadav, "Study of All Available Strategies Integrated in Developing an Emergency Control Plan", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 300-308, January-February 2022.

Journal URL : <https://ijsrst.com/IJSRST229157>

DRL Based Naïve Emergency Control for Complicated Power Systems

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Article Info

Volume 9, Issue 1

Page Number : 309-321

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022

Published : 22 Feb 2022

ABSTRACT

The power system's operating point will be less predictable as a result of these adjustments. Designing emergency controls offline via lengthy simulations has long been the norm. New sophisticated “wide-area emergency control algorithms” are needed since power system for the future is likely to vary more. The final line of defense for grid security and resilience is emergency control of the power system. For the most part, existing emergency response plans are developed off-line, using a “worst-case” scenario or a handful of representative operating situations. As the level of uncertainty and variability in contemporary electrical grids rises, these systems face considerable challenges in terms of adaptability and resilience. “Deep reinforcement learning (DRL)” for complex power systems was used in this thesis to build unique adaptive emergency control techniques that make use of DRL's non-linear generalization capabilities and high-dimensional feature extraction. “Reinforcement Learning for Grid Control (RLGC)” is a new open-source platform that was created to aid in the advancement and assessment of “DRL algorithms” for controlling electricity systems. There is a description of the emergency control systems for dynamic generator braking as well as platform and DRL-based under-voltage load shedding. The created DRL approach is tested for its potential to manage a wide range of simulation situations, uncertainty in model parameters, and noise in data.

Keywords: Emergency Control, Deep Reinforcement Learning, Transient Stability Dynamic Breaking, Load Shedding

I. INTRODUCTION

A. Overview

Owing to rising uncertainty, complexity, and data dimensions in power systems, traditional approaches

typically hit bottlenecks while trying to handle control and decision issues. Thus, data-driven strategies for fixing such challenges are being intensively investigated. “Deep reinforcement learning (DRL)” is one of these data-driven

methodologies and is recognized as actual “artificial intelligence (AI)”. DRL is a mix of “reinforcement learning (RL)” and “deep learning (DL)”. This branch of study has been employed to handle a broad variety of complicated sequential decision-making challenges, including those in power systems. This study initially discusses the core principles, models, methods, and approaches of DRL. The applications in power systems are then examined, comprising the electricity market, demand response, operational control, and energy management. In addition, current breakthroughs in DRL include the merging of RL with other classical approaches and the potential and problems of applications in power systems are highlighted as well.

The second is the programming approach, such as mixed integer programming [1], [2], dynamic programming [3], power system is a dynamic, complex, large-scale network of electrical components. Power systems have gone through many decades of evolution. During this period, economic, technical, political, and environmental motivations have converted conventional grids into more sophisticated, resilient, sustainable, and efficient smart grids [4] – [6]. Smart grids leverage bi-directional energy flow accompanied by bi-directional details flow among all the players, including manufacturers, consumers, distribution and transmission system operators, and demand response aggregators [6], [8]. Such variables have caused issues to the electricity grid from diverse viewpoints. Firstly, the high penetration of renewable power provides higher volatility to a power system.

To tackle these difficulties, effective procedures are necessary for planning and controlling the grid. This continual change of networks leads to greater unpredictability and difficulty in both the commercial transactions and the actual physical flows of power [9].

B. Introduction Deep-Reinforcement Learning

DRL integrates deep learning's sensing capability with reinforcement learning's decision-making capability. It is a form of AI that is more akin to human thought and is widely recognized as true AI. Fig. 1.1 illustrates the basic framework of DRL. Deep learning gathers information about the target observation from the environment and offers state detail about the present environment.

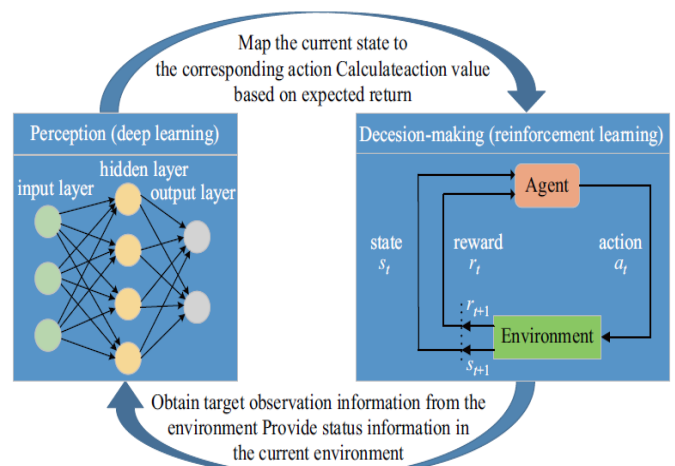


Fig. 1.1: DRL Framework

C. DRL Algorithms

DRL challenges may be phrased as optimization, planning, management, and control concerns. Solution methods RL, e.g. “Q-learning”, the Q function’s iteration procedure is as displayed in [10], whereas it will update as displayed in DRL [10]. The goal function may be described as [11] at this moment. The policy-based approaches directly optimize the quantity of interest while staying stable under the function approximations at each step by redefining the policy and calculating the value according to this new policy until the policy converges. At first, the objective function’s gradient is derived as policy parameters as indicated in [11], and then the weight matrix will update using [12].

D. Applications in Power System

After years of study, several articles have been published regarding the uses of DRL in power systems, and most of them were published after 2018. These

applications cover a broad variety of optimization issues, decisions, and control, in the power system, including electricity market, demand response, operational control, energy management, and many more.

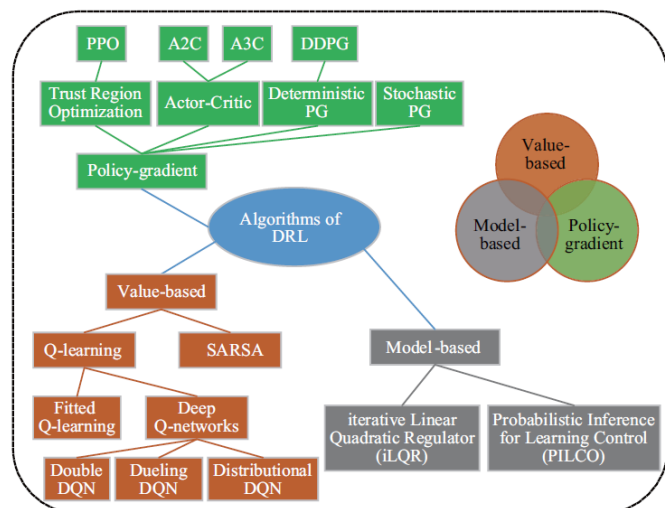


Fig. 1.2: Main DRL algorithms and their inter-relationship

In conclusion, DRL and its applications in the power system still confront numerous potential problems. These will provoke additional attention and inquiry, and there will certainly be more startling breakthroughs in the future.

II. LITERATURE REVIEW

A. Overview

In the literature, there are several examples of crises and preemptive management methods. It will be examined in this section which is the most crucial of all. The literature frequently makes use of one of two ways to choose remedial control measures. The first is sensitivity approaches, and the second is Optimal Power Flow (OPF) approaches. Emergency control measures are selected using sensitivity approaches, which are determined by the stability index's sensitivity when compared to the controls that are now accessible.

B. Sensitivity Approach

To find control actions, several linear methods have been proposed. From a power system model, it is possible to calculate the sensitivities of distinct measures of stability about the available control inputs, and then to implement these results to improve stability. These procedures are often extremely quick, which makes them excellent for use in emergencies. They are unsuitable for huge changes in configuration due to the failure of the linear assumption.

According to [3], voltage stability was improved by employing a control methodology that relied on descriptor load flow, Jacobian's least singular value. It relies on the sensitivity of reactive and active powers, and it is remedied utilizing a strategy that is based on the continuation of previous actions.

C. Optimal Power Flow Approach

The OPF may be utilized to reveal adequate emergency controls for a given situation. When compared to the sensitivity method, which relies on a linearization of the system, the OPF may encompass the entire model and thus take into consideration the nonlinear effects. Several stability indices may be applied to the "OPF formulation" to accommodate stability margins to achieve the desired level of resistance to fluctuation resistance. This is why the sensitivity methodologies have been largely replaced by the OPF technique in the scientific literature. The OPF is utilized to confront the economic challenges associated with the operation of a power system [15]. Consequently, "OPF formulations" such as "security-constrained OPF (SC-OPF)," "Integrate Security against Eventualities," and "Security-Constrained OPF (SC-OPF)" is used. The SC-OPF is a computationally intensive device that is utilized to retain the power system operating in a normal state of operation. On the other hand, the OPF may also be utilized to restore the cohesion of a power system [16], if necessary. A set of stability constraints may be incorporated into the OPF to compute the corrective

activity required to locate a new stable operating point.

According to [17], a method for revamping a system to offer damping to prevent small-signal instability without amending the closed-loop power oscillation damping controllers has been discovered and implemented. In [18], the topic of security against unforeseen events was also discussed. Because of the computational challenges involved, the OPF scheme for retaining small-signal stability is generally not adequate for emergency control in huge systems in general.

D. Operational Envelope

When managing power systems, it is possible to use an operational envelope that is estimated off-line, like that explained in [18], which addresses voltage and temperature stability. It is possible to implement emergency controls as controls that guide the operating point into the security region if the functional space of the power system has stability restrictions defined. With the help of specified contingencies, [19] developed a method for evaluating the boundaries of voltage, temperature, small-signal, and transient stability under specified conditions, and the results are displayed as a graph.

III. METHODOLOGY

A. Overview

All countries' national and economic security depends on reliable and resilient energy. Anticipated (e.g. N-1) threats have been well protected by a wide range of preventive management measures. In the preceding two decades, however, the United States, India, Brazil, and Europe all experienced multiple large-scale blackouts [1–3]. Emergency control has long been recognized as essential for limiting the scope and impact of power outages and other significant blackouts. Generation tripping or dispatch, dynamic braking, controlled system separation, and load shedding.

B. Problem Statement

To create new schemes that have great adaptiveness and resilience to handle the uncertainties and changes that occur in current electricity grids.

C. Research Objectives

To answer our issue statement, the present research has the below-mentioned objectives:

1. Developed an innovative and able to adapt “Emergency Control Techniques” utilizing “Deep Reinforcement Learning (DRL)” by using the non-linear generalization capabilities and high-dimensional feature extraction of DRL for “complex power systems.”
2. DRL's ability to withstand a wide range of simulation situations, the uncertainty of model parameters, and data noise is examined in the second phase of the research project.
3. Third, extensive case studies have shown that both the IEEE 39 bus and the two areas, four machine systems have excellent performance and resiliency.

D. Developing Algorithms For Grid Control

Reinforcement Learning for Grid Management (RLGC) is an open-source platform that has been created and released with the aim of designing, testing, and assessing RL algorithms for power system control [20]. Open-source benchmarks (like Image Net and Open AI Gym) are significant driving factors in machine learning improvement (including RL). RLGC's purpose is to provide a comparable open-source benchmark for RL in power grid management. Fig. 3.1 depicts the architecture of this open platform. It consists of two major sections:

1. The RL module; and
2. The power system simulation and control module.

Two configuration files are utilized to describe the settings for the dynamic simulation of the power system as well as the RL training parameters.

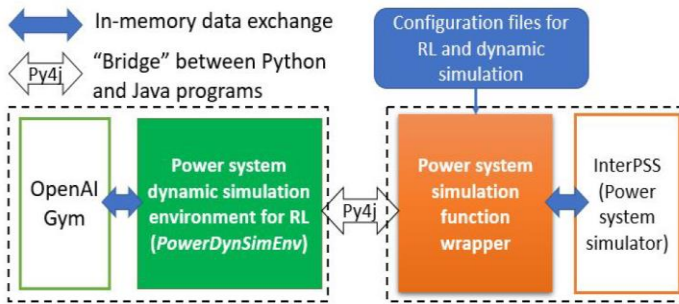


Fig. 3.1: An open platform for the development, skilling, and benchmarking of real-time control algorithms for power systems.

E. Implementation Details and Usage

RL module contains a Power DynSimEnv python class, which is created by widening the OpenAI Gym's standard basic environment Env class, which is named Power DynSimEnv. Control module and power system simulation developers are working on creating a wrapper for the Inter PSS simulation functions and capabilities, which will be used to interface with the PowerDynSimEnv environment in the Real-Time (RL) module. When applied to Algorithm 1, it consists of various key functions that represent the interactions between the environment and the learning agent (AL1).

A typical approach for testing algorithms of DRL and training NN models for grid control on the established platform consists of two stages: (1) the testing stage for verifying the taught NN and (2) the training stage for learning. The DRL will execute NN learning via training steps high in number throughout the training stage. It learns an optimum policy via exploitation and exploration and stores the best-performing NN settings automatically.

Fig. 3.2 illustrates the methodology for utilizing a grid control platform for testing and training the DRL model for grid control.

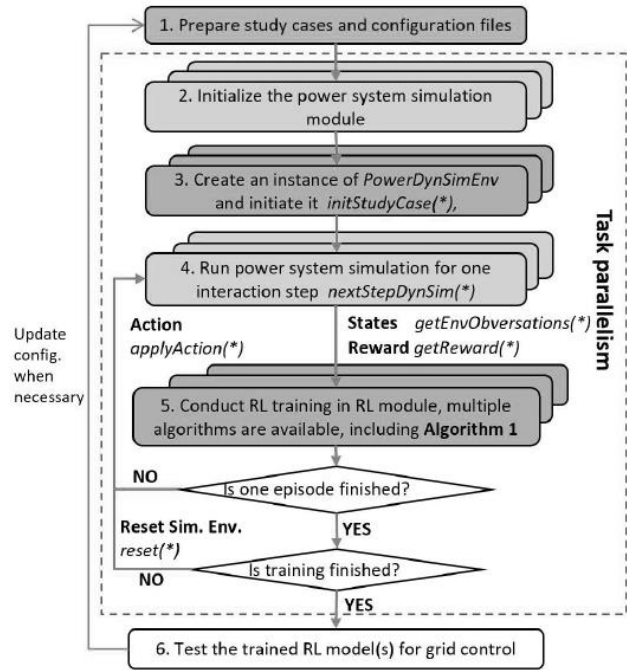


Fig. 3.2 shows a flowchart of a reminiscent approach for utilizing the platform to train and evaluate RL model(s) for grid control

F. DRL Algorithms For Grid Emergency Control

We explored and built control schemes based on DRL for two common forms of grid emergency control using the established platform stated in the preceding chapter:

1. Dynamic generator brake [8]; and
2. Low-voltage load shedding

Design and execution specifications for both emergency control systems' DRL algorithms will be covered in the following subchapters. These details will include neural networks, observations, actions, and reward systems, among other things.

IV. SIMULATION, TEST, AND RESULTS

Throughout the rest of the thesis, the same time steps are utilized in the test cases to ensure consistency. It took 9 hours to complete the training procedure on a Linux workstation with 32 AMD Opteron 1.44 GHz Processors and 64 Gigabit RAM, with no parallelism, on a computer. Our technique robustly learns effective policies when the parameters are properly tuned. Fig. 4.1 depicts the moving average of the reward over the course of the training. The decrease

observed at the 3600th episode, as depicted in Fig. 4.1, is associated with a significant negative reward as a result of one “bad” excursion during training. The instability of the DQN algorithm is not indicated by this result, on the contrary. For the DQN algorithm to continue to be trained, the DQN model must learn to avoid the poor control actions that it has encountered during the training process. The DQN model eventually converges to the local optimum solution. We have done a lot of testing, and we have found that all of the local optimums that we found are excellent solutions.

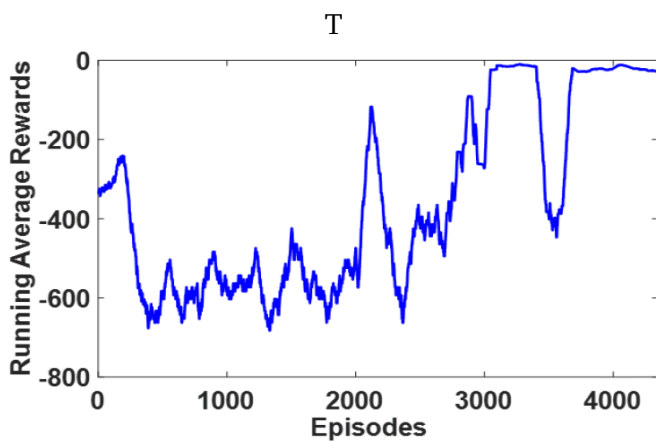


Fig. 4.1: The rewards’ moving average throughout the DRL skilling

Using a new and much larger set of scenarios, including a variety of combinations of fault location, power flow condition, and fault duration, we test the structural rigidity of the culminating control policy (law) after the DRL model training.

1. A variety of power flow predicaments are tested, which would include (a) the original power flow case for learning and training, (b) each load in the system decreases or increases by 50 MW, 100 MW, and 180 MW, and (c) the tie-line power flow decreases or increases by 20 MW, 40 MW, 70 MW, and 100 MW between buses 7 and 10. Because the two tie-lines are the only means of connecting areas 1 and 2, it is possible to adjust the tie-line power flow by raising the generators’ actual power output in one area while diminishing the generators’ actual power output in the other area in the

appropriate manner to achieve the desired result;

2. The problem location is picked for all the 10 buses;
3. The fault time is determined in a random manner between 0.3 s and 0.7 s.

The two-area power system is estimated to be able to withstand a fault for up to 0.583 seconds without losing stability without the use of dynamic braking. As an alternative, the system may remain stable if it is used in conjunction with the control rule learned by DRL in the various situations described above (we test 220 distinct scenarios). To make the inputs to the DRL-based control system more pragmatic, we add a zero mean as well, one percent Gaussian-distributed noise to the data that is supplied to the trained NN. The trained control based on DRL was compared to the standard 2-dimension Q-table-based “Q-learning” approach in [8], which we found to be superior. When sound is added to the observations, the findings reveal that the control based on DRL outperforms the traditional “Q-learning”-based control for all of the testing situations.

Fig. 4.2 (a) and (b) depict two illustrations of the RB actions for various power flow and faults conditions, for both DRL-based and traditional “Q-learning”-based control systems. As shown in Fig. 4.2 (a), the relative rotor angle and generator 3 speed (without and with RB actions) are depicted, as are the RB actions, for an intermittent defect at bus 4 with a period of 0.7 seconds, under the power flow condition that each load raises by 100 MW as compared to the power flow scenario used to train the operators. Under the original power flow situation for training, Fig. 4.2 (b) depicts the speed of generator 3 as well as the relative rotor angle and also the RB actions for a defect at bus 9 with a period of 0.6 seconds, and the RB actions for a defect at bus 9. Fig. 4.2 (a) and (b) show that if no RB actions are provided (red line), the system loses stability; however, when both DRL-based (blue line) and traditional “Q-learning”-based

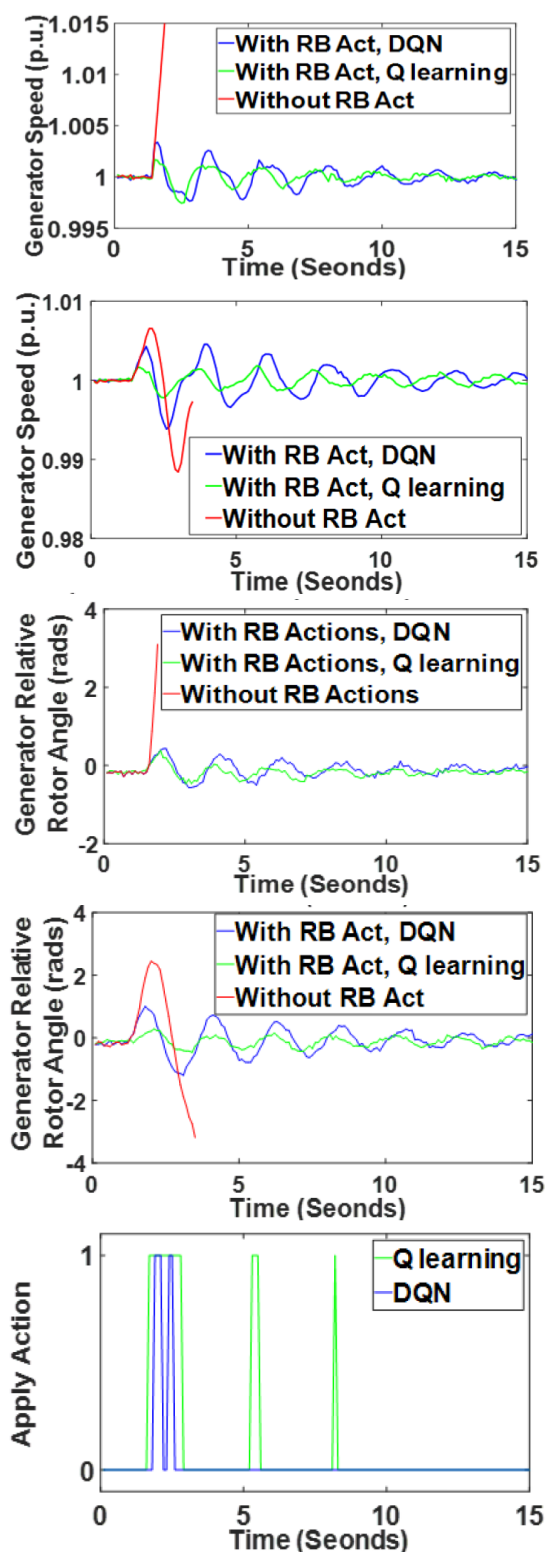
control (green line) provide RB actions, the system can maintain cohesion.

However, the control based on DRL offers unquestionably greater control actions as compared to the traditional “Q-learning”-based control, because the control based on DRL operates the RB in shorter time steps and, as a result, earns greater rewards. As illustrated in Fig. 4.2 (a) and (b), the control based on DRL would perform various RB actions at various times in each of the two circumstances. Every one of the outcomes displayed in Fig. 4.2 demonstrates the robustness, effectiveness, and adaptability of the DRL algorithm. However, it must be kept in mind that we also looked at different pre-fault periods; under normal circumstances, the control based on DRL does not apply any braking to the vehicle.

A. Under-Voltage Load Shedding

As shown in Fig. 4.3, an orchestrated UVLS scheme against FIDVR was constructed using the established platform and DRL algorithm, and the scheme was assessed on an amended IEEE 39-bus system [21], where step-down transformers were added to load buses 4, 7, and 18. A mix of constant impedance loads [23] and single-phase A/C motors [22] is used to model the original loads, which have been relocated to the transformers’ low-voltage side.

It is necessary to use the OpenAI Baselines version of the DQN method to establish a closed-loop control strategy for implementing load shedding at buses 4, 7, and 18 to prevent FIDVR and attain the voltage recovery criteria displayed in Fig. 4 to prevent FIDVR. According to this study, the reward function coefficients (9) are as follows: $c_1 = 260$, $c_2 = 150$, and $c_3 = 3$. It is observed that the voltage magnitudes at buses 4, 7, 8, and 18 and the step-down transformers’ low-voltage sides connected to them are greater than zero and that the proportions of loads served by buses 4, 7, and 18 are greater than one; therefore, $N_m = 11$. The most recent ten observation states are stacked and being utilized as a starting point.



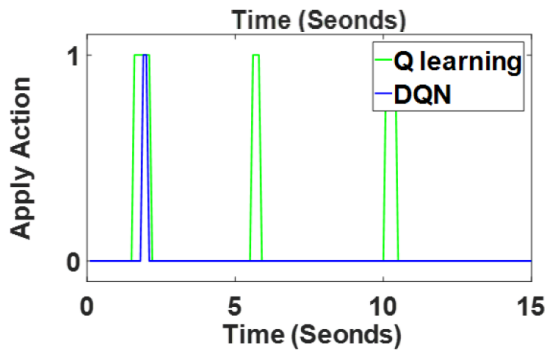


Fig. 4.2: The system's relative rotor angle and the generator speed evolution: Both buses 4 and 9 have a fault of 0.7 seconds, which means that N_i , the nodes in the input layer is 110 in number and N_r is 10

At each action time step, the control action for buses 4, 7, and 18 is either 1 (load shedding) or 0 (no-load shedding) (shedding 20 percent of the initial total load at the bus). This means that at each action step, there are a total of 8 possible combinations of potential discrete control actions, which corresponds to a total of 8 nodes in the output layer N_o . The following are some other critical hyperparameters to consider: 1,200,000 total interaction steps were used in the training; $N_{h1} = N_{h2} = 256$ nodes were used in the hidden layers; the learning rate was $\eta = 0.00005$; the learning rate was 0.00005; the minimum exploration rate was 0.02.

After a flat start of dynamic simulation, each episode begins with a short-circuit fault implemented randomly at bus 4, 15, or 21 with a randomly-chosen fault duration of 0.0 s (no-fault), 0.05 seconds, or 0.08 seconds; and the fault is self-cleared at the end of the simulation at 1.0 s of the simulation time. By selecting the fault location and duration at random, the training agent can ensure that the system interacts with it both with and without the presence of FIDVR conditions. No paralysis was experienced during the training procedures, which took 21 hours on the same Linux workstation that was utilized in the earlier case. Figure 4.4 depicts the rewards' moving average received throughout the training period.

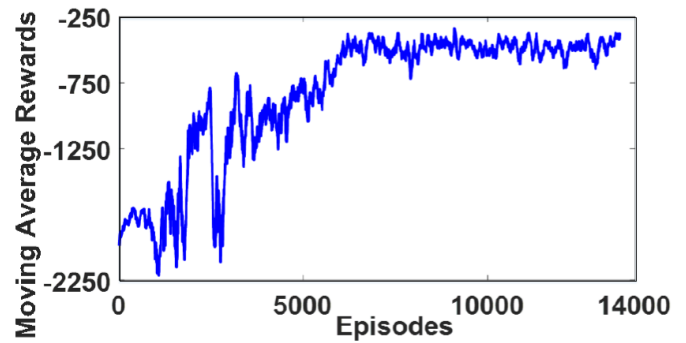
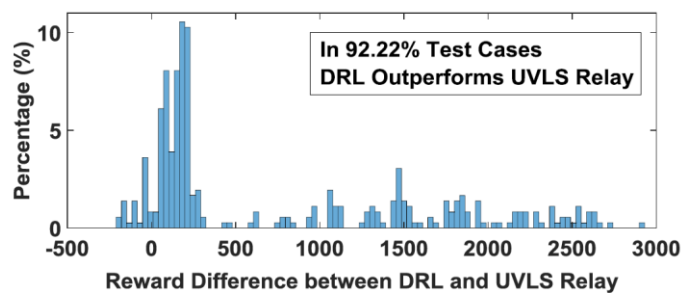


Fig. 4.3: The moving average of the awards received throughout the DRL load shedding management skilling for the 39-bus system.

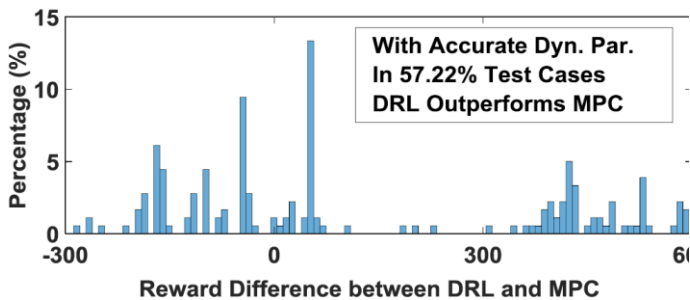
Using a set of 960 test situations containing various combo of power flow circumstances, fault locations, dynamic model parameters, and fault duration from the skilling contexts, we evaluated the structural rigidity and adaptiveness of the trained DRL agent. (1) four distinct load levels (80%, 90%, 110%, and 120%); (2) two distinct sets of critical dynamic parameters for the A/C motor model, one about (assumed) true values and the other incorporating a 10% rise in the A/C motor stalling performance parameters T_{stall} and V_{stall} [39]. Keep in mind that the A/C motor dynamic model is an aggregated model that displays a huge number of physical A/C in the real world, and as a result, its parameters may contain a variety of errors; (3) 30 distinct fault sites (corresponding to buses 1 through 30); and (4) four different fault length periods (corresponding to 0.02, 0.05, 0.08, and 0.1 s). For the UVLS relay load shedding scheme, we have tested the previously trained load shedding control based on DRL, along with an MPC methodology that utilizes a mixed integer programming optimization to address the issue posed by (6). Each of the three control approaches has been assessed in terms of the reward and the execution time specified in the design (9). The reward differences (i.e., the DRL's reward minus the reward of a comparative approach) for each test situation are computed to demonstrate the comparison findings; a positive number indicates that the DRL technique is better for the corresponding test case, and a negative number indicates that the comparative methods are superior. 462 of the 960 test

situations could result in FIDVR difficulties if nothing is done, necessitating the use of load shedding, according to the results.

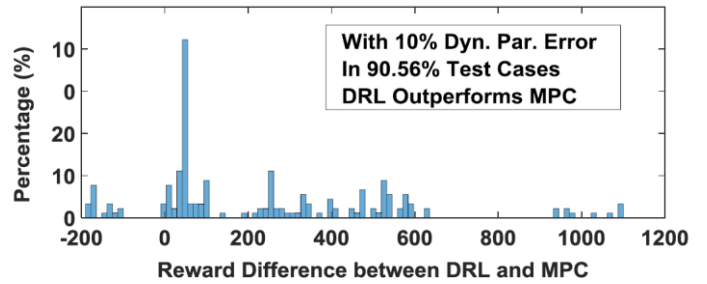
The reward difference' histogram between the UVLS relay and the DRL-based control is depicted in Fig. 8(a). This means that the control based on DRL outperformed the UVLS relay in 92.22 percent of the 462 test cases. Test Set A contains 229 test scenarios with the same dynamic characteristics as the training scenarios, whereas Test Set B contains 233 test scenarios with dynamic load parameters T_{stall} and V_{stall} that are 10 percent higher than the training scenarios (Test Set B). It is the primary goal of Test Set B to replicate the modeling gaps (or uncertainties) that can occur in real-world applications. It should be noted that the DRL approach based on DQN is model-free, whereas methods based on MPC rely strongly on the correctness of the model; as a result, it is critical to address modeling errors in applications based on MPC.



(a)



(b)



(c)

Fig. 4.4. Histogram of the reward gap among (a) UVLS and DRL for the 462 test cases that need load shedding; (b) MPC and DRL for the 229 test cases in Test Set A; and (c) MPC and DRL for the 233 test cases in Test Set B.

For Test Set A, Fig. 10 (b) portrays the reward difference' histogram between the DRL and the MPC, which reveals that DRL-based control outperforms the MPC in a slight majority of the test situations (the DRL outperforms the MPC in 57.22% of the test situations). The reward difference's histogram between the MPC and DRL techniques is shown in Fig. 10 (c) for Test Set B, and it reveals that the DRL approach outperforms the MPC technique in 90.56 percent of the test situations. Fig. 10 (b) and (c) illustrate considerable merit of the newly developed DRL approach over the MPC technique: the MPC method's effectiveness is highly dependent on the correctness of the system model, whereas DRL is model-independent and more resilient to modeling errors.

Calculation times for the DRL and MPC algorithms are summarized in Table 4.1. UVLS relays do not have a calculation time because they are either instantaneous or have a preset delay. The DRL method needs significantly less implementation time than the MPC technique, as the NN handling the complex mapping from observed states to actions is much more efficient in the DRL approach than the time-consuming, complex optimization solution procedures in the MPC technique. With a 0.13 second response time during an eight-second simulation event, the DRL technique can meet real-time

operating prerequisites and enables grid operators to validate control actions as needed.

Table 4.1: Comparison of The MPC And DRL's Average Computation Time

Average DRL Computation Time	Average MPC Computation Time
0.13 seconds	23.73 seconds

A new test scenario with a 120 percent load level is depicted in Figs. 11 and 12 to further demonstrate the advantages of the DRL technique. The effectiveness of the MPC, DRL, and UVLS relay control schemes are all compared for this new test scenario, which is shown in Fig. 13. There is a 0.1-second duration time for the fault to occur on bus 3, and the dynamic parameters V stall and T stall both rises by 10% as a result of the fault. The data is also contaminated with zero mean, one percent Gaussian-distributed noise to render the testing for the load shedding control based on DRL more realistically conducted This test scenario yields total rewards of -1271.61 points for the DRL, -1548.14 points for the MPC, and - 3778.80 points for the UVLS relay control, respectively. For various load shedding controllers, the voltage profiles at buses 4, 7, and 18 are shown in Fig. 11.

For various relay control schemes, the voltage profiles at buses 4, 7, and 18 are displayed in Fig. 12. The amount of load shedding at buses 4, 7, and 18 is shown in Fig. 12. It is considerable to keep in mind that the additional one percent noise does not affect the decision-making or the effectiveness of the DRL-based control. Both of the following factors contribute to the large reward difference (2507.19) between the UVLS relay and DRL: 1) Compared to the UVLS relay, the DRL sheds a considerably smaller amount of load. The figure illustrates that, when compared to the UVLS relay, the DRL sheds 60 percent (120 MW) less load for bus 4 (the DRL technique does not shed any load at bus 4) and 20 percent (14.64 MW) less load for bus 18; 2) when compared to the UVLS relay technique, the DRL method leads to a significantly better voltage recovery profile, as illustrated in Figure. With the control based on DRL, the voltages at all three load buses

with the A/C motors quickly recover above the voltage recovery envelope permitted by the operating standard, allowing for faster voltage recovery.

The UVLS relay mechanism, on the other hand, is unable to recover the voltages at the three buses even 3 seconds after the fault has been resolved, causing the UVLS relays to shed a higher load at these three buses as a result. Because the DRL technique sheds less load than the MPC method while still meeting the operating standard criteria, the reward difference (276.53) between the two techniques is primarily due to this fact. The figure displays that the DRL technique reduces bus 7 load by 20 percent (26 MW) and bus 18 load by 20 percent (14.64 MW) when compared to the conventional technique. Because the MPC approach continues to suffer from fallacious crucial model parameters (10 percent divergence from the genuine values), the MPC approach results in higher load shedding (10 percent difference from the true values). Be aware that even though the Figure displays that the MPC technique's voltage recovery profiles are a little bit greater than those of the DRL method (at the expense of additional loads shed), this does not result in a higher reward because a voltage recovery profile that is higher than the standard voltage recovery standard is not rewarded as per the rules (9).

We conclude that this is appropriate given that the ultimate goal of UVLS controls is to recover the voltage over the envelope allowed by industry standards with the least amount of load shedding possible In summary, when comparing the DRL approach to the MPC control techniques and UVLS relay, the DRL approach displays considerable improvements in terms of resilience and adaptability. The DRL model may also deliver control actions incredibly quickly (0.13 s on average) in emergencies, making it a good candidate for use in real-time emergency control situations.

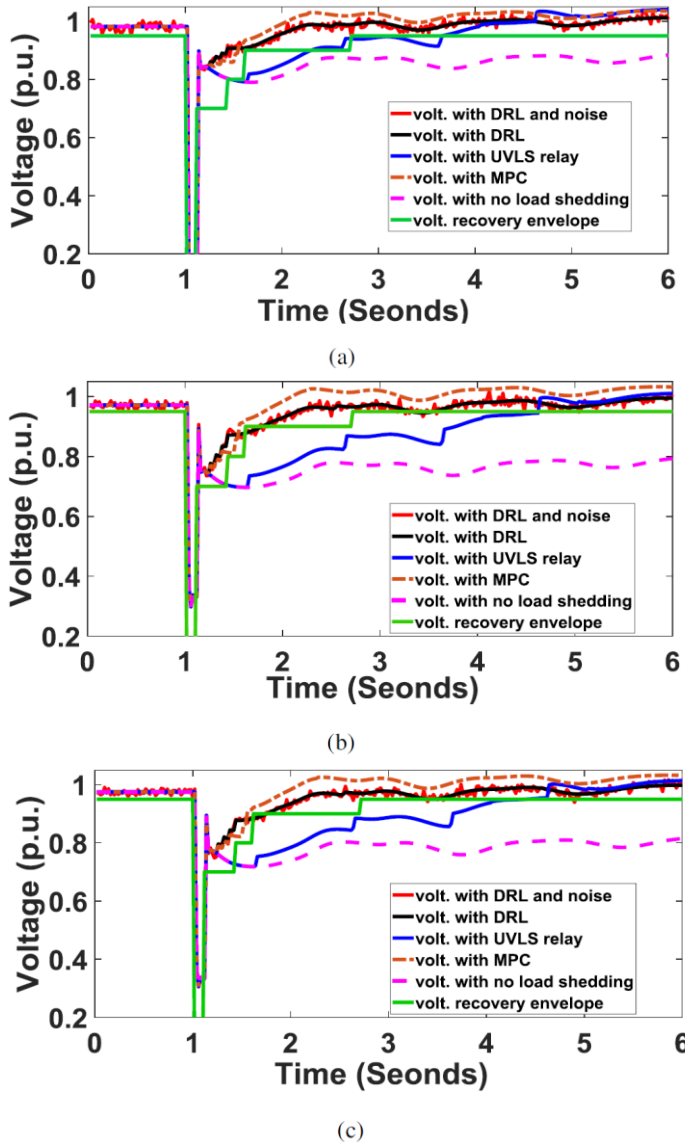


Fig. 4.5: Voltage profiles and required voltage recovery envelope for different types of loads shedding control methods: a) bus 4; b) bus 7; c) bus 18

V. DISCUSSIONS

There are numerous key issues for DRL use in general, and notably in respect to its usage in power system emergency control.

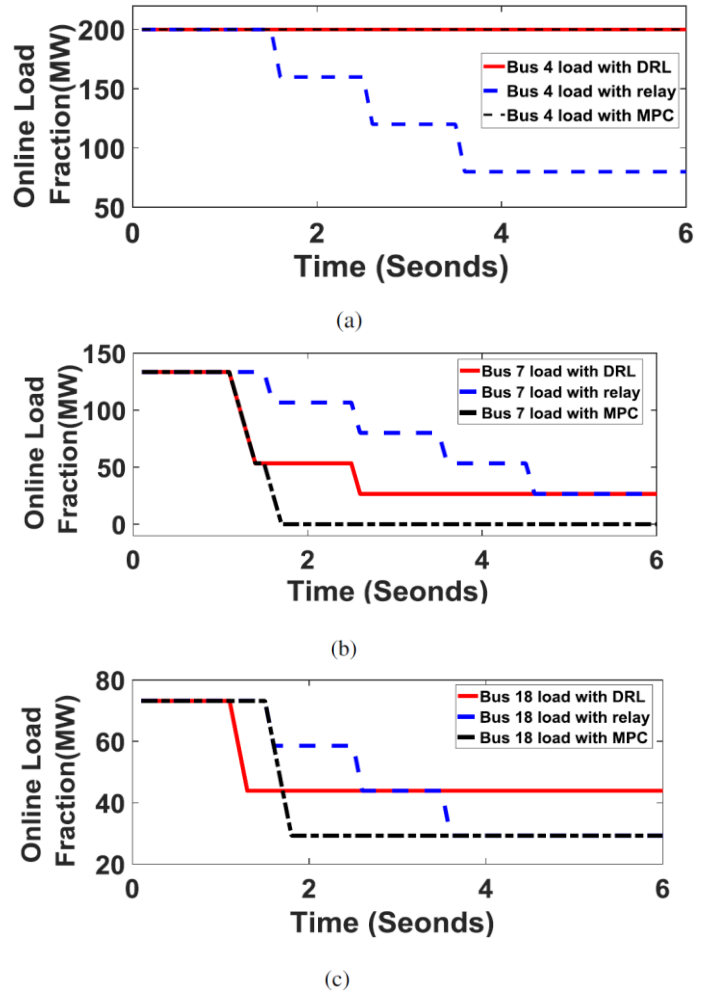


Fig. 5.1: Load fractions online when load shedding is managed via MPC, DRL, or UVLS relay mechanisms: (a) bus 4; (b) bus 7; (c) bus 18. The Proportions are multiplied by the interim busload, expressed in megawatts.

VI. CONCLUSIONS AND FUTURE WORK

In the event of a large disruption or a severe emergency, a reliable emergency control system is very essential. Building “adaptive emergency control systems” using DRL is the focus of this dissertation. As part of an effort to speed up the development and testing of grid control algorithms, an open-source platform called RLGC has been created. We seek to serve as a starting point for future research in this field by releasing it as an open-source project. “Dynamic generator brake and UVLS” are two typical emergency control solutions built on the platform. It was found that both “DRL-based emergency control

schemes” are adaptive and robust (to new scenarios, noise in observations, and model parameter uncertainty) as well as superior to MPC-based emergency control, conventional “Q-learning,” and other prevailing protection mechanisms. To efficiently tackle control issues linked with increased uncertainties in power systems, recent innovations like deep meta-reinforcement learning and safe exploration are being used.

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Cite this article as :

Alok Kumar Sriwastawa, Virendra Pratap Yadav, "DRL Based Naïve Emergency Control for Complicated Power Systems", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 309-321, January-February 2022.

Journal URL : <https://ijsrst.com/IJSRST229158>

Survey on Available Bartering Techniques and their Fundamentals

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ABSTRACT

There may be a contradiction between individual self-interest and the collective good of a population in large-scale dispersed systems. Cooperative and incentive-based systems are typically essential to control the behaviors of these players, to compensate for the possibly unfavorable availability consequences that may follow from individual acts. Incentives for cooperative behavior have taken several forms throughout economic history. To re-allocate resources efficiently, we use a bartering incentive structure as a sturdy base. For all its age as a trading method, bartering continues to surprise us in a variety of unexpected ways. As a research model, barter mechanisms are appealing because of their success and durability. In an e-barter system, money isn't necessarily involved in transactions. Agents undertake resource swaps on behalf of their separate consumers in multi-agent systems. They also have a tree structure depending on marketplaces. An appropriate design for this kind of system has been developed in this study. A web service will be used to specify the design. Due to the formal specification's abbreviation of many practical aspects, the process of creating a design definition for this typefaces various difficulties.

Keywords : Incentive-Based Systems, E-Barter System

Article Info

Volume 9, Issue 1

Page Number : 322-328

Publication Issue

January-February-2022

Article History

Accepted : 05 Feb 2022

Published : 15 Feb 2022

I. INTRODUCTION

A. Overview

Standard finance and marketing approaches are sometimes unable to deal with the growth of national and international commerce volume and financial crises. These solutions are still money-based and do not work to reduce the cost of money. Thus, the greatest strategy to lower the cost of money is to adopt non-money-based strategies that may change corporate resources efficiently. The barter technique is based on the notion of buying and selling products and services without using money. Barter is a

centuries-old system of exchanging products and services without using money (Terry and Gary, 1996: 167). Currently, barter transactions are classified as bilateral (classical) and multilateral (modern) (Toroslu, 2010: 5); retail, corporate, and international barter (Imşek, 2014: 29); and complete barter (100%) and partial barter (100%). Increase sales, reduce inventory, use idle capacity, get the right finance and marketing, avoid crises, and save money via barter (Uyan, 2013a: 2).

This study's goal is to present the barter approach, explain how it works in our nation, and

assess the advantages of barter for businesses. First, the notion of barter and its evolution are addressed. Then the pros and disadvantages of each sort of barter are described. In the conclusion and recommendations section, the issue was reviewed based on the results and recommendations for the future of the barter system.

B. Definition Of Barter

Conceptually, barter is a trade and financing method that is built on millennia ago in the economy, albeit it is still fresh today. The fundamental definition of a barter system is the trade of commodities or services without money (Edwards, 1996: 7). (Edwards, 1996: 7). The Barter term is originated from the English language and is characterized as "Exchange (things or services) for other goods or services without using money" in the Oxford Dictionary (Oxford Dictionaries, 2017). (Oxford Dictionaries, 2017). In Turkish, there is no barter term, however, in many definitions of barter, the word "exchange" is used.

In the Turkish Language Dictionary issued by Turkish Language Association (TDK), the exchange term is defined as "payment of the cost of a contract concluded between two nations by reciprocal goods" (Güncel Türkçe Sözlük, 2017). In TDK's Dictionary of Economic Terms, the exchange phrase has been indicated as the definition of the English word "barter" (İktisat Terimleri Sözlüğü, 2017). Barter is a strategy established by inspiration from the exchange system which is the oldest and simplest kind of trade method (Karluk, 2013: 437). (Karluk, 2013: 437).

Barter as an international commerce mechanism involves the trading of products between two nations without utilizing money (Madura, 1992: 383). (Madura, 1992: 383). As a corporate trading type, barter is the term of a method in which corporations exchange products and services directly with other companies, notably to alleviate the liquid situation and overstock (Yakovlev, 2010: 280). (Yakovlev, 2010: 280). In international sources, barter is described as the exchange of what you have for what you need

(Tugend, 2019: 8). (Tugend, 2019: 8). The barter system in Turkey is also presented with the premise of "give your surplus and take your need" (Barter Yeni Ekonomi, 2012: 10). (Barter Yeni Ekonomi, 2012: 10). In developing economies, the actions of barter merchants do not only make it simpler to share current resources more effectively but also allow for the increase of resources (Bauer, 2010: 4). (Bauer, 2010: 4). Barter is thus a specific financial tool that turns the economic resources of governments and enterprises into economic benefit. Today's contemporary barter system facilitates the exchange of products and services in an organized market.

In the literature, this structured barter form is referred to as "multilateral barter" and "financial exchange". But barter is a finance method more modern and extensive than simple trade (Özkan, 2012). Today, the barter system is sometimes referred to as the "stock exchange of the commodities and services" (Alptürk, 2019) and "free commerce" (Şimşek, 2014: 28). Indeed, today's modern barter system is created by the organizer company, there is a common market where companies that are members of the system can shop with each other, and the goods or services purchased in this market are paid by goods or services produced or traded, not by money (Yeşiloğlu and Yiğit, 1996: 16). Therefore barter is a financing tool that a business may purchase goods and services required and a trading approach through which a firm can sell products and services created.

C. Development Of Barter

Based on barter, there is the exchange of what you have for something you need. In the early periods when commerce was created in the simplest form, people were utilizing their surplus for their necessities, hence commodities and services were traded between sides. First, the coin, then banknote, began to be employed in the economy, then exchange and similar contracts have fallen into desuetude. The exchange system, which lost its relevance along with the development of money, became a current concern of enterprises and nations again to get rid of the

international economic crisis of 1929 (Uyan, 2013a: 1). (Ryan, 2013a: 1). Due to the collapse of commerce, from 1930 to 1933, most European nations have signed various barter arrangements. In particular, Germany has provided food and raw resources from European and Latin American nations via barter. In those years, owing to the war and the economic crisis, international barter, one of the counter-trade strategies, was utilized. But eventually barter applications started to expand to the commercial level as well (Sürmen and Kaya, 2011: 131). On the other hand, private sector firms have always utilized the corporate barter technique by themselves, they have purchased their requirements from the company and they have sold their goods to the same company, thus they formed bilateral barter. Over time, the barter method was updated, reinvented, and systematized with the influence of technical improvements, structured barter applications managed by barter corporations have emerged, thus barter began to be used as multilateral changes between products and services.

According to the US Department of Commerce, barter contributes around 30 percent of total global commerce in different forms. The BusinessTrend Analysts study has indicated that 40 percent of international commerce is done using the barter method. Again according to US data, barter commerce has risen approximately 16 percent each annum (Saygılıoğlu, 2019: 197). The first documented barter group was created in Switzerland in 1934 (Arslan and Aykutlu, 1999: 2-3). (Arslan and Aykutlu, 1999: 2-3). A structured barter system is most widely utilized in the USA. Today more than 900 barter firms are functioning in different nations and more than 700 thousand enterprises actively trade barter (Toroslu, 2010: 68). (Toroslu, 2010: 68). In Turkey, barter groups have been active since the 1990s (Bayrav, 2019:8), and the barter system started to be acknowledged in the 1994 economic crisis when overstock of enterprises was employed via trade.

I. TYPES OF BARTER

A. Retail Barter

In retail barter, a corporation pays for products or services purchased from a barter market by selling goods or services produced or traded on the market. This is also known as retail bartering or organized bartering. Retailers, service providers, and self-employed persons may use retail barter (Uyan, 2013a: 29). However, present legislation does not ban the creation of barter firms and barter transactions via these organizations (Arzova, 2010: 24; Acar and Tekşen, 2017: 5). In the globe since the 1930s, and Turkey since the 1990s. Today, a broad range of commodities and services are traded in the barter market in our nation, such as real estate, written and visual advertising, building materials, airline tickets, automobile rental, hotel accommodation, medical services, ready-made apparel, furniture, and educational services. A barter corporation, like a brokerage house, facilitates the exchange of goods and services among members. Member enterprises may fund their requirements by selling their products or services. Members must sign a barter agreement with the barter firm (Erkan, 2010: 2-4). The barter firm manages the main data (supply and requests) and presents them to the member companies. Barter brokers service all members. Member company barter authority monitors barter transactions. 100% barter (full barter) or partial barter transactions. Barter organizations report multilateral barter transactions as debt or receivables to the current accounts of member enterprises. (Şimşek, 2014: 29). Within the purchase credit limitations, member firms may use the barter system (Erkan, 2010: 2). In a barter system, the corporation sells or guarantees the purchasing limit (Uyan, 2013a: 71). A barter member firm may get a product from another barter member without paying for it, but it must sell its products or services to other barter members within a certain time frame (Erkan, 2010: 2). Non-payment of products or services by the member firm must be paid in cash to the barter company. The barter firm is the brokerage house, and

the buyer and seller are solely responsible for pricing, quality, delivery, and after-sales support. Expiration of the barter membership contract, member request, or if the barter firm deems it essential (Uyan, 2013a: 71). The member firm pays the barter corporation the yearly membership fee and the purchase and sales commissions (Türk Barter Üyelik Sözleşmesi, 2011: 5). Retail bartering is multilateral. It removes circumstances when bilateral barter transactions are impossible or dissatisfied, and it provides various alternatives to supply and demand (Zügül, 1998: 104-125.) In a multilateral barter transaction, numerous member firms join a barter corporation and shop together. This multi-sided and multi-commodity trade chain runs indefinitely.

B. Corporate Barter

Producers, principal distributors, and wholesalers swap products and services with other businesses to shift inventories, a practice known as corporate barter (Arslan and Aykutlu, 1999:9). (Imşek, 2014: 30) Construction, automotive, media, and tourist industries employ this sort of barter. When two firms are interested in one other's products, the managers will consider barter as a unique sort of commercial transaction including goods exchange (Yakovlev, 2010: 280). In reality, corporate barter transactions are bilateral. Bilateral barter is the simplest kind of barter and involves two organizations exchanging commodities (Krlolu, Akaytay, and Badat, 2015). Bilateral barter involves just two participants, both buyers, and sellers.

C. International Barter

Counter-trade agreements are the most common kind of international barter (Uyan, 2013a: 31). Counter-trade is international commerce involving governments or firms from different nations (Toroslu, 2010: 20). Counter-trade is a broad term. According to the items sold, the payment method, the payment time, the parties involved, and whether or not cash is utilized in the transaction (Durmuş, 2015: 13). Counter-trade is the exchange of commodities, services, technology, or receivables between nations,

not cash (Tekşen, 2016: 39). Counter-trade is recommended for transferring commodities, services, and technology to countries with currency shortages or devaluations (McVey, 1981:197). Counter-trade has been acknowledged as a significant factor in international commerce, even by wealthy nations (Oyman, 2015: 40). The 1929 global economic crisis ushered in modern counter-trade methods (Uyan, 2013a: 31). Countertrade has been vital in global trade since 1945. It was created by the former Eastern Bloc nations. (Arzova, 2010) Since the early 1970s, emerging nations with liquidity issues have traded bilaterally. Counter-trade agreements often include mining, agricultural products, and certain industrial items (Arslan and Aykutlu,1999: 10). There are many kinds of counter-trade agreements used in international commerce (Ersun and Arslan, 2010: 175). In actuality, the sorts of counter-trade witnessed include barter and clearance, sometimes carried out by the state. Counter-trade strategies vary in two major ways. The length, density, and extent of the connection between the parties. According to this, a powerful, intense, complete, and long-lasting connection between trade partners brings the parties closer to new opportunities for collaboration, closer to rooted relationships, and harmonizes their work and arrangements. Then strategies like barter take control (Ersun and Arslan, 2010: 177-178).

II. SOME AVAILABLE TECHNIQUES

Exchange of products or services for other goods or services other than money, according to the Oxford Advanced Learner's Dictionary (2010). Barter is the oldest method of trade in the world. Direct exchange of products and/or services between two or more trade partners have always been the norm. While the basic principles of barter exchange haven't altered, modern variants have conditions and agreements that are more flexible (Frikken and Opyrchal, 2018). Barter trade is defined in this research as any kind of commerce in which the entire or partial payment for products and/or services is

made by utilizing other goods and/or services. Barter trading is popular among businesses because of the many advantages it offers. It has previously been said that the use of barter trade may have a positive impact on a company's bottom line in several ways.

Although barter trading may be a good bargain for enterprises, Lighten (2012a) highlighted that only if they join it with their eyes wide open do they have a chance of success. Research demonstrates that barter commerce has its advantages and disadvantages, and this is evident from a survey of the literature. According to Ference (2019), barter trades are characterized by lengthy conversations before a deal can be struck. Even though this is advantageous in terms of getting to know each other better, the discussions might take a long time and deprive the company's employees of time to focus on other business matters. Barter trading may hurt a company's cash flow if it is not properly handled. Enterprises need to be aware of the dangers of accepting too much business via barter trading, according to Satov (1996). A company's cash flow might be adversely affected by barter trading because of taxes and other responsibilities that can only be paid in cash, such as salary, which must be paid by the company.

In addition, there may be issues in establishing the quality and value of the goods and services supplied; difficulty in disposing of items; the prospect of consumers becoming rivals; mismanagement and fraud. According to Campbell (2019) and ending (2013), 'distressed' inventory, which is inventory that is difficult to sell to conventional cash-paying clients, is a common source of barter exchange. In this way, corporations may get rid of outdated or subpar items via barter trading. The recipients may find these things of little use. Lack of knowledge or experience in a given product area might make it difficult to verify an offer's quality.

If a company agrees to trade in things that aren't strategic, it puts itself at risk. When it comes to accepting new items, Neal. (1992) advised corporations to be more discriminating in their

selection. Findings from a study of countertrade practices across UK businesses revealed a major issue: no 'in-house usage' for items on sale. If a company accepts a product that it does not intend to utilize, it may either sell it on the open market or trade it for something else of equal value. Reselling items given by consumers, as discovered by Liesch and Palia (1999), might also be challenging. Customers accepting barter items to resell them might be a problem for barter trade. Customers might become rivals of a business in several instances.

This is because the barter consumers will be attempting to sell their items to the same customers who would have purchased them from the original firm. Barter trading, according to Egan and Shipley (1996), is riskier than monetary transactions. Risks include mismanagement and fraud, among others. Keeping track of barter goods might be difficult or impossible if suitable procedures aren't followed. For any organization to be able to take advantage of the possibilities and cope with the possible challenges often connected with barter commerce, appropriate management techniques are essential.

To make the most of barter trade's advantages, senior management commitment is essential, according to Neal et al. (1992). Having the backing of the company's top management may assist foster a barter-friendly culture. As a result of their assistance, the organization can ensure that it has sufficient resources to support barter trade operations, including financial, human, and other resources According to Young (2016), the successful implementation of barter commerce requires an effective and efficient organizational structure. Companies who want to employ barter trading need to show their commitment by forming organizations specifically designed for this sort of trade, Young said. The barter transaction may be organized in a variety of ways by corporations. Barter trade coordinators, distinct barter trade departments, or independent service providers might all be employed. As noted by Neal (1992), the option of how an organization should be built to

efficiently deal with barter trade will be influenced by several elements, including the company's goals, available resources, scope, as well as the frequency of barter exchange.

Legal contracts are advocated by Hindin (2010) and Rutter (1996) to properly deal with additional hazards involved with barter commerce. It is also important to remember that the terms of the legal agreement may include details such as delivery dates and product quality, as well as consequences for non-performance. A company's policy guidelines may also serve as guidance for its personnel when it comes to barter trading. When it comes to managing barter trade, workers and management might benefit from having a written policy that outlines the best practices to follow.

III. USING BARTER IN BUSINESS

Economic liberalization has weakened economies by removing trade barriers. The economic crisis affects all enterprises, big and small. During a crisis or recession, enterprises' production capacity decreases, and their stockpiles cannot be converted into cash, causing liquidity issues. In quest of a remedy to periodic economic downturns, humanity has returned to the barter trading system. Today, barter is given to enterprises and nations uniquely and innovatively. Barter may be used for micro and macro transactions. From a micro viewpoint, retail barter is a great way for SMEs to finance and trade. One of the most crucial issues facing SMEs is funding, which influences their operations throughout their existence, particularly in times of crisis. Increasing loan prices made it difficult to give finance to SMEs during the recent global economic crisis. Moreover, bartering allows SMEs to finance their entry into global markets. However, SMEs lack a professional management style, making it difficult to identify target markets and create marketing tactics. As a result, they cannot sell all of their products and services. They start to run out of cash as their

inventories and idle capacity grow. During crises, liquidity issues become more acute.

IV. CONCLUSIONS AND FUTURE WORK

In today's economic climate, when financing is costly, demand has fallen, the market has grown stagnant, competition has risen, and global crises are on the rise, companies are resorting to alternative economic strategies to stay afloat. It's possible to exchange resources without using money using the barter model, which is one of the alternatives. It's no surprise that barter has endured through the ages as a viable mode of commerce and financing. The barter technique, which dates back to the earliest days of commerce, is being resurrected in a new form with the addition of new features. There are three forms of bartering now in use: retail (organized), corporate, and international. Now, barter is used in hundreds of industries and by tens of thousands of businesses worldwide. The barter market isn't only used by businesses; it's also used by public organizations, municipalities, local governments, and even governments to raise funds. Companies in our nation mostly utilize the barter system to solve idle capacity, stock surplus, liquidity issues, accumulated debts, dangerous receivables, financing, and marketing issues. Today, firms that are unable to adapt to quickly changing situations in several domains, including social, political, natural, technical, and economic, will not be able to prolong their existence for a long period. Even the world's biggest companies have an average lifespan of 40 to 50 years, although the life expectancy of businesses is far lower. Bartering is an innovative and successful strategy for enterprises to maintain their long-term presence, establish a long-term competitive edge, and create above-average profit margins. By using barter as a tool, companies may develop corporate, competitive, and operational management strategies at each of the three levels of management. Like barter, a proactive crisis management tool in businesses, barter may be used.

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Cite this article as :

Navodita, Sheela Singh, "Survey on Available
Bartering Techniques and their Fundamentals",
International Journal of Scientific Research in Science
and Technology (IJSRST), Online ISSN : 2395-602X,
Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 322-328,
January-February 2022.
Journal URL : <https://ijsrst.com/IJSRST229159>

Development of Recommendation System Based on Ai Techniques to Exchange Items Between Users

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ABSTRACT

Online bartering is becoming more and more commonplace as the Internet becomes more accessible. There are numerous parallels between recommending deals on an online bartering platform and conventional techniques to recommending products, including the requirement to model user preferences and product features. Bartering difficulties are intriguing and hard for various reasons, including the statement that users are providers and consumers, as well as the dynamic nature of the trading environment. Bartering needs us to understand more than simply the preferences of users, but also the dynamics of who trades with whom and at what time. We provide three new datasets from online bartering platforms to suggest new models for bartering-based recommendations. Existing solutions function poorly on real-world platforms because they depend on idealistic assumptions that are not supported by actual barter data. A Matrix Factorization-based technique is used to simulate the reciprocal interest that users have in each other's things. Social and temporal relationships between members also have a significant impact, thus we expand our model to include these aspects. Our strategy is tested on a variety of markets, including book, video game, and beer transactions, and we see positive results compared to other strategies.

Keywords : Matrix Factorization-Based Technique, Online Bartering Platform Conventional Techniques

Article Info

Volume 9, Issue 1

Page Number : 329-340

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022

Published : 23 Feb 2022

I. INTRODUCTION

A. Overview

This may be understood as a conflict in between the self-interest of its members and the greater good of society as a whole in large-scale dispersed ecosystems Mechanisms that give incentives and encourage cooperation are often required to control the participants' conduct to minimize the possibly

unfavorable availability consequences that may follow from individual activities. Economics has a long and varied history of ways to encourage collaboration. Bartering incentive patterns provide an ideal basis for a simple and resilient kind of trade for re-allocating resources in this thesis. Bartering is one of the oldest forms of commerce in the world, yet it still amazes us in many ways. The barter system's

success and long-term viability make it a good model to analyze.

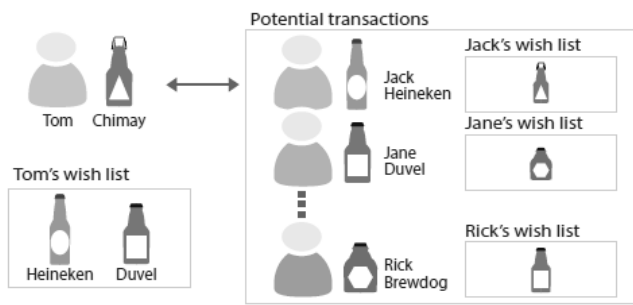


Fig. 1: Trade items with Barter System

B. Background Of Barter System

In Jackson Hole, Wyoming, in August 2000, the world's economic leaders convened for an annual policy summit. The chiefs of the central banks of Japan, Britain, and some other nations were in attendance, including Alan Greenspan.

"Mervyn King, Deputy Governor of the Bank of England," was one of the guests who reflected on the influence of internet commerce and the future of money.

There is no reason why items and services cannot be exchanged directly by consumers and suppliers via a system of direct exchange—effectively a huge barter economy, as he concluded, as cited below. Only a common account and sufficient computational capacity are needed to ensure that all transactions may be completed instantly.

- Payments would be made electronically between individuals, bypassing any intermediary that we could identify as a bank.
- Central banks and money as we know them would vanish.
- Barter is defined in a standard dictionary as the exchange of items or services without the use of cash.

C. Big Barter Networks

The following are a few instances of amazing deals:

"Fujitsu laser printers were exchanged for 1.7 million units of military ready-to-eat (RTE) meals, which were then sold to relief groups for urgent use

in the hurricane-ravaged states of Florida and Hawaii. Due to conflicts in the Persian Gulf, there was no need for the RTEs."

"An arrangement signed by PepsiCo, Inc. in April 1990 was the biggest trade transaction between a U.S. firm and the former Soviet Union, bringing in more than \$3 billion in total retail sales for the two countries."

To establish hundreds of bottling operations and "Pizza Hut" locations in the "Coalition of Independent States," PepsiCo will be able to utilize foreign currency credits from vodka sales.

In exchange for practically nothing, the Lexington Hotel in New York City received a cutting-edge computer system.

Computers were purchased in 1991 by a barter business in return for more than \$300,000 in "hotel room credits" that the firm could use or, with the hotel's consent, sell or trade for other products or services.

Bartering extra office space for products and services is another new trend.

Advertisement time, hotel rooms, and office equipment are just a few of the items that SGD and ICON3 exchange for spare space.

The fabled purchase of an island by "Peter Minuit" in 1626, in which he traded 60 gold pieces worth of trade items for an island known as Manhattan, is an example of the power of barter.

D. Introduction To The Ideal Model

The economy is believed to have been barter-based from its start [1]. The introduction of money as a means of trade and a unit of measurement facilitated the valuation of assets and shaped current economic practices. Barter has re-emerged in the lives of 21st-century consumers as a result of extensive digital communication [2]. Economic models have been resurrected based on the premise that things may be extended to service numerous owners, or that users can get access to obscure or difficult-to-obtain items. Swapping CDs, DVDs, books, and other media may be done on a variety of platforms, including

swapacd.com, swapadvd.com, readitswapit.co.uk, and bookmooch.com[3].

E. Scenarios Of The Bartering Approach

A long and diverse history of economic incentives for cooperation. In this thesis, bartering incentive patterns give a simple and robust way to re-allocate resources. The earliest method of business, bartering, still impresses us. Barter's success and longevity make it a valuable model to study. Throughout this thesis, we have specified three relevant situations in which the bartering approach may be used. Let's start with a well-known bartering arrangement:

- An Internet directory service application is used to demonstrate how a bartering-based technique might be used.
- We explain how agents, utilizing bartering, may acquire benefits in commodities without altruistic agents having to be present.
- In a bartering environment, we show the cost of dealing with selfish agents, as well as the impact on performance indicators like topology and disclosed information.

II. LITERATURE REVIEW

A. Priority work on the Best Barter Exchange Strategies, Begin as Early as Possible

The kidney exchange dilemma [4, 5] sparked early work on exchange market algorithm design [6]. For patients with incompatible live donors, algorithms have been devised to identify cross-matched patient-donor combinations in the regional transplant pool. By employing The Top Trading Cycles and Chains mechanism, Roth et al. [7] have addressed the issue Haddawy et al. [8] addresses the issue of identifying a balanced match between buyers and sellers in the setting of barter trade exchanges, which is an important study. There is an intermediary in charge of managing the transactions, and the parties are matched according to their supply and demand information and their credit in terms of a

private-labeled currency. On a network, a least-cost circulation issue is modeled. And last but not least, the work of Mathieu [9] attempts to solve the challenge of locating bartering rings in an online marketplace by using weighted trees to compare the similarity of search and offer queries.

B. Circular Exchange Of A Single Item (Csem)

A bartering network's exchange cycles are more complex than the kidney exchange dilemma. Users in a standard exchange market have numerous products to give away and perhaps multiple incoming items, rather than receiving and giving one item (a kidney). A directed network with nodes representing users and edges tagged with item IDs is used by Abassi et al. [10]. It is up to the users to decide what they want to buy and what they want to give away. Potential transactions may be seen in this graph by looking for directed cycles.

C. The Binary Value Exchange Model (Bvem)

"Su et al. [3] address the item exchange issue for "cycles of length two, which is a distinct approach (i.e., swaps). Competitive online situations such as online games with a heavy real-time updating schedule may benefit from the system. For this reason, the value to be optimized is the sum of all possible gains for each of the users. Many recommender systems use Matrix Factorization (MF). The low-rank approximation is used to estimate user preferences that are not seen in the user settings and the item set [11]. MF guesses these preferences using a sparse interaction matrix $R \in \mathbb{R}^{|U| \times |I|}$. An item's compatibility with a user is determined by the dot product of the user's interaction with the item and the low-dimensional space in which the user and the item are placed. To address social interactions and temporal dynamics, we mostly draw upon existing theories that extend the MF to integrate social regularisation [12] and "temporal dynamics in recommender system" (RS) recommendations [13].

D. The Bayesian Language (BPR)

Rendle and co-authors [14] have developed an optimization process called Bayesian personalized

ranking that directly optimizes a ranking measure. [15] (AUC). Implicit feedback is readily handled by this method since it simply analyses interactions that are ‘positive’ between the user and the object, while not distinguishing between observations that are negative or absent. Users prefer products they have seen over those they haven’t, and this intuition is crucial. Matrix Factorization or “Adaptive k-Nearest-Neighbors” may be used in combination with this pairwise optimization strategy.

III. THE PROPOSED MODEL

A. Notations

Table 1 is showing notation used in the thesis:

Table 1.1: Notation Used in Thesis

Notation	Description
R	Interaction matrix $\in \mathbb{R}^{ U \times I }$
I	Item set
U	User set
u_j	User $u_j \in U$
i_k	Item $i_k \in I$
$r_{u_j i_k}$	Entry in R (for user u_j and item i_k)
W_j	Wish list of user u_j
G_j	Give-away list of user u_j
H_j^g	History of given item for user u_j
H_j^r	History of received item for user u_j
$\hat{y}_{u_j i_k}$	Predicted preference of user u_j for item i_k
$\mathbb{1}$	Heaviside step function

B. Application of the system

In the beginning, restrict deals to friends since successful bartering takes expertise and practise. It’s simple to overvalue the object you want and undervalue your own. On the plus side, bartering has several benefits. Bartering does not need money. Bartering also allows for flexibility. For example, portable tablets may be swapped for laptops. For example, lawn mowers may be swapped for TVs. Homes may now be traded for trips, saving both parties money. The buddies may swap their house for a week or so, in return for your parents letting them stay at your home while on a family vacation. Another benefit of negotiating is that no tangible objects are exchanged. Instead, trade a service for an object. To get a skateboard, for example, you may offer to mend your friend’s bicycle in return for the skateboard. Bartering allows two people to receive

what they desire from each other without spending money [18]. On the technological side, the effort brings together findings from the following fields:

- Grid, peer-to-peer, and other distributed systems
- Agent-Based Simulation
- Complexity and Markets
- Economic Models
- Market Dynamics
- Scalability and performance issues
- Novel applications
- Dynamics of economic Networks
- Self-Organization/Adaptation of Multi-Agent Systems
- Cooperation, Competition, and Autonomy

C. Motivation

“Social and artificial societies” both rely on trade as a fundamental economic principle. The exchange theory covers a wide range of topics:

- Sociology assumes that all social life may be understood as a kind of transaction between agents.
- Exchanges between people and those who have political power are referred to as “politics.”
- The exchange of commodities and services is the basis of economics

D. Aim, Purpose, and Objective

The three sections of the thesis all have the same goal:

- It’s possible to create a distributed directory service that relies on barter.
- A bartering phenomenon: a series of bargaining agreements that transform a paperclip into a home.
- Resource distribution between self-interested, rational, and autonomous individuals in a bartering framework Because of the following reasons, these sections have a high degree of complexity:

- The theoretical framework and system creation and evaluation are used to study the numerous hopes on bartering.
- The environment’s collection of conflicting traits and entities (such as its popularity and its lack of resources)
- Finding a way to go from low-value objects to high-value ones in dynamic and selfish environments.
- With the barter principle in mind, the design of content distribution algorithms is severely limited. Dealing with selfish actors rather than cooperative ones results in efficiency losses, and the means to trade, in our case a bartering technique, is the price to pay [16].

IV. PROPOSED METHODOLOGY

A. Data Analysis

To test our technique, we first performed an empirical investigation by gathering the following datasets:

- **Swap** is a CD exchange platform
- **/r/gameswap** is a self-organized subreddit made for users to exchange video games.
- **Bookmooch** is a book exchange platform.
- **ReaditSwapit** is a book exchange platform.
- **Swapadvd** is a DVD exchange platform.
- **Ratebeer** is a beer exchange platform.

The rightmost column displays the proportion of people who, based on their public listings, have at least one trade opportunity. There are limited trade partners available to users on most sites. Table 2 provides some basic information about the datasets. Our primary emphasis is on datasets 4, 5, and 6 since they all include transaction histories.

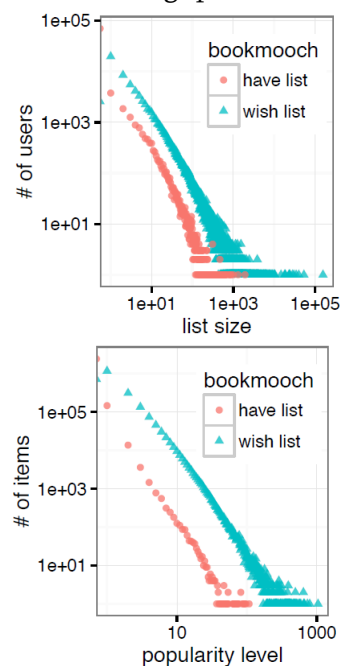
Table 2: Statistics for Some Platform

Platform	user count	item count	transaction count	% of users w/ at least one swapping partner
Bookmooch	84,989	2,098,699	148,755	0.2%
Ratebeer	2,215	35,815	125,665	65.9%
/r/gameswap	9,888	3,470	2,008	-
Swapacd	4,516	244,893	-	0.5%
Swapadvd	7,562	91,241	-	0%
ReaditSwapit	33,151	94,399	-	4.2%

B. The Datasets

For example, in Fig. 3.2, you can see how the size of users’ wish lists and give-aways, as well as the popularity of each item in terms of how many users possess it and the number of users that want it, are distributed across users (right column). According to these numbers, there are ‘power users’ [17] on the sites, since they seem to roughly follow power laws. Swapadvd Read and Swapacd

Table 2 shows that even with vast user bases like Bookmooch, there is a scarcity of exchanging partners. However, Ratebeer is an exception to the rule, which may be explained by the itSwapit, which yields comparable findings but was deleted for the sake of saving space.



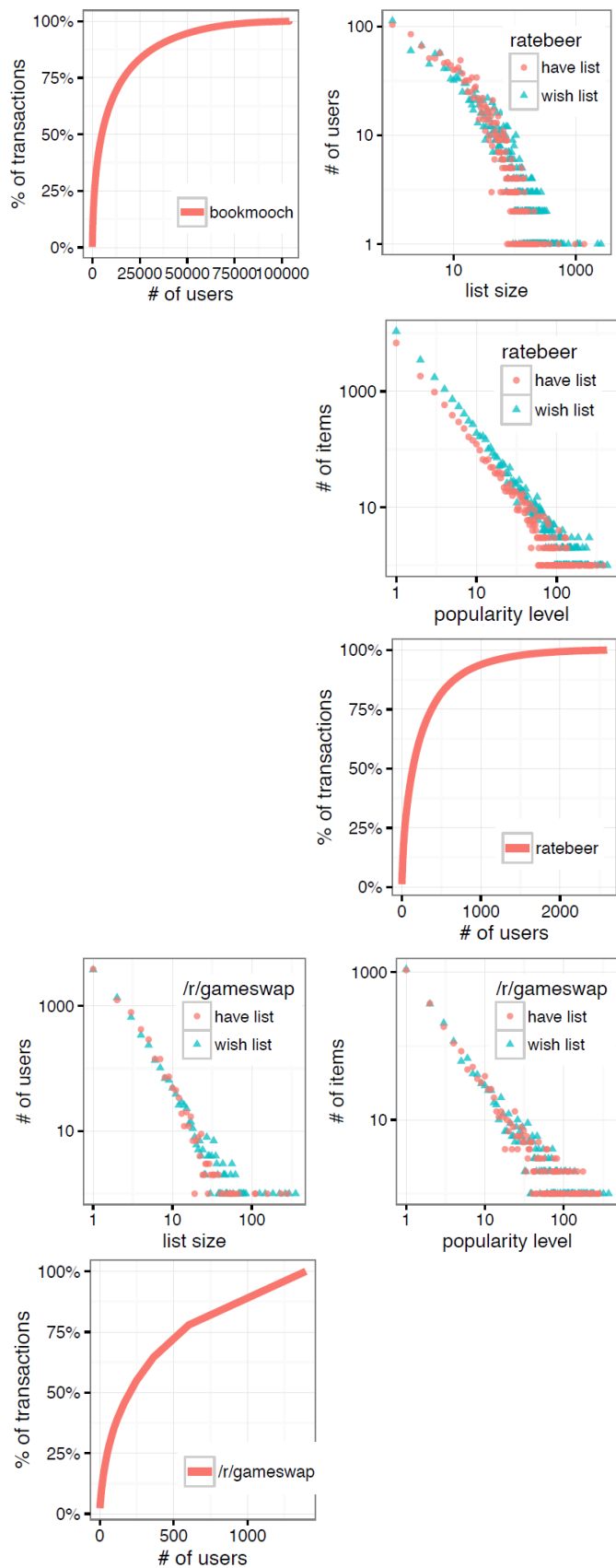


Fig. 2: When it comes to item list lengths and popularity, a power-law distribution holds across the three platforms under consideration. “(top:

Bookmooch; middle: Ratebeer; bottom: /r/gameswap).”

Using the CDF plots on the right, we can see how many swap operations each user does. Power users dominate all three platforms, as seen by the high volume of transactions.

C. Few Eligible Swapping Partner Pairs

If both users want goods on the other’s giveaway list, they might be trading partners. Table 2 summarises the proportion of users with at least one qualified switching partner for the snapshots of the swapping sites analyzed. /r/gameswap does not appear in the chart because the threads’ organization prevented us from obtaining a precise snapshot of all users’ haves and ‘wants’ at a given moment.

Uj’s preferences may have changed after they posted their item lists at time t , but it is incorrect to presume that they haven’t changed since uk posted their item lists at time D . (rendering the lists stale, they may have exchanged items). Hence, only those users who were active in the thread when the snapshot was taken may be included in the snapshot at $t + d$.

Table 2 shows that even with big user bases, such as Bookmooch’s, the lack of appropriate exchanging partners is an issue. For Ratebeer, there is an exception to the norm, which may be because the platform is many years older and has a worldwide user base.

BVEM [20] and CSEM [19] do not perform well on this data, producing too few (or no) suggestions per user due to the aforementioned scarcity. These algorithms match people entirely based on the content of give-away lists and desire lists. Despite this, as we’ll see in the examples below, numerous exchanges occur between people who aren’t necessarily eligible?

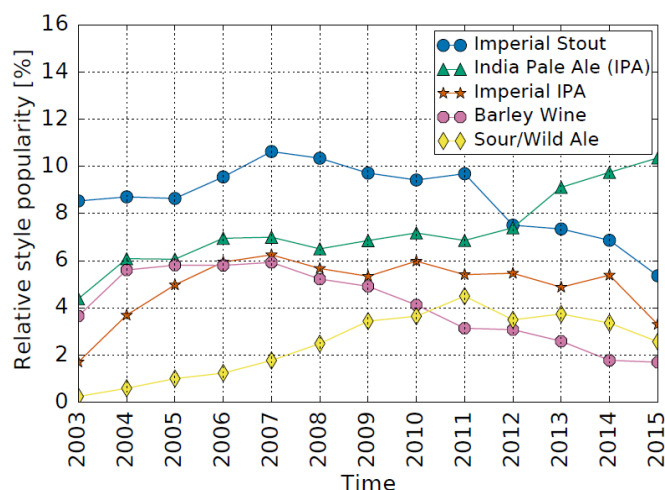


Fig. 3 shows the rise and fall in popularity of the world’s most popular beers throughout time (using the Ratebeer dataset).

D. Wish Lists Don’t include all of the Preferences that People Have

Bookmooch provides weekly database snapshots, allowing users to see how many of the books they get when trading on the site was already on their want lists. We were able to arrive at an average percentage of 33.2% per user using Bookmooch’s snapshots. There is a clear connection between this and the requirement for a recommender that can deduce a user’s inclinations toward products that they aren’t aware of (or didn’t expressly indicate in their wish list) and instead find by chance. This is an important problem that hasn’t been addressed before.

E. Trades with the Same Person may be done Several Times

An observation we make regarding transaction events supports our intuition that successful trading pairings are likely to trade again. Bookmooch, Ratebeer, and /r/gameswap are the three most popular places for people to exchange with one another. Social relationships may have a significant influence in deciding the trading partner of a user, and successful trading partners are more likely to trade again in the future, based on this research.

F. Transaction Volume and Time-Dependent Popularity

A bartering platform’s dynamic ecosystem is vulnerable to temporal trends. Figure 3 shows how

the popularity of beer genres changes over time, as assessed by the number of times they are traded. For example, by 2013, IPAs have overtaken Imperial Stouts as the most popular beer style, although Imperial Stouts had been the most popular before that time.

Another sort of time-dependent behavior is seen in Fig. 3. In each transaction, there is either a focus on the object itself (bottom plot) or the person who is transacting the item (top plot). The Y-value is determined by the number of days that have transpired since the last transaction by the specific user. On the other hand, goods and people with less frequent contact are represented in less active ways in Fig. 3.3.

Fig. 3.3 is showing the cumulative frequency plot of the Bookmooch transactions. However, it is important to keep in mind that although a small group of strong users (i.e., $t < 100$) performs numerous transactions each day, most other things are exchanged less often.

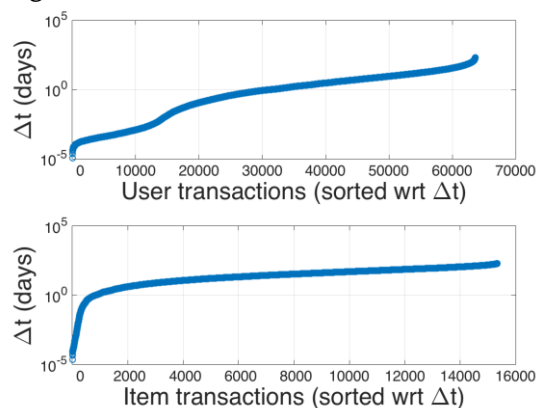


Fig. 3: Shows the cumulative frequency plot of the Bookmooch transactions.

G. Prior Work Limitations

The primary drawbacks of the previously stated techniques are due to the limitations they impose on their implementation. Because the “Circular Single-Item Exchange Model (CSEM)” [10] mandates that a user and their item be suggested to just one other user at a time, this limits the likelihood that an item will be transferred. A limitation like this would make it much more difficult to find swapping partners, as a user’s suggestion of an item would be contingent on

whether or not the item had previously been suggested to another person. Ideally, a product should be suggested to as many people as possible who may be interested in purchasing it. However, the BVEM, which more properly simulates the trade recommendation issue, needs an assumption that the item list length is limited to a certain amount for it to be tractable (say, less than 50).

Table 3: No of BVEM suggestions for different settings of the price “matching parameter” Each suggestion is addressed to two separate people.

	$\beta = 0.6$	$\beta = 0.7$	$\beta = 0.8$	$\beta = 0.9$
Total recommendations	113	111	110	110
Distinct users	155	152	150	150

The primary disadvantage of both prior techniques is that they examine only stated user preferences, which are far from full. Neither CSEM [18] nor BVEM [19] make advantage of implicit preference information contained in users’ transaction histories, but instead offer suggestions based purely on the things expressly included in a user’s wish list.

To substantiate the latter point, we evaluated the performance of BVEM [3] on the Bookmooch dataset, which is the only one that has the requisite item price information. The number of suggestions generated using this technique is shown in Table 3 for a dataset of 84,989 users, based on a September 2015 snapshot. Due to the rarity of ‘wants’ that coincide, only a few people (a maximum of 155) get suggestions under BVEM (see Table 2). We noticed that 3,864 different users acquired books through trades in the four months after the September snapshot, a substantially greater amount than the number of users who received recommendations. To make matters worse, BVEM’s recommendations on Swapadvd would be nonexistent owing to a lack of eligible switching partners, therefore the system’s total number of proposals is very low (a maximum of 113).

H. Proposed Methodology

Once the fundamental principles are established, the following step is to transform this generic model

into a concrete one. Then, using the overall model as a guide, the sorts of concerns to examine in such bartering worlds included the following:

- What is the cost of the difference between bilateral and Pareto optimum allocation? (i.e. the reduction in allocation efficiency, and is there a reduction?)
- What is the “cost of dealing with selfish agents” vs. “altruistic agents” in dispersed environments?
- What circumstances must exist in a market for a decision-maker to convert a non-value item into a valuable one?
- How many decision-makers following a similar pattern can accomplish this goal?
- Can bartering be used in a real-world scenario? Is it beneficial?
- How does the distribution of requests influence the stability of the knowledge obtained via bartering and, if so, in what manner?

I. Conceptualisation

The following summarises the technique of agent-based computational economics [19]:

- The researcher then creates a fictitious economic universe comprised of groupings of actors.
- Conduct an initial investigation to ascertain the nature of the issue to be resolved.
- The modeler then allows the world to grow naturally without additional interference from outside.
- The modeler establishes the world’s beginning circumstances, such as the world’s trade laws, the agents’ characteristics, and the learning model, which serve as the experiment’s preconditions.
- The researcher analyses and tries to interpret the data collected using economic principles or

makes policy recommendations to influence future actions.

V. MODEL AND SIMULATION

A. Model

Three new online bartering datasets are provided to assist our new “bartering-based recommendation algorithms.” Existing solutions are not supported by real-world platforms since they are built on idealistic notions. User mutual interest in each other’s goods is represented via Matrix Factorization. So now our model is temporally aware and socially taking into consideration members’ social connections and trading periods. Compared to previous ways, ours works better for video games, novels, and alcohol. Refer to the notation is described the Table 3.1.

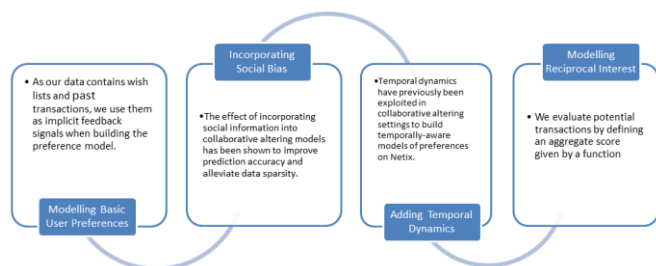


Fig. 4.1: A Proposed Model

B. Problem Definition and Notation

“The setting of the bartering platforms presently considered is described by a set of users $U = \{u_1, u_2, \dots, u_m\}$, and a set of items $I = \{i_1, i_2, \dots, i_n\}$ known at any time t . Each user u_j has a wish list W_j and a give-away list G_j , both of which are available for all members to see. W_j is a subset of I containing items which u_j wishes to obtain, while G_j is a subset of I with items to be given away by u_j .”

C. Modeling Basic User Preferences

Our model’s initial objective is to assess a user’s preference for a single item. Due to the presence of wish lists and previous transactions in our data, we utilize them as “implicit feedback signals” [20] while developing the preference model. According to Hu et al[21].’s technique, the “user-item interaction” matrix R is constructed as follows using implicit feedback signals:

$$r_{u_j i_k} = \begin{cases} 1, & \text{if } i_k \in W_j, \text{ or } (*, i_k) \in H_j^r \\ 0, & \text{otherwise} \end{cases}$$

D. Adding Temporal Dynamics

User preferences may change over time or vary regularly. Time-dependent dynamics have already been utilized in collaborative filtering contexts, for example, to construct temporally aware preference models on the networked information system Netix. Taking into consideration the available data, we extend our model from Equation 2 to account for the temporal dynamics of bartering platforms.

E. Incorporating Social Bias

It has been shown that adding social data into collaborative filtering models improves prediction accuracy and alleviates data scarcity. As noted the users prefer to trade with a specific subset of peers regularly on “the observed bartering platforms,” indicating that their selections are heavily influenced by social (or simply trust) factors. Additionally, this demonstrates that a simple low-rank decomposition of the interaction matrix R is incapable of completely capturing the dynamism of user behavior.

F. Experiments And Discussion

Because our input data contains implicit preference signals, the performance of our approaches should be geared towards appropriately rating items relative to one another, rather than successfully predicting missing values from the interaction matrix R . Rendle et al. [17] developed the BPR optimization approach specifically for this sort of optimization issue. The update rules for this setting are specified as follows, using the notation used by Rendle et al. [17]:

$$\theta \leftarrow \theta + \alpha \cdot (\sigma(-\hat{x}_{u_j i_k i_m}) \frac{\partial \hat{x}_{u_j i_k i_m}}{\partial \theta} + \lambda_\theta \Omega'(\theta)),$$

where σ is the Heaviside function and b is “the Heaviside function.” Negative user-item combinations (u_j, i_m) are selected at random from an unobserved interaction set for user u_j . This statistic indicates how effectively the model classifies goods that the user got via withholding transactions during training vs objects with which the user has not engaged or does not have an explicit desire.

To minimize verbose notation, we have written the AUC above in terms of our “simplest preference model” (yuj im). The preceding statement, however, may be altered to incorporate any of the previously specified models.

Table 4: AUC values for our technique (larger values are better)

Dataset	(1) MF	(2) MF+B	(3) MF+B+S	(4) MF+B+T	(5) MF+B+S+T	(6) B impr.	(7) B+S impr.	(8) B+T impr.	(9) Total impr.
Bookmooch	0.758	0.798	0.849	0.938	0.958	+2.0%	+9.15%	+18.06%	+19.98%
/r/gameswap	0.790	0.842	0.863	0.890	0.903	+5.19%	+7.31%	+9.99%	+11.29%
Ratebeer	0.824	0.892	0.962	0.969	0.983	+6.79%	+13.84%	+14.55%	+15.87%

The best technique for each dataset is boldfaced. MF stands for Matrix Factorization, B for Bidirectional Model, S for Social Bias, and T for Temporal Dynamics.

Users choice processes may be impacted by external variables, such as social relationships and item availability. In such a case, the success of a transaction cannot be completely described by a low-rank decomposition that represents unilateral preferences of users toward products. Bidirectionality (MF+B) greatly enhances the score over MF and leads to comparable gains in conjunction with the other models.

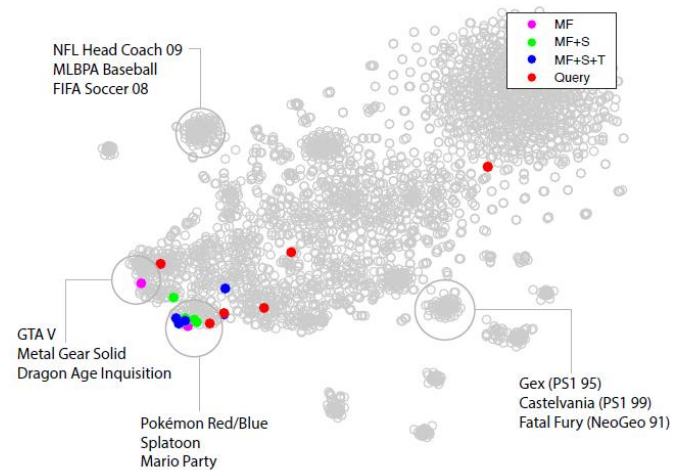


Fig. 4: t-SNE [28] embedding of the /r/gameswap dataset’s latent variables. The colored dots in Table 5 represent the projection of suggestions.

The implications of this are that a strong signal created by one of the traders may be able to compensate for a weak signal generated by random sampling performed on the fly. Following that, the hyperparameters are kept constant throughout the

testing phase, during which a new train/test split is drawn in the same way at the conclusion of each round. After that, the process is repeated. Table 4.2 summarises the outcomes from five rounds. We discovered that the optimum models for /r/gameswap and Ratebeer have 40-dimensional latent variables while Bookmooch has 100-dimensional latent factors.

G. Results

Table 4 illustrates the performance of our approach’s numerous implementations. Our technique outperforms ‘standard’ matrix factorization by an average of 15.71 percent across the three datasets we examine. Each model addition (temporal dynamics, social bias, and bidirectionality) significantly improves our method’s performance, delivering cumulative performance improvements of 4.66 percent, 5.44 percent, and 5.61 percent, respectively (respectively). On all three datasets, the AUC of “the final model (MF+B+S+T)” is more than 0.9. Table 4: An illustration of the suggestions generated by the models in Table 4.1

User’s wish list	MF		MF + S		MF + S + T				
	Recommendations (ranked)	#own most recent activity	Recommendations (ranked)	owner past activity trans.	Recommendations (ranked)	owner past activity trans.			
Super Mario World	Earthbound	14	22 wks.	Final Fantasy	24 wks.	2	Contra	<1 wk.	0
Sonic Generation	Sonic Generations	19	56 wks.	Kid Icarus	24 wks.	2	Fire Emblem	<1 wk.	0
Kirby’s Dream Land	Metroïd: Zero Mission	14	22 wks.	Super Mario Sunshine	28	22 wks.	Bayonetta: Two Souls	21 wks.	2
Metroïd: Zero Mission	Super Mario 64	28	22 wks.	Grand Theft Auto V	253	<1 wk.	Fire Emblem	92 wks.	1
Super Mario 64	Mario Kart: Super Circuit	28	<1 wk.	Fire Emblem	28	<1 wk.	Paper Mario	92 wks.	1
Mario Kart: Super Circuit	Sly 3: Honor Among Thieves	28	<1 wk.	Fire Emblem	28	<1 wk.	Paper Mario	92 wks.	1
Sly 3: Honor Among Thieves	Fire Emblem	28	<1 wk.	Fire Emblem	28	<1 wk.	Paper Mario	92 wks.	1

VI. DISCUSSION

Our method does not limit proposed trades to things on users’ wish lists, which is consistent with our finding that only 33.2 percent of products received by users are explicitly mentioned. Our technique, which uses Matrix Factorization to capture user preferences, may predict users’ interests in items they haven’t explicitly expressed an interest in, allowing for potentially serendipitous suggestions. A user’s wish list, with most of the goods being Nintendo console games. Recommendations are the correct word. Fig. 3.6 shows that all approaches successfully identify games that are connected. When social terms (MF+S) are added, the system suggests trades with previous trading partners, but many of them have been inactive for some time; when the temporal term (MF+S+T) is added, the system finally

identifies relevant games amongst active users, some of whom were prior trading partners.

VII. CONCLUSIONS AND FUTURE WORK

The goal of this thesis has been to examine how bartering mechanisms might be used to allocate resources in “large-scale distributed networks” without the presence of altruistic actors. In addition to the chapter-by-chapter summaries, we’ve compiled a comprehensive table of contents for this thesis. A common thread running across all of the research reported in this thesis is a desire to better understand how selfish, rational, and autonomous individuals with partial knowledge interact with one another to maximize their anticipated utility via bartering. A theoretical scenario, a use case, and a real-world application have been the focus of our research. Bartering in electronic contexts may be evaluated using any one of these case studies. However, each situation has distinct characteristics that make it stand out. In the future, we want to test our technique in a variety of situations where reciprocal interest plays a significant role, such as e-dating platforms, online video game partner matchups, etc. It’s also our goal to investigate the issue of trading things that have big price discrepancies and to investigate more complicated preference aggregation systems for simulating the bidirectionality of interest between possible trade partners.

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Cite this article as :

Navodita, Sheela Singh, "Development of Recommendation System Based on Ai Techniques to Exchange Items Between Users", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 329-340, January-February 2022.
Journal URL : <https://ijsrst.com/IJSRST229160>

Review on Analysis of Power Supply and Demand in Maharashtra State for Load Forecasting Using ANN

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ABSTRACT

Article Info

Volume 9, Issue 1

Page Number : 341-347

Publication Issue

January-February-2022

Article History

Accepted : 11 Feb 2022

Published : 24 Feb 2022

The Electric load forecasting (ELF) is a critical procedure in the electrical industry's planning and plays a critical role in electric capacity scheduling and power system management, hence it has piqued academic attention. As a result, for energy generating capacity scheduling and power system management, the accuracy of electric load forecasting is critical. This document provides an overview of power load forecasting methodologies and models. A total of 40 scholarly publications were included in the comparison, which was based on certain criteria such as time frame, inputs, outcomes, project scale, and value. Despite the relative simplicity of all studied models, the regression analysis is still extensively employed and effective for long-term forecasting, according to the research. Machine learning or artificial intelligence-based models such as Artificial Neural Networks (ANN), Support Vector Machines (SVM), and Fuzzy logic are preferred for short-term forecasts.

Keywords: Short term load forecasting, Back Propagation, Artificial Neural Network.

I. INTRODUCTION

Power utilities are needed to supply reliable power to consumers. Within style stages, utilities have to be compelled to set up ahead for predictable future load development underneath totally different attainable situations. Their choices and styles will have an effect on the profit or loss of crores of rupees for his or her organizations/utilities moreover as client fulfilment and future monetary process in their space. For efficient operation and planning of utility company, correct models of power load prediction are necessary.

Load forecasting is a very essential tool for an electrical utility to form necessary choices together with choices on the purchase, also for banking of power (with alternative corporations or identical state utilities or with the neighbouring states), in the generation of power, in load change and development in infrastructure [1]. It is very necessary for energy suppliers as well as for other alternative participants within the electrical energy transmission, generation, distribution, and markets.

For electric utilities, accurate forecasting of load accurately plays an awfully necessary role due to exceeding cutthroat competitive surroundings shaped by the electric business deregulating. An electric company is confronted with several economists and technical operational issues, along with planning and management of a utility electric system since customers should be provided electricity of high-quality in an exceedingly efficient and safe manner [1]. Load forecasting is also beneficial for an electric utility in creating necessary selections on generating, interchanging, and buying wattage, load change. Besides this, it is important for suppliers' utility, many establishments and others concerned with the electric energy generation and regulation [2].

II. LITERATURE REVIEW

There is far diversity in the load forecasting and its strategies so it's unattainable to enrich them within the restricted time duration. So, in this part of the introduction, the literature review on load forecasting and techniques is briefly summarized. This literature review about other topics is also discussed below. A revealed literature review is divided into 5 main parts:

(i) Multiple Regression Method

One of the foremost wide used statistical approaches is a regression. For load forecasting, multiple regression strategies are sometimes utilized to relate link between load utilization and alternative elements like day type, weather and client category.

Nikolic et al. [3] conferred that for consecutive day load forecasting there are many multiple regression models. Their models incorporate settled significances like stochastic influences, holidays like exogenous influences and average loads like the weather. [4–6] express alternative purpose of multiple regression models exercised to load forecasting.

(ii) Time Series

The time series methodology is created on the assumption that information has several internal

structures resembling trends, seasonal variation or autocorrelation. Uttermost typically used traditional time series strategies are a unit ARIMA (autoregressive integrated moving average), ARMA (autoregressive moving average), ARIMAX (autoregressive integrated moving average with exogenous variables) and ARMAX (autoregressive moving average with exogenous variables). Implementations of ARIMAX models for load forecasting have been presented by Fan and McDonald [6] and Cho et al [7]. A unique hybrid algorithmic rule for price/load forecasting. The hybrid algorithmic rule is classed into 3 parts; versatile wavelet packet transform, multi-input-multi-output (MIMO) model and autoregressive integrated moving average (ARIMA), artificial bee colony (ABC) algorithmic rule supported time-varying coefficient and stumble generation operator that's referred to as TV-SAC. Yang et al. [8] used Associate in nursing evolutionary programming (EP) approach to spot the ARMAX model parameters for some unspecified time in the future so that there should be hour load demand forecast at least one week ahead. The EP could be a technique for simulating evolution and constitutes a stochastic optimal algorithmic rule. In [9] multi-input-multi-output (MIMO) model has been used for the correlation between electricity value and load. The model encompasses 3 elements referred to as wavelet packet transform (WPT), generalized mutual data (GMI) and least square support vector machine (LSSVM). A fuzzy autoregressive moving average with exogenous input variables (FARMAX) at some unspecified time in the future ahead hourly load forecasting is projected by Yang and Huang [10].

(iii) Expert System

Discussing the short-term forecasting for power grid based in Taiwan, Ho et al. [11] present the knowledge-based skilled system. Based on the hourly recorded data of system load and various weather parameters for five years along with the local operator's information, the forecasting has been

performed. Presenting the location independent short-term forecasting technique, Rahman and Hazim [12] discussed the various factors affecting the forecasting and represented them in the parametric form as a defined rule base. Whereas, this rule base is dependent upon the location and varies accordingly. The results, considering location independent forecasting for various sites shows the approach to be fit, i.e., gives low forecasting errors. Thus, irrespective of the forecasting location, the load model, developed rule base system and the other parameters have been designed.

(iv) Fuzzy Logic

Presenting the fuzzy logic approach for load forecasting, in [13] various fuzzy based models based on the recorded data for two years, i.e., 2009-2011 have been shown. The work discusses the fuzzy logic-based forecasting of the load for the off-days, i.e., holidays. The results show accurate load forecasting and thus its benefits to the power system (in terms of economic load dispatch). Overcoming the statistical forecasting approaches which included the mathematical formulation of the given problem, fuzzy logic based forecasting approach is solely dependent upon the rule base designed in fuzzy toolbox [14]. Thus, the approach proves to be robust in the area of load forecasting. Also, as discussed by [15], the drawback of various forecasting tools and approaches, i.e. absence of crisp output is a major issue. Hence, in the fuzzy logic based base gives a crisp output value. Working on the validation of fuzzy logic based forecasting approach, the results of fuzzy depending upon the data of 1 year and for ANFIS compared with the online load data, shows MAPE to be 2.1 and 1.85. Presenting a comprehensive review of the various forecasting methodologies, [16] discusses the need, advantages and various applications of fuzzy logic based forecasting approach. Comparing the performance of fuzzy logic based system with back propagation neural network method based on historical data, shows the later to be more

complex and difficult to understand in comparison to fuzzy logic models.

(v) Neural Networks

With the awareness of neural network approach in the area of forecasting, in the year 1990, the approach was first time developed for the problem of load forecasting. With parallel and distributed units for processing, the neural network can be defined as the set of arrays including series of the repetitive uniform processor while connected to the grid. In a neural network, the two important key terms are learning and training. The learning in NN can be done by various methods like interconnecting the various processors of NN with each other [17]. Using the Neuroshell-2, in [18] short-term load forecasting have been done. Based on the neural network approach and other systems like the Expert system, Grey system theory and artificial neural network [19], the short term load forecasting gives satisfactory results. Comparing the forecasting system in real time with the available data shows NN tool to be more accurate and reliable. Focusing on the advantages of back propagation type neural network in load forecasting, it can be defined as a multilayer feed forward neural network (FFNN) consisting of a nonlinear function and a transfer function.

Discussing the properties of BP, The transfer function that can be obtained from the network will be linear or nonlinear input of the network depends upon the input to the network and the number of layers can also be increased up to 3 or 4 as required. It can also be fully connected or partially connected. The network of neural may be fully connected or non-fully connected. In [16] [20-22] the neural network is designed which is a three-layer network having a transfer function as a nonlinear sigmoid function in the short-term load forecasting. In [23] brand new technique has been utilized that is global best particle swarm optimization (GPSO) to boost the performance

of ANN. To get the higher training, performance, convergence characteristics and forecast accuracy the ANN, GPSO, and BP techniques have been used. In [24] the input layer to the output layer has been planned to get the standard sigmoid function and a linear transfer function. In [25] BP model is planned. it can be understood that the results obtained from the ANN was ready to have load characteristics, even though a partially connected ANN is favorable for replacing the temperature changes. Apart from this, [25] better forecasting results can also be obtained by the combination of several sub-ANN with the help of STLF approach. In [26] well planned recurrent high order neural network (RHONN). A 3-layer ANN through appropriate dimension is spare to estimate any uninterrupted non-linear function [26]. Load forecasting using a four-layer formation is enforced and the structure was reported in [11], [17], [27].

BP network can be a fair array which can see nonlinear mapping from input to output. After this, the choice of the input variable of load prediction network is of great importance. Generally, there are 2 options strategies. An expertise depends on [11], [17], [20], [24] and this option depends on statistical analysis related to ARIMA [25] and correlation analysis. Input variables are usually determined by engineering decisions and skills. In order to collect all things, the input variable can be grouped into five fundamental classes:

1. Historical loads [17-21], [24-26], [28].
2. Temperature [17-20], [24-25], [28].
3. Relative humidity [28].
4. Hour of day index [17], [20], [25].
5. Day of the week index [17], [25].

Intensive study on the effects of factors related to learning phase, bpm is presented by the authors of the motion factor [22]. He investigated a learning algorithm for adaptive training of neural networks. For the complete error function is employed in a predefined learning algorithm [29] by the principle of

"forced dynamic". The rate of modification of the network weight is given priority, for reducing the error function is forced to "decay" through a shear mode. In the direct proportion of the total error, the partner approach to change the weight is in [30]. With this, the period of the postponement zone unit is very short and the risk of the crowd in the country minimum has been greatly reduced. With this, the periods of stagnation area unit a lot of shorter and also the risk of tack in native minima are greatly reduced.

ANN can only perform operations according to the trained data whereas in case of STLF the selection of training sets was quite complicated. The selection was based on the similarity of characteristics of the training pairs present in the training set must be same as those to the forecasted in that day. To get smart forecasting results, day type data should be taken under consideration. A technique is to construct the various ANNs for everyday type and fed every ANN with the corresponding day type training sets [28]. The opposite is to use only one ANN, however, contain the day type data within the input variables [17], [21], [25]. The previous uses a variety of comparatively little size networks, whereas the latter has only one network of a comparatively giant size. A typical classification given in [17] categorizes the historical loads into 5 categories. These are a Monday, Tuesday-Thursday, Friday, Saturday and Sunday/Public vacation. The traditional ways to use observation and comparison [17], [24], and was supported unsupervised ANN ideas and selects the training set automatically [11], area unit used for day type classification.

III. CONCLUSION

The forecasting models have been studied in greater depth in this work, which is based on 40 of the most significant scholarly papers on electric load forecasting. Several factors, such as the project's scale, the forecast horizon time frame, temporal resolution, inputs, outputs, data pre-processing, and so on, have

been checked and examined. The study also looked into some of the common patterns in the use of these models. Regression analysis-based models and artificial neural networks (ANN), which are the most commonly used models in electricity predictions, are some of the more suited and recommended models for electric load projections. Artificial neural networks (ANN) models are mostly used in this context for short-term forecasting where electricity and power consumption patterns are more complex.

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Cite this article as :

Suraj G. Patil, Dr. M. S. Ali, "Review on Analysis of Power Supply and Demand in Maharashtra State for Load Forecasting Using ANN", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 341-347, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229152>
Journal URL : <https://ijsrst.com/IJSRST229152>

Studies on Effect of Antioxidant Enzymes Salicylic Acid and Jasmonic Acid Treated Plants of *Acalypha indica*.L

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ABSTRACT

Acalypha indica.L one of the traditional medicinal small annual shrubs belongs to the Euphorbiaceae Family, it grows up to 30-75 cm in height and is distributed in wet, temperate and tropical areas. It is available in gardens, road sides and throughout India. In the present work, we try to assess the antioxidant enzymes activity of SA & JA treated and control plants of *Acalypha*. Plants were treated with alone and different concentration combinations of SA & JA. After 55 days treated plants leaves were used for extractions. For extracting antioxidant enzymes, fresh leaves (0.5 gr) were ground using a tissue grinder in 5 mL of 50 mM cooled phosphate buffer (pH 7.8) placed in an ice bath. The homogenate was centrifuged at 15000 rpm for 20 min at 4 °C. The supernatant was used for determining the activities of enzymes. In this we find the antioxidant enzymes are Proline, superoxide dismutase (SOD), Glutathione reductase (GR), Ascorbic peroxidase (APX), Glycine betaine (GB). Highest antioxidant enzyme activity was observed at the combination of T8 (3mM SA + 2µM JA) and lowest in T6 (1 mM SA+2µM JA). All alone and combination of SA & JA treated plants were contains high antioxidant enzyme activity, when compared to control one.

Keywords: *Acalypha indica*. L, Plant growth regulators (SA & JA), Antioxidant enzymes.

Article Info

Volume 9, Issue 1

Page Number : 248-256

Publication Issue

January-February-2022

Article History

Accepted : 11 Feb 2022

Published : 24 Feb 2022

I. INTRODUCTION

Acalypha indica Linn. (Euphorbiaceae) is an annual erect herb and it is cosmopolitan distributed common weed plant (Ramachandran, 2008) [1]. It is used in treating pneumonia, asthma, rheumatism and also an emetic emmenagogue and anthelmintic (Chopra and Nayar, 1956) [2]. The juice of this plant used to treat a

number of skin disorders and also been reported to possess contraceptive activity (Bourdy and Walker, 1992) [3]. In India, *Acalypha indica* has been extensively used in Ayurvedic system of medicine for various ailments like hepato protective, anti-inflammatory, antitissive, antifungal, wound healing and also antibacterial agent (Gupta, *et. al* 2010) [4]. The plant based medicine was prominently used in

India and China for curing diseases (Duraipandyan *et al.*, 2007) [5]. In India, the plant derived traditional used in various methods like Ayurveda, Siddha, Unani and homeopathy. Because, India has an abundant source of plant flora throughout the country. Herbal medicines have been the basis of treatment and cure for various diseases and physiological conditions in traditional methods by Ayurveda and Homeopathy (Srinivasan *et al.*, 2007) [6]. The medicinal properties of plants could be based on the antioxidant, antimicrobial, antipyretic effect of the phytochemicals in them (Adesokan *et al.*, 2008) [7]. The Antioxidant activity of the extracts was analyzed by evaluating superoxide and hydroxyl radical scavenging activity and effect on lipid peroxidation. The ethanol extract showed significant antioxidant activity in all the free radical scavenging tests (Ranganathan *et al.*, 2013) [8]. Salicylic acid is an important and well-studied endogenous plant growth regulator that generates a wide range of metabolic and physiological responses in plants involved in plant defense in addition to their impact on plant growth and development (Vicent,; Lu, 2009; drees *et al.*, 2011) [9]. Jasmonic acid (JA) is an endogenous plant growth regulator widely distributed in higher plants (Meyer *et.al* 1984) [10]. Salicylic acid is well known for systemic acquired resistance, induce in plant response to many pathogens, and can also elicit the production of secondary metabolites in plants (Hayat *et al.*, 2010) [11], (Pieterse *et al.*, 1999) [12]. The present effort has been made objective of this current study was to evaluate the influence of Jasmonic acid (JA) and Salicylic acid (SA) on antioxidant activity of *Acalypha indica*.L

II. METHODS AND MATERIAL

Process of plant treatment with SA and JA:

A.indica. L plants were treated with Salicylic acid (SA) and Jasmonic acid (JA) individually and in combination with different concentrations for every 15 days of interval up to 55 days. SA and JA were

applied to the plants as foliar spray. T1 (Control), T2 (1.0mM SA), T3 (3.0mM SA), T4 (200 μ M JA), T5 (400 μ M JA), T6 (1mM SA + 200 μ M JA), T7 (1mM SA+ 400 μ M JA), T8 (3mM SA+200 μ M JA) and T9 (3mM SA + 400 μ M JA).

Preparation of Extracts: For extracting antioxidant enzymes, fresh leaves (0.5 g) were ground using a tissue grinder in 5 mL of 50 mM cooled phosphate buffer (pH7.8) placed in an ice bath. The homogenate was centrifuged at 15000 rpm for 20 min at 4°C. The supernatant was used for determining the activities of the enzymes.

Antioxidant enzyme analysis of treated and control plants of *Acalypha indica*.L:

Proline determination:

The proline from the third leaf from top was estimated according to the method of (Bates *et al.* 1973) [13a]. A sample of 0.5 g fresh leaf tissue was homogenized in 10 ml of 3 % Sulfosalicylic acid and the homogenate was filtered through Whatman No. 2 filter paper. Then 2.0 ml of the filtrate were mixed with 2.0 ml acid Ninhydrin, 20 ml 6 M Orthophosphoric acid, and 2 ml of Glacial acetic acid in a test tube. This mixture was incubated at 100 o C for 60 minutes and then cooled in an ice bath. Finally, 4.0 ml of Toluene were added to the solution and mixed vigorously by passing a continuous stream of air for 1-2 min. The chromophore containing Toluene was aspirated from the aqueous phase, warmed at room temperature and the absorbance was read at 520 nm using Toluene as a blank. The proline concentration was determined from a standard curve and calculated on fresh weight basis as follows:-

$$1\mu\text{mole proline g}^{-1}\text{ fresh weight} = (\mu\text{g proline ml}^{-1}\text{ x ml of toluene}/115.5)/(\text{g of sample}).$$

Superoxide dismutase (SOD):

The activity of SOD was determined by measuring its ability to inhibit the photo reduction of Nitroblue tetrazolium (NBT) following the method of

(Giannopolitis and Ries 1977) [14]. The reaction solution (3 ml) contained 50 μ M NBT, 1.3 μ M Riboflavin, 13 mM Methionine, 75 mM EDTA, 50 mM Phosphate buffer (pH 7.8), and 20 to 50 μ l of enzyme extract. The test tubes containing the reaction solution were irradiated under light (15 fluorescent lamps) at 78 μ mol m⁻² s⁻¹ for 15 min. The absorbance of the irradiated solution at 560 nm was read using a spectrophotometer (IRMECO, U2020). One unit of SOD activity was defined as the amount of enzyme that inhibited 50% of NBT photo reduction.

Glutathione reductase estimation(GR):

The glutathione reductase activity was determined by the method (Mavis and Stellwagen, 1968) [15]. Prepared the glutathione standards simultaneously with the samples for they assayed together. Each sample, including unknown and standard are in triplicate. In a 96-well plate, add 25 μ L of the 1X Glutathione Reductase solutions to each well to be tested. Add 25 μ L of the 1X NADPH solutions to each well to be tested. Add 100 μ L of the prepared glutathione standards or samples to each well to be tested. Mix thoroughly. Ensure that the plate reader is prepared for a kinetic assay and is set to read at 405 nm. Add 50 μ L of the 1X Chromogen and mix briefly. Immediately begin recording the absorbance at 405 nm at 1 minute intervals for 10 minutes. If using all the wells within the plate at one time, then it may be necessary to record the absorbance at 2 minute intervals. Then calculate the concentration of standards and samples.

Glycine betaine determination (GB):

The glycine betaine was determined following the (Grieve and Grattan; 1983) [16] method. The dry leaf material (1.0 g) was ground in 10 ml of distilled water and filtered. After filtration, 1 ml of the extract was mixed with 1 ml of 2M HCl. Then 0.5 ml of this mixture was taken in a glass tube and 0.2 ml of

Potassium tri-iodide solution was added to it. The contents were shaken and cooled in an ice bath for 90 min with occasional shaking. Then 2.0 ml of ice cooled distilled water and 20 ml of 1-2 Dichloromethane (cooled at -10 o C) were added to the mixture. The two layers formed in the mixture were mixed by passing a continuous stream of air for 1-2 min while tubes were still in the ice bath (4 o C). The upper aqueous layer was discarded and optical density of the organic layer was measured at 365 nm. The concentrations of the betaine were calculated against the standard curve.

Ascorbate peroxidase estimation (APX):

The activity of ascorbate peroxidase (APX) was measured using the method of (Nakano and Asada 1981) [17a]. The reaction cocktail (3 ml) contains a mixture of 50 mM phosphate buffer (pH 7.0), 0.2 mM EDTA, 2% H₂O₂, 0.5 mM ascorbic acid and 0.1 ml of enzyme extract. The decrease in ascorbate concentration was followed by a decline in the optical density at 290 nm, and activity was calculated using the extinction coefficient (2.8 mM⁻¹ cm⁻¹ at 290 nm) for ascorbate.

III. RESULTS AND DISCUSSION

Estimation of proline:

The estimation of proline is carried out by the method of (Bates et al., 1973) [18b] 25, 40 and 55 days of SA&JA treated plants contained high proline along with increasing hormonal concentrations. Highest proline content was observed at the combination of T8 (3mMSA+2 μ M JA) (24.8 μ mol/g) and lowest Proline content in T6 (1mM SA + 2 μ MJA) (22.0 μ mol/g). In the alone concentrations of SA & JA treated plants, highest Proline content was present in T3 (3.0mMSA) (19.04 μ mol/g). All alone and combination of SA & JA treated plants contained high proline content, when compared to control (15.06 μ mol/g) *Acalypha indica*.L plants.

Superoxide dismutase (SOD):

The estimation of superoxide dismutase (SOD) is carried out by the method of (Giannopolitis and Ries 1977) [19] 25,40 and 55 days of SA& amp; JA treated plants contained high SOD along with increasing hormonal concentrations. Highest SOD content was observed at the combination of T8 (3mMSA+2µMJA) (0.87µmol/g) and lowest SOD content in T6 (1mMSA + 2µM JA) (0.64 µmol/g). In the alone concentrations of SA & amp; JA treated plants, highest SOD content was present in T5 (4.0µM JA) (0.62µmol/g). All alone and combination of SA & amp; JA treated plants contained high SOD content, when compared to control (0.25µmol/g) *Acalypha indica*.L plants.

Glutathione reductase (GR):

The estimation of Glutathione reductase (GR) is carried out by the method (Mavis and Stell wagon 1968) [20]. 25, 40, and 55 days of SA& amp; JA treated plants contained high GR along with increasing hormonal concentrations. Highest GR content was observed at the combination of T8 (3mM SA+2µM JA) (2.80µmol/g) and lowest GR content in T6 (1mM SA + 2µM JA) (1.95 µ mol/g). In the alone concentrations of SA& amp; JA and combination of SA& amp; JA treated plants contained high GR constant, when compared to control (0.45µmol/g) *Acalypha indica*.L.

Ascorbic peroxidase (APX):

The estimation of ascorbic peroxidase (APX) is carried out by the method of (Nakano and Asada 1981) [21b]. 25,40and 55 days of SA& amp; JA treated plants contained high APX along with increasing hormonal concentrations. Highest APX content was observed at the combination of T8 (3mM SA+2µM JA) (16.72µmol/g) and lowest APX content in T6 (1mM

SA + 2µM JA) (15.97 µ mol/g). In the alone concentrations of SA& amp; JA treated plants, highest APX content was present in T3 (3.0mM SA) (14.12µmol/g). All alone and combination of SA& amp; JA treated plants contained high APX constant, when compared to control (6.57µmol/g) *Acalypha indica*.L.

Glycine betaine:

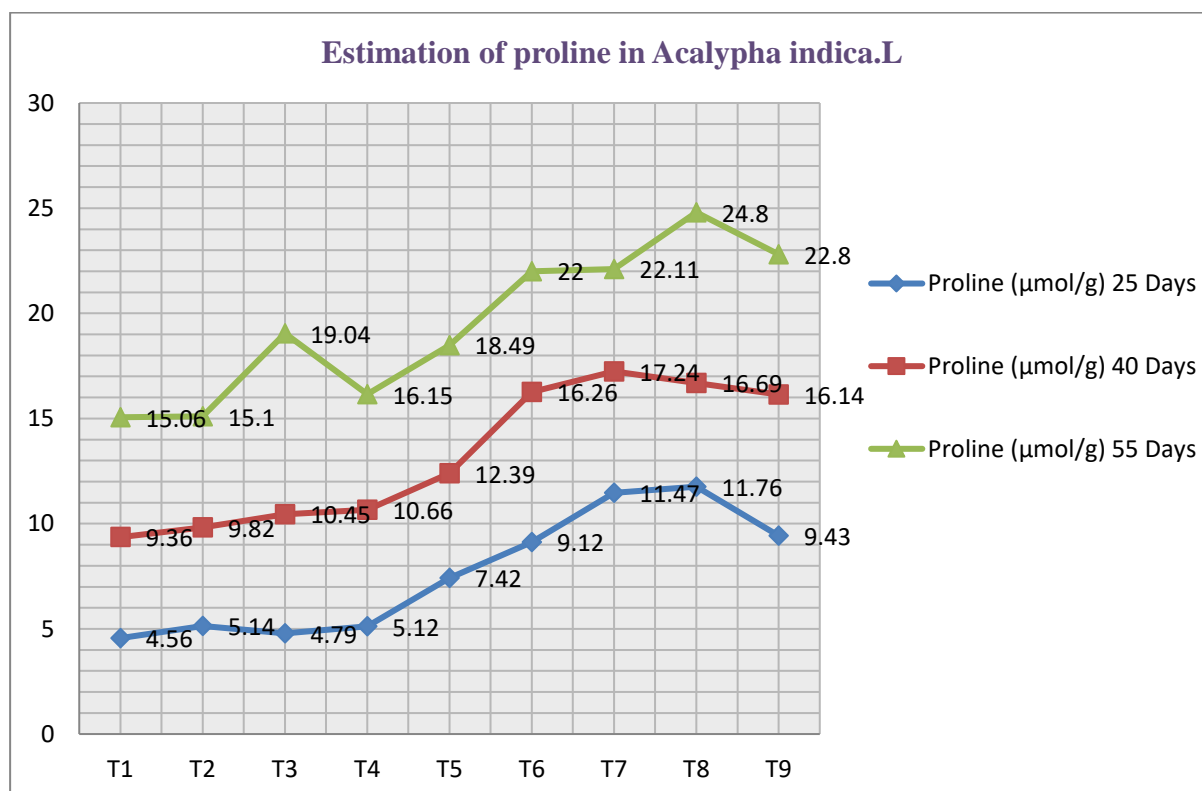
The estimation of Glycine betaine is carried out by the method of (Grieve et. al 1983) [22]. 25, 40 and 55 days of SA& amp; JA treated plants contained high GB along with increasing hormonal concentrations. Highest GB content was observed at the combination of T7 (1mM SA+4µM JA), (7.63µmol/g) and lowest GB content in T6 (1mM SA + 2µM JA) (6.51 µ Mol/g). In the alone concentrations of SA& amp; JA treated plants, highest GB content was present in T3 (3.0mM SA), (5.16 µ Mol/g). All alone and combination of SA& amp; JA treated plants contained high GB constant, when compared to control (1.57µmol/g) *Acalypha indica*.L.

Statistical analysis:

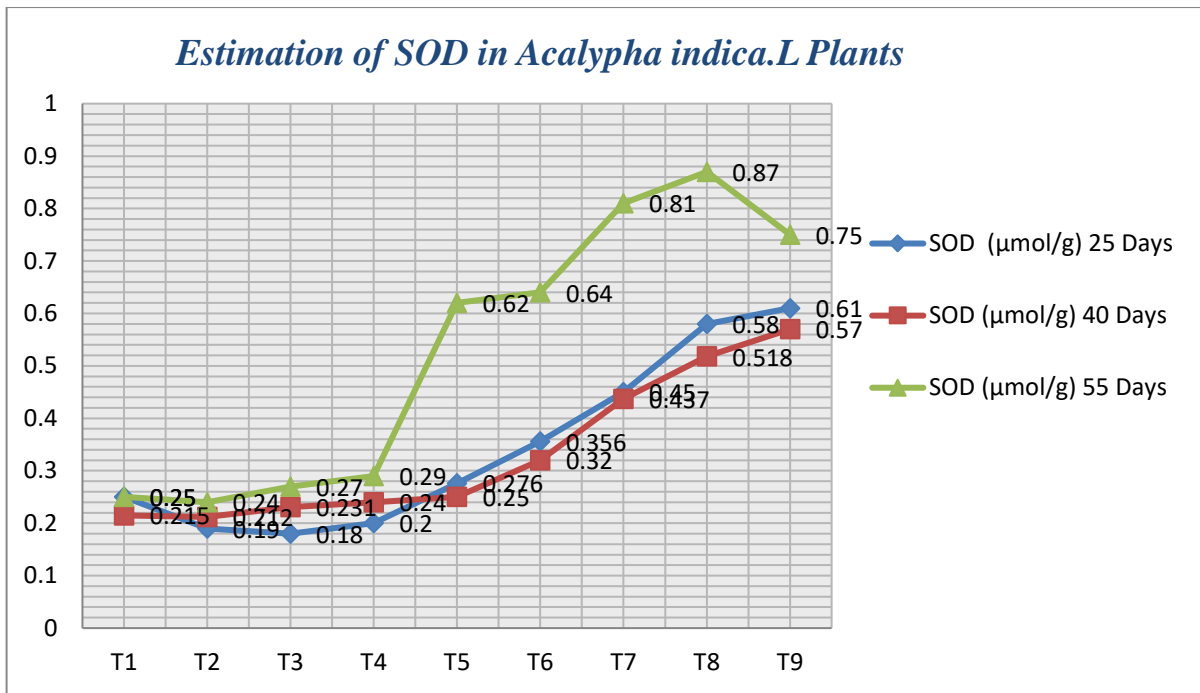
Four factor completely randomized design (Analysis of variance technique) of the data was computed for all attributes by using the MSTAT Computer Program (MSTAT Development Team, 1989). Four factors were five area samples, salt treatments, growth stages and different levels of glycine betaine. The bar graph using mean ± S.E values was drawn by using Microsoft Excel software. The Duncan's New Multiple Range test at 5% level of probability was used to test the differences among mean values following (Torrie et., al 1986)[23].

Table.4 Antioxidant enzyme analysis of 25, 40 and 55 days hormone (SA& JA) treated and control plants of *A. indica*.L

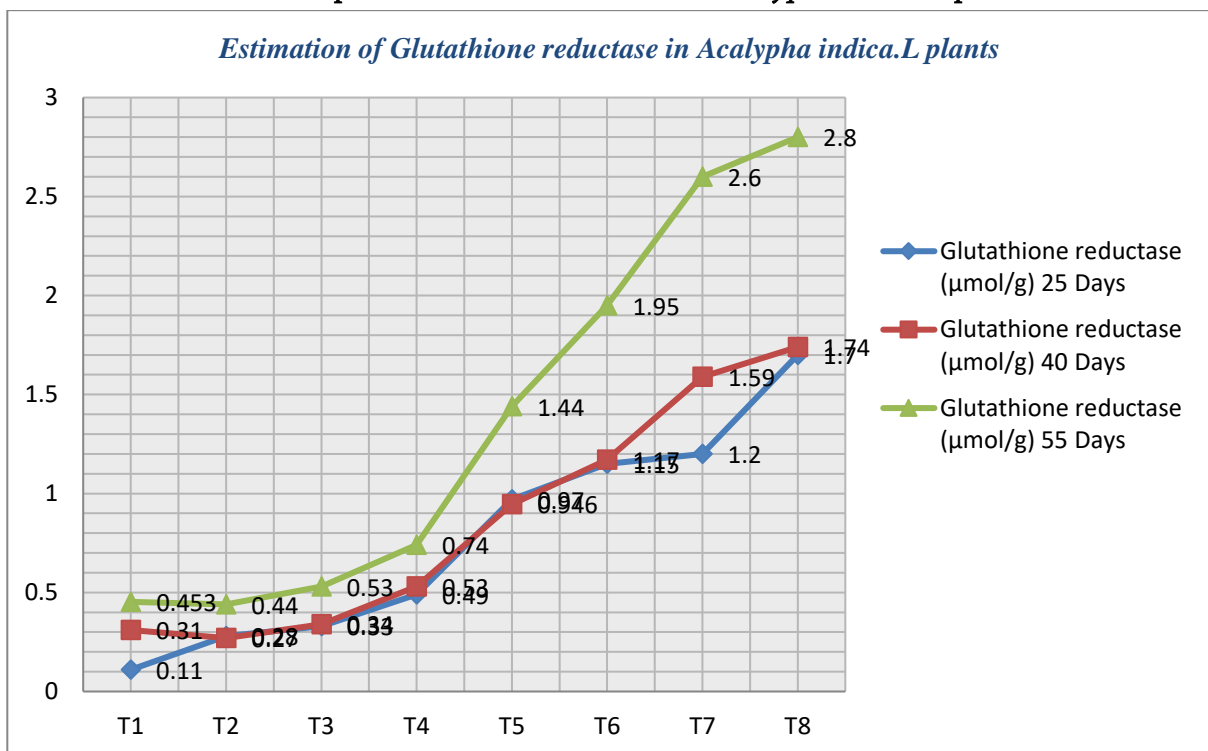
	Proline (μmol/g)			SOD (μmol/g)			Glutathione reductase (μmol/g)			Ascorbic peroxidase			Glycine Betaine (μmol/g)		
	25Days	40 Days	55 Days	25 Days	40 Days	55 Days	25 Days	40 Days	55 Days	25 Days	40 Days	55 Days	25 Days	40 Days	55 Days
T1	4.56±0.75	9.36±0.63	15.06±0.56	0.25±0.74	0.215±0.26	0.25±0.15	0.111±0.11	0.31±0.23	0.453±0.18	0.55±0.52	3.79±0.39	6.57±0.86	0.55±0.47	1.57±0.28	1.57±0.54
T2	5.14±0.21	9.82±0.446	15.1±0.48	0.19±0.52	0.18±0.89	0.24±0.27	0.28±0.17	0.27±0.16	0.44±0.17	1.65±0.14	3.47±0.82	6.51±0.37	1.65±0.69	2.1±0.18	2.1±0.27
T3	4.79±0.47	10.45±0.38	19.04±0.27	0.20±0.72	0.212±0.26	0.27±0.25	0.33±0.09	0.34±0.26	0.53±0.24	1.45±0.33	5.82±0.69	14.12±0.95	1.45±0.71	2.16±0.63	5.16±0.87
T4	5.12±0.58	10.66±0.29	16.15±0.62	0.24±0.57	0.231±0.83	0.29±0.17	0.49±0.17	0.53±0.30	0.74±0.22	1.67±0.87	6.27±0.26	8.10±0.49	1.67±0.57	3.47±0.47	3.47±0.18
T5	7.42±0.61	12.39±0.19	18.49±0.38	0.25±0.29	0.276±0.37	0.62±0.27	0.97±0.19	0.946±0.22	1.44±0.18	1.98±0.38	10.48±0.76	12.01±0.26	1.98±0.72	4.29±0.85	4.29±0.25
T6	9.12±0.28	16.26±0.37	22±0.15	0.32±0.48	0.356±0.44	0.64±0.19	1.15±0.20	1.17±0.24	1.95±0.33	1.85±0.65	12.32±0.99	15.1±0.76	1.85±0.85	6.51±0.23	6.51±0.82
T7	11.47±0.36	17.24±0.41	24.11±0.42	0.45±0.82	0.437±0.32	0.81±0.21	1.2±0.5	1.59±0.37	2.60±0.23	2±0.29	12.75±0.21	15.97±0.35	2.00±0.29	7.63±0.77	7.63±0.14
T8	11.76±0.16	16.69±0.38	24.8±0.59	0.58±0.39	0.518±0.64	0.87±0.16	1.7±0.2	1.74±0.28	2.80±0.25	2.1±0.35	12.58±0.62	16.72±0.73	2.10±0.58	4.17±0.19	7.47±0.86
T9	9.43±0.67	16.14±0.32	22.8±0.47	0.61±0.73	0.57±0.88	0.75±0.11	1.87±0.29	1.92±0.23	2.00±0.14	3.87±0.67	12.47±0.54	15.49±0.98	3.87±0.69	7.15±0.91	7.15±0.27



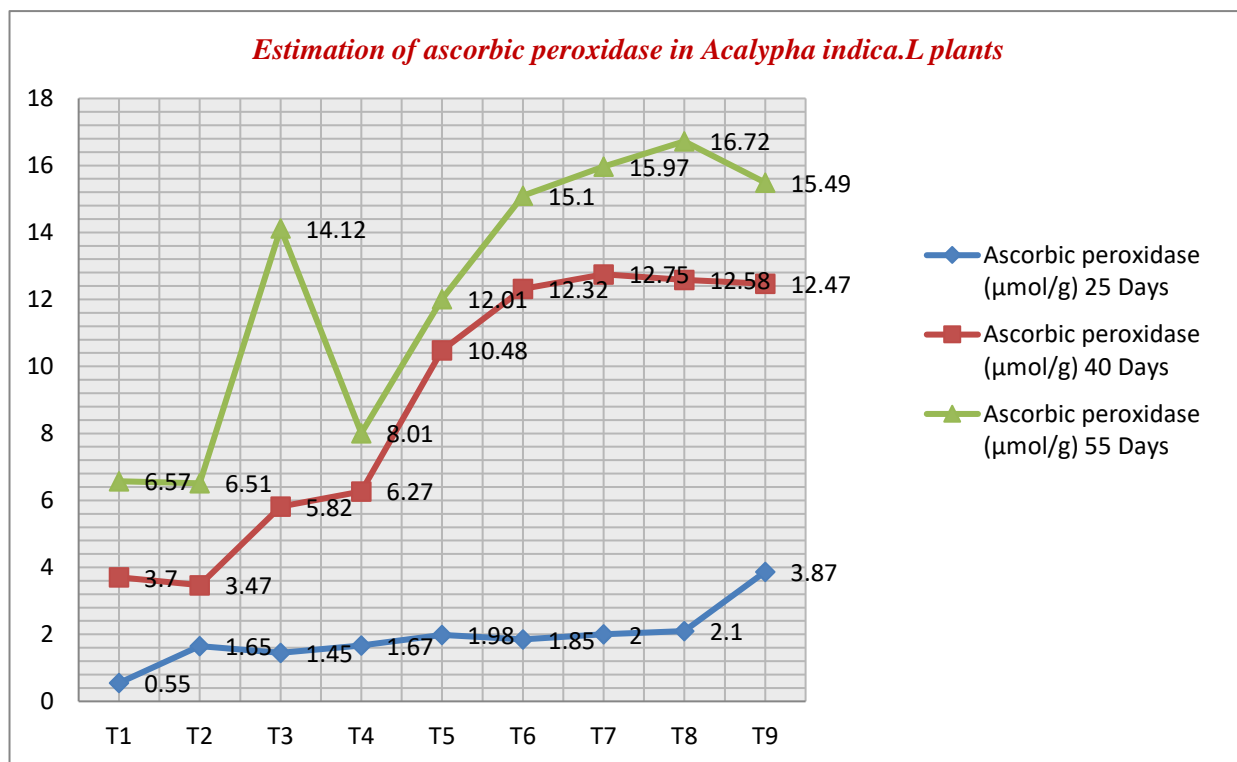
Effect on Proline content in *Acalypha indica* L. plants



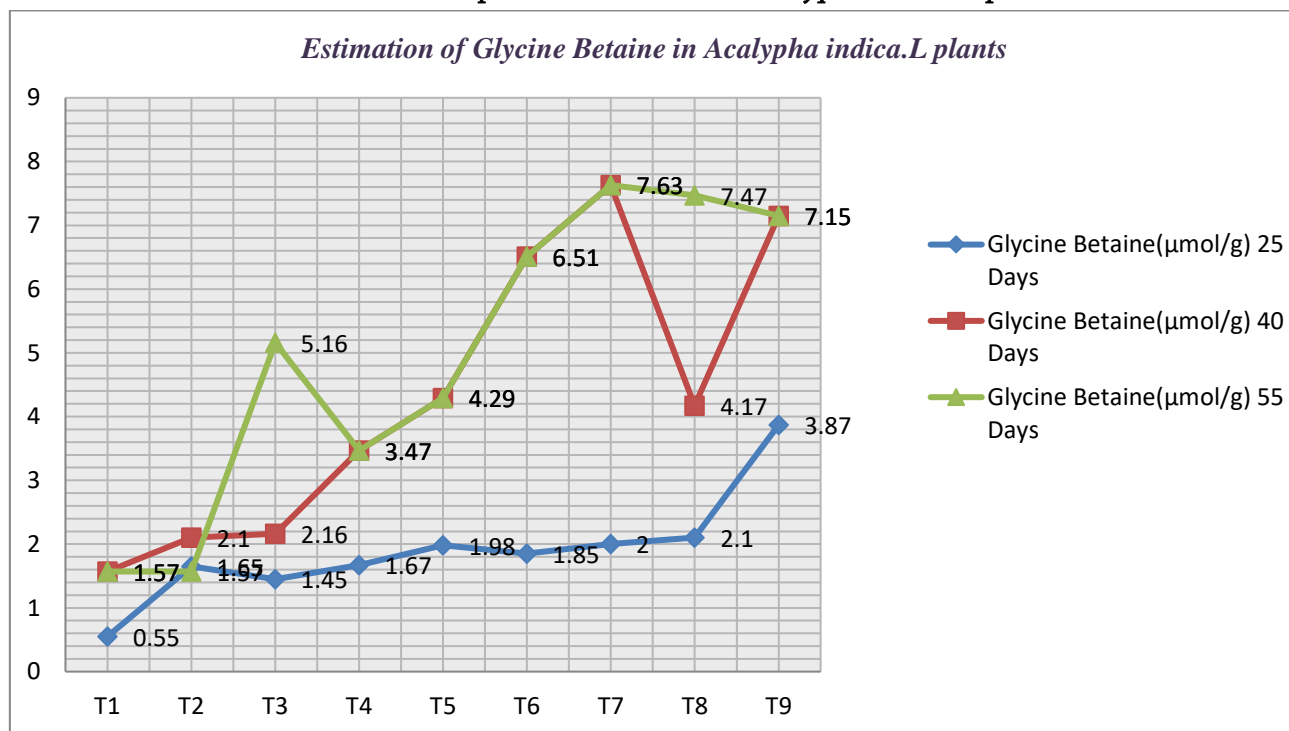
Effect on superoxide dismutase content in *Acalypha indica* L. plants.



Effect on glutathione reductase content in *Acalypha indica* L. plants



Effect on ascorbic peroxidase content in *Acalypha indica* L. plants



Effect on glycine betaine content in *Acalypha indica* L. plants

IV. CONCLUSION

In the present work, the data indicates alone and different combinations of SA and JA treated plants exhibit the more antioxidant enzyme activity. In this

we find the antioxidant enzymes are Proline, superoxide dismutase (SOD), Glutathione reductase (GR), ascorbic peroxidase (APX), and Glycine betaine (GB). Highest antioxidant enzyme activity was observed at the combination of T8 (3mM SA + 2µM

JA) and lowest in T6 (1 mM SA+2 μ M JA). All alone and combination of SA & JA treated plants were contains high antioxidant enzyme activity, when compared to control one.

V. ACKNOWLEDGEMENT

The author (Dr. Shireesha) is thankful to department of Botany, Telangana Social Welfare Residential Degree College for Women, Nizamabad. For providing opportunity to carry out the work.

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Cite this article as :

Dr. Shireesha Somineni, Raju Potharaju, "Studies on Effect of Antioxidant Enzymes Salicylic Acid and Jasmonic Acid Treated Plants of *Acalypha indica*.L", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 248-256, January-February 2022.

Available at doi :

<https://doi.org/10.32628/IJSRST229156>

Journal URL : <https://ijsrst.com/IJSRST229156>

Synthesis of Manganese doped Bi_2S_3 Crystal in Gel method and its thermal Characterisations

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ABSTRACT

Manganese doped Bismuth tri sulphide crystals are synthesising using simple gel technique at ambient temperature. X Ray Diffraction analysis was done to determine the structure. Orthorhombic crystal structure was found of grown crystal. FTIR method was utilized for the analysis of various functional groups present in the complex Thermal properties of the crystal was studied by TGA was Discussed .Effect of Doping, and concentration of reactants.

Keywords: Gel method, orthorhombic, XRD, FTIR, TGA

Article Info

Volume 9, Issue 1

Page Number : 257-261

Publication Issue

January-February-2022

Article History

Accepted : 11 Feb 2022

Published : 24 Feb 2022

I. INTRODUCTION

The gel method is simple technique for growing perfect and strain free crystals. The principle involved in this method is very simple. The solution of two appropriate compounds, which give rise to the essential insoluble crystalline material by simple reaction, two compounds are chemically reacted in set gel medium . In the gel method, gel prevents turbulence and helps to formation of good crystal by providing a framework of nucleation site. In addition, the gel media has a single place due to gel media control of nucleation centre characteristics. In gel method, convection is not present in gel media. It indicates that, for substances, which are insoluble in water, it is option for growth method.

Many of researchers have been grown undoped and doped crystals with the aim of to study and to identify

grown materials for practical and industrial applications. The influence of doping in growth media has been recognized for a long time as a relevant matter in the process of crystallization [1-3]. As for as transition metal doped Bismuth tri sulphide crystals are concerned, information about their growth by gel method, characterization. Therefore, it was felt worthwhile to grow Mn-doped Bismuth tri sulphide crystals and study their properties, which may have potential application in photovoltaic energy. The TGA curve of Manganese doped Bismuth tri sulphide crystal was subjected to study the weight loss measured using TGA method.

The purpose of present paper is to report the growth and influence of various parameters such as concentration of reactants, growth of mechanism of Bismuth tri sulphide crystals in gel with effect of

dopant and molar concentration, its optimum conditions and properties

II. METHODS AND MATERIAL

To grow the Manganese-doped Bi_2S_3 crystal samples, 5cc CH_3COOH solution was taken in beaker. With the help of burette, Na_2SiO_3 Solution was added drop by drop in beaker slowly with continuous stirring. Measure pH values of solution until it acquired the proper pH value. If pH value indicate 4.4 then. The 5 ml H_2S inner a reagent was added in gel solution. Then this mixture was poured in the test tubes of length 15 cm and 2.5 cm diameter. To take a precaution, open test tubes were closed by cotton plug. It would take 3 days for the gel to set. It kept as it is for two more days for ageing of gel and then poured the second reagent solution of BiCl_3 of 0.5M and same volume of 0.05M MnCl_2 on to the upper surface of set gel medium. The second reagent mixture solution was poured gradually alongside of test tube wall. When diffused outer reactant solution chemically reacts with inner reactant solution then growing procedure of crystals was start. After addition of the second chemical reactant, nucleation was observed within twenty-four hours. Shown in figure1.different shape and sized crystals were obtained as shown in figure 2.The colours of grown crystal were observed as creamy yellow colour. All experiments, Growth of crystals process obtain at room temperature. In gel medium, due the chemical reaction between Bismuth Chloride, Manganese Chloride and H_2S water solution we get different shape Manganese -doped Bismuth tri sulphide crystals

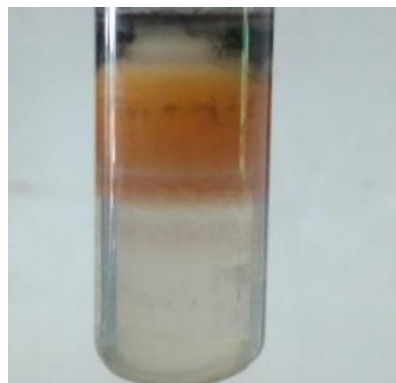


Figure 1 Mn doped crystals of Bismuth tri sulphide inside the test tubes



Figure 2 Manganese doped crystals of Bismuth tri sulphide outside the test tubes

III. RESULTS AND DISCUSSION

A. X-ray diffraction (XRD)

The XRD pattern of grown crystal power is as shown in figure 3. The observed X-ray diffraction patterns for Bismuth tri sulphide crystals doped by 0.05M Mn ions and the calculated (h k l) and d values, which were found to be in good agreement with the JCPDS data (Card no17- 0320). The crystal structures of Mn doped Bismuth tri sulphide is determined to be orthorhombic structure. Dopant has not changed the structure of the parent crystals. The grain size of the grown crystals was derived using x-ray diffraction line broadening analysis based on the Scherer formula. The breadth of the diffraction line was measured by the method of full width at half maximum. From XRD data for different parameters it was found that grain size of the undoped Bismuth tri sulphide

crystals increased on doping 0.05M of Mn and on subsequent doping shows an increasing tendency in grain size. Variations in lattice parameters, cell volumes, and intensity and diffraction angle of peaks attributes to the dopant in the crystal.

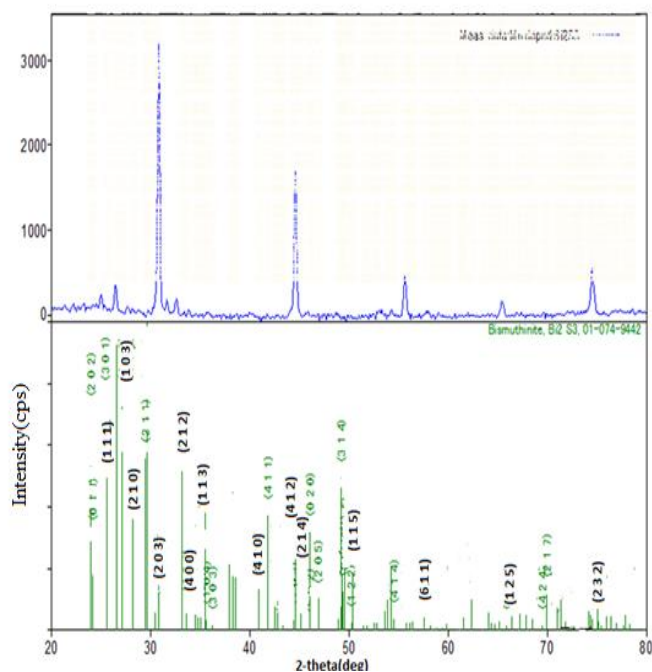


Figure 3 XRD Patterns of the crystals of Bismuth trisulphide doped by Mn for 0.05M

. By using Scherer’s formula, the crystallite size Calculated as $D = 37.63\text{nm}$

From XRD data and quadratic relation lattice Parameters evaluated as $a = 10.86\text{\AA}$, $b = 4.06\text{\AA}$ and $c = 10.22\text{\AA}$ i.e. $a \neq b \neq c$.

In Orthorhombic crystal structure the length of unit cells are different and $\alpha = \gamma = \beta = 90^\circ$.

B. Fourier transforms infrared spectroscopy:

Figure 4. Shows The FTIR Spectra of Mn doped Bismuth tri sulphide crystal. The spectrum was obtaining using SHIMADZU IRAffinity-1 cm^{-1} at Department of Chemistry, M.J.College Jalgaon. The FTIR analysis technique used to obtain the information about the chemical bonds in molecules and provides information based chemical composition of sample. *FTIR absorption peaks and molecular set vibration are related. As per to infrared spectra theory, Molecular set vibration and characteristic absorption*

bands were assign are related In FT-IR, light (covering the whole frequency range 4000cm^{-1} - 400cm^{-1}) is split into two beams. Either one beam is passed through the sample or both the beam are passed, but one beam is made to travel longer path than the other does. Due to recombination of two beams produces an inference pattern that is the sum of all the inference patterns created by each wavelength in the beam. By systematically changing the differences in the two paths, the inference patterns change to produce a detected signal varying with optical path difference.

However, Fourier transformation of the interferogram converts it into plot of % transmittance against wave number.

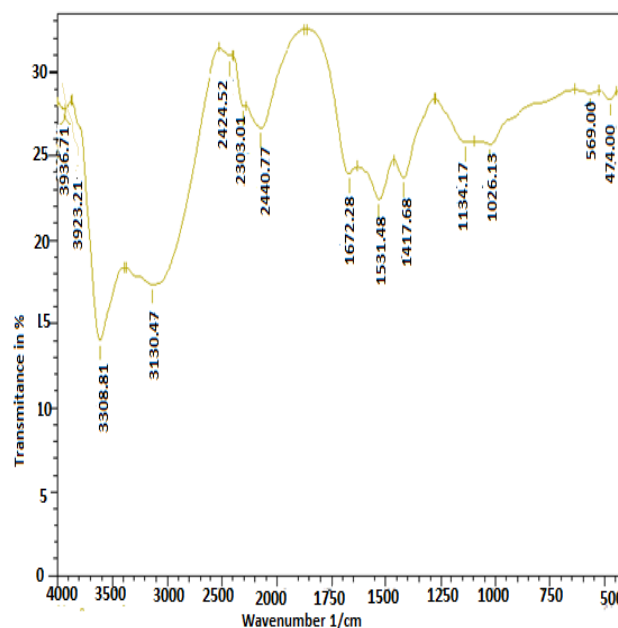


Figure 4 FT-IR spectra of Mn doped Bismuth trisulphide crystals

The FTIR Spectrum for a chemical compound is single characteristics, which shows the chemical bonding geometry. An important use of FTIR is to identify unknown compound and identify structure of unknown compound. Figure 4. Shows The FTIR Spectra of Mn-Bismuth tri sulphide

Using Fourier Transform Infrared Spectrometer in the range 500 cm^{-1} to 4000 cm^{-1} . The observed

spectrum of grown crystal is shown in figure 4. The bonds in the range 3500 to 3200cm^{-1} recognized to a symmetric O-H stretching of water molecules. The C-C bond stretching appears in range 2000 to 2300 cm^{-1} . It is seen that the peak at 2140.77 cm^{-1} can be assigned to C≡C bonds stretching. The sharp band present at 2424.52 cm^{-1} can be recognized C-C bond stretching. The band 1672.28 cm^{-1} can be attributed to C=C stretching of Alkyl group. The band appearing at 1531.48 cm^{-1} can be attributed N-O stretching vibration presence in nitro compounds. The band 1417.68 cm^{-1} can be attributed to bending frequency C - C group. The peaks at 1134.17 and 1026.13 cm^{-1} can be assigned to C-O stretching vibration bonding. The peak 569 cm^{-1} can be attributed Halogen compounds bond. The peak 474 cm^{-1} assigned to Bi-S bonding.

The other extra bands observed in the spectra are may be due to inclusion of sodium Meta silicate in the grown crystal.

C. Thermogravimetric analysis (TGA)

The TGA curve of Manganese doped Bismuth tri sulphide crystal was subjected to study the weight loss measured using TGA method. The TGA curve of grown crystals is as shown in figure 5.

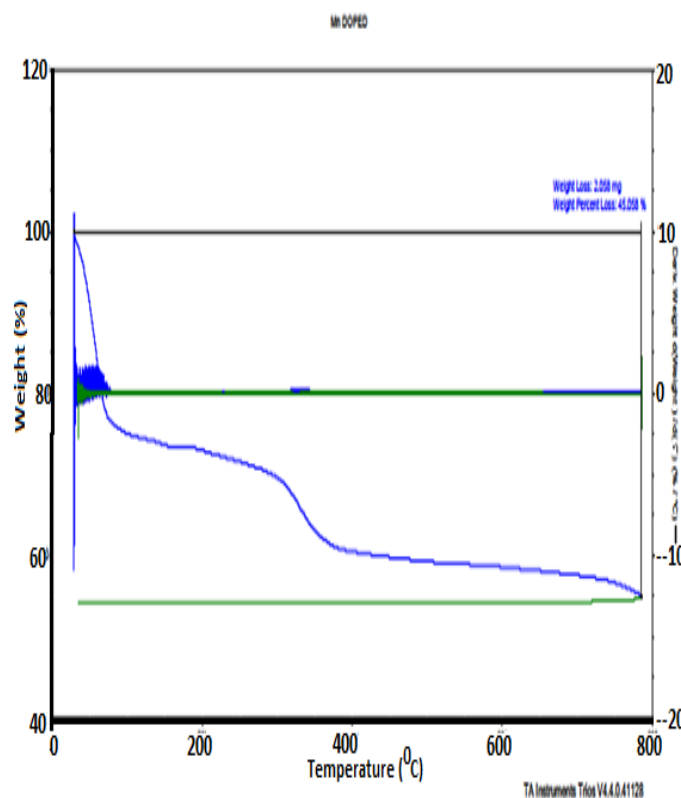


Figure 5. TGA curve of Mn doped Bi_2S_3 crystals

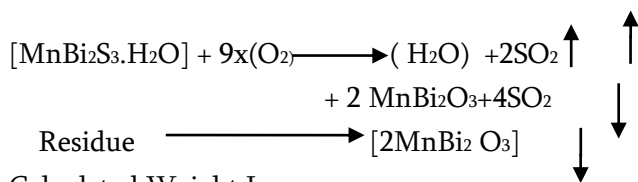
Decomposition of the first stage occurs in 28.32 to $52.20\text{ }^\circ\text{C}$ temperature range; observe weight loss of 10.82% in this range agreed with calculated weight loss 10.94% . This weight loss is attributed to loss of $[\text{2H}_2\text{O} + \text{2SO}_2]$ and decomposition is in continuous manner.

Decomposition of the second stage occurs in 52.20 to $221.69\text{ }^\circ\text{C}$ temperature range in which observed weight loss of 16.91% nearly agree with calculated weight loss 17.08% . Here observed weight loss appear less as compared with calculated. It can be attributed to incomplete decomposition of Bi_2S_3 . This weight loss is attributed to loss of $[\text{4SO}_2]$ and decomposition is in continuous manner. The remaining product finally turns into residue MnBi_2O_3 (Mn Bismuth Oxide) is conformed at $790.112\text{ }^\circ\text{C}$. The observed residue weight is 72.27% . This is nearly agreement with calculated residual weight 69.55% . This confirms presents of manganese and Bismuth in the grown crystals.

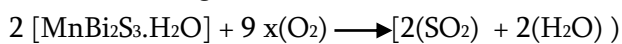
Observed Weight Loss: -

$$1. 28.32 \text{ to } 52.20 \rightarrow 100.117 - 89.297 = 10.82 \%$$

$$2. 5220 \text{ to } 221.69 \rightarrow 89.297 - 72.387 = 16.910 \%$$



Calculated Weight Loss



$$2 \times 587 + 18 \times 2 + 18 \times 16 \quad 18 \times 2 + 2 \times 32 + 4 \times 16$$

$$= 1174 + 36 + 288 \quad \longrightarrow \quad = 36 + 64 + 64$$

$$= 1498 \quad [164 \times 100 / 1498 \%$$



$$= 4 \times 32 + 16 \times 8$$

$$= 128 + 128 = 256$$

$$256 \times 100 / 1498 = 17.089\%$$



$$(2\text{MnBi}_2\text{O}_3) = 2 \times 55 + 4 \times 209 + 6 \times 16$$

$$= 110 + 836 + 96 = 1042$$

$$\text{Residue weight} = 1042 \times 100 / 1498 = 69.55\%$$

IV. CONCLUSION

By using silica gel method Manganese doped Bi_2S_3 crystals successfully grown. Single diffusion method is convenient for the growth of the Manganese-doped Bi_2S_3 crystals. The Period of gel-setting period depends on the pH value of mixture acetic acid and sodium meta-silicate solution and of sodium meta-silicate density. Grain size of the doped crystals increases with the concentration of Mn dopant. FTIR spectrum clearly indicates that the functional groups of undoped Bismuth tri Sulphides were not altered by the addition of the dopant. Presence of C=C, C-O-C, non-bonded O-H, C-H bond. TGA analysis suggest that the thermal stability of Bismuth tri- Sulphide crystal decreases due to Manganese doping

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Cite this article as :

K. B. Patil, "Synthesis of Manganese doped Bi_2S_3 Crystal in Gel method and its thermal Characterisations", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 257-261, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229161> Journal URL : <https://ijsrst.com/IJSRST229161>

Microgrid Power Quality Improvement Using Active Power Conditioner

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ABSTRACT

This paper discusses power system power quality issues and possible remedies using power electronics. Several worldwide standards This research shows how a Shunt active power filter can improve power quality in a microgrid system at the distribution level. The major goal of this study is to find an appropriate pulse generating strategy for improving the shunt active power filter's compensation capabilities. The device's compensating capability is mostly determined by the DC link capacitor voltage regulation. A fixed hysteresis current control approach has been employed in the past. An adaptive hysteresis current control technique has been developed here to improve the performance of a shunt active power filter. The suggested technique's performance has been verified in the MA TLAB/SIMULINK model platform under various operating conditions.

Keywords : Microgrid, Power quality (PQ), Shunt active power Filter, Total harmonic distortion (THD).

Article Info

Volume 9, Issue 1

Page Number : 262-268

Publication Issue

January-February-2022

Article History

Accepted : 21 Feb 2022

Published : 26 Feb 2022

I. INTRODUCTION

Electrical energy is the most efficient and widely used type of energy, and modern society is strongly reliant on it. Life would be impossible to envisage without the availability of power. At the same time, the quality of the electric power delivered is critical for the proper operation of end-user equipment. The word "power quality" has gained a lot of traction in the power industry, and it's something that both the electric power supply business and the end customers are worried about. The voltage and frequency ranges

of the power determine the quality of power given to consumers. There are many filter topologies in the literature like- active, passive and hybrid. In this project the use of hybrid power filters for the improvement of electric power quality is studied and analysed.

Increased non-linearity results in a variety of unfavourable characteristics, including low system efficiency and a low power factor. It also causes annoyance to other customers and communication network interference in the area. Over the next few

years, the impact of such non-linearity could be significant. As a result, overcoming these negative characteristics is critical.

Shunt passive filters, which are made up of tuned LC filters and/or high passive filters, are traditionally used to suppress harmonics and power capacitors are used to improve power factor. However, they have fixed compensation, are huge in bulk, and can exile resonance situations. Active power filters are now seen as a viable alternative over the classical passive filters, to compensate harmonics and reactive power requirement of the non-linear loads. The objective of the active filtering is to solve these problems by combining with a much-reduced rating of the necessary passive components.

II. SHUNT ACTIVE POWER FILTER

The Figure 1 depicts a shunt active power filter diagram. At the Point of Common Coupling, a shunt active power filter is connected in parallel (PCC). PCC refers to the point where the source and load meet in the middle. In most cases, the active power filter is used.

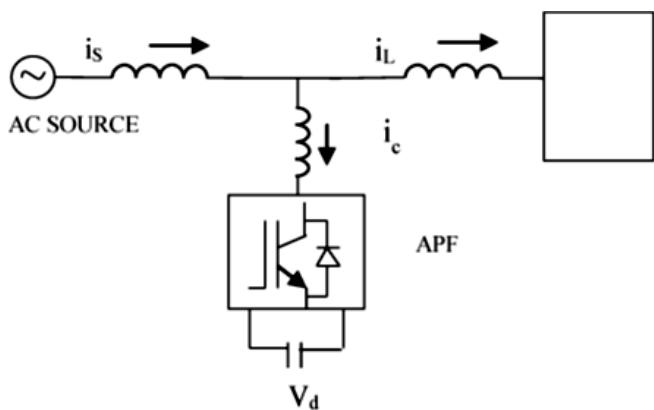


Fig 1: Shunt active power filter

The active power filter usually has an inverter structure, which can be either a voltage source inverter (VSI) or a current source inverter (CSI). Because CSI has some limitations, most of them choose VSI-based shunt active power filters. A dc link capacitor is linked to the VSI's output terminal, acting

as an energy storage element and utilized to maintain a constant DC voltage with small ripple in steady state. In order to obtain better correction, the capacitor's dc link voltage must be maintained constant. This is accomplished by the use of a PI controller, which operates in a closed loop.

III. MODELLING SAPF

Figure The filter is used to reduce the harmonics and improve the power quality. The filter that is connected to the system should be controlled effectively such that its response characteristics are as desired. Among the different available filter configurations, shunt active power filter is used in this work. The control circuit of the shunt connected APF is designed such way that the voltage injected by the APF compensates the harmonics and also enhances the performance of the shunt connected passive filter. The control strategy of the shunt active power filter is explained in detail below.

The instantaneous current $i_s(t)$ can be written as,

$$i_s(t) = i_L(t) - i_c(t) \tag{1}$$

The source voltage $V_s(t)$ is given by,

$$V_s(t) = v_m \sin \omega t \tag{2}$$

The load current will have a fundamental and harmonic component, if a non-linear load is applied, which can be represented as,

$$i_L(t) = \sum_{i=-n}^{\infty} \int \sin(\omega t + \phi_n) = I_1 \sin(n\omega t + \phi_1) + \sum_{n=2}^{\infty} \int \sin(\omega t + \phi_n) \tag{3}$$

The instantaneous load power $P_L(t)$ can be given as,

$$P_L(t) = V_s(t) * i_L(t) = P_f(t) + P_r(t) + P_h(t) \tag{4}$$

The fundamental real power $P_f(t)$ drawn by the load is,

$$P_f(t) = V_s(t) * i_s(t)$$

$$\text{where, } i_s(t) = I_m \sin \omega t \tag{5}$$

Source current supplied by the load after compensation is,

$$i_s(t) = P_f(t) / V_s(t) = I_1 \cos \phi_1 \sin \omega t = I_m \sin \omega t \tag{6}$$

$$\text{where, } I_{sm} = I_1 \cos \phi_1$$

There are also some switching losses I_{sl} in the PWM converter and hence the utility must supply a small overhead for the capacitor leakage and converter switching losses in addition to the real power of the load. The total peak current I_{sp} supplied by the source is,

$$I_{sp} = I_{sm} + I_{sl} \tag{7}$$

If the active power filter provides the total reactive power and harmonic power, then $i_s(t)$ will be in phase with the source voltage and becomes sinusoidal. At this time the compensation current of the active power filter is,

$$i_c(t) = i_L(t) - i_s(t) \tag{8}$$

The desired source current after compensation is,

$$i_{sa}^* = I_{sp} \sin \omega t$$

$$i_{sb}^* = I_{sp} \sin (\omega t - 120)$$

$$i_{sc}^* = I_{sp} \sin (\omega t + 120)$$

IV. SIMULATION PARAMETER

The MATLAB simulated model is shown in fig. 2. A model is developed to simulate the PI controller-based shunt active power filter in Simulink. The complete active power filter system is composed mainly of three-phase source, a nonlinear load, a voltage source PWM converter, and a PI controller. All these components are modelled separately, integrated and then solved to simulate the system.

The parameters selected for simulation studies are given in table 1. The three phase source voltages are assumed to be balanced and sinusoidal.

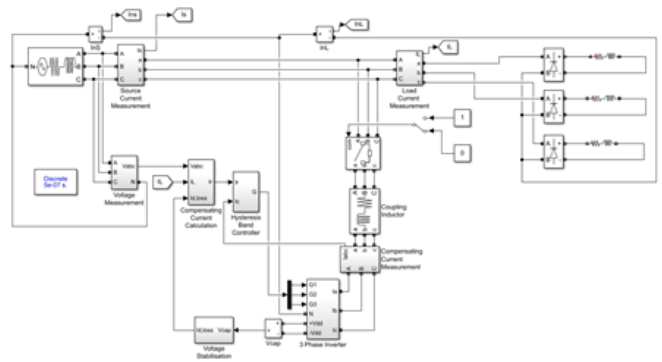


Fig. 2: MATLAB simulated model

A load with highly nonlinear characteristics is considered for the load compensation. The source current is equal to the load current when the compensator is not connected.

TABLE I
SYSTEM PARAMETERS AND THEIR VALUES.

System parameters	Values
Source voltage (V_s)	400V(peak)
System frequency (f)	50Hz
Source impedance (R_s, L_s)	0.1Ω;0.15mH
Filter impedance (R_c, L_c)	0.4Ω;3.35mH
Load impedance (R_l, L_l)	6.7Ω;20mH
DC link capacitance	2000μF
Reference DC link voltage (V_{dref})	220V

From the fig 3, It is clear that, the source current and source voltage are not in phase with each other. Due to this, the power factor of the system is reduced and system becomes unstable. The change in system parameters such as voltage, current, and frequency caused by these complicated loads is referred to as "power quality concerns."

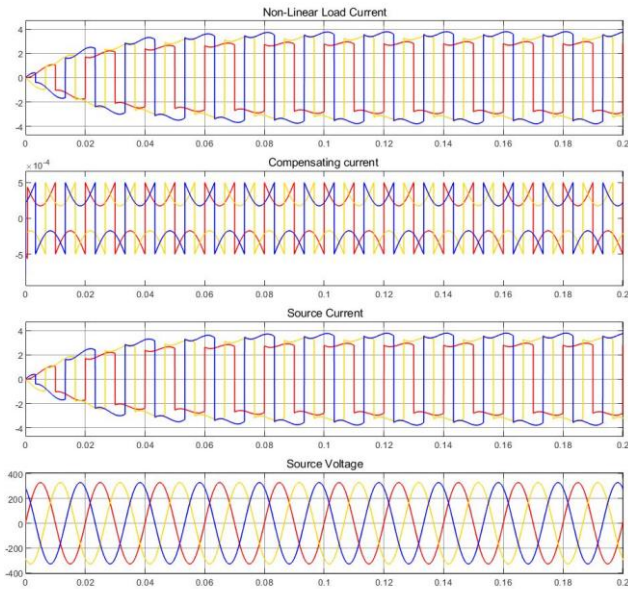


Fig 3: show the result of simulation of model before applying power filter to the system of non-linear load current, compensating current, source current and source voltage of phase R, Y and B respectively.

Poor power quality causes device and equipment failure, harmonics and unbalances in voltage and current, low power factor, and reactive power consumption. The major index for poor power quality is among these harmonics. As a result, it is vital to address these power quality issues and keep the % THD below specified limits, as dictated by IEEE standards.

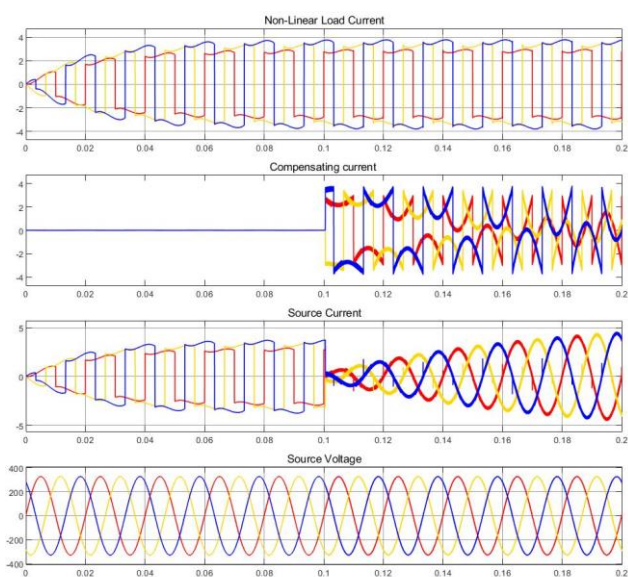


Fig 4: switching compensating current at t=0.1sec.

The compensator is switched ON at $t=0.1s$ and the integral time square error (ITSE) performance index is used for optimizing the and coefficients of the PI controller. The optimum values are found to be 0.2 and 9.32, respectively, which corresponds to the minimum value of ITSE. The source currents as well as compensating currents for PI controllers are shown in fig 4.

From the wave forms it is clear that harmonic distortion is reduced after connecting compensator. The PI controller gives better harmonic compensation. From the responses it is depicted that the settling time required by the PI controller is approximately 10 cycles. In Fig 5 The THD of source current before switching Active Power Filter is shown. The number of cycles for calculating the percentage of THD of source current is 8 cycles selected from 0.2 sec. The THD of source current before applying Active power filter is 47.80%. The source voltage and source current are not in phase with each other. Due to this, the power factor is affected and the system is not stable.

The fig. 6 shows THD after applying the current compensation to the system. The settling time required for PI controller is approximately 10 cycles. The number of cycles for calculating the percentage of THD of source current is 8 cycles selected from 0.2 sec. The THD of source current after applying Active power filter is 3.18%. The source current becomes harmonic free after applying current compensation.

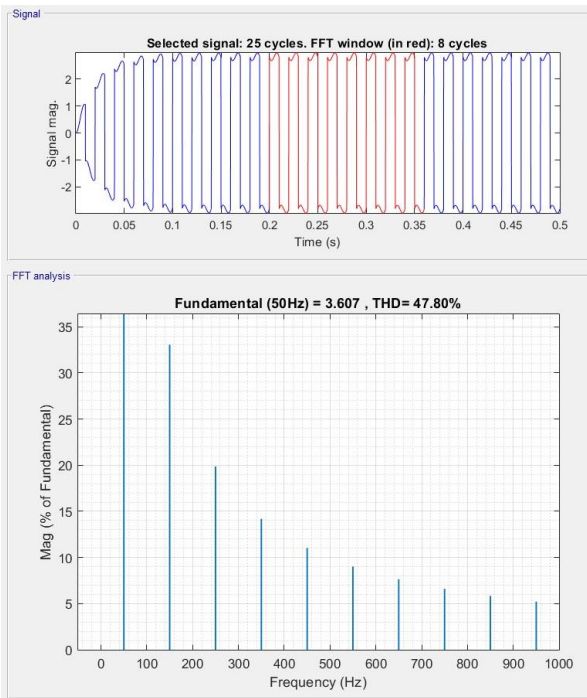


Fig 5: Total Harmonic Distortion (THD) before current compensation

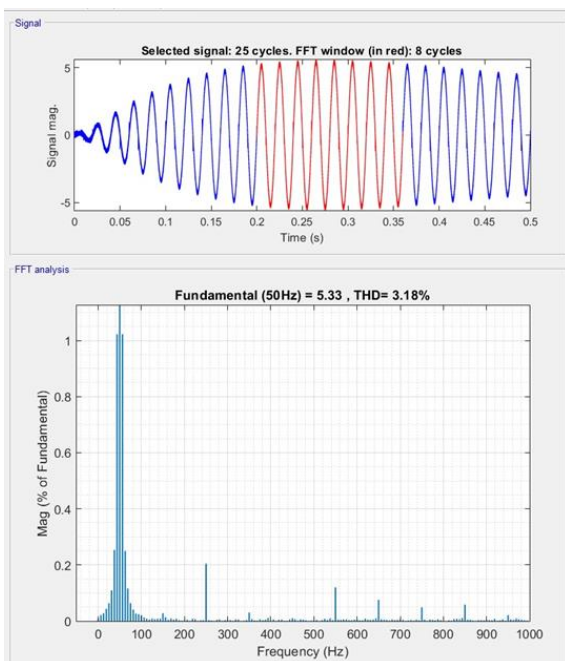


Fig 6: Total Harmonic Distortion (THD) after current compensation

The source current THD is reduced from 47.80% to 3.18% as shown in fig 5 and 6, the THD is reduced by 44.62%. After compensation both source voltage and current are in phase with each other means that the harmonics are eliminated and reactive power is compensated to make power factor close to unity. As

the source current is becoming sinusoidal after compensation power quality is improved.

V. CONCLUSION

A shunt active power filter has been investigated for power quality improvement. Various simulations are carried out to analyse the performance of the system. The PI controller-based Shunt active power filter is implemented for harmonic and reactive power compensation of the non-linear load. A program has been developed to simulate the PI controller-based shunt active power filter in MATLAB. It is found from simulation results that shunt active power filter improves power quality of the power system by eliminating harmonics and reactive current of the load current, which makes the load current sinusoidal and in phase with the source voltage. According to IEEE 519 standard, the maximum permissible THD for low voltage application is 5% and maximum permissible for individual voltage harmonics is 3%. The performance of the controllers has satisfied the IEEE standards as the resulted THD of source current after applying compensation is below permissible limit. A model has been developed in MATLAB SIMULINK and simulated to verify the results.

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Cite this article as :

Amit M. Sirsat, Dr. Swapnil B. Mohod, Dr. Mohan B. Tasare, "Microgrid Power Quality Improvement Using Active Power Conditioner", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 262-268, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229154>
Journal URL : <https://ijsrst.com/IJSRST229154>

Analysis of Power Supply and Demand in Maharashtra State for Load Forecasting Using ANN

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ABSTRACT

The power system energy management system plays a crucial role in load forecasting. Load forecasting lowers production costs, increases spinning reserve capacity, and improves power system reliability. Financial institutions, power suppliers, and other participants in the electric energy market, such as transmission, generation, and distribution, rely heavily on load forecasts. The allocation of generation for economic reasons is a critical goal of short-term load forecasting. For short-term load forecasting, this research provides a solution paradigm based on an artificial neural network. Dry bulb temperature, Dew point temperature, humidity, and load data are the inputs used to forecast the load. To minimize the error function generated from computed and actual load, the back propagation algorithm was implemented.

Keywords: Short term load forecasting, Back Propagation, Artificial Neural Network.

Article Info

Volume 9, Issue 1

Page Number : 269-277

Publication Issue

January-February-2022

Article History

Accepted : 20 Feb 2022

Published : 27 Feb 2022

I. INTRODUCTION

Every day, the amount of power required increases, and it varies during the day. The electricity constraint is usually greater at nightfall, and this is referred to as the peak period; it is also noticed that the evening peak is higher than the morning peak. At night, all types of users, including farmers, small industries, and small company endeavours, require power to operate their equipment.

As a result, demand during this time period surpasses supply. Our electrical generation is primarily reliant on natural resources such as coal, oil, and gas, all of

which will run out one day. There are no substantial hydro potential resources, nuclear project investment costs, or current public outcry, and no research into non-conventional energy producing systems.

People in Maharashtra have been experiencing significant electricity shortages, especially during peak hours of the day. It is also obvious that the deficit doubles during certain months of the year. In a normal scenario, supply and demand are out of sync. As a result, MSEDCL has implemented load shedding. When calculated the annual average demand and supply for the last five years, it is discovered that in

2011, demand exceeded 19000MW during peak hours of the day, giving us an idea of future electricity needs.

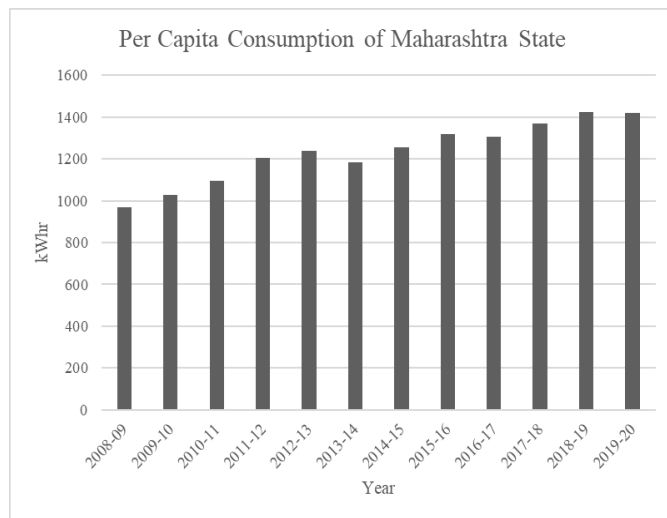


Fig 1: Per Capita Electricity consumption in Maharashtra State

The fig 1 shows the per capita electricity consumption in Maharashtra state from year 2008 to 2020. The per capita consumption for year 2008-09 is 969.4 kWhr and at year 2020 it is 1417.73 kWhr. There is an increase of 46% in per capita power consumption from year 2009 to 2020.

The main objective of the research work is to develop a solution methodology and algorithm to forecast, hourly peak load; by incorporating weather conditions i.e., dew bulb temperature, dew point temperature and humidity. In this work, an attempt is made to implement the above forecast using an artificial neural network approach, i.e., backpropagation algorithm and Levenberg Marquardt algorithm.

II. LOAD FORECASTING IMPLEMENTATION ALGORITHM

Back Propagation (BP) alludes to a wide group of ANN, whose design comprises of various interconnected layers. The learning algorithm of BP is based on the Deepest Descent technique. The proper number of hidden units limits the error of the non-

linear function of high complexity. BP is a systematic technique of training multilayer ANN. It is designed on a high mathematical foundation and has excellent application potential. The networks include sensory units that represent the input layer, one or more hidden layers of calculation nodes, and the output layer of the calculation nodes. Input signals on a layer-by-layer basis propagate through the network in the forward direction. These neural networks normally allude to as a multilayer perceptron's as shown in Figure 2.

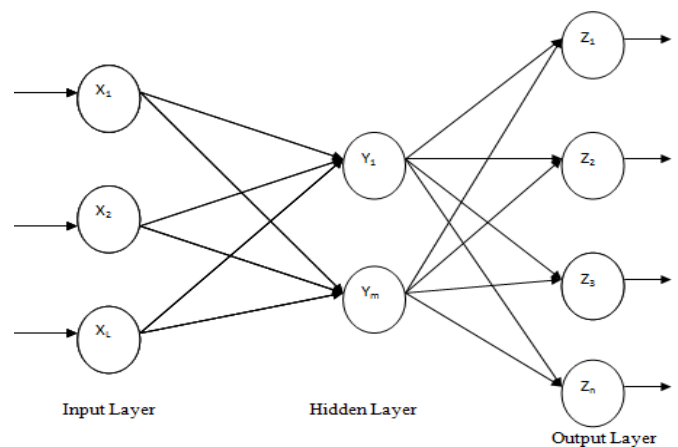


Fig 2 Multi-Layer Fed Forward Network.

Error back propagation basically, an implementation of multilayer perceptron in such a supervised manner with the help of comprehensive algorithm, with success to solve some difficult and different variations. This algorithm depends on the error of learning error correction. While considering the different layers of the neural network, there was basically two passes while learning error back propagation first one is the forward pass and second one is the backward pass. Within the forward pass, it was a type of activity pattern that can be applied on the sensor node of the neural network, and its effect is propagated by the layer via the network layer [38]. Finally, due to the actual response to the network, a set of output has been created. In case of forward pass, the load was considered to be mounted on the network. On the basis of error correction rule, the load was adjusted in the network in case of backward pass which was quite different from the forward pass case. Error signal can

be generated by the difference of the network output and the desired output and further the generated signal was transferred within the network but in the backward direction due to which it was called error backpropagation.

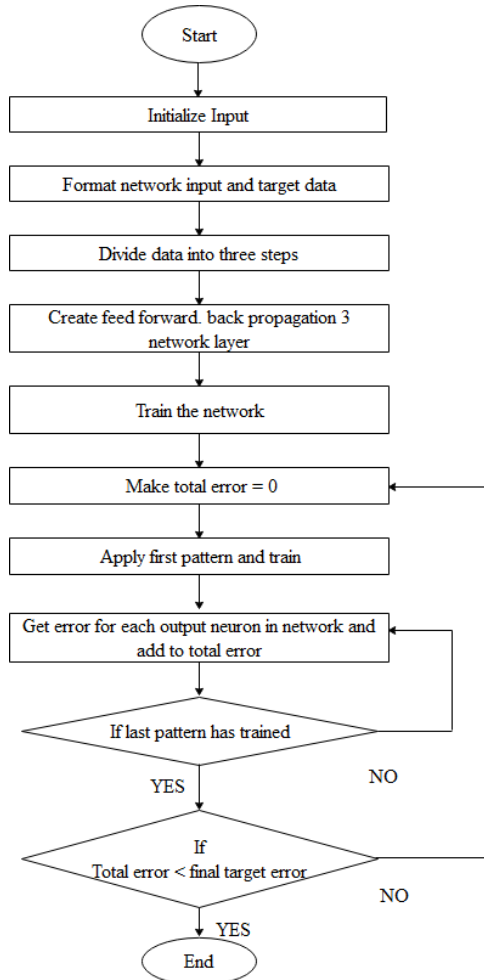


Fig 3: Back Propagation Flowchart

Back propagation method was utilized for the estimation of weight within the network [39], as shown in fig. 3 shows back propagation flowchart. for the analysis of the network, this method considered the loss function with respect to output of the neural network need to be analyzed which typically means that the desired target value is known. BP is a supervised learning method. It was basically a formation of rule by the feed forward neural network by the utilization of chain rule for each layer of the network.

The relative error between the actual and forecasted load demand has been obtained to ensure the accuracy of forecasts. If the error obtained is positive, it symbolizes over forecast indicating that the forecasted load is greater than that of the actual load. For negative values, the case is vice versa. The accuracy is computed by calculating the mean square error (MSE) and root mean square error (RMSE) given as follows,

$$MSE = \frac{1}{N} \sum_{i=1}^n (Load_{actual} - Load_{forecasted})^2$$

$$RMSE = \sqrt{\frac{1}{N} \sum_{i=1}^n (Load_{actual} - Load_{forecasted})^2}$$

III. LEVENBERG-MARQUARDT SOLUTION METHODOLOGY

There are five major steps to obtain the result or to train the network. The five steps are briefly explained below one by one and the flowchart is shown in Figure 4.

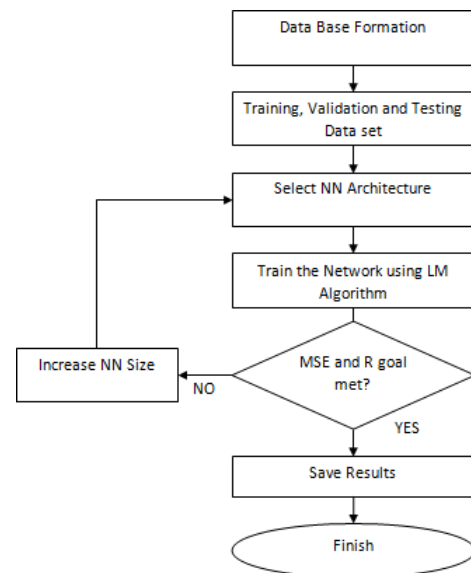


Figure 4: Flowchart of training and testing of ANN

A. Data Collection and Preparation: The chronological data were composed for this research. The chronological load data is taken from the 33kv Old Power House Rahatgaon, Amravati

and the weather data are acquired from the internet. The one-month load data and weather data are used for the training the network.

- B. Data Pre-processing:** Scaling of raw input data is normally important to diminish the bias caused by a various measuring unit of original input variables. The approach utilized for scaling the network input and target was to standardize the mean and standard deviation of the training set.
- C. Network Structure Design:** The next step behind rendering the training and validation data set is to outline the structure for neural networks. This has to do with choosing a network topology and the resolve of the input nodes, output nodes, number of hidden layers and the number of hidden nodes. The network topology is mostly determined based on the sort of task to be performed by the planned network. The multilayer feedforward neural networks have been effectively applied for prediction. The number of input nodes is usually set equal to the number of input variables.

The following are the input variables for this research

- a) Dry bulb temperature
- b) Dewpoint temperature
- c) Humidity

The output of the neural network represents the forecasted load data for the forecasting day. The determination of the number of hidden layers and the number of neurons within the hidden layers is an important decision within the plan of neural networks. Too many hidden neurons cause many trainable weights, which might build a neural network to become erratic and unreliable. On the other hand, too few hidden neurons limit the learning ability of a neural network and improve its approximation performance [40]. However, there is no distinct guideline for deciding the number of neurons in the hidden layers. The usual practice is by using trial and error which cannot yield an optimum network design and therefore the method is time-consuming.

D. Network Training: After the network has been outlined, the following stage is to train the network. The training of an artificial neural is an iterative method that has to do with changing the association weight. BP algorithmic rule has been generally used in the past as a fundamental learning, algorithmic rule for training feed-forward neural networks; in any case, it takes a long time in training due to the nature of gradient descent. Several techniques are utilized to enhance the execution of back propagation, among them one is by Levenberg Marquardt. Levenberg Marquardt is embraced for training the neural network amid this research. Levenberg Marquardt is the numerical optimization-based technique in which performance index is to be optimized.

IV. RESULT AND DISCUSSION

Back propagation was considered as the important ingredient in the short-term forecasting. For the forecasting purpose, hourly data was collected from the Punjab electricity board for the various days that helped in the training of the technique as well as for forecasting purpose and also the weather data is taken from the Meteologix India web site. The dew point temperature, dry bulb temperature, and humidity are taken as input and the load data is taken as the output. To train the network data, the data are divided into three parts, i.e. Validation, Training, and Testing. The BP algorithm is used to train the network and implemented in MATLAB.

The inputs dew point, dry bulb temperature, humidity and load are presented in figure 5.

- (i) Dew Point Temperature: It was basically a temperature value at which the air losses its control over the water vapor due to which some of the air molecules converted in to the water droplet and this particular temperature was lower than the temperature.
- (ii) Dry Bulb Temperature: whenever the thermometer was used for the measurement of temperature then it is called dry bulb temperature basically, it was atmospheric

temperature read by the thermometer whenever it was exposed in the surrounding.

(iii) Humidity: it was nothing but a water droplet which was present the atmosphere but they were completely invisible for the human was basically a water molecule in the gaseous state. As humidity increases, ability of body to resist the sweating capacity reduces due to reduction in the rate of evaporation of moisture from the body.

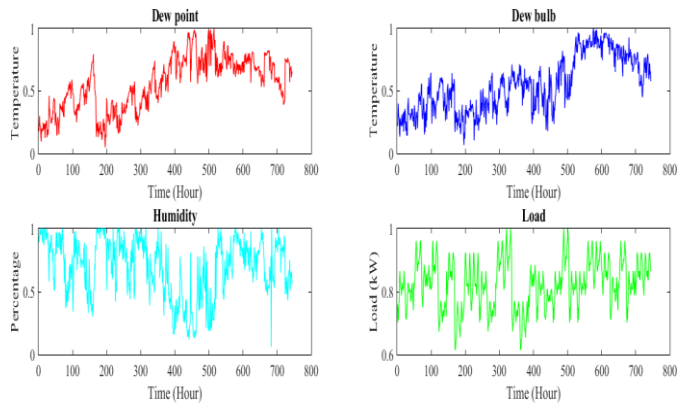


Figure 5: Representation of input data

The network is trained for 5000 iterations with the presented data. In this, the training function is 'trainlm' and the activation function is sigmoid. It is observed that the mean square error is 0.0061 and root mean square error is 0.0784 after training it is also observed that the actual load and forecasted load have so much variation or fluctuations as shown in Fig. 6. As there is a large variation between actual and forecasted load obtained by BP algorithm. So, load forecasting has also been done by Levenberg Marquardt algorithm.

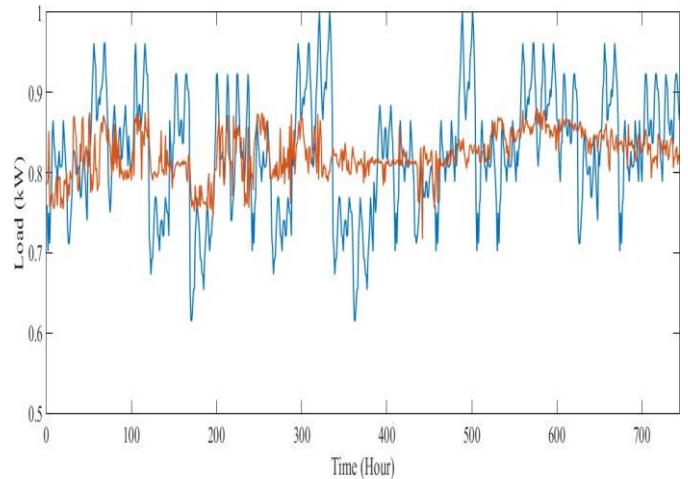


Figure 6: Representation of Actual and Forecasted Load

A. Single layer Network

In case of single layer network, there was single input layer as well as single output layer. Further, the neurons present in the input layer received the signals at the input terminal whereas the neurons present in the output layer received the output signal in a similar way. The input cells were connected to the similar output cell by the utilization of synaptic link carrying weight with it. Due to which this was considered as the feed forward neural network as the inverse operation cannot be possible in this network.

TABLE I
REPRESENTS THE DIFFERENT SIZE OF THE HIDDEN NEURON AND ERROR IN SINGLE LAYER FEED-FORWARD NETWORK.

Hidden Neuron size	MSE	RMSE
3	0.0063	0.0796
6	0.0071	0.0843
9	0.0075	0.0866
12	0.0069	0.0834
15	0.0071	0.0843
18	0.0073	0.0857
21	0.0072	0.0852

Despite of the fact that the network having two layers still it was considering as a single layer due to single output layer receiving signal from input layer [39].

The data is forecasted with different sizes of the hidden layer and the best results are observed when hidden neuron size is 3 as shown in Table 1. The Figure 7 represents the actual load and forecasted load in the hidden neuron size of three.

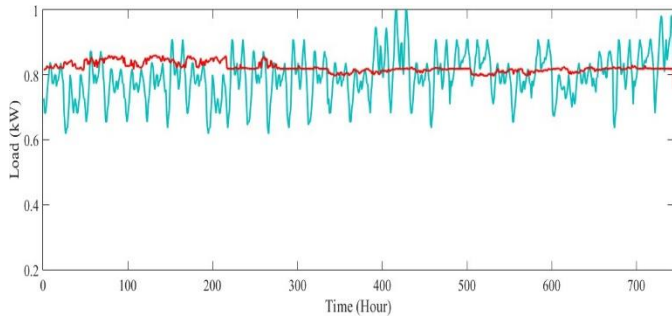


Figure 7: Represents the actual load and forecasted a load of hidden neuron size three.

B. Multilayer Network

As its name indicates is formed from multilayers. So, architectures of multilayer feed- forward network possessing an auxiliary layer considering between the input layer and the output layer. The hidden neurons present within the middle layer was considering for the computational purpose.

TABLE III

REPRESENTS THE DIFFERENT SIZE OF THE NEURON AND ERROR IN MULTILAYER FEED-FORWARD NETWORK.

Hidden Layer 1	Hidden Layer 2	MSE	RMSE
3	6	0.0070	0.0835
6	9	0.0067	0.0819
9	12	0.0071	0.0843
12	15	0.0069	0.0831
15	18	0.0078	0.0883
18	21	0.0072	0.0849
21	24	0.0075	0.0866

The major importance of hidden layer as the computational work performed by the layer before the input signal received by the output terminal [39]. The input hidden layer weight was basically, a synaptic weight links formed by the combination of input neurons and the hidden neurons.

The Table II shows that while changing the neuron size of the hidden layer the error is also changed and the Figure 8 shows the actual load and forecasted a load of the hidden layer having less error.

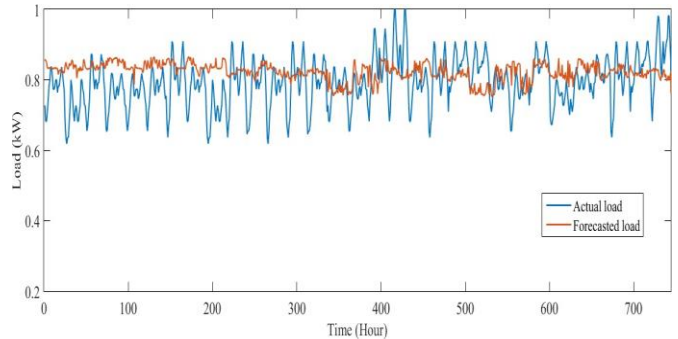


Figure 8: Represents the actual load and forecasted load of the hidden neuron size six and nine.

V. CONCLUSION

In this work results obtained by using ANN technique for short-term load forecasting for the Amravati city, Maharashtra has been analysed. The most widely used technique in ANN is BP algorithm and LM algorithm. The forecasting has been evaluated on the basis of calculating Mean Square Error and Root Mean Square Error between the actual value and forecasted value. Three inputs namely Dew point temperature, Dry bulb temperature and Humidity have been taken as input. The effect of change in number of hidden neurons and number of hidden layers is also studied. The following observations are made:

1. The BP algorithm results into lower error compared to LM algorithm for same input.
2. One hidden layer is sufficient for the formulation of Load forecasting problem.
3. The increase in hidden neurons increases the error.

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Cite this article as :

Suraj G. Patil, Dr. M. S. Ali, "Analysis of Power Supply and Demand in Maharashtra State for Load Forecasting Using ANN", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 269-277, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229155>
Journal URL : <https://ijsrst.com/IJSRST229155>

Optimize The Turning Parameter Using Taguchi Methodology

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Article Info

Volume 9, Issue 1

Page Number : 278-285

Publication Issue

January-February-2022

Article History

Accepted : 13 Jan 2022

Published : 20 Feb 2022

ABSTRACT

Turning is a most popular cutting process which is widely used in small as well as large scale industries. The selection of better combination of input parameter be means enhancement in productivity. The aim of this paper is to optimize the turning parameter (cutting speed, feed rate, depth of cut) using Taguchi methodology for minimizing surface roughness. The experiment were performed according to the L_9 orthogonal design matrix on the lathe machine. The result shows that optimal condition of the parameters gives surface finish which is better than initial . The cylindrical turning is a popular metal cutting prceses used in the industries to removed unwanted material in desired workpiece material.

Keywords : Turning, Cutting, Taguchi, Roughness , Optimization , ANOVA, Experimentation

I. INTRODUCTION

Cynindrical turning is a metal cutting operation use in each and every production to increase the productivity ,reliability and quality of the object . The cylindrical turning is a metal cutting operation is use to remove extra unwanted material in desired workpiece during turning of any garde material workpiece or any material workpiece . In this cylindrical turning performed on the centre lathe machine remove extra material in form of chips .During this operation single point cutting tool which is only one cutting edge remove the extra unwanted material in form of chips .This operation is performed in the centre lathe machine remove the extra mareial [1,2].Turning is primary metal cutting

operation is removed the material and increase surface finish of an object . Turning operation is used to remove the unwanted material desired workpiece in form of chips. The general turning operation is involves to rotating workpiece hold in three jaw chuck in a centre lathe machine.In most cases tool fixed in centre lathe machine at 90° angle .The point cutting tool in one cutting edge remove the workpiece material in form of chips [3,4].Turning proceses is remove the internal as well as eexternal diameter of the cylindrical rotating objects. The surface quality of the workpiece material is mostly depend upon the various input parameters give on the lathe machine. The input parameters of a as cutting speed , depth of cut , feed rate its effect directly and indirectly surface quality of an object [4,5].

The turning operation is most popular industrial process for machining of circular object. In production industries are facing more and more difficulties like clamping, holding, chattering/vibration and dynamic instabilities etc. [5,6]. Turning generally axially symmetric with a single point cutting remove the extra material in form of a desired shape and size. It is metal removing process used in each industries removed extra unwanted material in form chips. Due to important of turning operation researchers always make effort to improve the efficiency of a product at low cost. These operation enhance the productivity, quality, reliability of an objects. [7,8]. It is a metal removal process performed in different type of lathe machine. Turning is used machining of conventional as well as advanced and difficult-to-machine engineering materials. It is type of cutting technology reduce the material in form of chips desired shape and size [8,9]. These processes is largely used in manufacturing industries to cut a material from the both surface i.e external as well as internal. The turning is metal cutting processes reduce the material in in form of a desired shape and size.

II. LITERATURE REVIEW

The performance of turning process were analysed by various researcher to identify the significant parameter. Manoj et al. [10] performed Turning operation on lathe machine consider input parameter (cutting speed, depth of cut, feed rate) to produce good surface finish. Further they determine optimum value of Ra using Taguchi and Anova methodology. Hassan and Afzal et al. [11] performed turning operation of stainless steel workpiece. They conducted experiment on Lathe Machine using a hybrid whale optimization algorithm. (Cutting speed, Depth of cut, Feed rate) consider as a input parameter as performed as output as a good surface finish in an optimum condition. The application of Taguchi approach for optimization of the control parameter related to the different machining processes was

tested by many researchers [12-14]. Yang et al. [15] optimized the cutting parameters related to the turning operation using Taguchi approach. Nalbant et al. [16] optimize the control parameters such as nose radius, feed rate and depth-of-cut to minimize the surface roughness of the turned parts. The optimum level of cutting parameters for minimum value of the cutting force and surface roughness were determined using Taguchi method during turning of cast Iron. Asitürk and Akks [18] used L₉ orthogonal array to optimize surface roughness during hard turning of the AISI4140 steel. Thamizhmani et al. [19] were also optimized the parameter related to the turning operation using Taguchi approach. Therefore, the Taguchi based optimization technique has been applied to optimize the process parameter of the dual turning process. The aim of the present study is to optimize the control parameters of the turning process. For this, experiments were performed in the centre lathe machine. All the experiment were performed according to the L₉ Design matrix considering the effect of cutting speed, feed rate, depth of cut on the average surface roughness (Ra). The analysis of variance (ANOVA) technique has been used to analysis the experimental data and also discusses the most influential turning parameter.

III. EXPERIMENTATION

All the experiment is perform on the centre lathe machine (Manufactured by Payal machine tool). The workpiece is held into three jaw chuck in centre lathe machine. The experimental setup shown in centre lathe machine as Figure-1

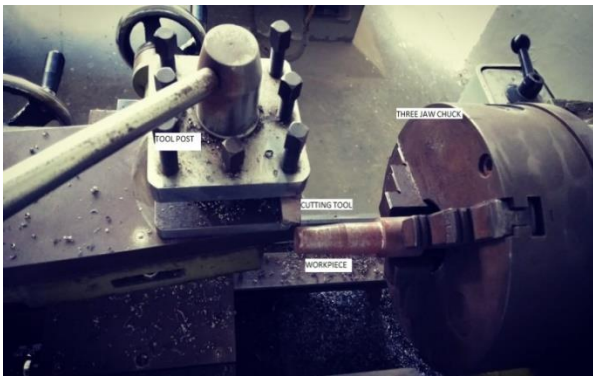


Figure- 1 Experimentation on Centre Lathe Machine

The experimentation Alloy steel AISI1040 (UNSG10400) is consider as workpiece material. This alloy steel is used in couplings crankshaft and cold headed parts. The diameter of workpiece is taken 30mm for easy to hold in three jaw chuck in a centre lathe machine for the turning operation. In this experiment single point cutting tool used to cut the material in specified dimensions. This single point cutting tool is one cutting edge penetrate the workpiece material to cut the desired shpe and size. In this experiment used the cutting tool made of a HSS material easy to cut a AISI1040 alloy steel .This cutting tool material is very high hot hardness capacity easy to cut a workpiece as very high cutting speed .This experiment performed on a centre lathe machine .The workpiece material AISI1040 alloy steel hold in the three jaw chuck on a centre lathe machine .The single point cutting tool made of HSS material remove the extra unwanted material from the desired shape and size .This experiment obtained the data from one Way ANOVA analysis of variance and optimize process parameter using the Taguchi Methodology .The result show that surface roughness Ra optimal condition better than initial condition .This Ra surface roughness meature by the help of TR-200 surface measuring instrument .



Figure-2 TR -200 Measuring Instrument

The Experiment three parameter are selected for turning of Alloy Steel (AISI1040) the range and Level of each parameters summarised in Table -3

Table-1 Range and Level of each Parameter

Parameter	Symbo l	Level- 1	Level - 2	Level-3
Cutting Speed (mm/min)	V	20	30	40
Feed rate (mm/rev)	F	0.25	0.5	0.75
Depth of cut (mm)	D	0.5	1	1.5

To optimize process parameter minimized Ra surface roughness .The process parameters is (cutting speed, feed rate, depth of cut) optimize using Taguchi approach, a well- known L₉ orthogonal design matrix for four –factors with three level is select to perform the experiments. The signal (S/N) ratio is use to analyse the experiment results. The analysis of variance (ANOVA) technique is apply to check the feasibility of the experimental results and the percentage contribution of each factor. Generally three quality characteristics such as “nominal is better”, “higher is better” and “lower is better” are used to analyse the experimental results. In present study, the surface roughness has been taken as response parameter [23]. Therefore the “lower is better” quality characteristic has been use to analyse

the experimental results which can be determined as [21, 22].

$$S/N = 1/n \sum_{i=1}^n y_i^2$$

Where y_i = observed response or quality value at the i th the experiment run order and n =number of trials at the same level of the parameters.

A Data Collection

This experiment show analysis of experiment data total 9 – number of experiments is conduct on centre lathe machine. The Taguchi based L_9 orthogonal design matrix is use to optimize the experimental data [31]. The experimental observation with the S/N ratio for each factors summarised in Table-2

S.No	V	F	D	Ra ₁	Ra ₂	Ra ₃	Ra (ave)	S/N ratio
1	1	1	1	1.60	2.10	2.90	2.2	4.84
2	1	2	2	1.45	2.15	2.45	2.01	4.04
3	1	3	3	1.25	2.00	2.02	1.75	3.06
4	2	1	2	1.40	2.10	2.80	2.1	4.41
5	2	2	3	1.90	2.45	3.80	2.71	7.34
6	2	3	1	1.10	2.15	2.66	1.97	3.88
7	3	1	1	1.15	2.65	2.40	2.06	4.24
8	3	2	3	2.00	2.50	3.00	2.5	6.25
9	3	3	2	2.00	2.16	3.16	2.44	5.9

B Analysis of Variance (ANOVA)

Check the feasibility and accuracy of the experiment result analysis of variance (ANOVA) technique applied. Generally, ANOVA is a statistical technique used to analyse the experimental observation data collect by the experimenter using standard experimental techniques. This is widely used to separate the total variability established between the random and systematic parameters. It is also used to determine the impact of independent variables on the dependent variables during analysis of the regression models [10,21]. There are many test used to know the adequacy of data such as sum of square (SS), degree of freedom (DF), Mean sum of square (MSS), Mean square error (MSE), F-value etc. Therefore, ANOVA

analysis has been carried out and summarised in the Table -3

Group	Count	Sum	Average	Variance
Column-1	9	270	30	75
Column-2	9	4.5	0.5	0.046875
Column-3	9	9	1	0.1875

Table -4 ANOVA Results

Factor	SS	DF	MSS	F-value	p-value	F-Critical
V	77.04	2	38.52	1.44	1.84E-10	2.816708
F	1711.5	2	855.7	32.08		
D	77.04	2	38.52			
R	53.34	2	26.67			
Total	1918.92	8	959.41	959.41		

C Analysis of Data Using Taguchi Methodology:

Taguchi Methodology is a statistical technique that used to optimize the single as well as the multi objective optimization problem. It needs to perform the experiments according to the orthogonal design matrix. Therefore the total 9 – number of the experiment observations summarized in Table 4 are analysed to find the S/N ratio of each factor using equation (1). Generally, S/N ratio are used to identify the rank and optimal cutting condition for each controlled parameter. The S/N ratios for each factor with their level and respective ranks are summarised in Table 7. It has been observed by (Table 4) that rank of the each control parameter (based on S/N ratios) are as cutting speed (1), feed rate (2), depth of cut (3).

Instead of this the optimal level of the control parameters i.e Cutting speed (mm/min). Feed Rate (mm/rev), depth of Cut (mm) are as Level 1, Level 2, Level 3 respectively. Thus it has been decided that the optimal combination of control parameter as $V_2F_2D_3$ has been more suitable for the better quality [32-36].

TABLE 5: Effect of factors level on the S/N Ratio

Factor	Level-1	Level-2	Level-3	Delta Max-Min	Rank
V	3.98	5.211	4.84	1.23	I
F	4.49	5.87*	4.29	1.58	II
D	4.32	4.8	5.55	1.23	III

*optimum value

D Experimental Validations

Experiment have been carried out on the same cylindrical workpiece material as AISI(1040) alloy steel. Firstly the experimental validation has been conducted at the optimal condition of the parameter obtained by Taguchi’s methodology as cutting speed =40mm/min, Feed rate =0.5 mm/rev, Depth of Cut =1.5mm. The Ra value obtained at optimal condition of control parameter has been compared with Ra value obtained at initial set condition of parameters such as speed =20mm/min, Feed Rate =0.25mm/rev, Depth of cut =1.5mm the comparative analysis of Ra values at different Turning condition has been summarised in Table -9

TABLE 6: Comparative Analysis of Ra

Response	Initial Condition	Optimum Condition
Level	$V_1F_1D_1$	$V_3F_2D_3$
S/N ratio	4.01	2.85
Ra(μm)	2.84	1.40

Percentage of improvement in S/N ratio =70%

Percentage of improvement in Ra value =50%

In has been observed Table 8 that the optimal combination of input parameter gives better surface finish as compared to the initial combination of input parameter for the turning of a alloy steel (AISI1040). In similar way the S/N ratios also improved sat the optimal condition between the parameters. The percentage improvements (at optimal condition) in the S/N ratio and in the Ra value are as 50% and 70% respectively. The initial and optimal value of Ra as shown in Figure-6

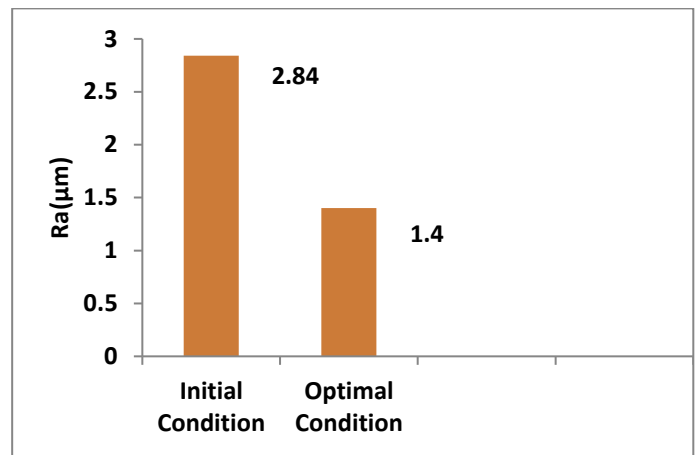


Figure -3 Comparisons between Initial and Optimal Ra(μm)

The Initial and optimal value of the surface roughness shown in the Bar Chart as shown in Figure-4

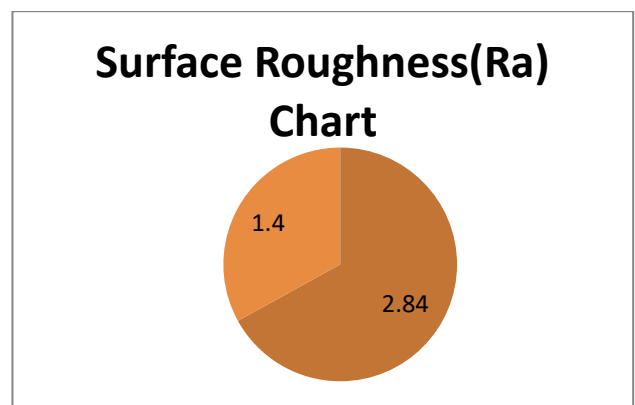


Figure -4 Pie Chart Initial and Optimum Value of Ra (μm)

IV. CONCLUSION

In present study an effort has made to optimize the process parameter for minimization of the surface roughness during the turning of AISI 1040 alloy steel. The effect of the controlled parameter such as cutting speed, feed rate, depth cut has analysed on the average surface roughness using Taguchi optimization technique. After careful analysis, following conclusion have been drawn.

1. The cutting speed is very important parameter `cutting directly and indirectly surface finish during turning of Alloy Steel 1040.
2. The primary depth of cut is low (among all the process parameter) effect on the surface finish within the range of the selected input parameters.
3. The optimum combination in between the control parameters as $V_3F_2D_3$ is obtained with the range of the selected input parameters.
4. The depth of cut is low (among all the process parameters) effect on the surface finish within the range of the selected input parameter.
5. The S/N has been improved (approximately 70) at contribution of parameter as compared to the initial condition of controlled parameter.
6. The optimal combination of the input parameter gives better surface finish as compare to initial se parameters
7. The percentage improvement in surface finish at optimum level of controlled parameter is 50% higher is obtained as compared to the initial parameters condition of the normal turning of AISI1040.

Acknowledgement

I am very grateful to **Dr. R. N .Yadav** ,Head of Department of Mechanical Engineering for providing me the necessary facilities in the Department .I would like to acknowledge with deep apperception the academic ,understanding and encouragement provide by my supervisor Dr .R.N Yadav, Prof Aamir , Depatment of Mechanical Engineering throughtout

this project work . The Patience , Inspiration guidance and Construction criticism of them was extremely valuable in this project work . Their help for beyond what a normal supervision could provide not only limited to academic aspects .

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Cite this article as :

Azadar Mehdi, "Optimize The Turning Parameter Using Taguchi Methodology", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 278-285, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST218553> Journal URL : <https://ijsrst.com/IJSRST218553>

Review on Microgrid Power Quality Improvement Using Active Power Conditioner

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ABSTRACT

This paper discusses power system power quality issues and possible remedies using power electronics. Several worldwide standards for power quality control are briefly discussed, as well as some significant methods for analysis. Non-sinusoidal waveforms are introduced and assessed in an electrical circuit. The compensatory features and principles of operation of passive filters, shunt, hybrid, and series active power filters are presented. For each type of power filter, the topologies and control schemes of various power circuits are examined. Simulation and experiment are used to prove the compensating features of each topology with its corresponding control scheme. Harmonic current, power factor, and load unbalance can all be compensated for by the filter. Harmonic current, power factor, and load unbalance can all be compensated for by the filter. A power filter that has been employed there continuously monitors the load current and adapts to changes in load harmonics.

Keywords: Microgrid, Power quality (PQ), Shunt active power Filter, Total harmonic distortion (THD).

Article Info

Volume 9, Issue 1

Page Number : 286-290

Publication Issue

January-February-2022

Article History

Accepted : 20 Feb 2022

Published : 26 Feb 2022

I. INTRODUCTION

Now-a-days with the advancement in technology there is a drastic improvement in the semi-conductor devices. With this development and advantages, the semi-conductor devices got a permanent place in the power sector helping to ease the control of overall system. Moreover, most of the

loads are also semi-conductor-based equipment. But the semi-conductor devices are non-linear in nature and draws non-linear current from the source. And also, the semi-conductor devices are involved in power conversion, which is either AC to DC or from DC to AC. This power conversion contains lot of switching operations which may introduce discontinuity in the current. Due to this discontinuity

and non-linearity, harmonics are present which affect the quality of power delivered to the end user. In order to maintain the quality of power delivered, the harmonics should be filtered out. Thus, a device named Filter is used which serves this purpose.

There are many filter topologies in the literature like- active, passive and hybrid. In this project the use of hybrid power filters for the improvement of electric power quality is studied and analysed.

Increase in such non-linearity causes different undesirable features like low system efficiency and poor power factor. It also causes disturbance to other consumers and interference in nearby communication networks. The effect of such non-linearity may become sizeable over the next few years. Hence it is very important to overcome these undesirable features.

Classically, shunt passive filters, consist of tuned LC filters and/or high passive filters are used to suppress the harmonics and power capacitors are employed to improve the power factor. But they have the limitations of fixed compensation, large size and can also exile resonance conditions.

Active power filters are now seen as a viable alternative over the classical passive filters, to compensate harmonics and reactive power requirement of the non-linear loads. The objective of the active filtering is to solve these problems by combining with a much-reduced rating of the necessary passive components.

II. LITERATURE REVIEW

To overcome the problems caused by harmonics, filters are used. There are different filter topologies present in the literature for this purpose. At first passive filters are used but they are dependent heavily on the system parameters. They also have the problems of resonance with system impedance and are suitable for filtering out a particular frequency harmonic. Therefore, to overcome the problems of passive filters, active filters are used. These are used

since 1970's to compensate the reactive power, negative sequence currents.

The use of active power filters for power quality improvement is discussed in [2]. In this paper a review of active filter configuration for power quality improvement is presented along with control strategies. It is found that the active filters are facing some drawbacks when employed for power quality improvement. They are High converter ratings are required, Costlier when compared to its counterpart, passive filter, huge size, Increased losses.

Therefore, to overcome these drawbacks a hybrid power filter which is a combination of active and passive filters is proposed in [3]. This paper discusses how a combination of both active and passive filters is an economical solution for power quality improvement. To enhance the characteristics of passive filter and also the system, the active filter should be controlled properly. There are different control techniques for this purpose.

The main aim of any control technique is to make active filter inject a voltage in to the system that compensates the harmonics. To achieve this output voltage of the active filter is controlled such that it is equal to a pre-calculated reference value. The active filter is controlled better with instantaneous reactive power theory. This is presented in [4] and it discusses the different control algorithms from the formulations of instantaneous reactive power theory. Finally, it concludes that vectoral based theory yields better results with sinusoidal currents when compared with other algorithms.

The control of series active in conjunction with shunt passive filter using dual instantaneous reactive power vectoral theory is presented in [5]. In this paper the proposed theory is validated by simulating it in MATLAB SIMULINK environment. The proposed control strategy is simulated for both balance and unbalanced load conditions.

The study of a new control technique for three-phase shunt hybrid power filter scheme is studied by author, in that scheme three phase shunt hybrid

power filter was used [6]. The author present improvement of power quality by means of unified power quality conditioner with the use of PID and fuzzy logic controller into the power system for harmonic deformation through the use of fuzzy logic controller technique is used [7]. it has proposed in PLL with PI, PID and Fuzzy Logic Controllers based Shunt Active Power Line Conditioners the three phase 415v,50hz supply given to the system the harmonics will reduces from the system [8]. The author shows that Shunt Active Power Line Conditioners for compensating harmonics and reactive power which is very useful to calculate total harmonic distortion in source current [9].

A hybrid passive filter configuration for VAR control and harmonic compensation scheme was proposed, the author the control strategy is based on the vectoral theory dual formation of instantaneous reactive power [10]. In this paper the author gives an sliding mode of control of selective and THD in voltage and current under non sinusoidal environment, which is proficient to reduce the harmonics of the power system [11].

Hybrid Active Filter for Reactive Power and Harmonics Compensation in a distribution Network by using this method the author reduces the THD in the system [12]. In this paper Compensation strategies performance comparison of shunt active filter and hybrid active filter used for improving the power factor of the system [13]. Active and passive filtering for harmonic compensation theory was proposed in which the control technique is based on the instantaneous reactive power theory for improvement of the power factor and to reduce total harmonic distortion to standard limits [14].

In [15], an adaptive fuzzy low pass filter for harmonic extraction has been proposed to ameliorate the performance of APF. three phase APF based on SRF theory with SVPWM control was proposed in [16]. PQ theory, active and reactive currents theory performance was studied under unbalanced voltage system in [17]. Study of PQ, SRF, constant active and

reactive power theory, constant (unity) power factor algorithm, sine multiplication theory has been proposed in [18]. Sliding mode-based DC voltage controller for grid current's peak detection was proposed by [19]. The use of self-tuning filter in unbalanced distorted grid voltage conditions (STF) has been proposed by [20, 21, 22, and 23]. PQ, SRF, and modified PQ theory were studied in [23].

III. SHUNT ACTIVE POWER FILTER

Figure 1 depicts a shunt active power filter diagram. At the Point of Common Coupling, a shunt active power filter is connected in parallel (PCC). PCC refers to the point where the source and load meet in the middle. In most cases, the active power filter is used.

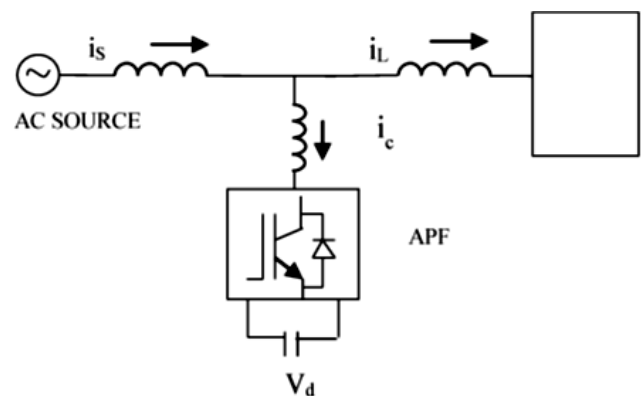


Fig 1: Shunt active power filter

The active power filter usually has an inverter structure, which can be either a voltage source inverter (VSI) or a current source inverter (CSI). Because CSI has some limitations, most of them choose VSI-based shunt active power filters. A dc link capacitor is linked to the VSI's output terminal, acting as an energy storage element and utilized to maintain a constant DC voltage with small ripple in steady state. In order to obtain better correction, the capacitor's dc link voltage must be maintained constant. This is accomplished by the use of a PI controller, which operates in a closed loop.

IV. CONCLUSION

The study of various types of filter systems is described in this research, which deals with difficulties linked to harmonics in power system networks. Several worldwide standards for the control of power quality issues are briefly presented, as well as several significant tools for electrical analysis. Non-sinusoidal waveform circuits are introduced and assessed. These tools are useful in the implementation of control algorithms for filters, among other things. Finally, new virtual impedance algorithms allow linking many active powers in the same power grid to run autonomously in decentralised microgrids, much like generation systems sharing load power. The active filters can help to improve power quality, increase grid dependability, and make dispersed microgrids more practicable.

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Cite this article as :

Amit M. Sirsat, Dr. Swapnil B. Mohod, Dr. Mohan B. Tasare, "Review on Microgrid Power Quality Improvement Using Active Power Conditioner", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 286-290, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229153> Journal URL : <https://ijsrst.com/IJSRST229153>

Economical Application of Industrial Waste in Road Construction

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ABSTRACT

In present scenario, safe disposal of industrial waste is a major issue. These waste materials pollute the environment, and many of them are nonbiodegradable. The industrial waste utilization in road construction has proved to be of great use in efficient handling of waste material generated by industries and has enhanced the properties of road. By properly utilizing the resources, it has also reduced pollution and disposal issues. In road building, a variety of industrial wastes are used as a whole or partial replacement. A study of different types of industrial waste has been discussed by many researchers and numerous experiments have been carried out to improve quality of road and have appropriate replacement in order to reduce pollution, cost of disposing waste and saving natural traditional road constructing material. This paper emphasizes on reduction of expenditure of traditional road material and have a suitable replacement of natural resources which would benefit environment and society.

Keywords: Industrial Waste, Cost Saving, Pavement, Road Construction

Article Info

Volume 9, Issue 1

Page Number : 291-300

Publication Issue

January-February-2022

Article History

Accepted : 20 Feb 2022

Published : 28 Feb 2022

I. INTRODUCTION

The Road is considered as a medium for transportation for man and goods. It is also responsible for development of locality, area and surrounding. The Road in its preliminary stage had a

very crude composition. Since there was no development on transportation technology and vehicles like carts, carriage and simple wagons constituted majorly of road vehicles.

Over the centuries as the human race progressed this resulted in development of other things. So as per the proverb: "Necessity is the mother of invention" [1].

Human race passed the era of Modernization and industrialization which made a huge impact on human society and remarkable discoveries took place which created history. One of such discovery was making of motor vehicle on 29 January 1886, Carl Benz. And after that many modifications took place simultaneously there was modification in road construction. In the past, road construction has relied on soil, stone aggregates, sand, bitumen, and cement, among other materials. The number of employers grew as a result of man's increased need. Due to all this development, there was increase in vehicles like cars, buses, truck and there has been urge to create roads for Municipal Corporation or private companies [2]. To meet the ever-increasing population demand and mans greed has costed the environment badly like deforestation, mining in order to extract materials for road etc. On the contrary the roads are imposed to tremendous loads and exposed to harsh climatic conditions which leads to roads deterioration. Due to this government has to carry separate budget for maintenance of road for every year [3].

Generally, in present scenario due to problems like exhausting of traditional road material and striving to save environment made it essential to use these materials carefully. Industrial waste product is one such category which is suggested by the scientist as the alternative material for highway construction. These industrial wastes are currently causing a disposal and pollution crisis, so their effective use in road construction can help to alleviate pollution and disposal issues [4], [5].

Waste materials such as blast furnace slag from steel industries, fly-ash from thermal power plants and coal-fired industries cement kiln dust from cement industries, phosphatic fertilizer industry phosphogypsum, and a variety of other solid waste have proven to be beneficial for road construction [6].

II. SOURCES OF INDUSTRIAL WASTE

The term "industrial waste" refers to solid, liquid, and gaseous emissions, as well as residual and undesirable scraps generated by an industrial activity or process[7].They are specialized to a given industry and their properties can range from inert to extremely biodegradable, toxic, reactive, odorous, corrosive, hot, cold, colorful, viscous, inflammable, and so on[8].

Classification of industrial waste and their sources are as follows;

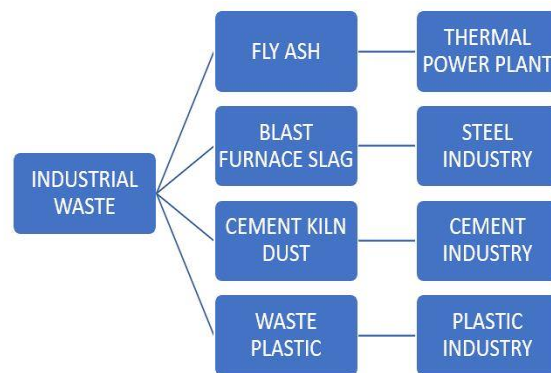


Figure 1: Classification of industrial waste [6]

1) Fly ash:

Fly ash is a finely divided residue produced by the burning of pulverised coal that is conveyed from the combustion chamber by exhaust gases. Fly ash is produced by coal-fired power and steam generating plants [6].

Classification of fly ash:

➤ F Class Fly Ash:

Fly ash is categorised as class F if it contains at least 70% silica, alumina, and iron oxide and has a low amount of calcium oxide (Cao) d) In other words, tougher, older anthracite and bituminous coal creates Class F fly ash when burned. This fly ash is pozzolanic in nature, with less than 20% lime (Cao) content [9].

➤ C Class Fly Ash:

It contains at least 50% silica (SiO₂), alumina (Al₂O₃), and iron oxide (Fe₂O₃) by mass, and the calcium oxide (Cao) concentration is high (from 10% to 30%), with a strong reactivity of practically all elements. Class C

fly is typically created by burning lignite or subbituminous coal [9].

2) Slag:

There are two types of slag depending upon Physiochemical and mineralogical characteristics:

a) Blast Furnace Slag.

Blast furnace slag is a calcium-silicate based material that is collected off the top of molten iron after it has been removed from ore in a blast furnace[10]. There are two types of BF slag are as follows;

- b) Granulated Blast Furnace Slag (GBFS).
- c) Air Cooled blast furnace slag.

3) Steel Slag.

Basic oxygen steelmaking (BOF) slag, commonly known as Linz–Donawitz steelmaking slag. Steel slag is formed in BOF convertor where steel scrap and melted pig iron are reacted by oxygen blowing [10].

4) Cement Kiln Dust:

Cement kiln dust is hazardous bypass dust produced in large quantities during the manufacturing of Portland cement [11].

5) Plastic waste:

Polymers are substances with a high molecular mass that are made up of a large number of repeating structural units derived from simple molecules Monomers are simple molecules that combine to form polymers[12][13].

III. WASTE GENERATION

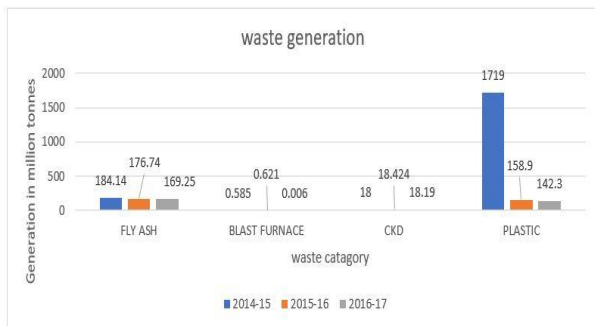


Figure 2: Waste generation data [14]–[18]

IV. INTRODUCTION TO PAVEMENT

The term pavement is normally used to describe the series of layers which form the structure of road. In Engineering terms, the pavement is defined as “A man made surface on natural ground on which the people, vehicle or animals can cross or move” [19].

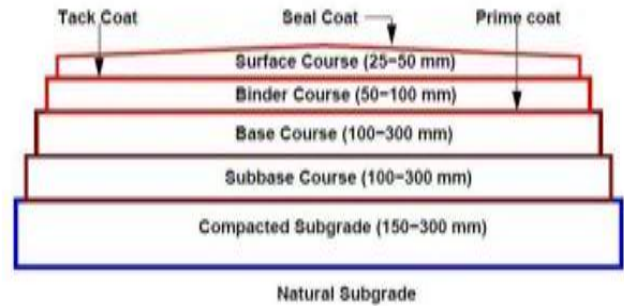


Figure 3: Cross section of road pavement [20]

1) Qualities required by pavement:

An Ideal Pavement should have followed qualities/ should fulfill following requirements:



Figure 4: Qualities of ideal pavement [21], [22]

2) Types of Pavements:

The Pavement can be classified on the basis of Structural performance into two categories are as

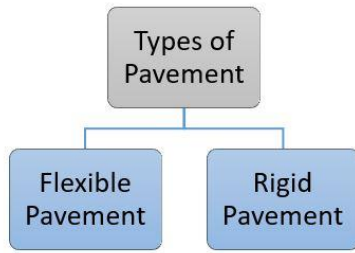


Figure 5: Types of pavements [23]

➤ Flexible Pavement:

A flexible pavement layer is one that is made up of a mixture of aggregates and bitumen that has been appropriately heated and blended before being put and compacted on a bed of granular layer [22]. Flexible pavement can be constructed in multiple layers, with the top layer being of the finest quality to endure highest compressive stress as well as wear and tear. Grain-to-grain transfer through the granular structure's points of contact will carry wheel load strains to the lower layers of flexible pavements [23]. Low-quality materials can be utilised in the lower levels because they are subjected to less stress [24].

➤ Rigid Pavement:

Rigid pavements are comprised of cement concrete or reinforced concrete slabs that are set over a low strength concrete layer or a well compacted layer of aggregates, or both [22].

3) Setbacks of flexible and rigid pavement



Figure 6: Setbacks of Flexible pavement [25]



Figure 7: Setbacks of Rigid pavement [25]

4) Pavement Material & Characterization:

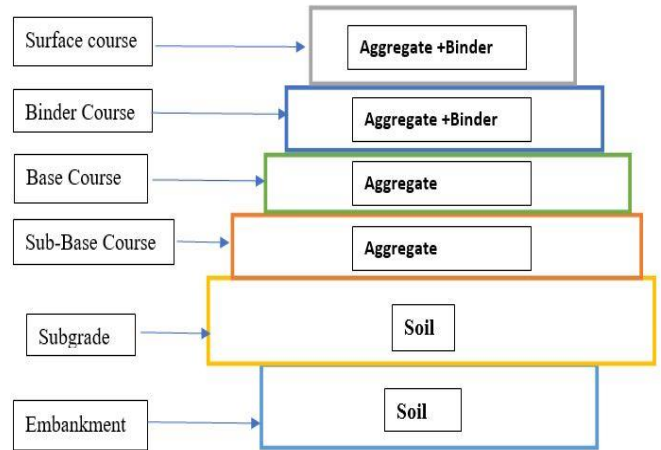


Figure 8: Pavement Material & characterization [26], [27]

V. USES & PROPERTIES OF INDUSTRIAL WASTE

1) Uses

➤ Fly ash:

- i. Portland cement concrete.
- ii. Stabilized base course.
- iii. Soil improvement
- iv. Asphalt pavements
- v. Grouts for pavement sub sealing [28], [29]

➤ Blast furnace slag:

- i. Cementitious binder
- ii. Coarse aggregate for asphalt.
- iii. Base of sub base course material.
- iv. Binder in soil stabilization [30].

➤ Cement kiln dust:

- i. Stabilization of base course.
- ii. Binder in bituminous mix.
- iii. Mineral filler in asphalt paving [31].

➤ Waste plastic:

- i. Bituminous mix.
- ii. Flexible pavement [32], [33].

2) Properties:

Table 1: Chemical composition of Industrial waste [6], [34], [35]

Component	Fly ash	Granulated blast Furnace Slag	Cement Kiln Dust
SiO ₂	50.2–59.7	30.20-35.09	55.5%
Al ₂ O ₃	14-32.4	17.54	4.5%
Fe ₂ O ₃	2.7-16.6	0.7	2.1%
CaO	0.6-9	37.80-39.50	8.1%
MgO	0.2-4.7	5.50-7.50	1.3%
K ₂ SO ₄	-	-	5.9%
Na ₂ SO ₄	-	-	1.3%
CaSO ₄	-	-	5.2%
KF	-	-	0.4%
SO ₃	N.A	0.70-1.90	-
K ₂ O	0.2-4.7	0.3	-
Na ₂ O	0.2-1.2	0.3	-
TiO ₂	0.3-2.7	0.68	-
Mn ₂ O ₃	-	-	-
MnO	-	0.83	-
P ₂ O ₃	N.A	0.37	-
P ₂ O ₅	N.A	-	-
Fe	-	0.7	-
Sulphide Sulphur	-	0.66	-
Loss on Ignition	0.5-7.2	1.08	-

Table 2: Physical Properties of Industrial waste [17], [36], [37]

Properties	Fly Ash	Granulated Blast Furnace Slag	Cement Kiln Dust	Waste Plastic
Specific Gravity	1.90-2.55	2.08-2.45	3.01-3.16	0.94-0.96
Plasticity	Non plastic	-	0-40%	Plastic
Loose bulk	-	1052	480	570

density (kg/m ³)				
Density	-	1236	1350-1500	-
Maximum dry density (gm/cc)	0.9-1.6	-	-	940
Water Absorption %	-	-	-	-
Moisture Content %	38.0-18.0	8.0-10.0	-	-
Cohesion (KN/m ²)	Negligible	-	-	0.2
Angle of Internal Friction (ϕ)	30°-40°	-	-	-
Coefficient of Consolidation C _v (cm ² /sec)	1.75×10 ⁻⁵ - 2.01×10 ⁻³	-	-	-
Compression Index (C _c)	0.05-0.4	-	-	-
Permeability	8×10 ⁶ -7×10 ⁴	-	3×10 ⁴	-
Clay Lumps and Friable particles (%)	-	1	-	-

VI. RESULTS

Let us consider, a department has to complete a construction for road work of length 1km and 6meters wide by referring pavement design guidelines created by IRC for CBR 4% the total pavement thickness would be 610 mm whose cost can be estimated are as follows

Table 3: Abstract of Cost [38]

Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
Embankment	4050	Cum	500	20,25,000/-
Subgrade	2790	Cum	1000	27,90,000 /-
Sub-Base Course	2790	Cum	2500	69,75,000 /-
Base Course	1800	Sq.m	250	4,50,000 /-
Prime Coat	6000	Sq.m	90	5,40,000 /-
Binder Course	450	Sq.m	900	4,05,000 /-
Tack Coat	6000	Sq.m	70	4,20,000 /-
Surface Course	450	Sq.m	500	2,25,000 /-
Seal Coat	6000	Sq.m	200	12,00,000 /-
Total Amount				1,50,30,000 /-

Now as we have made replacement of plastic waste in Prime, Tack & Seal coat so we will need to calculate the cost of Prime, Tack & Seal coat by blend over of pure bitumen & plastic blended bitumen.

Calculations:

Surface Area of Road which have to be cover up by Bitumen = Length × Width
 = 1000×6
 = 6000 sq.m or m².

As per IRC guideline:

For all types of road surface requires volume of bitumen 0.98-1.10 kg per sq.m for prime, tack & seal coating.

- Road Seal coat with pure Bitumen
 - Total volume of bitumen required for Prime, Tack & Seal coat
 = (Surface area of road) × (Volume of Bitumen required per sq.m)
 = 6000×1 (Say 1 kg Bitumen is reqd. per Sq.m)
 = 6000 Kg.
 - Total cost of pure bitumen Prime coat

= (Total volume of bitumen required for Prime coat) × (Rate)
 = 6000 × 90
 = Rs. 5,40,000 /-.

- Total cost of pure bitumen Tack coat
 = (Total volume of bitumen required for Tack coat) × (Rate)
 = 6000 × 70
 = Rs. 4,20,000 /-.
- Total cost of pure bitumen Seal coat
 = (Total volume of bitumen required for Seal Coat) × (Rate)
 = 6000 × 200
 = Rs. 12,00,000 /-.

2. Road Seal Coat with Bitumen and Shredded Waste Plastic

As per IRC 098:2013 Guideline,

For Road Construction use of plastic waste mixing in bitumen is in between 6% to 8% of weight of Bitumen.

- Cost of waste shredded plastic in Kilograms is in between Rs.10/Kg to Rs.16/Kg

(Above Rate is given by Rudra Environmental Solutions (India) Ltd.)

Table 4: Costing of waste plastic [39]

Sr. No	Particulars	Approx. Rate (Rs/Kg)
1	Waste Plastic	0
2	Collection of plastic	2
3	Transportation	2
4	Cleaning/ Shredding	2
5	Labour Charges	3
6	Machinery Charges Including electricity / Maintenance	2
	Total	≈ Rs. 11

- Total volume of Waste shredded plastic required for Prime, Tack and Seal Coat.
 = (Total volume of bitumen required for seal coat) × 8%
 = 6000 × 8/100

- = 480 Kg.
- Total Cost of Waste shredded plastic required for Prime, Tack and Seal Coat.
 = (Total volume of waste shredded plastic reqd. for seal coat) × (Cost of plastic per Kg)
 = 480 × 11
 = Rs. 5280 /-.
- Cost of Prime coating of proposed road with mixture of Bitumen & Waste Plastic.
 = (Actual cost of bitumen reqd. after plastic mixing) + (Total cost of waste Plastic)
 = ((6000 – 480) × 90) + (5280)
 = Rs. 5,02,080 /-.
- Cost of Tack coating of proposed road with mixture of Bitumen & Waste Plastic.
 = (Actual cost of bitumen reqd. after plastic mixing) + (Total cost of waste plastic)
 = ((6000 – 480) × 70) + (5280)
 = Rs. 3,91,680 /-.
- Cost of Seal coating of proposed road with mixture of Bitumen & Waste Plastic.
 = (Actual cost of bitumen reqd. after plastic mixing) + (Total cost of waste plastic)
 = ((6000 – 480) × 200) + (5280)
 = Rs. 11,09,280 /-.
- Total cost of plastic mixed coats
 = Prime coat + Tack coat + Seal coat
 = 5,02,080 + 3,91,680 + 11,09,280
 = Rs. 20,03,340 /-.
- Total cost of conventional coats
 = Prime coat + Tack coat + Seal coat
 = 5,40,000 + 4,20,000 + 12,00,000
 = Rs. 21,60,000 /-.

Table 5: Comparison of cost between coats

Layers	Cost by conventional method	Cost by plastic mixing
Prime coat	5,40,000	5,02,280
Tack coat	4,20,000	3,93,680
Seal coat	12,00,000	11,09,280

- Savings
 = Total cost of conventional coat - Total cost of plastic mixed coats
 = 21,60,000 – 20,03,040
 = Rs. 1,56,960 /-.
- Savings %
 = (Saving in Rs. / Total cost of conventional coats)
 = (1,56,960 / 21,60,000) × 100
 = 7.26 %

When compared to standard bitumen Prime, Tack & Seal coat, the cost savings gained are 7.26 percent. The cost savings from employing plastic in the prime, seal, and tack coat are Rs.1,56,960/-. The amended coatings have the extra benefit of lowering the viscosity of the bituminous mix. This enables a lower operating temperature, resulting in decreased VOC and CO emissions. In terms of wear resistance, plastic-bitumen composite roads exceed normal asphalt concrete roads.

VII. CONCLUSION

From this study paper it concludes that around 7.26% of cost has been cut back following the use of waste plastic in bitumen. Using this modified bitumen seal coat not only reduces the budget but also enhances the properties of coat layer. The use of industrial waste in various road projects will eventually result in decline of waste in dumping yards. The industrial waste reduces the use of exhaustible conventional materials, which contributed to environmental pollution and also required high cost of extraction. In accordance to the above point, the use of industrial waste should be encouraged in construction of road projects in India, since it not only proves to be cost friendly but also eco-friendly in an already overly polluted environment.

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Cite this article as:

Tejas Biranje, Omkar Lad, Shataratha Navale, Sumeet Bankar, Dr. Mrs. Sonali Dhokpande, "Economical Application of Industrial Waste in Road Construction", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 291-300, January-February 2022. Available at doi: <https://doi.org/10.32628/IJSRST229171>
Journal URL: <https://ijsrst.com/IJSRST229171>

Distributed Estimation with Decentralized Control for Quadruple-Tank Process

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ABSTRACT

This paper proposes the design of quadruple-tank process due to the unique multivariable MIMO system under minimum and non-minimum scenario with respect to the valve ratio. This model is then implemented the distributed estimation algorithm with decentralized control. The inputs are set in divergent gains of pumps while the four-tank process is interconnected so that the stability properties are different, making the usage of decentralized control is reasonable. The number of outputs is designed the same as those of inputs which are also that of distributed Luenberger observer with the continuous linearized dynamical system. This distributed comprises local estimates only in certain output, meaning that it would lead to insufficiency so that the neighbouring links under some network topologies are required in the dynamical system. This concept fortunately works in two different characteristic stability of the tank process regarding estimating the states. This success leads to the further research of the more large-scale dynamic complex system.

Keywords: Decentralized Control, Distributed Estimation, Quadruple-Tank Process, Sensor Networks

Article Info

Volume 9, Issue 1

Page Number : 301-307

Publication Issue

January-February-2022

Article History

Accepted : 20 Feb 2022

Published : 28 Feb 2022

I. INTRODUCTION

The design dealing with complex multivariable dynamical systems have been attracting a lot of interest in the field of control theory, such as quadruple-tank process [1] and [2]. This scaled structure is particularly suitable in measuring the performance limitation according to the identification batch-algorithm model [3] of the complex control system with the non-minimum mentioned [4] as the elaboration of [5]. Since the system is interconnected meaning that one could influence another, this also leads to the importance of guaranteeing the poles in the left-plane. Several control theories have been proposed to handle this with the mathematical model built in from the sliding-mode [6], robust control [7], or the more advanced predictive control as done in [8]. Furthermore, it could be generalized with the structure of decentralized control as stated in [9] and [10] with the capable of linearizing the non-linear dynamics so that the location of the stability could be

well-administered. This quadruple tanks refers to what was done by [2] with two divergent scenarios of the stable minimum and the difficult with the non-minimum phase, however, the analysis of the zero locations are not discussed, just yet. Notwithstanding, this plant is applied to test based on the estimation concept of the proposed filtering module [11] and distributed estimation based on the classical Luenberger observer as conducted in [12] and [13] for the linear system. This distributed algorithm currently has been widely studied as a new window in the control field to locally predict the states through neighbouring links. The history of distributed is succeeded by the decentralized done in [14] with the interconnected system based on the classical Kalman filtering and its distributed in [15]. Furthermore, the track fusion applying the cross covariance was also initiated by [16] with the evolution of the maximum likelihood (ML) as [17]. The consensus of the distributed is well-defined in [18] whereas the consensus filtering is conducted in [19] with the same Kalman

filtering and its pseudo estimates [20] and decoupling control [21], even with the augmented estimates from the fusion itself [22]. The ideas behind the research conducted in [12] are used further in [23] being inspired by the estimator in the domain of discrete-time applying deep elaboration of the observability connection as stated in [24]. The required conditions are suggested in [24] regarding the necessary and sufficient to build the augmented observer with appearance of the distributed estimation using the concept of detectability [5] that for certain node i paralleling with the output i , it needs the information from the connected node from the topology. The construction of the paper is then initiated with the mathematical modelling of the quadruple-tank process along with the decentralized control. The following is the distributed observer and the numerical scenarios to show the proposed ideas under some criteria regarding the limitation being ended by the conclusion.

II. MATHEMATICAL DESCRIPTION

The scheme of quadruple-tank process comprising four interconnected tanks being driven by two pumps as depicted in Fig. (1). This tank process includes multivariable-input multivariable-output (MIMO) plant with two inputs and outputs, constituting the input (u) voltages to both pumps (v_1, v_2) influencing the whole tanks and the output (y) voltages from both level measurement devices (y_1, y_2) in tank 1 and 2. Since the measurement devices are located only in the bottom two tanks, the objective is to maintain the level (h_i) of the tanks working in certain design of set-point with inlet flow rates. While the pumps run, they are then divided into two directions using the three-way valve, which each of them operates only to the two diagonal position tanks.

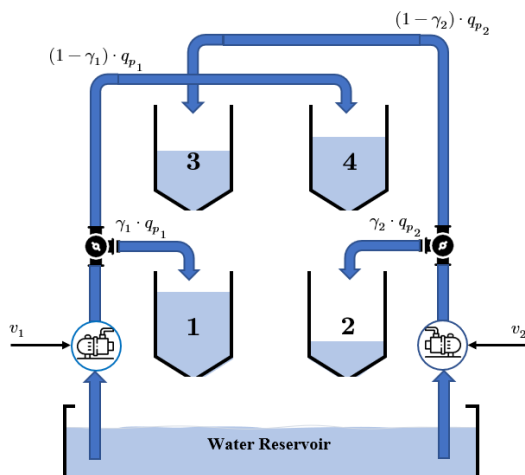


Figure 1: The design of quadruple-tank process

The voltage being implemented to pump n with $n = 1,2$ is v_n and the corresponding outlet flow from n -th pump is $q_p(n)$, which equals to $k_n v_n$ where k is the constant pump and v_n is the velocity rate going through the pump. Another important

scenario is the position or behaviour of the valves, affecting the distribution to those four tanks, with the ratio of $(\gamma_1, \gamma_2) \in [0,1]$. This means that if from the i -th pump, the ratio to tank 1 is (γ_1) , with flow rate $\gamma_1 k_1 v_1$, then the counterpart ratio of tank 4 is $(1 - \gamma_1)$, with flow rate $(1 - \gamma_1) k_1 v_1$. Similarly, this concept also administers the rest two tanks with another ratio (γ_2) from another pump. The dynamic of the tanks refers to this paper [2] and the mathematical models are presented as follows. Firstly, it is required to consider the mass balance theorem and the law of Bernoulli's, saying that the accumulation rate of mass in a system (m_T) equals to the difference between mass of inlet flow (m_i) and the outlet (m_o) to the system.

$$\frac{dm_T}{dt} = m_i - m_o \tag{1}$$

and the Eq. (1) could be altered into the non-linear process depending on the fluids, therefore

$$A \frac{dh}{dt} = \rho q_i - \rho q_o \tag{2}$$

Since the fluid is the same with $\rho_1 = \rho_2 = \rho_3 = \rho_4$, Eq. (2) is simplified with Eq. (3)

$$A_i \frac{dh_i}{dt} = (q_i)_i - (q_o)_i \tag{3}$$

where for certain tank $i = 1, \dots, 4$, the variables of A_i, h_i, q_i , and q_o represent the cross-sectional area of certain tank, the fluid level, the inlet and the outlet flow of the tanks respectively. Moreover, the inlet flow for the whole tanks q_{i_1}, \dots, q_{i_4} affected by the ratio of the valve γ_n is described as follows,

$$\begin{aligned} q_{i_1} &= \gamma_1 k_1 v_1; & q_{i_3} &= (1 - \gamma_2) k_2 v_2; \\ q_{i_2} &= \gamma_2 k_2 v_2; & q_{i_4} &= (1 - \gamma_1) k_1 v_1 \end{aligned} \tag{4}$$

whereas the outlet flow from a tank $q_o(i)$ is denoted in Eq. (5) with a_i and g are the open cross-section of the bottom-outlet flow and the gravitational acceleration in turn

$$q_{o_i} = a_i \sqrt{2gh_i} \tag{5}$$

Taking the whole dynamics (inlet-outlet) of the tanks along with the parameters of the valve and the pumps, the non-linear dynamic of the quadruple-tank from Fig. (1) is shown below. Keep in mind that there exist two inputs from lower tanks, flowing from the pipe and the upper outlet tanks which are affected by the diagonal-term of the corresponding pump

$$\Delta h \tag{6}$$

$$A_4 \frac{dh_4}{dt} = q_{i_4} - q_{o_4} = (1 - \gamma_1)k_1 v_1 - a_4 \sqrt{2gh_4}$$

The Bernoulli's law in Eq. (6) could be then reconstructed in Eq. (7) for the sake of the state-space representation, therefore

$$\begin{aligned} \frac{dh_1}{dt} &= -\frac{a_1}{A_1} \sqrt{2gh_1} + \frac{a_3}{A_1} \sqrt{2gh_3} + \frac{\gamma_1 k_1}{A_1} v_1 \\ \frac{dh_2}{dt} &= -\frac{a_2}{A_2} \sqrt{2gh_2} + \frac{a_4}{A_3} \sqrt{2gh_4} + \frac{\gamma_2 k_2}{A_2} v_2 \\ \frac{dh_3}{dt} &= -\frac{a_3}{A_3} \sqrt{2gh_3} + \frac{(1 - \gamma_2)k_2}{A_3} v_2 \\ \frac{dh_4}{dt} &= -\frac{a_4}{A_4} \sqrt{2gh_4} + \frac{(1 - \gamma_1)k_1}{A_4} v_1 \end{aligned} \tag{7}$$

Eq. (7) could be also simplified for the so-called conductance K_i . The variables being used in the laboratory-scale process are written in Table (I) regarding the upper (A_i) and lower (a_i) open cross-sectional for each tank (i) along with the ratio of the measured gain signals (k_c) whilst Table (II) asserts the condition of the couple operating points of the quadruple-tank process comprising the initial values of level (h_i^0) and velocity (v_i^0). Furthermore, those are defined as P_- and P_+ declaring the minimum-phase and the counterpart of non-minimum-phase scenario in turn

$$K_i = \frac{a_i}{A_i} \sqrt{2g} \tag{8}$$

TABLE I
Parameter of the laboratory-scale quadruple-tank

Variable	Unit	Values
A_1, A_3	cm ²	28
A_2, A_4	cm ²	32
a_1, a_3	cm ²	0.071
a_2, a_4	cm ²	0.057
k_c	V/cm	0.5
g	cm/s ²	981

TABLE II
Operating points of the minimum P_- and non-minimum phase P_+ of the quadruple-tank process

Variable	Unit	P_-	P_+
$(h_1^0), (h_2^0)$	cm	(12.4), (12.7)	(12.6), (13.0)
$(h_3^0), (h_4^0)$	cm	(1.8), (1.4)	(4.8), (4.9)
$(v_1^0), (v_2^0)$	V	(3.00), (3.00)	(3.15), (3.15)
$(k_1), (k_2)$	cm ³ /Vs	(3.33), (3.35)	(3.14), (3.29)
$(\gamma_1), (\gamma_2)$		(0.70), (0.60)	(0.43), (0.34)

The non-linear model in Eq. (7) could be changed into the linear approximation by proposing the following variables $x_i = h_i - h_i^0, u_i = v_i - v_i^0$ from Table (II). With the standard state-space design of $\dot{x} = Ax + Bu$ and the output $y = Cx$, the complete equation is presented in Eq. (9). Moreover, the certain values of time-constant for each tank T_i is influenced by the initial level h_i^0 and the static variables, as shown in Eq. (10), such that

$$T_i = \frac{A_i}{a_i} \sqrt{\frac{2h_i^0}{g}} \tag{10}$$

$$\frac{dx}{dt} = \begin{bmatrix} -\frac{1}{T_1} & 0 & \frac{A_3}{A_1 T_3} & 0 \\ 0 & -\frac{1}{T_2} & 0 & \frac{A_2}{A_2 T_4} \\ 0 & 0 & -\frac{1}{T_3} & 0 \\ 0 & 0 & 0 & -\frac{1}{T_4} \end{bmatrix} x + \begin{bmatrix} \frac{\gamma_1 k_1}{A_1} & 0 \\ 0 & \frac{\gamma_2 k_2}{A_2} \\ 0 & \frac{(1 - \gamma_2)k_2}{A_2} \\ \frac{(1 - \gamma_1)k_1}{A_1} & 0 \end{bmatrix} u; \quad y = \begin{bmatrix} k_c & 0 & 0 & 0 \\ 0 & k_c & 0 & 0 \end{bmatrix} x \tag{9}$$

$$G(s) = C(sI - A)^{-1}B + D = \begin{bmatrix} \frac{\gamma_1 c_1}{1 + sT_1} & \frac{(1 - \gamma_2)c_1}{(1 + sT_3)(1 + sT_1)} \\ \frac{(1 - \gamma_1)c_2}{(1 + sT_4)(1 + sT_2)} & \frac{\gamma_2 c_2}{1 + sT_2} \end{bmatrix} \rightarrow c_n = \frac{T_n k_n k_c}{A_n} \tag{11}$$

$$G_-(s) = \begin{bmatrix} \frac{2.6}{1 + 62s} & \frac{1.5}{(1 + 23s)(1 + 62s)} \\ \frac{1.4}{(1 + 30s)(1 + 90s)} & \frac{2.8}{1 + 90s} \end{bmatrix} \quad G_+(s) = \begin{bmatrix} \frac{1.5}{1 + 63s} & \frac{2.5}{(1 + 39s)(1 + 63s)} \\ \frac{2.5}{(1 + 56s)(1 + 91s)} & \frac{1.6}{1 + 91s} \end{bmatrix} \tag{12}$$

$$\det G(s) = \frac{c_1 c_2}{\gamma_1 \gamma_2 \prod_{i=1}^4 (1 + sT_i)} \times \left[(1 + sT_3)(1 + sT_4) - \frac{(1 - \gamma_1)(1 - \gamma_2)}{\gamma_1 \gamma_2} \right] \tag{13}$$

From Eq. (10) and Table (II), the time-constant for each operating-point is shown in Table (III) which is used in the state-space matrices Eq. (9) and the transfer functions Eq. (11),

TABLE III

Time-constant for the operating points P_- and P_+		
Variable	P_-	P_+
(T_1, T_2)	(62,90)	(63,91)
(T_3, T_4)	(23,30)	(39,56)

For the particular h_i^0 , the transfer function in Eq. (11) is utilized to yield the stationary control signal from Eq. (9) with specific (c_i). Keep in mind that the valve ratio γ_n for the non-minimum P_+ and minimum P_- is set with $0 < (\gamma_1 + \gamma_2) < 1$ and $1 < (\gamma_1 + \gamma_2) < 2$ as written in Table (2).

The transfer function in Eq. (11) is affected by the variables working in two different operating points. Moreover, this means the transfer function results in two divergent physical modelling as reported in Eq. (12). More specifically, $G_-(s)$ represent the minimum phase whereas the $G_+(s)$ constitutes the non-minimum scenario. Transfer functions in Eq. (11) and (12) have zero locations leading to the physical representation of the system with respect to certain ratio of γ_n . The zeros in Eq. (11) are then supposed to be the numerator of the following characteristic rational formula as written in Eq. (13). These zero results furthermore in the analysis of either left- or right-half plane. From Eq. (14), it can be inferred that the analysis of determining the scale of γ_1 and γ_2 is if the $\eta \rightarrow 0$, the two zeros are approaching the negative of either a T_3 or T_4 while as $\eta \rightarrow \infty$, those would be then in the extremely asymptotically (-/+) of ∞ , such that

$$\eta := \frac{(1 - \gamma_1)(1 - \gamma_2)}{\gamma_1 \gamma_2} \tag{14}$$

Recalling the parameters of minimum and non-minimum, the first accounts for $(\gamma_1 + \gamma_2) = 1.30 > 1$ which means that the flow going to the two bottom tanks is greater than that of the two top tanks and by contrast, (P_+), the flow to the lower tanks would be smaller compared to the upper. This also indicates that controlling the two bottom tanks is much easier than the left (1 & 3) or the right (2 & 4) tanks. Beyond that, the zeros location is not the only consideration, rather the direction. Likewise, the transfer function (G) is having the zero direction by the following equation Eq. (15) and (16).

Another concept is what was proposed by [25] regarding the relative gain array (RGA) denoting how the MIMO control system is measured. This is defined as $Y = (G)_0 * (G^{-1})_0$ where the symbol of (*) describes the multiplication by element (-†) with the inverse transpose of matrix. The RGA of this system is given as follow depending solely on the valve ratio, therefore

$$\lambda = \frac{\gamma_1 \gamma_2}{\gamma_1 + \gamma_2 - 1}$$

$$\tilde{\lambda} = \frac{(1 - \gamma_1)(1 - \gamma_2)}{1 - \gamma_1 - \gamma_2} \tag{17}$$

For the decentralized scenario with the non-minimum, the RGA then is designed as Eq. (17) indicating that $\tilde{\lambda} > 0$ and this is preferable. Moreover, the stability property is also considered for the input gain flow v_n^0 if Eq. (18)

$$\begin{bmatrix} \gamma_1 k_1 & (1 - \gamma_2) k_2 \\ (1 - \gamma_1) k_1 & \gamma_2 k_2 \end{bmatrix} \tag{18}$$

is a non-singular matrix with $\gamma_1 + \gamma_2 \neq 1$

III. DECENTRALIZED CONTROL

Since the quadruple-tank is the multivariable control system, the decentralized control is proposed with $u = \text{diag}[C_1 \ C_2] e$ as depicted in Fig. (2) for the specific proportional-integral (PI) control law as written in Eq. (20). Decentralized control requires the parallel dimension of input-output system and the positive diagonal element of RGA $G(0)$ with this decentralized makes it easy to be controlled, otherwise, with negative diagonal element, it leads to be the instability

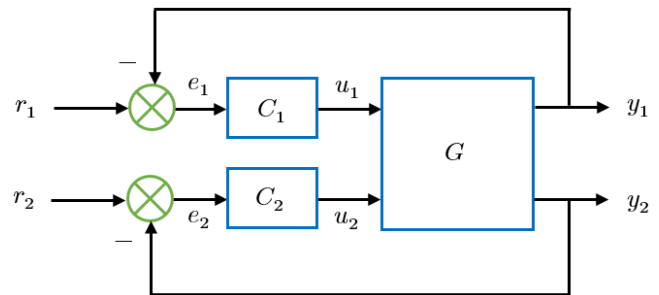


Figure 2: Decentralized control design with the coupling of C_1 and C_2

Inside the $G(s)$, the transfer function is designed as in Eq. (19) and the control gain parameters being used in the simulation are obtained from the root-locus calculation. Those gain K_p, K_i

$$\begin{bmatrix} \psi_1 \\ \psi_2 \end{bmatrix}^T \begin{bmatrix} \frac{\gamma_1 c_1}{1 + zT_1} & \frac{(1 - \gamma_2) c_1}{(1 + zT_3)(1 + zT_1)} \\ \frac{(1 - \gamma_1) c_2}{(1 + zT_4)(1 + zT_2)} & \frac{\gamma_2 c_2}{1 + zT_2} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}^T \tag{15}$$

$$\text{RGAY} = \begin{bmatrix} \frac{\gamma_1 \gamma_2}{\gamma_1 + \gamma_2 - 1} & \frac{-(1 - \gamma_1)(1 - \gamma_2)}{\gamma_1 + \gamma_2 - 1} \\ \frac{-(1 - \gamma_1)(1 - \gamma_2)}{\gamma_1 + \gamma_2 - 1} & \frac{\gamma_1 \gamma_2}{\gamma_1 + \gamma_2 - 1} \end{bmatrix} \rightarrow \begin{bmatrix} \lambda & 1 - \lambda \\ 1 - \lambda & \lambda \end{bmatrix} \tag{16}$$

values for certain pump n are different and this research focuses on the minimum phase P_- only to be implemented using the distributed estimation explained in the next chapter.

$$G(s) = \begin{bmatrix} G_1 & G_2 \\ G_3 & G_4 \end{bmatrix} = \begin{bmatrix} \frac{\Phi_1}{\varphi_1 s + \xi_1} & \frac{\Phi_2}{\vartheta_2 s^2 + \varphi_2 s + \xi_2} \\ \frac{\Phi_3}{\vartheta_3 s^2 + \varphi_3 s + \xi_3} & \frac{\Phi_4}{\varphi_4 s + \xi_4} \end{bmatrix} \quad (19)$$

$$C_n = K \left(1 + \frac{1}{(T_i)_{nS}} \right) \rightarrow n = 1,2 \quad (20)$$

IV. DISTRIBUTED ESTIMATION

Since the area of control systems have been increasing upon the demand of the more complex systems, one is to estimate the state from networked system. To deal with this, the usage of distributed estimation with switching its localization into key neighbourhood communication [12] and [13] attracts the most as portrayed in Fig. (3)

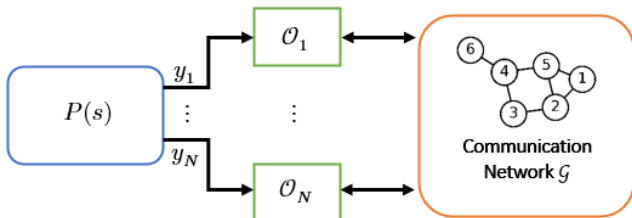


Figure 3: Scheme of distributed estimation over N output y_N and observer O_N

Suppose the following time-domain linear system as in Eq. (21), where $x \in \mathbb{R}^n$ and $y \in \mathbb{R}^p$ are the state and measurement in turn. This distributed enables the y as $\text{col}(y_1, \dots, y_N)$ and H_i as

$\text{col}(H_1, \dots, H_N)$ with N is assigned the number of nodes in the network \mathcal{G} , where $\sum_{i=1}^N p_i = p$ and $y_i \in \mathbb{R}^{p_i}$. This y_i is then assumed as the solely key data being obtained by certain local node (i) to estimate the states by using the neighbouring links to cope with the lack of insufficient data with the constraint of the designed network topology,

$$\frac{dx}{dt} = Ax, \quad y = Hx = \begin{bmatrix} H_1 \\ \vdots \\ H_N \end{bmatrix} x = \begin{bmatrix} y_1 \\ \vdots \\ y_N \end{bmatrix} \quad (21)$$

Furthermore, this research considers the distributed estimation with Luenberger structure containing N local output and observers having the following dynamics for each node i as stated in Eq. (21), where $\hat{x}_i \in \mathbb{R}^n$, $L_i \in \mathbb{R}^{n \times p_i}$ and $M_i \in \mathbb{R}^{n \times n}$ are the estimated state, the injection and weighting gain matrices to be designed for node i . The values of γ and \mathcal{N}_i is a scalar coupling gain and the communicated nodes of certain node i . More specifically, the matrices of L_i and M_i comprises

$$L_i := T_i \begin{bmatrix} L_{id} \\ 0 \end{bmatrix}, \quad M_i(k_i) := T_i \begin{bmatrix} k_i M_{id} & 0 \\ 0 & I_{\sigma_i} \end{bmatrix} \quad (23)$$

with the weighted values of $k_i \geq 1$ along with the identity matrix of I_{σ_i} . σ_i shows the size of the matrix from the size information from the undetectable subspace U_i of the couple (A, H_i) . Moreover, the orthonormal matrix T_i should be designed from the following criteria to obtain the desired value, such that

$$H_i T_i = \begin{bmatrix} H_{id} & 0 \\ A_{id} & 0 \\ A_{ir} & A_{iu} \end{bmatrix} \quad (24)$$

where the couple (A_{id}, H_{id}) suppose to be detectable $U_i = 0$. Keep in mind that the definition if detectable if slightly lower

$$\dot{\hat{x}}_i = A\hat{x}_i + L_i(y_i - H_i\hat{x}_i) + \gamma M_i^{-1}(k_i) \sum_{j \in \mathcal{N}_i} (\hat{x}_j - \hat{x}_i) \quad (22)$$

$$(A_{id} - L_{id}H_{id})^T M_{id} + M_{id}(A_{id} - L_{id}H_{id}) = -I_{n-\sigma_i} \quad (25)$$

$$\dot{\hat{x}}_i = A\hat{x}_i + L_i(y_i - H_i\hat{x}_i) + \gamma M_i^{-1}(k_i) \sum_{j=1}^N \alpha_{ij} (\hat{x}_j - \hat{x}_i) \quad (26)$$

$$\left(k_i - \frac{\beta}{\theta(\bar{\epsilon})} \right) \left(\gamma - \frac{\bar{\beta}}{2\lambda_2} \right) > \frac{\bar{\beta}^2 N^2}{2\lambda_2 \theta(\bar{\epsilon})}; \rightarrow \forall i \in \mathcal{N}; \quad k_i \geq 1; \quad \gamma > \frac{\bar{\beta}}{2\lambda_2}; \quad \theta(\bar{\epsilon}) = \frac{1}{2} \left(1 - \left(1 - \frac{\bar{\epsilon}^2}{2} \right)^2 \right) \quad (28)$$

$$M_i(k_i)(A - L_i H_i) = T_i \begin{bmatrix} k_i M_{id} & 0 \\ 0 & I_{\sigma_i} \end{bmatrix} T_i^T (A - L_i H_i) T_i T_i^T = T_i \begin{bmatrix} k_i M_{id} & 0 \\ 0 & I_{\sigma_i} \end{bmatrix} \begin{bmatrix} A_{id} - L_{id} H_{id} & 0 \\ A_{ir} & A_{iu} \end{bmatrix} T_i^T \quad (29)$$

$$e_i = \hat{x}_i - x \rightarrow \frac{de_i}{dt} = (A - L_i H_i)e_i + \gamma M_i \sum_{j=1}^N \alpha_{ij} (e_j - e_i) \quad (30)$$

$$= \Lambda e - \gamma \bar{M} (\mathcal{L} \circ I_n) e \rightarrow \begin{cases} \Lambda = \text{diag}\{A - L_1 H_1 & \dots & A - L_N H_N\} \\ M = \text{diag}\{M_1 & \dots & M_N\} \end{cases}$$

than observability saying that the states condition of the unobservable is stable. The next is to find the matrices of L_{id} and M_{id} which could be opted from solving $A_{id} - L_{id}H_{id}$ as the Hurwitz and the following equation in Eq. (25) in turn and the complete equation for certain local i in the observer is denoted in Eq. (26). Bear in mind that the initial states designed from Eq. (21) and (22) are maintained to be converged the true states as in Eq. (27) with the assumption that the network topology is then connected yet undirected along with the detectability of the couple (A, H)

$$\lim_{t \rightarrow \infty} \|\hat{x}_i(t) - x(t)\| \quad (27)$$

If the parameters of k_i and γ are opted rewarding the conditions in Eq. (28) with $\beta_i := 2\|A_{ir}\|^2 + \|A_{iu}^T + A_{iu}\|$ and $\bar{\beta} := \max(i \in \mathcal{N}) \beta_i$ where β is the sum of β_i from 1 to N . The idea of the characteristic of T_i is that it is the orthonormal matrix so that it satisfies following the Eq. (29) with the error of the local node i in Eq. (30) as the combination of the two equations, Eq. (21) and (22).

V. NUMERICAL SCENARIOS

This chapter is used to elaborate the concept with some simulation. The dynamic of the system is presented in Eq. (9) with the suitable parameter as in Table (1), (2), and (3) for certain phase-conditions either minimum P_- or non-minimum P_+ . Since the nodes are only two $N = 2$, the communication occurs between them with $y_i = H_i x$,

$$\begin{aligned} H_1 &= [k_c \quad 0 \quad 0 \quad 0] \\ H_2 &= [0 \quad k_c \quad 0 \quad 0] \end{aligned} \quad (17)$$

The detail parameters being used in the simulation are $\gamma = 6$, $k_1 = 3$, and $k_2 = 4.5$ with initial condition of $x_0 = [8 \quad 5 \quad -2 \quad 1]$ along with decentralized control parameters of $(K_1 T_{i1})_1 = (3,30)$ and $(K_2 T_{i2})_1 = (2.7,40)$ for the minimum phase P_- and for the non-minimum phase P_+ of $(K_1 T_{i1})_2 = (1.5,110)$ and $(K_2 T_{i2})_2 = (-0.12,220)$ with ten times settling time longer than that of the minimum-phase. The parameters for distributed estimation are presented in the following details, such that,

$$\begin{aligned} T_1 &= \begin{bmatrix} I_2 & \mathbf{0} \\ \mathbf{0} & I_2 \end{bmatrix} & T_2 &= \begin{bmatrix} I_2 & \mathbf{0} \\ \mathbf{0} & I_2 \end{bmatrix} \\ L_{1d} &= \begin{bmatrix} 3 \\ 1 \end{bmatrix} & L_{2d} &= \begin{bmatrix} -1 \\ 3 \end{bmatrix} \\ M_{1d} &= \begin{bmatrix} 0.5 & -0.5 \\ 0.5 & 1 \end{bmatrix} & M_{2d} &= \begin{bmatrix} 0.286 & -0.25 \\ -0.25 & 0.387 \end{bmatrix} \end{aligned}$$

The numerical scenario for minimum phase shows that the system could deal with the interconnected tanks system with the proposed parameters as being depicted in Fig. (4c) with the following error in Fig. (4a). Keep in mind that the peak errors happened are due to the changes of set-points as shown in the time of 100, 200, 300 and 350 from the two voltages since the four tanks are the interconnected system which affects one from others. However, the dynamics MIMO system is then stabilizing with the very fast time. By contrast, the non-minimum phase is much more difficult to be controlled and it needs ten times setting time than that of their counterparts as presented in Fig. (4b) for the error and Fig. (4d) for the output dynamics. Likewise, the peaks occurred are made of the changes of set-points. Furthermore, regarding the distributed estimation, both true states (x) response with the black-dashed

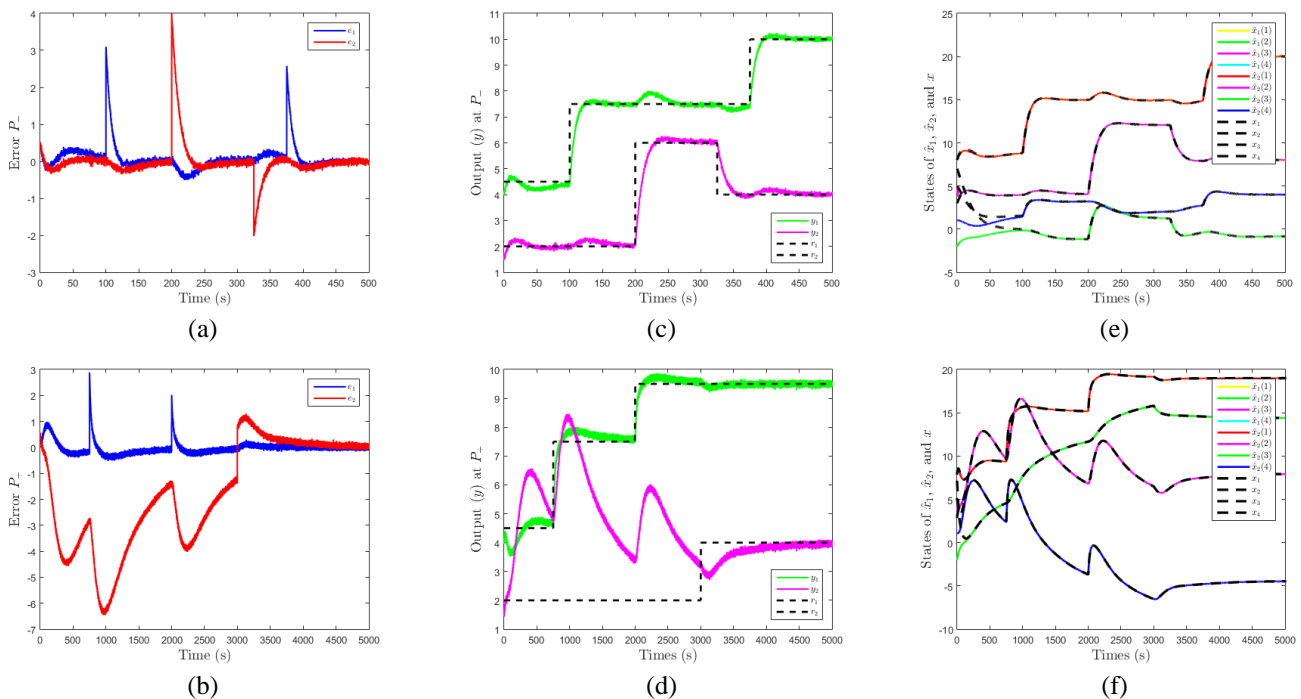


Figure 4: The error of the two parameters from the minimum-phase P_- as (a) and the non-minimum P_+ as (b) using decentralized PI control; The two responses of the true output (y) from P_- as (c) with 500s and P_+ as (d) with ten times longer settling time by 5000s with the same gains of control as designed; The response states of the distributed estimation of the P_- (e) and P_+ (f) with the same initial conditions.

lines could be followed by the estimates of (\hat{x}_1) and (\hat{x}_2) . Regarding Fig. (4e)-Fig. (4f), the performance of the estimation is depicted and shows the ability of tracking.

VI. CONCLUSION

The mathematical dynamics of the quadruple-tank have been written along with some key parameters, such that the valve gains dividing the flow with $\gamma_1 + \gamma_2 < 1$ would be non-minimum and otherwise is the minimum. The constructed decentralized PI control also show the adverse of maintaining the scenario of non-minimum compared to their counterpart. With respect to the distributed estimation, it has been designed using local communication as much as the number of outputs. This local Luenberger observer design could deal with the dynamics of the quadruple-tank process while it is erratic in the early stages of iterations. Our future work would be the changes of distributed estimation along with some distributed fault detection and fault-tolerant control.

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Cite this Article : Moh Kamalul Wafi, Bambang L. Widjiantoro, "Distributed Estimation with Decentralized Control for Quadruple-Tank Process", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 301-307, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229167>
Journal URL : <https://ijsrst.com/IJSRST229167>

Analysis Of Acceptance and Use of E-Procurement Applications Using Unified Theory of Acceptance and Use of Technology (UTAUT) In the Procurement of Goods and Services at PT. JMS

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ABSTRACT

This study analyzes the acceptance and use of e-Procurement applications using the UTAUT Model developed by Vankatesh (2003). Respondents in this study were 182 people from the entire population at PT. JMS has the duty to carry out procurement or parties who have an interest in e-procurement applications. There are six hypotheses in this study that have been processed using partial least squares (PLS). Research shows that performance expectations, business expectations and social factors significantly influence the interest in using e-Procurement applications, as well as the conditions that facilitate and interest in the use of technology significantly influence the behavior of using e-Procurement applications. This research model results in an R² value in the endogenous construct of technology utilization interest of 0.64 and an R² value in the endogenous construct of application usage behavior of 0.73 which means that the model is substantial enough to predict the acceptance and use of e-Procurement applications in the procurement process goods and services at PT. JMS.

Keywords: UTAUT, e-Procurement, Partial Least Square

Article Info

Volume 9, Issue 1

Page Number : 308-315

Publication Issue

January-February-2022

Article History

Accepted : 20 Feb 2022

Published : 28 Feb 2022

I. INTRODUCTION

An effective and efficient in procurement of goods and/or services of PT. JMS is one of the important part in improving the financial management of PT. JMS. Geographical location of PT. JMS which spread throughout Indonesia does not allow the procurement process to be carried out in a centralized manner so that it is carried out by each unit of work.

One of the control of the procurement process carried out by each unit of work, PT. JMS utilizes information technology in the process of procuring goods and/or services. The process of procuring goods and/or services of PT. JMS by electronic system will further improve and ensure efficiency, effectiveness, transparency and accountability in the spending of PT. JMS. In addition, the process of procuring goods / or services of PT. JMS by electronic system can also ensure the availability of information, and encourage fair competition and the realization of justice (non-

discriminative) for all business actors who participate in the process of procuring goods and/or services at PT. JMS.

In the context of implementing the procurement of goods and/or services of PT. JMS with the electronic system, the Deputy Director of Procurement developed an electronic application for the procurement of goods and/or services called e-Procurement to be applied in the process of procuring goods and/or services at the Head Office, Regional Offices and Branch Offices throughout Indonesia.

Nowadays, the utilization of the e-Procurement application is not maximized, in fact there are still many procurement processes that are carried out without using the e-Procurement application, employees who carry out the procurement process know the benefits of using the e-Procurement application but for reasons of sudden procurement or it is easier without using the application makes the procurement implementers do not use the e-Procurement application.

The level of user acceptance regarding the implementation of the e-Procurement application at PT. JMS can be measured by one of the theoretical approaches that can describe the level of acceptance and use of a technology, namely the Unified Theory of Acceptance and Use of Technology (UTAUT). Through UTAUT, it can be understood that the reactions and perceptions of users towards technology can influence their attitude in accepting the use of technology.

II. BASIC THEORY

A. E-Procurement

Electronic procurement or e-Procurement is the procurement of goods and/or services carried out using information systems and electronic transactions in accordance with statutory provisions. According to Hardjowijono (Nightisabha et al, 2009) that the

benefits of implementing e-Procurement are as a tool in creating governance that is free from corruption and nepotism as a macro benefit from e-Procurement, and as for the direct benefits expected from the implementation of e-Procurement which is a shorter process, especially in terms of time and bureaucracy as well as cost savings in the procurement process. E-Procurement according to Muhtar (2011) is an electronic procurement of goods and services that regulates business transactions through computers and the process of procuring goods and services is carried out online. The benefits of e-Procurement according to Palmer (Nightisabha et al, 2009) are achieving good collaboration between buyers and suppliers, reducing the use of field workers, improving coordination, reducing transaction and procurement costs, low inventory levels and good transparency. Then Oliviera also explained (Purwanto et al, 2008) that e-Procurement is the process of purchasing goods and services needed for operational needs electronically. Neef (Purwanto et al, 2008) states that e-Procurement is the adoption of an internet-based system in the purchasing process. Meanwhile, according to Croom and Jones (Purwanto et al, 2008) the notion of e-Procurement is an integrated and wide area database system based on the internet with a network of communication systems in part or all of the purchasing process.

B. UTAUT

Unified theory of Acceptance and Use of Technology (UTAUT) is a theory of acceptance and use of technology developed by Vankatesh, Thong and Xu (2003), UTAUT was developed through studies conducted on eight models / theories of acceptance / technology adoption that are widely used in previous Information System research. UTAUT has four main constructs that directly affect user acceptance and user behavior. These four constructs are 1) performance expectancy, 2) effort expectancy, 3) social influence, and 4) facilitating conditions.

In detail, each construct can be described as follows:

1. Performance expectancy is defined as the degree to which an individual believes that using the system will help in improving his performance. This concept describes the benefits of the system for users related to perceived usefulness, extrinsic motivation, job fit, relative advantage (Venkatesh et al., 2003).
2. Effort expectancy is the level of ease of use of the system that will be able to reduce the effort (energy and time) of individuals in doing their work. The three constructs that make up this concept are perceived ease of use, ease of use, and complexity (Venkatesh et al., 2003).
3. Social factors are defined as the degree to which an individual perceives that others convince him that he should use the new system. Social factors as direct determinants of interest in using IS are represented by related constructs, namely subjective norms, social factors and image (Venkatesh et al., 2003).
4. The conditions that facilitate the use of information technology are the degree level to which a person believes that the organizational and technical infrastructure exists to support the use of the system. Triandis (1980) defines supporting conditions as “objective factors that can facilitate carrying out an action. The theory of attitude and behavior proposed by Triandis (1980) in Tjhai (2003) states that the use of information technology by workers is influenced by individual feelings towards the use of personal computers, social norms in the workplace that pay attention to the use of personal computers, habits related to computer use, consequences expected from the use of personal computers, and the conditions that facilitate the use of information technology. Research Thompson, et, al. (1991) found that there was no relationship between conditions that facilitate users and the use of information technology.
5. Interest in the use of information technology (behavioral intention) is defined as the level of desire or intention of users to use the system continuously with the assumption that they have access to information. Thompson et. al., (1991) stated that a person's belief in the usefulness of IS will increase their interest and in the end the individual will use IS in his work. Venkatesh et. al., (2003) stated that there is a direct and significant relationship between interest in the utilization use of SI and the use of SI.
6. The behavior of using information technology (use behavior) is defined as the intensity and/or frequency of users in using information technology. The behavior of using information technology is very dependent on the user's evaluation of the system. An information technology will be used if the information technology user is interested in using the information technology because of the belief that using the information technology can improve their performance, using information technology can be done easily, and the influence of the surrounding environment in using the information technology. In addition, the behavior of using information technology is also influenced by conditions that facilitate users in using information technology because if the information technology is not supported by the necessary equipment and facilities, the use of information technology cannot be implemented.

Related to this research, it can be defined that:

1. Performance Expectancy (PE) is defined as an action where someone believes that using e-Procurement will help improve their performance.
2. Effort Expectancy (EE) is defined as the level of ease associated with using the system.
3. Social Influences (SI) is defined as the extent to which an individual perceives the importance of

his work environment (in this case the social sphere) in the use of the new system.

4. Facilitating Condition (FC) is defined as the level to which a person believes that an organization and technical infrastructure exist to support the use of the system.
5. Behavior Intention (BI) is the main behavior of organizations in technology acceptance. Consistent with the theory that underlies all the effects on Behavioral Intention above, it is expected that Behavioral Intention will have a significant influence on the use of technology.
6. Use Behavioral (UB) is the behavior to be achieved in the use of technology.

C. Partial Least Square (PLS)

PLS is a component or variant-based Structural Equation Modeling (SEM) equation model. According to Ghozali (2006), PLS is an alternative approach that shifts from a covariance-based SEM approach to a variance-based approach.

The PLS specification model is divided into 2, namely:

1. Structural Model (inner model)

The structural model or inner model describes the relationship between latent constructs based on the theory. The design of the structural model of the relationship between latent constructs is based on the formulation of the problem or hypothesis (Ghozali, 2006).

2. Measurement Model (outer model)

The measurement model or outer model defines how the attitude of the indicator block relates to its latent construct. The design of the measurement model determines the nature of the indicators of each latent construct, whether reflexive or formative, based on the operational definition of the variable (Ghozali, 2006).

III. METHODOLOGY

The object of the research used is the employees in the branch office, regional office and PT.JMS head office .

According to Morissan (2012), the population is a collection of subjects, variables, concepts, or phenomena. Examining each member of the population can be done to determine the nature of the population in question. The population in this study are users of e-Procurement applications either in the General Sector or in other working unit who have an interest in the use of e-Procurement applications.

The sample according to Morissan (2012) is part of the population that represents the entire population that is representative, a sample that is not representative of every member of the population, regardless of the sample size, cannot be generalized to explain the nature of the population in which the sample is taken. The population in this study is not large, so the entire population is designated as a research sample whose function is to test and measure every element in the population

According to Sugiyono (2013) Research variables are everything in any form determined by the researcher to study so that information is obtained about it, then conclusions are drawn.

This study used the UTAUT approach which was adapted according to the research objectives. The UTAUT constructs used include:

1. Exogenous constructs, then known as sources variables or independent variables that are not predicted by other variables in the model. The exogenous constructs in this study are the constructs of performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC).
2. Endogenous constructs, are the factors that are predicted by one or more constructs. Endogenous constructs can predict one or several other

constructs, but endogenous constructs can only be causally related to endogenous constructs. The endogenous constructs of this study are the constructs of behavior intention (BI) and use behavior (UB).

The data used is primary data derived from the results of a questionnaire survey using an online survey format (google docs) involving about 182 respondents using the e-Procurement application, which consists of 2 parts;

1. The first part consists of questions related to the respondent's personal data
2. The second part is used to obtain data regarding the dimensions of the question using a Likert scale ranging from 1 to 5 with responses Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4 and Strongly Agree = 5.

The conceptual description of the research model with the UTAUT model can be seen in Figure 1.

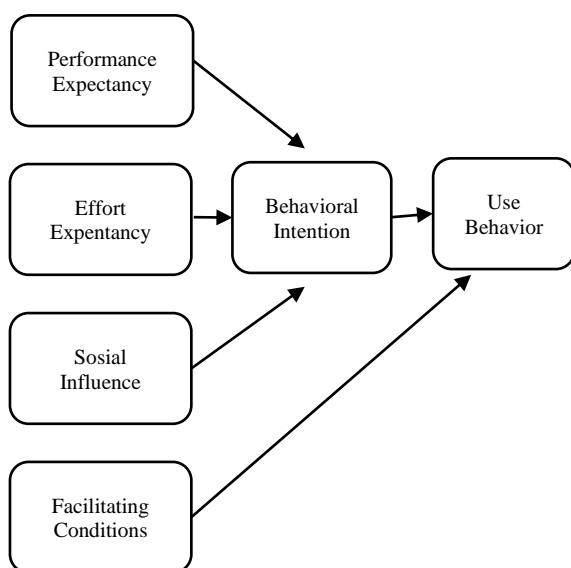


Figure 1. Conceptual Model Research Model of Acceptance and Use of e-Procurement Applications (refer to Venkatesh et al, 2003)

Referring to the research conceptual model in Figure 1, the hypotheses used are as follows:

1. There is an effect of performance expectancy on behavioral intention to use e-Procurement applications.
2. There is an effect of effort expectancy on behavioral intention to use e-Procurement applications.
3. There is an influence of social factors (social influence) on the interest in the use (behavioral intention) of e-Procurement applications.
4. There is an influence of facilitating conditions on the use behavior of e-Procurement applications
5. There is an influence of interest in utilization (behavioral intention) affecting the behavior of the use (use behavior) of e-Procurement applications

IV. RESULTS AND DISCUSSION

Model testing is carried out to determine the contractual relationship with the indicators. In data analysis using PLS, there are 3 stages, namely convergent validity, discriminant validity and composite reliability.

A. Indicator Reliability

Testing of validity indicators is carried out to ensure that each indicator is able to explain the latent variables. Before testing, the model must be defined first, then tested using the PLS Algorithm and bootstrapping. This step is done to see the reliability of the indicator by calculating the loading factor of each indicator. The validity indicator can be seen from the factor loading value. If the loading factor value of an indicator is more than 0.5 (> 0.5) and the t statistic is more than 2.0 (> 2.0), then it is said to be valid. On the other hand, if the loading factor value of an indicator is less than 0.5 (< 0.5) and has a t statistic value of less than 2.0 (< 2.0), it is said to be invalid. This study used a loading factor > 0.5 . Indicators that have a loading factor value of < 0.5 will be removed. (Sofyan Yamin, Heri Kuniawan, 2011).

Table 1
Output Outer Loading

	BI	EE	FC	PE	SI	UB
BI1	0.97					
BI2	0.97					
EE1		0.91				
EE2		0.92				
EE3		0.83				
FC1			0.80			
FC2			0.88			
FC3			0.78			
FC4			0.83			
FC5			0.79			
PE1				0.89		
PE2				0.88		
PE3				0.89		
PE4				0.84		
SI1					0.90	
SI2					0.90	
SI3					0.91	
UB1						0.92
UB2						0.93

B. Convergent Validity

Convergent Validity is used to measure the extent to which each variable that reflects the convergent construct is compared with the variables to measure the different constructs. Fornell and Larcker proposed a value of Average Variance Extracted (AVE) > 0.500 (Urbach and Ahlemann, 2010). Based on the measurement results in Figure 2, the AVE value describes adequate convergent validity (AVE > 0.500) which means that the construct has good convergent validity. (Sofyan Yamin and Heri Kuniawan, 2011).

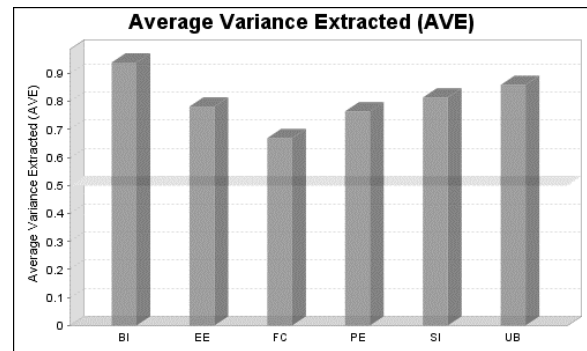


Figure 2. AVE Output

C. Discriminant Validity

Discriminant Validity evaluation is carried out in two stages, namely looking at the cross loading value to see how far the measurement of the constructs is different from the others. Discriminant validity is seen from the cross loading value. Cross loading is determined by looking at the relationship between the component scores of each latent variable with all other items. If the loading of each indicator is higher than the designated construct than the other constructs, and each construct is the highest load of its own item, it can be said that the model construct is different from the others. In this study, the cross loading value > 0.700, as shown in table 2 can be said to have good discriminant validity.

Table 2
Output Cross Loading

	BI	EE	FC	PE	SI	UB
BI	0.97					
EE	0.64	0.88				
FC	0.78	0.66	0.82			
PE	0.74	0.69	0.82	0.87		
SI	0.75	0.65	0.89	0.78	0.9	
UB	0.82	0.64	0.79	0.67	0.78	0.93

D. Internal Consistency Reliability

Internal Consistency Reliability can be measured in two ways, namely by Cronbach's Alpha and composite reliability. Alpha Cronbach assumes that all indicators are equally reliable. Therefore, it often

overrides the reliability of the internal consistency of latent variables in PLS. According to (Cronbach, 1951) the Cronbach Alpha value should not be less than 0.600. Figure 3 shows the results of Cronbach's Alpha test, the results show that all constructs have a value > 0.600. It can be concluded that the reliability of internal consistency is met.

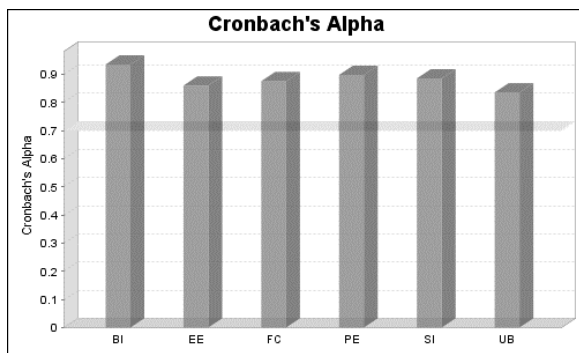


Figure 3. Output of Cronbach's Alpha

V. RESULTS HYPOTHESIS TEST

At this testing stage, an examination of the structural model is carried out, where this examination includes the significance (hypothesis above) and the value of R Square. Based on the path coefficients table below, Performance expectancy, Effort Expectancy, and Social Influence are significant on Behavioral Intention, because they have a t statistic value greater than 2.0. Path coefficients also show significant Behavioral Intention and Facilitating Conditions on use behavior. (Sofyan Yamin and Heri Kuniawan, 2011).

Table 3
Output Path Coefficients

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)
PE -> BI	0.308	0.305	0.080	3.853
SI -> BI	0.400	0.400	0.078	5.142
FC -> BI	0.400	0.397	0.089	4.498

UB				
EE -> BI	0.171	0.174	0.074	2.330
BI -> UB	0.505	0.510	0.106	4.789

The final value of R Square is as follows;

Table 4
Output R Square

	R Square	R Square Adjusted
BI	0.64	0.63
UB	0.73	0.73

Judging from the results of the R-square output in table 4 above, it indicates that the structural model in this study belongs to the "good" category (Ghozali, 2006).

The R Square value of the Behavioral Intention construct is 0.64%. This means that the construct of effort expectancy, performance expectancy, social influence, can only explain 64% and the rest is explained by other variables outside the model.

The value of R Square for construct use behavior is 0.73%. This means that the behavioral intention construct and the facilitating conditions h can only explain 73% and the rest is explained by other variables outside the model.

VI. CONCLUSION

e-Procurement applications by employees of PT. JMS which has users in the e-Procurement application using The Unified Theory Of Acceptance and Use Of Technology (UTAUT) model can be concluded that the Performance Expectancy (PE) construct has a positive effect on the Behavior Intention (BI) construct by 31%, the Effort Expectancy construct (EE) has a positive effect on the Behavior Intention (BI) construct of 17%, the Social Influence (SI)

construct has a positive effect on the Behavior Intention (BI) construct of 40%, the Behavior Intention (BI) construct has a positive effect on the Use Behavior (UB) construct of 50%, the Facilitating Condition (FC) construct has a positive effect on the Use Behavior (UB) construct by 40%.

In this regard, it is hoped that the management of PT. JMS can increase the benefits and usability of using e-Procurement applications in the process of procuring goods and/or services and increase the ease of use of e-Procurement applications.

e-Procurement application will be more useful by receiving input for improvement from procurement implementers at the Head Office, Regional Offices and Branch Offices so that the application is used to meet the needs of its users.

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Cite this article as : Zulkifli Jufri, Budiman, "Analysis Of Acceptance and Use of E-Procurement Applications Using Unified Theory of Acceptance and Use of Technology (UTAUT) In the Procurement of Goods and Services at PT. JMS", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 308-315, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229169> Journal URL : <https://ijsrst.com/IJSRST229169>

Cyber Security : Strategy to Security Challenges A Review

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ABSTRACT

During recent years, the wireless communication and technologies have given rise to many cyber crimes and exploited the cyber security. Cybersecurity is the protection and prevention of internet-connected systems like hardware, software and data from cyberthreats and harms. Cyber security is important for the protection of confidentiality, integrity and availability of information assets. Perhaps the biggest challenge of cyber security is the continuous and immense growth in technology. The paper proposes challenges and issues related to cyber security. Some major challenges are phishing attacks, ransomware attack, IoT attacks and many more.

This paper proposes a framework describing cyber terrorism. So there is need to create awareness about cyber security so that there will be safe and secure environment for users.

Keywords: Confidentiality, Ransomware Attack, Cyber Threat, Integrity, Availability.

Article Info

Volume 9, Issue 1

Page Number : 316-319

Publication Issue

January-February-2022

Article History

Accepted : 20 Feb 2022

Published : 28 Feb 2022

I. INTRODUCTION

Today Internet is the fastest growing infrastructure in everyday life. In today's technical environment many latest technologies are changing the face of the mankind. [1] Earlier, there was a system to send any information via letters, telegrams, etc. This system was quite time consuming and was not reliable. Later on, the development took place by invention of telephone, which helped to communicate from large distances and now there is an era of wireless technology. While doing this information exchange, it is mandatory that your information is to be safe while going through many processes. This implies the main purpose of cyber security. Cyber security is a

broad term that has evolved over time with no clear consensus on its exact meaning. [2]

The world is experiencing rapid growth in cyberspace today [3]. Such an extraordinary growth in information access gives opportunities to those with malicious intentions. It is the need of the hour [3] and the act of protecting the systems and technologies from unusual activities. Cyber security means maintaining the Integrity, Confidentiality, and Availability (ICA) of computing assets belonging to an organization or connecting to another organization's network. Due to the evolution and increase of cyber threats, many researchers believed and urged to educate the new generation about the concepts of

cyber-security [4]. Cyber-crimes occur due to negligence in cyber-security and awareness among the clients [5-6]. As stated in the recent research [7], the US has introduced the threat intelligence frameworks. This framework works on the principle of gathering information from various sources which have been carefully examined by human security experts. Besides, researcher also taking aid of machine learning techniques to analyze threats which in advanced way respond to attack incidents[8-9].

Cyber security gives the assurance and guarantees to internet users their communication way/internet is secure and protected against any attack of unauthorized third person.

II. CYBER SECURITY

Cyber security is the set of rules, body of technologies, processes and procedures to protect the electronic data, networks, computers, and programs from any attack and unauthorized access. Cyber security must satisfy three points:

- 1) Measure amount of data for the protection of information technology.
 - 2) The Level of protection as an outcome from application of those taken measures.
 - 3) The field associated with the professional endeavor.
- These three aspects of cyber security play a vital role to prevent and secure a personal data of every user of internet, business, and government [10].

Those data are essential because they can be hacked by other person for illegal activities. Various powers oversee the lofty ascent in hostile cyber intrusions and unapproved network breaks. The blast of new advancements and development of societal reliance on allinclusive interconnected innovation, joined with the robotization and commoditization of cyberattack tools, digital aggressor modernity, and low passage hindrances into the cybercrime market 10 are no uncertainty among the key ones [11].

CHALLENGES ON CYBER SECURITY IN INDIA

1) Cyber Terrorism:

There is one more term associated with this topic “Cyber Security”, i.e., “cyber terrorism”. Cyber terrorism is a way or a path or a mechanism through which an enemy is trying to know all the secrets of any nation and posing the threat to nation’s policy. 'Cyber terrorism is the convergence of terrorism and cyber space. It is generally understood to mean unlawful attacks and threats of attacks against computers, networks, and information stored therein when done to intimidate or coerce a government or its people in furtherance of political or social objectives[12].

Elements of Cyber Terrorism	<ul style="list-style-type: none"> • Politically-motivated cyber attacks that lead to death or bodily injury; • Cyber attacks that cause fear and/or physical harm through cyber attack techniques; • Serious attacks against critical information infrastructures such as financial, energy, transportation and government operations; <ul style="list-style-type: none"> • Attacks that disrupt non-essential services are not considered cyber terrorism; and • Attacks that are not primarily focused on monetary gain.
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2)Threat to ICT infrastructure:

Means to exploit, distort, disrupt, and destroy information resources range from hacker tools to devices such as electromagnetic weapons; directed energy weapons; HPM (High Power Microwave) or HERF (High Energy Radio Frequency) guns; and electromagnetic pulse (EMP) cannons. The attack against an information infrastructure can be carried out with both physical implements (hammer, backhoe, bomb, HERF, HPM) and cyber-based hacking tools. The same is true for the target: It can be cyber,

consisting for example of information or applications on a network, or physical, such as computers or a telecommunications cable. [13]

3) National cyber security :

There is no way to underestimate the hacker, because the method by which the information is stolen by illegal means is totally out of imagination, as we are ignorant about the ways of stealing information. The changing phase of cyber attacks as well as ever-increasing sophistication of attack methods have complicated the efforts of collecting valuable intelligence information for effective proactive, preventive and protective measures. [14]

4) Human Error or Failure:

A] Phishing:- A form of social engineering in which the attacker provides what appears to be a legal communication, but it contains hidden or embedded code that redirects the reply to 3rd party side, in an effort to extract personal or confidential information.

B] Ransomware Attacks. C] IOT Threats

III. CONCLUSION

Following conclusions can be drawn from above description :-

1. Internet has become a basic part of life in all over world. There are many advantages and disadvantages. The critical advantage is misuse of internet by criminal persons via unauthorized access and sources. People urge secure and protected platform who use internet. Cyber security gives the facility to internet users access/use the secure and protected source and way. Intranet has a private network used in government organizations and especially in military. It is more secure as compared to local internet but some drawbacks are occurred in this network. Then onion routing and intelligent agents control/protect the all over system by any threats and attacks. The security is the fundamental issue in the versatile specially appointed system [15]

2. The goal of a cyber security management program is to identify the risks, understand their likelihood and impact on the business, and then put in place security controls that mitigate the risks to a level acceptable to the organization. [16]

3. Cyber security is becoming more and more important as world is highly interconnected with different networks. [17]

4. Protect wireless devices: Personal firewalls can protect individual devices from attacks launched via the "air connection" or from the internet. [18]

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Cite this article as :

Shruti Rajesh Nistane, Radhika Rajesh Sharma, "Cyber Security : Strategy to Security Challenges A Review", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 316-319, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229170>
Journal URL : <https://ijsrst.com/IJSRST229170>

Study Of Salivary Glands Masses by Cytology and Confirmed by Histology : An Evaluation of Complication With FNAC

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ABSTRACT

In this paper, we studied about the salivary glands masses by cytology and confirmed by histology, and an evaluation of complication with FNAC.

Keywords : Salivary Glands, Aspiration Cytology, FNAC

Article Info

Volume 9, Issue 1

Page Number : 320-323

Publication Issue

January-February-2022

Article History

Accepted : 20 Jan 2022

Published : 28 Jan 2022

I. INTRODUCTION

Fine needle aspiration cytology is the sampling of a palpable or non-palpable (Radiological) mass by means of fine needle with negative pressure applied by an attached syringe. The clinical value of FNAC is not limited to neoplastic condition only but it is also valuable in the diagnosis of inflammatory, infectious and degenerative condition. The major salivary glands are the sources of most glandular lesions. The localized swelling of the salivary gland may be caused by neoplastic, cystic, or sialolithiasis, sialadenitis or systemic disease; often difficult to differential diagnosis. Surgical biopsy has never gained wide acceptance for diagnosis of salivary gland lesion mainly because of the risk of fistula formation and complication. Moreover, certain neoplasms like pleomorphic adenoma to recur after excision has added to this fear.

II. METHODS AND MATERIAL

The materials for the present work comprise of smears prepared from aspiration of masses from salivary glands attending the outdoor as well as admitted indoor patients of various department of Patna Medical College and Hospital, Patna. The clinical examination and investigation procedures were performed according to the performa given below:

REGISTRATION AND HISTORY

Registration of Patient

- (i) Name
- (ii) Age/Sex
- (iii) Religion
- (iv) Occupation
- (v) Date of admission
- (vi) Registration number

Presenting complaints

History of present complain

- Duration of mass
- Any recurrent increases in growth
- Any pain in lump

General Examination of the Patient

Local Examination of the Swelling of Salivary Gland

Investigation :

- Routine examination of blood and urine.

FNAC (FINE NEEDLE ASPIRATION CYTOLOGY) OF THE SALIVARY GLAND SWELLING

Technique of FNAC:

Equipments:

Needle and syringes: Standard disposable 22 gauge (<0.1 mm) 38 mm length mounted on a 10 ml plastic disposable syringe.

Glass Slides:

Fixatives: 90% ethanol in coupling jars

Others: Skin disinfectants, spirit, cotton swab, cover slip etc.

Patient Preparation:

The patients were explained the procedure to ensure co-operation. Most of the patients were made to lie down supine on the couch for convenience. The skin was disinfected at the area over the mass with spirit.

III. RESULTS AND DISCUSSION

In case of salivary glands 55 cases were diagnosed as true positive (84.62%) and false positive (zero). True negative 5 cases (7.63%) and false negative 5 case (7.69%).

Table 1: Showing fallacious result in 65 cases of salivary glands masses by cytology and confirmed by histology

Tissue of origin	True positive	True negative	False positive	False negative
Salivary glands	55	5	0	5

The sensitivity of cytological diagnosis in this series

$$Sensitivity = \frac{True + ve}{True + ve + false - ve} = \frac{55}{55 + 5} = \frac{55}{60} = 91.67\%$$

Was 91.67%.

And specificity

$$Specificity = \frac{True - ve}{True - ve + False + ve} = \frac{5}{5 + 0} = \frac{5}{5} = 100\%$$

Was 100%.

Practical Observation During FNAC:

In this series only those patients were including who had presented themselves for both aspiration cytology as well as excision by surgical procedure. It was observed that majority of the parents were willing to subject their children to needling but not for surgical maneuvers. It was found that even some clinicians were reluctant to suggested for such maneuvers. The middle and older aged patients were willing for both aspiration and excisional biopsy. The needle aspiration could be done easily in relatively larger masses but with some different in smaller ones. Oozing of blood was observed in many cases but all were easily controlled by local pressure. Materials aspirated were usually sufficient for cytological examination except in a few cases. No complications due to fine needle aspiration were observed in this series.

Evaluation of Complication with FNAC:

The postulated complication of FNAC like spread of tumor along needle tract, hematoma formation and infection were not noticed during the period, the patient stayed in the hospital. Local oozing of blood was noticed in many cases and they were controlled easily by firm pressure with dry cotton or gauze piece. Reported complications of the procedure are also minimal especially when fine needles of 21 to 23 gauge are used. In the present series 22-gauge needles were used. Many workers have studied the incidence of needle tract seeding after the FNA biopsy. **Edward H Smith, 1984** found the incidence as approximately 0.5: 10,000.

Livargi et al., 1983 published literature showing 2 cases of needle tract seeding out of 11,000 cases.

UEngzell PL Epostic (1971) conducted a survey and followed the patient of FNAC for 10 years. There was no occurrence of tumour along the needle tract.

Kline and Neal (1978), HO et al. (1977) Lalli et al. (1978) have with much shorter follow up reported no evidence of significant complication, including needle tract seeding.

As regard to the vascular and lymphatic dissemination of tumour cells following FNA biopsy, no evidence of any complication has been observed in the series. Similar reports of **Berg and Robbins (1962), Engzell et al.** were documented.

H. Mayanja, Kizza et al. (1985) found no complication, especially of infections.

It can be thus inferred from these observations that fine needle aspiration cytology is not associated with any significant complication.

IV. CONCLUSION

The overall diagnostic accuracy of fine needle aspiration cytology was 90.90%. There was zero false positive diagnosis cytologically with incidence of zero % out of total 95 cases of salivary glands masses diagnosis by fine needle aspiration cytology were possible in 65 cases. There was no complication whatsoever in the series as a result of fine needle aspiration biopsy.

We can conclude that FNAC of salivary glands masses has good diagnostic value in our centre. However, unbiased mind and thorough search of smear with patience are important pre-requisites for correct diagnosis.

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Cite this article as :

Dr. Nita Kumari, "Study of Salivary Glands Masses by Cytology and Confirmed by Histology : An Evaluation of Complication With FNAC", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 320-323, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229173>
Journal URL : <https://ijsrst.com/IJSRST229173>

Speech Based Emotion Recognition Using Machine Learning

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Article Info

Volume 9, Issue 1

Page Number : 324-329

Publication Issue

January-February-2022

Article History

Accepted : 20 Jan 2022

Published : 28 Jan 2022

ABSTRACT

Emotion is a natural feeling which is distinguished from reasoning or knowledge, it is a strong feeling derived from one's circumstance or surroundings. With the increase in man to machine interaction, speech analysis has become an integral part in reducing the gap between physical and digital world. An important sub field within this domain is the recognition of emotion in speech signals, which was traditionally studied in linguistics and psychology. Speech emotion recognition is a field having diverse applications. When implemented the Speech Emotion Recognition (SER) will be able to understand different human emotion such as anger, fear, happiness, sadness etc. Speech is a medium of expression of one's perspective or feelings to other. Emotion recognition from audio signal requires feature extraction and classifier training. The feature vector consists of elements of the audio signal which characterize speaker specific features such as tone, pitch, energy, which is crucial to train the classifier model to recognize a particular emotion accurately. Thus, with the help of SER we can make conversations between human and computer more realistic and natural. Automatic Speech Emotion Recognition (SER) is a current research topic in the field of Human Computer Interaction (HCI) with wide range of applications. The speech features such as, Mel Frequency cepstrum coefficients (MFCC) and Mel Energy Spectrum Dynamic Coefficients (MEDC) are extracted from speech utterance. The Support Vector Machine (SVM) is used as classifier to classify different emotional states such as anger, happiness, sadness, neutral, fear, from Berlin emotional database.

Keywords : Speech Emotion Recognition, Human Computer Interaction, Mel Frequency cepstrum coefficients, Support Vector Machine

I. INTRODUCTION

Automatic Speech Emotion Recognition is a very recent research topic in the Human Computer

Interaction (HCI) field. As computers have become an integral part of our lives, the need has risen for a more natural communication interface between humans and computers. To achieve this goal, a

computer would have to be able to perceive its present situation and respond differently depending on that perception[1]. Part of this process involves understanding a user's emotional state. To make the human-computer interaction more natural, it would be beneficial to give computers the ability to recognize emotional situations the same way as human does. Automatic Emotion Recognition (AER) can be done in two ways, either by speech or by facial expressions. In the field of HCI, speech is primary to the objectives of an emotion recognition system, as are facial expressions and gestures[2]. Speech is considered as a powerful mode to communicate with intentions and emotions In the recent years, a great deal of research has been done to recognize human emotion using speech information Many researchers explored several classification methods including the Neural Network (NN), Gaussian Mixture Model (GMM), Hidden Markov Model (HMM), Maximum Likelihood Bayes classifier (MLC), Kernel Regression and K-nearest Neighbors (KNN), Support Vector Machine (SVM) The Support Vector Machine is used as a classifier for emotion recognition. The SVM is used for classification and regression purpose. It performs classification by constructing an N-dimensional hyperplanes that optimally separates the data into categories. The classification is achieved by a linear or nonlinear separating surface in the input feature space of the dataset. Its main idea is to transform the original input set to a high dimensional feature space by using a kernel function, and then achieve optimum classification in this new feature space.

- RAVDESS : The Ryson Audio-Visual Database of Emotional Speech and Song that contains 24 actors (12 male, 12 female), vocalizing two lexically-matched statements in a neutral North American accent.
- TESS : Toronto Emotional Speech Set that was modeled on the Northwestern University Auditory Test No. 6 (NU-6; Tillman & Carhart, 1966). A set of 200 target words were spoken in

the carrier phrase "Say the word' by two actresses (aged 26 and 64 years).

- EMO-DB : As a part of the DFG funded research project SE462/3-1 in 1997 and 1999 we recorded a database of emotional utterances spoken by actors. The recordings took place in the anechoic chamber of the Technical University Berlin, department of Technical Acoustics. Director of the project was Prof. Dr. W. Sendlmeier, Technical University of Berlin, Institute of Speech and Communication, department of communication science. Members of the project were mainly Felix Burkhardt, Miriam Kienast, Astrid Paeschke and Benjamin Weiss.
- Custom : Some unbalanced noisy dataset that is located in data/train-custom for training and data/test-custom for testing in which you can add/remove recording samples easily by converting the raw audio to 16000 sample rate, mono channel (this is provided in create_wavs.py script in convert_audio(audio_path) method which requires ffmpeg to be installed and in PATH) and adding the emotion to the end of audio file name separated with '_' (e.g "20190616_125714_happy.wav" will be parsed automatically as happy).

Applications of Speech Emotion Recognition include psychiatric diagnosis, intelligent toys, lie detection, learning environment, educational software, and detection of the emotional state in telephone call center conversations to provide feedback to an operator or a supervisor for monitoring purposes.

II. SYSTEM IMPLEMENTATION

The importance of emotions in human-human interaction provides the basis for researchers in the engineering and

Figure 1. Speech Emotion Recognition System. computer science communities to develop automatic ways for computers to recognize emotions. As shown

in fig. 1 the input to the system is a .wav file from Berlin Emotion Database that contains emotional speech utterance from different emotional classes. After that features extraction process is carried out. In feature extraction process two features are extracted MFCC [6], [7] and MEDC [8]. After that the extracted features and their corresponding class labels are given as input to the LIBSVM classifier. The output of a classifier is a label of a particular emotion class. There are total five classes angry, sad, happy, neutral and fear. Each label represents corresponding emotion class.

III. PROPOSED SYSTEM

3.1 Feature Extraction

In previous works several features are extracted for classifying speech affect such as energy, pitch, formants frequencies, etc. all these are prosodic features. In general prosodic features are primary indicator of speaker's emotional state. Here in feature extraction process two features are extracted Mel Frequency Cepstral Coefficient (MFCC) and Mel Energy spectrum Dynamic coefficients (MEDC). Fig. 2 shows the MFCC feature extraction process. As shown in Fig. 2 feature extraction process contains following steps:

- **Preprocessing:** The continuous time signal (speech) is sampled at sampling frequency. At the first stage in MFCC feature extraction is to boost the amount of energy in the high frequencies. This reemphasis is done by using a filter.
- **Framing:** it is a process of segmenting the speech samples obtained from the analog to digital conversion (ADC), into the small frames with the time length within the range of 20-40 ms. Framing enables the non-stationary speech signal to be segmented into quasistationary frames, and enables Fourier Transformation of the speech signal. It is because, speech signal is known to

exhibit quasistationary behavior within the short time period of 20-40 ms.

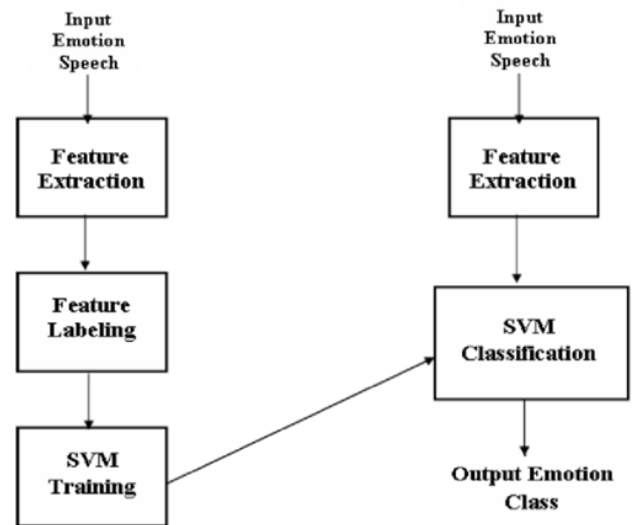


Figure 2. MFCC feature extraction

- **Windowing:** Windowing step is meant to window each individual frame, in order to minimize the signal discontinuities at the beginning and the end of each frame.
- **FFT:** Fast Fourier Transform (FFT) algorithm is ideally used for evaluating the frequency spectrum of speech. FFT converts each frame of N samples from the time domain into the frequency domain.
- **Mel Filterbank and Frequency wrapping:** The mel filter bank [8] consists of overlapping triangular filters with the cutoff frequencies determined by the center frequencies of the two adjacent filters. The filters have linearly spaced centre frequencies and fixed bandwidth on the mel scale[5].
- **Take Logarithm:** The logarithm has the effect of changing multiplication into addition. Therefore, this step simply converts the multiplication of the magnitude in the Fourier transform into addition
- **Take Discrete Cosine Transform:** It is used to orthogonalise the filter energy vectors. Because of this orthogonalization step, the information of the filter energy vector is compacted into the first number of components and shortens the vector to number of components.

- Another feature Mel Energy spectrum Dynamic coefficients (MEDC) is also extracted. It is extracted as follows: the magnitude spectrum of each speech utterance is estimated using FFT, then input to a bank of 12 filters equally spaced on the Mel frequency scale. The logarithm mean energies of the filter outputs are calculated $E_n(i)$, $i=1, \dots, N$. Then, the first and second differences of $E_n(i)$ are calculated. MEDC feature extraction process. The MEDC feature extraction process contains following steps shown in figure 3:

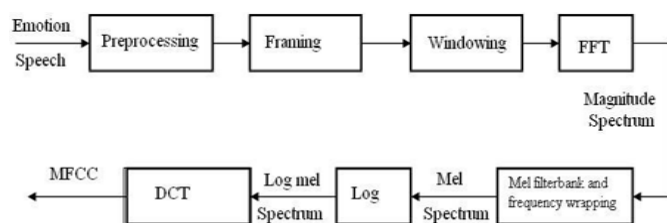


Figure 3. MEDC feature extraction

- Preprocessing, Framing, Windowing, FFT & Mel filter bank and Frequency wrapping processes of MEDC feature extraction are same as MFCC feature extraction.
- Take logarithmic mean of energies: In this process a mean log of every filter energy is calculated. This mean value represents energy of individual filter in a filter bank.
- Compute 1st and 2nd difference: The final Mel energy spectrum dynamics coefficients are then obtained by combining the first and second differences of filter energies.

3.2 Feature Labelling

In Feature labelling each extracted feature is stored in a database along with its class label. Though the SVM is binary classifier it can be also used for classifying multiple classes. Each feature is associated with its class label e.g. angry, happy, sad, neutral, fear

3.3 SVM Classification

In general, SVM is a binary classifier, but it can also be used as a multiclass classifier. LIBSVM [9], [10] is a most widely used tool for SVM classification and regression developed by C. J. Lin. Radial Basis

Function (RBF) kernel is used in training phase. Advantage of using RBF kernel is that it restricts training data to lie in specified boundaries[9]. The RBF kernel nonlinearly maps samples into a higher dimensional space, so it, unlike the linear kernel, can handle the case when the relation between class labels and attributes is nonlinear[8]. The RBF kernel has less numerical difficulties than polynomial kernel. The other classifiers that can be implemented into the project are:

- RandomForestClassifier.
- GradientBoostingClassifier.
- Recurrent Neural Networks

IV. EXPERIMENTATION AND RESULTS

Berlin Emotion database contains 406 speech files for five emotion classes. Emotion classes Anger, sad, happy, neutral, fear are having 127, 62, 71, 79 and 67 speech utterance respectively. The LIBSVM is trained on MFCC and MEDC feature vectors using RBF and Polynomial kernel functions. The LIBSVM is used to test these feature vectors. The experimentation is carried out by varying cost values for RBF kernel and degree values for Polynomial kernel. Both gender independent and gender dependent experiments are performed. Using RBF kernel at cost value $c=4$, it gives recognition rate of 93.75% for gender independent case, 94.73% for male and 100% for female speeches. The recognition rate using Polynomial kernel at degree $d=4$ is 96.25% gender independent, 97.36% for male and 100% for female speeches.

Table 1. Confusion matrix of the RBF LIBSVM classifier (Gender Independent)

Emotion	Emotion Recognition (%)				
	Angry	Sad	Happy	Neutral	Fear
Angry	100	0	0	0	0
Sad	0	100	0	0	0
Happy	0	0	100	0	0

Neutral	0	6.25	0	93.75	0
Fear	0	0	30.76	0	69.24

The Confusion matrices using RBF kernel gender independent, male and female are shown in Table 1, 2 and 3. Table 4, 5 and shows Confusion matrices using Polynomial kernel gender independent, male and female.

Table 2. Confusion matrix of the RBF LIBSVM classifier (Male)

Emotion	Emotion Recognition (%)				
	Angry	Sad	Happy	Neutral	Fear
Angry	100	0	0	0	0
Sad	0	100	0	0	0
Happy	16.66	0	83.34	0	0
Neutral	0	0	0	100	0
Fear	0	0	0	14.85	85.15

Table 3. Confusion matrix of the RBF LIBSVM classifier(Female)

Emotion	Emotion Recognition (%)				
	Angry	Sad	Happy	Neutral	Fear
Angry	100	0	0	0	0
Sad	0	100	0	0	0
Happy	0	0	100	0	0
Neutral	0	0	0	100	0
Fear	0	0	0	0	100

Table 4. Confusion matrix of the Polynomial LIBSVM classifier (Gender Independent)

Emotion	Emotion Recognition (%)				
	Angry	Sad	Happy	Neutral	Fear
Angry	100	0	0	0	0
Sad	0	100	0	0	0
Happy	0	0	100	0	0
Neutral	0	0	0	100	0
Fear	7.69	0	15.18	0	76.92

Table 5. Confusion matrix of the Polynomial LIBSVM classifier (Male)

Emotion	Emotion Recognition (%)				
	Angry	Sad	Happy	Neutral	Fear
Angry	100	0	0	0	0
Sad	0	100	0	0	0

Happy	0	0	100	0	0
Neutral	0	0	0	100	0
Fear	0	0	14.28	0	85.72

Table 6. Confusion matrix of Polynomial LIBSVM classifier (Female)

Emotion	Emotion Recognition (%)				
	Angry	Sad	Happy	Neutral	Fear
Angry	100	0	0	0	0
Sad	0	100	0	0	0
Happy	0	0	100	0	0
Neutral	0	0	0	100	0
Fear	0	0	0	0	100

V. CONCLUSION

In this paper and throughout this project, we showed how we can leverage Machine learning to obtain the underlying emotion from speech audio data and some insights on the human expression of emotion through voice. This system can be employed in a variety of above-mentioned setups like human-computer interaction, Call Centre for complaints or marketing, in voice-based virtual assistants or chatbots, in linguistic research, etc.

VI. FUTURE WORK

A few possible steps that can be implemented to make the models more robust and accurate are the following

An accurate implementation of the pace of the speaking can be explored to check if it can resolve some of the deficiencies of the model.

Figuring out a way to clear random silence from the audio clip.

Exploring other acoustic features of sound data to check their applicability in the domain of speech emotion recognition. These features could simply be some proposed extensions of MFCC like RAS-MFCC or they could be other features entirely like LPCC, PLP or Harmonic cepstrum.

Following lexical features based approach towards SER and using an ensemble of the lexical and acoustic models. This will improve the accuracy of the system because in some cases the expression of emotion is contextual rather than vocal.

Adding more data volume either by other augmentation techniques like time-shifting or speeding up/slowing down the audio or simply finding more annotated audio clips.

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Cite this article as :

Dr. Loganathan R., Arjumand Yusufi, Umar Rasool Yetoo, Waseem Ahmed R., Zaki Hussain, "Speech Based Emotion Recognition Using Machine Learning ", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 324-329, January-February 2022. Available at doi : <https://doi.org/10.32628/IJSRST229168>
Journal URL : <https://ijsrst.com/IJSRST229168>

Study of Modern Methods in Topological Vector Spaces

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ABSTRACT

Article Info

Volume 9, Issue 1

Page Number : 47-55

Publication Issue

January-February-2022

Article History

Accepted : 05 Jan 2022

Published : 17 Jan 2022

In this present paper, we studied about modern methods in topological vector spaces. A topological vector space is one of the basic structures investigated in functional analysis. The elements of topological vector spaces are typically functions or linear operators acting on topological vector spaces, and the topology is often defined so as to capture a particular notion of convergence of sequence of functions. Hilbert and Banach spaces are well known examples unless stated otherwise, the underlying field of a topological vector space is assumed to be either the complex number 'C' or the real number 'R' [1-2].

Keywords: Topology, Vector- Space, Hilbert Spaces, Homomorphic, Functional Analysis.

I. INTRODUCTION

In topology and related areas of mathematics a topological property or topological invariant is a property of a topological space which is invariant under homomorphism. That is, a property if whenever a space X possesses that property every space homomorphic to X possesses that property. Informally, a topological property is a property of space that can be expressed using open sets. A common problem in topology is to decide whether two topological spaces are homomorphic or not. To prove that two spaces are not homomorphic, it is sufficient to find a topological property which is not shared by them [3].

A vector space is an abelian group with respect to the operation of addition and in and in a topological vector

space. The inverse operation is always continuous (since it is same as multiplication by -1). Hence every topological vector space is an abelian topological group [7].

In Functional Analysis and related areas of mathematics, locally convex topological vector spaces or locally convex spaces are examples of topological vector spaces (TVS) that generalize normed spaces. They can be defined as topological vector spaces whose topology is generated by translations of balanced, absorbent, convex sets. Alternatively, they can be defined as a vector space with a family of semi norms, and a topology can be defined in terms of that family. Although in general such spaces are not necessarily norm able, the existence of a

convex local base for the zero vector is strong enough sufficiently rich theory of continuous linear functionals [4].

II. MODERN METHODS IN TOPOLOGICAL VECTOR SPACES

A Hilbert space V is a complex vector space assigned a positive definite inner product $u \cdot v$ with the property that Cauchy sequences converge. These are conceptually the simplest topological vector spaces, with the topology defined by the condition that a subset U of V is open if and if it contains a neighbourhood $\|v - u\| < \epsilon$ for every one of the points u in U . But there are other naturally occurring spaces in which things are a bit more complicated. For example, how do you measure how close two functions in $C^\infty(\mathbb{R}/\mathbb{Z})$ are? Under what circumstances does a sequence of functions f_n in $C^\infty(\mathbb{R}/\mathbb{Z})$ converge to a function in that space? If two functions in $C^\infty(\mathbb{R}/\mathbb{Z})$ are close then their values should be close, but you should also require that their derivatives be close [5]. So, you introduce naturally an infinite number of measures of difference:

$$\|f\|_m = \sup_x |f^{(m)}(x)|,$$

and say that $f_n \rightarrow f$ if $\|f_n - f\|_m \rightarrow 0$ for all m . The most fruitful way to put topologies on many other infinite-dimensional vector spaces is by using measures of the size of a vector that are weaker than those on Hilbert spaces.

Proposition. If ρ is a non-negative function on the vector space V , the following are equivalent:

- (a) for all scalars a and b , $\rho(au + bv) \leq |a|\rho(u) + |b|\rho(v)$;
- (b) for any scalar a , $\rho(av) \leq |a|\rho(v)$, and $\rho(tu + (1 - t)v) \leq t\rho(u) + (1 - t)\rho(v)$ for all t in $[0,1]$;
- (c) for any scalar a , $\rho(av) = |a|\rho(v)$, and $\rho(u + v) \leq \rho(u) + \rho(v)$

The real-valued function ρ on a vector space is said to be convex if,

$$\rho(tu + (1 - t)v) \leq t\rho(u) + (1 - t)\rho(v)$$

for all $0 \leq t \leq 1$, and these conditions are essentially variations on convexity.

Any function ρ satisfying these conditions will be called a semi-norm. It is called a norm if $\rho(v) = 0$ implies $v = 0$.

A prototypical norm is the function $\|x\| = \sqrt{|x_1|^2 + \dots + |x_n|^2}$ in \mathbb{C}^n or the integral $\int_{\mathbb{R}^n} |f(x)|^2 dx_1 \dots dx_n$

for f in the space of continuous functions on \mathbb{R}^n of compact support. The functions $\|f\|_m$ on $C^\infty(\mathbb{R}/\mathbb{Z})$ are semi norms[6].

Proof. That (c) implies (b) and that (b) implies (a) is immediate. Assuming (a), we have

$$\rho(v) = \rho(a^{-1}av) \leq |a|^{-1}\rho(av) \leq |a|^{-1} |a|\rho(v) = \rho(v),$$

leading to homogeneity.

Corollary. The kernel

$$\ker(\rho) = \{v \in V / \rho(v) = 0\}$$

of a semi-norm on a vector space is a linear subspace.

From now on I'll usually express semi norms in norm notation— $\|v\|_\rho$ instead of $\rho(v)$.

The conditions on a semi norm can be formulated geometrically, and in two rather different ways. The graph of a semi norm ρ is the set Γ_ρ of pairs $(v, \|v\|_\rho)$ in $V \oplus \mathbb{R}$. Let Γ_ρ^+ be the set of pairs (v, r) with $r > \|v\|_\rho$. The

conditions for ρ to be a semi norm are that Γ_ρ^+ be convex, stable under rotations $(v, r) \mapsto (cv, r)$ for $|c| = 1$, and homogeneous with respect to multiplication by positive scalars. (I recall that a subset of a vector space is convex if the real line segment connecting two points in it is also in it.)

A more interesting geometric characterization of a semi norm is in terms of the disks associated to it. If ρ is a semi norm its open and closed disks are defined as

$$B_\rho(r-) = \{v \mid \|v\|_\rho < r\}$$

$$B_\rho(r) = \{v \mid \|v\|_\rho \leq r\}$$

We shall see in a moment how semi norms can be completely characterized by the subsets of V that are their unit disks. What are the necessary conditions for a subset of a vector space to be the unit disk of a semi norm?

A subset of V is **balanced** if cu is in it whenever u is in it and $|c| = 1$, and **strongly balanced** if cu is in it whenever u is in it and $|c| \leq 1$. (This is not standard terminology, but as often in this business there is no standard terminology.) Convex and balanced implies strongly balanced [7].

A subset X of V is **absorbing** if for each v in V there exists ε such that $cv \in X$ for all $|c| < \varepsilon$. It is straightforward to see that if ρ is a semi norm then its open and closed disks $B_\rho(r-)$ and $B_\rho(r)$ are convex, balanced, and absorbing.

A semi-norm is determined by its unit disks. If $r_v = \|v\|_\rho > 0$ then

$$\frac{\|v/r\|_\rho}{\|v\|_\rho} > 1 \quad \text{if } r < r_v$$

$$\frac{\|v/r\|_\rho}{\|v\|_\rho} = 1 \quad \text{if } r = r_v$$

$$< 1 \quad \text{if } r > r_v.$$

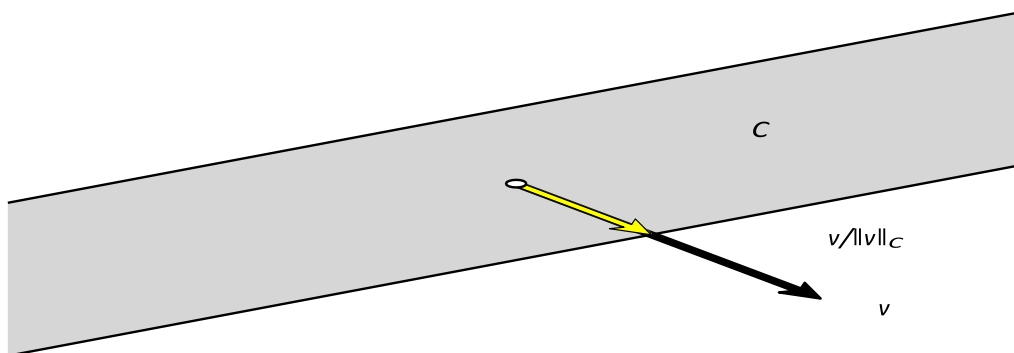
we have

$$\|v\|_\rho = \inf\{r > 0 \mid v/r \in B\}$$

for B equal to either $B_\rho(1)$ or $B_\rho(1-)$.

Conversely, suppose C to be an absorbing subset of V . The intersection of the line $\mathbb{R} \cdot v$ with C is an interval, possibly infinite, around 0. Since C is absorbing, there exists $r > 0$ such that $v/r \in C$. Define

$$\|v\|_C = \inf\{\lambda \geq 0 \mid v/\lambda \in C\}$$



For example, if v lies on a line inside C then $\|v\|_C = 0$.

Proposition. If C is convex, balanced, and absorbing then $\rho(v) = \|v\|_C$ is a semi norm [8].

If C is not convex or balanced then it can be replaced by its convex, balanced hull, so the first two of these requirements are not onerous. But its not being absorbing is fatal—in that case, the semi norm will be infinite almost everywhere. So in practice it is that condition that one has to be careful about. Similarly, if one is given a formula for a semi norm, the important thing to check is that it be finite.

Proof. It is immediate that $\|cv\|_C = c\|v\|_C$ for $c > 0$, and since C is balanced it is immediate that $\|cv\|_C = \|v\|_C$ for $|c| = 1$. Finally, the function $\rho(v) = \|v\|_C$ is convex since C is.

The semi norm determined by C is called its **gauge** [100].

Several such sets C may determine the same semi norm. For example both the open and closed unit disks of ρ determine ρ . The correspondance becomes bijective if we impose a simple condition on C . I'll call a subset of V **linearly open** if its intersection with any real line is open.

Lemma. If ρ is a convex real valued function then the region $\rho < c$ is linearly open.

For example, the open unit disk defined by a semi norm is linearly open.

Proof. Suppose P to be a point in V such that $\rho(P) < c$. I must show that every real line in V containing P contains also an open interval around P . It suffices for this to show that if Q is any other point in the vector space V , then points on the initial part of the segment from P to Q also satisfy $\rho < c$. If $\rho(Q) < c$ then the whole segment $[P, Q]$ lies in the region $\rho < c$. Otherwise say $\rho(Q) \geq c > \rho(P)$ or $\rho(Q) - \rho(P) > c - \rho(P) > 0$.

$$\rho((1 - t)P + Q) \leq (1 - t)\rho(P) + t\rho(Q) = \rho(P) + t(\rho(Q) - \rho(P))$$

so if we choose t small enough so that

$$t(\rho(Q) - \rho(P)) < c - \rho(P) \text{ or } t < \frac{c - \rho(P)}{\rho(Q) - \rho(P)}$$

then

$$\rho((1 - t)P + tQ) < \rho(P) + (c - \rho(P)) = c.$$

Proposition. The map associating to ρ the open unit disk $B_\rho(1-)$ where $\|v\|_\rho < 1$ is a bijection between semi norms and subsets of V that are convex, balanced, and linearly open [9].

Proof. The previous result says that if ρ is a semi norm then $B_\rho(1-)$ is convex, balanced, and linearly open. It remains to show that if C is convex, balanced, and linearly open then it determines a semi norm for which it is the open unit disk. For the first claim, it suffices to point out that a convex, balanced, linearly open set is absorbing. That's because for any v the line through 0 and v must contain some open interval around 0 and inside C . This means that we can define in terms of C the semi norm $\rho = \rho_C$.

Why is C the open unit disk for ρ ? It must be shown that a point v lies in C if and only if $\|v\|_C < 1$. Since C is convex, balanced, and linearly open, the set $\{c \in \mathbb{R} \mid cv \in C\}$ is an open interval around 0 in \mathbb{R} . Hence if v lies in C , there exists $(1 + \epsilon)v \in C$ also, and therefore $\|v\|_C \leq 1/(1 + \epsilon) < 1$.

Conversely, suppose $\|v\|_C = r < 1$. If $r = 0$, then cv lies in C for all c in \mathbb{R} . Otherwise, v/r is on the boundary of C — $v/\eta \in C$ for $\eta > r$ but $v/\eta \notin C$ for $\eta < r$. Since $r < 1$, there then exists some $r_+ < 1$ such that $v/r_+ \in C$, and since C is convex and v lies between 0 and v/r_+ the vector v also lies in C .

In general, linearly open sets are a very weak substitute for open ones in a vector space, but convex ones are much better behaved. Linearly open sets will occur again in the discussion of the Hahn Banach Theorem, in which convex linearly open sets play a role. For now, I content myself with the following observation:

Proposition. In a finite dimensional vector space, every convex linearly open set is open [106-110].

Proof. Let U be a linearly open subset of V . We must show that for every point of U there exists some neighbourhood contained in U . We may as well assume that point to be the origin. Let (e_i) be a basis of V . There exists $c > 0$ such that all $\pm ce_i$ are in U , and since U is their convex hull, which is a neighbourhood of the origin.

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- Rakesh Kumar Bharti, Chandra Deo Pathak, Dr. Rajnarayan Singh, "Study of Modern Methods in Topological Vector Spaces", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 330-334, January-February 2022.
Journal URL : <https://ijsrst.com/IJSRST221252>

Analytical Study of Pavement Structure Considerations

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Article Info

Volume 9, Issue 1

Page Number : 335-339

Publication Issue

January-February-2022

Article History

Accepted : 05 Jan 2022

Published : 21 Jan 2022

ABSTRACT

In this paper, we using geotextiles in secondary roads to stabilize weak subgrades. However, from an economical point of view, a complete life cycle cost analysis, which includes not only costs to agencies but also costs to users, is urgently needed to assess the benefits of using geotextile in secondary road flexible pavement.

Keywords: Geotextiles, Pavement, TBR.

I. INTRODUCTION

Life Cycle Cost Analysis can be used to determine the relationship between performance and cost when geotextiles are incorporated in pavements. The AASHTO 1993 Pavement Design Guidelines were used in this study. Pavement reliability is considered as 70%, and the standard deviation is considered as 0.49 (secondary road).

HMA Thickness (mm)	Base Thickness (mm)	Subgrade Strength (*CBR %)			
		0.5	2	4	6
50	100				1
	150			2	3
	200		4	5	6
	250		7	8	9
75	100			10	11
	150		12	13!	14
	200		15	16	
	250		17		
100	100		18	19	
	150		20		
	200		21		
	250		22		
125	100				
	150		23		
	200	24			
	250	25			

*Bihar Bearing Ratio ;!(ref) represents the reference design

Table 1 shows the matrix of possible secondary road pavement design combinations based on four different HMA thickness (50, 75, 100, and 125mm), four different granular base thicknesses (100, 150, 200, and 250 mm), and four different subgrade strengths (CBR=0.5, 2, 6 and 8%). The design layer coefficient was considered as 0.44 for the HMA layer and the drainage coefficient as 1.0. Using a combination of the aforementioned pavement composition and characteristics, there are 64 design combinations; however, only a fraction of these combinations are considered to be realistic and somewhat representative of secondary road traffic conditions. According to the traffic count data in 2004, the annual average daily traffic (AADT) of a secondary road varies from several hundred to several thousand. Therefore, 25 design combinations based on the Bihar traffic features of the secondary roads in the state of Bihar were selected on which to conduct the cost-effectiveness analysis comparison in this study. The 25 representative designs are designated 1 through 25 in Table 1.

II. PAVEMENT PERFORMANCE PREDICTION

The evaluation of pavement performance is a crucial step in the life cycle cost framework. The ability to predict the remaining life or the distress levels of a pavement section allows engineers, planners, and highway agencies to plan ahead for maintenance and rehabilitation activities, budget for future expenditures, and makes decisions about the timing of those rehabilitation activities. With ample time to plan, state transportation agencies can minimize their costs as well as minimize the impact of their construction activities on the traveling public and others affected by such construction.

Therefore, the first step in the life cycle cost framework is to evaluate a pavement design and the conditions under which it is expected to operate throughout its design life or its analysis period. The framework presented in Figure 1 shows the steps required to prepare an analysis for the life cycle cost procedure. The general inputs relating to the project as a whole, independent of pavement type must be defined prior to identifying pavement design alternatives. These inputs include such conditions as predicted traffic patterns, pavement loading, and economic variables. Once the general and specific conditions are defined, the life cycle cost framework simulates the predicted traffic loading and environmental conditions for each year of the analysis period. At the end of each year, the performance models predict the level of distress or damage to the pavement based on that year's current traffic conditions.

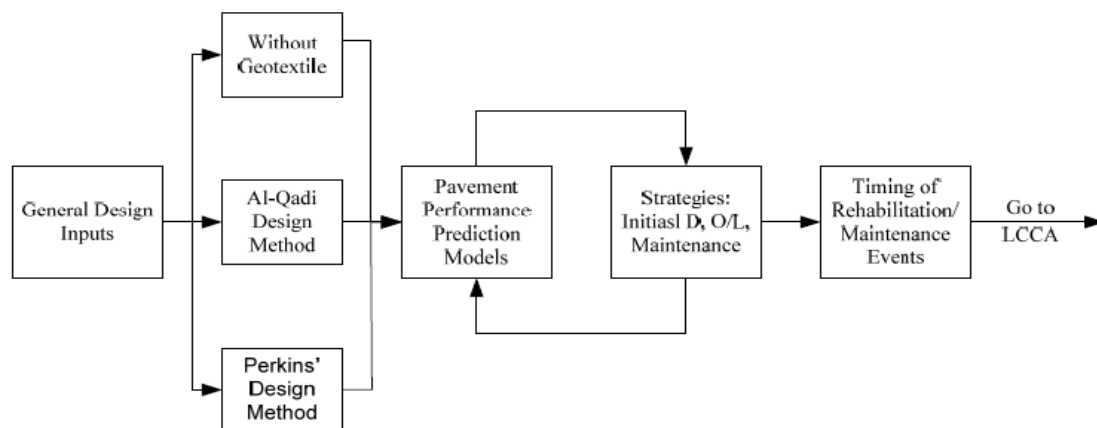


Figure 1: Life Cycle Cost Framework- Pavement Performance

III. PAVEMENT LOADING

Often, vehicular loading of the pavement is the parameter that has the greatest effect on the performance of pavements. Although other factors, such as environmental conditions, affect the performance of pavements, they only help to modify and calibrate performance models to local conditions. The effects of vehicular loading,

however, are universal and affect all pavements in any locale. This section will address the method by which the amount of vehicular loading is determined and predicted for the entire analysis period.

In the method that will be discussed, the engineer obtains, or predicts, the equivalent single axle loads (ESALs) for the first year and an estimated annual growth rate. Another method uses the average daily traffic (ADT) for the first year, predicts the ADT for the final year of the analysis period, the percentage of trucks throughout the analysis period, and then designs an ESAL value for the entire analysis period. In order to determine the appropriate ESAL value for each year, the traffic evaluation module begins with the initial year ESAL and increases this value annually by the growth rate. This is represented by equation 1 below, which shows the calculation for the current year's ESAL value:

$$ESAL_{\text{current}} = ESAL_{\text{initial}} \cdot (1 + g)^i \quad (1)$$

Where;

g = annual ESAL growth rate, and

i = current year, between 0 and analysis period

In the study, the user cost model not only requires the current annual ESAL value, it also requires the cumulative value to predict the level of serviceability. The algorithm used to determine the annual cumulative values is as described below. Given the first and last year ADT values, an annual growth rate can be derived by the following formula:

$$ADT_{\text{final}} = ADT_{\text{initial}} \cdot (1 + g)^n \quad (2)$$

Where;

g = annual growth rate, and

n = analysis period.

Then, solving for g ,

$$g = \left(\frac{ADT_{\text{final}}}{ADT_{\text{initial}}} \right)^{1/n} - 1 \quad (3)$$

The annual cumulative ESAL value, then, is calculated by deriving the first year ESAL value from the growth rate and the total ESALs:

$$ESAL_{\text{cumulative}} = ESAL_{\text{initial}} \cdot \frac{(1+g)^n - 1}{g} \quad (4)$$

$$ESAL_{\text{cumulative}} = ESAL_{\text{initial}} \cdot \frac{g}{(1+g)^n - 1} \quad (5)$$

From this point, the cumulative ESAL values for each year are determined by:

$$ESAL_{\text{annual, cumulative}} = ESAL_{\text{initial}} \cdot \frac{(1+g)^i - 1}{g} \quad (6)$$

where,

i = current year.

IV. PAVEMENT SERVICE ABILITY PREDICTION MODEL

The AASHTO design guide equation for flexible pavements, which is the major model in use today for predicting the pavement serviceability ratings, is used in predicting the remaining serviceable life of a pavement in the study. The equation is used to determine the design thickness of a flexible pavement, or the allowable loads for a specific thickness. This equation can also be used to determine the decrease in PSI for given inputs and traffic loading. The AASHTO design equation is shown below:

$$\log W_{80} = Z_R S_o + 9.36 \log(SN+1) - 0.2 + \frac{[\log(\Delta PSI) / (4.2 - 2.5)]}{0.4 + 1094 / (SN+1)^{5.19}} + 2.32 \log M_R - 8.07 \quad (7)$$

where,

W_{80} = number of 80kN equivalent single axle load applications estimated for a selected design period and design lane;

R = reliability;

Z_R = the normal deviate for a given reliability R;

S_0 = standard deviation;

Δ PSI= Present Serviceability Index difference between initial value (P_i) and the terminal value (P_t);

SN= design structure number indicative of total required pavement layer thickness and their corresponding moduli; and

M_R = subgrade resilient modulus.

Each year the current level of traffic is updated in the AASHTO equation and the equation is solved for the PSI value, which provides an estimate of the structural condition of the pavement. This equation can be used with a known or predicted value of ESALs to predict the PSI of a pavement, given other design parameters that will be readily available to the pavement design engineer. Using the PSI prediction, rehabilitation requirements will be evaluated.

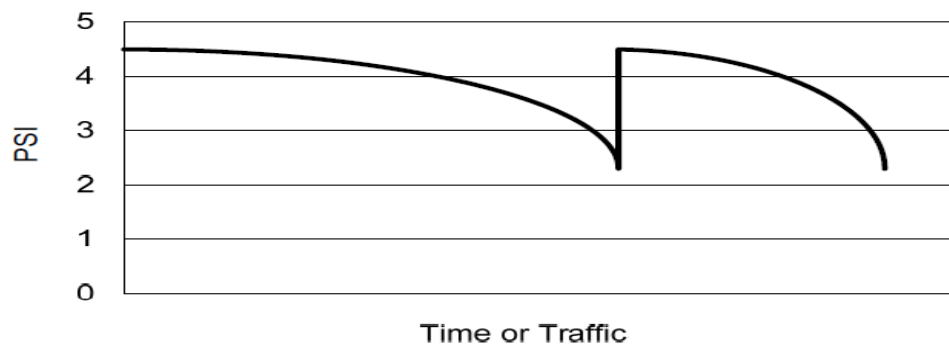


Figure 2: Typical Time or Traffic Versus PSI Curve with One Rehabilitation

The AASHTO model is used for consistency, since it is the same model that will be used for pavement thickness design. NCHRP Report 277 (Darter et. al, 1985) suggested that it was an effective approach as pavement thickness affects the rate of loss of pavement serviceability. Figure 4.2 shows a typical PSI curve with respect to time or traffic. This example shows a major rehabilitation toward the end of the predicted service life, and no action was taken after that.

V. PAVEMENT SERVICE LIFE PREDICTION OF GEOTEXTILE INCORPORATED PAVEMENT

The pavement service life for the design alternative which incorporates geotextiles needs to be quantified. The method to account for the service life benefit due to the utilization of geotextiles in pavement is presented as follows. The AASHTO pavement design equation 4.7 can be rewritten into the following form:

$$\Delta\text{PSI} = 2.7 \times 10^4 \left[\left(0.4 + \frac{1094}{(\text{SN}+1)^{5.19}} \right) [\log W_{80} - Z_R S_0 - 9.361 \log(\text{SN} + 1) + 0.20 - 2.32 \log M_R + 8.07] \right] \quad (8)$$

Changing Present Serviceability Index (Δ PSI) is altered with increases in the applied ESAL: as the applied ESAL increases, Δ PSI increases. The terminal PSI value (P_t) is equal to initial PSI (P_i) value minus Δ PSI. Therefore, P_t decreases as applied ESAL increases. When the P_t reaches 2.0, a major rehabilitation may need to be applied. Hence, the service life of the pavement can be determined. The applied cumulative ESAL up to the year of rehabilitation is cESAL. Using the calculated cumulative ESAL (cESAL) and the TBR, corresponding to the model used, the allowable ESAL for the pavement incorporating geotextiles can be determined:

$$ESAL_G = cESAL \times TBR$$

(9)

Utilizing $ESAL_G$ and ΔPSI at rehabilitation in equation 1 will give SNG (structure number for pavement with geotextiles).

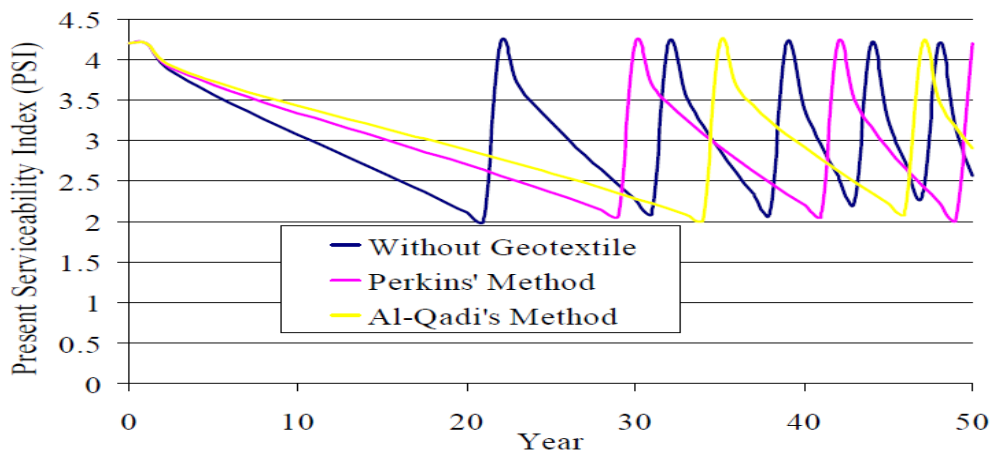


Figure 3: Service Life Comparison between Three Alternative Flexible Pavement Design Approaches

The latter can be used to calculate the $\Delta PSIG$. $\Delta PSIG$ represents the change in PSI when geotextiles are used between P_i and the corresponding P_t to the ESAL equivalent to that of P_t without geotextiles. An example of predicted service life of a pavement among these three design alternatives is shown in Figure 3. In this example, the pavement has an HMA layer of 100mm, a base layer of 375mm, and a subgrade of CBR 0.5%. For this low CBR, the TBR value is 2.45 (Al-Qadi's method) and 1.86 (Perkin's method), respectively.

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Cite this article as :

Sanjiv Kumar, K. B. Singh, A. K. Rai, "Analytical Study of Pavement Structure Considerations", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 335-339, January-February 2022.
Journal URL : <https://ijsrst.com/IJSRST221258>

Study of General Theory of Relativity and Cosmological Model of Copernicus

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ABSTRACT

In this present paper, we studied about mechanics of general theory of relativity and cosmological model. Copernicus forwarded the process of gravitation and he explained that the velocity of a falling body is depending upon its mass.

Keywords: Relativity, Gravitational Radiation, Cosmological Model, Universe.

Article Info

Volume 9, Issue 1

Page Number : 340-344

Publication Issue

January-February-2022

Article History

Accepted : 20 Jan 2022

Published : 28 Jan 2022

I. INTRODUCTION

Copernicus' view was significant – step forward towards an understanding of gravitation, for it started that gravity not only existed on the earth, but affected the other celestial bodies. Next, it was necessary to a falling body depended on its mass. Galileo is said to have started experimenting with different weights released simultaneously from the top of the leaning tower of Pisa in about 1589. Johannes Kepler (1571-1630) contribution was also important. His first scientific study, “The Cosmographic Enigma” which was published in 1596, was essentially a search for a numerical relationship between the various characteristics of the planetary orbits in the solar system. In 1602, Kepler discovered

the second law of planetary-motion, viz, the radius-vector from the sun to any planet sweeps equal areas in equal intervals of time. In 1602, Kepler discovered the law later called the “first”. Viz, the orbits of the planets are ellipses with the Sun at a focus. It is thought that Newton discovered the universal – law of gravitation $F=G$. Between 1667 to 1670, but he did not publish his discovery for a long time. At about the same time Robert Hooke (1635-1703), Giovanni Borelli (1608-1679) and Christian Huygens (1629-1695) all came under closeness in discovering the law, too. Hooke published an essay on the Earth's motion in 1674, in which he formulated the universal law of gravitation under the statement that the force was inversely proportional to the first power of the distance.

Consequently, we need a space-time, whose metric-tensor has components $g(x)$ that change from point to point, i.e., the space-time should be curved. This enables us to consider geometrical properties of space – time that change at different points. The next problem is to determine the specific nature of the relationship between the values of the component's g and the properties of gravitational interactions. This was the task that Einstein & Grossmann formulated and began work on in their article. In the section “Physics”, which Einstein wrote, he stated: “Thus we come to the conclusion that in a general case the gravitational field is characterized by ten space-time functions. These ten functions replace Newton's Single gravitational potential [1-5].

II. GENERAL THEORY OF RELATIVITY

In “general Theory of Relativity”, Einstein made a clear-cut relationship between gravitation and the principle of equivalence and accelerated frames. It has been known since Galileo's time that all bodies in the gravitational field of the earth have same acceleration, no matter what their individual properties (e.g. mass, substance, shape) are. Consequently, their accelerations depend on the points in space where they happen to be. Can we, therefore, attribute the gravitational characteristics (acceleration) to the points in space, where the bodies are, rather than to the bodies themselves? However, Minkowski's flat space-time does not have the properties needed to implement this idea- “it is homogeneous, that is everywhere uniform and isotropic (metric tensor) g are constant (their individual modules are either zero or unity). That is, in a general case, only ten of its components are independent. These components are the main “bricks” for building the general relativity. One may ask why the interval is given in terms of a square/ This is mainly due to the symmetry properties of the interval with respect to the direction between two adjacent points (AB-BA) [3-5].

How do bodies move in a curved – spaced – time? It was quickly realized that test bodies (those with small masses) move along geodesics in curved-space time. In order to obtain a geodesic, the external path between two points must be found by setting the variation of the path between the two points equal to zero if the ends of the path are fixed.

III. COSMOLOGICAL MODEL OF COPERNICUS

The cosmological model of Copernicus required that the distance to stars be very much larger than an astronomical unit; otherwise, the parallax of the stars as the Earth goes around on its orbit, would be large enough to see with the naked eye.

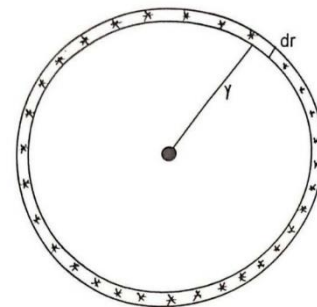


Figure 1 : A Star-filled spherical shell, of radius r and thickness dr , centered on the Earth

Moreover, since the Copernican system no longer requires that the stars be attached to a rotating celestial sphere, the stars can be at different distances from the Sun. These liberating realizations led Thomas Digges, and other post-Copernican astronomers, to embrace a model in which stars are large glowing spheres, like the Sun, scattered throughout infinite space [6-9]. Let's compute how bright we expect the night sky to be in an infinite universe.

Let n be the average number density of stars in the Universe, and Let L be the average stellar luminosity. The flux received here at Earth from a star of

Luminosity L at a distance r is given by an inverse square law:

$$f(r) = \frac{L}{4\pi r^2} \quad (1)$$

Now consider a thin spherical shell of stars, with radius r and thickness dr , centered on the Earth (Figure 1). The intensity of radiation from the shell of stars (that is, the power per unit area per steradian of the sky) will be.

$$f(r) = \frac{L}{4\pi r^2} \cdot n \cdot r^2 dr = \frac{nL}{4\pi} dr. \quad (2)$$

The total intensity of starlight from a shell thus depends only on its thickness, not on its distance from us. We can compute the total intensity of starlight from all the stars in the Universe by integrating over shells of all radii.

$$J = \int_{r=0}^{\infty} dJ = \frac{nL}{4\pi} \int_0^{\infty} dr = \infty. \quad (3)$$

Thus, I have demonstrated that the night sky is infinitely bright [10-12]. This is utter nonsense.

Therefore, one (or more) of the assumptions that went into the above analysis of the sky brightness must be wrong. Let's scrutinize some of the assumptions.

One assumption that we made is that we have an unobstructed line of sight to every star in the universe. This is not true. In fact, since stars have a finite angular size as seen from Earth, nearby stars will hide more distant stars from us from Earth, nearby stars will hide more distant stars from our view. Nevertheless, in an infinite distribution of stars, every line of sight should end at the surface of a star; this would imply a surface brightness for the sky equal to the surface brightness of a typical star [13-15]. This is an improvement on an infinitely bright sky, but is still distinctly different from the dark sky which we actually see. Heinrich Olbers himself tried to resolve Olbers Paradox by proposing that distant stars are hidden from view by interstellar matter which absorbs starlight. This resolution will not work, because the interstellar matter will be heated by starlight until it has the same temperature as the surface of a star. At that point, the interstellar matter

emits as much light as it absorbs, and is glowing as brightly as the stars themselves [16,17].

A second assumption we made is that the number density n and mean luminosity L of stars are constant throughout the universe; more accurately, the assumption made in equation (3) is that the product nL is constant as a function of r . This might not be true. Distant stars might be less luminous as less numerous than nearby stars. If we are in a clump of stars of finite size, then the absence of stars at large distances will keep the night sky from being bright. Similarly, if distant stars are sufficiently low in luminosity to the sky brightness. In order for the integrated intensity in equation (3) to be finite, the product nL must fall off more rapidly than $nL \propto 1/r$ as $r \rightarrow \infty$.

A third assumption is that the universe is finitely large. This might not be true [18-23]. If the universe only extends to a maximum distance r_{\max} from us, then the total intensity of starlight we see in the night sky will be $j \sim nLr_{\max}/(4\pi)$. Note that this result will also be found if the universe is infinite in space, but is devoid of stars beyond a distance r_{\max} .

A fourth assumption, slightly more subtle than the previous ones, is that the universe is infinitely old. This might not be true. Since the speed of light is finite, when we look farther out in space, we are looking farther out in time. Thus, we see the Sun as it was 8.3 minutes ago, Proxima Centauri as it was 4 years ago, and M231 as it was 2 million years ago [24-27].

If the universe has a finite age t_0 , then intensity of starlight we see at night will be at most $j \sim nLct_0/(4\pi)$. Note that this result will also be found if the universe is infinitely old, but has only contained stars for a finite time t_0 .

A fifth assumption is that the flux of light from a distant source is given by the inverse square law of

equation (1). This might not be true. The assumption that

$f \propto 1/r^2$ would have seemed totally innocuous to Olbers and other nineteenth century astronomers; after all, the inverse square law follows directly from Euclid's laws of geometry. However, in the twentieth century, Albert Einstein, that great questions of assumptions, demonstrated that the Universe might not obey the laws of Euclidean geometry. In addition, the inverse square law assumes that the source of light is stationary relative to the observer. If the universe is systematically expanding or contracting, then the light from distant sources that will be redshifted to lower photon energies or blue shifted to higher photon energies [28-29].

IV. CONCLUSION

Finally, the infinitely large, eternally old, Euclidean universe which Thomas Digges and his successors pictured simply does not hold up to scrutiny. This is a textbook, not a suspense novel, so, I'll tell, you right now: the primary resolution to Olbers' Paradox comes from the fact that the universe has a finite age. The stars beyond some finite distance, called the horizon distance, are invisible to us because their light hasn't had time to reach us yet. A particularly amusing bit of cosmological trivia is that the first person to hint at the correct resolution of Olber's Paradox was Edgar Allen Poe. In his essay "Eureka: A Prose Poem", completed in the year 1848, Poe wrote, "Were the succession of stars endless, then the background of the sky would present us an [sic] uniform density.... since there could be absolutely no point, in all that background, at which would not exist a star. The only mode, therefore, in which under such a state of affairs, we could comprehend the voids which our telescopes find in innumerable directions, would be by supposing the distance of the invisible background so immense that no ray from it has yet been able to reach us at all.

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Cite this article as :

Ghanshyam Kumar, K. B. Singh, D. K. Singh, "Study of General Theory of Relativity and Cosmological Model of Copernicus", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 340-344, January-February 2022.
Journal URL : <https://ijsrst.com/IJSRST229486>

A Survey on Road Accident Prediction Techniques Based on Various Methodologies

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ABSTRACT

Article Info

Volume 9, Issue 1

Page Number : 345-356

Publication Issue

January-February-2022

Article History

Accepted : 05 Jan 2022

Published : 20 Jan 2022

This may be understood as a conflict between the self-interest of its members and the greater good of society as a whole in large-scale dispersed ecosystems. Mechanisms that give incentives and encourage cooperation are often required to control the participants' conduct to minimize the possibly unfavorable availability consequences that may follow from individual activities. Economics has a long and varied history of ways to encourage collaboration. Bartering incentive patterns provide an ideal basis for a simple and resilient kind of trade for re-allocating resources in this thesis. Bartering is one of the oldest forms of commerce in the world, yet it still amazes us in many ways. The barter system's success and long-term viability make it a good model to analyze. When it comes to the Internet, bartering is becoming more commonplace. Making trade recommendations for an "online bartering platform" is a lot like making conventional recommendations, especially when it comes to modeling users' tastes and the attributes of the goods they consume. Some elements, however, make bartering difficulties intriguing and complex, notably the fact that users are both providers and customers, together with a highly dynamic business setting. "It is important to understand not just the preferences of users but also the social dynamics of who trades with whom, and the time dynamics of transactions occurring. In this paper, we will study the ways of analyzing road accident prediction techniques.

Keywords - Bartering, SGD, ICON3, Matrix Factorization, The Binary Value Exchange Model, Circular Exchange Of A Single Item

I. INTRODUCTION

A. Overview

This may be understood as a conflict between the self-interest of its members and the greater good of society as a whole in large-scale dispersed ecosystems

Mechanisms that give incentives and encourage cooperation are often required to control the participants' conduct to minimize the possibly unfavorable availability consequences that may follow from individual activities.

Economics has a long and varied history of ways to encourage collaboration. Bartering incentive patterns provide an ideal basis for a simple and resilient kind of trade for re-allocating resources in this thesis. Bartering is one of the oldest forms of commerce in the world, yet it still amazes us in many ways. The barter system's success and long-term viability make it a good model to analyze.

When it comes to the Internet, bartering is becoming more commonplace. Making trade recommendations for an "online bartering platform" is a lot like making conventional recommendations, especially when it comes to modeling users' tastes and the attributes of the goods they consume. Some elements, however, make bartering difficulties intriguing and complex, notably the fact that users are both providers and customers, together with a highly dynamic business setting. It is important to understand not just the preferences of users but also the social dynamics of who trades with whom, and the time dynamics of transactions occurring.

B. Background Of The Barter System

In Jackson Hole, Wyoming, in August 2000, the world's economic leaders convened for an annual policy summit.

The chiefs of the central banks of Japan, Britain, and some other nations were in attendance, including Alan Greenspan.

"Mervyn King, Deputy Governor of the Bank of England," was one of the guests who reflected on the influence of internet commerce and the future of money.

C. Big Barter Networks - A Mix of the Old and the New

For example, in the modern-day, the introduction of computers not only transformed the global but also helped to revive trading. Bartering has become a simple and low-cost method of trade as a result of the new technology's incredible monitoring and inventory management capabilities. In today's

world, bartering is a great way to get a wide range of goods, from computers to jewelry to books to CDs to movies to hotel rooms.

There is no end to it.

- Bartering is a large industry, and it's just becoming bigger.
- These stories demonstrate the complexity and resurrection of modern-day bartering.

The following are a few instances of amazing deals:

"Fujitsu laser printers were exchanged for 1.7 million units of military ready-to-eat (RTE) meals, which were then sold to relief groups for urgent use in the hurricane-ravaged states of Florida and Hawaii. Due to conflicts in the Persian Gulf, there was no need for the RTEs."

"An arrangement signed by PepsiCo, Inc. in April 1990 was the biggest trade transaction between a U.S. firm and the former Soviet Union, bringing in more than \$3 billion in total retail sales for the two countries."

To establish hundreds of bottling operations and "Pizza Hut" locations in the "Coalition of Independent States," PepsiCo will be able to utilize foreign currency credits from vodka sales.

In exchange for practically nothing, the Lexington Hotel in New York City received a cutting-edge computer system.

Computers were purchased in 1991 by a barter business in return for more than \$300,000 in "hotel room credits" that the firm could use or, with the hotel's consent, sell or trade for other products or services.

Bartering extra office space for products and services is another new trend.

Advertisement time, hotel rooms, and office equipment are just a few of the items that SGD and ICON3 exchange for spare space.

The fabled purchase of an island by "Peter Minuit" in 1626, in which he traded 60 gold pieces worth of

trade items for an island known as Manhattan, is an example of the power of barter.

When it comes to electronic bartering, file-sharing programs are one of the most prominent instances of peer-to-peer trading.

Using the bartering method, a peer can receive about equal amounts of incoming data and outgoing data.

In both public and private settings, large-scale network exchanges of collaborative information are becoming more common.

In the second case, obtaining a membership requires that you have a connection to an existing member. For example, “file-sharing networks”:

- Broadcasting of movies and television programs
- Patches and upgrades are distributed
- Global e-commerce might be transformed through bartering, thanks to the Internet.
- Trading has returned to our “economic systems” as a result of the Internet.
- Being able to link an endless number of traders and provide an infinite number of possibilities for trading partners.

II. THREE IMPLICATIONS OF THE BARTERING ADVANTAGE

The bartering strategy is used in three different circumstances in this thesis.

- Using a standard bartering model as a starting point:
- Using a bartering environment, we demonstrate the costs and consequences of dealing with selfish actors, including topology and leaked knowledge.
- Bartering has a lot of promise before it can be used effectively in the real world.
- A new paradigm is examined in this thesis, which examines the earliest system of commerce.

- We demonstrate how bartering may be used to get items without the presence of altruistic actors.
- The Internet is a worldwide network of computer networks that are all linked together.
- Real-world Internet directory services are the focus of our bartering strategy.
- High transaction costs have often plagued economies based mostly on bartering.
- Bartering is the “Internet Age” is the focus of this study.
- Many of the difficulties of prior eras may be addressed in this linked society.

III. INTRODUCTION TO THE IDEAL MODEL

The economy is believed to have been barter-based from its start [1]. The introduction of money as a means of trade and a unit of measurement facilitated the valuation of assets and shaped current economic practices. Barter has re-emerged in the lives of 21st-century consumers as a result of extensive digital communication [2]. Economic models have been resurrected based on the premise that things may be extended to service numerous owners, or that users can get access to obscure or difficult-to-obtain items. Swapping CDs, DVDs, books, and other media may be done on a variety of platforms, including swapacd.com, swapadvd.com, readitswapit.co.uk, and bookmooch.com.

In contrast, the aforementioned systems lack methods to propose deals, necessitating a user-driven search for suitable trading partners. To barter, there must be a double coincidence of ‘wants,’ meaning that both parties want the things of the other. This makes it difficult to complete the transaction. Bartering has a lot of potential to enhance the customer experience, especially in light of the current trend toward environmentally friendly activities.

It’s not clear how best to propose transactions on an online bartering platform, however, some study has been done. Barterquest.com, for example, uses a trade

matching approach, however, their data was unavailable. However, user preference modeling is not a part of their matching process.

It is necessary to identify potential trade partners within the platform's user base before constructing a recommender system for bartering platforms.

Users on the site have a public "Want List" and a public "Give-Away List" of products they'd want to give away in return for the items they want.

There has been some initial research on the issue [3] that offers a tight matching criterion between the explicit user "wants" and "haves," resulting in trade compatibility only if their reciprocal want lists/give-away lists meet.

In real-world datasets obtained from online bartering platforms, we discover that such an approach is very unsuccessful since the double coincidence of "wants" and "haves" is quite low, with less than 5% of users being qualified to get suggestions.

A system with the ability to provide "serendipity" is necessary, as shown by actual data showing that things being transacted are not necessarily on users' wish lists before the transaction.

So-called "recommendation engines" would be capable of recommending products a user likes, but which are not indicated among their preferences, either because they removed them from the wish list or are ignorant of their existence.

Summary: Existing methodologies often do not provide suggestions that are consistent with observed transactions, presumably indicating that users are influenced by factors other than those disclosed by wish list analysis.

Using Matrix Factorization [4], we offer a model that estimates cross-references between possible trading partners, or more specifically the level of reciprocal interest that two consumers have for each other's products.

Finally, we'd want our system to identify the most probable things to be traded between every given pair

of potential users. Then, based on the sorted list of partner-item pairings, we may provide swap suggestions.

We begin with a classic matrix factorization technique, which we then expand by including social and temporal dynamics since we discover that users gain confidence in trading partners via repeated transactions and prefer to trade in bursts of recurrent activity.

As a way to capture these impacts, we offer a socially and temporally aware model that significantly outperforms earlier matching-based techniques and "vanilla" matrix factorization.

Three large-scale real-world datasets, including want lists, give-away lists, and actual transaction histories, are also part of our effort. This enables us to qualitatively assess our methods by comparing them to those that have already taken place and those that haven't taken place. Data from bartering platforms suggest a radically different user behavior from what was previously anticipated. This contribution is incredibly essential.

An assessment method that has been unexpectedly absent from prior studies on bartering is used to compare the quality of the suggestions generated with the real-world evidence provided by the historical data. Bartering data from the real world is used as an example to demonstrate the limitations of a state-of-the-art item exchange technique [3].

Rather than depending on the imperfect truth offered by users' wish lists, our technique addresses various limitations of earlier approaches by using user preference modeling.

To provide additional options and serendipity, we may utilize this method to rank all of the swap possibilities that a user has in the system.

In August 2000 the world's economic leaders met for an annual policy conference in Jackson Hole, Wyoming. Alan Greenspan was there, as were the heads of the central banks of Britain, Japan, and 26 other countries.

One of the attendees, Mervyn King, Deputy Governor of the Bank of England, ruminated on the impact of electronic commerce and the future of money. His conclusion, quoted below, was startling to some:

- There is no reason that products and services could not be swapped directly by consumers and producers through a system of direct exchange—essentially a massive barter economy.
- All it requires is some commonly used unit of account and adequate computing power to make sure all transactions could be settled immediately.
- People would pay each other electronically, without the payment being routed through anything that we would currently recognize as a bank. Central banks in their present form would no longer exist—nor would money.”

A standard dictionary defines barter as trading goods or services without the exchange of money. This is conducted between parties who have products or services that each other needs or wants. The keyword here is need. Barter has survived to this day. Why? Simply because people needed it then, as they need it now, only the methods have changed over time.

In the days before the Internet, skilled business owners performed barter exchanges mostly by word-of-mouth, choosing to approach others in other trades based in a large part on the recommendations of business owners they knew and trusted. At present barter has been used in situations of economic crises, as in the U.S. or recently in Argentina. In these situations, money loses its value, and obtaining goods requires the use of other means. In this context, barter offers up a way to interchange goods with similar values. However, bartering has many other sides where it is relevant. This thesis explores cases where bartering could be applied. The thesis first develops a common model for bartering amongst electronic entities and then explores several different bartering scenarios with diverse and exclusive properties.

Starting each case from the same model, specific properties are studied. Results are subsequently verified using simulations and analysis which to explore the dynamics underlying each scenario and the validity of the model is checked.

In human society, resource reallocations are, in most cases, performed through markets. This occurs on many different levels and many different scales, from our daily grocery shopping to large trades between big companies and/or nations. Barter has been used many times as a way to supply the needs of developing societies.

The large-scale barter networks – In the modern-day, the advent of computers not only revolutionized the world but also facilitated a sudden resurgence of bartering. The tremendous capabilities of this new technology of tracking barter transactions and maintaining huge inventories made bartering an easy and inexpensive form of trading. Today, it is amazing to see what can be obtained through bartering: computer hardware and software, household items, jewelry, books, CDs, movies, hotel accommodations, etc. The list is endless. Barter is a big business and getting bigger with every passing day.

Several modern barter tales illustrate the growing sophistication and resurgence of the barter. Some examples of exciting transactions:

- A broker arranged the exchange of 500 Fujitsu laser printers for 1.7 million units of military ready-to-eat (RTE) meals, which were in turn sold to relief agencies for immediate use in hurricane-ravaged Florida and Hawaii. The RTEs were surplus from the Persian Gulf conflict.
- In the largest trade deal ever inked between a U.S. corporation and the former Soviet Union, PepsiCo, Inc. agreed in April 1990 to renew its agreement to trade Pepsi-Cola concentrate syrup for Stolichnaya Russian vodka until the year 2000 – a pact worth more than \$3 billion in total retail sales. Several innovative countertrade

mechanisms will allow PepsiCo to use foreign exchange credits from vodka sales to build dozens of bottling plants and several Pizza Hut restaurants in the Coalition of Independent States.

- New York City's Lexington Hotel obtained a sophisticated computer system for almost nothing. In 1991, a barter firm gave the hotel money to buy the computers in exchange for more than \$300,000 in room credits that the firm could use or, with the hotel's approval, sell or barter for other goods or services.
- Another recent innovation is bartering goods and services for excess office space. Both SGD and ICON3 trade advertising time, hotel rooms, or office equipment, among other goods and services, for unused space.
- Occasionally, barter gets amazing deals as the legendary purchase of an island by Peter Minuit, who in 1626 bartered trade goods valued at 60 gold coins for an island called Manhattan.

One of the most visible examples of electronic bartering today is the use of peer-to-peer technology to complete multi-party barter exchanges in file-sharing applications. The bartering strategy ensures that for a peer the amount of incoming data is roughly equal to the amount of outgoing data. The use of mass collaborative network exchanges goes from public to private environments. In this latter, to get an account it is necessary to know someone who is already a member (e.g. funfile4, pretome5, stmusic6). File-swapping networks have been used for:

- Changed the values of music and its role in the music industry's future
- Diffusion of films and TV shows
- Distribution of patches and upgrades

With the inherently global Internet, bartering could change the face of global e-commerce. The Internet reintroduced bartering back into our economic systems. Being capable of connecting an

infinite number of traders and opening an unlimited opportunity for trade partners.

IV. SCENARIOS OF THE BARTERING APPROACH

A long and diverse history of economic incentives for cooperation. In this thesis, bartering incentive patterns give a simple and robust way to re-allocate resources. The earliest method of business, bartering, still impresses us. Barter's success and longevity make it a valuable model to study. Throughout this thesis, we have specified three relevant situations in which the bartering approach may be used. Let's start with a well-known bartering arrangement:

- An Internet directory service application is used to demonstrate how a bartering-based technique might be used.
- We explain how agents, utilizing bartering, may acquire benefits in commodities without altruistic agents having to be present.
- In a bartering environment, we show the cost of dealing with selfish agents, as well as the impact on performance indicators like topology and disclosed information.

The exploration of bartering in the Internet Age is at the heart of this research. High transaction costs (i.e. the improbability of the desires, requirements that trigger a trade occurring at the same time and location) have plagued economies dominated by bartering in the past "(i.e. the improbability of the wants, needs that cause a transaction occurring at the same time and place)." Today, the Internet is a global system of interconnected computer networks that span the globe. This interconnected world may overcome many of the challenges of previous eras. Within the context of this new paradigm, this thesis investigates the oldest system of trade. We want to show in this thesis that bartering has a lot of promise, but that it also has a lot of challenges that need to be investigated.

V. OVERVIEW OF THE PROPOSED MODEL

The economy is said to have been barter-based from its inception [1]. Money ultimately emerged as a medium of exchange and a measure of value,

simplifying asset valuation and shaping today's economic practices. Barter has made a comeback in the 21st century because of the increased use of digital communication [2]. Economic models have been resurrected based on the premise that things may be extended to service numerous owners, or that users can get access to obscure or difficult-to-obtain products. bookmooch.com, readitswapit.co.uk, swapadvd.com, and Swapacd.com, are just a few of the many sites that allow people to trade products of all kinds.

It's also worth noting, though, that these systems are quite ad-hoc and can't propose transactions to their members. To barter, there must be a double coincidence of 'wants,' meaning that both parties want the things of the other. This makes it difficult to complete the transaction. Bartering is a natural match for green practices; therefore this challenge has a lot of promise for enhancing the user experience. In contrast, little study has been carried out on the best ways to propose deals on an online bartering platform.

Other services, including barterquest.com [5] use a trade matching approach, however, their data was unavailable. However, user preference modeling is not a part of their matching process.

It is necessary to identify potential trade partners within the platform's user base before constructing a recommender system for bartering platforms. Users on the site have a public "Want List" and a public "Give-Away List" of products they'd want to give away in return for the items they want. There has been some initial research on the issue [3] that offers a tight matching criterion between the explicit user "wants" and "haves," resulting in trade compatibility only if their reciprocal want lists/give-away lists meet. A surprising result of this technique is that it fails miserably on real-world datasets gathered from online bartering platforms where the coincidence between "wants" and "haves" is so low that suggestions can be made to less than 5% of the users. A system with the ability to provide "serendipity" is necessary, as shown by actual data showing that things being transacted are

not necessarily on users' wish lists before the transaction. For example, an automated system could suggest products that a person likes but aren't explicitly stated in their preferences, either because the user overlooked them when creating the wish list or because they are unaware of their existence. Current approaches, according to our results, do not give recommendations that are consistent with observed transactions, which might imply that customers are impacted by variables other than those revealed by wish list research.

Using Matrix Factorization [4], we offer a model that estimates cross-references between possible trading partners, or more accurately the level of reciprocal interest that two users have for each other's products. Ultimately, our objective is to identify the most probable goods to be traded between a pair of users, and we do this by calculating the sorted list of partner-item combinations in order of reciprocal preference.

Traditional matrix factorization algorithms are used to generate an initial model, which is then further enhanced by including social and temporal dynamics since we've found that users establish confidence in trading partners over time by engaging with them repeatedly. There are significant gains over earlier matching-based techniques, as well as 'vanilla' matrix factorization, in our model to capture these impacts, which is both socially and temporally aware.

This enables us to assess the quality of our methods by comparing how well they rank completed transactions with those that have not. This is a critical addition since the data shows that bartering platforms' users behave substantially differently than previously thought.

For the first time, we evaluate the validity of our suggestions by comparing them to the actual bartering histories that have been obtained [2, 3, 4]. An item exchange approach that has been around for a while is compared and critiqued using real-world bartering datasets. In contrast to earlier solutions, our

methodology addresses many shortcomings by using user preference modeling rather than depending only on users' wish lists to solve the issue. We may use this method to rank all of a user's swap options in the system, resulting in more options and a greater chance of serendipity.

"Social and artificial societies" both rely on trade as a fundamental economic principle. The exchange theory covers a wide range of topics:

- Sociology assumes that all social life may be understood as a kind of transaction between agents. See [5] and [6] for further information.
- Exchanges between people and those who have political power are referred to as "politics." [7]
- The exchange of commodities and services is the basis of economics MAS [8]
- MAS [8], Grid [9], and P2P [4] are examples of Artificial Societies that allow for the exchange of digital commodities or resources.

Ancient and contemporary civilizations alike have relied on barter as a medium of commerce. Many various" aspects of "distributed Artificial Societies" might benefit from barter, from file sharing to query forwarding, from routing, from knowledge dissemination, from storage-sharing systems, to WIFI hotspot sharing, to name just a few. Commercial systems like Linspot7, Netshare8, and Fon9 make use of this technique. Other examples are BizXchange, ITEX Bartercard, Continental Trade Exchange, and the Bartercard. The Internet Age is full of expectations for barter arrangements. [10] and [11] both say:

"Is it possible that advances in technology will mean that the arbitrary assumptions necessary to introduce money into rigorous theoretical models will become redundant and that the world will come to resemble a pure exchange economy? Electronic settlements in real-time hold out that possibility."

By Nicholas Negroponte:

"A parallel and more intriguing form of trade in the future will be barter. Swapping is a very attractive

form of exchange because each party uses a currency that is devalued for them i.e. an unwanted possession, that otherwise would be wasted. The most stunning change will be peer-to-peer, and peer-to-peer-to-peer.. transactions of goods and services. While this is nearly impossible to do in the physical world, it is trivial in cyberspace. Add the fact that some goods and services themselves can be in digital form, and it gets easier and more likely."

Ad-hoc networks, multi-agent systems, and peer-to-peer networks are all examples of distributed situations where bartering is an appealing paradigm to explore. These are obvious instances of large-scale contexts where efficient bartering methods may be seen in action. For the resources of the *participants* to be exploited, these communities' members must work together as independent entities. If a system does not have the correct incentives, it may be rendered pointless by selfish conduct. External motivations for collaboration are necessary to counteract this. When it comes to incentives, a bartering strategy is proposed [12].

VI. LITERATURE REVIEW

A. Overview

Other studies that are closely similar to ours include studies of bartering and trade in general, as well as models of users' latent preferences for particular commodities. Each of these topics is covered in depth in the sections that follow.

B. Priority Work on the Best Barter Exchange Strategies, Begin As Early As Possible

The kidney exchange dilemma [14, 15] sparked early work on exchange market algorithm design [16]. For patients with incompatible live donors, algorithms have been devised to identify cross-matched patient-donor combinations in the regional transplant pool. By employing The Top Trading Cycles and Chains mechanism, Roth et al. [17] have addressed the issue Haddawy et al. [18] address the issue of identifying a balanced match between buyers and sellers in the

setting of barter trade exchanges, which is an important study. There is an intermediary in charge of managing the transactions, and the parties are matched according to their supply and demand information and their credit in terms of a private-labeled currency. On a network, a least-cost circulation issue is modeled. And last but not least, the work of Mathieu [19] attempts to solve the challenge of locating bartering rings in an online marketplace by using weighted trees to compare the similarity of search and offer queries.

C. Circular Exchange Of A Single Item (CSEM)

A bartering network's exchange cycles are more complex than the kidney exchange dilemma. Users in a standard exchange market have numerous products to give away and perhaps multiple incoming items, rather than receiving and giving one item (a kidney). A directed network with nodes representing users and edges tagged with item IDs is used by Abassi et al. [20]. It is up to the users to decide what they want to buy and what they want to give away. Potential transactions may be seen in this graph by looking for directed cycles.

D. The Binary Value Exchange Model (Bvem)

"Su et al. [3] address the item exchange issue for "cycles of length two, which is a distinct approach (i.e., swaps). Competitive online situations such as online games with a heavy real-time updating schedule may benefit from the system. For this reason, the value to be optimized is the sum of all possible gains for each of the users.

Many recommender systems use Matrix Factorization (MF). The low-rank approximation is used to estimate user preferences that are not seen in the user settings and the item set [21]. MF guesses these preferences using a sparse interaction matrix $R \in \mathbb{R}^{|U| \times |I|}$. An item's compatibility with a user is determined by the dot product of the user's interaction with the item and the low-dimensional space in which the user and the item are placed.

To address social interactions and temporal dynamics, we mostly draw upon existing theories that extend the MF to integrate social regularization [22] and "temporal dynamics in recommender system" (RS) recommendations [21].

E. This is a personal ranking of 2.5 in the Bayesian language (BPR)

Rendle and co-authors [24] have developed an optimization process called Bayesian personalized ranking that directly optimizes a ranking measure. [17] (AUC). Implicit feedback is readily handled by this method since it simply analyses interactions that are 'positive' between the user and the object, while not distinguishing between observations that are negative or absent. Users prefer products they have seen over those they haven't, and this intuition is crucial. Matrix Factorization or "Adaptive k-Nearest-Neighbors" [17] may be used in combination with this pairwise optimization strategy.

VII. CONCLUSIONS AND FUTURE WORK

A variety of data mining approaches have been used to analyze the accident dataset, including SOM (Self-Organizing Map), K-modes, Hierarchical clustering, latent class clustering (LCC), BIRCH clustering, and classification techniques such as Support Vector Machines (SVM), Naive Bays, Decision Trees (Random Forest, J-48, etc.), Multilayer Perceptrons, Lazy Classifiers (K-star and IBK), BIRCH clustering. The classification accuracy is enhanced by this method based on casualty class so that it can be seen what factors affect (like most accidents occurred between 12:00 and 20:00 and the driver was involved in most of the cases, Dry road surface, day lightening condition, clear weather condition, most of them are youth and adult, mostly car involved in the accident, weekday, Male, etc.) and who is involved more in an accident between the driver, passenger or pedestrian. SVM, Naive Bays, and Decision Tree classification accuracy is better on k-modes clusters than on SOMs, according to the findings of the first experiment. For road accident data with categorical variables, k-mode

clustering would be a better alternative than other methods, according to this study. Improvements have been made to the accuracy of the first result, and the second result is a consequence of this. When compared to k-mode clustering, the results using hierarchical clustering were superior.

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Development of Naïve Method to Analyse the Road Accidents Based on Data Mining Techniques

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ABSTRACT

“Road Accident is an all-inclusive calamity with the continually growing trend. In India, according to the Indian road safety campaign every minute, there is a traffic accident and about 17 people die each hour in road accidents. There are several types of car accidents such as rear-end, head-on, and rollover accidents. India, according to the Indian road safety campaign every minute, there is a traffic accident and about 17 people die each hour in road accidents. There are several types of car accidents such as rear-end, head-on, and rollover accidents. The state-recorded police reports or FIRs are the records that provide information regarding the accidents. The event may be self-reported by the individuals or documented by the state police. Using Apriori and Nave Bayesian approaches, recurrent patterns of road accidents are predicted in this research. The government or non-profit organizations might use this pattern to enhance road safety and implement preventative measures in high-accident areas. From 2020 to 2021, a total of 11,574 accidents happened on the roads in the Dehradun district. Based on the variables of accident type, road type, lightning on road, and road feature, K modes clustering found six clusters (C1–C6). Each cluster and the EDS have been used to construct rules using association rule mining. Rules with high lift values are used in the study. Using the rules for each cluster, it is possible to learn about the causes of accidents in that cluster. When compared to EDS-generated rules, this comparison reveals that EDS-generated rules do not give relevant information that may be linked to an accident. If additional features linked with an accident are accessible, more information may be discovered. We also did monthly and hourly trend analyses of all clusters and EDS to reinforce our technique. According to trends, clustering before an analysis helps us locate better and more helpful outcomes that we wouldn't otherwise be able to find.”

Keywords - Hierarchical Clustering, K-modes clustering, Self-Organizing Map, Three-and-a-half inches of Birch, Invite Vector Machine Support, Latent Class Clustering, Intentional Bayes

Article Info

Volume 9, Issue 1

Page Number : 357-366

Publication Issue

January-February-2022

Article History

Accepted : 05 Jan 2022

Published : 20 Jan 2022

I. INTRODUCTION

A. Overview

The proposed framework may be implemented in the form of an ongoing software program. This topic may be implemented in the government sector. The general public may make use of the current framework to learn about the many types of mishaps that might occur in a certain region or city. The goal of the new piece was to discover any hidden connections and linkages between various elements showing street accidents with fatal consequences. In India, street security may be improved by collaborating with all of the major stakeholders, including the police, the state, and the local government. Precautionary steps will be taken based on a study of the current system, which uses record information and physically dissects it to find out how many accidents there have been. In addition, a slew of gadgets and programs are available to monitor traffic accidents; however, they just collect data from various sources and do not conduct a full investigation. Currently, everything is done manually, which is time-consuming, expensive, and leaves a lot of information hidden. As a result, it is less effective. For the proposed research, we are looking for correlations and links between numerous elements that may have previously gone unnoticed, as well as the prevalence of traffic accidents and their potentially lethal outcomes. Similar information extraction may assist enhance road safety when done in close collaboration with all of the most significant players, such as the police department, state government, and federal government. First, the current circumstances and our motivation for analyzing data on road traffic accidents are explained; next, the survey data set is presented and pre-processing operations are performed to prepare mining data; and last, the chosen methodologies and evaluations are used.

Long-distance riders and travelers may use the data mined by data miners to make informed choices about their journey by using the tools and procedures developed for data mining to the controlled data.

B. Databases

This study's test location is a section of the G60 Freeway in Shanghai, India. The road portion is 48.7 km long and has 6–10 lanes (3–5 lanes in each direction).

C. Objective

The general goal of this thesis is to acquire accuracy and discover the elements behind crashes or accidents that might be useful in reducing the accident ratio shortly and could be useful in saving many lives, deteriorating wealth destruction, and many other things. The following section provides an overview of research publications relevant to this thesis.

I. LITERATURE REVIEW

A. Overview

The field of transportation accident investigation is very important (Kumar and Toshniwal, 2016a). Several studies have used statistical methods and data mining techniques (Savolainen et al. 2010; Karlaftis and Tarko, 1998; Jones et al. 1991, Poch and Mannering 1996, Maher and Summersill, 1996) to analyze traffic crash data, and to establish relationships between accident attributes and road accident severity. The findings of this research are very valuable since they shed light on the many factors that contribute to car accidents. To combat the high accident rates in the study region [37-41, 32, 7, 19, 42-43, 79-80], being aware of these accident variables is unquestionably beneficial.

B. Factors Responsible For Accident

An investigation conducted by Peng and Boyle [59] aimed to gather information on the influence of

commercial driving considerations on the severity of ROR, single-vehicle collisions. Using safety belts lowered the risk of ROR collisions, according to one study. ROR crashes were made more likely by distracted and careless driving. Fatigue, laziness, and speeding all contributed to an increase in the likelihood of serious injury or death in ROR accidents. Drivers of commercial motor vehicles (CMVs) in good condition had a decreased risk of serious injury or death in rear-end (ROR) collisions. It was 3.8 times more likely for a ROR accident to be injurious and fatal if it happened on provincial roads or dry streets. There were no additional criteria that were considered important. Few driver factors, including exhaustion and laziness, speed, diversion, distractedness, and the use of a safety belt in a ROR incident, were shown to have a significant impact on the likelihood of a ROR crash being fatal.

C. Traditional Statistical Approach For Accident Analysis

Not all statistical procedures are data mining methodologies. Statistical techniques or "statistics" are not. They were in use long before the phrase "data mining" was coined to describe their use in corporate contexts. Statistical methods, on the other hand, are driven by data and used to discover patterns and develop prediction models. In road safety studies, statistical methods have also played an essential role. Researchers Karlaftis and Tarko (1998) examined the relationship between rider age and accident frequency. The data on traffic accidents were analyzed using negative binomial models and cluster analysis. Data from road accidents has been the subject of many significant statistical analyses, including those by Savolainen et al. (2010); Karlaftis and Tarko (1998); Jones et al. (1991); Poch (1996); as well as Poch and Mannering (1996).

D. Data Mining Approaches For Accident Analysis

It has been claimed that clustering before analysis of traffic and road accident data is highly effective in dealing with the high degree of variability

in these datasets, as recommended by Kumar and Toshniwal (2015a). Latent class clustering (LCC) was utilized by Ona et al. (2013) to eliminate data heterogeneity. Using LCC, they found that it may be used to discover many clusters in the data set, as well as varied criteria for determining which clusters should be included in the analysis. In addition, (Kumar and Toshniwal, 2016d) compared accident data from Haridwar, Uttarakhand, India with those from other cities in India. Clustering approaches such as LCC and K-modes (Chaturvedi et al., 2001; Kumar and Toshniwal, 2015b) were utilized in this work to group the data before completing the analysis. In addition, they used the Frequent Pattern (FP) development approach to extract the association rules that explain the accident patterns in each cluster. They concluded that both methods are equally effective in forming clusters and eliminating heterogeneity from the data. There was no evidence that one method was preferable to another, however.

II. PROPOSED METHODOLOGY

A. K-modes clustering

It is the goal of clustering, an unsupervised data mining technique, to group together data items in such a manner that objects inside a group are more similar than those in other clusters. When working with huge sets of numerical data, clustering algorithms like the K-means [67] method are a popular choice. The dataset is divided into k clusters using this method. However, the choice of an effective clustering technique is dependent on the kind and form of data. The primary goal of this research is to identify the location of an accident based on its frequency of occurrence.

B. Self-Organizing Map (SOM)

Self-Organizing Map (SOM) by Teuvo Kohonen [69] gives a visualization of data that assists high dimensional data by decreasing the dimension of data. SOM likewise describes the clustering idea by gathering comparative data together. Thusly one might say that SOM decreases the dimension of data and presentation similitudes among datasets. With SOM,

clustering is executed by having a few units go after the present object. Once the information has been gone into the framework, the network of neurons is prepared by giving data about sources of info. The weight vector of the unit nearest to the present object turns into the triumphant or dynamic unit. Amid the preparation organize, the values for the input factors are progressively balanced trying to safeguard neighborhood connections that exist inside the input dataset. As it gets nearer to the input object, the weights of the triumphant unit are balanced and in addition to its neighbors. At the point when a training set has been forced to the neural systems then their Euclidean separation to conclusive weight, vectors are figured. Presently the neuron weight is around the weight of input data. In this way, this is called the triumphant unit or Best Matching.

C. Hierarchical Clustering

Figure 2 depicts a clustered tree (or "node"), where each segment (or "node") is linked to at least two subsequent segments. Hierarchical clustering After settling and sorting out the pieces into a tree, we have what might be considered an important categorization plot.

On the clustered tree, each node is placed next to another node that has equivalent data. Iteratively connecting each node in a tree until all information in the set can be seen is an effective way to offer users a sneak peek at what they may expect to see once the tree is complete. As soon as you begin the tree-creation process, you have no idea how many clusters you'll end up with.

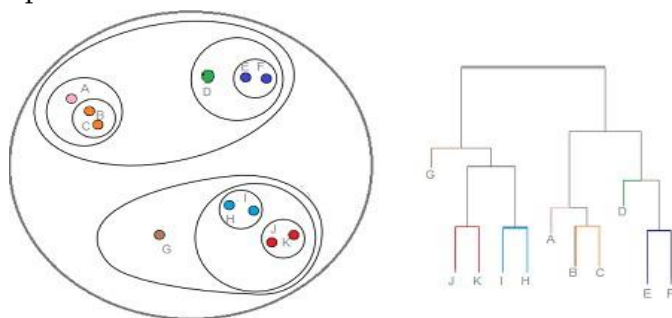


Fig. 3.1 A dendrogram (right) depicting nested hierarchical clusters (left)

D. Latent Class Clustering (LCC)

Using LCC for road and traffic accident data analysis is a common clustering technique. LCC's greatest strength is its versatility, as it can be used to the category, numerical, or mixed attribute data. As an added benefit, the LCC utilizes many cluster selection criteria, such as Akaike Information Criteria (AIC) (Akaike, 1987), Bayesian Information Criteria (BIC) (Raftery, 1986), and CAIC (consistent AIC) (Fraley and Raftery, 1998) to help determine the optimal number of clusters to build.

E. Three-and-a-half inches of Birch

To produce efficient clusters, BIRCH, a well-known dynamic clustering approach, employed hierarchical cluster analysis on a huge dataset. Prior clustering algorithms were limited in their ability to handle huge datasets because of memory constraints. This means that BIRCH is a very efficient algorithm in terms of both CPU and memory use.

F. Invite Vector Machine Support

Analogous to a regression or classification technique, SVM is a supervised learning approach. SVM uses decision planes to describe the boundaries of the decision space. Decision planes are a way of distinguishing between a group of items that are distinct in terms of their class. Using hyperplanes in n-dimensional space, a classifier approach is used to do a classification problem. SVM can handle many categorical and continuous variables and help with classification and regression tasks.

G. Intentional Bayes (Ib)

A classifier based on Bayes' hypothesis with concerns about autonomy across indicators. Due to its simplicity and lack of astounding measure approximation, this approach is very useful for dealing with enormous datasets.

H. DECISION TREE

ID3's upgrade, J48, extends its capabilities. J48's extra components indicate data that has been omitted. J48 is a Java-based open-source implementation of the C4.5 computation in WEKA.

When it comes to tree trimming, the WEKA offers several different options. Pruning may be used as a technique for accuracy if an overfitting situation arises. Many different types of random forest algorithms may be used for regression and classification, and they all work by generating a large number of decision trees during training time and then determining which one is the most accurate. For the routine of decision trees to overfit their training set, random decision forests are ideal to use. Every leaf must be cleaned or pure before the categorization can be completed recursively in various computations. Dynamic conjecture of a choice tree's equilibrium between adaptability and exactness is the aim here.

I. Perceptrons with many layers

Using a non-linear modification of the input data, an MLP may be seen as a logistic regression classifier. Here, the input dataset is moved into space and placed in a linearly separable location

J. Association Rule Mining

Association rule mining [30] is an extremely well-known data mining approach that emphasizes fascinating and veiled links between distinct characteristics in a massive informative index. Association rule mining generates an arrangement of standards that describe the fundamental instances in the information collection.

The associativity of two attributes of crashes is dictated by the recurrence of their event together in the informational collection. A run $X \rightarrow Y$ demonstrates that if X happens then Y will likewise happen.

K. Interestingness computation

An association rule is considered a solid control if it fulfills the base limit criteria, i.e., support and confidence.

L. Cluster Selection Criteria

The most difficult part of cluster analysis is determining how many clusters to create from the data. The number of clusters may be identified using the given information criteria with LCC. For clustering

purposes, we employed the Gap statistic (Tibshirani et al., 2001) as well as the AIC, BIC, and CAIC information criteria.

M. Data Collection

[70] Leeds UK's internet data source is used to collect traffic and road accident statistics. From 2011 to 2015, there were a total of 13062 incidents included in this data set. Data preprocessing yields 11 characteristics appropriate for further investigation. The following variables will be examined: the number of cars involved, the time of the accident, the road surface, the weather, the presence of lightning, the casualty's gender, age, and the day and month of the incident. Table 3.1 shows the accident data.

Table 3.1: Road Accident Attribute Description

S. No.	Attribute	Code	Value	Total	Casualty Class		
					Driver	Passenger	Pedestrian
1.	No. of vehicles	1	1 vehicle	3334	763	817	753
		2	2 vehicle	7991	5676	2215	99
		3+	>3 vehicle	5214	1218	510	10
2.	Time	T1	[0-4]	630	269	250	110
		T2	[4-8]	903	698	133	71
		T3	[6-12]	2720	1701	644	374
		T4	[12-16]	3342	1812	1027	502
		T5	[16-20]	3976	2387	990	598
		T6	[20-24]	1496	790	498	207
3.	Road Surface	OTR	Other	106	62	30	13
		DR	Dry	9828	5687	2695	1445
		WT	Wet	3063	1858	803	401
		SNW	Snow	157	101	39	16
4.	Lightening Condition	FLD	Flood	17	11	5	0
		DLGT	Day Light	9020	5422	2348	1249
		NLGT	No Light	1446	858	389	198
5.	Weather Condition	SLGT	Street Light	2598	1377	805	415
		CLR	Clear	11584	6770	3140	1666
		FG	Fog	37	26	7	3
6.	Casualty Class	SNY	Snowy	63	41	15	6
		RNY	Rainy	1276	751	350	174
7.	Sex of Casualty	DR	Driver	7657	0	0	0
		PSG	Passenger	0	3542	0	0
		PDT	Pedestrian	0	0	1862	0
8.	Age	M	Male	7758	5223	1460	1074
		F	Female	5305	2434	2082	788
		Minor	<18 years	1976	454	855	667
		Youth	18-30 years	4267	2646	1158	462
9.	Type of Vehicle	Adult	30-60 years	4254	3152	742	359
		Senior	>60 years	2567	1405	787	374
		BS	Bus	842	52	687	102
		CR	Car	9208	4959	2692	1556
		GDV	Goods Vehicle	449	245	86	117
		BCL	Bicycle	1512	1476	11	24
10.	Day	PTV	PTWW	977	876	48	52
		OTR	Other	79	49	18	11
		WKD	Weekday	9884	5980	2499	1404
11.	Month	WND	Weekend	3179	1677	1043	458
		Q1	Jan-March	3017	1731	803	482
		Q2	April-June	3220	1887	907	425
		Q3	Jul-Sep	3376	2021	948	406
		Q4	Oct-Dec	3452	2018	884	549

Table 3.2 summarises the frequency of traffic-related deaths and injuries.

Table 3.2: Road Accident Attribute Description

S. No.	Attribute	Attribute Values	Code	Total
1.	Number of Victims NOV	1 victim	1	1200
		2 victim	2	855
		3 or more victim	+2	245
2.	Age of victim: AOV	0-18 years	CHD	305
		18-30 years	YNG	722
		30-50 years	ADU	815
		50 or more years	SNR	458
3.	Gender: GEN	Male	M	1589
		Female	F	711
4.	Time of day: TOD	[0-6]	T1	155
		[6-12]	T2	660
		[12-18]	T3	626
		[18-24]	T4	859
5.	Month: MON	Jan-Mar	Q1	611
		Apr-Jun	Q2	468
		Jul-Sep	Q3	590
		Oct-Dec	Q4	631
6.	Lighting condition: LIG	Day Light	DLT	1180
		Dusk	DUS	365
		Road Light	RLT	270
		No Light	NLT	485
7.	Roadway Feature: ROF	Intersection	INT	985
		Slope	SLP	320
		Curve	CUR	458
		Straight	STR	537
8.	Road Type: ROT	Highway	HIW	1459
		Local	LOC	841
9.	Accident Severity: ASV	Killed or Severe	KSI	712

N. Description of the Dataset for Result No. 5

Federal Aviation Administration (FAA) statistics on aircraft crashes (p. 71) All aircraft accidents from "1908 to 2020" are included in this dataset. There were a few characteristics in the dataset, including Fatalities, Aboard, Registration, Type, Route, Flight, Operator, Location, Time, Date, and Ground. Because the summary column was all text, we decided to remove it from this dataset. Our goal was to focus on text analysis.

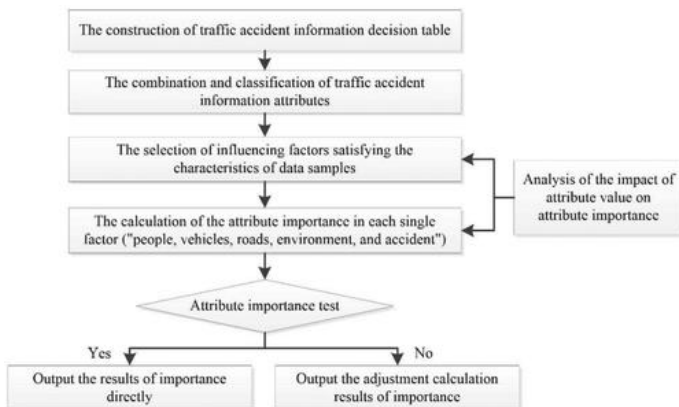


Fig. 3.3: The process of mining algorithm of traffic accident based on rough set theory.

III. RESULTS AND ANALYSIS

A. Overview

There are several machine learning approaches has been implemented to achieve accuracy and determine the most occurrence factor involved in an accident. Results are divided into 5 sections.

B. Result No. 1 (Road-user Specific Analysis of Traffic Accident using Data Mining Techniques)

SVM (support vector machine), naive bays, and decision trees have been used to categorize this dataset based on casualty class. Figure 4.1 displays the accuracy in categorization that was attained. Compared to the other two classifiers, decision trees had the greatest accuracy of 70.7 percent.

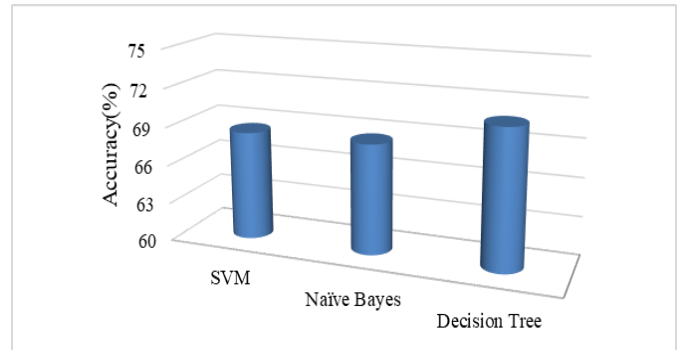


Fig. 4.1: Classification accuracy of different classifiers on accident data

"SOM (Self-organizing map) and K-modes" procedures, two clustering methods, have been used in this study's findings. Using k-modes instead of SOM, the outcome is better, and this shows that classifiers perform better when they are trained on k-mode clusters.

Datasets were sorted into three categories using SVM in this research based on the kind of casualty. There is an improved level of accuracy of 75.5838 percent in this classifier's output compared to a prior dataset that was not clustered, which is roughly 7 percent higher in terms of precision and recall. Table 4 shows the results of SVM on k-mode clusters.

Table 4.1: Performance of SVM

Rate of error= 0.1628								
Predicted values					Confusion Matrix			
Class	Precision	Recall	TPR	FPR	Class	DR	PSG	PDT
DR	0.779	0.909	0.90	0.36	DR	6958	153	546
PSG	0.824	0.375	0.37	0.03	PSG	1828	1330	384
PDT	0.630	0.851	0.85	0.083	PDT	146	132	1584

Based on casualty classification, Nave Bays was used in this research to categorize the dataset, and this classifier classified the dataset into three categories. Again, accuracy, error rate, error, recall, TPR, and other parameters play a significant influence in determining the final product. Clustering improved accuracy to 76.4583 percent, compared to 68.5375 percent without clustering. On k-mode clusters, Nave Bays performs well, as seen in Table 4.2.

Table 4.2: Performance of Naive Bayes

Rate of error=0.2352								
Predicted values					Confusion Matrix			
Class	Precision	Recall	TPR	FPR	Class	DR	PSG	PDT
DR	0.788	0.86	0.86	0.33	DR	6649	515	493
PSG	0.697	0.43	0.43	0.07	PSG	1624	1535	383
PDT	0.742	0.828	0.828	0.078	PDT	170	151	1541

A Decision Tree classifier was utilized in this work, which resulted in a higher level of accuracy than previously achieved without clustering. An increase in accuracy of 18% was realized. Decision tree performance on clusters derived from k-modes is shown in Table 4.3.

Table 4.3: Performance of Decision Tree

Rate of error=0.1628								
Predicted values					Confusion Matrix			
Class	Precision	Recall	TPR	FPR	Class	DR	PSG	PDT
DR	0.784	0.893	0.893	0.348	DR	6841	422	394
PSG	0.724	0.457	0.457	0.065	PSG	1649	1620	273
PDT	0.683	0.770	0.770	0.060	PDT	231	197	1434

1) 4.2.6 Analysis

Each classification approach has been tested and found to have a satisfactory accuracy, false-positive rate (FPR), true positive rate (TPR), error rate (ER), recall (RR), and a distinct confusion matrix

(CCM) for the various classification strategies. The confusion matrix may be used to compare the performance of various classification approaches.

As can be seen from these tables, the "total accuracy of analysis with clustering" is presented with the assistance of Table 4.2.

Fig 4.2 shows the classification accuracy of SVM, Naive Bayes, and decision trees on k-modes and SOM clusters. In comparison to SOM-derived clusters, those formed by k-modes clustering exhibit higher classification accuracy. SOM fails miserably in clustering data with categorical road accident characteristics, whereas the k-modes approach succeeds.

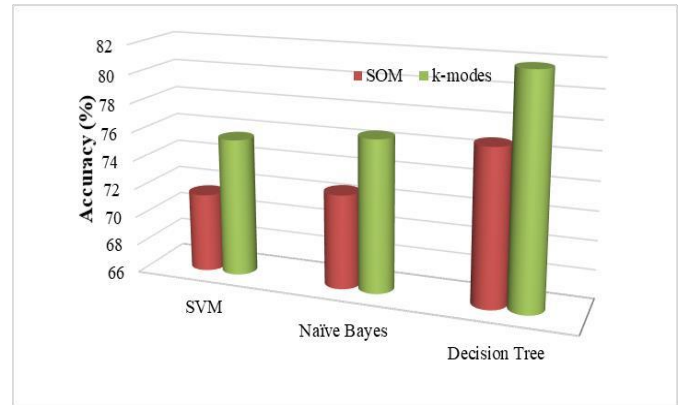


Fig. 4.2: Classification accuracy on clusters obtained from k-modes and SOM

As can be seen from Tables 7 and 12 the accuracy level increased after clustering. It is shown comparison chart in fig. 7 without clustering and with clustering.

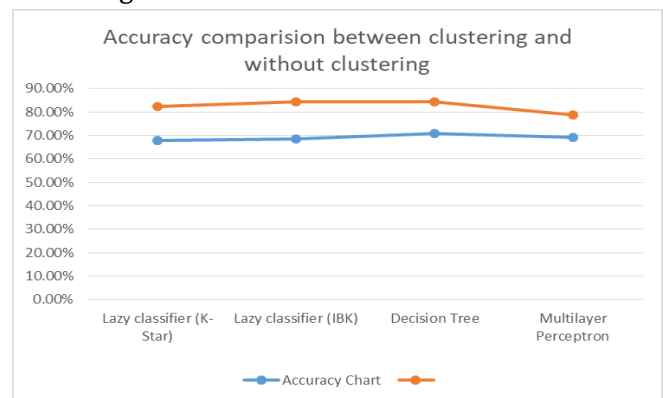


Fig. 4.5: Compared accuracy chart with clustering and without clustering

IV. CONCLUSIONS AND FUTURE WORK

A variety of data mining approaches have been used to analyze the accident dataset, including SOM (Self-Organizing Map), K-modes, Hierarchical clustering, latent class clustering (LCC), BIRCH clustering, and classification techniques such as Support Vector Machines (SVM), Nave Bays, Decision Trees (Random Forest, J-48, etc.), Multilayer Perceptrons, Lazy Classifiers (K-star and IBK), BIRCH clustering. In this research, the goal is to compare the classification performance before clustering methods and after clustering approaches. K-modes clustering was used to divide the dataset into four homogenous groups, which were then examined using Bayesian Networks in a subsequent step. Each cluster and all of the data are represented by a different Bayesian Network. Performance metrics are also used to assess these Bayesian Networks. The results show that the classification accuracy has increased marginally, while the ROC values for several clusters have declined slightly. As a result, the performance of the classifier in terms of accuracy is skewed toward one class value with an estimated high number of occurrences.

Data from traffic accidents in an Indian area was used to compare the performance of three clustering techniques: LCC, k-modes, and BIRCH. The goal of this research was to determine which of the three strategies above generates the most effective clusters for categorization. Different cluster selection criteria are used to identify the right number of clusters in the data. The number of clusters, $k=2$, was agreed upon by all of the criteria employed. Using the previously identified clusters, we next used three widely used classification approaches (NB, SVM, and RF) to further refine our findings. To compare LCC with NB and SVM, the findings revealed that it produced more accurate clusters and was capable of classifying data with the highest degree of accuracy. Several clustering approaches were examined for their computing performance on a variety of cluster models. k-modes are shown to be more efficient than the other two methods for generating diverse cluster sizes.

Results No. 5 were based on a thorough analysis of accident data. All accidents that occurred between "1908 - 2016" are included in this dataset. SOM, hierarchical clustering, and association rules are a few of the methods used to identify the relationships between the most often occurring phrases. Engine failure, weather conditions, pilot error, and other factors are often cited as contributing factors in aviation accidents. If the causes of crashes are taken into account, they might worsen shortly.

To pick a clustering technique to construct homogenous segments out of accident data based on computation speed or better clusters for classification, this research might be helpful.

In this thesis, we used the K modes clustering and association rule mining technique to develop a framework for studying road accident patterns. From 2009 to 2014, there were 11,574 accidents on the Dehradun district's road network. Based on the variables of accident type, road type, lightning on road, and road feature, K modes clustering found six clusters (C1–C6). Each cluster and the EDS have been used to construct rules using association rule mining. For the analysis, strong rules with high lift values are used. Each set of rules reveals the conditions around the incidents that occur inside that set. To see whether these associations may be made with an accident, the results of this comparison were compared to those created by EDS rules. If additional features linked with an accident are accessible, more information may be discovered. We also conducted trend analysis of all clusters and EDS on a monthly and hourly basis to reinforce our technique.

As previously stated, a large number of collisions occur often in areas of the road known as "accident hotspots." The building of new roads is impractical due to credit limits, thus increasing the safety of existing roads is the most significant measure in minimizing road accidents and road casualties with the largest effect. Several options exist under this strategy, including proactive steps to enhance safety by

addressing dangerous circumstances on the current road network to avoid accidents, as well as reactive actions aimed at addressing problem sites identified as accident hotspots.

Results from models based on artificial neural networks show that the frequency method of accidents is biased toward locations with large traffic volumes and also ignores accident severity. It's not included in the Equivalent Property Damage Only Index, and the divergence goes toward high-speed sites on residential roads. As a consequence, taking into account both of these factors may lead to more accurate findings. As a result of taking "return to mean in accident data" into account, the suggested technique improves estimate accuracy, making it the best choice for pinpointing high-accident areas on suburban highways in comparison to previous approaches.

According to trends, clustering before an analysis helps us locate better and more helpful outcomes that we wouldn't otherwise be able to find. According to the data, rural areas have a greater death rate than urban areas. The kind of vehicle, the driver's age, and the categorization of other road users are all included in the statistical analysis. A graphical depiction of the projected data outcomes is shown. Accident metrics may be better understood by the public via the use of graphic representations."

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Development of Naïve Pattern Matching Approach for Personalization of Web Based On WAM

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ABSTRACT

An enormous amount of both useful and pointless information may be found on the internet. It is quite tough to identify useful information for a single customer that changes often. Data that was useful at one point in time may be irrelevant in the future or under other circumstances. Step by step, the web is becoming more and more up-to-date. We call it "Web Personalization" because the web is a non-style medium that recognizes organized and non-organized data, as well as requests and non-requests for organization, to discover the relevant data and create them according to the passion of a customer. By using information mining tools, a web model is created for each customer to ensure that they are receiving personalized online content when they inquire about services or data. Web Personalization frameworks based on distinct areas are a major problem in today's processes, as they provide relevant information and services to each unique customer at various points in time. In this project, we'll be working with a mining partner with a significant amount of load that we'll organize in a certain way. Doing a lot of work on the sections of the site will be dependent on how many people come and how much time they spend there. Once the example mining technique has been used, it is possible to differentiate between consecutive web visits and designs that rely on a large amount of load to create a tree-type structure for improved recommendation generation. Client importance may be measured using the suggested weighting scheme. To retain the back-to-back web get to designs and to create recommendation guidelines for the customer, we recommended a squished data model.

Keywords - Web Personalization, Fuzzy Logic, User Access Patterns

Article Info

Volume 9, Issue 1

Page Number : 367-381

Publication Issue

January-February-2022

Article History

Accepted : 05 Jan 2022

Published : 20 Jan 2022

I. INTRODUCTION

A. Overview

There has been very fast growth in the use of the internet and the World Wide Web. This has resulted

in new techniques for the plan and improvement of the outline information system and organization of information. There are a large number of web structures that are significant and not in a state of order

and the customers many times get confused with the results. E-business, increasing rapidly and the web business is focusing on the prediction of the necessities of the customer.

This necessitates that the websites be redesigned to better meet the demands of the client and to make them more convenient. This is when Web Personalization comes in handy. Customers' browsing histories are taken into account when Web Personalization reorganizes the website's content following their preferences. According to Mulvenna and colleagues (2000), the primary goal of Web Personalization is to "provide customers with the data they need without expecting from them to seek it directly." [1].

Additionally, the terms "web personalization" and "customization" are not interchangeable. There is a big gap between who is responsible for making the modifications. Customization allows the site to be tailored to suit the preferences and requirements of individual customers. When a consumer log in, their page becomes a little more crowded.

Web Personalization is facilitated by the availability of many types of data on the Internet:

- Content Data
- Structure Data
- Usage Data
- User Profile Data

B. Web Personalization Structure

There is a spread of the internet in our daily life, such that all our day-to-day activities, correspondence, information transfer, business, retails, money transfer, education, social media, etc. are fully dependent on the internet and web space. There is a flood of so much and many types, of data, that it has become the prime requirement for the web developers and controllers to regroup, re-positions, re-organize and re-structure data so that it can be fetched as per the requirement of the customer or and when required.

Data available on the may be helpful, may be futile, organized, non-organized. Even some data are helpful today and some data may be a waste for the customer tomorrow. In this dynamic situation, the need of the customer and data required for him changes continuously. Web Personalization provides a real-time solution to this dynamic solution. The process of Web Personalization involves an information mining system, investigation of required data, and administration of data. The following is the structure of the web model that will be used to tailor online content for each consumer.

The internet is flooded with a plethora of both useful and pointless information. It is quite tough to identify useful information for a certain customer who changes from time to time since the information is always changing. In terms of user/customer precious time, there are a variety of vital data points that will not be relevant for different periods or in an alternative case. These web crawlers may be concerned with the step-by-step process of staying up to speed with the latest advances. When we browse the internet, we come across some intriguing information. Many pieces of information and data are useful, yet many others are pointless for the user. It is very difficult to compile, qualify and quantify the helpful data for a particular client. This is when the data are changing again and again. The data of today may not be helpful tomorrow. Web technology is also changing with daily innovations. The web is overwhelmed with data of all individuals and all types of organizations. In these situations, it is a great challenge to organize all the data and design it to the requirement of the client. For this, we use the term web personalization. At any point in time when the customer wants to extend their question to the framework for administrations and data the framework extricate and investigates the data or substance from the log records with the assistance of information mining systems and structure. A web model to Personalize the web content for each client appeared in fig 1.1 which is shown below.

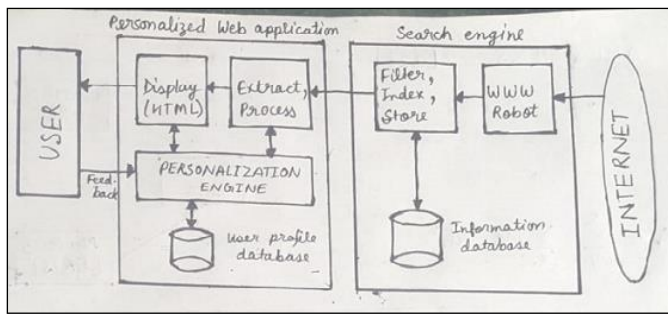


Fig. 1.1 Structure of Web Personalization Model

Web Personalization is the methodology of tailoring a web site or content [3] of the web site to the requirements of every particular user or set of users, taking benefit of the information attained through the exploration of the customers' navigational performance [4]. Personalization is the process of providing administrations to each consumer in a customized manner. At the moment, there are only a few databases on the system, and the great majority of web structures are unable to provide data to clients with tailored assistance. Because of the proliferation of information on the internet, the Web Personalization framework has become a need. A Web Personalization approach must be able to identify additional information problems and allow the clients to exercise in any event attempt to get the information they desire [5] before it can be implemented.

An effective Web Personalization strategy must be able to identify the excess information burden and establish the client practice for them to get the information they desire [5]. The information must satisfy the needs of the customers. If the client's inquiry asks for is express, looking information on the net may end up being basic [6].

C. Ways to Compute Recommendations

Web customization that is programmed may break down information to process recommendations in a variety of ways, including:

- 1) Content-based filtering [9]
- 2) Collaborative sifting [10]
- 3) Rule-based filtering [11]

D. Problems, Challenges, And Issues In Web Personalization

Web Personalization has to go through numerous improvement stages. At first, began as an apparatus to allure and hold clients by giving them the probability to find more on-site and keep up their advantage. The following stage is promoting and supporting administrations and items, and afterward, increment income of customer's spending by offering comparable administrations and items. Today, Web Personalization intends to accelerate the conveyance of the pertinent or helpful data to a client to adjust data and administrations agreeing his prerequisites.

As follows, there are five important repercussions and issues associated with Personalization:

- Customer data and its Security and Privacy
- Honesty and Integrity in dealing with customers
- Acquiring Confidence of Customers
- Cost
- Benefits to Customers and Proper Utilization of Web Personalization to Customers

E. Examples Of Web Personalization

- 1) U-Tube
- 2) Amazon
- 3) Google Search
- 4) Indiamart
- 5) Times of India

F. Advantages Of Web Personalization

- 1) Better Lead Generation
- 2) Better Conversion Rate
- 3) Websites become more effective
- 4) Increased sale
- 5) More loyalty of Customers
- 6) More Accurate and Relevant Recommendations
- 7) A better understanding of customers

- 8) Fewer follow-up actions for sale.
- 9) Less time for resources of sales

G. Objective

One of the primary goals of the current effort is to develop a pattern matching method for online personalization, which will be used in the future. This is based on weighted association mining to provide a better suggestion for each user.

II. LITERATURE REVIEW

A. Methods Of Web Personalization Based On Category

In Classification-based Web Personalization [12], the following two approaches are used.

- a) Grouping oriented in which the customers are allowed to use the activity data of other customers with similar inclinations.
- b) A rule-based on which the primary focus is on web content rules. Here, more important is the perception of the clients, not the old browsing history. Customer interest may be known by the customer’s reactions to the contents of the website. It is based on rules, principal, and tradition.

Grouping can be done with the help of System Logger, Category Generator, and Customizer. By applying a few data mining strategies [13], we can fetch information from the log Category Generator which tells about the details of the category of each customer in the grouping.

With the help of this methodology, authors broadened the regular affiliation rule technique by doling out a critical weight [9] to everything in exchange to look at the significance of everything inside the exchange and expand another algorithm dependent on the anticipated weighted affiliation rule mining strategy. Amid this weighted alliance standard mining approach, the maker consigned a quantitative burden to the whole thing from applying period on each page and the count of visitors on each page as opposed to standard twofold loads. Within the process of mapping the

weighted visits, the visitors count on the particular page and the spend time with the visitors on the page is used to be verified its centrality in each exchange [10].

B. Methods Of Web Personalization Based On Multilevel

A unified model for multi-level web personalization [14] has been suggested to incorporate all the systems and strategies brought together. Thus we can any concept by multiple views. Also, a single attribute may have many structures. Based on clients' current behavior, the entire framework gives the rundown of prescribed web content to the client. With the help of this system, the creator proposed a representation that prescribed administration or items to the client in which they are keen on by which we can get the details of the past activity done by the customer on the web [8].

A unified model is used to retrieve information to a web personalized by transplanting and updating information, which is then shown on the web. It may be shown as follows:

Here U = Group of users

S = Group of net services

R = Relationship between U and S

Examples $R \subseteq U \times S$ or $(U, S) \in R$

In which $u \in U$ and $s \in S$, as a user u is dispatched by a service s , which is defined as uRs .

The recommendation by the Author can be depicted as the Web Personalization function (Δ) to view the accomplishment of a web service s to a web user u . After assuming we can simply signify specific user’s information, user’s profile and all the necessary details of a vector u , and every feature of a vector service’s s , the function of the Web Personalization’s equation which is later defined as:

$$\Delta(u, s): \vec{u} \times \vec{s} \rightarrow [0, 1] \tag{2.1}$$

By altering data in this manner, an integrated model may be used to collect information from a web server and personalize it for the user. It is composed of many sub-models, as seen in Figure. 2.1, which is presented below::

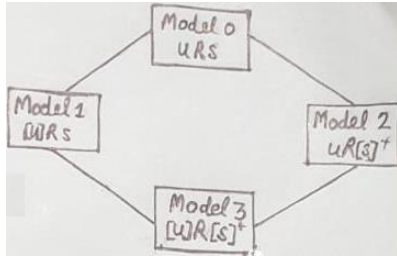


Fig. 2.1 Sub-models UWP Model

The above sub-models are depicted for the recovery and customization of the data which is indicated by the necessities and the advantage of the visitor's review are as under-

- **Model 0:** This paradigm lets consumers pick the desired service from a set of providers.
- **Model 1:** It shows the collection of users to suggest a service by peer estimation.
- **Model 2:** Recommend the service by related content, receiving the fundamental concept of gain on deep context, semantics, or ontological information about the function or framework.
- **Model 3:** Associations of two group events. It means an individual user with a collection of services and a collection of users with distinct services. When the Request of traits that categories the clients is changed, then a distinctive progressive system [15] can be developed for similar properties.

The layered structure is underlined, it is more comprehensive and ideal for hypothesis development in a staggered model may increase the grasp of the Web Personalization notion itself and deliver progressively accurate recommendations. On the off chance that the request of traits that characterize the clients is changed, at that point distinctive progressive system [15] can be developed for similar properties in this way, the multifaceted nature of the model is expanded.

C. Methods Of Web Personalization Based On Fuzzy Logic Techniques

This model is based on content-based filtering [16]. It focuses on product filtering [16]. It focuses on product filtering [17]. This model deals with uncertainties and ambiguity for better personalization. The limitation is that the correctness of the fuzzy system is difficult.

Following are the key points of this model.

- Two data modules and two preparing modules are taken into consideration in this approach.
- Data modules are used to collect the customer data and administrative data.
- Preparing module estimates, client preference, and product filtering [17].
- The inclination is fetched by a fuzzy logic system with the help of unclear information from the customer web history. This approach coordinates the fuzzy logic for getting the customers' needs using numerical methods and managing the uncertainty.

The inclination learning is bolstered by the fuzzy logic system which manages the unclear information or data from the client's exercises. The proposed technique gives another idea to web Personalization that coordinates fuzzy logic for estimation of clients' resemblance. Fuzzy sets are depicted as a numerical method to imply and manage uncertainty and uncertain in processing territory which is relying upon enrollment capacities. The enrollment work characterizes how every individual indicates from info mapped participation esteem in the interval $[0, 1]$. The proposed strategy manages the unclearness of clients' online exercises; the proposed framework delivered the most fitting and significant esteem dependent on the client's conduct and their entrance time. Creating suitable participation capacities for fuzzy sets is a huge testing issue in fuzzy frameworks plan. It is a troublesome errand since it specifically influences the rightness of the fuzzy framework.

D. Methods Of Web Personalization Based On Interest Of Customers

It is discovered that customers' advantage on the recommendations depends on their past web behavior or navigational conduct on the web [18]. In this approach information about past web history, navigational data on the websites is collected and the data can be stored on the server. The author used the k-means algorithm to group the information and calculation to go get the required record.

The k-means algorithm is based on attributes to the group in keeping items into k-sets. It is based on an expected maximization procedure that uses the clusters of users by their interest and level of interest

The main focus is on clustering, relevancy is medium and complexity is also medium. This model is created on the client's intrigued [19] areas. This is based on customer-based snap history without taking care of time spent on each page.

E. Methods Of Web Personalization Based On Weights

In this approach main focus is on the weighting scheme. Relevancy is high and complexity is also high.

In this methodology, the regular application rule technique has been broadened by introducing the critical weight [20] in everything to expand another algorithm [21]. This is dependent on the anticipated weighted affiliation mining rule strategy [22]. Quantitative lead has been added to everything which depends on the time spent on each page. These two parameters (time spent and visit tally) are used to check its centrality in every transaction [23].

Time spent on every page has been made very important in this model. The customers spent more time on a page only when that page is worth it for them. He does not skip the page if it is important. He will invest energy on a page that is of real worth to him. That is why more weight is given. This better recommendation can be given to the user/customer.

F. Methods Of Web Personalization Based On User Access Patterns

With the aid of this approach, a flattened data model[24], provided by the author and known as Pattern-tree, is created, which is designed to maintain the sequential web get to designs organized, and a competent technique is structured for producing suggestion rules for clients. [24] Before doing design mining, the preparation of data must be connected to the site logs that are being used. The preprocessing procedures that are being used include information cleaning and information altering. Each request in a succession record is a record of exchanges arranged by exchange gets to period with every exchange; evaluate the all grouping example with the least amount of assistance.

Based on the customer's current access arrangement, the Pattern tree displays the access method that is most appropriate for the suggestion rules generating available module. To determine the value of the recommender display, numerous estimate methods have been offered, including fulfillment and exactness. Although the proposed framework has completed a continuous arrangement, it is difficult to determine which child node should be prescribed by the system to the client.

It is not possible to determine the true meaning of an object with the assistance of that item for a certain customer. Even clients who are not enthusiastic about a certain item might benefit by merely tapping on that item again and over again, which is known as backing.

G. Methods Based On Relevance

To retrieve the report, the pertinence input techniques [25] are implemented. The significance of website pages is obtained via contact with the internet, the discovery of intriguing themes, and the acquisition of foundational knowledge about the subject of interest. The author offered important input based on the catchphrase map in this approach, which completes the customer's anticipation from the watchword area by completing the catchphrase map. Because the customers' inclinations are anticipated on keyword space rather than report space, in which queries are

spoken to the search engines, this technique outperforms the traditional significance input methodology. It may be conceivable to do an important evaluation if the framework can complete the client's preferences from the watchword map that he has customized.

The authors presented a process for deleting Far2Near (rework the watchwords that were initially far apart from one another) and Near2Far (modify the catchphrases that were initially near to one another) catchphrase sets from a customer's modification on a catchphrase map using this approach. Identifying and extracting such keyword sets is a necessary step to interpret significance criticism on a catchphrase map. Within the current arrangement of the report, the suggested approach may create inquiries as irregular combinations of watchwords to the exclusion of the usual pertinence criticism, which has the greatest impact on available record space. For keyword mapping, this method required several different e restates.

H. Methods Of Web Personalization Based On Neural Network

The Kano-ANN technique [26] was developed by the author as a way to merge artificial neural networks with Kano's method. In the context of clustering raw data into groups based on similar highlights, the term "artificial network" refers to the ART-based grouping of artificial networks. There are two levels to the ART: a correlation layer that gets the information vector and shifts contributions to their best match in the acknowledgment layer, and an acknowledgment layer that enhances the true yield and stifles others. Developed by Noriaki Kano in the 1980s, the Kano model categorizes customer preferences into five categories: appealing, one-dimensional, must-be, indifferent and reverse.

This concept's fundamental commitment is to approach the problem of product and administration recommendation in a manner that is specifically tailored to the needs of the customer, as determined by

brain research. When used to client clustering rather than known methods like K-means, ANN is more adaptable to new clients. [27].

I. Methods Of Web Personalization Based On Consumer Behavior

A model of consumer behavior [28] is stored in an information base as part of this approach to Web Personalization, which makes use of customers' behavior over time. Intermittent access is eliminated by this technique, which occurs repeatedly within a predetermined duration, such as weekly or monthly. Customers' online get-to-resemblance and behavior may be better understood with these intermittent access designs.

Semantic information about online material accessed by clients is included in web logs. Customers' true behavior, similarity, and proclivities are difficult to discern, therefore semantic upgrading of web logs is necessary if it is to be very lucrative. Semantically [29] enhanced data from online logs were used by the author to construct a buyer behavior learning base model.

To develop a model of consumer behavior based on fuzzy logic, the author proposes using this approach. This model is then used to express the sequential notion.

J. Without Any Input Of User

This page-gathering method [30] is used to acquire a customized or significant result. Candidate interface settings are perceived and coordinated with list sheets depending on the client get to log in this method without human intervention. As a byproduct of the site's architecture, web logs organically preserve information about the visitors' activity. A graphical or tree group may be used to store the entry example for further analysis. The page accumulation method works by creating clear index sheets that allow clients to navigate the web as they see fit. This algorithm uses group mining to determine the best way to organize pages on a website based on the idea that visitors return

to the site often. Cluster mining is a deviation from traditional grouping in which everything may be placed in a single bunch, but in group mining, a single object can be placed in several covering groups. Due to the usage of group mining, it is possible to increase the complexity of the clustering process.

It has been shown that the quality and limitations of different Web Personalization techniques rely on the strategy presented or employed by the author(s). There are a few approaches that are dependent on the content of a website or an object to describe its class. Customers and clients have a strong desire to have their wants and desires met, which may be harnessed via a variety of Web Personalization strategies. Several of the aforementioned solutions are reliant on the client's behavior to remove data from the learning base, while others are based on fuzzy logic.

The correlation of different methodologies for Web Personalization is done dependent on different parameters like procedures utilized by author, user's involvement, because of various parameters, centered fulfillment, and accuracy. The qualities 'Low', 'Normal', and 'High' for parameters accuracy and fulfillment are given while contrasting all methodologies.

III. PROPOSED METHODOLOGY

A. Strategy

This paper work provides a Web Personalization technique that uses continuous access design mining partners with a weight factor for each component in a pattern. Depending on the amount of time a client spends looking at a web page, we assign a critical load to that page. A strong progressive pattern mining strategy is used to identify repeating succeeding web access patterns based on the crucial weight in this method. Pattern-tree is the name given to the tree structure used to store the designs of the entrances, which are used for identifying and recommending system connects for reference and suggestion.

B. Problem Formulation

R. Forsati's notion [16] was inspired by the fact that the amount of time a consumer spends on online material and checking out a product is a strong indication of their interest in such items. Instead of using a careful counterpart to identify the optimal offering, this technique uses the weighted construction to determine each URL's heaviness in the web log and the connections between current client sessions. Custom-fit web suggestion may be improved by using a weighted parameter, which refers to a thinking process that identifies which web substances are more likely to be retrieved by present consumers in the future.

Although the suggested technique gives greater consideration to pages and consistently prescribes pages with the most critical weight, lesser weighted pages may at times be beneficial or vital to the client because of certain entry design, and this is the true downside of this methodology. the pattern tree, which keeps the progressive access designs that are used for designing and supplying systems for proposal or references in the Access Pattern method [19].

In this way, we offer an approach that makes use of a sequential access pattern mining partner with a significant load in an arrangement. Everything gets an enormous load based on the amount of time a customer spends on it and the number of people that visit it, rather than two separate loads. To develop a weighted pattern tree for the better suggestion, use the example mining technique to discriminate between intermittent back-to-back web access patterns that are depending on notable load.

C. Proposed Methodology

With this technique, we present a framework for Web Personalization that makes use of a progressive access design mining partner with a weight parameter, all in a pattern. To make a suggestion, this framework first needs to gather data on page views, time spent on each, and page size. It is used in the weighting scheme to examine the relevance of site pages in a transaction, as opposed to the parallel loads that are considered in previous exams, so that the client's attention may be

taken away more accurately. When a customer isn't interested in what he's looking at, he doesn't spend a lot of time on it, and if he does, he moves on to something else soon.

However, a customer may alter their mind due to a little piece of online material, hence the amount of information may influence the actual time spent on the site. Equation 3.1 is used to find the length. Frequency refers to the number of times a web page or archive is accessed by different users. We provide a significant weight (equation 3.3) to each content or item in a transaction based on these criteria, which include the amount of time a client spends viewing a web substance and the frequency with which they visit.

$$\text{Duration}(I) = \frac{\text{Time Spent}(I)}{\text{Size}(I)} \quad (3.1)$$

$$\text{Frequency}(I) = \frac{\text{Number of visit}(I)}{\text{In-degree}(I)} \quad (3.2)$$

$$\text{Weight}(I) = \text{Frequency}(I) * \text{Duration}(I) \quad (3.3)$$

We are now working on a weighted pattern tree design. To maintain the back-to-back online get-to-designs and to create recommendation guidelines for clients, an effective technique is constructed using our flattened data model, which we presented. transaction get to time with the rest of the transactions.

Event-repetitions are permitted i.e. it is not essential that $e_i \neq e_j$ for $i \neq j$ in S . Assume that item access can be recapped in an access series or order. A web access sequence S is called a sequential web access pattern, if $\text{weight}(S) \geq \text{Avg. weight}$, where is Avg. weight a given weight threshold. An access item $e_i \in E$ is known as a significant item, if $\text{weight}(I_i) \geq \text{Avg. weight}$. Otherwise, it is known as an insignificant item. The average weight of each sequence is calculated by this equation 3.4:"

$$\text{Avg. Weight} = \frac{\sum_{j=1}^m W_j}{\text{Number of Pattern Sequence}(m), \text{in } i^{\text{th}} \text{ level}} \quad (3.4)$$

A Weighted Pattern-tree was created by requiring one test of each subsequent access pattern by an individual

user with the associated weighted event. Figure 3.1 shows the technique used to build the weighted sequence tree.

```

Algorithm: Weighted Pattern-tree
Ip: Web Access Sequence
Consecutive Web Access Pattern created on weight
O/p: T – Weighted Pattern-tree:
Scheme:
a: Generate an void source node N
b: For each order SeWSWAP, signified as S = e1e2...en, do
1: Set present_node point to N.
2: For i = 1 to n do,
2.1: if present_node has a child node pointed as ei use the weight by adding their weight and set present_node point to ei else make a new child node with the weight, set present_node point to new child node.
2.2: pass the pattern sequence to the labeled ei+1 which weight > average weight of all pattern sequence in ei label
c: Return Pattern-tree T.
    
```

Fig. 3.1 Algorithm of weighted pattern tree

Customer current access sequence is used by the Recommendation Rules Generation module to select the best access track in the Pattern tree. Estimates of model relevance are based on the model's ability to meet or exceed expectations. Removed instances are stored in the Pattern-tree, which is used to identify indistinguishably and provide links for the recommendation. The depth of the Pattern tree is measured by the length of the longest track in the Pattern tree. When the length of the current access request is more than the depth of the Pattern-tree, the associated track will not occur. This means that the current access request is less in length than the Pattern-profundity tree's before to request coordinating method's commencement.

Algorithm: Recommendation Rules Generation

I/p:
 T – Weighted Pattern-tree
 S = e₁e₂...e_n - present access order of a customer
 MinL - minimum length of access order
 MaxL - maximum length of access order, (less than the depth of tree)

O/p:
 RR – recommendation rule of a group of sequenced access items for S.

Scheme:

a: Reset RR = ∅.

b: If |S| > MaxL then eliminate the first |S| - MaxL + 1 events from S.

c: If |S| < MinL then return RR, otherwise set present node point to the root node N of T.

d: For each event e_i from the crown of S to the end do

- 1: If present_node has a child node pointed as e_i, then set present_node point to this child node.
- 2: else eliminate the head element from S, and recap from step c.

e: If present_node has child nodes, then inset these child nodes into RR sequenced by their weight.

6: Return RR.

Fig. 3.2 Algorithm of recommendation rule generation
IV. RESULTS AND DISCUSSION

A. Measurement Of Performance

When determining the applicability of the suggested approach, two factors are taken into consideration for the evaluation of the findings during the computation. Specification or accuracy and satisfaction are the two parameters that are being discussed here. The amount of recommended items (website pages) is used to determine the accuracy of the assessment of accuracy. How feasible it is for a consumer or client to get to the recommended pages has been calculated with precision. Estimation of customer satisfaction based on the likelihood that a client would be satisfied consistently. When it comes to scientific structure, accuracy [19] and pleasure might be described as follows:

$$Precision = \frac{\text{Correct recommendation } (R_c)}{\text{Total recommendation } (R)} \quad (4.1)$$

$$Satisfaction = \frac{\text{Visited recommendation } (K_{vs})}{\text{Recommended sequence } (R_s)} \quad (4.2)$$

The precision is fundamental as it takes to care for deciding how plausible a client visits the prescribed pages that are recommended by the framework. What's more, satisfaction helps in deciding how

conceivable a client visits the prescribed pages successively, he/she is consecutively fulfilled or not.

B. Calculation And Analysis Of Outcome

The suggested approach is tested on four different places and eight different customers as part of the process of determining quantifiable results. Precision and contentment are the two metrics that are used in this process. In the event of performance comparison, the after the impact of the proposed work is compared to the aftereffect of existing work that is reliant on the User Access Pattern. It becomes clear from the results that the suggested effort contributes to the recovery of more relevant suggestions in an appropriate setting. Thus, the suggested work has greater accuracy and satisfaction levels than the present work and vice versa. As shown in Table 4.1, the investigation of the Personalization based on the User Access Pattern and suggested solutions to the problem of exactness are both examined.

Table 4.1 Comparison of User Access Pattern Performance and proposed work Performance based on precision in web personalization

User	User Access Pattern in Personalization			Proposed Method in Personalization		
	R	R _c	Precision	R	R _c	Precision
A	7	5	0.71	6	4	0.66
B	6	4	0.66	5	5	1
C	7	4	0.57	5	4	0.80
D	6	5	0.83	5	3	0.60
E	8	6	0.75	5	5	1
F	6	6	1	5	5	1
G	7	6	0.85	7	4	0.57
H	9	5	0.55	5	5	1

It is obvious from Table 4.1 that the proposed work recovered more relevant forms from the current technique based on the User Access Pattern than the present approach. Precision is more valuable than the current technique, which is a good thing. It is conceivable that the value of accuracy is equivalent to the value of the present technique as a result of a shift in the user's interest. Table 4.2 depicts a comparison of

the Personalization based on User Access Pattern and the suggested work based on customer satisfaction.

Table 4.2 Comparison of web personalization patterns based on user access and level of satisfaction

User	User Access Pattern Satisfaction in Web Personalization	Proposed Method Satisfaction in Web Personalization
A	0.71	0.66
B	0.66	1
C	0.57	0.80
D	0.83	0.60
E	0.75	1
F	0.85	1
G	0.50	0.57
H	0.50	1

In a similar vein, it can be observed in Table 4.2 that there is an increase in satisfaction, or that it is sometimes equal. Based on the User Access Pattern, the proposed work would deliver the highest level of individualized pleasure possible.

Figure 4.1 depicts a graphical representation of the comparison between the improved form-focused crawler and the proposed work in terms of accuracy for all eight users concerning their domain. This is shown by the graph in figure 4.1, which demonstrates that the suggested technique has more accuracy than Personalization based on User Access Pattern. As a result, in terms of accuracy, the suggested technique outperforms Personalization based on User Access Pattern.

Figure 4.2 depicts a graphical representation of the comparison between Personalization based on User Access Pattern and planned work in terms of satisfaction for all eight users.

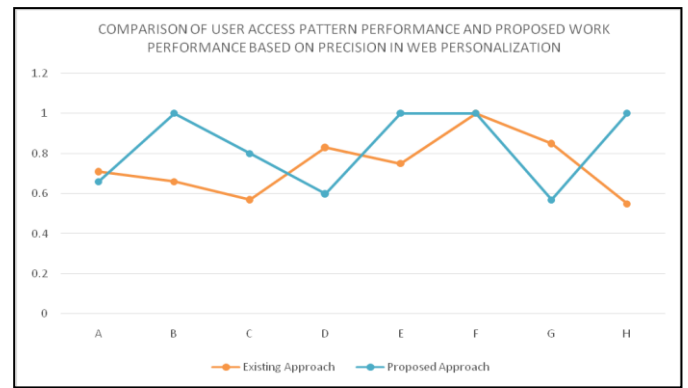


Figure 4.1 Graphical comparisons between existing approach personalization based on User Access Pattern and proposed work in terms of satisfaction.

The satisfaction graph given in figure 4.2 demonstrates that the suggested strategy provides more satisfaction than the current approach based on the User Access Pattern (UAP). As a result, the suggested technique is more satisfying than Personalization based on User Access Pattern in terms of user happiness.

Based on the assessment and comparative study shown above, it can be concluded that the suggested technique outperforms the current strategy, which is personalization. As personalization assists in offering better recommendations and matching depending on the user's needs and requirements, it is also useful in delivering web links for better suggestions. As a consequence, the suggested technique contributes to the enhancement of accuracy and satisfaction while also assisting in the delivery of superior outcomes.

C. GUI Snapshots Of Implementation And Results

Here, we will see the user interfaces of the application by which we can input the data and it will give the results as well as summarize the implementation aspect of the proposed process:

Initial window at the start of execution

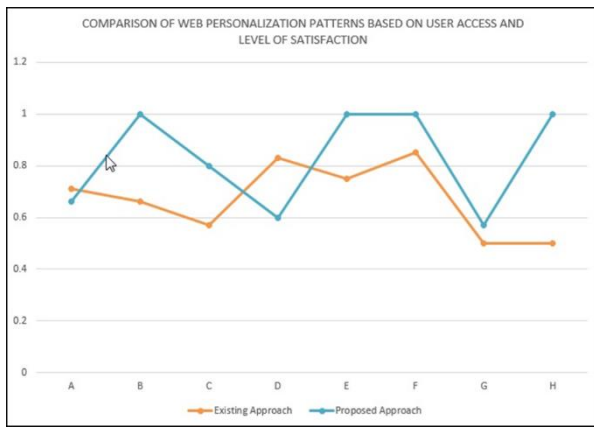


Figure 4.2 depicts the initial window at the start of execution when the user must log in to his or her account

GUI interface shows the welcome page which considers the visit count and estimates the frequency of represented web pages.

The window for accessing the domain

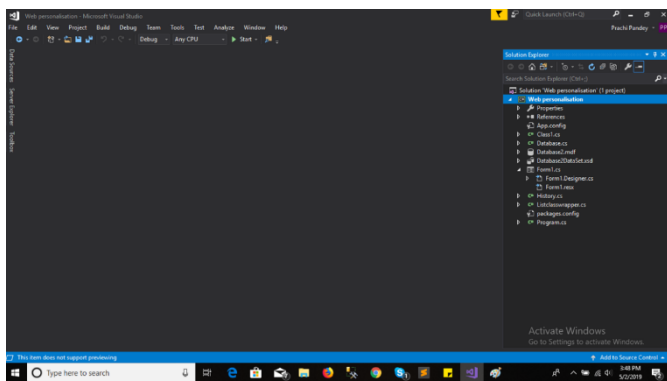


Figure 4.3 GUI snapshot 1.

The above-represented images show the recommendation considered by the browser implemented using the proposed methodology.

The window for the weighted item

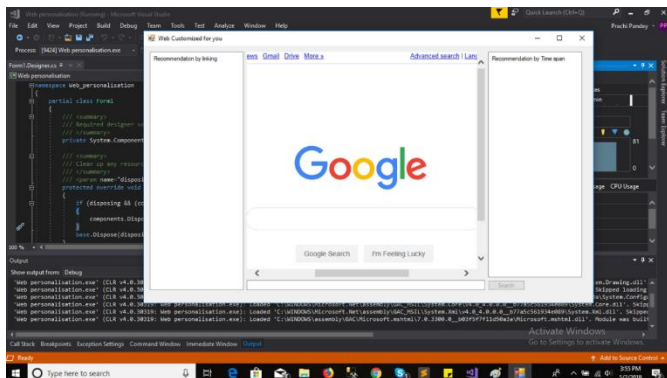


Figure 4.4 GUI snapshot 2

The above image shows the calculation of the weights based on the mathematical formulation shown in the research proposal, the computed weights are about the visit count and the frequency of visiting the particular link.

Windows for Pattern sequence

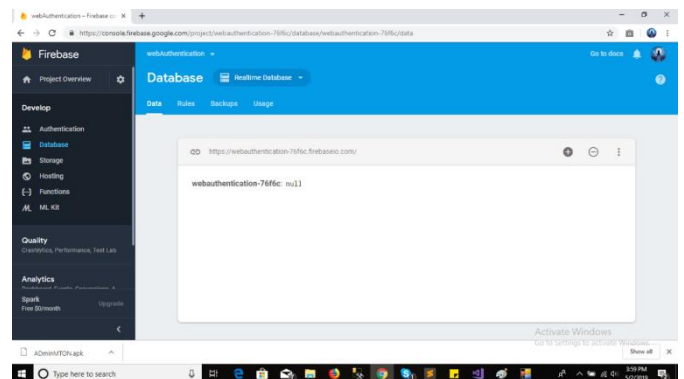


Figure 4.5 GUI snapshot 3

The period-based recommendations are being considered for the user based on the past patterns considered by the user.

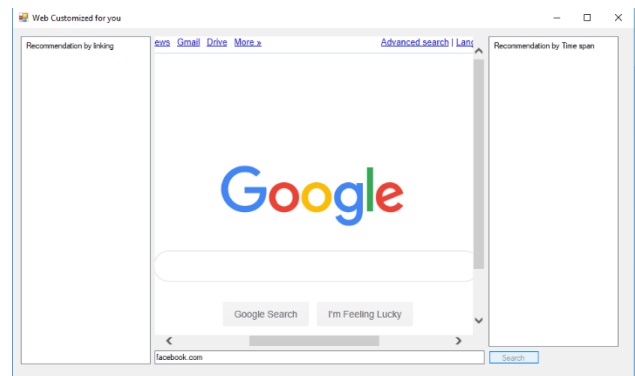


Figure 4.6: GUI snapshot 4

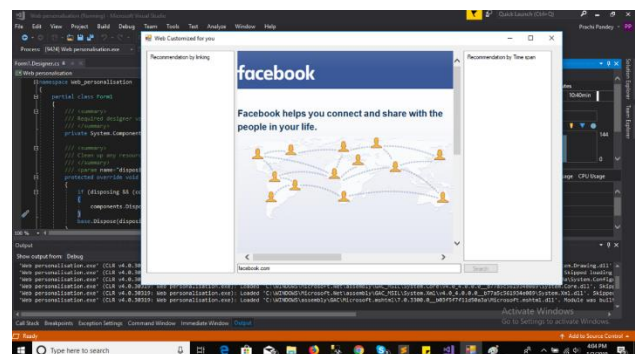


Figure 4.7: GUI snapshot 5

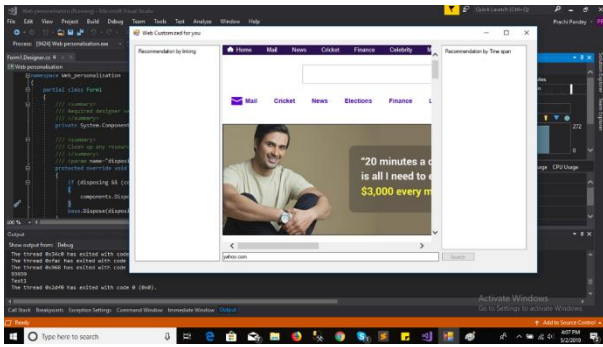


Figure 4.8: GUI snapshot 6

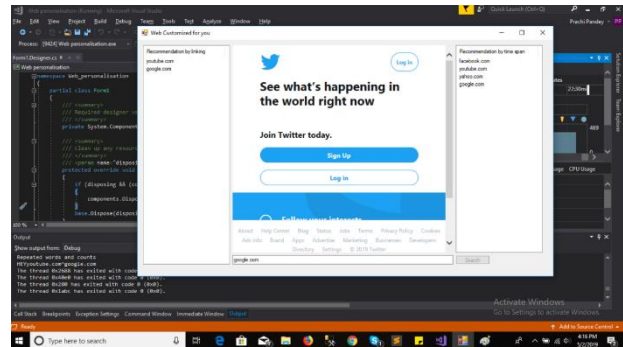


Figure 4.12: GUI snapshot 10

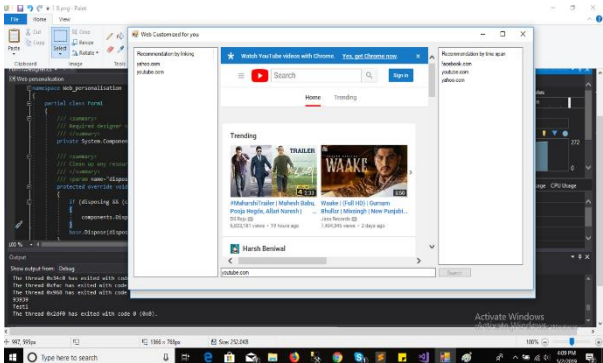
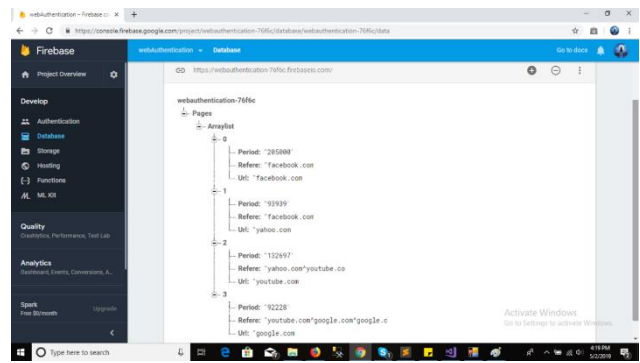


Figure 4.9: GUI snapshot 7



V. CONCLUSIONS AND FUTURE DIRECTIONS

Personalization has been discussed in this study as a means of providing services to each customer in a manner that is tailored to their needs. Currently, there are a few informative collections accessible on the internet; nonetheless, the vast majority of web structures are incapable of delivering the information to clients with customized assistance. The design or architecture that is used for heavy weight and client get to design for online recommendation is offered, and it is an upgrade over the User Access Pattern method, which is described below. The suggested work provides a structure that makes use of a consecutive access design mining partner with a weight parameter, as well as everything else, as an example. Instead of the usual twofold loads, we first assigned a quantitative load to everything based on the amount of time spent on each page and the number of visits to each page. The time spent on a page and the number of times a page has been visited are used to determine the size of a page in each exchange in the weighted pattern. A squished information model (referred to as a Pattern-tree) will be developed later on to maintain the progressive web's access to designs while also generating

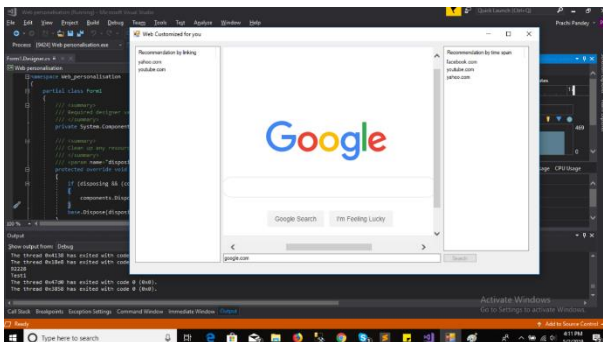


Figure 4.10: GUI snapshot 8

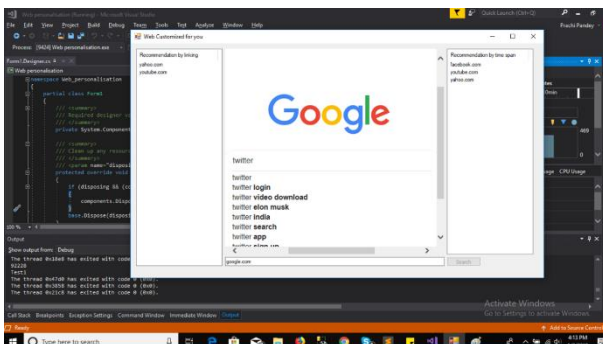


Figure 4.11: GUI snapshot 9

recommendation guidelines for clients. It is necessary to link preprocessing of information to web logs before doing design mining; the preprocessing approaches used information cleansing and information modification to set up that information for another operation. Based on this research, it is anticipated that the suggested work, which makes use of weight parameters and access design for an online recommendation, would aid in the removal of large amounts of data with a significant increase in the review and fulfillment of requests.

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Study and Survey of Available Pattern Matching Approach for Personalization of Web

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ABSTRACT

Users' Web use logs are used to personalize websites depending on the information they provide. This information is gathered to analyze the content and structure of websites to find a solution to this issue. Depending on the user profile that is increasingly being built on the web pages or documents, the search engine may alter the efficiency of current tactics. An effective new online search based on individual categorization and clustering is presented in this research. Classification is the goal of this method. Semantic web search is moving in the direction of personalization for users who need to locate relevant information. Web personalization is classified and semantic search tools are examined in this article. Personalization necessitates the creation of an interesting profile for each user. As a result of the benefits that ontologies provide, many semantic web applications now employ them for personalization. Most semantic web search tools employ agent technology to achieve their features.

Keywords - Web personalization, websites

Article Info

Volume 9, Issue 1

Page Number : 382-389

Publication Issue

January-February-2022

Article History

Accepted : 05 Jan 2022

Published : 20 Jan 2022

I. INTRODUCTION

In Classification-based Web Personalization [1], the following two approaches are used. Grouping is oriented in which the customers are allowed to use the activity data of other customers with similar inclinations.

A rule-based on which the primary focus is on web content rules. Here, more important is the perception of the clients, not the old browsing history. Customer interest may be known by the customer's reactions to the contents of the website. It is based on rules, principal, and tradition.

Grouping can be done with the help of System Logger, Category Generator, and Customizer. By applying a few data mining strategies [2], we can fetch information from the log Category Generator which tells the details of the category of each customer in the grouping.

With the help of this methodology, the authors broadened the regular affiliation rule technique by doling out a critical weight [3] to everything in exchange to look at the significance of everything inside the exchange and expand another algorithm dependent on the anticipated weighted affiliation rule mining strategy. Amid this weighted alliance standard

mining approach, the maker consigned a quantitative burden to the whole thing from applying period on each page and the count of visitors on each page as opposed to standard twofold loads. Within the process of mapping the weighted visits, the visitors count on the particular page and the spend time with the visitors on the page is used to be verified its centrality in each exchange [4].

II. WEB PERSONALIZATION BASED ON MULTILEVEL

A unified model for multi-level web personalization [5] has been suggested to incorporate all the systems and strategies brought together. Thus we can any concept from multiple views. Also, a single attribute may have many structures. Based on clients' current behavior, the entire framework gives the rundown of prescribed web content to the client. With the help of this system, the creator proposed a representation that prescribed administration or items to the client in which they are keen on by which we can get the details of the past activity done by the customer on the web [6].

A unified model is used to retrieve information to a web personalized by transplanting and updating information, which is then shown on the web. It may be shown as follows:

Here U = Group of users

S = Group of net services

R = Relationship between U and S

Examples $R \subseteq U \times S$ or $(U, S) \in R$

In which $u \in U$ and $s \in S$, as a user u is dispatched by a service s , which is defined as uRs .

The recommendation by the Author can be depicted as the Web Personalization function (Δ) to view the accomplishment of a web service s to a web user u . After assuming we can simply signify specific user's information, user's profile and all the necessary details of a vector u , and every feature of a vector service's s , the function of the Web Personalization's equation which is later defined as:

$$\Delta(u, s): \vec{u} \times \vec{s} \rightarrow [0, 1] \quad (2.1)$$

By altering data in this manner, an integrated model may be used to collect information from a web server and personalize it for the user. It is composed of many sub-models, as seen in Figure. 1, which is presented below:

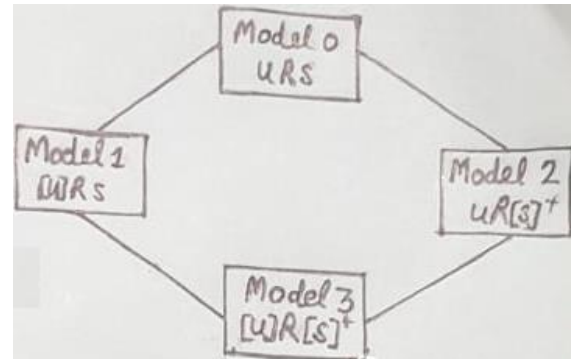


Fig. 1 Sub-models UWP Model

The above sub-models are depicted for the recovery and customization of the data which is indicated by the necessities and the advantage of the visitor's review are as under-

- **Model 0:** This paradigm lets consumers pick the desired service from a set of providers.
- **Model 1:** It shows the collection of users to suggest a service by peer estimation.
- **Model 2:** Recommend the service by related content, receiving the fundamental concept of gain on deep context, semantics, or ontological information about the function or framework.
- **Model 3:** Associations of two group events. It means an individual user with a collection of services and a collection of users with distinct services. When the Request of traits that categorize the clients is changed, then a distinctive progressive system [7] can be developed for similar properties.

The layered structure is underlined, it is more comprehensive and ideal for hypothesis development in a staggered model may increase the grasp of the Web Personalization notion itself, and deliver progressively accurate recommendations. On the off chance that the request of traits that characterize the clients is changed, at that point distinctive progressive system

[7] can be developed for similar properties in this way, and the multifaceted nature of the model is expanded.

III. WEB PERSONALIZATION BASED ON FUZZY LOGIC TECHNIQUES

This model is based on content-based filtering [8]. It focuses on product filtering [8]. It focuses on product filtering [9]. This model deals with uncertainties and ambiguity for better personalization. The limitation is that the correctness of the fuzzy system is difficult.

Following are the key points of this model.

- a) Two data modules and two preparing modules are taken into consideration in this approach.
- b) Data modules are used to collect the customer data and administrative data.
- c) Preparing module estimates, client preference, and product filtering [9].
- d) The inclination is fetched by a fuzzy logic system with the help of unclear information from the customer's web history. This approach coordinates the fuzzy logic for getting the customers' needs using numerical methods and managing the uncertainty.

The inclination to learn is bolstered by the fuzzy logic system which manages the unclear information or data from the client's exercises. The proposed technique gives another idea to web Personalization that coordinates fuzzy logic for estimation of clients' resemblance. Fuzzy sets are depicted as a numerical method to imply and manage uncertainty and uncertain in processing territory which is relying upon enrollment capacities. The enrollment work characterizes how every individual indicates from info mapped participation esteem in the interval [0, 1]. The proposed strategy manages the unclearness of clients' online exercises; the proposed framework delivered the most fitting and significant esteem dependent on the client's conduct and their entrance time. Creating suitable participation capacities for fuzzy sets is a huge testing issue in fuzzy frameworks plan. It is a troublesome errand since it specifically influences the rightness of the fuzzy framework.

IV. WEB PERSONALIZATION BASED ON THE INTEREST OF CUSTOMERS

It is discovered that customers' advantage in the recommendations depends on their past web behavior or navigational conduct on the web [10]. In this approach information about past web history, and navigational data on the websites is collected and the data can be stored on the server. The author used the k-means algorithm to group the information and calculation to get the required record.

The k-means algorithm is based on attributes to the group in keeping items into k-sets. It is based on an expected maximization procedure that uses the clusters of users by their interest and level of interest. It is given by equation 2.2:

$$V = \sum_{i=1}^k \sum_{x \in S_i} |x_i - \mu_i|^2 \quad (2.2)$$

Where there are k clusters S_i , $i = 1, 2, \dots, k$. μ_i is the centroid or mean point of all the points $x \in S_i$

When the clients come, their past visit count is stored in the system. The distance function D_{is} (V_{ij} , V_{inew}) between the j-th customer in the knowledge base and the new customer is:

$$Dis(V_{ij}, V_{inew}) = \sqrt{\sum_i^m \left(\text{weight}_1(i) * \left| \frac{V_{ij}(i) - V_{inew}(i)}{\text{stddev}(i)} \right| \right)} \quad (2.3)$$

In this formula, we know that,

Where V_{ij} = vector holds concerned domain value.

$V_{ij} = 1$, when the i-th concerned domain is in j-th concerned domain set ij.

Otherwise

$$V_{ij}(i) = 0$$

V_{inew} = vector of the new user's concerned domain set.

m = number of the concerned domain

The main focus is on clustering, relevancy is medium and complexity is also medium. This model is created on the client's intrigued [11] areas. This is based on customer-based snap history without taking care of time spent on each page.

V. WEB PERSONALIZATION BASED ON WEIGHTS

In this approach main focus is on the weighting scheme. Relevancy is high and complexity is also high.

In this methodology, the regular application rule technique has been broadened by introducing the critical weight [12] in everything to expand another algorithm [12]. This is dependent on the anticipated weighted affiliation mining rule strategy. Quantitative lead has been added to everything which depends on the time spent on each page. These two parameters (time spent and visit tally) are used to check its centrality in every transaction [13].

Time spent on every page has been made very important in this model. The customers spent more time on a page only when that page is worth it for them. He does not skip the page if it is important. He will invest energy on a page that is of real worth to him. That is why more weight is given. Similarly, Time spent by every customer on a web item is also important. It can be found by equation 2.4

Where Duration = Time spent on each page.

This shows the importance of the page to the concerned user. This is because a user spends more energy and time only when the page is more interesting to him. If the user is not interested in a page, he skips that page and goes rapidly. Also, a rapid skip may be due to the small size of page content.

$$Duration(I) = \frac{\frac{Total\ duration(I)}{Size(I)}}{\max_{j \in T} \frac{Total\ duration(I)}{Size(I)}} \quad (2.4)$$

Frequency Calculation

Frequency shows how many times a web page is visited by different customers. If the frequency is higher, it means the user interest is higher on the page. Frequency can be calculated by equation 2.5.

$$Frequency(I) = \frac{No\ of\ visit(I)}{\sum_{j \in T} No\ of\ visit(j)} * \frac{1}{in\ degree(I)} \quad (2.5)$$

$$Weight(I) = Frequency(I) * Duration(I) \quad (2.6)$$

In this calculation, it is clear that a higher weight will be assigned to the more interesting item as per the user. Also, this weight can be utilized to judge how

much the page is important to the user. This better recommendation can be given to the user/customer.

VI. WEB PERSONALIZATION BASED ON USER ACCESS PATTERNS

With the aid of this approach, a flattened data model[14], provided by the author and known as Pattern-tree, is created, which is designed to maintain the sequential web get to designs organized, and a competent technique is structured for producing suggestion rules for clients. [14] Before doing design mining, the preparation of data must be connected to the site logs that are being used. The preprocessing procedures that are being used include information cleaning and information altering. Each request in a succession record is a record of exchanges arranged by exchange gets to period with every exchange; evaluate the all grouping example with the least amount of assistance.

Based on the customer's current access arrangement, the Pattern tree displays the access method that is most appropriate for the suggestion rules generating the available module. To determine the value of the recommender display, numerous estimate methods have been offered, including fulfillment and exactness. Although the proposed framework has completed a continuous arrangement, it is difficult to determine which child node should be prescribed by the system to the client.

It is not possible to determine the true meaning of an object with the assistance of that item for a certain customer. Even clients who are not enthusiastic about a certain item might benefit by merely tapping on that item again and over again, which is known as backing.

2.8 METHODS BASED ON RELEVANCE

To retrieve the report, the pertinence input techniques [15] are implemented. The significance of website pages is obtained via contact with the internet, the discovery of intriguing themes, and the acquisition of foundational knowledge about the subject of interest. The author offered important input based on the catchphrase map in this approach, which completes

the customer's anticipation from the watchword area by completing the catchphrase map. Because the customers' inclinations are anticipated on keyword space rather than report space, in which queries are spoken to the search engines, this technique outperforms the traditional significance input methodology. It may be conceivable to do an important evaluation if the framework can complete the client's preferences from the watchword map that he has customized.

The authors presented a process for deleting Far2Near (rework the watchwords that were initially far apart from one another) and Near2Far (modify the catchphrases that were initially near to one another) catchphrase sets from a customer's modification on a catchphrase map using this approach. Identifying and extracting such keyword sets is a necessary step to interpret significance criticism on a catchphrase map. Within the current arrangement of the report, the suggested approach may create inquiries as irregular combinations of watchwords to the exclusion of the usual pertinence criticism, which has the greatest impact on available record space. For keyword mapping, this method required several different e restates.

2.9 METHODS OF WEB PERSONALIZATION BASED ON NEURAL NETWORK

The Kano-ANN technique [16] was developed by the author as a way to merge artificial neural networks with Kano's method. In the context of clustering raw data into groups based on similar highlights, the term "artificial network" refers to the ART-based grouping of artificial networks. There are two levels to the ART: a correlation layer that gets the information vector and shifts contributions to their best match in the acknowledgment layer, and an acknowledgment layer that enhances the true yield and stifles others. Developed by Noriaki Kano in the 1980s, the Kano model categorizes customer preferences into five categories: appealing, one-dimensional, must-be, indifferent and reverse.

This concept's fundamental commitment is to approach the problem of product and administration recommendation in a manner that is specifically tailored to the needs of the customer, as determined by brain research. When used to client clustering rather than known methods like K-means, ANN is more adaptable to new clients. [17].

2.10 METHODS OF WEB PERSONALIZATION BASED ON CONSUMER BEHAVIOR

A model of consumer behavior [18] is stored in an information base as part of this approach to Web Personalization, which makes use of customers' behavior over time. Intermittent access is eliminated by this technique, which occurs repeatedly within a predetermined duration, such as weekly or monthly. Customers' online get-to-resemblance and behavior may be better understood with these intermittent access designs.

Semantic information about online material accessed by clients is included in weblogs. Customers' true behavior, similarity, and proclivities are difficult to discern, therefore semantic upgrading of weblogs is necessary if it is to be very lucrative. Semantically [19] enhanced data from online logs were used by the author to construct a buyer behavior learning base model.

To develop a model of consumer behavior based on fuzzy logic, the author proposes using this approach. This model is then used to express the sequential notion.

2.11 WITHOUT ANY INPUT FROM THE USER

This page-gathering method [20] is used to acquire a customized or significant result. Candidate interface settings are perceived and coordinated with list sheets depending on the client gets to log in this method without human intervention. As a byproduct of the site's architecture, weblogs organically preserve information about the visitors' activity. A graphical or tree group may be used to store the entry example for further analysis. The page accumulation method works by creating clear index sheets that allow clients to navigate the web as they see fit. This algorithm uses

group mining to determine the best way to organize pages on a website based on the idea that visitors return to the site often. Cluster mining is a deviation from traditional grouping in which everything may be placed in a single bunch, but in group mining, a single object can be placed in several covering groups. Due to the usage of group mining, it is possible to increase the complexity of the clustering process.

It has been shown that the quality and limitations of different Web Personalization techniques rely on the strategy presented or employed by the author(s). There are a few approaches that are dependent on the content of a website or an object to describe its class. Customers and clients have a strong desire to have their wants and desires met, which may be harnessed via a variety of Web Personalization strategies. Several of the aforementioned solutions are reliant on the client's behavior to remove data from the learning base, while others are based on fuzzy logic.

Every one of the methodologies utilized distinctive procedures and diverse parameters for Personalization. Along these lines, the rundown of the considerable number of methodologies regarding their quality and constraints, in the tabular form is delineated in Table 2.1.

Within this area, we have examined the contrast between the above methodologies dependent on various parameters. We have concentrated on strategies in comparing approach and importance, intricacy as appeared. Fundamental importance indicates that the customer receives data that is correct or appropriate, and this is what is meant by the terms "low," and "mid." Accuracy, fulfillment, and other relevant parameters are all important in Web Personalization. Suggestion criteria may be used to determine how likely a client is to have viewed the pages in question. In addition, complexity is defined as the number of emphases needed to do the computation, and they are classified as low, medium, and high. There is table 2.2 for the above parameters. The correlation of the different methodologies

depending on the literature review is delineated in Table 2.2.

Table 2.1: Summary of above discussed Approaches for Web Personalization.

Parameter /Approach	Focus	Strength	Limitations
Category based Web Personalization	Web content, rules	User can take the benefit of other users' similar interest	Rule based personalization depend upon the customer's perception
Multilevel Web Personalization	Hierarchal structure	Any concept can be understood by multiple views	A single attribute may have the many structures
Fuzzy Logic based Product Filtering for Web Personalization	Product filtering	Deal with uncertainty and ambiguity for better personalization	Correctness of fuzzy system is difficult
Web Personalization based on User's Interested Domain	Hyperlink structure	Content recommendation based on the interest of individual user	Only the click history cannot identify the actual interest of user
Web Personalization based Weighted Association Rule	Hyperlink structure with time constraint	Provide highly weighted pages to the users based on their importance	No pattern follows
Web Mining based on User Access Pattern For Web Personalization	Extract useful pattern	Recommended the web content based on user' access sequence	Support cannot identify the actual importance of web document
Web Personalization method based on Relevance Feedback on Keyword Space	Near2Far Far2Near problem	Better recommendation due to keyword space instead of document space	Increase the number of iteration due to keyword space
Application of Neural Network and Kano's method to content recommendation in Web Personalization	ART(Artificial Resonance Theory)	Based on human psychology for better suggestion	Implementation of ANN, Used of classical clustering algorithm
Web Content Recommender system based on Consumer Behavior Modeling	Enhancement of hyperlink structure with time stamp	Construct the knowledge base with large semantic information to provide better suggestion	Time to time updating required
Techniques for Adaptive Website and Web Personalization without any User Effort	Cluster mining	Less user effort	Overlapping of clusters is difficult

Table 2.2: Parametric Comparison of Different Approaches for Web Personalization.

Parameter / Approach	Technique used	Relevancy	Complexity
Category based Web Personalization	Collaborative filtering, observational personalization	Low	High
Multilevel Web Personalization	Personalization Function	Medium	High
Fuzzy Logic based Product Filtering for Web Personalization	Fuzzy Logic	High	Medium
Web Personalization based on User's Interested Domain	Clustering	Medium	Medium
Web Personalization based Weighted Association Rule	Weighting Schema	High	High
Web Mining based on User Access Pattern For Web Personalization	Data mining technique	Medium	High
Web Personalization method based on Relevance Feedback on Keyword Space	RF on Keyword space	High	High
Application of Neural Network and Kano's method to content recommendation in Web Personalization	Kano's -ANN approach	High	High
Web Content Recommender system based on Consumer Behavior Modeling	Knowledge base control	High	High
Techniques for Adaptive Website and Web Personalization without any User Effort	Page Gather Algorithm	Medium	Low

The correlation of different methodologies for Web Personalization is dependent on different parameters like procedures utilized by the author, and user's involvement, because of various parameters, centered fulfillment, and accuracy. The qualities 'Low', 'Normal', and 'High' for parameters accuracy and fulfillment are given while contrasting all methodologies.

VII. CONCLUSIONS AND FUTURE WORK

Personalization has been discussed in this study as a means of providing services to each customer in a manner that is tailored to their needs. Currently, there are a few informative collections accessible on the internet; nonetheless, the vast majority of web structures are incapable of delivering the information to clients with customized assistance. Because of the proliferation of information on the internet, the Web Personalization strategy has become a need. If a Web Personalization framework cannot detect the additional information difficulty, it must be capable of allowing the customers to exercise in any case attempt to find the information they want. It is discussed several different approaches for eliminating the strategy for Web Personalization that are available. Those previously offered techniques have a few preferences and limitations that are worth noting. For these approaches to be more productive and effective, it is necessary to address the barriers to the performance presentation of the framework to achieve an increase in the overall productivity and effectiveness of the approaches.

The suggested architecture may also be used to develop a toolbar that will work in conjunction with the internet browser advantageously. By providing the client with enhanced recommendations based on their advantage and requirements, it will be possible to provide the concerned zones and administrations proposal while also increasing the significance of the prescribed framework and increasing the significance

of the prescribed framework by providing the client with enhanced recommendations.

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5G Technologies

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Article Info

Volume9, Issue 1

Page Number: 390-394

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022

Published :25 Feb 2022

ABSTRACT

5G technologies will change the way most high-bandwidth users access their phones. With 5G pushed over a VOIP-enabled device, people will experience a level of call volume and data transmission never experienced before. 5G technology is offering the services in Product Engineering, Documentation, supporting electronic transactions (e-Payments, e-transactions) etc. As the customer becomes more and more aware of the mobile phone technology, he or she will look for a decent package all together, including all the advanced features a cellular phone can have. Hence the search for new technology is always the main motive of the leading cell phone giants to out innovate their competitors. Recently apple has produced shivers all around the electronic world by launching its new handset, the I-phone. Features that are getting embedded in such a small piece of electronics are huge.

The 5g design is based on user-centric mobile environment with many wireless and mobile technologies on the ground. In heterogeneous wireless environment changes in all, either new or older wireless technologies, is not possible, so each solution towards the next generation mobile and wireless networks should be implemented in the service stratum, while the radio access technologies belong to the transport stratum regarding the Next Generation Networks approach. In the proposed design, the user terminal has possibility to change the Radio Access Technology - RAT based on certain criteria. For the purpose of transparent change of the RATs by the mobile terminal, we introduce so-called Policy-Router as node in the core network, which establishes IP tunnels to the mobile terminal via different available RATs to the terminal. The selection of the RAT is performed by the mobile terminal by using the proposed user agent for multi-criteria decision making based on the experience from the performance measurements performed by the mobile terminal

I. INTRODUCTION

The world has seen a lot of changes in the realm of communication. Today we no more use landlines. Everyone possesses a mobile phone that functions

24X7. Our handsets not only keep us connected with the world at large but also serve the purpose of entertainment gadget. From 1G to 2.5G and from 3G to 5G this world of telecommunications has seen a

number of improvement along with improved performance with every passing day.

The 5th generation is envisaged to be a complete network for wireless mobile internet, which has the capability to offer services for accommodating the application potential requirements without suffering the quality. The ultimate goal of 5G is to design a real wireless world, that is free from obstacles of the earlier generations.

5G technology will change the manner in which cellular plans are offered worldwide. A new revolution is about to begin. The global cell phone is around the corner. The global mobile phone will hit the localities who can call and access from one country to another's local phone with this new technology. The way in which people are communicating will altogether upgrade. The utilization of this gadget will surely move a step ahead with improved and accessible connectivity around the world. Your office will shrink into your handset with this cell phone that is going to resemble PDA (personal digital assistant) of twenty first century. 5G technology has a bright future because it can handle best technologies and offer priceless handset to their customers. May be in coming days 5G technology takes over the world market. 5G Technologies have an extraordinary capability to support Software and Consultancy. The Router and switch technology used in 5G network providing high connectivity. The 5G technology distributes internet access to nodes within the building and can be deployed with union of wired or wireless network connections. The current trend of 5G technology has a glowing future.

1.1 DEFINITION

5G Wireless System is a complete wireless communication with almost no limitation; somehow people called it REAL wireless world. But till present day 5G wireless system concept is only theory and not real, so it is not applicable for use.

5G (5th generation mobile networks or 5th generation wireless systems) is a technology used in

research papers and projects to denote the next major phase of mobile telecommunication standards beyond 4G. 5G is not officially used for any specification or official document yet made public by telecommunication companies or standardization bodies. New standard releases beyond 4G are in progress by standardization bodies, but are at this time not considered as new mobile generations but under the 4G umbrella. The implementation of standards under a 5G umbrella would likely be around the year of 2020.

1.2 PROPERTIES

- Worldwide cellular phone: Phone calls in any country can be done easily like a local phone call.
- Extraordinary data capabilities: Data capabilities of the 5G system is much higher than other generation so you can store more number of data with less problem in storing them.
- High connectivity: Connectivity speed of 5G is almost 25 Mbps.
- More power features in hand held phones: You'll have all features of PDA laptops in your mobile phone, which makes it more powerful.
- Large phone memory, more dialing speed, more clarity in audio video.

II. EVOLUTION FROM 1G TO 5G EVOLUTION

2.1 1ST GENERATION

First Generation wireless technology (1G) is the original analog (An analog or analogue signal is any continuous signal for which the time varying feature (variable) of the signal is a representation of some other time varying quantity), voice-only cellular telephone standard, developed in the 1980s. The prominent ones among 1G system were advanced mobile phone system (AMPS), Nordic mobile telephone (NMT), and total access communication system (TACS).



- Developed in 1980s completed in early 1990s
- Based on analog system
- Speed up to 2.4 kbps
- AMPS (Advance Mobile Phone System) was launched by the US it was the 1G mobile system
- Allows user to make voice calls in 1 country

2.2 2ND GENERATION

2G (or 2-G) is short for second-generation wireless telephone technology. Second generation 2G cellular telecom networks were commercially launched on the GSM standard in Finland in 1991. 2G network allows for much greater penetration intensity. 2G technologies enabled the various mobile phone networks to provide the services such as text messages, picture messages and MMS (Multi Media Messages). 2G technology is more efficient. 2G technology holds sufficient security for both the sender and the receiver. All text messages are digitally encrypted. This digital encryption allows for the transfer of data in such a way that only the intended receiver can receive and read it.

Second generation technologies are either time division multiple access (TDMA) or code division multiple access (CDMA). TDMA allows for the division of signal into time slots. CDMA allocates each user a special code to communicate over a

multiplex physical channel. Different TDMA technologies. GSM technology was the first one to help establish international roaming. This enabled the mobile subscribers to use their mobile phone connections in many different countries of the worlds is based on digital signals, unlike 1G technologies which were used to transfer analogue signals. GSM has enabled the users to make use of the short message services (SMS) to any mobile network at any time. MS is a cheap and easy way to send a message to anyone, other than the voice call or conference. This technology is beneficial to both the network operators and the ultimate users at the same time.

In comparison to 1G's analog signals, 2G's digital signals are very reliant on location and proximity. If a 2G handset made a call far away from a cell tower, the digital signal may not be enough to reach it. While a call made from a 1G handset had generally poor quality than that of a 2G handset, it survived longer distances

- This is due to the analog signal having a smooth curve compared to the digital signal, which had a jagged, angular curve. As conditions worsen, the quality of a call made from a 1G handset would gradually worsen, but a call made from a 2G handset would fail completely.

- Developed in late 1980s completed in late 1990s
- Based on digital system
- Speed up to 64 kbps
- Services such are digital voice SMS with more clarity

2G are the handsets we are using today, with 2.5G having more capabilities.

2.3 3RD GENERATION

International Mobile Telecommunications-2000 (IMT-2000), better known as 3G or 3rd Gen-eration, is a generation of standards for mobile phones and mobile telecommunications services fulfilling specifications by the International Telecommunication Union. The use of 3G technology

is also able to transmit packet switch data efficiently at better and increased bandwidth. 3G mobile technologies proffers more advanced services to mobile users. The spectral efficiency of 3G technology is better than 2G technologies. Spectral efficiency is the measurement of rate of information transfer over any communication system. 3G is also known as IMT-2000.



- Developed between late 1990s early 2000s until present day
- In 2005, 3G is ready to live up to its performance in computer networking (WCDMA, WLAN and Bluetooth) and mobile devices area (cell phone and GPS)
- Transmission speed from 125 kbps to 2 Mbps
- Superior voice quality
- Good clarity in video conference
- Data are sent through technology called packet switching
- Voice calls are interpreted using circuit switching
- Fast Communication, Internet, Mobile T.V, E-mail, PDA, information surfing, on-line shopping/ banking, Multi Media Messaging Service (MMS), 3D gaming, Multi-Gaming etc.
- Global roaming

2.4 4TH GENERATION

4G refers to the fourth generation of cellular wireless standards. It is a successor to 3G and 2G families of

standards. The fourth generation (4G) is a conceptual framework and a discussion point to address future needs of a high speed wireless network that can transmit multimedia and data to and interface with wire-line backbone network perfectly just raised in 2002. The speeds of 4G can theoretically be promised up to 1Gbps.

Some of the applications of 4G are: 1. Mobile TV a provider redirects a TV channel directly to the subscriber's phone where it can be watched. 2. Video on demand a provider sends a movie to the subscriber's phone. 3. Video conferencing subscribers can see as well as talk to each other. 4. Tele-medicine a medical provider monitors or provides advice to the potentially isolated subscriber. 5. Location-based services a provider sends localized weather or traffic conditions to the phone, or the phone allows the subscriber to find nearby businesses or friends. 6. Mobile ultra-broadband (gigabit speed) access and multi-carrier transmission.

- Developed in 2010
- Faster more reliable
- Speed up to 100 Mbps
- Both cellular and broadband multimedia services everywhere
- High performance
- Easy global roaming
- Low cost



2.5 5TH GENERATION

5G Technology stands for 5th Generation Mobile technology. 5G technology has changed the means to use cell phones within very high bandwidth. User never experienced ever before such a high value technology. The 5G technologies include all type of advanced features which makes 5G technology most powerful and in huge demand in near future. The gigantic array of innovative technology being built into new cell phones is stunning. 5G technologies which are on hand held phone offering more power and features than at least 1000 lunar modules.

- A user can also hook their 5G technology cell phone with their Laptop to get broadband internet access. 5G technology including camera, MP3 recording, video player, large phone memory, dialing speed, audio player and much more you never imagine. Next major phase of mobile telecommunication wireless system
- 10 times more capacity than others
- Expected speed up to 1 Gbps
- Faster reliable than 4G
- Lower cost than previous generations



III. CONCLUSION

It is high time that India should strengthen the domestic telecommunication manufacturing market to enable local industries to capture both domestic as well as global market.

An” intelligence-first” approach will need to be adopted by Telecom providers for managing core networks as an important business investment.

This technology helps to promotes stronger links between people working in different fields creation future concepts of mobile communication, internet services, cloud computing, all pie network nanotechnology.

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Big Data with Cloud Computing

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Article Info

Volume9, Issue 1

Page Number: 395-403

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022

Published :25 Feb 2022

ABSTRACT

With the recent advancements in computer technologies, the amount of data available is increasing day by day. However, excessive amounts of data create great challenges for users. Meanwhile, cloud computing services provide a powerful environment to store large volumes of data. They eliminate various requirements, such as dedicated space and maintenance of expensive computer hardware and software. Handling big data is a time-consuming task that requires large computational clusters to ensure successful data storage and processing. [1] Security and Privacy of information is the biggest challenge to cloud computing. Security and privacy issues can be overcome by employing encryption, security hardware and security applications.[2] In this work, the definition, classification, and characteristics of big data are discussed, along with various cloud services, such as Microsoft Azure, Google Cloud, Amazon Web Services, International Business Machine cloud, Hortonworks, and MapR. A comparative analysis of various cloud-based big data frameworks is also performed. Various research challenges are defined in terms of distributed database storage, data security, heterogeneity, and data visualization.[1]

Key words: big data; data analysis; cloud computing; Hadoop

I. INTRODUCTION

With recent technological advancements, the amount of data available is increasing day by day. For example, sensor networks and social networking sites generate overwhelming flows of data. In other words, big data are produced from multiple sources in different formats at very high speeds [1] At present, big data represent an important research area. Big data are rapidly produced and are thus difficult to store, process, or manage using traditional software. Big data technologies are tools that are capable of storing meaningful information in different types of formats. For the purpose of meeting users' requirements and

analyzing and storing complex data, a number of analytical frameworks have been made available to aid users in analyzing complex structured and unstructured data [3]. Several programs, models, technologies, hardware, and software have been proposed and designed to access the information from big data. The main objective of these technologies is to store reliable and accurate results for big data [4] In addition, big data require state-of-the-art technology to efficiently store and process large amounts of data within a limited run time.

Three different types of big data platforms are interactive analysis tools, stream processing tools, and batch processing tools[4]. Interactive analysis tools are

used to process data in interactive environments and interact with real-time data. Apache Drill and Google's Dremel are the frameworks for storing real-time data. Stream processing tools are used to store information in continuous flow. The main platforms for storing streaming information are S4 and Strom. Hadoop infrastructure is utilized to store information in batches. Big data techniques are involved in various disciplines, such as signal processing, statistics, visualization, social network analysis, neural networks, and data mining. Mohajer et al. designed an interactive gradient algorithm that receives controlled messages from neighboring nodes. The proposed method uses a self-optimization framework for big data.

II. DEFINITIONS OF BIG DATA

Big data refers to data sets that are too large or complex to be dealt with by traditional data processing application software. Data with many fields (rows) offer greater statistical power, while data with higher complexity (more attributes or columns) may lead to a higher false discovery rate. Big data analysis challenges include capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating, information privacy, and data source. Big data was originally associated with three key concepts: volume, variety, and velocity.[The analysis of big data presents challenges in sampling, and thus previously allowing for only observations and sampling. Therefore, big data often includes data with sizes that exceed the capacity of traditional software to process within an acceptable time and value [5].

2.1 Characteristics of big data

Big data are characterized by three Vs: volume, velocity, and variety. These characteristics were introduced by Gartner to define the various challenges in big data [1] With new-generation architecture, data are now stored in different types of

formats; hence, the three Vs may be extended to five Vs, namely, volume, velocity, variety, value, and veracity[1]

- (1) **Volume:** Data are generated by multiple sources (sensors, social networks, smartphones, etc.) and are continuously expanding. The Internet produces global data in large increments. In 2012, approximately 2.5 exabytes (EB) of data were produced every day. According to the report of International Data Cooperation, the volume of data in 2013 doubled, reaching 4.4 zettabytes (ZB). In 2020, the volume of data reached 40 ZB. Table 2 shows the names of the units of data that can be measured in bytes[14].
- (2) **Velocity:** Data are exponentially growing at high speeds. Millions of connected devices are added on a daily basis, thereby leading to increases in not only volume but also velocity[15, 16]. One relevant example is YouTube, which generates big data at high speeds[17, 18]. Table 3 presents the number of users in India who had used social media networks by February 2021. Figure 1

Table 1 Units of data.

Name of unit	Equals	Size in bytes Bit
	1 or 0	1/8
Nibble	4 bits	1/2
Byte	8 bits	1
Kilobyte (KB)	1024 bytes	210
Megabyte (MB)	1024 KB	220
Gigabyte (GB)	1024 MB	230
Terabyte (TB)	1024 GB	240
Petabyte (PB)	1024 TB	250
Exabyte (EB)	1024 PB	260
Zettabyte (ZB)	1024 EB	270
Yottabyte (YB)	1024 ZB	280

Table 2 Users in India as of February 2021.

Application name Count		Application name Count	
WhatsApp	53 Crore	Instagram	21 Crore
YouTube	44.8 Crore	Twitter	1.75 Crore
Facebook	41 Crore		

Big Data contains a large amount of data that is not being processed by traditional data storage or the processing unit. It is used by many multinational companies to process the data and business of many organizations. The data flow would exceed 150 exabytes per day before replication.

There are five v's of Big Data that explains [7] shows the five Vs of big data.

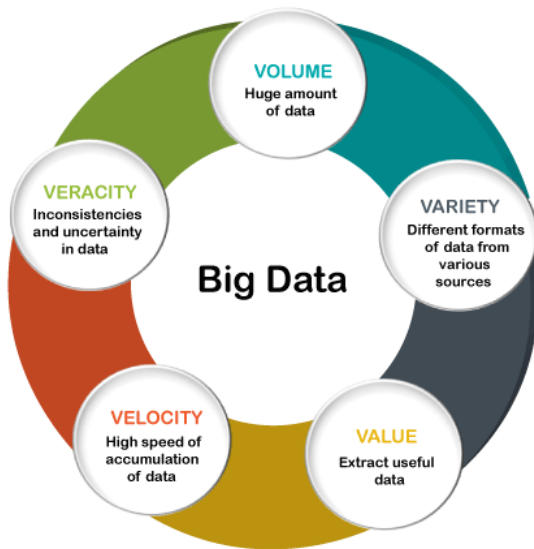


Fig 1: Five Vs of big data.

(3) **Variety:** Data are generated in multiple formats via social networks, smartphones, or sensors. These tools produce data in the form of data logs, images, videos, audio, documents, and text. Data may also be structured, semi structured, and unstructured [1]. Collected data can be unstructured, semi-structured or structured in nature. Unstructured data is data that is unorganized and comes in different files or formats. Typically, unstructured data is not a good fit for a mainstream relational database because it doesn't fit into conventional data models. Semi-structured data is data that has not been organized into a specialized repository but has associated information, such as metadata. This makes it easier to process than unstructured data. Structured data, meanwhile, is data that has been organized into a formatted repository. This means the data is made more

- addressable for effective data processing and analysis.[8]
- (4) **Value:** Value is an important characteristic of big data. It relates to how data can be dealt with and converted into meaningful information[1]. The last V in the 5 V's of big data is value. This refers to the value that big data can provide, and it relates directly to what organizations can do with that collected data. Being able to pull value from big data is a requirement, as the value of big data increases significantly depending on the insights that can be gained from them.[8]
- (5) **Veracity:** Veracity refers to the quality, correctness, and trustworthiness of data. Therefore, maintaining veracity in data is mandatory[1,2]. For example, data in huge amounts create confusion, whereas small amounts of data can convey incomplete or half information.[1]. Data can sometimes become messy and difficult to use. A large amount of data can cause more confusion than insights if it's incomplete. For example, concerning the medical field, if data about what drugs a patient is taking is incomplete, then the patient's life may be endangered.[8]

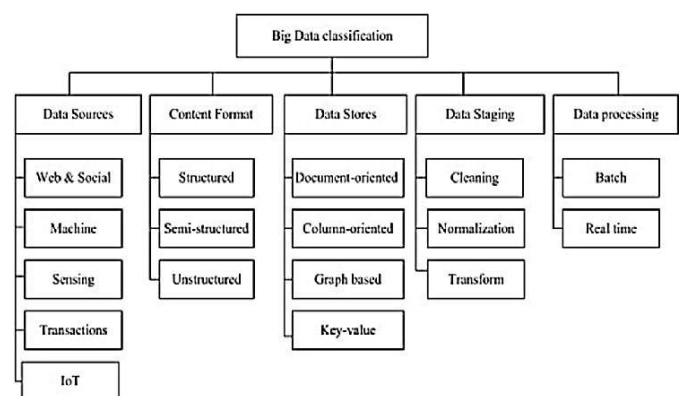


Fig 2: Types of big data.

2.2 Types of big data

Data are produced at unprecedented rates from various sources, such as financial, government, health,

and social networks. Such rapid growth of data can be attributed to smart devices, the Internet of Things, etc. In the last decades, companies have failed to store data efficiently and for long periods[1,2]. This drawback relates to traditional technologies that lack adequate storage capacity and are costly. Meanwhile, big data require new storage methods backed by powerful technologies[7]. Big data can be classified into several (1) categories. Figure 2 depicts the classification of big data.

Table 4 Types of big data.

Type	Category	explanation
Data Source	Social Media	Social media represents an important aspect of big data. Facebook, Twitter, emails, and microblogs are social media sources that generate massive amounts of data daily[27].
	Machine Generated data	Software and hardware, such as medical devices, computers, and other types of machines that generate data without human interferences.
	Sensing	Various types of sensing devices that generate data and convert them into signals
	Transaction	Financial, business, and work data generate time-based dimensions that define data.
	IOT	Tablets, smartphones, and digital camera devices are connected over the Internet and thus generate huge

amounts of data and information.

Structure d-dat	Structured-data are in a consistent order with a well-defined format. The advantage of structured-data is that they are easy to maintain, access, and store on computers. Structured-data are stored in the form of rows and columns; an example is a DataBase Management System (DBMS)
Content format source	Semi-structure d data Semi-structured data can be considered as another form of structured-data. It inherits a few properties of structured-data that do not represent the data in database models. An example is Common Separated Value (CSV) files
Unstructured data	Unstructured data do not follow the formal structure rules of data models. Images, videos, text messages, and social media posts are examples of unstructured data.
Key value stores	Key value stores are used to store and access data in key/value pairs. They are basically designed to store massive data and manage heavy loads. Apache HBase, Apache

		Cassandra, Redis, and Riak are examples of key value store databases
	Graph stores	Graph stores are used to analyze data on the basis of the relationships between nodes, edges, and properties. Neo4j is an example of a graph store.
Data store sources	Column family stores	Column family stores keep data and information within a column of a table at the same location on a disk in the same way a row store keeps row data together. Google Bigtable is an example of column family stores.
	Document-oriented stores	Document-oriented stores offer complex data forms in multiple formats, such as XML, JSON, text, string, array, or binary forms. CouchDB and MongoDB are examples of document-oriented stores
	Cleaning	Cleaning is a process in which noisy data, outliers, and missing values are removed.
Data Staging	Transformation	In data transformation, data are transformed in an appropriate format for analysis.
	Normalization	Normalization is a process used to reduce redundancies from data

	Batch data processing	MapReduce-based systems are used to process data in the form of batches. Apache Hadoop, Apache Mahout, Skytree Server, and Dryad are examples of batch processing.
	Real-time data processing	Streaming systems, such as S4, are based on distributed frameworks that allow users to design applications for processing continuous unbounded streams of data

III. CLOUD COMPUTING SERVICES

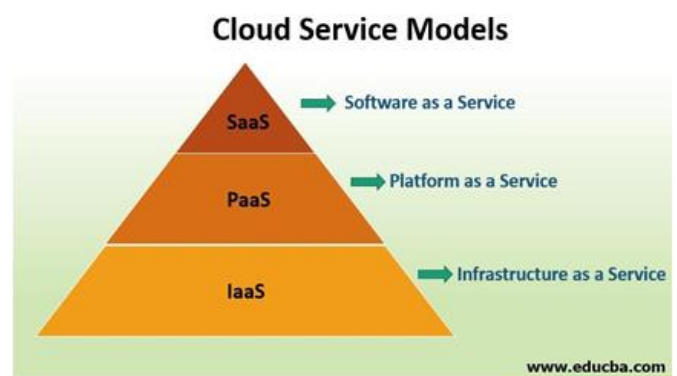


Fig 3: CLOUD COMPUTING SERVICES

IV. CLOUD COMPUTING

Cloud computing offers a cost-efficient and scalable solution to store big data. According to the National Institute for Standards and Technology, “Cloud Computing is based on pay-per-use services for enabling convenient, on-demand network access to a shared pool of configurable computing resources such as servers, networks, and services that can be rapidly provisioned and released with minimal management

effort or service provider interaction”. Cloud computing services can be[3] classified into the following three categories[1]:

(1) Infrastructure as a Service (IaaS): These services are basically based on the principle of “pay for what you need”. It provides high-performance computing to customers. Amazon Web Services (AWS),Elastic Compute Cloud, and Simple Storage Services (S3) are examples of IaaS. AWS and S3 provide online storage services. At nominal charges, customers can easily access the world’s largest data centers. At present, three companies provide IaaS landscape services: Google, Microsoft, and HP. Google provides Google Compute Engine to access IaaS services. Microsoft also provides a cloud platform through its Window Azure Platform. HP offers HP Cloud, which is designed by NASA and Rack Space.

The cloud computing environment has two important aspects: the frontend and the backend. From the frontend side, users access cloud services through an Internet connection; at the backend, all cloud services are runFigure 3 shows the various types of cloud computing services[42].

Big data and cloud computing are closely associated. With technological changes, big data models Provide Distributed processing, parallel technologies, large storage capacity, and real-time analyse is of heterogeneous databases.

(2) Software as a Service (SaaS): With the help of the Internet, all applications are run on remote cloud infrastructure in SaaS. To access SaaS services, users need an Internet connection and a web browser, such as Google Chrome or Internet Explorer[40]. Users connect to a desktop environment via a virtual machine, in which all software programs are installed. SaaS provides more facilities to users than IaaS.

(3) Platform as a Service (PaaS): It provides a runtime environment to users. It allows users to create, test, and run web applications. Users can easily access PaaS on the basis of the pay-per-use mode using an Internet connection. PaaS provides the infrastructure (networking, storage, and services) and platform (DBMS, business intelligence, middleware) for running a web application life cycle. Examples of PaaS include Microsoft Azure and Google Cloud[41].

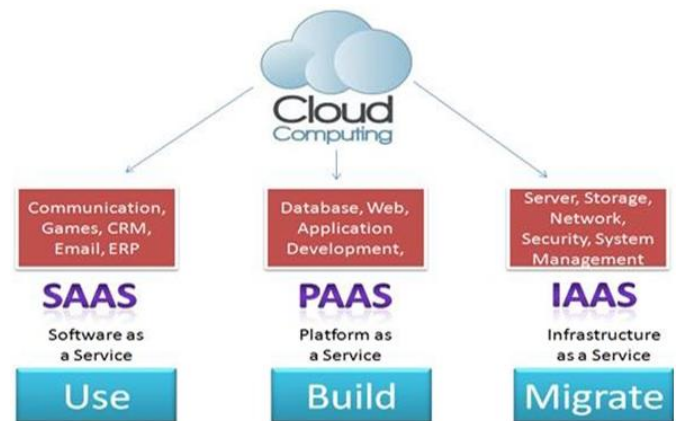


Fig 4 : Cloud computing services.

Data security and privacy are also considered in big data models. Big data require large amounts of storage space and thus entail the use of cloud computing. Cloud computing offers scalability and cost savings[43]. Moreover, it provides massive amounts of storage capacity and processing power. types of tasks. It accesses distributed queries over Cloud computing works on different types of technologies, such as distributed storage and virtualization, and processes data for different types of tasks. It accesses distributed queries over multiple datasets and gives responses in a timely multiple datasets and gives responses in a timely example of big data processing in a cloud environment that allows the storage of massive amounts of data in a cluster[9]. In other words, MapR is an efficient and cost effective model for processing big data. The MapR framework comprises the map and reduce functions for handling big data.

Cloud computing also plays an important role in distributed system environments by facilitating storage, boosting computing power, and aiding network communication. Big data technologies store data in cloud clusters rather than in local storage file systems.

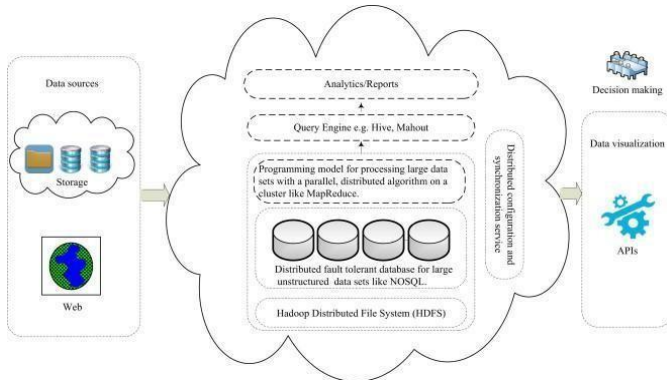


Fig 5: Big data and cloud computing.

Several companies provide big data cloud platforms. Moreover, various cloud computing platforms are available to store big data. Table 5 shows a comparative analysis of big data cloud frameworks for storing massive amounts of data[10]. Cloud services such as Microsoft Azure, Google Cloud, AWS, IBM, Hortonworks, and MapR are compared on the basis of various parameters.

V. RESEARCH ISSUES IN BIG DATA

As data are growing at exponential rates, a number of issues and problems emerge during the processing and storage of big data. Few tools are available to resolve these issues and problems in a cloud environment. Technologies, such as PigLatin, Dryad, MongoDB, Cassandra, and MapR, are not able to resolve these issues in big data processing. Even with the help of Hadoop and MapR, users cannot execute queries on databases, and they have low-level infrastructures for data processing and management. Some issues and problems in big data are summarized as follows[11]:

- (1) **Distributed database storage system:** Numerous technologies are used to store and retrieve huge amounts of data. Cloud computing is an important aspect of big data. Big data are generated by multiple devices on a daily basis. At present, the main issue in distributed frameworks is the storage of data in a straightforward manner and the processing and migration of data between distributed servers.
- (2) **Data security:** Security threats are an important issue in a cloud computing environment. Cloud computing has been transformed with modern information and communication technologies, and several types of unresolved security threats exist in big data. Data security threats are magnified by the variety, velocity, and volume of big data. Meanwhile, various issues and threats, such as the availability of data, confidentiality, real-time monitoring, identity and access authorization control, integrity, and privacy, exist in big data when used with cloud computing frameworks. Therefore, data security must be measured once data are outsourced to cloud service providers[11].
- (3) **Heterogeneity:** Big data are heterogeneous in nature because data are gathered from multiple devices in different formats, such as images, videos, audio, and text. Before loading data into a warehouse, they need to be transformed and cleaned, and the processes present challenges in big data[12]. Combining all unstructured data and reconciling them for use in report creation are incredibly difficult to achieve in real-time.
- (4) **Data processing and cleaning:** Data storage and acquisition require preprocessing and cleaning, which involves data merging, data filtering, data consistency, and data optimization. Thus, processing and cleaning data are difficult because of the wide variety of data sources[13]. Moreover, data sources may contain noise and errors, or they may be incomplete. The challenge

is how to clean large amounts of data and how to determine whether such data are reliable.

(5) **Data visualization:** Data visualization is a technique to represent complex data in a graphical form for clear understanding. If the data are structured, then they can be easily represented in the traditional graphical way. If the data are unstructured or semistructured, then they are difficult to visualize with high diversity in realtime. heterogeneity/data formats.

VI. CONCLUSION

Cloud computing has transformed the way businesses around the world do business in a way that many people are unaware of. Understanding the difference among various types of cloud computing and identifying which one is best suited for a growing business is tremendously important. This paper provides the knowledge of the introduction to cloud computing, its concepts, models and services. The paper also discusses the comparison of all cloud computing deployment models in table form. These clouds are compared against supported platforms, supported languages, storage capacity, services, and products. Fig. 3 shows Public cloud is the most popular general deployment option, with a usage share of over 61%. Traditional on-premises deployment, with just under half (49%) of shared use, ranks second. Hybrid cloud, which combines public cloud services with on-premises private cloud infrastructure, ranks third, with approximately 39% usage. The study encouraged respondents to choose from several of the five cloud deployment options. It shows a tenth (9%) selected all five, and almost a fifth (19%) selected four out of five. Among them two-thirds (64%) selected at least two cloud deployment options. The upshot is that while the public cloud is by far the most popular choice, most of the organizations surveyed employ a mix of cloud types. Interestingly, multi-cloud or the use of multiple cloud computing and storage services in a single

homogeneous network architecture had the fewest users (24% of respondents). [1]

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Robotic Process Automation for Stock Selection Process and Price Prediction Model using Machine Learning Techniques

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Article Info

Volume9, Issue 1
Page Number: 404-412

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022
Published :25 Feb 2022

ABSTRACT

Among these last few years we have seen a tremendous increase in the participation in financial markets as well as there are more robotic process automation jobs emerging in recent years. We can clearly see the scope and increased requirement in both these domains. In the stock market, predicting the stock prices/direction and making profits is the main goal whereas in rpa, tasks which are done on a regular basis are converted into automated or semi-automated form. In this paper we have tried to apply both things into the picture such as developing a price prediction model using machine learning techniques and automating the stock selecting process through technical screeners depending on user requirements. Stacked LSTM and Bi-directional LSTM ML techniques are used and for automation part powerful rpa tool Automation Anywhere has been used. Factors such as evaluation metrics and graph plots are compared for models and advantages, and disadvantages are discussed for using systems with rpa and without rpa practices. Price prediction plots have been analyzed for stocks of different sectors with highest market capitalization and results/analysis and inferences have been stated.

Keywords - Stacked LSTM, Bi-directional LSTM, Stock Market Prediction, Robotic Process Automation.

I. INTRODUCTION

Stock market

India's financial system consists of capital markets and money markets. Capital markets provide for the conversion of small, scattered household savings into productive investments. Capital markets provide investors with investment security. Well-organized and regulated capital markets provide significant economic development room by making long-term funds available in exchange for financial security. The

Indian stock market is a platform where investors can buy and sell stocks.

A stock exchange is a mutual organization or company that provides both stock brokers and dealers with a "trading" function for trading stocks, other securities, and all other financial instruments. Securities traded on the exchange include stocks, investment trusts, derivatives, pooled investment products and bonds issued by companies. It should be noted that securities can only be traded if that particular stock is listed on a particular stock exchange. Normally, all records are kept in one

central location, but because modern markets are electronic networks, transactions are increasingly less tied to physical locations, gaining speed and transaction cost benefits. .. There are many stock exchanges in India, but only two are important. The old Bombay Stock Exchange (BSE) and the new National Stock Exchange (NSE).

India's stock forecasts are very important because they are used by most ordinary people as well as business people. People are more likely to lose or earn money from their lifetime savings on the stock market. The system is completely chaotic. Price fluctuations depend on multiple factors such as government bonds, news, fundamentals, social media data, company production, historical prices, and the country's economy, making it difficult to create an accurate model. It is not advisable to consider only one factor in a predictive model. In that case, the result will not be accurate.

Therefore, including multiple factors such as news, social media data, and historical prices can improve the accuracy of your model. In the olden days, buyers and sellers of all kinds gathered together to make transactions, but now that IT is on track, almost all operations are done electronically, reducing paper usage. I am. Investors no longer have to gather on the stock exchange and are free to trade from their homes or offices over the phone or the Internet.

1) Role in the Financial Sector of Information Technology

Information generation performs a chief function in economic offerings for numerous reasons, however most significantly at the digital networks that alternate records associated with the finance sector. Today, economic offerings are all versions primarily based totally on growing a faster, greater green provider for customers. Since cloud-primarily based totally and new generation records are so regularly used, the significance of records generation is enormously critical.

In this twenty-first century, the commercial enterprise global is marked through drastic modifications. These modifications manifest through non-stop improvements in computer & telecommunication technologies. The preference of the perfect IT is a critical selection as it's far certain to have a protracted term & lasting effect at the destiny of the enterprise. Up-gradation of generation enables in growing productivity, decreasing cost & enhancing general quality. It is being helpful & has a first rate effect on commercial enterprise.

- IT can assist to discover the essential regions for aggressive gain enterprise of Business enterprise.
- Competitive blessings can be accomplished through numerous strategies in commercial enterprise with the assistance of IT.
- Helps in coping with the strategic alignment of essential commercial enterprise processes.
- Decision-making and operational manipulation through managers progressed through IT. · I can assist in preserving the conversion dating with customers, suppliers, trials, ability new entrants, and many others. IT in commercial enterprise outcomes in progressed verbal exchange, reduced costs, decreased selection making time, tracking the competition and higher manipulation of transactions.
- IT may be used as innovation withinside the functioning of the entire commercial enterprise gadget in the course of strategic commercial enterprise planning.
- IT enables a boom rate of change, decreasing paperwork & emergence of the worldwide economic gadget.

2) Information Technology (It) Shaping Indian Stock Market

Traditionally withinside the Indian inventory marketplace inventory buying and selling is carried out thru inventory agents, individually or thru telephones. As the wide variety of human beings buying and selling withinside the Indian inventory

marketplace has accelerated hastily withinside the previous couple of decades, a few problems like busy telecel smartphone lines, vicinity constraints, neglected verbal exchange and many others begin developing in Indian inventory dealer workplaces or organizations. Information generation (inventory marketplace software) enables inventory agents in fixing those troubles with on-line inventory buying and selling. It is an internet-primarily based totally inventory buying and selling facility. Investors or shareholders can change stocks through an internet site with no guide intervention from inventory agents. In this case, those on-line inventory buying and selling organizations are inventory agents for the investor.

II. LITERATURE SURVEY

Deep Learning

Artificial intelligence (AI) and Deep getting to know is a kind of system getting to know that follows the manner human beings benefit from information of sure types. Deep getting to know is a completely critical detail of information science, which includes predictive modeling and statistics.

Advantages	Disadvantages
1. The same neural network-based approach can be applied to many different applications and data types.	1. It is very costly to train due to very complex data models.
2. Deep learning is flexible to be adapted to new problems in the future.	2. No particular theory to guide you in selecting the right deep learning tools as it requires knowledge of topology, training method and other parameters.

Robotic process automation

Robotic Process Automation (RPA) is a process automation technology that performs repetitive tasks based on the characteristics of software robots (bots) or artificial intelligence (AI) / digital workers.

Advantages	Disadvantages
1. No Coding Anyone doesn't require any programming or coding knowledge as RPA tools are used to automate applications in any department where the day to day office work is performed across an enterprise.	1. Potential Job Losses If a robot can work faster with a more consistent rate than human, then it is assumed that there will be no need for human input. It is the main concern for the employees, and this results in a major threat to the labor market.
2. User-Friendly Robotic Process Automation (RPA) doesn't require a special kind of knowledge, such as coding, or deep IT skills. RPA software is easy to understand and user-friendly, and very easy to use.	2. Initial Investment Cost RPA is still in the stage of innovation and so it can present challenges that may result in unwanted outcomes. So, it isn't easy for organizations to decide whether they should invest in rpa or wait until its expansion.

<p>3. Security It provides options to assign role-based security capabilities to ensure action specific permissions. Further, the entire automated data, audits, and instructions which can be accessed by bots, are encrypted to avoid any malicious tampering.</p>	<p>3. Hiring Skilled Staff Many organizations believe that to work with RPA, the staff must have essential technical knowledge of automation as robots may require some programming skills and an awareness of operating RPA technology.</p>
<p>4. Efficiency gain. RPA can quickly complete tasks than humans, and it's able to do so at a much cheaper cost.</p>	<p>4. Employee Resistance Any change in the organization may cause stress to the employees because people are habitual.</p>

III. PROPOSED WORK

The project we are working on is stock market forecasting. We have developed a bot that automates this entire process. H. Stock market forecast. Here, the bot automatically retrieves the required inventory data from the Yahoo Finance website. Use the stack LSTM model to predict future stock prices. Therefore, to predict the stock price, use the following four-step model.

1. Data collection.
2. Data preprocessing.
3. Creating a stacked LSTM model.
4. Predicting the future and plotting the output.

1. Data collection.

First, you need the data you want to work on to proceed with the task. Therefore, in order to collect the data, we will collect the data in Yahoo Finance through the Panda library. After collecting the data, save it in csv format. file format. Since LSTMs are

sensitive to data scales, we apply a minmax scalar in the range of (0) to the data.

2. Data preprocessing.

After collecting and saving the data. The data needs to be trained (or) preprocessed. Data preprocessing is done in two steps.

i. Train First, train your data. Use cross-validation with numbers generated by random seed values. To train the data in chronological format, the next data must depend on the previous data. ii. Because the test data was trained in chronological format. Test your data using time steps. A time step is a number that a particular number is said to depend on the previous number.

3. Create a stacked LSTM model.

To create a stack of models, you need to convert the data to 3D. Then start building the stack using the sequential model.

4. Predicting the future and plotting the output.

To do the prediction, firstly we will check performance metrics. We will also be using inverse transformation to our data and later RMS performance metrics. Finally, we will be plotting our graph in which:

Blue represents the complete data set.

Green represents our prediction for our tested data

Orange represents trained data.

Robot process automation part We have developed a bot that automates this entire stock market forecasting process. Here, the bot automatically retrieves the required inventory data from the Yahoo Finance website and stores and processes the data as needed. Later, the code will run automatically and a chart showing the future of the stock will be drawn. This allows you to automate the entire process using a single bot.

Stock Screener

Equity Screener is a set of tools that allow investors or traders to quickly screen a large number of available stocks and increase exchange-traded funds according to investor criteria.

There are two types of cleaners
 Technical Screener and Basic Screener

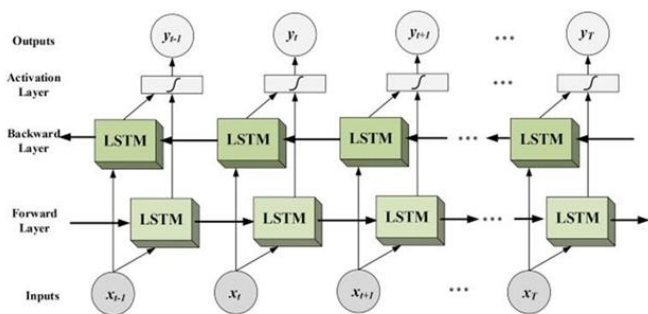
First, use a technical screener to access chartink.com. We selected a 15-minute breakout (live market) for the top stocks and later extracted the stock symbol from the RPA bot into the Jupyter notebook. I used Yahoo Finance's ticker to collect data about specific stock data for two years. We have acquired data for 2 years due to the higher accuracy of certain stocks compared to 5 years.

Long-term short-term model

LSTMs are very powerful against sequence prediction problems because they can store historical information. In this case, this is important because the previous price of the stock is important in predicting future prices.

Bidirectional LSTM

BIDirectional Long Short Term Memory is a type of LSTM in which input flows in both directions, and is BIDirectional LSTM. Unlike regular LSTMs, where the input flows in only one direction, BIDirectional allows the input to flow in both directions, retaining past and future information.



Description

Evaluation Metrics

Evaluation of any machine learning model requires to satisfy technical as well as business point of view. If any model does not evaluate and directly launch that model it will affect the business if that product doesn't match to the required parameters. There are lots of evaluation metrics to be used to estimate the

accuracy of a prediction model. But, for Time Series, the following metrics are suitable for our model:

Root Mean Squared Error (RMSE)

RMSE is a frequently used measure of the differences between the values predicted or estimated by the model. It is a way to measure the error of a model in predicting quantitative data.

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (Y_i - \hat{Y}_i)^2}$$

Here,

N stands for number of non missing data points

Y_i stands for actual observation time series

^

Y_i stands for estimated time series i stands for variable i

Mean Absolute Percentage Error (MAPE)

MAPE is the ratio of the mean absolute difference between the predicted value and the true value divided by the true value. The true value is A_t and the expected value is F_t. The total number of values in the test set refers to the number (n). Using the denominator works better with non-zero and non-extreme data.

$$MAPE = \frac{100}{n} \sum_{t=1}^n \left| \frac{A_t - F_t}{A_t} \right|$$

R-Squared

This is a statistical measure that represents the percentage of variance of the dependent variable as described by the independent variable or the variable in the regression model. Here, SS_{tot} shows the sum of the squares of the deviations from the sample mean of the dependent variable, and SS_{res} shows the sum of the squares of the residuals from the expected value.

$$R^2 = 1 - \frac{SS_{res}}{SS_{tot}}$$

IV. RESULT ANALYSIS

Since the types of models we have used are depend upon time series data which produces prediction results depending upon the previous patterns from sequence of variable length using recurrent neural networks. So, When we checked data for more than 2 years of period we always saw that the predicted plot always used to be downwards now this scenario resulted because of unexpected conditions like occurrence of covid which resulted in major downfall trend. so we have choose dataset for last 2 years so that we can neglect the unfamiliar situations and our model could predict data more accurately.

After the development of model and training testing phase we have chosen RMSE, MAPE and R-squared metrics which works best for evaluation of model performance for time series based data. Now the two factors that affects the outcome of data is depended upon the no of epochs and the batch size used for developing the model. In table 1 we have taken number of epochs as 100 and tested Evaluation metrics for both the models for stacked lstm and bidirectional lstm Using different batch sizes. Similarly for table 2 we have used 50 epochs, observing both the tables 1 and 2 we can see that as we start reducing the batch size training time increases but all the metrics give better results.

Table-1: Comparison of RMSE,MAPE and R-squared metrics for different batch sizes for 100 epochs for both stacked LSTM and Bi-directional LSTM model.

LSTM Bi-LSTM

No . of Epochs	Batch size	Time (sec)	RMSE	MAPE	R-squared	Time (sec)	RMSE	MAPE	R-squared	Points (LSTM, BI-LSTM)
100	64	49	48.008	4.012	0.459	84	23.743	4.173	0.641	(1, 2)
100	32	57	11.005	3.401	0.585	89	85.582	4.099	0.419	(3, 0)
100	16	94	57.421	3.703	0.479	121	29.140	2.996	0.650	(0, 3)
100	8	166	38.538	2.663	0.733	204	6.919	3.030	0.635	(2, 1)
100	4	301	30.707	2.476	0.748	392	12.346	2.239	0.7905	(0, 3)

No . of Epochs	Batch size	Time (sec)	RMSE	MAPE	R-squared	Time (sec)	RMSE	MAPE	R-squared	Points (LSTM, BI-LSTM)
50	64	49	55.66	4.295	0.388	48	13.751	3.285	0.601	(0, 3)
50	32	57	11.829	3.648	0.482	99	75.819	4.024	0.427	(3, 0)

Total = (6,9)

Table-2 : Comparison of RMSE,MAPE and R-squared metrics for different batch sizes for 100 epochs for both stacked LSTM and Bi-directional LSTM model.

LSTM Bi-LSTM

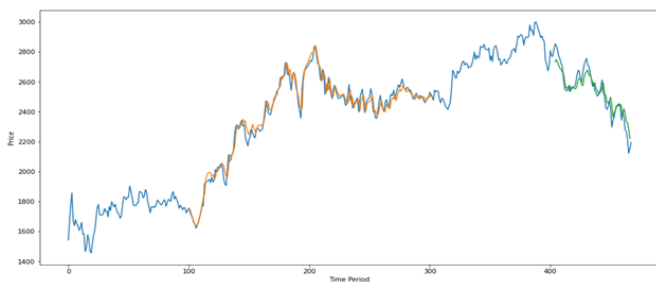
No . of Epochs	Batch size	Time (sec)	RMSE	MAPE	R-squared	Time (sec)	RMSE	MAPE	R-squared	Points (LSTM, BI-LSTM)
50	64	49	55.66	4.295	0.388	48	13.751	3.285	0.601	(0, 3)
50	32	57	11.829	3.648	0.482	99	75.819	4.024	0.427	(3, 0)

50	1	4	43.	3.5	0.	6	70.	3.	0.	(3,
	6	6	56	01	54	4	98	84	45	0)
			4		8		8	9	6	
								0		
50	8	8	24.	2.9	0.	1	41.	3.	0.	(3,
		2	41	30	69	0	02	13	61	0)
			6		0	7	7	9	7	
50	4	1	14.	2.0	0.	1	15.	2.	0.	(3,
		5	54	59	81	9	93	74	71	0)
		3	7		9	2	5	3	2	

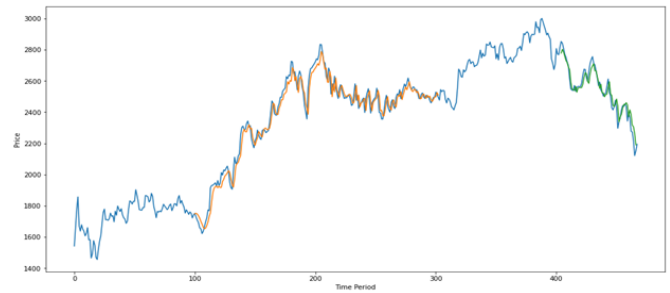
Total =(12,3)

Since we are using rpa approach to deduct the human intervention of selecting stocks manually which will reduce the human interaction and save a lot of time when we want to run the model multiple times for different stocks and generate reports. So time also plays a major role for our system, so observing both the tables 1 and 2 we see that there is no much of difference between between 100 and 50 epochs rather we can see that for 50 epochs and 4 batch size the results are better compared to 100 epochs of 4 batch size in stacked LSTM and also the main advantage here is less time consumption for model which results in faster execution. No in all the cases Bi-directional LSTM works better than stacked LSTM, considering all the scenarios like evaluation metrics, time constraint and training testing plots we finalized that the best results are formed for Stacked LSTM of 50 epochs for 4 batch size as well as Bi-directional LSTM 100 epochs of 4 batch size.

Train and Test Results :



BI-LSTM : 100 Epochs 4 Batch-size



LSTM : 50 Epochs 4 Batch-size

Predicted Plots:



BI-LSTM : 100 Epochs 4 Batch-size



LSTM : 50 Epochs 4 Batch-size

Looking at the predicted graph plots and training testing plots for the values we have selected we can see that there is not much of a difference while comparing plots for both the models. So, further we did some more analysis for these models considering different stocks from different sectors which have the highest market cap in their particular domain and a comparison has been shown in table 3 of evaluation metrics for both the models.

Table-3 : Comparison of RMSE,MAPE and R-squared metrics for different sector stocks with selected parameters for stacked LSTM and Bi-directional LSTM model.

LSTMBI-LSTM

Sectors	RMS E	MA PE	R-squar ed	RM SE	MA PE	R-squar ed
TCS	103.265	3.132	-0.048	49.211	5.816	-0.964
HUL	10.810	1.855	0.746	4.876	2.164	0.638
HDFC	14.547	2.059	0.819	12.346	2.239	0.7905
MARU TI SUZU KI	101.346	2.835	0.717	68.24	2.808	0.727
SUN PHAR MA	6.345	1.870	0.718	39.152	4.628	-0.305

Since all the valuation metrics play a major role in analyzing the performance of our model/system in some stock scenarios after training and testing we might not get good scores for our metrics, so it is advised to neglect such cases whenever you don't see good scores forming.

Predicted Plots:



BI-LSTM_HDFC : 100 Epochs 4 Batch-size



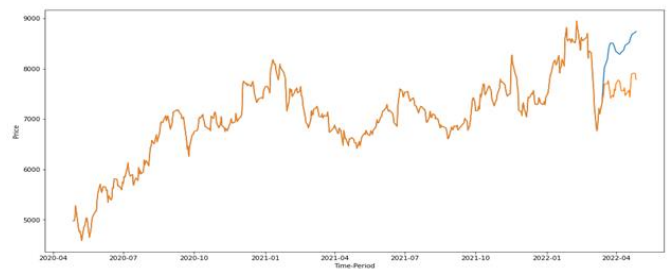
LSTM_HDFC : 50 Epochs 4 Batch-size



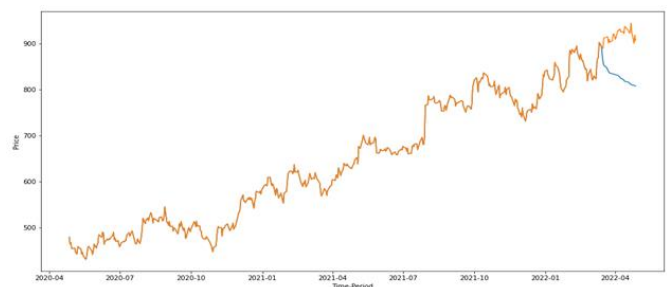
LSTM_HUL : 50 Epochs 4 Batch-size



BI-LSTM_HUL: 100 Epochs 4 Batch-size



LSTM_MARUTI : 50 Epochs 4 Batch-size



LSTM_SUNPHARMA : 50 Epochs 4 Batch-size

Upon observing all the predicted plots and data we can found that there is not much of a difference between both the models results for parameters we have chosen i.e (50 epochs 4 batch size for stacked LSTM and 100 epochs 4 batch size for BI-LSTM) but still in majority cases 50 epochs LSTM have found out to be slightly more better than the 100 epochs, as well as 50 epochs will always take less time for execution process compared to 100 epochs which becomes advantage for our system. Predicted market plots are compared with actual market data that has been formed for the last 30 days.since, the data is dependent on time series it wont show you the exact same pattern but you can rely on the direction of the pattern that is been forming through our model.

Inferences

1. Considering a new breakout happening towards the up or down side it is advised not to believe that right away as sometimes it may be a false breakout.But you can reconsider the stock again for next day or two and if the pattern follows the same path you might make some good profits.
2. In some scenarios you could also get early into a breakout trade following our models pattern but you have to maintain a proper risk management strategy in case the market conditions change and trade goes wrong.
3. It is advised that before applying the trades, the user should have some basic knowledge regarding the stock market and technical analysis (support,resistance,all time high, etc..) Which will minimize the risk of choosing the right trades and taking action accordingly.

Advantage through RPA :

Considering a scenario where uses technical screener (15 minutes Breakouts) which shows all the stocks which have given breakout in the last 15 min, now if the user want to run this model for the stock appearing at top of the list after every 15 minutes he will have to do the process manually by visiting the

screener site every 15 minutes and then adding the name manually to the model and then the execution will start and generate report, but through RPA all of this manually work can be neglected and user could get his reports every 15 minutes without any human interaction manually. In Automation Anywhere there is a control room which consists features of scheduling the time of execution of particular bot, so by these means we can schedule our bot to run after every 15 minutes and generate our system analysis automatically.Even you can schedule multiple bots which can run for different stock screeners simultaneously and produce results.

V. CONCLUSION AND FUTURE WORK

Predicting stock prices is a difficult task as there are too many factors involved which comes into play but still one can make good predictions through historical data and stacked LSTM and Bi-directional LSTM are best model for time series forecasting based data, we used RMSE, MAPE and R-squared as evaluation metrics for our model even with different sector of stocks and found that with 50 epochs and 4 batch size LSTM model was producing good results in most of the cases and was the fastest one taking minimal execution time out of all other parameter configurations. Robotic process automation has been very useful for our system when a user wants to run multiple stock screeners simultaneously or at a given intervals for multiple times as well.This system can help users to generates analysis reports within minimal time usage without any manual process requirement which can save a lot of time and help users to take decisions more effectively. In future work we can analyze model for more stocks of various categories considering different stock screeners which are best suitable for the type of for particular model along with more parameters such as volume of sock, volatility, etc., for better results.

Cloud Computing for Emerging Mobile Cloud App

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Article Info

Volume9, Issue 1

Page Number: 413-415

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022

Published:25 Dec 2022

ABSTRACT

The tutorial will begin with an explanation of the concepts behind cloud computing systems, cloud software architecture, the need for mobile cloud computing as an aspect of the app industry to deal with new mobile app design, network apps, app designing tools, and the motivation for migrating apps to cloud computing systems.

The tutorial will review facts, goals and common architectures of mobile cloud computing systems, as well as introduce general mobile cloud services for app developers and marketers. This tutorial will highlight some of the major challenges and costs, and the role of mobile cloud computing architecture in the field of app design, as well as how the app- design industry has an opportunity to migrate to cloud computing systems with low investment. The tutorial will review privacy and security issues. It will describe major mobile cloud vendor services to illustrate how mobile cloud vendors can improve mobile app businesses. We will consider major cloud vendors, such as Microsoft Windows Azure, Amazon AWS and Google Cloud Platform. Finally, the tutorial will survey some of the cutting edge practices in the field, and present some opportunities for future development.

Keywords: Mobile App Design; Mobile Cloud Computing; Cloud Architecture; Mobile Security; Mobile Privacy.

I. INTRODUCTION

- This tutorial aims to provide basic and advanced features of mobile app design in mobile cloud computing system for students (undergraduate and graduate) and researchers who are interested in designing mobile apps, tools, infrastructures from both academia and industry.
- The outcome of this tutorial will provide the understanding of the following concerns: “When do we need mobile cloud computing for designing mobile apps, tools and the

infrastructures of online mobile apps?”, “How does mobile cloud computing improve the process of app design, tools and marketing?”, “What are the pros and cons of mobile cloud computing for designing apps, tools and infrastructures?”, “How does mobile cloud computing relate to improvement of app industry?”. In addition, this tutorial will discuss opportunities and challenges of deploying an online app by cloud computing. Finally, the tutorial will present some case studies of both sides of mobile cloud vendors and consumers as

best practices in the real world. The tutorial aims to provide a viewpoint of start-up mobile app design companies, if they employ mobile cloud computing for their infrastructure and it will review cost-effective models.

This tutorial is divided into the following sections:

1. Introduction

- This section will consider motivations, goals, the definition of cloud computing, cloud architectures, mobile and computer applications, platforms and how these definitions are important for designing mobile apps.

2. Cloud Computing and General Services

- This section will consider different services of the mobile cloud computing systems, such as SaaS, PaaS and IaaS. The section will discuss the pros and cons of each service for mobile cloud computing and the requirements for designing an app.

3. Mobile Cloud Service for Mobile Apps

- This section will provide a definition and requirements for designing and developing infrastructures for offline and online apps. This section will introduce the implementation of cloud databases and cloud computing for designing apps.

4. Case Study of Apps in Cloud Computing

- Cloud Vendors and Implementation Theories. This section will consider different and important case studies of mobile apps design in industry and science fields. Also, this section will consider the key mobile cloud vendors services, such as Microsoft, Google, Amazon, open-source cloud services and open-source tools.

5. Best Practice of Migration to the Cloud

- This section aims to review best industrial app practices of the migration from traditional IT infrastructures to mobile cloud computing.

II. LITERATURE SURVEY

Authors focus on role of middleware in mobile cloud computing i.e. Loss of connection, Bandwidth/Latency, Limited Resource (Cloud computing and Personal Mashup Platform).

Authors introduce a concept of Mobile Cloud Operating System. It is a lightweight operating system intended for mobiles, netbooks or table PCs that access Web-based applications and stored data from remote servers. The

objective of mobile cloud operating system is management of cloud resources.

An interesting research work on Mobile Cloud Computing is observed in the research work of Chang, R. et al. (2013).

Authors defines the MCC is an emergent mobile cloud paradigm which leverage Cloud Computing, Mobile Computing and Networking and the goal is to deliver secure mobile cloud resources, service applications in a pay-as-you-use model

Authors also discuss the generations of mobile cloud infrastructure and services, The authors also focused on the usage of SCWS (Smart Card Web Services) rivalry to intensify security of MCC. As per authors, a cloud security solution aspect for mobile cloud ecosystem, SCWS is one of the best approach, however it needs to get enhanced in all mobile devices, tablets, laptops, etc., all together after innovative actions from the operators and service providers. Figure 15 shows the server administration architecture of SCWS.

III. ADVANTAGES OF MOBILE CLOUD:

- Flexibility. Mobile cloud computing allows you to store and retrieve data from anywhere in the world through any device as long as it is connected to the internet. ...
- Multiple Platform Support. ...
- Data Availability at all times. ...
- Cost efficiency. ...
- Data back-up. ...
- Data recovery.

IV. CONCLUSION

- This section will review the opportunities and challenges of designing apps in mobile cloud computing systems. Then for the conclusion, the audience will be encouraged to think about the problems and opportunities for their ideas about apps design in mobile cloud computing.

V. FUTURE SCOPE

Mobile computing has grown immensely in recent years and it is projected that in the future, mobile computing will control almost all technological activities in the world. This will be projection will be looked at in this research paper. Mobile simply describes a computing device that is not restricted.

VI. APPLICATIONS

1. Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS) ...
2. Hybrid cloud and multicloud. ...
3. Test and development. ...
4. Big data analytics. ...
5. Cloud storage. ...
6. Disaster recovery. ...
7. Data backup.

VII. REFERENCES

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A Study on Green Cloud Computing

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Article Info

Volume9, Issue 1

Page Number: 416-423

Publication Issue

January-February-2022

Article History

Accepted : 15Jan2022

Published :25Jan2022

ABSTRACT

Cloud computing provides computing power and resources as a service to users across the globe. This scheme was introduced as a means to an end for customer's worldwide, providing high performance at a cheaper cost when compared to dedicated high-performance computing machines. This provision requires huge data-centers to be tightly-coupled with the system, the increasing use of which yields heavy consumption of energy and huge emission of CO₂. Since energy has been a prime concern of late, this issue generated the importance of green cloud computing that provides techniques and algorithms to reduce energy wastage by incorporating its reuse. In this survey we discuss key techniques to reduce the energy consumption and CO₂ emission that can cause severe health issues. We begin with a discussion on green matrices appropriate for data-centers and then throw light on green scheduling algorithms that facilitate reduction in energy consumption and CO₂ emission levels in the existing systems. At the same time the various existing architectures related to green cloud also discussed in this paper with their pros and cons.

Keywords: Green cloud computing, energy efficiency, CO₂ emission

I. INTRODUCTION

According to Wikipedia [wiki], Cloud computing is a collection of a variety of computing concepts in which thousands of computers communicate in real-time to provide a seamless experience to the user, as if he/she is using a single huge resource. This system provides multiple facilities like – web data stores, huge computing resources, data processing servers etc. The concept of cloud computing is around since the early 1950s, although the term was not coined back then. Time sharing systems was how it was addressed back then. During the period of 1960-1990, a host of experts did hint the era of cloud computing in their books or quotes. The term dumb terminal attached to

the mainframes was more famous in this period, in-lieu of the term cloud computing. In the early 1990s, even the telecommunications companies began offering VPNs (Virtual Private Networks) instead of dedicated connections, which were decent in QoS but were comparatively cheaper. In 1999, Salesforce.com was among one of the first to provide enterprise applications via a website. This move aided the advent of cloud computing which was introduced around 2002 by Amazon, the organization which can be considered as one of the pioneers in th field with their Amazon Web Services (AWS) and Elastic Compute Cloud (EC2). Since 2009, after the introduction of web 2.0, other big shots in the web

industry viz. Google, Yahoo etc. have also joined the club.

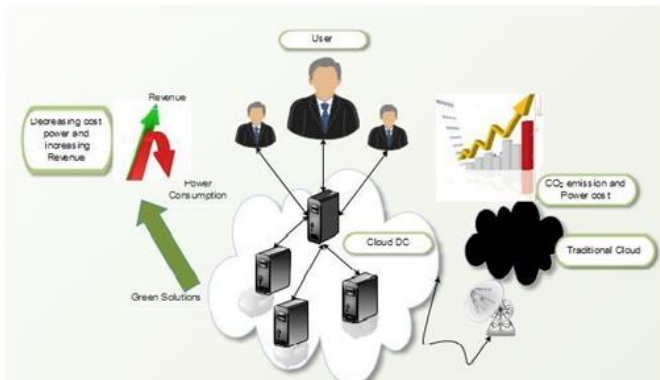


Figure 1. Cloud and Environment

Cloud computing can be considered as a hierarchy of concepts, which comprises of several models. The first model is the Service Model [11] which further includes three models namely – software as a service, platform as a service and infrastructure as a service. Second is the Deployment model which further comprises of public cloud, private cloud, community cloud and hybrid cloud.

According to National Institute of Standards and Technology (NIST) – “the major objective of cloud computing is to maximize the shared resources and at the same time the disadvantage is its high infrastructure cost and unnecessary power consumption.”

According to National Institute of Standards and Technology (NIST) – “the major objective of cloud computing is to maximize the shared resources and at the same time the disadvantage is its high infrastructure cost and unnecessary power consumption.”

Global warming has been a big concern of late, with high power consumption and CO₂ emission acting as a catalyst to increase the same. The world has become highly protective about the environment with inputs from contributors such as – Greenpeace, Environmental Protection Agency (EPA) of the United States and the Climate Savers Computing Initiative to name a few. With the continuously increasing popularity and usage of cloud computing

and the increasing awareness of the people across the globe towards the use of eco-friendly resources has forced the researchers to devise concepts towards an eco-friendly energy efficient flavour of cloud computing called green cloud computing. According to the previous works green cloud computing facilitates the reduction of power consumption and CO₂ emission along with the reutilization of energy in an efficient way.

Cloud uses thousands of data-centers in order to process the user queries and to run these data-centers bulk amount of power is used for cooling and other processes. Every year this power consumption is gradually increasing and green cloud computing endeavours to reduce the same thus playing a helpful role to curb these issues. There are various techniques and algorithms used to minimize this expenditure [13]. Among various avenues, one area of research focuses on reduction in energy consumption by computer servers [11], whereas the other lays stress on dynamic cluster server configuration [20, 21] to reduce the total power consumption by balancing load and effectively utilizing only a subset of the resources at hand. Similarly Dynamic CPU clock frequency scaling [22, 23] again incorporates some form of load balancing to save power during different load conditions. In addition to these, some more techniques are used to measure the power consumption in data-centers. The first one was developed by the Green Grid called Power Usage Effectiveness (PUE) metric to measure the effectiveness of data centers. PUE tells about the amount of extra power required for cooling IT equipment [16].

It is clear from Figure 1 that in cloud scenario power consumption is very high with high carbon emission whereas at the same time in green cloud this is very less as compared to traditional cloud. Green clouds avoid power wastage and this is the reason for adoption of this technology by IT companies like Google, Microsoft, Yahoo!, etc. According to a survey done in the year 2007 IT industries contribute to 2%

of the total carbon emission every year [19]. European Union (EU) is also of the view that severe reductions of the order of 15%-30% is required to maintain the global temperature and stop it from increasing drastically before 2020 [19].

The remainder of this article is organized as follows. Section II reviews previous research in the field of green cloud computing. In Section III we briefly describe the approach used to address the problem. Section IV examines the proposed work with the existing method. Finally, we summarize the study and give way for future research in Section V.

II. EXISTING WORK

The use of Green Cloud Computing has increased substantially in the recent past. A lot of research has been done to incorporate and enhance the applicability of Green Cloud in real life scenarios with these help of various parameters. Usage of energy is dramatically increases in data centers. Cavdar et al., [1,2] introduced for improving the energy efficiency of the running data centers, the Green grid is proposing some parameters like Power Usage Effectiveness (PUE)[7] and Data centre Efficiency (DCE) metrics [10], TDP (Thermal Design Power) [2], etc. PUE is the common parameter.

According to Wikipedia “PUE is a measure of how efficiently a computer datacenter uses its power “The range of PUE is varies from 1.0 to infinity. If the value of PUE approaching 1.0 it means efficiency is 100% and full power is used by IT equipment’s. In recent years some companies achieved low PUE levels, like Google PUE with 1.13 [9]. If the value of PUE is 1.5 it means that energy consumed by IT equipment in 1kWh, by data centre 1.5 kWh and 0.5 WH energy has wasted as fruitless work like cooling, CPU dissipation and other work. Table I explain some parameters proposed for data centers. In many data centre the value of PUE reached to 3.0 or more but by using correct design 1.6 values should be achievable [5]. This calculation is done in Lawrence Berkley

National Labs [8] which illustrate that 22 data centers 22 datacenters measured had PUE values in the 1.3 to 3.0 range [8].

Truong Duy, Sato and Inoguchi et al., [3] implement the green scheduling algorithm combines with neural network predictor for reducing the energy consumption in cloud computing. In this algorithm, the server predicts the load from time t to the time it takes for restarting and calculates the peak load. According to the peak load the number of server state is decided. Let, N_o is the number of server in ON state and N_n is the number of necessary servers. If the $N_n > N_o$ then, choose server in OFF state, signal them to restart and if $N_n < N_o$ choose server in ON state and signal them to shut down.

Fumiko Satoh et al., [4] also focus on reducing the usage of energy in data centers. But for the future energy management they develop an energy management System for cloud by the use of sensor management function with an optimized VM allocation tool. This system will help to reduce the energy consumption in multiple data centers and results shows that it will save 30% of energy. This system also used to reduce the energy in carbon emissions.

Table 1. Green metrics power measurement

Metric	Explanation	Formula
Power usage Effectiveness (PUE)	It is the fraction of total energy consumed by the service of a data centre to the total energy consumed by IT equipments.	Total facility energy PUE = $\frac{\text{Total facility energy}}{\text{IT Equipme nt energy}}$

Carbon Usage Effectiveness (CUE)	It is a calculation of green house gases (CO ₂ , CH ₄) release in atmosphere by the data centre	(Total CO ₂ emission from total energy used for service of data centre) CUE = $\frac{\text{Total energy consumed by IT equipment}}{\text{Total CO}_2 \text{ emission}}$	Compute Power Efficiency (CPE)	It determines the total amount of power is truly used for computing.	IT equipment utilization energy CPE = $\frac{\text{IT equipment utilization energy}}{\text{Total energy consumed}}$ PUE
Water Usage Effectiveness (WUE)	It is calculation of yearly water used by data centre like for cooling, energy Production.	Annual usage of water WUE = $\frac{\text{Total energy used IT equipment}}{\text{Annual usage of water}}$	Green Energy coefficient (GEC)	It measure the amount of green energy used to provide services to data centre.	Green energy consumed GEC = $\frac{\text{Green energy consumed}}{\text{total energy consumed}}$
Energy Reuse Factor (ERF)	It calculates the reusable energy Like hydro power, solar power etc used by data center.	used of reused energy ERF = $\frac{\text{Total energy used IT equipment}}{\text{Total energy used}}$	Space, Wattage and Performance (SWaP)	It is used for work out the space and energy required by the data centre.	Performance SWaP = $\text{Space} * \text{power}$
Energy Reuse Effectiveness (ERE)	It is a parameter for measuring the profit of reuse energy from a data centre.	Total energy - reused energy ERE = $\frac{\text{Total energy used IT equipment}}{\text{Total energy used}}$	Data Centre Energy Productivity (DCeP)	It calculates the quantity of useful work done by data centre as compare to total energy consumed to make this work.	Total Useful work done DCeP = $\frac{\text{Total Useful work done}}{\text{Total energy used to do this work}}$
Data centre Infrastructure Efficiency (DCiE)	This factor is used to calculate The energy efficiency of a data Centre.	Total IT equipment power DCiE = $\frac{\text{Total IT equipment power}}{\text{Total facility power}} * 100\%$			
Data Centre Productivity (DCP)	It calculates the amount of useful work done by data centre.	Total Useful work DCP = $\frac{\text{Total Useful work}}{\text{Total resource used to do this work}}$			

Cooling is other major issue that consumes huge amount of energy in data centers. Previously, the cooling is done by using mechanical refrigerator that supply chilled water for the IT equipments. Now a day's pre cooling also called as free cooling is used. Free cooling minimizes the use of mechanical cooling. Like Face book deploys their data centre in Sweden which has cold and dry climate. Microsoft leaves servers in open air in order to cool the servers easily. Also Google uses river water to cool their data centre [1]. There are different hardware technologies like virtualization and software technologies like software

efficient algorithm used to decrease the consumption of energy.

Rasoul Beik et al., [6] proposes an energy aware layer in software –architecture that calculate the energy consumption in data centers and provide services to the users which uses energy efficiently. Bhanu Priya et al., [11] gave a cloud computing metrics to make the cloud green in terms of energy efficiency, different energy models has been discussed in this paper to reduce the power consumption and CO2 emission to make cloud more green. This survey takes three major factors under consideration; any cloud can be green by following these factors, first cause to make cloud greener is virtualization, Second is Work load distribution and third is software automation, some other factors are also discussed like pay-per-use and self-service which is proved as a key for reduction of energy consumption.

According to Kliazovich and Pascal Bouvry [12] expenses on cloud data centers maintenance and operation done in cloud are gradually increasing. In this paper author has focused on the work load distribution among the data centers so that energy consumption can be calculated in terms of packet level. By this technique packet level communication is achieved. Packet level simulation of energy has been done through the simulator, like for green cloud NS2 simulator and for cloud only one existing called “cloudsim”. This simulation is done at three levels: “two-tier, three-tier, and three-tier high-speed data center architectures”. Kaur and Singh et al., [13] performed the different challenges in the field of energy in cloud computing, a model is proposed by author to calculate the energy wasted by producing various gases in environment. The proposed model contains various fields Data, Analysis, Record, Put on guard, restrain along with the virtualization concept in green cloud to make it energy efficient and for healthy environment.

Hosman and Baikie et al., [14] gave a new challenge in the field of cloud computing, datacenters consumes a lot of energy and energy is available every time is

not necessary, so the author is discussing in his paper about the solar energy. How the solar energy can play a vital role in data centers energy consumption is the hot topic of discussion. In this paper author proposed a small level cloud data center which is the combination of three technologies are “less power consumption platform, energy efficient cloud computing and DC power distribution”. Owusu et al., [17] performed a survey to establish the current state of the art in the area of energy efficiency in cloud computing. They beautifully mention the field of energy efficiency as a controversial area to cloud computing. This paper discusses one area of controversy; the energy efficiency of cloud computing. Yamini et al., [18] Introducing the key approaches like virtualization, Power Management, Recycling of material and telecommuting of green cloud computing very beautifully. The major focus of this paper is the consolidation or scheduling of task and resource utilization in green cloud computing to reduce the high consumption of energy. The decent results shown in the paper not for the direct drastic energy reduction but applies possible saving of electricity in huge cloud data centers. According to Buyya [19] the demand of cloud is drastically increasing now a day and the consumption of energy and excretion of harmful gases is also extreme which is very harmful and a big issue in the field of health care and also a big reason of the increase in cost of operations in cloud. Buyya gave a presentable and evidential literature survey of the various different members of cloud which participate in the total energy consumption. Structure of cloud are discussed in this paper which turn on the use of green cloud computing.

Buyya et al., [24] Contributes carbon green cloud architecture which points on the third party concept, consist of two types of directories named as green offer and carbon emission. These directories help us to provide and utilize the Green services from users and providers both. Green brokers access the services from green offers directory and scheduled services

according to least CO₂ emission. Beloglazov and Buyya et al., [25] focuses on virtual machine for the reduction of the energy consumption. An author proposes the dynamic reallocation technique for VMs and toggles off the unused servers which results, considerable energy saving in the real Cloud Computing data centers.

Nimje et al., [28] addressed the security of the cloud data centres in order to achieve green cloud environment by using virtualization concept. Various methods are involved in the paper to address the security and reduction of power consumption. Virtualization here came in to picture because it reduces the load from the data centres and provides deployment, management and delivery of resources in simple manner. Nimje included hypervisor environment to provide the virtualization and works as a security tool to achieve high level of security in green cloud computing.

III. EXISTING APPROACHES

Buyya et al., [24] Contributes carbon green cloud architecture which points on the third party concept, consist of two types of directories named as green offer and carbon emission. These directories help us to provide and utilize the Green services from users and providers both.

The services of the providers are registered in the "Green offer Directory". The Green Broker accessed these services and organized it according to the price, time and the service that offer least CO₂ emission. The Carbon Emission Directory keeps and stores the data which contains the information of energy and cooling efficiency of cloud services and data centers. The green broker used the up to date information about services.

Whenever the user request for the services, it contacts with the Green Broker. The Green Broker uses these directories and chooses the green offer and energy efficiency information and allocates the services to the private cloud. And finally give the

result to the users. This directory idea is beautifully used by the Hulkury et al., [26] and Garg et al., [27] and proposes a new architecture called as integrated green Cloud architecture (IGCA) shown in Figure 2. It smartly includes client oriented in the Cloud Middleware that verifies the cloud computing is better than the local computing with QoS and budget.

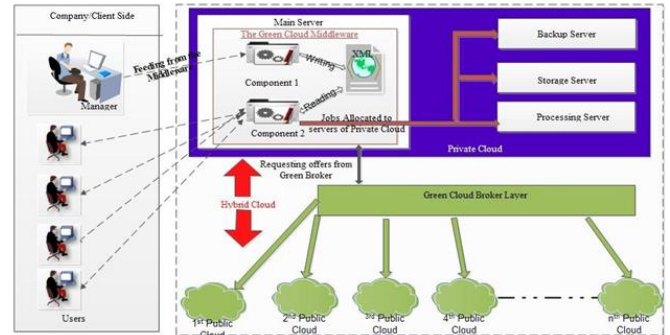


Figure 2. Integrated green Cloud architecture (IGCA)

This architecture has two elements; one is the client and second is the server side. In the client side the manager and the users are present, which deals with the execution destination of the job and in the server side includes the green cloud middleware, green broker and sub servers like processing servers, storage servers etc. The directory concept is used in the green broker layer of IGCA for organizing all the information of the public cloud and provides the best green service to the user.

The green cloud middleware has two components. The manager is the main head that deals with one component and stores all the information of the middleware. The usage of the user's PC, the servers present on the private clouds all the information. The frequencies of each sever like high, medium and low. The energy usage, storage capacity [26] and other information also exist in the component of middleware.

When the manager got request from the client. The request is dividing into jobs and distributed among the users meanwhile they also stores the information about job into the component. The carbon emission and energy used for the execution of job on the private cloud by servers, on the public cloud by using

green broker or on the client's PC is calculated and show to the users. The best green offer is selected by the manager by taking into consideration the security level of the job also. When the decision is making out by the manager then this information is store in the XML file for future usage.

The second component is accessed by all the users for reading the XML file. This file stocks all the information of the execution of job. The locations of the jobs are registered in the file and according to the addresses, they will execute. If the job entry is not in the file then the job will be executed either on the PC of the client or in the private cloud. The execution of job is takes place in three places. First if the job is executed LOCALLY (on the requester side) then this information is stored in the client side so next time when the request arrives it will not get through will middleware. If the job is executed in the private cloud the location as well as the server name is fetched from the file. Or if it is in public cloud, we will take help from the green broker to know the most excellent green decision for the execution of the job. The middleware know all the information about the three places. Energy used by the workers working in the company is also calculated by the middleware for taking further decisions.

The processing speed, energy consumption, bandwidth or others factors are responsible for deciding the best location for the execution of the job. By considering all the factors the middleware will compute and judge the place from the three places. The IGCA provides the balance in the job execution and provide the security and quality of service to the clients. The manager divides the task and top quality green solution by considering all the places (public, private, local host).

In this architecture the manager plays the central coordinator work which allocates the job to the users and does all decision making. But at the same time the manager is the weakest point in this architecture as it is the central point of failure, as if the manager fails everything in the architecture collapses.

IV. ADVANTAGES AND DISADVANTAGES

As we have discussed above that all existing architectures have some constructive as well as destructive points. Buya et al., [19] gave the architecture for green cloud the major advantage of this architecture is Co2 emission directory, this directory measures the best suitable service which gives less carbon emission so straight away it indicates that energy will also decrease because Co2 emission and energy consumption both are directly proportionate to each other. Similarly the disadvantage is that only CO2 emission and energy is not the factor to be under consideration like Quality Provisioning, Security, etc.

Hulkary et al., [26] covers these factors also under consideration by taking other components which search service first on the private cloud later on public cloud this reduces the time consumption and provides better results as compare to Buya Architecture. The major disadvantage which we observed here is that manager of the system is the central point of communication so if manager will crash then whole system will fall apart at the same time decision making done by manager is not intelligent and all work has been done manually.

These are the some of the advantages and disadvantages which observed here in these existing architectures and which can be further improve for the future work.

V. CONCLUSIONS AND FUTURE WORK

In this paper we addressed the problem of traditional cloud and the use of green cloud at the same time we enlighten the recent work which has been done in the field of green cloud computer for healthy and greener environment. Consequently we gave a comparative study in the field of green cloud computing. There are many possible directions of future work. While in the paper we address the problem of efficient way to fetch the results from the

cloud so all the features covered in the paper can be achieved. Further we can implement the approach to automate the manager of the green cloud who makes all the decisions regarding the services.

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Super ERP System

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Article Info

Volume9, Issue 1
Page Number: 424-426

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022
Published :25 Feb 2022

ABSTRACT

We have been using ERP systems since many years but it never got so much attention which we can get with cloud computing. One of the biggest benefits of a cloud-based ERP solution is overall reduced costs. Cloud based ERP system provides solutions to all the difficulties encountered by conventional ERP systems. In this research paper we will be discussing and analyzing the issues and development concerning with the execution of Enterprise Resource Planning in cloud computing. It provides simplicity to the existing ERP systems and improves overall time and other problems. In this paper I will be discussing implementation and development of ERP in Cloud Computing. In this I have covered diverse aspects of both ERP and Cloud Computing and after studying their major advantages and disadvantages I have suggested few recommendations.

I. INTRODUCTION

Introduction of Artificial Intelligence in Education:

ERP is a packaged business software system or business management system that enables one to manage the efficient and effective use of resources by providing a solution for the organization's information and processing needs. Cloud ERP reception offers lower entry costs to the clients. An organization essentially needs to lease the product but will access the full elements of typical ERP over the web. It additionally allows uncommon access to framework, streamlined and quickened forms, together with the constant perceivability that each business can profit

Cloud Computing

Cloud-based computing (also called Software as a Service, or SaaS) allows users access to software

applications that run on shared computing resources (for example, processing power, memory, and disk storage) via the Internet. These computing resources are maintained in remote data centers dedicated to hosting various applications on multiple platforms. Cloud ERP is Software as a Service that allows users to access Enterprise Resource Planning (ERP) software over the Internet. Cloud ERP generally has much lower upfront costs, because computing resources are leased by the month rather than purchased outright and maintained on premises.

II. LITERATURE SURVEY

This research will consist of quantitative and qualitative methods which considered the widely used methods. Quantitative method in this study will consist of applying survey in collecting data from a wide area by selecting a representative of a large

population sample. The quantitative method is applicable while collecting the necessary data for this research as it is reflected on various IT experts' opinion towards the use of IT resources into cloud computing system.. Quantitative techniques is considered necessary to achieve an effective result. Basically, the utilization of quantitative technique for correlative purposes will be gone for encouraging the accumulation of sufficient information. Subsequently, quantitative strategy is viewed as logical and target as it utilizes logical methods for discovering reasons and clarifications for specific circumstances in the public. The research questionnaire will have three sections. Section one will contains the applicable data with respect to the association. craftsmanship two will contains the statistic inquiries of the respondents. Section three will incorporates polls for the diverse develops in research show

III. ADVANTAGES OF CLOUD ERP

The cost of the cloud based ERP implementation is lower compared to the traditional implementation. The cost of energy and maintenance, configuration etc is reduced. The scalability feature of cloud based ERP is enormous. The elasticity of the cloud based approach is one of the main advantages. The flexibility of cloud ensures competitive advantages to a particular company. Another advantage is faster implementation of software. Any changes suggested by the consumer can be implemented easily. The companies are free to concentrate on their improvements without thinking about the software implementations. Resource sharing and allocation becomes a very difficult task in the host based ERP systems. In cloud systems all the difficulties are handled care by the providers[3]. Migrating to a new technology or software is simpler in cloud based applications

IV. CONCLUSION

Implementation of ERP in Cloud Computing has solved many problems of many companies as ERP and Cloud Computing both contains many advantages and little disadvantage too but when there is a mix of two good things it leads to get better in time as discussed above ERP helps an organization accomplish more excellent productivity and benefit as it is a facilitated provision that an organization can use to store and supervise information from each one period of business including manufacturing, marketing and sales, inventory management, shipping and payment, product planning cost and development whereas Cloud Computing provides flexibility, better reliability, security, portability, collaboration, unlimited storage, unlimited file access and many more. Cloud ERP is nothing more than a ERP hosted on a cloud by cloud providers Cloud ERP is an adaptable and financially beneficial choice for small and medium-estimated organizations and offers far reaching profits for development and extension. This ERP platform has been tested in many aspects, such as function, reliability, security, compatibility and performance in the cloud computing environment.

V. FUTURE SCOPE

Cloud ERP system can be optimized in future by using various technology. Cloud-Based ERP is a great scope for SMEs. There are advantages of cloud-based ERP that need to be observed and considered by SMEs. Almost all the articles selected have discussed about the cost. This agenda recommends several factors that will play a significant role for the SME to adopt cloud-based ERP.

APPLICATIONS

1. Quick access.
2. Unlimited storage
3. Reliability
4. Flexibile handling

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Blockchain in Banking Sector

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Article Info

Volume9, Issue 1
Page Number: 427-431

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022
Published :25 Feb 2022

ABSTRACT

The Blockchain is an encrypted database that stores information statistics, or in different words, it is a virtual ledger of any transactions, contracts - that needs to be independently recorded. One of the key capabilities of Blockchain is that this virtual ledger is out there throughout several masses and heaps of computer and isn't always sure to be stored in a single place. Blockchain has already commenced disrupting the financial offerings area, and it's far this technology which underpins the virtual currency- bitcoin transaction. The aim is to conduct research on the effect of blockchain technology on the financial sector. There is no doubt that the world is curious to see how this promising technology will influence or shape the future of banking. Blockchain enhances safety in data storage and transmutation, avails a decentralized and transparent network infrastructure and significantly reduces the costs in operations. These remarkable attributes make blockchain a very promising and in-demand solution even in an industry as restricted as the banking sector

Keywords:- blockchain, DLT, decentralization, virtual ledger

I. INTRODUCTION

A Blockchain is a digital, immovable, dispersed ledger that sequentially records transactions in real time. Blockchain technology has the potential to completely reform the universal financial industry by offering the numerous opportunities of how people transact with money and values [1]. The essential for each subsequent transaction to be combined to the ledger is the respective consent of the network participants normally called nodes, thereby creating a continued system of control with respect to manipulation, errors, and data quality, control, direction [1]. Blockchain is a chain of blocks – each is being a storehouse that stores information referring to a transaction and links to the earlier block in the

same transaction. These connected blocks form a sequential chain providing a pathway of the basic transaction. Generic copies of all information are shared on the Blockchain. Participants separately validate information without a consolidate authority. In fact, if one node fails, the remaining nodes continue to act or operate, with ensuring no disruptions. A transaction on Blockchain can be accomplished only if all the parties on the network collectively approve it. However, consensus-based rules can be edited to suit multiple situations. Blocks constructed are cryptographically fixed in the chain. This means that it become absurd to delete, edit or copy already created blocks and then put it on network, after that creating the true digital assets and assuring a high level of durability and trust. Moreover,

the decentralized storage in a Blockchain is known to be very failure-contrary [1].

Even in the event of the deficiency of a huge number of network participants, the Blockchain still remains accessible, eradicate the single point of failure. Data stored in a Blockchain is enduring

Types of block chain: - 1. Public Blockchain Public blockchain are open-source. Anyone can participate in this blockchain, means anyone can participate in the transaction aided by the Blockchain, every participant can see what blocks are getting added and therefore anyone can participate in the consensus process i.e. the process of what blocks get added to the chain and what the current state is simply [2].

2. Hybrid blockchain By actually occupying a unique place within the blockchain ecosystem in that it is a hybrid blockchain, which means that it combines the public blockchain privacy benefits that gives businesses significant flexibility to choose what data they want to make public and transparent and what data they want keep private.

3. Permissioned or closed-loop Blockchain The distinction in an acknowledged blockchain as compare to the public blockchain is that the right to certify the transaction is provided to only very little preselected nodes. The right for reading the blockchain may be public, or may restricted to the participants. 4. Private Blockchain Private blockchain simply says, write permissions are restricted to one organisation. Major applications include database management, auditing i.e. specific area of single entity. To provide the right to read or validate to public is not needed here [2].

II. RELATED WORK

Some existing surveys discuss literature in the area of application of blockchain as financial technology (FinTech) for the banking business. However, none of those surveys focus solely on peer-reviewed publications about utilisation of DLT by banks. Firstly, the work of Rio reviewed stages of acceptance of DLT

by central banks between 2016 and 2017 for their various systems and functions. The review was based on grey literature, i.e., on a central banks own available publications, reports and press releases. The subset of utilised countries were those that belonged to the Organisation for Economic Co-operation and Development (OECD) and to the G20 organizations, including the Bank for International Settlement (BIS) and the European Central Bank (ECB), but excluded European Union (UE) and countries outside the OECD. The work concluded that, despite all central banks used in the study expressing interest in DLT, not one had an operational DLT-based system .

The reasons for the current unavailability of live blockchain applications were due to issues with: Speed, cost of processing, security, transparency and privacy, legal settlement finality scalability, network effects and immature technology

III. LITERATURE SURVEY

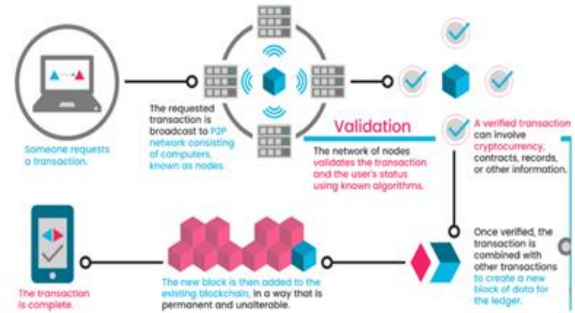
Blockchain technology is a new technology which is based on numerical and economic assumptions for managing a database between numerous members without the demand of any central authority. It is an assured distributed database, tamper evident, wherein the efficacy of a transaction can be verified by parties in the transaction. Each group of these transactions is assigned to as a block. A Block records some or all of the current transactions and goes into a blockchain as a permanent record once it is ended. The benefit of Blockchain is that financial transactions no longer need any central authority and are instantly validated, cleared and settled. Blockchain technology emerge to be an innovation which ensures a major change for capital markets and other financial services. The blockchain is going to disturb the banking industry in coming years. The World Economic Forum predicted that by the end of 2017, most of the banks would start projects related to the blockchain. In the past few years, Fintech start-ups functioning on Blockchain has got the venture capital funding of

more than 1.4 Billion During the same period, more than 2500 patents have been registered and over 90 Central Banks are currently emerged in discussions on blockchain globally. Moreover, the current statistics show that 69-percent banks are examining with blockchain. The above statistics justify the evolution of the technology whose first figures were defined at the time of global financial crisis or subprime crisis in 2008.

IV. WORKING OF BLOCKCHAIN

Blockchain is a system of recording information in a way that makes it difficult or impossible to change, hack, or cheat the system. A blockchain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the blockchain [3] Each block in the chain contains a number of transactions, and every time a new transaction occurs on the blockchain, a record of that transaction is added to every participants ledger. The decentralised [2] database managed by multiple participants is known as Distributed Ledger Technology (DLT). Blockchain is a type of DLT in which transactions are recorded with an immutable cryptographic signature called a hash. This means if one block in one chain was changed, it would be immediately apparent it had been tampered with. If hackers wanted to corrupt a blockchain system, [2] they would have to change every block in the chain, across all of the distributed versions of the chain. Blockchains such as Bitcoin and Ethereum are constantly and continually growing as blocks are being added to the chain, which significantly adds to the security of the ledger. A blockchain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the blockchain. Each block in the chain contains a number of transactions, and every time a new transaction occurs on the blockchain, a record of that transaction is added to every participants ledger

How does Blockchain Work?



V. KEY FEATURES OF THE BLOCKCHAIN

Near real-time updates: Based on formation policies, the information on the blockchain nodes are renovate in close to real-time. The transactions can be globally legalizing on the chain. Chronological and time-stamped: Blockchain as the name depicts is a chain of blocks each [5] being a repository that stores information connecting to transactions and also link to the previous block. These connected blocks form a chronological chain providing a stream of the underlying transactions. Moreover, the blockchain can be construct to also keep information about transaction chains, that could establish either (I) the source of inputs, or (ii) the linking between numerous hops in a business process beyond entities. Distributed ledger: Identical transcript of the information is shared on the blockchain. Participants independently approve the information without a centralized authority. Even if one node be ruined, remaining nodes continue to operate, assuring no/low disruption to business. Furthermore, the decentralized storage in a blockchain is known to be failure-opposing. [5] Even in the event of failure of a large number of network participants, the blockchain remains accessible, eliminating the single point of failure.

VI. ADVANTAGES OF BLOCKCHAIN IN BANKING SECTOR

Faster transactions These are another top advantage of utilizing Blockchain in banking. Utilizing blockchain technology, exchanges can be made inside the space of seconds, which is quicker than most customary financial strategies. As banks can keep away from agents by utilizing the Blockchain, clients can make exchanges at a faster speed. This will bring about clients and banks ready to finish and handle more exchanges. [9]

Improved security and Fraud Reduction Banks can have better secure exchange data utilizing the assistance of shared records. In the event that blockchain innovation is utilized in banking, exchanges will be quick and the possibility of somebody catching exchange data or redirecting installments will be decreased fundamentally.

Cost reduction This is one of the advantages of the Blockchain for banks Most banks are investigating and exploring the use of Blockchain. It was found that Blockchain can reduce up to 70

Digital currencies With the utilization of advanced monetary standards, banks can profit with Blockchain. With digital currency, banks will actually want to more effectively clear and settle monetary exchanges quicker and all the more safely.

Improved information quality Any sort of information can be put away in current blockchain innovation and furthermore permits it to be gotten to adhering to predefined rules and guidelines.[9]

VII. APPLICATIONS

Blockchain in banking as digital identity verification

Banks wouldnt be able to carry out online financial transactions without identity verification. However, the verification process consists of many different steps that consumers dont like [9] But With blockchain, consumers and companies will benefit from accelerated verification processes. Thats because

blockchain will make it possible to reuse identity verification for other services securely.

Blockchain in banking for accounting and auditing

The blockchain technology will simplify compliance and streamline the traditional double-entry bookkeeping systems. Instead of keeping separate records based on transaction receipts, businesses can add transactions directly into a joint register. All the entries in the register will be distributed [9].

VIII. CONCLUSION

Blockchains could revolutionize the underlying technology of the payment clearing and credit information systems in banks, thus upgrading and transforming them. Blockchain applications also promote the formation of multi-center, weakly intermediated scenarios, which will enhance the efficiency of the banking industry This unique technology offers the banking industry many unique opportunities. But certain challenges must be overcome for noticeable impacts to occur in the banking sector. In summary, blockchain can impact and revolutionize the banking sector. The only thing needed is its right application and use.

IX. FUTURE WORK

- Banking executives believe that blockchain will have to fulfill several conditions before becoming a mainstream technology in banking. The investment will come with significant returns. Once fully adopted, blockchain is expected to enable banking institutions to process payments faster and more accurately, all the while reducing transaction processing costs. All in all, blockchain-enabled banking applications will deliver a better customer experience and help traditional banking institutions to compete with fintech startups.
- Once a number of banks have adopted blockchain, the market competition will pressure

all banks to pass on the initial profit made back to individuals.

- Blockchain technology can be utilised towards much more than just digital currencies such as Bitcoin or developing new financial technologies. This smart contract can be used for other areas, such as documents provenance, ownership rights, digital or physical assets or to stop fraud. In the diamond industry for instance, the digital ledger for diamond identification and transaction verification has enabled to bring more transparency in a once very opaque diamond market

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Cloud Computing Applications : A Review

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Article Info

Volume9, Issue 1

Page Number: 432-435

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022

Published :25 Feb 2022

ABSTRACT

In recent years, cloud computing is an emergent field in the Internet era. There is rapid development in high-performance computing and technology extended from grid computing to cloud computing to provide computing resources on pay per basis. Cloud service providers developed applications for users to easily access cloud services with quality of service (QoS) because cloud application plays an important role in service delivery of cloud organization. This paper provides a review of cloud computing technology, cloud models, deployment and cloud applications such as types of applications, reliability, and security. Finally, open research issues are provided for future research development

Keywords: Cloud computing, Applications, Security, storage.

I. INTRODUCTION

Cloud computing has come with the concept of computing resources as a utility, which can be consumed based on pay on demand the same as you go fashion like electricity, water and gas . Cloud services mainly controlled and supported by data centers . Cloud computing as a utility is a long-held dream in the information technology sector and it will become true with the advent of low-cost data centers . Security is another major obstacle for opening up the vision of computing as a utility . Data centers are the most important entity in cloud service architecture. Data centers act as cloud providers, which provide different types of cloud services to users . A range of information technology companies provides services to their users as pay as you go fashion . These companies are Facebook, Amazon, Salesforce, Yahoo, Cisco, Microsoft, and Google .

They have their own data centers deployed at different geographical locations

▪ Cloud computing service models

Cloud computing is also said to be a model for acquiring flexible on-demand access to network with an interconnected pool of configurable IT resources like networks, server machines, storage devices, applications, and online services. These cloud models promote the availability and composed of five essential characteristics, three service delivery models, and four deployment models.

The cloud delivery model is further divided into three models.

1. SaaS (Software as a service)

This is one of the types of cloud delivery model in which the software or services are used on the cloud provider base and consist of software applications [19].

The connectivity is made through interfaces such as web or email. SaaS offers services promptly requested by the user's such webmail, interface application or software and business applications such as ERP, CRM, and SCM [20]. SaaS platform provides a limited approach at the client end that makes the server end much resourceful. Therefore it provides minimal integrated control for service-based functionality to endusers of the client.

2. PaaS (platform as a service)

This is the way to provide a base (platform) to the consumer for the deployment of cloud infrastructure with the help of its applications without enabling own local machine. PaaS refers to sharing platform layer and software layered resources such as operating systems and application-based frameworks. All the categories of cloud computing provide support as per the standards or limitations of resources. Client users adopt PaaS service mainly because of less than optimal solutions or results of IaaS. This statement looks rationale at some point, but in reality, it depends on the specifications of the IT applications involved in the network

3. IaaS (infrastructure as a service)

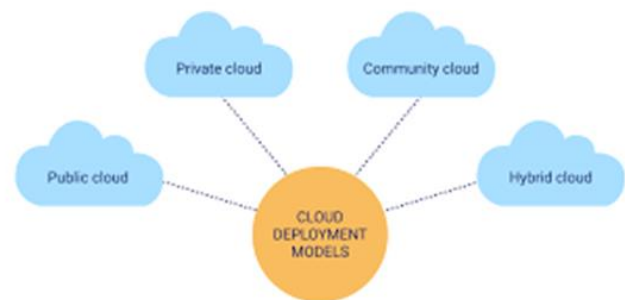
In IaaS cloud service provider shares a pay-as-you-go facility to access the several features of network servers, computational applications, and storage over the web or internet [24]. IaaS can be a single virtual or physical service or a combination of both [25]. It behaves as the basic unit of IT resources, which minimizes the workload and reduces the number of computing resources. IaaS, PaaS, and SaaS are proposed to be layer-based services one after the other .

IaaS provides a platform of physical control to users of cloud services such as computer devices, networks, and storage used in the virtualization process. PaaS is the second step in accessing the cloud resources by taking control of the system at management level such as operating system and run time application .

SaaS is the last service based on the end-user application, where the main control remains with the vendor or owner of the cloud . This is the simplest description of three services at the primary level understanding each offer a dynamic layer of reflection after that. IaaS abstracts absent the physical compute, organize, capacity, and the innovation required to virtualizes those assets. IBM has provided chart based information for understanding the nature of services controlled at different layers is also shrink or extend the resources. It will certainly adjust the expenditure cost and unnecessary availed infrastructure

• **Cloud Deployment Models**

The deployment models are dependent on the infrastructure of the network. There are four common cloud deployment models:



- A. Public cloud
- B. Private cloud
- C. Community cloud
- D. Hybrid cloud

1. **Public Cloud**

The public cloud makes it possible for anybody to access systems and services. The public cloud may be less secure as it is open for everyone. The public cloud is one in which cloud infrastructure services are provided over the internet to the general people or major industry groups. The infrastructure in this cloud model is owned by the entity that delivers the cloud services, not by the consumer.

2. Private Cloud

The private cloud deployment model is the exact opposite of the public cloud deployment model. It's a one-on-one environment for a single user (customer). There is no need to share your hardware with anyone else. The distinction between private and public cloud is in how you handle all of the hardware. It is also called the "internal cloud" & it refers to the ability to access systems and services within a given border or organization.

3. Hybrid cloud

By bridging the public and private worlds with a layer of proprietary software, hybrid cloud computing gives the best of both worlds. With a hybrid solution, you may host the app in a safe environment while taking advantage of the public cloud's cost savings. Organizations can move data and applications between different clouds using a combination of two or more cloud deployment methods, depending on their needs.

4. Community cloud

It allows systems and services to be accessible by a group of organizations. It is a distributed system that is created by integrating the services of different clouds to address the specific needs of a community, industry, or business. The infrastructure of the community could be shared between the organization which has shared concerns or tasks. It is generally managed by a third party or by the combination of one or more organizations in the community.

II. LITERATURE SURVEY

This paper presents a systematic literature review to explore the current key issues related to cloud computing adoption. This is achieved by reviewing 51 articles published about cloud computing adoption. Using the grounded theory approach, articles are classified into eight main categories: internal,

external, evaluation, proof of concept, adoption decision, implementation and integration, IT governance, and confirmation. Then, the eight categories are divided into two abstract categories: cloud computing adoption factors and processes, where the former affects the latter. The results of this review indicate that enterprises face serious issues before they decide to adopt cloud computing. Based on the findings, the paper provides a future information systems (IS) research agenda to explore the previously under-investigated areas regarding cloud computing adoption factors and processes. This paper calls for further theoretical, methodological, and empirical contributions to the research area of cloud computing adoption by enterprises.

III. CONCLUSION AND REVIEW

It conclude that cloud computing resources have still become one of the common tools to extend the business along with lowering the operational cost. The most important factor of cloud computing applications will remain the data/information security, availability, accessibility, integrity, and redundancy. With the advent of social network and app-based features, huge data of users has become the top priority. The organizations tend to not compromise with the security issues and sometimes become susceptible to threats as well as malware attacks by hackers. This can be one of the reasons for the existence of a professional who is hired by the companies to cope with hacking vulnerabilities. And eventually, cloud applications are more prone to such disastrous intrusion because of their web-based applications or virtualized resources. In either way, the research or understanding of the most updated scripts, applications, programming languages and security tools can help in solving the most complex security threats of the cloud environment.

IV. FUTURE SCOPE

Cloud Computing simplifies accessibility, provides virtual storage space, and addresses backup issues. It also provides security against unauthorized access and loss of data. It helps organisations to save huge investments on services and infrastructure for data storage, software licenses, servers and hardware.

The scope of cloud computing is very bright. According to a report, the cloud computing market in India is at \$2 billion and is expected to grow with an annual growth rate of 30%. By 2020, the cloud computing market in India is supposed to reach \$4 billion and create more than a million jobs in this country.

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Data Migration from SQL to No SQL using Snapshot- Live Stream Migration

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Article Info

Volume9, Issue 1
Page Number: 436-443

Publication Issue

January-February-2022

Article History

Accepted : 15Jan2022
Published : 25Jan2022

ABSTRACT

Due to massive use of new technologies, the huge amount of data is available and needs to be processed appropriately. Such tremendous amounts of data add a great number of challenges to the traditional database paradigm. Data migration is the procedure of transforming data from one type of database to another. Companies are moving their database from one database (e.g., RDBMS) to another new one (e.g., NoSQL) because of many reasons such as new database can handle more data, that could be fast, scalable etc. Relational database has been used by many organizations for storing and analyzing enterprise database since last few decades. Relational database stores information in a structural or relational way because it follows the structured model but it has many restrictions as compared to the non-structured model. NoSQL uses document model, graph model, keyvalue etc., as compared to RDBMS databases. NoSQL was primarily designed for storing and retrieving a large amount of data. Using NoSQL database in new enterprises is not a major issue because the new application design will be based on NoSQL database. But the issue appears when existing systems that are built on relational database are restructuring database system to implement NoSQL database. They need to reanalyze the system requirements to build up the new database schema. In this research, we will study an approach for migrating real time as well as old data from SQL to NoSQL database using database snapshot and live-stream of database changes. This research also helps us to understand how snapshot and live data migration shows the higher performance as compared to other methods.

Keywords: Data migration, RDBMS, SQL, NoSQL, database schema.

I. INTRODUCTION

1.1 Introduction

Data migration is a process of transforming data from a source database to target database. Data is migrated from one database (e.g., RDBMS) to another new one (e.g., NoSQL) because of many reasons such as new

database can handle more data, that could be fast, scalable etc. Companies are moving their database from one database to another new one because of many reasons such as new database can handle more data, that could be fast, scalable etc. But the issue appears when existing systems that are built on relational database are restructuring database system

to implement NoSQL database. In this research, we will study an approach which concentrates on parallelly migrating snapshot data and live stream data of RDBMS to the NoSQL database. We will also study various pre-existing models for data migration. Relational database has been used by many organizations for storing and analyzing enterprise database since last 3-4 decades. Relational database stores information in a structural or relational way because of relational database follows the relational model. Relational database is used in an environment where data is growing slowly and adheres some structure.

1.2 Motivation

Data migration is one of the important technologies in recent times. It has also gained importance in cloud platforms. Companies are moving their database from one database to another new one because of many reasons such as new database can handle more data, that could be fast, scalable etc. But the issue appears when existing systems that are built on relational database are restructuring database system to implement NoSQL database. Having knowledge of databases like MySQL and MongoDB and also basics of cloud, motivated me to choose this topic as my seminar topic.

1.3 Aim and Objectives

1.3.1 Aim

In recent times, organizations are moving from RDBMS to NoSQL due to benefits of NoSQL. The aim of this topic is to understand data migration and study how data can be migrated from SQL to NoSQL system and also find an efficient method for the same.

1.3.2 Objectives

- Understand basic concepts like Relational and non-relational databases, data migration, etc.
- Understand complex concepts of database snapshots, live stream data, etc.
- Study and compare various data migration methods to find out the most efficient technique.

1.4 Introduction to the Topic

Relational database has been used by many organizations for storing and analyzing enterprise database since last 3-4 decades. Relational database stores information in a structural or relational way because of relational database follows the relational model. Relational database is used in an environment where data is growing slowly and adheres some structure.

Now, the data is increasing exponentially and it has been generated from different sources. Such huge data is called big data, which has three types of key concepts, i.e., volume, variety, and velocity (3 V's of big data). This data also can be structured or unstructured. Big data is stored in a new type of database, called NoSQL (mostly said non-relational database or not only SQL). Software companies such as, Amazon, Facebook, Google etc., realize that relational database was not able to store and analyze such type of data. They developed new type of database as per their requirements; e.g., Amazon developed DynamoDB, Google developed Bigtable as their NoSQL databases.

Data migration is a process of transforming data from a source database to target database. Companies are moving their database from one database to another new one because of many reasons such as new database can handle more data, that could be fast, scalable etc. But the issue appears when existing systems that are built on relational database are restructuring database system to implement NoSQL database. In this research, we will study an approach which concentrates on parallelly migrating snapshot data and live stream data of RDBMS to the NoSQL database. We will also study various pre-existing models for data migration.

II. LITERATURE SURVEY

2.1 Introduction

In the Literature Survey we will discuss various concepts involved in Data migration. Relational

database is used for storing and retrieving information in a structural or relational way while NoSQL uses other types of models for example the document model, graph model, key-value etc. NoSQL was primarily designed for storing and retrieving a large amount of data. NoSQL is a new breed of databases that do not based on the relational model and do not use SQL for data manipulation. Several previous researches had been conducted in relation to data transformation process from SQL database to NoSQL database.

Various approaches for data migration which are already used. Data preprocessing is required to ensure appropriate data migration from a relational database to NoSQL database. Graph transforming algorithm is one of the simple and easy transformation algorithms. However, it must be kept in mind that the algorithm cannot transform data optimally in the case of relational databases that have subtype-supertype structures. [1].

Big Data solution in handling data has gained good proficiency, such as NoSQL because of which the developers in the past decade to started suggesting and using the big data databases, such as Oracle NoSQL, etc. This approach has two modules: data transformation and data cleansing. The first phase is the transformation of a relational database to Oracle NoSQL database through model transformation. The required elements for model transformation are input model, transformation description, transformation engine and transformation rules. Data cleansing is provided by the second part to improve data quality and prepare and make it really very useful for the for big data analytics [2].

A linear transformational approach is suggested to be useful in order to achieve a solution that can map between a wider range of schemas. This common IR model can support the productivity of transformation agents and reduce their complexity and thus optimizes their performance. The hierarchical composition is applied to the internal design of each translation system. Where the translation rules are

distributed across different translation agents, based on the structure of the target schema (model) [3].

A snapshot of database generally represents instance data of database at a particular time. This is a very common technique, which is mostly used in relational databases for migrating data from one relational database to another relational database. Nowadays, this technique is also used in relational to NoSQL databases migration such as, mongify tool. In live data replication technique, the live data changes are processed by stream processor for transforming and copying into new database by capturing the live data changes through any changed data capture software [4].

2.2 Different Approaches of Data Migration

The various data migration approaches are as follows:

2.2.1 Enhanced Graph Transforming

The enhanced graph transforming algorithm can transform data from SQL database to NoSQL database. A simulation where data is migrated from relational database to NoSQL database. The dataset is converted to relational tables. The completion of the multiple relationships does not require comparing the number of instance entities between the two tables. The initial step in solving this case is to convert the relational database into a graph. The next step is to remove edges that cause transitive dependencies in the graph, followed by combining the vertices and removing the next edges starting from the leaf node [1].

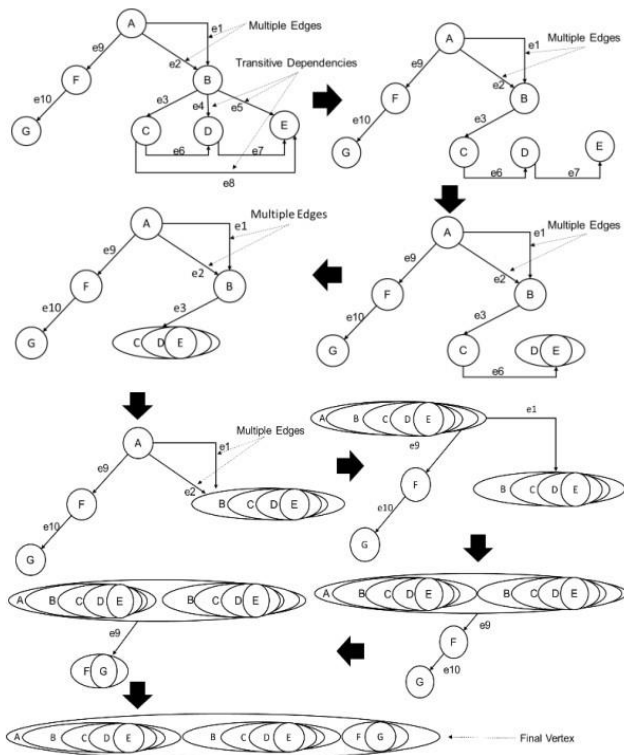


Figure 2.1: Enhanced Graph Transformation process [1]

Afterwards, the NoSQL schema is generated according to the sequence of combined vertices in the final vertex. The row keys in the schema are adopted from the primary key of the root table in the relational database. After that, data is migrated from relational database to NoSQL database schema. This experiment also runs transformation process using graph transforming algorithm, multiple nested schemas, and DDI concepts [1].

2.2.2 Intelligent Data Engineering for Migration

In this paper, they have proposed an approach that has two modules: transformation module and data cleansing module. The first one is to transform RDB to Oracle NoSQL database through model transformation. The latter provides data cleansing methodology to improve data quality. Model driven Architecture is an approach that deals with models to develop software. The required elements for model transformation are input model, transformation description, transformation engine and

transformation rules. In this approach SiTra is used as a transformation engine to transform the input model to output model and maps the concepts of input model (SQL Server, RDBs model) to output model (Oracle NoSQL model) for the generation of transformation rules that are used by SiTra for transformation. Model to model transformation is our main concern that transforms a model into another model. The MDA approach maps concepts of source metamodel into corresponding concepts of target metamodel. The Java based MDD (Model-Driven Development) Approach is used to implement model transformations. The two interfaces are used to implement the transformation rules i.e. rule interface and transformer interface. The rule interface is implemented for each transformation rule and it has two methods, check method and build method. [2].

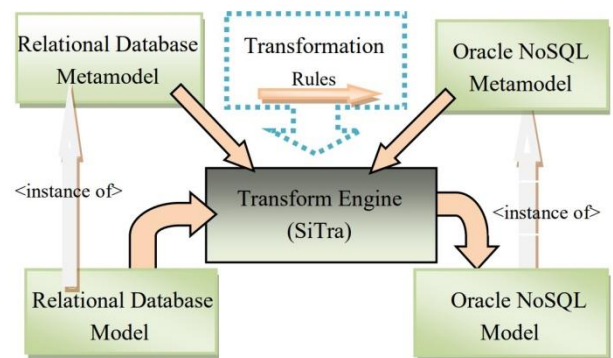


Figure 2.2: Intelligent Data Engineering for Migration [2]

2.2.3 Linear Composition of Transformation agents

A linear transformational approach is used in order to achieve a solution that can map between a wider range of schemas. Thus, it can cover types of translations between different database vendors, SQL vendors like MySQL and Oracle, and NoSQL vendors like MongoDB and Cassandra, and even the graph data model such as Neo4J database. From this point of view, the demand for introducing the more common and less technical intermediate representation (IR) model using a textual Domain-Specific Modelling Language (DSML) has emerged. This common IR model can support the productivity of transformation

agents, reducing their complexity and optimizing their performance. The hierarchical composition is applied to the internal design of each translation system. Where the translation rules are distributed across different translation agents, based on the structure of the target schema (model). It is worth mentioning that it is still an open question whether the benefit of considering the structure of the target schema when designing the translation system outweighs the structure of the source one. It is worth mentioning that defining the mapping between NoSQL schemas, such as graph- or documentbased and RDBMS ones is not a straightforward task. Based on the transformation language and framework used (declarative/ imperative), the mapping process normally involves a series of transformation iterations to form the final structure of entities, its properties and data integrity and constraints, including relationships. The detailed design and implementation of the suggested transformation framework is out of the scope of this paper [3].

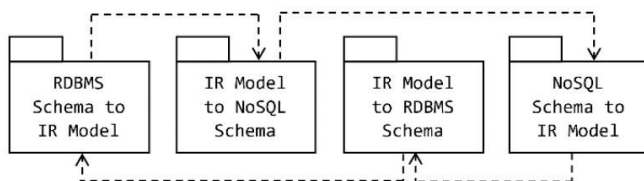


Figure 2.3: Linear Composition [3]

2.2.4 Snapshot Migration

While snapshot data is migrated, various settings are migrated from the source snapshot to the destination. These actions are all performed as one transaction. If the source snapshot was the default, that property is also transferred to the target. Runtime environment variable and server configuration settings are migrated from the source to the target snapshot. Default values set at design time are not migrated. The changes to the environment variable or server configuration that occur during run time are migrated from the source if they have a modified date that is more recent than any change that occurred at run time in the target snapshot. A change at run time always overrides the snapshot default settings [4].

2.3 Various Algorithms for Data Migration

Some of the pre-existing data migration algorithms are as follows:

2.3.1 Intelligent Data Engineering Transformation Algorithm

In this algorithm, each concept of SQL Server database is mapped to corresponding concepts of Oracle NoSQL. Oracle NoSQL have no join operation; it uses parent child relationship instead of join operations. Relational databases have concept of permissions whereas Oracle NoSQL has the concept of privileges [2].

Transformation algorithm

1. Create table object of the source.
 2. Generating a list of target table objects from sourcetable's objects.
 3. Mapping the source table objects to target table objects.
 4. Create object of each column of source table.
 5. Mapping the source column object to target field object.
 6. If value is true
 7. Select the transformation rule
 8. // rule is applicable or not, when more than one rule is available for same type object.
 9. endif
 10. The target table object is created.
 11. The target object of each column is created.
 12. Select primary key.
 13. Keep a history of transformed objects.
- // to avoid duplicate creation of target objects.

2.3.2 Enhanced Graph Transforming V2 Algorithm

The algorithm is implemented to transform data from relational database with simple and non-simple graph characteristics. The first step of this algorithm is performed by converting the relational database structure into a graph. If the number of Vertex in the graph is only one and loop occurs ($|V|=1$ and $I[v]>0$), the graph is added with a vertex used to store

attributes identified by a foreign key that forms the loop $(V \leftarrow V+v1; v1 \leftarrow \{x | x \in V \wedge v1 \subseteq v\};$. Next, vertices integration is completed and edges that form a loop is eliminated $(\{v\} \cup \{v1\}; E \leftarrow E - \langle f(u), v \rangle; V \leftarrow V - v1);$. When the final vertex has outdegree and indegree that equal zero, the iteration is terminated. If the number of vertices in the graph is more than one $(|V| > 1)$, identification of leaf node in the graph is done $(P \leftarrow \{v | v \in V \wedge O[v] = 0\})$. If the graph has the leaf node $(|V| > 1; \text{ and } P > 0)$, the vertices integration process and edges elimination are completed. However, when there is no leaf node $(|V| > 1; \text{ and } P=0)$, it is possible that there are multiple edges and/or loop in the graph. When there are multiple edges in the graph, the comparison of the number of instance entities between vertices related to multiple edges is made $(X = \{x | x \leftarrow \forall \text{ instance entities } u\}; Y = \{y | y \leftarrow \text{instance entities } f(u)\}; |X| > |Y|)$ [1].

identified by the foreign key forming the loop $V \leftarrow V+u1; u1 \leftarrow \{x | x \in V \wedge u1 \subseteq u\};$. Then, it is integrated into the vertex that contains a loop, followed by the removal of edge that results in a loop $(\{u\} \cup \{u1\}; E \leftarrow E - \langle u, u1 \rangle; V \leftarrow V - u1);$. This iteration of transformation is kept running until the final vertex has outdegree and indegree that equal zero [1].

2.4 Workflow

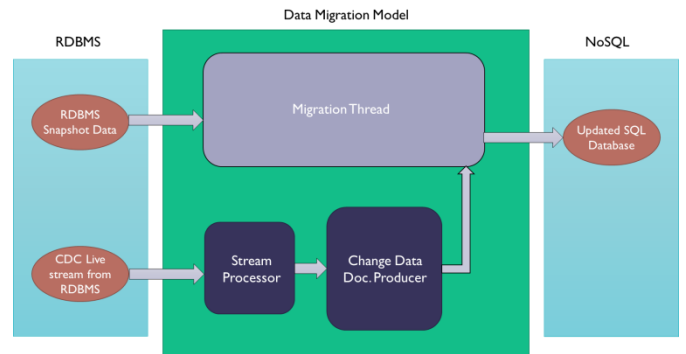


Figure 3.1: Database Snapshot Live Stream DB Migration Workflow

Database Snapshot Live Stream DB Migration approach provides a solution for database migration for NoSQL systems. This approach focuses on parallelly migrating snapshot data and live stream data of RDBMS to the NoSQL database component (Documents) in NoSQL database.

A function can be developed for creating snapshot data of RDBMS tables, and then it will start the CDC for live stream of databases changes. Our main focus is on copying all the data, because in a big data application data is updated/ produced in a high speed. Migrating snapshot data also consumes some time in real life application, so the changes (insert/update/delete) occurred during snapshot database migration, will also be reflected in new NoSQL database.

The approach comprises of three components i.e., migration thread, stream processor changed data document producer. The model considers two inputs; namely, snapshot data of RDBMS mode live stream of changed data capturer. Snapshot can be created by creating JSON files from SQL queries. For example,

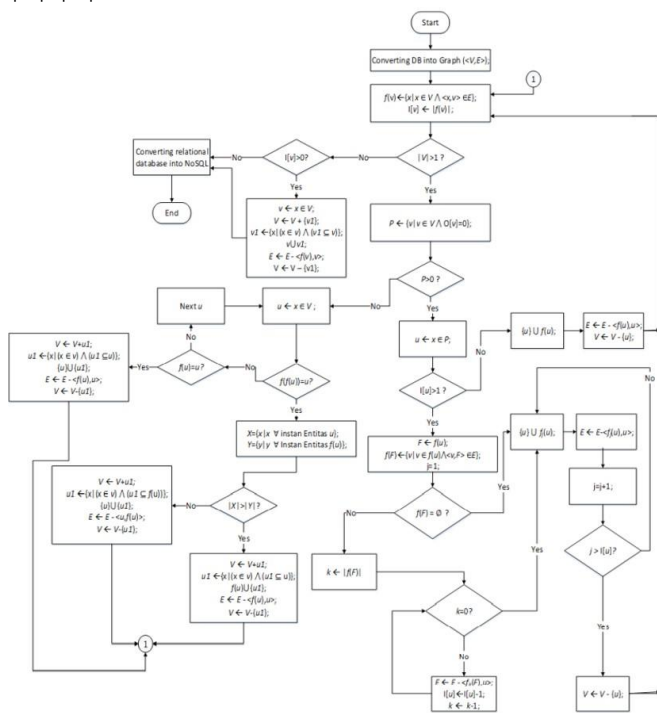


Figure 2.4: Enhanced Graph Transforming V2 Flowchart [1]

The next process is the integration of additional vertex to the one that has smaller number of instance entities $(\{u\} \cup \{u1\}; \text{ or } f(u) \cup \{u1\}; E \leftarrow E - \langle u, u1 \rangle; V \leftarrow V - u1);$. When there is a loop on a graph, a vertex is added to the graph to accommodate attributes

MySQL database provides extension to SQL queries for creating JSON files.

The migration thread component in this approach firstly creates a pipeline for each document of MongoDB (NoSQL). Thereafter, it reads the data of individual document (each table data) from snapshot data of database in parallel and copies it into individual document of NoSQL database. The stream processor component of model reads the data from changed data capturer. The change data capturer reads the RDBMS databases log for any database changes. The changed databases are forwarded to stream processor for grouping and filtering the data for particular database.

The filtered data is then transferred to third component of model. The change data document producer will create inserted/ updated/ deleted data record of each document parallelly. Now, first component of model, migration thread, will reads this new data which is created by change data document producer parallelly.

2.5 Algorithm

In this algorithm, our primary focus is on the migration of two things; namely, snapshot data of RDBMS, and live stream of changed data of RDBMS. Algorithm considers listOfColls as an input, which is a collection or array of JSON files of snapshot data of RDBMS tables for each collection of MongoDB. It reads each collection from listOfColls, and creates a new thread, then pass this collection to a thread startMigrationThread. This creates number of threads same as those are collections in listOfColls. This startMigrationThread performs two tasks; first it copies the snapshot data in NoSQL and it checks and copies the temporary data created by other startCDCThread. This output is then copied to temporary database for processing by startMigrationThread.

Transformation Algorithm

Input: var listOfColls- A list of JSON files for each collection of NoSQL (Snapshot Data).

Output: Update NoSQL database with Snapshot and Live stream of Changed data.

Begin for each Collection x in listOfColls

Begin

Call startMigrationThread(x)

End

Call startCDCThread End Algorithm;

function startMigrationThread(Collection x)

//Runs in a different Thread

Begin copyDataInNoSQL x

copyCDC_DataInNoSQL from Temporary DB for

Collection x.name End startMigrationThread;

function startCDCThread() //Runs in a different Thread

Begin

ReadDataFromChange_Data_Capturer

CopyChanged Data in Temporary DB

End startCDCThead;

III. APPLICATIONS

3.1 Probable Applications

The applications of the Database snapshot and live stream database migration approach are as follows :

- NoSQL database has many benefits over RDBs. Hence, this technology can help organizations who wish to move old as well as update real-time data changes from SQL to NoSQL.
- The companies or organizations moving from local storage system to a cloudbased system to optimize operations can use this approach.
- Installation of new systems to previously existing applications sharing the same dataset.
- For replacement, upgrade, and expansion of storage systems this approach can be very useful.
- AWS DMS(Database Migration Service) and AWS SCT(Schema Conversion Tool) are already existing applications using such data migration technology.

IV. CONCLUSION

Migration of data from RDBMS to NoSQL database is a very complex task where data is regularly updating and increasing in size very fast. The proposed approach for data migration from RDBMS to NoSQL is presented, which uses both the data migration techniques, snapshot and live stream of change data parallelly. This model has three components; namely, migration thread, stream processor and changed data document producer. It takes two inputs; namely, snapshot data of relational database mode and live stream of changed data capturer.

This approach helps us to efficiently migrate the snapshot as well as live data stream of changed data in NoSQL. It is also found that proposed model performs faster than other existing models and it also migrates the live data.

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Wearable Biosensors

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Article Info

Volume9, Issue 1

Page Number: 444-448

Publication Issue

January-February-2022

Article History

Accepted : 15 Feb 2022

Published :25 Feb 2022

ABSTRACT

One of the new technologies in the field of health is wearable biosensor, which provides vital signs monitoring of patients, athletes, premature infants, children, psychiatric patients, people who need long-term care, elderly, and people in impassable regions far from health and medical services. The aim of this study was to explain features and applications of wearable biosensors in medical services. Smart wearable in the technology industry for 2021 is one that is looking to be a big and profitable market. Wearable biosensors capable of continuous vital signs monitoring and feedback to the user will be significantly effective in timely prevention, diagnosis, treatment, and control of diseases.

KEYWORDS: Wearable biosensors, Ring sensor, Smart devices, Healthcare Diagnosis

I. INTRODUCTION

Miniaturization of laboratory apparatus into microscale devices is a promising technology called lab-on-a-chip (LOC) [1]. About 30 years ago the concept of micro total analysis systems (μ TAS) emerged from the field of semiconductor fabrication and was enhanced by microelectromechanical systems (MEMS) technologies [2-4]. The μ TAS concept is to shrink an entire analytical procedure, such as cell sorting, single-cell capture, captured-cell transport, cell lysis, and intracellular analysis, into a miniaturized multifunctional chip [5-7], and nowadays its well-known synonym is called lab-on-a-chip (LOC) [3,4]. This growing field has garnered considerable attention since scaled-down biochemical analysis has several key advantages over both conventional and current laboratory benchtop methods [3,5]. These advantages are consistently demonstrated in clinical medicine, engineering,

biology, and life science, etc., for example, to expedite the experimental process by embracing automation and parallelization [1,8,9]; to lower the cost by reducing the volume of expensive reagents [1,5,10,11]; to yield better interpretation of experimental results by gleaned vital information at cellular even molecular levels [12-14].

Interest in device miniaturization [15-17], combined with advances in bio microfabrication and enabling materials [18], is motivating various microfluidic methods in which microchips can be mass-manufactured at extremely low cost via polymers (e.g., polydimethylsiloxane, PDMS) and soft lithography for microfabrication [5,19]. Microfluidics is the science of microscale devices that process and manipulate extremely low (10^9 to 10^{18} L) amounts of fluids in microchannels with dimensions of tens of micrometers [10]. Conventional macroscale experimental technologies meet difficulties to deal with such low amounts of fluids, impeding their

development in various fields. Conversely, microfluidic technologies begin to address numerous tough challenges, because fluid phenomena at the microscale are dramatically different from those at the macroscale [3].

Despite all the attractive capacities of LOC/microfluidics devices that have enabled the widespread implementation of microchip-based systems in biology and life science [3–5,22], microfluidic technologies often only improve the performance of existing macroscale assays or provide equivalent alternatives [13]. Conversely, they have not reached their full potential due to the lack of essentially new capacities [3]. In recent years, however, LOC/microfluidics technologies begin to address some problems that have not yet been solved by current laboratory benchtop methods. An excellent example can be found in wearable/ambulatory healthcare monitoring and sports analytics harnessing skininterfaced wearable biosensors [15,23]. Although this field is still in its infancy, the fundamentals of it are exceptionally strong: in the past decade, the wearable LOC devices gradually integrated with well-established techniques, including biocompatible materials [24,25], flexible electronics [26–30], optical/electrochemical sensors [14,26,31,32], microfluidics [21,33–35], near-field communications (NFC) [36], pain-free microneedles [37–40], as well as big data and cloud computing [14,41,42]. These above-mentioned enabling techniques establish the foundations for a new generation of wearable biosensors that directly interfaced with the human epidermis instead of rigid packages embedded in wrist straps or bands [23,43–45]. The distinguishing characteristics of the emerging wearable biosensors, lightweight, flexibility, and portability [31,36,46], have made them especially suitable for point-of-care testing (POCT). Therefore, brand-new wearable biosensors capable of real-time physiological monitoring quickly emerge, as shown in Figure 1. However, these wearable biosensors are mainly designed for health monitoring

[15,34,41,45,47,48], especially, some of them are only developed to measure the physical strain/stress bending change [25,49,50]. Although many wearable devices have been deployed in sports, they are used to monitoring biophysical markers [23], such as movement [51] and cardiovascular information (e.g., blood oxygenation) [26,52,53].

On the business side, CDO needs to constantly review the governance policy and conflict management is important to follow the continual data change based on business changes. Also, the CDO needs to develop the governance policy to prevent the various risks for publishing only the minimum necessary information due to risks. Finally, short-term development and design based on implicit domain knowledge and assumptions can make data reuse more difficult. For such problems, IBM and Microsoft have proposed data management systems with a data catalog to establish the data governance method to eliminate the tradeoffs between analytics cost and operation cost.[16]

The term “visual analytics” was introduced as “the science of analytical reasoning facilitated by interactive visual interfaces” [7]. However, it was pointed out that, based on current practice, a more specific definition would be that visual analytics combines automated analysis techniques with interactive visualizations for an effective understanding, reasoning, and decision making based on large and complex datasets [8]. In systems like, for example, the Visual Cluster Rendering System (VISTA) [9], the objective is to display the dataset in such a way that it would be easy for a human to manually cluster data and verify existing clustering results visually.

In systems like the Visual Cluster Rendering System (VISTA) [9] the objective is to display the dataset in such a way that it would be easy for a human to manually cluster data and verify existing clustering results visually. While VISTA is often intended to import an existing clustering to validate or modify the

clustering, it is also able to produce clustering by itself though its interactive visualizations.[17]

II. LITERATURE SURVEY

In this section, we discuss the literature supporting the use of wearable devices in cardiovascular patient care, reviewing the critical clinical studies on the most common cardiovascular applications published in the past 15 years

2.0.1 Risk assessment and lifestyle interventions.

Global cardiovascular disease risk assessment is traditionally based on clinical risk scores that estimate the 10-year risk. However, most of these scores do not capture the dynamic changes in personalized risk that closely follow lifestyle habits. The incorporation of subjective lifestyle behaviours in risk assessment has been challenging; therefore, objective data derived from wearables provide a renewed opportunity to make the assessment of the risk of cardiovascular disease more accurate, comprehensive and dynamic over a lifetime. Several studies have shown wearable-measured physical activity to have an inverse dose-dependent relationship with all-cause mortality^{5,34–38}. Moderate-to-vigorous physical activity (MVPA), measured with the use of triaxial accelerometers, was associated with a lower mortality than light physical activity or sedentary behaviour in several US cohorts and in a Swedish population-based cohort^{34–38}. Another study of women with a mean (s.d.) age of 72 (5.7) years showed that as few as 4,400 steps per day were significantly associated with a 41% the benefits levelled at 7,500 steps per day³⁹. Of note, stepping intensity was not associated with mortality after adjusting for steps per day. Wearable data also facilitate the application of realtime behavioural change techniques (BCTs) such as just-in-time adaptive interventions, designed to dynamically assess user needs and provide the appropriate amount and type of intervention at the relevant time. Several trials were designed to assess the benefits of wearable-

guided BCTs. The mActive trial enrolled 48 outpatients from an academic.

2.1 Screening and diagnosis

2.1.1 Hypertension.

Initiating hypertension screening in young adulthood is widely recommended to prevent cardiovascular disease²⁴. Oscillometric or cuff-less wearables that accurately measure BP and are continuously worn on the wrist might be more convenient in the ambulatory setting than traditional upper arm BP devices for the screening of hypertension, the selfmonitoring of BP and the titration of antihypertensive drugs⁴⁸.

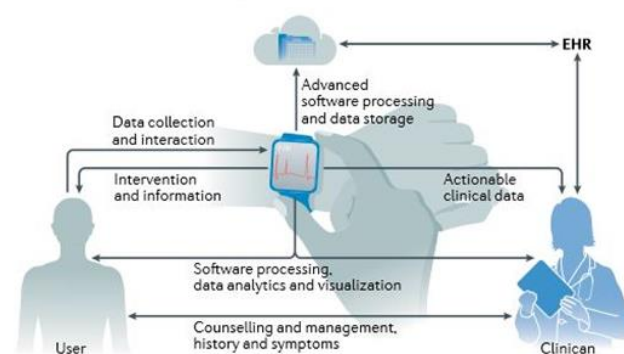


Fig. Smart wearable data workflow and integration in clinical practice

2.1.2 Atrial fibrillation and other arrhythmias

The global burden of AF and its association with stroke, HF and mortality have been well established⁴⁹. Wearables might be a convenient tool to diagnose asymptomatic or symptomatic AF²⁰. The mSToPS study⁵⁰, which included both a randomized trial and a prospective cohort, evaluated the effect of immediate versus delayed continuous ECG monitoring with the use of a Zio patch (iRhythm Technologies, USA) on new AF diagnosis at 4 months and 1 year.

2.1.3 Other diagnostic applications

For risk factor screening, a semi-supervised learning algorithm, developed from 57,000 personweeks of data from Fitbit, Apple Watch and Wear OS (Google, USA), classified high cholesterol levels and hypertension with high accuracy (area under the curve (AUC) 0.7441 and 0.8086, respectively) using HR and step count data available from these commercial wearables⁵⁹. In another study, a convolutional neural network developed with a training dataset of 35,970, 12-lead ECGs and validated in an independent dataset of 52,870 ECGs classified ventricular dysfunction with good accuracy⁶⁰.

III. CONCLUSION

It is clearly evident that accelerometers and motion sensors, biochemical sensors, and photoplethysmography sensors are the most prominent wearable biosensor technologies. We know that each of these technologies has specific challenges that need to be addressed during the sensor design process. Accelerometers and motion sensors require the integration of another wearable physiological monitoring device as well as some type of computer software interface equipped with specific algorithms for signal manipulation and analysis. Biochemical sensors have more complex requirements concerned with the biocompatibility and other chemical properties of the human body. There must not only be consistent sample delivery to the active surface of the sensor, but also the long term stability of the sensing interface. In addition, low sample detection limits that require cumbersome and repetitive sensor calibration are other common issues. There are multiple environmental factors that must be considered including the sample having active interferences to overcome and biofouling in the joint of the sensor. Photoplethysmography sensors have the motion artifact challenge that needs to be addressed in order to ensure optimum signal quality. These types of sensors must deal with the fluctuation

in light absorption from the exposure to various ambient lighting conditions as well. We know that all of these sensors must be comfortable and compact enough so that they can be worn everyday just like regular clothing. It is from this perspective that we must always take the overall safety of the patient into account during the sensor design process. The overall accuracy of accelerometers and their integration with physiological monitoring definitely could be addressed in the future to improve precision and effectiveness. The extreme versatility and flexibility of biochemical sensor applications make them always a candidate for further investigation and analysis. There may be more efficient methods to attenuate the effects of diverse ambient lighting conditions on photoplethysmography sensors. It is quite obvious there is a need for additional research into developing more technologies involving wearable biosensors because of their significant appeal for mobile monitoring in the medical device industry. This will provide us with even more methods to effectively monitor patients and provide healthcare practitioners with additional tools at their disposal.

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Study of Creativity Among Boys and Girls of Secondary School

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Article Info

Volume 9, Issue 1

Page Number : 449-454

Publication Issue

January-February-2022

Article History

Accepted : 06 Jan 2022

Published : 20 Jan 2022

ABSTRACT

In this present investigation we studied about “A comparative Study of Creativity Among Boys and Girls of Class VIII of Secondary School” in Bihar, India with special reference to West Champaran District. The objectives and hypotheses, method and the material chosen to accomplish the requirements of the study are discussed in this chapter.

Keywords: Creativity, Flexibility, Mental Health.

I. INTRODUCTION

Students of VIII class belonging to different secondary schools located in West Champaran district in Bihar state constituted the population for the study. Among West Champaran revenue district, the schools located in urban and rural areas were selected at random from each sub-division and 2 schools each from rural and urban areas were selected at random from each subdivision. Five boys and five girls were selected at random from each of the school, thus giving a total of 600 subjects for the study, equally distributed between the two sexes, two localities and two schools of each locality. The distribution of the sample of the subjects in different sub-groups is presented in table.

II. OBJECTIVES

The following objectives are setup for the present study.

- To find out whether boys and girls differ in their creativity.
- To find out whether children were belonging to rural and urban localities differ in their creativity.
- To examine whether students of different school of class VIII of study are significantly related to creativity.

To examine whether high and low perceived school environment, mental ability and mental health of students with regard to their creativity.

III. HYPOTHESES

- 1a:** There would be significant difference with respect to fluency scores (verbal) of creativity of boys and girls.
- 1b:** There would be significant difference with respect to fluency scores (verbal) of creativity of students belonging to rural and urban localities.

1c: There would be significant difference with respect to fluency scores (verbal) of creativity of students of different school of study.

SAMPLE

SCHOOL	URBAN		SCHOOL	RURAL		
	BOYS	GIRLS		BOYS	GIRLS	
K. R. High School, Bettiah	50	50	S. Heart. High School, Banu Chhapra, Bettiah.	50	50	200
Kendriya Vidyalay , Bettiah	50	50	S. B. S. High School, Bagha	50	50	200
TOTAL	100	100		100	100	400

IV. MATERIAL AND METHODS

A bio-data sheet was prepared seeking information about the respondents' sex, locality, type of management, type of family, education and occupation of the parents etc.

CREATIVITY TEST

Creativity battery test re standardized by **Rajasekhar Reddy (2004)** was used in the study. The test is the modified version of Creativity test developed and standardized by **Venkatarami Reddy in 1982**. The battery of creativity tests used consisted of 10 subtests. Seven of them were verbal tests while the remaining three were nonverbal tests. The present study is focused on the study of the mental health, mental ability and school environment on Creativity. The major hypotheses in the study were concerning the influence of gender (boys and girls), locality of residence (rural and urban) and Class of study (8th, 9th and 10th class) on creativity. An attempt was made to ascertain whether the differences in gender, locality and class of study were any significant relationship with the creativity of the subjects. The fluency flexibility and originality and composite creativity scores of the subjects were analyzed separately for verbal tests and nonverbal tests and also for the total of verbal and nonverbal tests, applying analysis of variance of 2X2X3 factorial design.

VERBAL TESTS

Table -2: Mean and SDs Fluency Scores of different subgroups

Category		N	Mean	SD
Gender	Boys	300	103.02	16.55
	Girls	300	92.98	14.46
Locality	Rural	300	99.45	15.09
	Urban	300	100.55	17.45
Class of Study	VIII	200	92.75	17.30
	IX	200	95.96	16.69
	X	200	98.75	17.30

Table two shows the mean fluency scores and SDs of different sub groups of the subjects on the verbal tests it could be seen from the table that the mean scores of the boys was 103.02 while that of girls scores was 92.98 this shows that boys scored higher than girls. It could be seen from the table that the students from urban scored better than those from rural subjects. The mean scores of urban students were 100.55, while that of rural students was 95.45. When the students were classified according to class of study which they belonged, it was found that the mean score of the students of 8th class was the least, while students of 10th class scored the highest, 9th class students falling in between. The mean scores of the students of the three classes were -8th class 92.75, 9th class 95.96, and 10th class 98.75 respectively.

Table-3: Results of ANOVA of the Fluency Scores on Verbal Tests.

Source of Variance	Sum of Squares	df	Mean Sum of Squares	F
Gender(A)	15130.28	1	15130.28	67.74 **
Locality (B)	3896.40	1	3896.40	17.45 **
Class of Study (C)	2338.81	2	1169.41	5.26 *
AXB	473.48	1	473.48	2.10 @
AXC	2733.61	2	1366.81	6.19 *
BXC	7066.01	2	3533.01	15.81 **
AXBXC	213.61	2	106.81	0.47 @
WSS	131334.78	588	223.36	
Total	163186.99	599		

** Significant at 0.01 level * Significant at 0.05 level @ Not Significant

To examine whether there was any significant between creativity of the students belonging to different gender, localities and class of study, and to probe into the effect of the interaction between different variables, the creativity scores of different sub groups of subjects analyzed using analysis of variance and the results obtained are shown in table 3.

V. RESULTS AND DISCUSSION

Hypothesis -1a

There would be significant difference with respect to fluency scores (verbal) of creativity of boys and girls.

The hypothesis 1a stated that there would be significant difference with respect to fluency scores (verbal) of creativity of boys and girls. It could be seen from the table the F value for gender was 67.72, which was significant at 0.01 level. This shows that there was significant difference between the mean fluency scores of boys and girls as measured by verbal tests. The mean scores of boys and girls presented in table II shows that boys

was higher than girls. The results are corroborated with the earlier findings of Kelly, 1965; Middents, 1968; Raina, 1970; Goyal, 1973; Narayana, 1981; Venkat Rama Reddy and Bala Krishna Reddy, 1984; Chandrakant, 1987; Tegano and Moran, 1989; Singh, 1991; Yang and Ching, 2004; Naderi, 2008; Saima Siddiqi, 2011; Smritikana Mitra, 2013 who also found that boys performed better than girls. Based on the results obtained, the first hypothesis stating that there would be significant difference with respect to fluency scores (verbal) of creativity of boys and girls is accepted.

Social norms, traditions, customs, family structure, rearing practices etc., the movements of adolescent; girls especially are restricted and their activities are

closely supervised not only by parents and caretakers but also by neighbors in the close communities. Their thinking is guided so as to conform to the social norms and the activities also restricted which sets limits to their creativity, unlike the case of boys.

Hypothesis -1b

There would be significant difference with respect to fluency scores (verbal) of creativity of students belonging to rural and urban localities.

The hypothesis 1b predicted that there would be significant difference with respect to fluency scores (verbal) of creativity of students belonging to rural and urban localities. The F value for locality was 17.45, which was significant at 0.01 level, indicating a significant difference between rural and urban subjects. The mean score of the subjects belonging to urban was 100.05 while those hailing from rural localities scored 95.45. This shows urban subjects were more creative than rural children as measured by the fluency component of verbal tests. Urban environment is more stimulating and conducive for the development of creativity. Passi, 1972; Singh, 1977; Srivatsava, 1981; Agarwal and Gupta, 1982; Venkatrami Reddy and Bala Krishna Reddy, 1984; Singh and Singh, 1984; Marsh, 1985; Mishra, 2000; Muhammad Nadeem Anwar et al 2012; Bashir and Hussain, 2012 also found that urban students are more creative compared to those hailing from rural areas. The results of the present study are in line with these findings. Based on the results obtained the hypothesis 1b stating that there would be significant difference with respect to fluency scores (verbal) of creativity of students belonging to rural and urban localities is accepted as warranted by the results.

Over the past few decades Indian society is influenced by Western culture, the society is fast getting modernized. Participation in socio cultural aspects, innovative curriculum, stimulated school environment, interaction with public, life style,

facilities available, opportunities, exposure etc., fortunately will be more in urban life than rural. This explains the development of creative thinking between rural and urban students.

Hypothesis -1c

There would be significant difference with respect to fluency scores (verbal) of creativity of students of different class of study.

The hypothesis 1c predicted that there would be significant difference with respect to fluency scores (verbal) of creativity of students of different class of study. The F value of 5.26 was significant at 0.05 level. This shows that there was significant difference between the creativity of the students belonging to different class of study. The obtained mean of 8th class, 9th class and 10th classes were 92.75, 95.96 and 98.75. Each group differs significantly from the others. 8th class students scored the least, while the students of 10th class scored somewhat highest than 9th class students and the 9th students falling in between 8th and 10th class students. The results are corroborated with the earlier findings of Piers, Daniels and Quackenbush, 1960; Iscoe and Pierce, 1963; Olshin, 1965; Ogletree, 1971; Ahmrf, 1980; Dharmangadan, 1981; Passi, 1982; Venkat Rami Reddy and Salina 1988; Sudhakar Reddy, 1989; also found a significant and positive relationship between age and level of education and the creativity of the students.

According to Torrance (1962) creativity gets hampered whenever there is stress on the child. The stress may be in the form of adjusting to new environment, transition from one school to another and one society to another. Up to secondary school final examination (10th class) students are promoted to higher classes based on their attendance. But at SSC level there is pressure on the child to achieve better academic grade points. This pressure on studies promotes achievement, naturally curbs creative thinking. The same findings were observed in the present

investigation. The F value of 2.10 for gender and locality interaction, which was not significant, indicates that the effect of sex was independent of the locality to which students belonged and vice versa. The F value 6.19 for gender and class of study interaction, which was significant at 0.05 level, indicates that the effect of sex was not independent of the class to which the students belonged, and vice versa. The obtained mean values also clearly indicating the significant difference between the variables. The F value of 15.81 for locality and class of study interaction was significant at 0.01 level. This indicates that the effect of both variables on each other. The F value of the three-factor interaction (GXLXC) was 0.47, which is not significant, indicating that the effect of any two variables taken at a time was independent of the level of the third variable.

VI. CONCLUSION

Creativity is the act or ability to create something new through imaginative skills. It is a mental process involving the generation of new ideas. Creativity is finding concepts or association between existing and new concepts or rearranging what is known in order to find out what is not known. Hence, creativity has become a chief psychosocial motif of the 20th century. Creativity is more than a word today. It is an incantation. It is a kind of psychic wonder. Creative talent makes history through reshaping man's world.

There is significant difference between the creativity of boys and girls as measured by the verbal and non-verbal tests. Boys scored significantly better than Girls. This was true for all the components of creativity- fluency, flexibility, originality and composite creativity score.

With regard to the variable, class of study; there was a significant difference between the creativity of the children belonging to different class of study as measured by the verbal and non- verbal tests. X class

students scored better than VIII and IX class students, VIII class students secured low creativity scores and IX class students are in between. In case of the creativity- fluency, flexibility, originality and composite creativity score.

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Cite this article as :

Ashok Kumar Mishra, Dr. Arun Kumar Ray, Dr. Raman Kumar, "Study of Creativity Among Boys and Girls of Secondary School", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 449-454, January-February 2022.

Journal URL : <https://ijsrst.com/IJSRST229526>

Predictive Modeling using Machine Learning and Pattern Classification Approaches for Health Care – A Review

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ABSTRACT

Predictive modeling is the general concept of building a model that is capable of making predictions. Typically, such a model includes a machine learning algorithm that learns certain properties from a training dataset in order to make those predictions. Predictive modeling can be divided further into two sub areas: Regression and pattern classification. Regression models are based on the analysis of relationships between variables and trends in order to make predictions about continuous variables, e.g., the prediction of the maximum temperature for the upcoming days in weather forecasting. In contrast to regression models, the task of pattern classification is to assign discrete class labels to particular observations as outcomes of a prediction.

Keywords: Predictive modeling, Regression and pattern classification. Regression models

Article Info

Volume 9, Issue 1

Page Number : 178-182

Publication Issue

January-February-2022

Article History

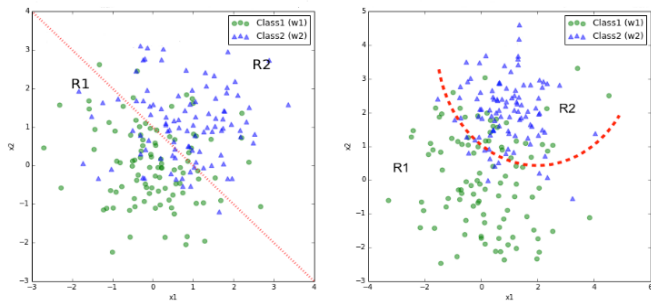
Accepted : 25 Jan 2022

Published : 03 Feb 2022

I. INTRODUCTION

Pattern classification tasks can be grouped into two main sub-categories: Supervised and unsupervised learning. In supervised learning, the class labels in the dataset, which is used to build the classification model, are known. For example, a dataset for spam filtering would contain spam messages as well as “ham” (= not-spam) messages. In a supervised learning problem, we would know which message in the training set is spam or ham, and we’d use this information to train our model in order to classify new unseen messages. To go back to the above example: A pattern classification task in weather forecasting could be the

prediction of a sunny, rainy, or snowy day. To not get lost in all possibilities, the main focus of this article will be on “pattern classification”, the general approach of assigning predefined class labels to particular instances in order to group them into discrete categories. The term “instance” is synonymous to “observation” or “sample” and describes an “object” that consists of one or multiple features (synonymous to “attributes”).



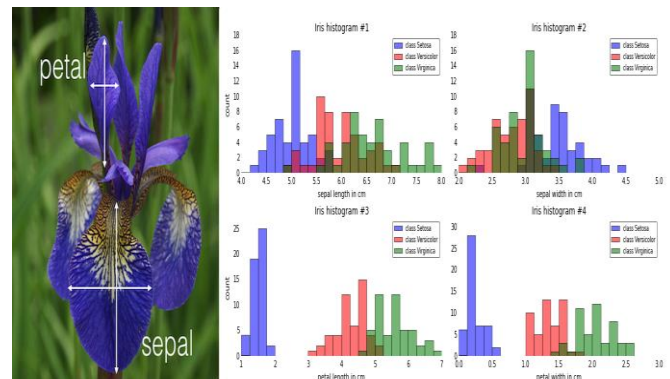
The figure above shows an exemplary classification task for samples with two random variables; the training data (with class labels) are shown in the scatter plots. The red-dotted lines symbolize linear (left) or quadratic (right) decision boundaries that are used to define the decision regions R1 and R2. New observations will be assigned the class labels “w1” or “w2” depending on in which decision region they will fall into. We can already assume that our classification of unseen instances won’t be “perfect” and some percentage samples will likely be mis-classified.

The respective IPython notebooks can be found in the “Statistical Pattern Classification Examples” section in my pattern classification repository if you are interested in how the decision boundaries were computed.

In contrast, unsupervised learning task deal with unlabeled instances, and the classes have to be inferred from the unstructured dataset. Typically, unsupervised learning employs a clustering technique in order to group the unlabeled samples based on certain similarity (or distance) measures. A third class of learning algorithms is described by the term “reinforcement learning”. Here, the model is learned from a series of actions by maximizing a “reward function”. The reward function can either be maximized by penalizing “bad actions” and/or rewarding “good actions”. A popular example of reinforcement learning would be the training of self-driving car using feedback from the environment. Recently, I stumbled across another nice example of reinforcement learning where the game Flappy Bird” has been trained to play itself.

II. SUPERVISED LEARNING

As of today, the famous “Iris” flower dataset is probably one of the most commonly used examples when it comes to introducing various concepts in the field of “data science”. The Iris dataset was created and used by R. A. Fisher in context of his discriminant analysis in 1936, and it is freely available at the UCI machine learning repository.



Here, it serves as a perfect example of a supervised classification task, where the class labels are the three flower species: Setosa, Virginica, and Versicolor. And every of the 150 instances (individual flowers) consists of four features:

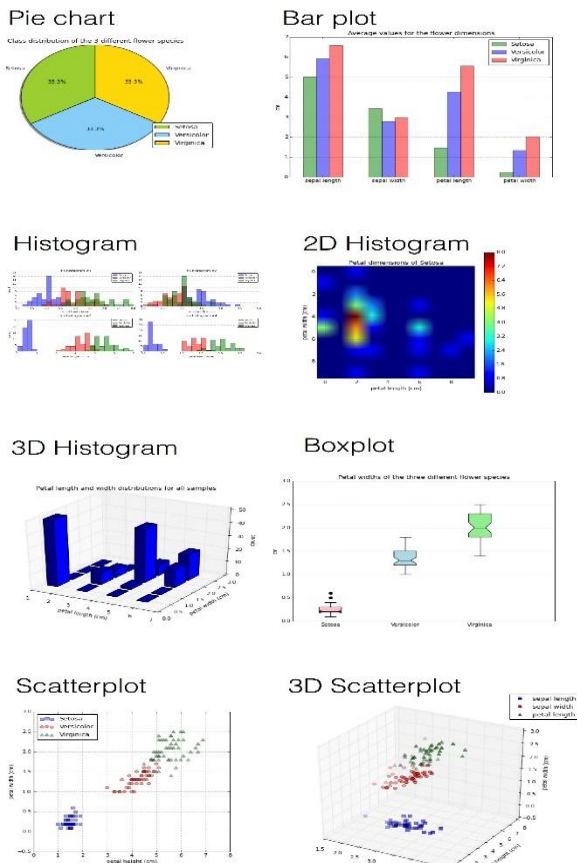
- Sepal width
 - Sepal length
 - Petal width
 - Petal height
- (all measured in centimeters).

VISUALIZATION

When we are dealing with a new dataset, it is often useful to employ simple visualization techniques for explanatory data analysis, since the human eye is very powerful at discovering patterns. However, sometimes we have to deal with data that consists of more than three dimensions and cannot be captured in a single plot:

One way to overcome such limitations could be to break down the attribute set into pairs and create a scatter plot matrix. In practice, the choice of a “good and useful” visualization technique highly depends on the type of data, the dimensionality of the feature space, and the question at hand.

Below are just a few examples of more or less useful visualizations of the Iris dataset.



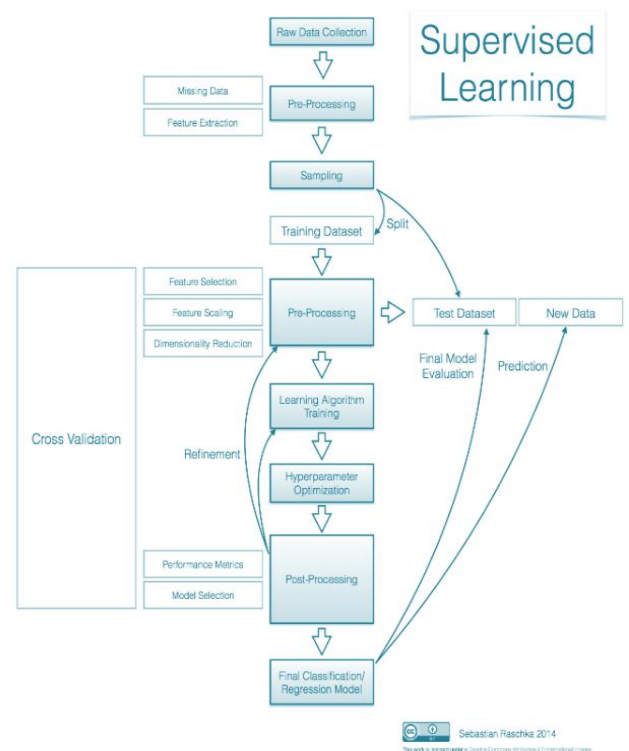
The code that was used to create these plots can be found in the IPython notebook [Matplotlib examples

Visualization techniques for exploratory data analysis](https://github.com/rasbt/pattern_classification/blob/master/data_viz/matplotlib_viz_gallery.ipynb). Looking at those plots above, the scatter plots and (1D) histograms in particular, we can already see that the petal dimensions contain more discriminatory information than the sepal widths and lengths based on the smaller overlap between the three different

flower classes. This information could, for example, be used for feature selection in order to remove noise and reduce the size of our dataset.

III. PROPOSED METHODOLOGY

In the following section, we will have a look at some of the main steps of a typical supervised learning task, and the diagram below should give us an intuitive understanding of how they are connected.



Raw data collection and feature extraction

When we’d download the Iris dataset, we noticed that it is already in “good shape”, and it seems that R. A. Fisher has already done some initial “pre-processing” for us: No missing data and numeric features that can be used by a learning algorithm. However, let us assume that the raw data of the Iris dataset consisted of a series of images. In this case, a first pre-processing step (feature extraction) could involve the scaling, translation, and rotation of those images in order to

obtain the dimensions of the sepals and petals in centimeters.

Occlusion of the leaves could be a problem that might lead to missing data: Many machine learning algorithms won't work correctly if data is missing in a dataset so that "ignoring" missing data might not be an option. If the sparsity (i.e., the amount of empty cells in the dataset) is not too high, it is often recommended to remove either the samples rows that contain missing values, or the attribute columns for which data is missing. Another strategy for dealing with missing data would be imputation: Replacement of missing values using certain statistics rather than complete removal. For categorical data, the missing value can be interpolated from the most frequent category, and the sample average can be used to interpolate missing values for numerical attributes. In general, resubstitution via k-nearest neighbor imputation is considered to be superior over resubstitution of missing data by the overall sample mean. Other interesting approaches that are related to feature extraction could include the aggregation of petal and sepal measurements, e.g., ratios between petal or sepal widths and heights.

Sampling

Assuming that we extracted certain features (here: sepal widths, sepal lengths, petal widths, and petal lengths) from our raw data, we would now randomly split our dataset into a training and a test dataset. The training dataset will be used to train the model, and the purpose of the test dataset is to evaluate the performance of the final model at the very end.

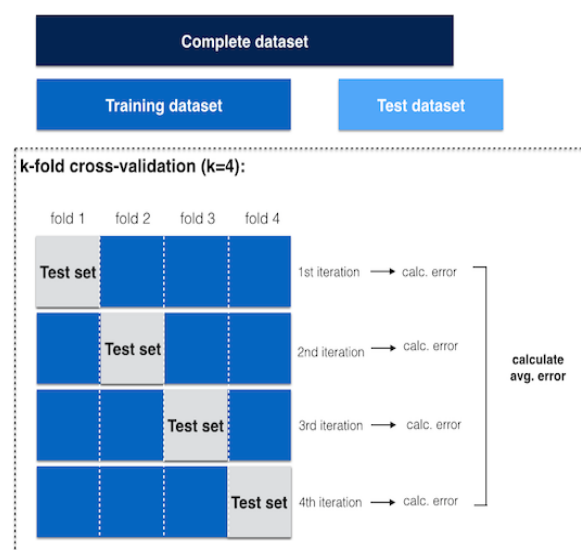
It is important that we use the test dataset only once in order to avoid overfitting when we compute the prediction-error metrics. Overfitting leads to classifiers that perform well on training data but do not generalize well so that the prediction-error on novel patterns is relatively high. Thus, techniques

such as cross-validation are used in the model creation and refinement steps to evaluate the classification performance. An alternative strategy to re-use a test dataset for the model evaluation would be to create a third dataset, the so-called validation dataset.

Cross-Validation

Cross-validation is one of the most useful techniques to evaluate different combinations of feature selection, dimensionality reduction, and learning algorithms. There are multiple flavors of cross-validation, and the most common one would probably be k-fold cross-validation.

In k-fold cross-validation, the original training dataset is split into k different subsets (the so-called "folds") where 1 fold is retained as test set, and the other $k-1$ folds are used for training the model. E.g., if we set k equal to 4 (i.e., 4 folds), 3 different subsets of the original training set would be used to train the model, and the 4th fold would be used for evaluation. After 4 iteration, we can eventually calculate the average error rate (and standard deviation) of the model, which gives us an idea of how well our model generalizes.



Normalization

Normalization and other feature scaling techniques are often mandatory in order to make comparisons between different attributes (e.g., to compute distances or similarities in cluster analysis), especially, if the attributes were measured on different scales (e.g., temperatures in Kelvin and Celsius); proper scaling of features is a requirement for most machine learning algorithms.

The term “normalization” is often used synonymous to “Min-Max scaling”: The scaling of attributes in a certain range, e.g., 0 to 1.

$$X_{norm} = \frac{X - X_{min}}{X_{max} - X_{min}}$$

Another common approach is the process of (z-score) “standardization” or “scaling to unit-variance”: Every sample is subtracted by the attribute’s mean and divided by the standard deviation so that the attribute will have the properties of a standard normal distribution ($\mu=0$, $\sigma=1$).

$$z = \frac{x - \mu}{\sigma}$$

One important point that we have to keep in mind is that if we used any normalization or transformation technique on our training dataset, we’d have to use the same parameters on the test dataset and new unseen data.

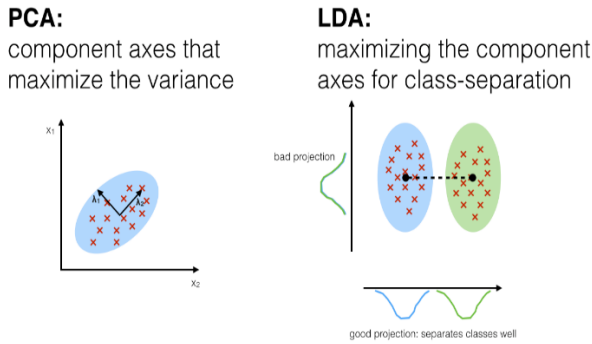
Feature Selection and Dimensionality Reduction

Distinguishing between feature selection and dimensionality reduction might seem counter-intuitive at first, since feature selection will eventually lead (reduce dimensionality) to a smaller feature space.

In practice, the key difference between the terms “feature selection” and “dimensionality reduction” is that in feature selection, we keep the “original feature axis”, whereas dimensionality reduction usually involves a transformation technique.

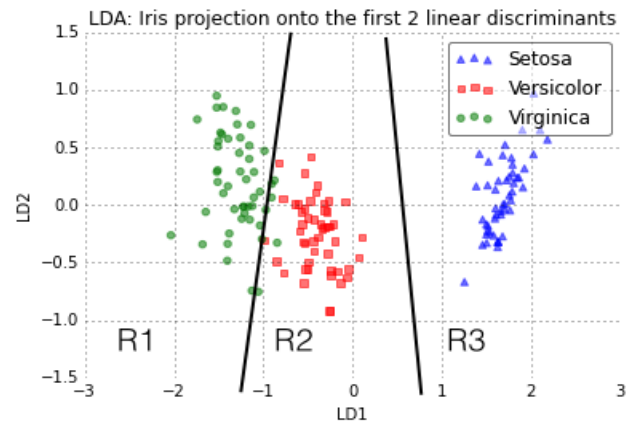
The main purpose of those two approaches is to remove noise, increase computational efficiency by retaining only “useful” (discriminatory) information, and to avoid overfitting (“curse of dimensionality”).

In feature selection, we are interested in retaining only those features that are “meaningful” - features that can help to build a “good” classifier. For example, if we’d have a whole bunch of attributes that describe our Iris flowers (color, height, etc.), feature selection could involve the reduction of the available data to the 4 measurements that describe the petal and sepal dimensions. Or, if we’d start with those 4 attributes (sepal and petal lengths and widths), we could further narrow down our selection to petal lengths and widths and thereby reduce our feature space from 4 to 2 dimensions. Feature selection is often based on domain knowledge (note that it is always helpful to consult a domain expert) or exploratory analyses, such as histograms or scatterplots as we have seen earlier. Finding the feature subset of a certain size that optimizes the performance of a classification model would require an exhaustive search - the sampling of all possible combinations. In practice, this approach might not be feasible because of computational limitations so that sequential feature selection (Feature Selection Algorithms in Python) or genetic algorithms are being used to select a sub-optimal feature subset.

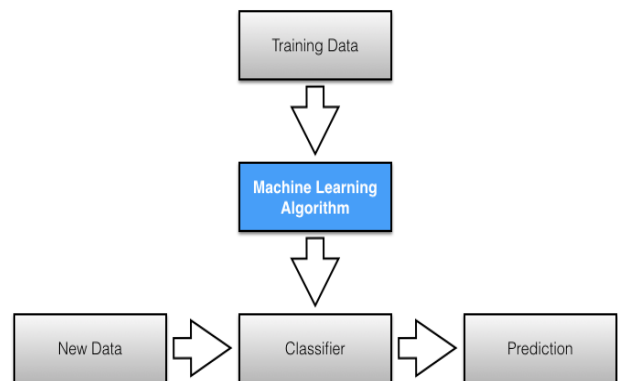
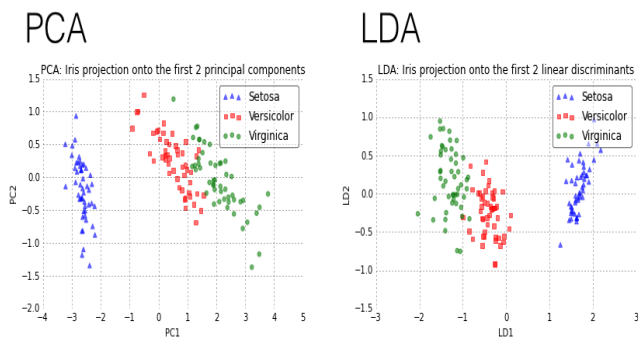


Commonly used dimensionality reduction techniques are linear transformations such as Principal Component Analyses (PCA) and Linear Discriminant Analysis (LDA). PCA can be described as an “unsupervised” algorithm, since it “ignores” class labels and its goal is to find the directions (the so-called principal components) that maximize the variance in a dataset. In contrast to PCA, LDA is “supervised” and computes the directions (“linear discriminants”) that will represent the axes that maximize the separation between multiple classes.

(R1, R2, R3). Based on these decision regions, new observations can be classified among the three different flower species: R1 → Virginica, R2 → Versicolor, and R3 → Setosa.



Learning algorithms and hyper parameter tuning



More details about PCA and LDA can be found in those two articles:

- Linear Discriminant Analysis bit by bit
- Implementing a Principal Component Analysis (PCA) in Python step by step

The image below shows the iris data plotted on a 2-dimensional feature subspace after transformation via Linear Discriminant Analysis (LDA). The black lines denote exemplary, linear decision boundaries that divide the feature space into three decision regions

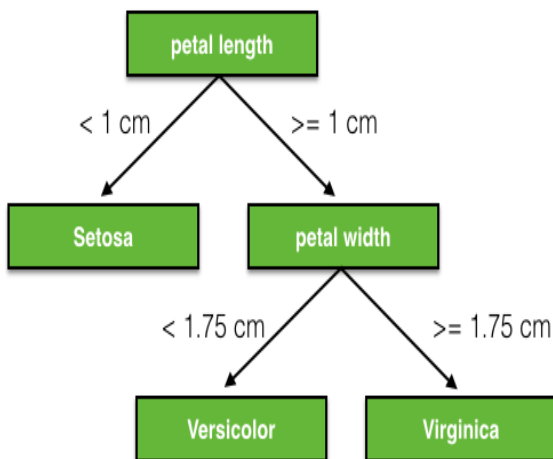
There are a enormous number of different learning algorithms, and the details about the most popular ones are perfect topics for separate articles and applications. Here is just a very brief summary of four commonly used supervised learning algorithms:

- A **Support Vector Machine (SVM)** is a classification method that samples hyperplanes which separate between two or multiple classes. Eventually, the hyperplane with the highest margin is retained, where “margin” is defined as the minimum distance from sample points to the hyperplane. The

sample point(s) that form margin are called support vectors and establish the final SVM model.

- **Bayes classifiers** are based on a statistical model (i.e., Bayes theorem: calculating posterior probabilities based on the prior probability and the so-called likelihood). A Naive Bayes classifier assumes that all attributes are conditionally independent, thereby, computing the likelihood is simplified to the product of the conditional probabilities of observing individual attributes given a particular class label.
- **Artificial Neural Networks (ANN)** are graph-like classifiers that mimic the structure of a human or animal “brain” where the interconnected nodes represent the neurons.
- **Decision tree classifiers** are tree like graphs, where nodes in the graph test certain conditions on a particular set of features, and branches split the decision towards the leaf nodes. Leaves represent lowest level in the graph and determine the class labels. Optimal tree are trained by minimizing Gini impurity, or maximizing information gain.

A very simple decision tree for the iris dataset could be drawn like this:



Hyperparameters are the parameters of a classifier or estimator that are not directly learned in the machine learning step from the training data but are optimized separately. The goals of hyperparameter optimization are to improve the performance of a classifier and to achieve good generalization of a learning algorithm. A popular method for hyperparameter optimization is Grid Search. Typically, Grid Search is implemented as an exhaustive search (in contrast to randomized parameter optimization) of candidate parameter values. After all possible parameter combination for a model are evaluated, the best combination will be retained.

Prediction-error metrics and model selection

A convenient tool for performance evaluation is the so-called confusion matrix, which is a square matrix that consists of columns and rows that list the number of instances as “actual class” vs. “predicted class” ratios.

A confusion matrix for a simple “spam vs. ham” classification could look like:

		predicted class	
		Spam	Ham
true class	Spam	True Positive (TP)	False Negative (FN)
	Ham	False Positive (FP)	True Negative (TN)

		predicted class	
		Spam	Ham
true class	Spam	100	50
	Ham	10	800

Often, the prediction “accuracy” or “error” is used to report classification performance. Accuracy is defined as the fraction of correct classifications out of the total number of samples; it is often used synonymous to specificity/precision although it is calculated differently. Accuracy is calculated as

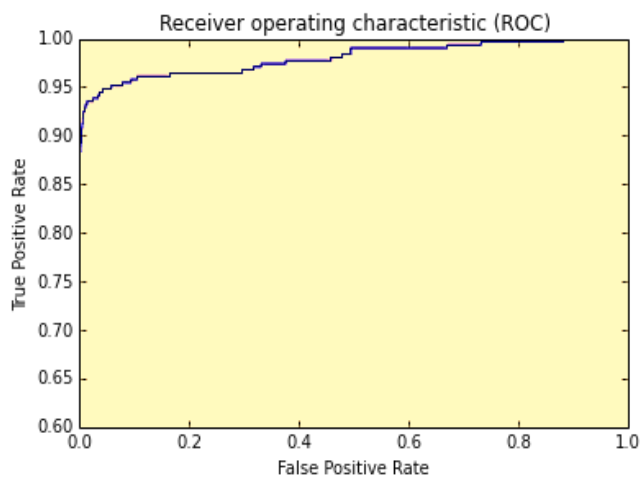
$$\frac{TP + TN}{P + N}$$

where TP=True Positives, TN=True Negatives, P=Positives, N=Negatives.

The empirical error of a classification model can be calculated by 1-Accuracy.

However, the choice of an appropriate prediction-error metric is highly task-specific. In context of an “email spam” classification, we would especially be interested in a low false positive rate. Of course, a spam email that was classified as ham is certainly annoying, but not as bad as missing any important information by mis-classifying “ham” as “spam”.

One convenient way to tweak a classifier in context of a binary classification problem such as “spam” classification is the Receiver Operating Characteristic (ROC, or ROC curve).



Other indicators for classification performances are **Sensitivity**, **Specificity**, **Recall**, and **Precision**.

Sensitivity (synonymous to recall) and precision are assessing the “True Positive Rate” for a binary classification problem: The probability to make a correct prediction for a “positive/true” case (e.g., in an attempt to predict a disease, the disease is correctly predicted for a patient who truly has this disease).

$$Sensitivity = \frac{TP}{TP + FN}$$

$$Precision = \frac{TP}{TP + FP}$$

Specificity describes the “True Negative Rate” for a binary classification problem: The probability to make a correct prediction for a “false/negative” case (e.g., in an attempt to predict a disease, no disease is predicted for a healthy patient).

$$Specificity = \frac{TN}{TN + FP}$$

In a typical supervised learning workflow, we would evaluate various different combinations of feature subspaces, learning algorithms, and hyperparameters before we select the model that has a satisfactory performance. As mentioned above, cross-validation is a good way for such an assessment in order to avoid overfitting to our training data

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Cite this article as :

Dr. Rabindranath S, Dr. Doddegowda B J, Vasanth C Bhagawat, "Predictive Modeling using Machine Learning and Pattern Classification Approaches for Health Care - A Review", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 455-463, January-February 2022. Journal URL : <https://ijsrst.com/IJSRST229532>

Naïve method of identification of COVID-19 Infection using X-Ray Image

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Article Info

January-February-2022

Page Number : 464-474

Publication Issue :

Volume 9, Issue 1

Article History

Accepted : 01 January 2022

Published : 28 February 2022

Abstract – It is anticipated that severe pneumonia due to the COVID-19 would significantly impact medical services. Accurate diagnosis is crucial to reducing stress on the healthcare system. Imaging techniques such as chest X-rays and CT scans are often used to diagnose pneumonia. Despite CT scan being the gold standard, CXRs are still useful because they are more widespread, faster, and cheaper. This study aims to determine whether or not CXR images alone are sufficient for differentiating COVID-19 pneumonia from other types of pneumonia and healthy lungs. COVID-19, short for Novel Coronavirus Disease, is the name given to the virus that was identified late in 2019 in China and is considered exceedingly infectious. SARS-CoV-2 is a coronavirus, like many others, that may cause serious sickness. The sickness emerged in Wuhan, China, in December of 2019 and has since spread to more than 213 nations. People infected with COVID-19 often have a high body temperature, dry cough, and acute weariness. A multiclass and a hierarchical pneumonia classification were considered in developing our classification method. Because of the uneven data distribution in this region, we also suggested including resampling methods into the schema to re-balance the classes. Our results indicate that texture is one of the key visual elements of CXR photos, and our classification schema extracts features using a pre-trained CNN model and a set of well-known texture descriptors. We also explored early and late fusion techniques inside the schema to take advantage of the capabilities of many texture descriptors and base classifiers concurrently.

Keywords – COVID-19 Infection, X-Ray Image, COVIDX-Net, MobileNetV2, Xception, InceptionV3, ResNetV2, DenseNet121, VGG19

I. INTRODUCTION

Few in the contemporary period foresaw the outbreak of pneumonia produced by the coronavirus that causes severe acute respiratory syndrome (SARS CoV-2) or coronavirus illness 2019, which began at year's end (COVID-19). Medical professionals worldwide struggle to keep up with the fast global spread of the COVID-19 pandemic. The disease was first detected in Wuhan, China, but has now spread to every continent. Due to the time required for diagnosis and the high cost of test kits, deep learning and artificial intelligence research and apps

have been developed to help doctors treat patients battling illnesses. There is a substantial obstacle to success presented by the high cost of diagnostic laboratory kits, especially in less developed countries. Using X-ray images for automatic detection might be helpful for hospitals and governments without access to a CT scanner or a laboratory kit for detecting COVID-19. A proper diagnosis is crucial since there is currently no effective therapy available. Deep learning approaches have been used for analyzing COVID-19 CXR images. In addition, we have classified the many studies in this field into three distinct

groups: COVID-19 studies in the medical field, DL works in CAD connected to COVID-19, and CAD studies related to COVID-19 via deep transfer learning. The results, proposed procedures, datasets, data preparation, and evaluation techniques have all been covered.

II. KEY DIFFERENCES

The primary goal of this machine-learning-based analysis system is to assess illness features and generate useful forecasts. Images must be preprocessed, areas of interest associated with the disease must be segmented, compelling features must be computed, and detection and classification models must be built using these features. For instance, the KNN model achieves a 96.4% accuracy in a subset of non-COVID-19 & COVID-19 situations [17]. Somewhere there's a discrepancy with this sum. Several DL models have been published to properly categorize and identify COVID-19 instances. The suggested technique uses deep learning to identify potential covids in chest X-rays. The photos are classified as either infected with COVID-19 or not infected with COVID-19 using this technique. Imaging modalities such as chest X-rays (or radiography) and chest CTs are more useful in identifying lung-related issues.

Nonetheless, a thorough chest x-ray is more cost-effective than a chest CT. Evidence of opacity on COVID-19 X-ray pictures has been found. There were individuals in one research who had ground-glass opacity on both eyes [2]. 50%-60% of children with COVID-19 had consolidation and ground-glass opacities [3]. To aid in the screening of huge quantities of radiograph images for COVID-19 suspicious patients, this essential feature may assist construct a deep learning model.

Among machine learning methods, deep learning has shown to be the most effective, and its analysis of a big dataset of chest x-rays may have a major effect on the effectiveness of the Covid-19 screening program. In this study, we used the PA projection to compare chest x-rays from patients with and without the covid-19 mutation. We will first apply data augmentation and picture cleaning before experimenting with several deep learning-based CNN models and evaluating their results. Deep learning has great promise to greatly improve the

efficiency of machine learning for automated lung radiology interpretation. Access to training and testing datasets that allow for repeatability and comparability is crucial in deep learning research. The primary goal of this machine-learning-based analysis system is to assess illness features and generate useful forecasts. Images must be preprocessed, areas of interest associated with the disease must be segmented, compelling features must be computed, and detection and classification models must be built using these features. For instance, the KNN model achieves a 96.4% accuracy in a subset of non-COVID-19 & COVID-19 situations [17].

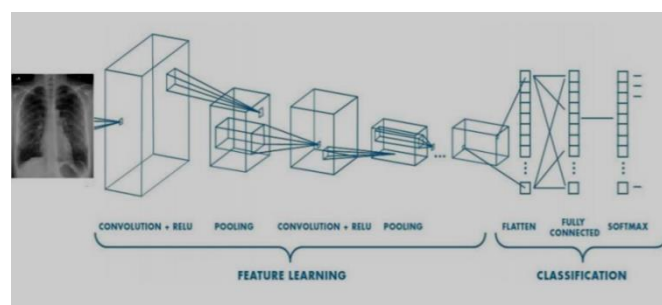


Fig. 1: System overview

The picture collection features both commonplace and unusual things including pencils, animals, buildings, textiles, and geological formations. Methods for transfer learning include keeping the last three layers (classification, completely linked, and SoftMax) frozen. Afterward, the last three layers are taught to identify brand-new data types. Positive outcomes from using pretrained models have been seen, with some cases yielding results on par with seasoned radiologists [11].

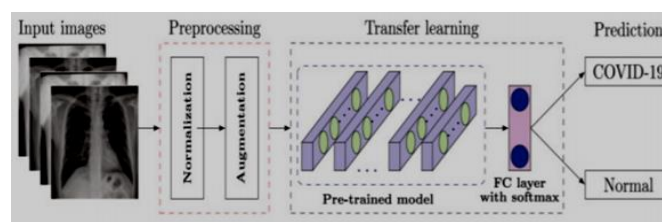


Fig. 2: Transfer Learning

High-quality input data is essential for successful deep learning. Garbage in, and garbage out is a valid maxim for deep learning, including lung radiography deep learning. Research has shown that internal and external variables contribute to radiologists' interpretation mistakes [12].

Some instances of the former are scan, recognition, judgment, and cognitive mistakes, while others include fatigue, overwork, and distraction.

Recently, a dataset [4] of radiologist-judged labels for lung X-ray 14 was developed [11]. These labels are exceptional because they required the review of a panel of doctors who specialize in radiology and have at least three years of experience in general radiology. Using a previously established pre-trained model that was retrained using adjudicated data to recognize images with airspace opacity, a COVID-19 abnormality, this study aims to construct a deep learning model for COVID-19 case prediction in light of the recent discovery of equivocation as a significant feature in COVID-19 patients.



Fig. 3: Step-by-step walkthrough of the solution

III. STEP-BY-STEP WALKTHROUGH OF THE SOLUTION

The steps that are followed are as follows:

- This research obtained chest X-ray pictures of Covid-19 patients, healthy people, and pneumonia patients from the Kaggle repository. We gathered data from 21,025 chest X-rays to build and test our model. Fig. 1. a and 1. b show two examples of chest X-rays taken from different patients. Model building and hyperparameter tuning were done using a 2000 chest X-ray images dataset. In other words, the patient population in the training and test sets were completely separate.
- Image inputs should be resized to fit the size of the input layer of the pre-trained network. Figure 3(a) and 3(b) are examples of Covid x-ray pictures (b).
- You'll need a large amount of data to achieve trustworthy findings from a deep-learning approach. Although, it's safe to assume that there isn't enough information to solve any issue. Particularly when it comes to matters of health, data collection may be a costly and time-consuming endeavor. These problems may be addressed using augmented

methods. By augmenting, we can fix the overfitting issue and make the suggested model more precise.

- Modify the network design by exchanging the average pooling, fully-connected layer, and softmax layers of the pre-trained network with a classification output to determine the likelihood of COVID-19 and the regular class.
- Instruct the System.
- Please use the testing dataset to evaluate the classifiers. A collection of chest X-ray images was employed with models InceptionV3, Resnet-50, and VGG-16.
- The model's performance may be analyzed by plotting accuracy and loss with time.
- The task is to create a user interface to identify covid in a radiographic picture.

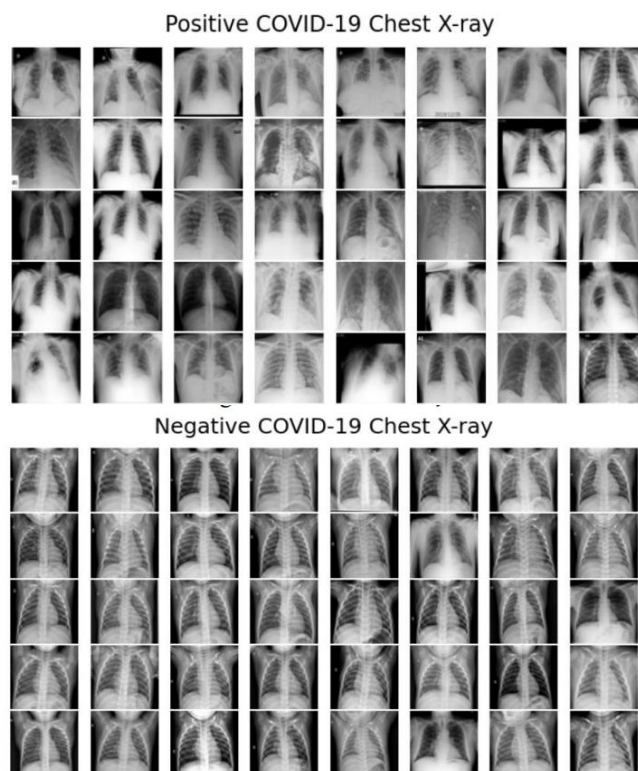


Fig. 4: Covid Positive and Normal Chest Image

IV. MODEL AND MODEL EVALUATION

A. VGG16

Deep Convolutional Networks for Large-Scale Image Recognition, written by Karen Simonyan and Andrew

Zisserman, is credited as the first publication of VGG models. Compared to VGG99's 19 weighted layers, VGG16 only has 16. Because it is so straightforward and reminiscent of the first convolutional networks, the VGG design is widely used. The basic motivation behind VGG was adding more convolutional layers to the network to make it deeper. The small size of the convolutional windows (3x3) allowed for this. This classifier learns from the 1000 labeled images in the ImageNet database. However, we can only utilize two categories since we're only interested in classifying Covid and Normal X-ray pictures. Easily import only the convolutional part of VGG16 by setting the include_top parameter to False.

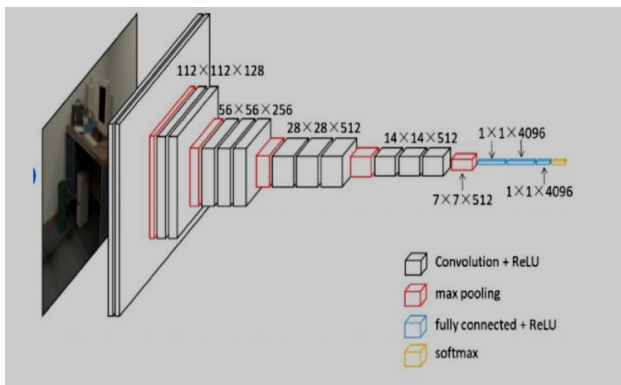


Fig. 5: The classifier

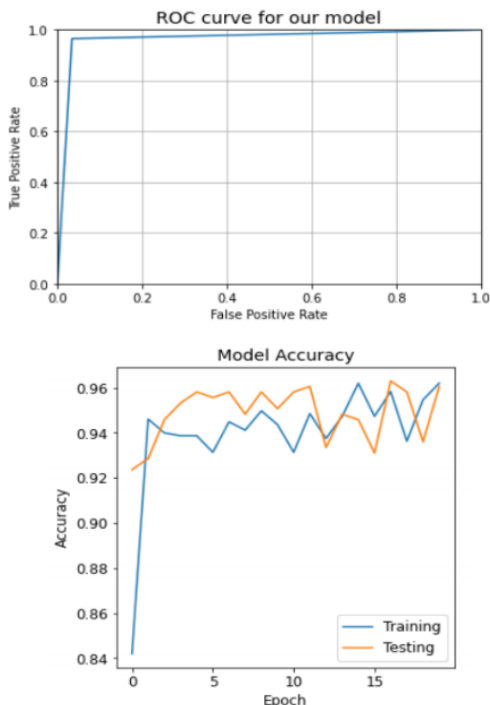


Fig. 6: Epochs and Accuracy

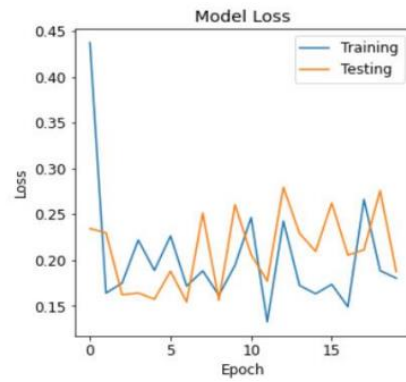


Fig. 7: Loss vs. Epochs (VGG16)

	precision	recall	f1-score	support
0	0.97	0.97	0.97	203
1	0.97	0.97	0.97	203
accuracy			0.97	406
macro avg	0.97	0.97	0.97	406
weighted avg	0.97	0.97	0.97	406

Fig. 8: VGG16 Classification

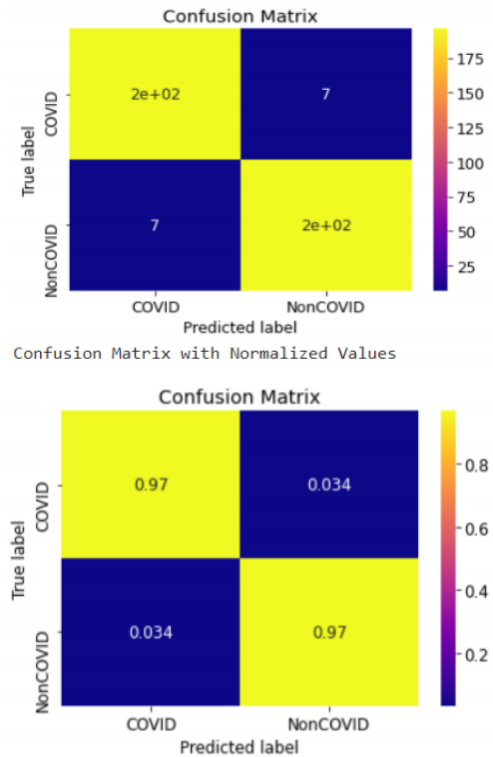


Fig. 9: Confusion Matrix

B. ResNet50

The ResNet-50 network has 50 layers of convolutional neural connections. To access a network that has already been trained on more than a million images, you may utilize the publicly available ImageNet dataset. The

network can divide a picture into one thousand categories, such as plants, electronic devices, and animals.

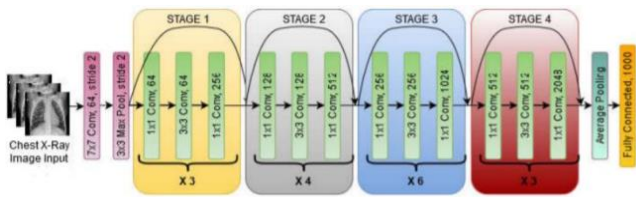


Fig. 10: Architecture of Proposed System

The ROC curve, Classification report, confusion matrix, Model Accuracy, and Model Loss plots are below.

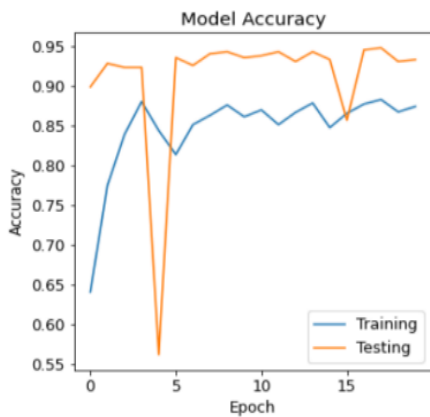
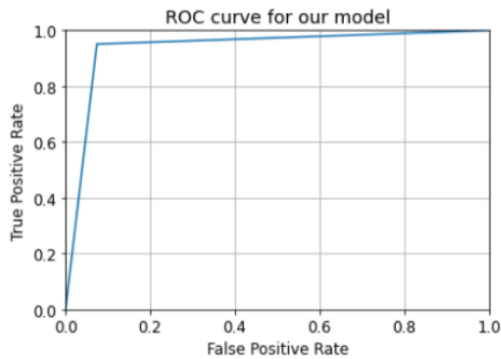


Fig. 11: Epochs ResNet50 and Accuracy

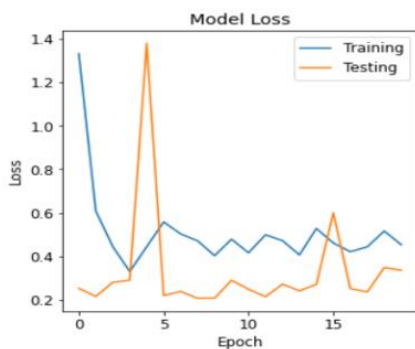
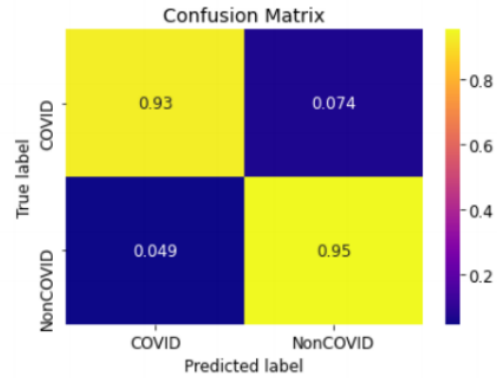


Fig. 12: Loss vs. Epochs (ResNet50)

	precision	recall	f1-score	support
0	0.95	0.93	0.94	203
1	0.93	0.95	0.94	203
accuracy			0.94	406
macro avg	0.94	0.94	0.94	406
weighted avg	0.94	0.94	0.94	406

Fig. 13: Classification Report for ResNet50

Confusion Matrix with Normalized Values



Confusion Matrix without Normalization

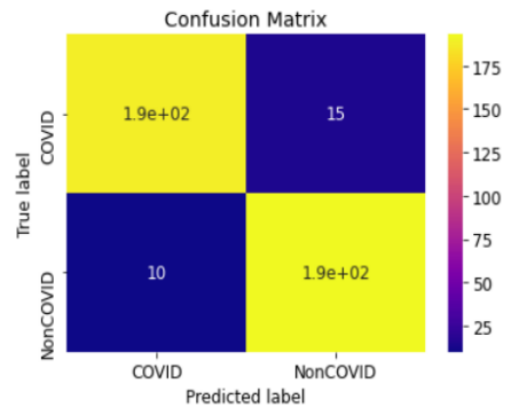


Fig. 14: Matrix

C. InceptionV3

Specifically, Inception-V3 is a 48-layer deep convolutional neural network. Using the ImageNet database, you may access a network version that has already been trained on more than a million images. Photos taken with this network may be sorted into one thousand distinct categories, such as keyboard, mouse, pencil, and animal. Therefore, the network has acquired rich feature representations for many different classes of images.

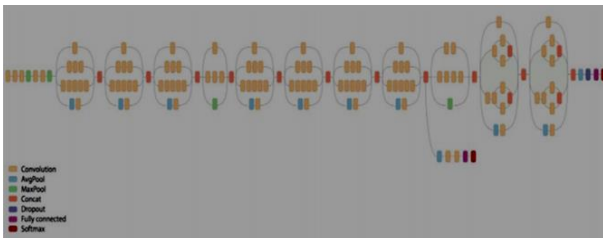


Fig. 15: Architecture

V. COMPARISON TO BENCHMARK :

Table 1: Comparison of benchmark

Model	No. of parameters	Testing Accuracy
VGG-16	20,074,562	97
ResNet50	23,788,418	94
Inception V3	23,788,418	94

As we can observe from our models' accuracies, The maximum accuracy was attained with VGG-16, followed by ResNet50 and inceptionV3.

VI. VISUALIZATION

As of late, transfer learning has been a popular deep learning technique used in a computer vision system (TL). Rather than beginning the learning process from zero, TL allows us to develop an accurate model using patterns acquired from solving diverse problems [56, 57]. Therefore, it is time-efficient and produces high-quality results even with a limited data set. There are two stages to the process of transfer learning. The initial phase of transfer learning is picking a DL model that has already been trained. We may choose from a plethora of already trained models in the literature, all of which have been trained on massive benchmark datasets and are therefore well-suited to tackle the challenge we set out to address. Keras, for instance, has a large library of pre-trained models including VGG, Inception, and ResNet. Then all that remains is to choose the one that will do the job best. The model then has to be tuned depending on the amount of our dataset and how well it matches the pre-trained model's dataset. For example, if we have a huge dataset distinct from the dataset used to train the model, we will need to retrain the whole model.

It is a common problem in ML models that they overfit. When a model memorizes the training dataset without absorbing its essential properties, trends, and limits, this phenomenon manifests itself. Then its effectiveness on

new information is compromised. On the other hand, overfitting is suspected when the model's accuracy is high for the training data but declines dramatically when presented with fresh data. Overfitting occurs in training when no data augmentation is used, as seen in Figure 3. To lessen the impact of the overfitting issue, many methods exist. Increasing the available training datasets is the first step toward a solution. Second, enriching the data with operations like picture rotation, magnification, and flipping the image horizontally or vertically is helpful.

Finally, dropout regularisation, L1 regularisation, and L2 regularisation are all viable choices. The overfitting issue may be mitigated, at last, by adopting a model with fewer layers and neurons. Normal feature extraction occurs at the convolutional layer. The flattened layer follows the convolutional base and converts the feature matrix from two dimensions to a vector. Then, we passed the result into a softmax activation layer for final classification. All of these networks use an optimizer called 'rmsprop,' an input size of (224, 224, 3), an initial learning rate of 0.001, a batch size of 32, and a total of 50 epochs. Since the result has plateaued, we have implemented the Keras callback function ReduceLROnPlateau to slow down the learning rate. The learning rate will slowly slow by a factor of 0.3. The network's overfitting issue is mitigated in part by this function. Examples of feature maps produced from the VGG network's first convolution layer are shown in Fig. 1-(c). It's proof that the TL method may be used to glean useful data from photos.

A. VGG16

In 2014, the ILSVR(Imagenet) competition was won by the VGG16 CNN architecture. It's one of the best vision model architectures out there right now. Two fully connected (FC) layers precede a softmax output layer at the end. The number 16 in VGG16 indicates the number of weighted layers it contains. This network contains a huge number of parameters—around 138 million.

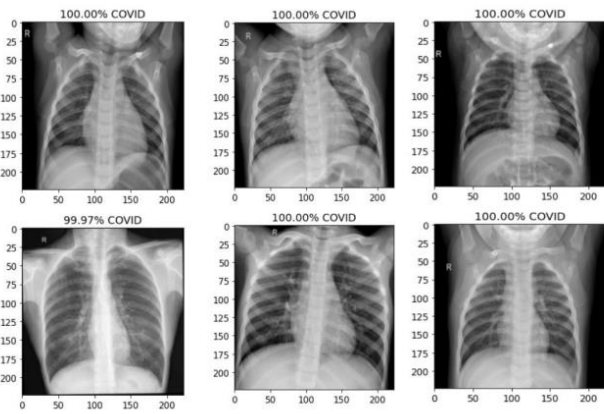


Fig. 16: Visualization by VGG16

B. ResNet50

ResNet50 has been the most interesting breakthrough in computer vision and deep learning. ResNets' design makes it possible to train extraordinarily deep neural networks with hundreds or thousands of layers while maintaining great performance. Image recognition was the original application of ResNets, but the paper suggests that the framework may be used for other, non-computer vision issues with the same results. Given that adding more layers also increases accuracy, some may wonder why we required Residual learning to train incredibly deep neural networks. It is well-known that Deep Convolutional neural networks perform very well when tasked with extracting low-, medium-, and high-level properties from images.

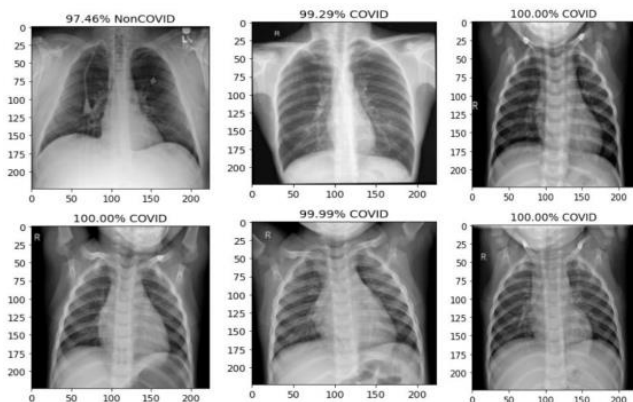


Fig. 17: Visualization by ResNet50

C. INCEPTIONV3

Similarly to how ImageNet is a library of labeled images, Inception is a tool for classifying images in the field of

computer vision. As a result of its success, the Inceptionv3 architecture has been adopted for usage in a wide variety of other projects, often pre-trained using data from ImageNet. In the field of biological sciences, for instance, it has been put to use in studies about the study of leukemia. After an online meme repeating a line from Christopher Nolan's Inception went viral, the original name was changed to this codename.

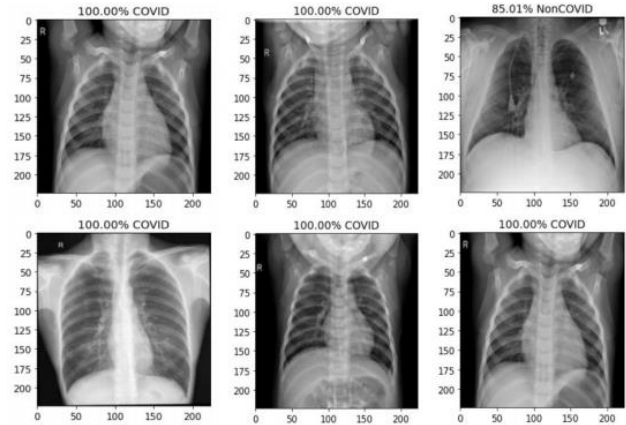


Fig. 17: Visualization by InceptionV3

VII. GUI

The VGG models' accuracy was superior to those of the ResNet and Inception models. The radiographic picture is read by a Flask-based UI, which feeds the data into a VGG Model for prediction. Based on the chosen picture, the prediction result will be a binary classification of covid/normal detection. It has Flask APIs that take in information about radiographic images through a graphical user interface (GUI) or API calls and then uses vgg to predict a value and return it. Its client-side HTML/CSS style lets consumers inspect pictorial info while away from their computer. It uses the POST method on the REST API (/detect) to deliver the picture data and then reports whether or not the covid detection was positive.

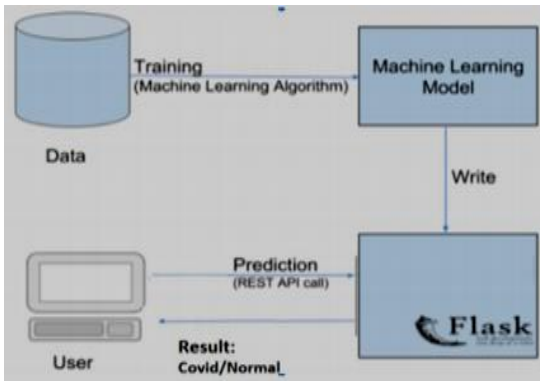


Fig. 18: Pipeline for Development of Model including UI

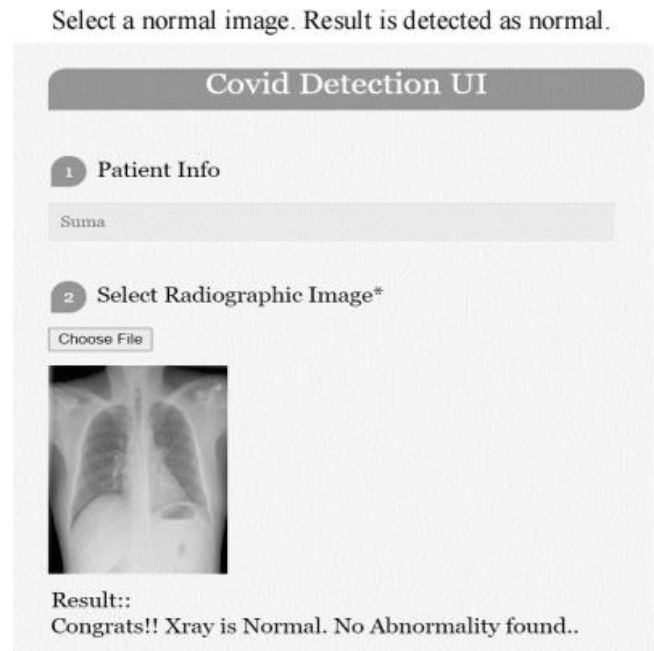


Fig. 20: Detected Result

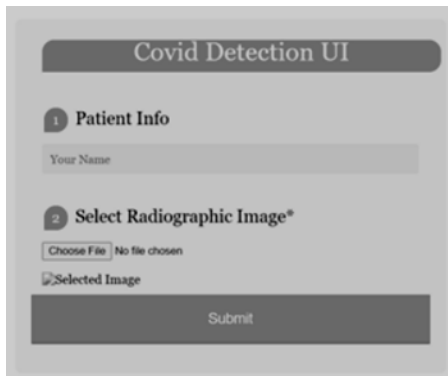
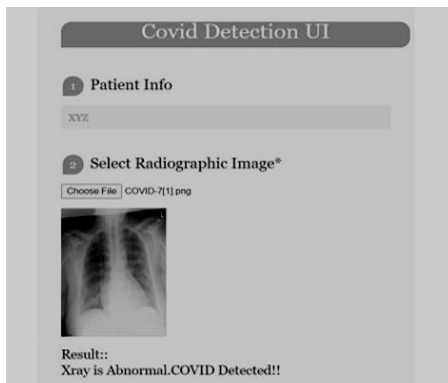


Fig. 19: Select Image from Covid Test Images



VIII. API Sample Usage

A. Covid Image

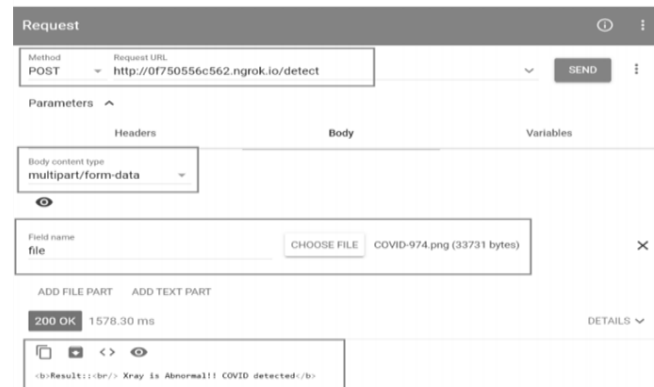


Fig. 21: Detected Covid in Result

B. Normal Image

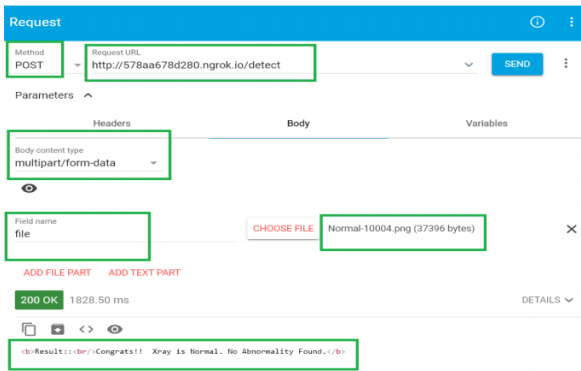


Fig. 22: Detected Normal Image in Result

C. Implications

This research presented a deep learning-based system to identify and categorize COVID-19 cases in X-ray pictures. With our model's comprehensive framework, feature extraction is unnecessary. Our approach has the potential to achieve a performance accuracy of 97%. This method may help alleviate the lack of radiologists in remote parts of COVID-19-affected nations. In the future, we want to verify our model by including more photos. This model may be saved in the cloud after it has been created to facilitate speedy diagnosis and assist in the rehabilitation of afflicted individuals. The clinical workload should be much reduced as a result of this.

Deep learning techniques need large input data before producing trustworthy outcomes. However, there is probably not enough information to solve any issue. Particularly when it comes to matters of health, data collection may be a costly and time-consuming endeavor. We hope that by utilizing more similar photographs in the future, we can strengthen our model and improve its accuracy.

IX. CONCLUSIONS AND FUTURE WORK

The COVID-19 coronavirus infection is threatening the life of billions of people because of its extremely contagious nature. According to WHO, infected people and deaths are increasing rapidly. This viral infection inflames the lungs of the infected people. Therefore, one of the possible approaches to recognize those inflames by chest x-ray. In this study, we have presented an automated CAD technique to detect COVID-19 cases

from pneumonia and healthy cases using chest x-ray images. We have utilized 15 deep transfer learning models, and the performance is evaluated using different metrics. The results confirm that the VGG series are the most suitable models for this task. Though CNN achieves maximum results in medical image analysis tasks, there is still scope for development. First, researchers can develop a partly new CNN model to analyze COVID-19 chest X-ray images by selecting the top CNN models, finding their respective advantages, and merging their best parts to enhance the final classification performance. Secondly, there is a scarcity of publicly accessible COVID-19 CXR image datasets. Therefore to develop a publicly accessible database would be beneficial for future researchers. In the prospect, we intend to develop a more efficient CNN structure to identify COVID-19 cases from CXR images. Thirdly, selecting the top CNN models and combining them with classical image features will be easier to link machine-learned knowledge and human knowledge together to obtain an even better classification performance. Fourthly, though the texture feature is a low-level feature, it is useful for adequately explaining the image content (such as in the field of fracture detection techniques in bone X-ray images [63]). Therefore, a combination of some texture descriptors such as content descriptor [64] (local binary patterns, edge detection histogram) and local density features [65] with deep learning features can lead to a superior performance of the model. Fifthly, Noise is one key factor in digital radiography responsible for degrading the model performance. Consequently, in the preprocessing step, generative adversarial network (GAN) [66, 67], non-local mean filter [68], fuzzy genetic filter [69], and robust navigation filter [70] based x-ray image denoising method can bring a significant improvement of the model performance. Finally, an application of the feature fusion (or ensemble learning) technique to the best-performing CNN models can enhance the final classification performance [71]. Here, it will be easier for the practical development of software.

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Study and Survey Available Identification technique of COVID-19 Infection using their X-Ray Image

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Article Info

January-February-2022

Page Number : 475-484

Publication Issue :

Volume 9, Issue 1

Article History

Accepted : 01 January 2022

Published : 28 February 2022

Abstract – Few in the contemporary period foresaw the outbreak of pneumonia produced by the coronavirus that causes severe acute respiratory syndrome (SARS CoV-2) or coronavirus illness 2019, which began at year's end (COVID-19). Medical professionals' worldwide struggle to keep up with the fast global spread of the COVID-19 pandemic. The disease was first detected in Wuhan, China, but has now spread to every continent. Due to the time required for diagnosis and the high cost of test kits, deep learning and artificial intelligence research and apps have been developed to help doctors treat patients battling illnesses. There is a substantial obstacle to success presented by the high cost of diagnostic laboratory kits, especially in less developed countries. Using X-ray images for automatic detection might be helpful for hospitals and governments without access to a CT scanner or a laboratory kit for detecting COVID-19. A proper diagnosis is crucial since there is currently no effective therapy available. Deep learning approaches have been used for analyzing COVID-19 CXR images. In addition, we have classified the many studies in this field into three distinct groups: COVID-19 studies in the medical field, DL works in CAD connected to COVID-19, and CAD studies related to COVID-19 via deep transfer learning. The results, proposed procedures, datasets, data preparation, and evaluation techniques have all been covered.

Keywords – COVID-19 Infection, X-Ray Image, COVIDX-Net, MobileNetV2, Xception, InceptionV3, ResNetV2, DenseNet121, VGG19

I. RELEVANT INVESTIGATIONS

For COVID-19 patients is proposed by Fang et al. [28]. Fifty-one adults (mean age 45) with recent travel or residency in Wuhan with fever or acute respiratory illness symptoms were selected for this study. Initially, the RT-PCR test for COVID-19 was positive in 36 out of 50 samples. There were 12 positive results from the second round of RT-PCR testing. Patients were positive on the third RT-PCR

test (2-5 days later), and one patient was positive on the fourth (7 days). Testing revealed that 98% of the 51 individuals had viral pneumonia by the end of the first day. Based on these findings, chest CT is preferred over RT-PCR because of its higher sensitivity (98% vs. 71%).

A study by Bernheim et al. [29] compared the results of the first chest CT scans conducted on 121 symptomatic positive COVID-19 patients according to how long it had been since the beginning of

symptoms (0-2 days for 36 patients, 3-5 days for 36 patients, and 6-12 days for 25 patients).

Analyzing data from 1014 patients in Wuhan between January 6 and February 6, the authors (Tao et al.) [11] conclude with 888 of 1014 patients testing positive for the condition. In addition, the authors analyze the time it takes for RT-PCR findings to shift from negative to positive and discover that, on average, this occurs after 6.9 2.3 days.

To evaluate the efficacy of chest CT and CXR in managing COVID-19, Rubin et al. [30] convened a multidisciplinary panel of radiologists and pulmonologists with experience treating patients with COVID-19 from 10 different countries. The author provides fourteen vital questions and eleven choice points on three tiers—risk factors, community circumstances, and resource constraints. The authors offer five primaries and three additional recommendations for using CXR and CT in the treatment of COVID-19 based on the available evidence.

II. RELATED DL WORKS IN CAD OF COVID-19

Add compiles a database of CXR pictures that researchers may use at any time. After using a pre-trained ResNet, three iterations of fine-tuning are done. Input images are continuously resized from 128 by 128, 224 by 128, and 229 by 229 during the three-stage refining process. Their proposed procedure uses six thousand and nine images (including sixty-nine COVID-19 examples). When sorting items into four distinct classes, they attained a 96.23 percent accuracy rate.

Binary categorization of CXR pictures using the Capsule Network architecture is proposed by Afshar et al. [32] to discover COVID-19 occurrences; they call it COVID-CAPS. Most (90%) of the dataset is used for training, whereas only 10% is used for

validation. The improved framework obtains a 95.7% accuracy, while the pre-trained one gets a 98.3% accuracy.

Somewhere about 13,800 CXR pictures are utilized to train the network. Three hundred and eighty-three of them have been identified as having COVID. As for how well the model performs in a three-class classification scenario, it gets 92.6% correct.

Hemdan et al. [34] propose a novel deep learning-based system, COVIDX-Net, for autonomously diagnosing COVID-19 from CXR images. The network's nodes include MobileNetV2, Xception, InceptionV3, ResNetV2, DenseNet121, VGG19, and Inception Re-convolutional Network Version 2. The suggested technique is analyzed using fifty computed tomography (CXR) images, 25 of which are positive COVID-19 images. The remaining 20% of images are used for research and analysis. Every picture has been shrunk down to a perfect 224 by 224. VGG19 and DenseNet201 have a 90% success rate.

Shetty et al. [35] suggest using deep learning to recognize COVID-19 in CXR images. The proposed method involves feeding the outputs of several CNN models into a support vector machine to perform classification. Fifty control shots and fifty COVID-19-infected photos are used in the study. We use 60% of the photos to train the model, 20% to validate it, and 20% to test it. In terms of classification accuracy, ResNet50 achieves a maximum of 95.38 percent.

This network is based on a modified version of a standard AlexNet that has already been trained. The model is based on data from 170 CXRs and 361 CT images. The whole dataset is split in half: half is used for training, while the other half is used for validation. Pre-trained networks reach 98% accuracy

in binary classification, whereas modified CNN achieves 94.11% accuracy.

Using 3905 X-Ray pictures labeled with one of six classes, Apostolopoulos et al. [37] train a state-of-the-art CNN model dubbed MobileNet. In addition, 455 COVID-19 CXR photos are included. During this processing phase, we do the augmentation work and resize the photos to 200 by 200 pixels. In binary classification tests, they attained a 99.18% success rate, whereas, in seven-class classification tasks, they only managed an accuracy of 87.66%.

If you're looking to spot COVID-19 in CXR pictures, Loey et al. [38] recommend using a Generative Adversarial Network (GAN) with deep transfer learning. Given the scarcity of available COVID-19 CXR images, they resort to GAN to create new ones. There were 307 photos gathered, split across four categories: viral pneumonia bacterial pneumonia, normal, and COVID-19. With GAN, 90% of the dataset is used for training and validation, while 10% is preserved for testing. Transfer learning is performed using a pretrained version of the AlexNet, GoogleNet, or Resnet18. On a four-class (GoogleNet) issue, they got an accuracy of 80%; on a three-class (AlexNet) problem, they got 85.3%; and on a two-class (GoogleNet) problem, they got 100%.

CXR with transfer learning, along with several deep learning models (most notably CNN), have shown good results in identifying COVID-19, as shown above. However, it is not obvious how various CNN transfer learning methods compare in terms of performance. To identify CXR COVID-19, this thesis compares the efficiency of fifteen different CNN models trained using transfer learning.

III. RELATED DEEP TRANSFER LEARNING WORKS IN CAD FIELDS

Zhang et al. [39] present a deep transfer learning-based classification strategy for dividing cervical

cells into healthy and cancerous tissue. To measure the efficacy of the suggested approach, we consider the HEMLBC private dataset and the Herlev public dataset. In the preliminary processing, they carry out patch extraction and augmentation procedures. On the Herlev and HEMLBC datasets, they both reach 98.3% accuracy.

In [40], Chen et al. provide a deep transfer learning system for identifying cervical immunohistochemistry pictures using the Inception-V3 network. In the preparation phase, the data augmentation job is done. On average, they succeed with a precision of 77.3%.

Breast histopathology photos are classified using a convolutional neural network (CNN) pre-trained on the ImageNet dataset by Song et al. [41]. The FV-encoding is used to first represent the pictures. After then, a layer of adaptation is created for fine-tuning. In the end, with just 30% of the data being tested, an accuracy of 87% was achieved.

To differentiate COVID-19 CXR photographs from regular CXR shots, Zhang et al. propose a deep learning approach [43]. The core of the network is a pretrained ResNet. For training, 50 out of 100 COVID-19 and 1430 Normal CXR pictures are used, while the remaining images are used for testing. In terms of COVID-19 detection, this approach is 96% accurate, whereas for non-COVID-19 it is 70.65% accurate.

Abbas et al. [44] propose using pre-trained ResNet-50 as transfer learning in their previously created CNN, Compose network (DeTraC-Net), the Decompose, Transfer, and categorizing COVID-19 chest X-ray pictures into mild and severe instances of the acute respiratory syndrome. Using their suggested approach to analyze the performance of 50 standard COVID-19 pictures, they found an accuracy of 95.12%.

To identify patients with coronavirus pneumonia on CXR, Narin et al. [45] offer a CNN-based method. In this setup, InceptionV3, Inception-ResNetV2, and ResNet50, are used as the pre-trained network models. There are control CXR utilized to evaluate the proposed model. Most (80%) of the data is used for training purposes, while a smaller percentage (20%) is used for testing. They found that, compared to other models, ResNet50 has the greatest accuracy (98%) in binary classification.

IV. LITERATURE REVIEW

To automate COVID-19 identification from chest X-ray pictures, numerous recent research has presented Deep Learning techniques [22, 25] with great performance. Using a variant of DarkNet et al. [26] showed its utility for both binary (COVID-19 vs. Normal) and multiclass classification. A dataset including 114 COVID-19 CXRs reported a sensitivity of 90.65% for the binary scheme and 85.35% for the multiclass technique. High discriminating performance with 98.7 percent sensitivity when MobileNetV2 was tested on a dataset containing 224 COVID-19 instances by Apostolopoulos et al. [27]. Chowdhury et al. [30] explored using six deep CNNs on a dataset consisting of 423 COVID-19 CXR pictures, testing them with both binary and multiclass methods. DenseNet201 has the highest binary and multiclass systems sensitivity scores at 99.7% and 97.9%, respectively. CheXNet was used as a feature extractor by Yamac et al. [31], and Convolution Support Estimation Network (CSEN) was suggested as a classifier to differentiate between normal CXRs, bacterial pneumonia, viral pneumonia, and COVID-19. On the QaTa-COV19 dataset, which consists of 462 COVID-19 CXR pictures, the network performed well, achieving a sensitivity of 98%.

Recognition of COVID-19 was suggested using a patch-based deep CNN architecture by Oh et al. [33]. At first, we used a fully connected (FC)-DenseNet103 to extract lung regions; next, we used a patch-based classification using ResNet50 and majority voting to determine the outcome. The suggested pipeline has a sensitivity of 96.9% on the COVID-19 identification challenge and an IoU of 95.5% on the lung segmentation task. It is a difficult challenge for clinicians to distinguish between members of the Coronavirus family using CXR pictures, hence we recently looked at the potential of deep networks to do so [34]. Lung areas are segmented using the U-Net model and then categorized with a deep CNN classifier in a suggested cascaded system. For the segmentation test, our suggested pipeline produced a 93.1 percent IoU and a 96.4 percent Dice Similarity Coefficient (DSC), while for the recognition task, it achieved a 96.7 percent sensitivity. A sensitivity of 57% and a specificity of 80% were attained in this classification task, which is a very poor result. As a result, the introduced pipeline may be very helpful in the first phases of a particular disease's or pandemic's onset, when annotated data are few. However, supervised techniques are preferred when enough annotated data are provided to train the deep CNN models. Recent studies have shown great classification performance but have also pointed out several problems and limitations. The first problem is that even the biggest of these studies only includes a few hundred CXR samples. This makes it difficult to generalize their conclusions in practice and casts doubt on how well they are evaluated. Second, they didn't try to evaluate and pinpoint the situation beyond identifying COVID-19 and other sorts. These problems reduce its usefulness, especially in a realistic clinical environment.

Contrarily, just a few researchers [36, 37] put lung segmentation at the forefront of their detection process. This protects the network from irrelevant features from places other than the text, backdrop, bones, heart, or lungs, and provides accurate classification decisions. To counter this, earlier segmentation methods largely used the Montgomery [38] and Shenzhen [39] CXR lung mask datasets to train on a total of 704 X-ray pictures for Normal and TB patients. Due to this, segmentation fails in novel settings, such as with severe COVID-19 situations or low-quality photos with low signal-to-noise ratios.

When assessing a patient's condition and determining an appropriate course of therapy, COVID-19 detection is only one part of the puzzle [40]. Perhaps COVID-19 can leave a signature in those specific areas. However, the scope of their suggested method is restricted to determining the precise location of COVID-19 infections. As a result, there is undoubtedly potential for development, notably in identifying and quantifying infection locations via calculating the total percentage of infected areas in the lungs. This may help clinicians gauge the extent of COVID-19 pneumonia and monitor its development over time.

Against this background, we try to conquer the hurdles mentioned above and the study's restrictions. Key contributions made by this thesis include:

With 10,701 normal (healthy) images, 11263 non-COVID (but sick) images, and 11956 COVID-19 photos, COVID-QU-Ex [65] is the biggest COVID-19 benchmark dataset to date. COVID-QU-Ex is the go-to standard by which all other COVID-19 quantifications, localization, detection, and models are measured, especially those based on cutting-edge deep network architectures.

To decrease the manual work required to annotate the photos in the COVID-QU-Ex dataset, we have created ground-truth lung segmentation masks using a sophisticated human-machine collaboration technique. This is the first effort of its kind to create such comprehensive ground-truth lung segmentation masks. Along with the results of this research, both the dataset and the associated ground-truth demonstrations will be made available as a benchmarking resource. We anticipate that the major benchmark COVID-19 CXR pictures and associated ground-truth lung masks will be invaluable to researchers, physicians, and engineers worldwide who are working to develop new methods for the early identification of COVID-19.

In addition, we have conducted experiments to determine which model is best suited for each segmentation job by using three image architectures (FPN) [44], U-Net++ [43], and U-Net [42] with varying backbone encoder topologies. We used InceptionV4 [47], DenseNet161 [47], DenseNet121 [46], ResNet50 [46], and ResNet18 [45]. This is a monumental achievement since it allows for the most precise diagnosis and evaluation of the condition.

Since there is now no vaccination available, isolating those who have been cured is the best action to control the outbreak. However, differentiating positive patients from negative ones quickly becomes a challenge. Several papers described their methods for spotting abnormalities on chest X-rays and CT scans. Indeed, Gozes et al. (2020) presented a model that could distinguish between those with and without coronavirus. Lung abnormality mapping and measurement were also accomplished using the suggested approach. Two distinct parts made up the whole: Subsystem A: Nodules and tiny opacities were identified with the help of a 3D analysis performed using off-the-shelf software. Metrics and

pinpointing were then supplied. In the first stage of subsystem B, lung Crop, the lung ROI was harvested using a lung segmentation module (U-net architecture). The second phase involves utilizing the deep convolutional neural network model ResNet50 to detect irregularities in coronaviruses. The third stage included determining the precise location of the anomaly. Grad-cam was used to extract network-activation maps whenever a fresh slice tested positive.

Narin et al. suggested a fully automated deep learning-based technique that uses X-ray images to predict Covid19 (2020). Three distinct Deep Convolution Neural Network topologies were employed in the suggested technique. All the pictures were scaled to 224 by 224 pixels and were taken from a dataset that included 50 X-rays taken of covid19 patients and 50 regular X-rays. The authors employed transfer learning models to get around the difficulty of the small dataset. They also used a transfer learning strategy and a cross-validation procedure where k was set to 5. Pre-training the model ResNet50 yielded satisfactory results (an accuracy score of 98.0%).

To aid radiologists in the automated identification of Covid19, Hemdan et al. (2020) introduced a deep learning classifier architecture called COVIDX-Net. Thanks to the established framework, X-ray pictures of Covid19 may be sorted into positive and negative categories. The authors used seven distinct recurrent neural networks (RNN) designs (MobileNetV2, Xception, InceptionResNetV2, InceptionV3, ResNetV2, DenseNet121, and VGG19). They employed 50 X-ray pictures, divided equally between normal and Covid19 positive patients, as part of a dataset (25 X-ray images for each). All the pictures have been shrunk down to 224x224 dimensions. We trained using 80% of the photos and evaluated with 20%.

Hafeez (2020) CNN architecture for differentiating instances of Covid19 from other Pneumonia (Bacteria and viruses) and usual problems. Wang and Wong's COVIDX dataset was utilized (2020). There are 5941 chest radiographs in this data collection, taken from 2839 different individuals. A subset of the COVIDX dataset was employed for this study; specifically, Viral (931), Bacterial (660), the Covid19 (48 pictures), and Normal sets (1203 images). The Cyclical Learning Rate was utilized to aid in selecting the best learning rate at each stage of the training procedure, which consisted of three distinct phases. Compared to Covid-83.5% Net's accuracy, the suggested Covid-ResNes achieved 96.23%.

Chest X-ray and CT scan pictures of the lungs may be used to detect cancer, and Bhandary et al. (2020) have published a deep-learning framework. Modified AlexNet provided the foundation for the suggested model (MAN). So, they put out a pair of hypotheses: One such solution is to utilize a MAN model in conjunction with a Support Vector Machine (SVM) to differentiate pneumonia photos from generic ones. When compared against the ResNet50, VGG16, AlexNet, VGG19, and MAN Softmax models, the suggested model outperformed them with impressive accuracy (96.8%). Spiral CT scans of the lungs were utilized for this analysis. To boost classification accuracy, the authors combined MAN with the Ensemble-Feature-Technique (EFT). The model was then coupled with a support vector machine (SVM), k-Nearest Neighbors (k-NN), and Random Forest to categorize CT images as Malignant or Benign (RF). These findings demonstrated that when MAN and SVM were used together, they produced high levels of accuracy (97.27 and 86.47, respectively) both with and without EFT.

Using Chest X-ray pictures, they proposed a deep-learning algorithm for detecting Covid19 in healthy individuals. The three pillars on which the model

rested were: The first is a residual convolutional neural network with 18 layers, which serves as the backbone. The rule of thumb for this method is to take a chest X-ray and pull out the salient details. The second component is the Pcls categorization score generator head. The characteristics extracted provided the energy, while the backbone network kept everything running smoothly. The anomaly detecting head, the third part, may provide a scalar anomaly score Pano. When making a call, a threshold T was used with the categorization and scalar anomaly calculation results. The findings revealed that the sensitivity also fell when the threshold T was lowered.

For CT image classification, they employed a concatenation of convolutional neural networks (CNN). There are four stages to the method outlined here: 1) The photos were processed beforehand to isolate functional lung areas. 2) Several potential picture cubes were separated using a 3D convolutional neural network. Covid19, Influenza-A, and normal image patches were differentiated using an image classification technique. 4) a full analysis report for a single CT sample was prepared using the noisy-or Bayesian algorithm. Regarding segmentation, we employed the VNET-IR-RPN model, and when it came to classification, we turned to the ResNet-18 and the ResNet-18.

Using a novel deep learning algorithm, Shan et al. could segregate and quantify infection areas in CT scans from COVID-19 patients (2020). Using a HITL strategy and the VB-Net Neural Network, the authors assisted radiologists in providing context for the automated annotations made in each instance. The model's efficacy was then determined using assessment measures. The CT scans were sorted into several groups. To train the segmentation network, it will be fed CT images that radiologists manually contoured. After that, radiologists reviewed and

adjusted the segmentation findings by hand, all while considering fresh data to feed the model. The model was built iteratively by repeatedly going through this procedure.

To ensure that no important research was overlooked, we prioritized sensitivity in our study selection process above accuracy. So far, with a few exceptions, all research in this area has focused only on binary categorization. To that end, this study aims to solve the following research issues by contrasting the most up-to-date deep convolutional neural network architectures for automatically classifying X-ray and CT pictures into normal, bacterial, and coronavirus classes:

- Does deep learning provide any method that stands out from the crowd?
- Coronavirus early screening using DL on CT and X-ray images: possible?
- How reliable is DL's diagnosis using CT and X-ray images?
- Can DL help with coronavirus treatment, tracking, and, detection,?

V. DATA AND PATIENTS

Adult patients at four Israeli medical sites were included in retrospective research conducted during and after the first COVID-19 pandemic outbreak. There were 2427 frontal (AP/PA) CXR pictures from 1384 patients (average age 63 years, male to female ratio 832:552) included in this analysis, 360 of which had a positive COVID-19 diagnosis and 1024 of which did not. The X-rays were taken using several portable devices. Every patient with symptoms who tested positive for COVID-19 using RT PCR was routinely admitted to the hospital, regardless of how mild their symptoms were. Standard chest X-rays were taken on the day of admission and again later for follow-up. Photos that tested positive for COVID-19 were interpreted as such regardless of the

severity of the lung damage seen. All CXR images in our cohort that did not include COVID-19 were collected from the same X-ray equipment before the outbreak in January 2017 through April 2019. Depending on the patient's medical history, these might range from normal to abnormal radiographs.

Of the whole CXR dataset, 15% (or 350 CXR) were used for the test, with 179 CXR (51% positive) and 171 CXR (49% negative). Images of patients with more than one were utilized for the test or train set, but never both. This was done so that the model wouldn't automatically attribute the label to patient-specific visual characteristics (such as metal implants) that aren't necessarily there. Patients from all four hospitals are represented in the training and testing sets.

All photographs were utilized at their native resolution with no lossy compression, with just 4% (101/2426) of the total images being omitted because of skewed orientation or other distortions. Ninety-eight of them tested positive for COVID-19. This study did not employ clinical and radiological results as independent exclusion criteria.

VI. IMAGE MANIPULATION

To begin, each picture is processed utilizing augmentation, which is a collection of visual alterations, normalisation, which establishes a uniform scale of image size and color, and segmentation, which highlights the region of the lungs and combines it with the rest of the image. The full collection of images is then loaded into a neural network, which returns a classification conclusion for each picture as either positive or negative for coronavirus illness 2019 (COVID-19). In addition, the network's final layer's embedded features are retrieved to discover other pictures with the same traits as the input image.

Changes in direction and brightness are only two examples of the kinds of alterations that may be made using augmentations. Although they have no bearing on classification accuracy, variations in orientation and pixel values during the picture-collecting process may impact the network's training performance. They help broaden the dataset by generating a variety of pictures, which improves the reliability and generalizability of the model [15, 16]. Importantly, we engaged with radiologists to define the augmentation parameters to guarantee they would match natural variance in CXR acquisition.

The normalization procedure aims to create uniformity in picture size and other attributes. Each picture is cropped to remove unwanted dark areas, the brightness is equalized across the board, and the resolution is scaled using bilinear interpolation to a uniform 1024 by 1024 pixels.

To improve performance, we added a new picture channel trained using lung segmentation data from an external dataset using a U-net, as described in [17]. While training, this network may obtain information from a CXR pixel mask that indicates the likelihood that each pixel is part of the lungs.

VII. OUTPUT AND NETWORK DESIGN SPECIFICATIONS

ResNet34, ResNet152 [18], CheXpert [9], VGG16 [19], ResNet50, and were the five network models we compared. These designs use the method of mapping pictures from a high-dimensional space to a low-dimensional space, where a simple border may separate image classes [9]. An ensemble model that takes the findings from several networks and returns a single result was also used to refine the picture classification process further.

We also present a technique for collecting many CXR pictures comparable to a particular image, adding this functionality to categorization.

Information regarding clinical indications seen in the images should be captured by activating layers of the neural network. We utilized the embeddings generated by the network's last layer to find the images' closest neighbors to look for similarities among the resultant vectors.

VIII. ANALYSIS AND RATING

The ROC and P-R curves were used alongside accuracy, sensitivity, and specificity to assess the models. Ten independent random splits of the data were used to determine confidence intervals (CIs). The CI was calculated by computing the required metrics for each model using 100 bootstrap samples taken from the test set. Each statistic provides two and ninety-five percentile confidence intervals (CIs). We provide the CIs for the first data split in the thesis. We test the model on a collection of 22 CXRs that a radiologist has deemed difficult to diagnose and compare its performance with and without any picture preprocessing. Using t-distributed stochastic neighbor embedding (t-SNE) [20], a technique that translates multi-dimensional data into a two-dimensional space to facilitate visualization, we give further insight into the model's effectiveness by displaying its findings.

IX. CONCLUSION

To stop the new coronavirus from infecting other people, it is crucial to diagnose the virus as soon as possible. Along with this study, we developed a deep transfer learning-based system that combines chest X-ray pictures of patients with COVID-19 and those without the condition to automatically identify the illness. The proposed classification model can identify COVID-19 with an accuracy of greater than 98 percent. Our study's findings indicate that, given its strong overall performance, doctors and other health professionals should naturally rely on it to aid in clinical decision-making. This work has a thorough grasp of the

application of deep transfer learning algorithms to find COVID-19 as soon as feasible. COVID-19 kills millions of people worldwide and poses a danger to the healthcare industry.

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Study of Convex Spaces and Their Tensor Products

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Article Info

Volume 9, Issue 1

Page Number : 475-479

Publication Issue

January-February-2022

Article History

Accepted : 01 Jan 2022

Published : 20 Jan 2022

ABSTRACT

In this paper, we will make considerable use of the notion of a continuous bilinear map $X \times Y \rightarrow Z$ where X, Y and Z are topological vector spaces.

Keywords: Convex Spaces, Topology, Tensor, Vector Spaces, Functional Analysis.

I. INTRODUCTION

We will make considerable use of the notion of a continuous bilinear map $X \times Y \rightarrow Z$ where X, Y and Z are topological vector spaces. In particular, we will make use of the following:

2.1 Proposition

If X, Y and Z are topological vector spaces then any bilinear map $\phi : X \times Y \rightarrow Z$ is continuous if it is continuous at $(0,0)$.

Proof. Let (x_0, y_0) be a point of $X \times Y$ and let W be a 0-neighbourhood in Z [85-93]. We choose a 0-neighbourhood W_1 with $W_1 + W_1 + W_1 \subset W$. Since ϕ is continuous at $(0,0)$, there are 0-neighbourhood $U \subset X$ and $V \subset Y$ such that $\phi(U \times V) \subset W_1$. If we choose $s, t \in (0,1)$ so that $x_0 \in sU, y_0 \in tV, sU \subset U$ and $tV \subset V$, then for $x \in x_0 + sU$ and $y \in y_0 + tV$ we have

$$\phi(x, y) - \phi(x_0, y_0) = \phi(x - x_0, y_0) + \phi(x - x_0, y - y_0) + \phi(x_0, y - y_0) \subset W_1 + W_1 + W_1 \subset W.$$

This proves that ϕ is continuous at (x_0, y_0) .

The algebraic tensor product $X \otimes Y : x \in X, y \in Y$ subject to the relations

$$(ax_1 + bx_2) \otimes y = a(x_1 \otimes y) + b(x_2 \otimes y), x_1, x_2 \in X, y \in Y, a, b \in \mathbb{C}$$

$$x \otimes (ay_1 + by_2) = a(x \otimes y_1) + b(x \otimes y_2), x \in X, y_1, y_2 \in Y, a, b \in \mathbb{C}$$

It follows that every element $u \in X \otimes Y$ may be written as a finite sum

$$u = \sum_{i=1}^n x_i \otimes y_i.$$

The minimal number n of terms required in a representation of u as above is called the rank of u . If u is expressed as above using a minimal number of terms, that is, so that the number of terms n is equal to the rank of u , then it

turns out that the sets $\{x_i\}_{i=1}^n$ and $\{y_i\}_{i=1}^n$ must both be linearly independent. Of course, this representation of u is far from being unique.

One easily shows that the tensor product is characterized by the following universal property:

2.2 Proposition

The map $\theta : X \times Y \rightarrow X \otimes Y$, defined by $\theta(x, y) = x \otimes y$, is a bilinear map with the property that any bilinear map $X \times Y \rightarrow Z$ to a vector space Z is the composition of θ with a unique linear map $\psi : X \otimes Y \rightarrow Z$.

If X and Y are locally convex topological vector spaces, there are at least two interesting and useful ways of giving $X \otimes Y$ a corresponding locally convex topology [1-8]. The most natural of these is the projective tensor product topology, which we describe below:

If p and q are continuous seminorms on X and Y , respectively, we define the tensor product seminorm $p \otimes q$ on $X \otimes Y$ as follows:

$$(p \otimes q)(u) = \inf \left\{ \sum p(x_i)q(y_i) : u = \sum x_i \otimes y_i \right\}$$

It follows easily that $p \otimes q$ is, indeed, a seminorm. Furthermore, we have:

2.3 Lemma

For seminorms p and q on X and Y .

- (1) $(p \otimes q)(x \otimes y) = p(x)q(y)$ for all $x \in X, y \in Y$;
- (2) If $U = \{x \in X : p(x) < 1\}$ and $V = \{y \in Y : q(y) < 1\}$, then

$$co(\theta(U \times V)) = \{u \in X \otimes Y : (p \otimes q)(u) < 1\}$$

Proof. From the definition, it is clear that

$$(p \otimes q)(x \otimes y) \leq p(x)q(y) \text{ for all } x \in X, y \in Y$$

On the other hand, for a fixed $(x, y) \in X \times Y$, using the Hahn-Banach theorem we may choose linear functional f on X and g on Y such that $f(x) = p(x), g(y) = q(y)$ and $|f(x')| \leq p(x'), |g(y')| \leq q(y')$ for all $x', y' \in X \times Y$. Then if $x \otimes y = \sum x_i \otimes y_i$ is any representation of $x \otimes y$ as a sum of rank one tensors, we have

$$p(x)q(y) = f(x)g(y) = \sum f(x_i)g(y_i) \leq \sum p(x_i)q(y_i)$$

Since $(p \otimes q)(x \otimes y)$ is the inf of the expressions on the right side of this inequality we have $p(x)q(y) \leq (p \otimes q)(x \otimes y)$. This proves (4.1).

Certainly $co(\theta(U \times V)) \subset \{u \in X \otimes Y : (p \otimes q)(u) < 1\}$ since the latter is a convex set containing $\theta(U \times V)$. To prove the reverse containment, let u be an element of $X \otimes Y$ with $(p \otimes q)(u) < 1$. Then we can represent u as $u = \sum x_i \otimes y_i$ with

$$\sum p(x_i)q(y_i) = r^2 < 1$$

If we set $x'_i = r p(x_i)^{-1} x_i$ and $y'_i = r q(y_i)^{-1} y_i$, then $p(x'_i) = r = q(y'_i)$. Thus, $x'_i \in U$ and $y'_i \in V$. Furthermore, if $t_i = r^{-2} p(x_i)q(y_i)$, then

$$u = \sum t_i (x'_i \otimes y'_i) \text{ and } \sum t_i = 1$$

Thus, $u \in co(\theta(U \times V))$ and the proof of (2) is complete.

3.1 Definition

The topology on $X \otimes Y$ determined by the family of seminorms $p \otimes q$, as above, will be called the projective tensor product topology. We will denote $X \otimes Y$, endowed with this topology, by $X \otimes_p Y$.

If $f \in X^*$ and $g \in Y^*$ then we may define a linear functional $f \otimes g$ on $X \otimes Y$ by

$$(f \otimes g) \left(\sum x_i \otimes y_i \right) = \sum f(x_i)g(y_i)$$

One easily checks that this is well defined and linear.

3.2. Proposition

The projective tensor product topology is a Hausdorff locally convex topology on $X \otimes_p Y$ with the following properties [9-12] :

- (1) the bilinear map $\theta : X \times Y \rightarrow X \otimes_p Y$ is continuous;

- (2) $f \otimes g \in (X \otimes_{\pi} Y)^*$ for each $f \in X^*$ and $g \in Y^*$;
- (3) A neighbourhood base for the topology at 0 in $X \otimes_{\pi} Y$ consists of sets of the form $co(\theta(U \times v))$ where U is a 0-neighbourhood in X and V is a 0 neighbourhood in Y .
- (4) any continuous bilinear map $X \times Y \rightarrow Z$ to a locally convex space Z factors as the composition of θ with a unique continuous linear map $X \otimes_{\pi} Y \rightarrow Z$;

Proof. Lemma 4.3(1) implies that each $(p \otimes q) \circ \theta$ is continuous at $(0,0)$ and this implies that θ is continuous at $(0,0)$ and, hence, is continuous everywhere by Proposition 4.1 [97-100].

The continuity of $f \otimes g$ for $f \in X^*$ follows from the fact that $|f|$ and $|g|$ are continuous seminorms on X and Y and $|(f \otimes g)(\sum x_i \otimes y_i)| \leq \sum |f(x_i)| |g(y_i)| \leq \sum |f(x_i)| |g(y_i)| \leq |f| \otimes |g|(\sum x_i \otimes y_i)$ This proves (4.2).

The fact that the projective topology is Hausdorff follows from (4.2). In fact, if $u \in X \otimes Y$ then we may write $u = \sum x_i \otimes y_i$, where the set $\{x_i\}$ is linearly independent. Then we may choose $f \in X^*$ such that $f(x_i) \neq 0$ if and only if $i = 1$ and we may choose $g \in Y^*$ such that $g(x_i) \neq 0$. Then the element $f \otimes g \in (X \otimes Y)^*$ has the non-zero value $f(x_1)g(x_1)$ at u . Thus, $U = \{v \in X \otimes Y : |(f \otimes g)(v)| < f(x_1)g(x_1)\}$ is an open set containing 0 but not containing u .

Part (3) is an immediate consequence of Lemma 4.3.(2)

If $\phi : X \times Y \rightarrow Z$ is a continuous bilinear map, then $\phi = \psi \circ \theta$ for a unique linear map $\psi : X \otimes_{\pi} Y \rightarrow Z$ by Proposition 4.2. To prove (4.4) we must show that ψ is continuous. Let W be a convex 0-neighbourhood in Z . Since ϕ is continuous, there exist 0-neighbourhoods U and V in X and Y , respectively, such that $\phi(U \times V) \subset W$. Then the convex hull of $\theta(U \times V)$ is a 0-neighbourhood in $X \otimes Y$ by (4.3) and it clearly maps into W under ψ . Thus ψ is continuous.

Note that (4.4) of the proposition says that projective tensor product topology is the strongest locally convex topology on $X \otimes Y$ for which the bilinear map $\theta : X \times Y \rightarrow X \otimes Y$ is continuous.

Note that (4.4) of the above proposition says that projective tensor product topology is the strongest locally convex topology on $X \otimes Y$ for which determines its topology. Also, if X and Y are metrizable then so is $X \otimes Y$.

If X, Y and Z are locally convex spaces and $\alpha : X \rightarrow Y$ is a continuous linear map then the composition

$$X \times Z \rightarrow Y \times Z \rightarrow Y \otimes_{\pi} Z$$

is a continuous bilinear map $X \times Z \rightarrow Y \otimes_{\pi} Z$ and, by Proposition 4.5.(4), it factors through a unique continuous linear map $\alpha \otimes id : X \otimes_{\pi} Z \rightarrow Y \otimes_{\pi} Z$. This shows that, for a fixed l.c.s. Z , $(\cdot) \otimes_{\pi} Z$ is a function from the category of locally convex spaces to itself. Similarly, the projective tensor product is also a function in its second argument for each fixed l.c.s. appearing in its first argument.

3.3. Proposition

If $\alpha : X \rightarrow Y$ is a continuous linear open map, then so is $\alpha \otimes id : X \times Z \rightarrow Y \otimes Z$

Proof. To show that $\alpha \otimes id$ is open we must that each 0- neighbourhood in $X \otimes Z$ maps to a 0-neighbourhood in $Y \otimes Z$. However, this follows immediately from Proposition 4.5(3) and the hypothesis that α is an open map.

The space $X \otimes_{\pi} Y$ is generally not complete. It is usually useful to complete it.

4.1 Definition

The completion of $X \otimes_{\pi} Y$ will be denoted $X \widehat{\otimes}_{\pi} Y$ and will be called the completed projective tensor product of X and Y [13-15].

Note that if $\alpha : X \rightarrow Y$ is a continuous linear map, the map $\alpha \otimes id : X \widehat{\otimes}_{\pi} Y \rightarrow Y \widehat{\otimes}_{\pi} Z$. Even under the hypothesis of Proposition 4.6 this map is not generally a surjection. However, we do have:

4.2. Proposition

If X, X and Z are Frechet spaces and $\alpha : X \rightarrow Y$ is a surjective continuous linear map, then $\alpha \otimes id : X \widehat{\otimes}_{\pi} Y \rightarrow Y \widehat{\otimes}_{\pi} Z$.

Proof. By the open mapping theorem, the map α is open. Then $\alpha \otimes id$ is open by Proposition 3.6. Since, the topologies of X, Y and Z countable bases at 0 the same in true of $X \otimes_{\pi} Z$ and $Y \otimes_{\pi} Z$. However, an open map between metrizable t.v.s.'s has the property that every Cauchy sequence in the range has a subsequence which is the

image of a Cauchy sequence in the domain. Since every point in the completion $X \widehat{\otimes}_\pi Z$ is the limit of a Cauchy sequence in $Y \widehat{\otimes}_\pi Z$, the result follows.

Obviously, the analogues of Proposition 4.6 and 4.8 with the roles of the left and right arguments reversed are also true. There is other hypothesis under which the conclusion of the above Proposition is true and we will return to this question when we have developed the tools to prove such results [101-104]. In the case where X and Y are Fréchet spaces, elements of the completed projective tensor product $X \widehat{\otimes}_\pi Y$ may be represented in a particularly useful form:

4.3. Proposition

If X and Y are Fréchet spaces then each element $u \in X \widehat{\otimes}_\pi Y$ may be represented as the sum of a convergent series.

$$u = \sum_{i=1}^{\infty} \lambda_i x_i \otimes y_i$$

where $\sum_{i=1}^{\infty} |\lambda_i| < \infty$ and $\{x_i\}$ and $\{y_i\}$ are sequences converging to 0 in X and Y , respectively.

Proof. Let $\{p_n\}$ and $\{q_n\}$ denote increasing sequences of seminorms generating the topologies of $p_n \otimes q_n$. If $\{u_n\}$ is a sequence in $X \otimes Y$ converging to u in the projective topology, then we may, by replacing $\{u_n\}$ by an appropriately chosen subsequence, assume that the sequence $\{u_n\}$, where $v_n = u_1$ and $v_n = u_n - u_{n-1}$ for $n > 1$, satisfies

$$r_n(v_n) < n^{-2} 2^{-n} \text{ and } \sum v_n = u$$

It follows that we may write each v_n as a finite sum

$$v_n = \sum_i x'_{ni} \otimes y'_{ni} \text{ with } \sum_i p_n(x'_i) q_n(y'_i) < n^{-2} 2^{-n}$$

If we set

$$x_{ni} = n^{-1} p_n(x'_{ni}), \quad y_{ni} = n^{-1} q_n(y'_{ni})^{-1} y'_{ni}, \quad \lambda_{ni} = n^2 p_n(x_{ni}) q_n(y_{ni})$$

then

$$p_n(x_{ni}) = q_n(y_{ni}) = n^{-1}, \quad \sum_i |\lambda_{ni}| < 2^{-n} \text{ and } v_n = \sum_i \lambda_{ni} x_i \otimes y_i$$

and so

$$u = \sum_{n,i} \lambda_{ni} x_i \otimes y_i, \quad \sum_i |\lambda_{ni}| < \infty \text{ and } \lim_n p_m(x_{ni}) = \lim_n q_m(y_{ni}) = 0 \quad \forall m$$

The proof is complete if we reindex $\{x_{ni}\}, \{y_{ni}\}$ and $\{\lambda_{ni}\}$ to form singly indexed sequences.

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Cite this Article

Amaresh Kumar, Dr. Md. Mushtaque Khan, "Study of Convex Spaces and Their Tensor Products", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 475-479, January-February 2022.

Journal URL : <https://ijsrst.com/IJSRST22969>

Study of Ground Water Quality and Variation in Physico-Chemical Parameters of The Tube -Well of Gandhi Chowk (Chapra Municipality)

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Article Info

Volume 9, Issue 1

Page Number : 480-487

Publication Issue

January-February-2022

Article History

Accepted : 01 Jan 2022

Published : 20 Jan 2022

ABSTRACT

In this paper we studied about the ground water quality and variation in physico-chemical parameters of the tube -well of Gandhi chowk (Chapra municipality). Groundwater is the major source of water supply for domestic purposes in Urban as well as Rural parts of India. There are various reasons for this, which include non-availability of potable surface water and a general belief that groundwater is purer and safer than surface water due to earth mantel covering. Presence of more than 200 chemical constituents in groundwater has been documented including approximately 175 organic and more than 50 inorganic and radio nucleotides. The sources of these chemicals are both natural and anthropogenic.

Keywords : MSW, Landfill, pH, Waste, WQI.

I. INTRODUCTION

In the developing countries, contamination of water supplies by organic compounds is of minor concern or of no concern at all. In such places the major health problems are the result of inorganic chemicals contamination, poor sanitary conditions and illness brought about by pathogenic organisms. Once the groundwater at a site is degraded, it may remain in an unusual or even hazardous condition for decades or centuries. The typically low velocity of groundwater prevents a great deal of mixing and dilution, consequently, a contaminant plume may maintain a high concentration as it slowly moves from points of recharge to zone of discharge (Pattyjohns, 1979) [1-7].

The physical, chemical and biological quality of water may vary within wide limits. It is very difficult to distinguish the origin (natural or anthropogenic) of many water quality problems. Natural quality reflects the type and amount of soluble and insoluble substances with which the water has come in contact. The quality of groundwater is most commonly affected by waste disposal and land use. Another major source of contamination in the storage of waste materials is in excavations, such as pits and mines.

Water-soluble substances that are dumped, spilled, spread or stored on the land surface eventually may infiltrate. Groundwater can also become contaminated by the disposal of fluids through wells and, in lime stone terrains, through sinkholes directly into aquifers. Likewise, infiltration of contaminated surface water has caused groundwater contamination in several places. Irrigation tends to increase the mineral content of both

surface and groundwater. The degree of severity in such cases is related to hydrologic properties of the aquifer, the type and amount of waste, disposal method and climate.

Another cause of groundwater quality deterioration is pumping of groundwater, which may precipitate the migration of more mineralized water from the surrounding strata to the well. In coastal areas pumping has caused seawater intrusion to freshwater aquifers. In parts of West Bengal, arsenic contamination problem has been attributed to excessive pumping of shallow groundwater.

Various studies carried out in the past have reported the presence of excessive Fluoride, Arsenic, Nitrite, Sulphate, Heavy metals, Salinity, Hardness and Pesticides etc. from different parts of the country. It has been reported that 77% of urban population and only 31% of rural population in India has access to portable water supply.

II. SOURCES OF GROUNDWATER CONTAMINATION

2.1. On the land surface problems: -

- 1) Infiltration of contaminated surface water.
- 2) Land disposal of solid and liquid materials
- 3) Mining and Industrial tailings
- 4) Dumps
- 5) Disposal of sewage and sludge
- 6) Fertilizers and pesticides
- 7) Accidental spills

2.2. Above the water table problems: -

- 1) Septic tanks
- 2) Surface impoundment
- 3) Landfills
- 4) Waste disposal in excavations
- 5) Leakage from underground storage tanks and pipelines
- 6) Artificial recharge

2.3. Below the water table problems: -

- 1) Waste disposal in wet excavations
- 2) Agricultural drainage wells and canals
- 3) Well disposal of wastes
- 4) Underground storage
- 5) Mines
- 6) Exploratory wells and test holes
- 7) Abandoned wells
- 8) Water supply wells
- 9) Groundwater development

Seasonal variation of physico-chemical characteristics of groundwater of Saran. In Saran, there are insufficient numbers of collection bins for the waste. The collected waste is very often scattered by cows and other stray animals before Municipal Workers have a chance to clean the surroundings [8-12].

The indiscriminate disposals of solid waste inside the urban area of both the townships are used as land filling. The disposal sites are not well managed and the exposed garbage breeds flies and other disease

transmitting vectors. Both the harmless domestic waste and infectious hospital waste are routinely mixed and dumped together in the disposal site. This put the city sanitation workers at risk of contracting diseases. Rag Pickers as well as general public are also exposed to the risk of disease and the rag pickers are also at the risk of encountering physical harm through contact with discarded sharps.

Such disposals besides the disease risk, possess a potential for ground and surface waters as pollutant leach or run off from unmanaged waste piles. The solid waste generated from both the domestic as well as industry sources are usually dumped on land. Depending upon the characteristic of the substances dumped leaching takes place contaminating the land as well as groundwater due to percolation of leachate. Since the domestic refuse contains some of the objectionable material, which not only has adverse effect over the surface but also the material if leached, can contaminate the groundwater.

There have been many instances of spreading of water borne diseases due to run off as well as leaching of urban refuse at several parts of the globe. Keeping the above in view in order to assess the impact of such open dumping of both domestic as well as hospital waste, twenty locations from different corners of the city were selected mostly by considering either the maximum no of users or in and around the dumping site of municipal solid waste or hospital solid waste or the site where no probability of contamination. The groundwater samples were collected randomly from a number of Tube well, Bore well and Dug well from these areas and the water quality parameters were analyzed [13-17].

The details of the locations of sampling points are presented in table 5.2 and the 39 analyzed physico-chemical parameters of the groundwater samples collected during the year November, 2019 to October, 2020 and November, 2020 to October, 2021 are presented in table 1 to table 19. Water Temperature, Electrical Conductivity, Turbidity and Fecal and Total coliform expressed as °C, $\mu\text{mho/cm}$, NTU and MPN 1/100 ml respectively. pH value expressed in pH unit. Rest parameters are expressed as mg/l.

3. pH

The pH is a measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. It has no direct adverse effect on health, however, a low value, below 4.0 will produce sour taste and higher value above 8.5 shows alkaline taste. A pH range of 6.5 – 8.5 is normally acceptable as per guidelines suggested by ISI. In the present study, the fluctuation of pH in the samples was from 5.7 to 9.0. The pH below 7 indicates that the sample water was slightly acidic may be due to the presence of minerals in the groundwater. In the present study, $\text{pH} < 7$ was found in the groundwater samples of Uma Nagar, Bhagwan Bazar, Mouna Chowk, Gandhi Chowk [18-24].

Table 1: Analyzed physico-chemical parameters of the Tube -well of Gandhi Chowk.

Parameters	2019-2020				2020-2021			
	Winter		Summer		Rainy	Winter	Summer	Rainy
Temperature	18	28	26	20	25	24		
Ph	6.5	6.8	6.2	6.5	6.8	6.4		
Turbidity	2.5	2.7	3.5	2.7	2.9	4.0		
TDS	150	158	136	156	156	138		
TSS	8.0	12	22	11	12	16		
Hardness	98	102	118	110	104	107		
EC	279	298	275	295	302	270		

Chloride	22	20	18	17	18	20	
Sulphate	102	113	115	109	110	117	
Total Alkalinity		110	112	120	121	116	114
Calcium		16.2	16	14.9	18	15	.6 15
Magnesium	30	30	28	28	29	31	

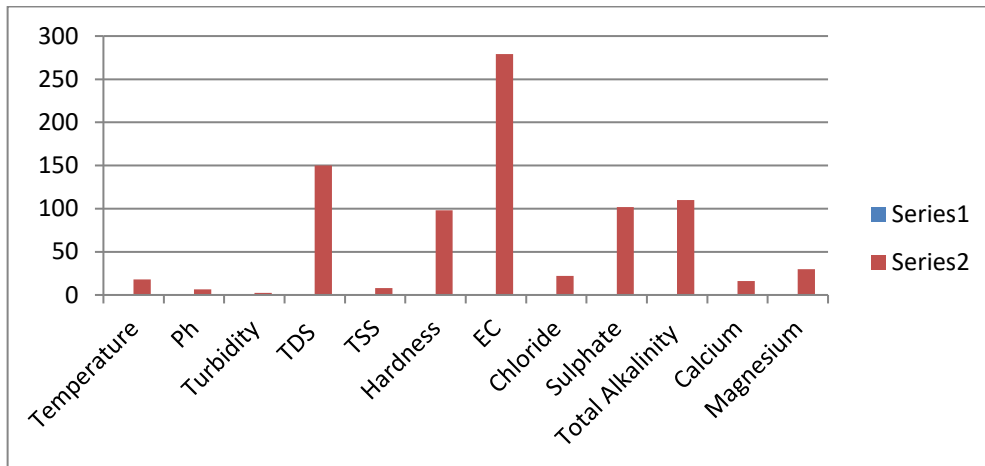


Figure-1: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in Winter Season 2019-20

However, it has been seen that the dug well samples of Brahm pur show low pH (5.7 to 6.2) than the prescribed limit throughout the study period [25-30]. Low pH values than the prescribed limit also have been found in the samples of Uma Nagar during Rainy season. Similarly, the samples of Bhagwan Bazar throughout the year of 2019- 2020 showed low pH. Samples of Gandhi Chowk exceeds the prescribed limit of pH. These variations in pH may be due to the condition of earth and minerals present. The condition of earth is greatly affected by the waste dumped.

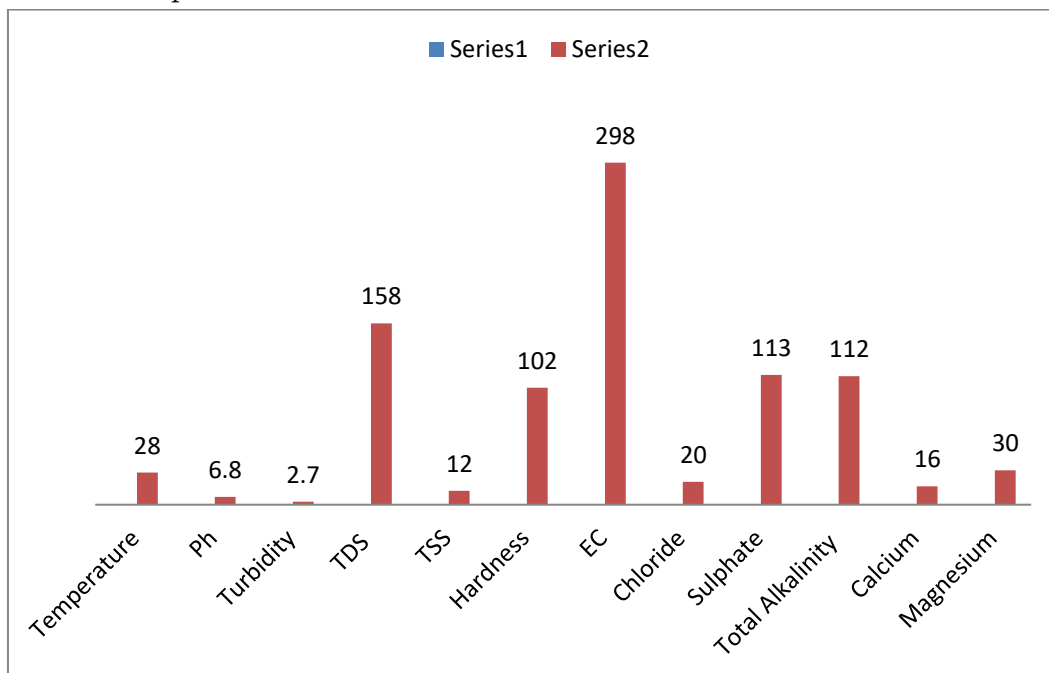


Figure-2: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in summer Season 2019-20

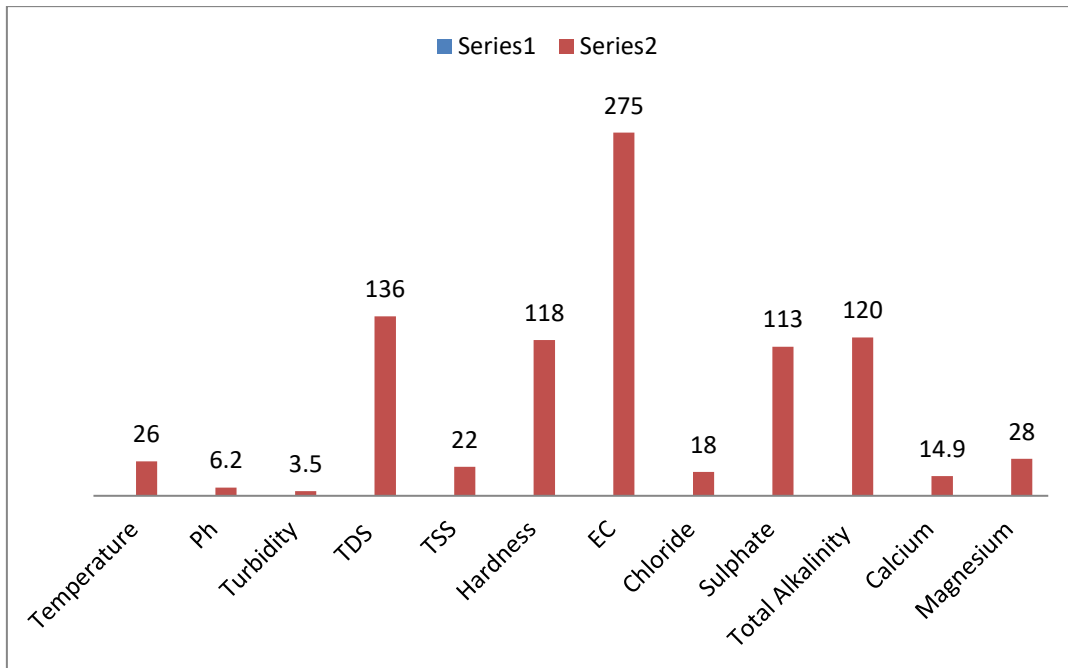


Figure-3: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in Rainy Season 2019-20

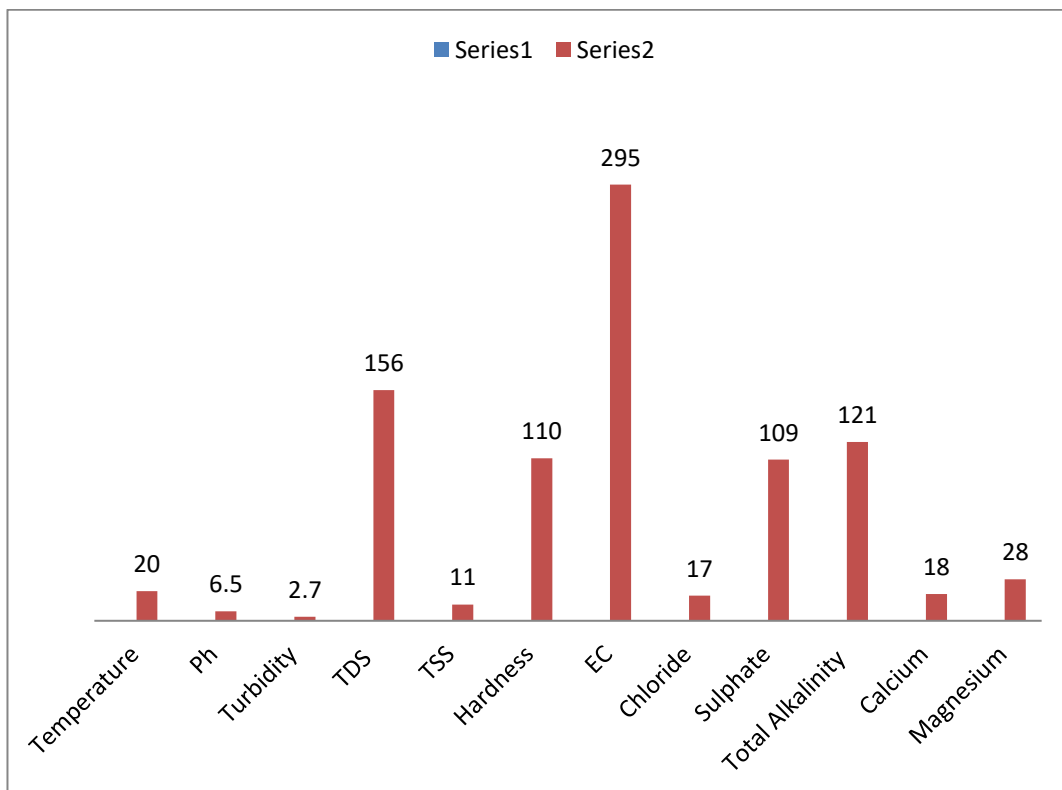


Figure-4: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in Winter Season 2020-21

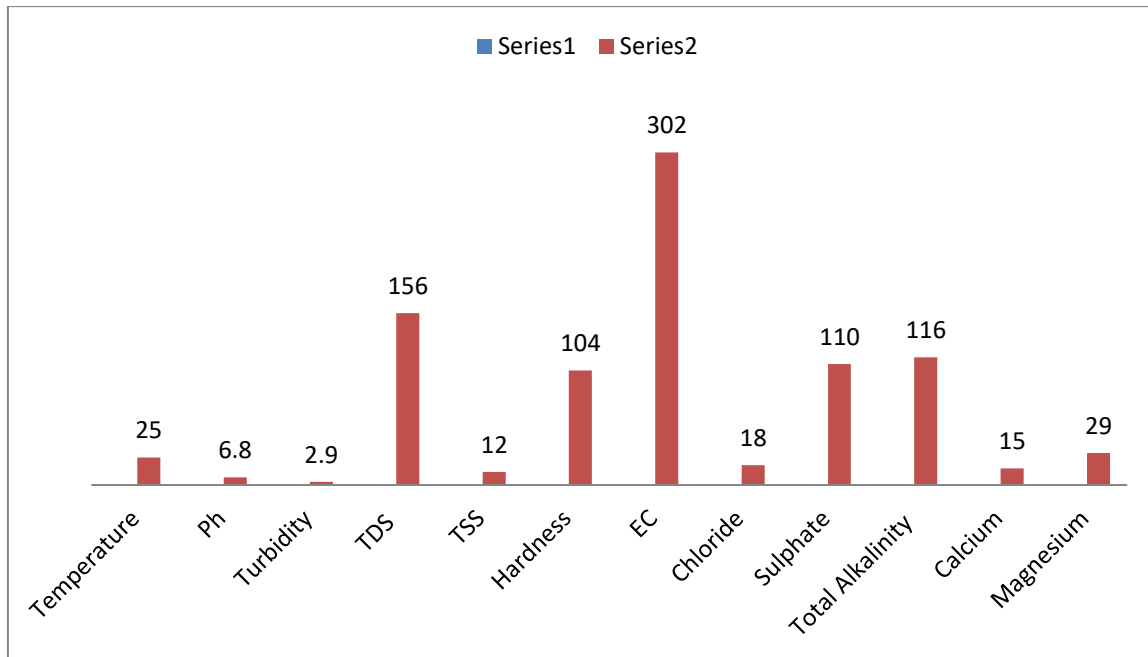


Figure-5: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in Summer Season 2020-21

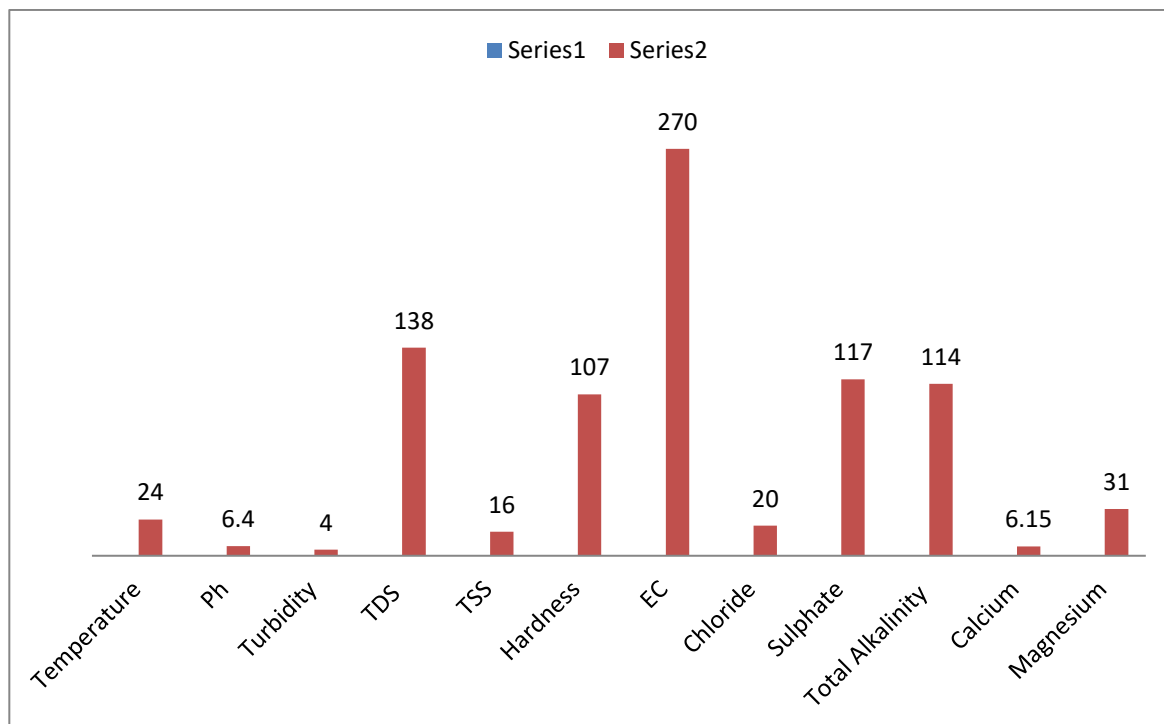


Figure-6: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in Rainy Season 2020-21

III. CONCLUSION

The pH is a measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. It has no direct adverse effect on health, however, a low value, below 4.0 will produce sour taste and higher value above 8.5 shows alkaline taste. A pH range of 6.5 – 8.5 is normally acceptable as per guidelines suggested by ISI. In the present study, the fluctuation of pH in the samples was from 5.7 to 9.0. However, it has

been seen that the dug well samples of Brahm pur show low pH (5.7 to 6.2) than the prescribed limit throughout the study period. Low pH values then the prescribed limit also have been found in the samples of Uma Nagar during Rainy season. Similarly, the samples of Bhagwan Bazar throughout the year of 2019- 2020 showed low pH. Samples of Gandhi Chowk exceeds the prescribed limit of pH. These variations in pH may be due to the condition of earth and minerals present. The condition of earth is greatly affected by the waste dumped.

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Cite this Article

Bishal Kumar Singh, Dr. Rabindra Singh, "Study of Ground Water Quality and Variation in Physico-Chemical Parameters of The Tube -Well of Gandhi Chowk (Chapra Municipality)", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 480-487, January-February 2022.

Journal URL : <https://ijsrst.com/IJSRST2295195>

Technical and Smart Textiles and their Applications

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Article Info

Volume 9, Issue 1

Page Number : 488-494

Publication Issue

January-February-2022

Article History

Accepted : 01 Jan 2022

Published : 20 Jan 2022

ABSTRACT

Technical textiles have been idealized to be one of the most active energetic and promising areas for the textile industry. The advancement of polymer, fibers, yarns, chemical technology and fabric technology are there driving forces for the development of technical textiles. The industry is coming into view because people are now ready to spend the money on achieving comfort in their tough life. Technical textiles can satisfy those needs that cannot be fulfilled by traditional textiles. Textiles with nano materials and much more with textiles it will be possible to offer innovative solutions for global problems such as pollution, health issues transport protection communication.. Smart textiles are the most exciting innovation in the field of textile engineering. The development of smart textiles reaches for beyond imaginations some storage maybe scene science fiction. The economic value and impact of smart textiles are gigantic. The advent of smart textiles makes it possible to be the traditional textile sector to a level of a high technological industry. Moreover it appears that this is only possible by intense cooperation between people from various backgrounds and disciplines such as microelectronics, computer science, material science, polymer science, biotechnology.

Keywords :- Smart Textiles, Technical Textiles

I. INTRODUCTION

Textile products manufactured primarily for its performance and functional properties rather than aesthetic or decorative characteristics. The primary function of textile is to shield humans but with advancement in technology. Textile industry is rapidly developing with varied special features in addition to its primary function. The demand to smart materials and intelligent textiles grows increasingly all over the world. In other words, technology has also taken control of textile industry. Smart textiles have superior performance and functionalities

for the applications ranging from simple to more complicated uses such as military, healthcare, sportswear, etc. Smart or intelligent textiles can also be called as the next-generation textiles.

Smart Textiles are the textile materials that have the ability to sense and hence react to external stimulus with the help of electronic sensors incorporated. Along with its application in different fields like sports, military, fashion/lifestyle etc, it has applications in health care for continuous monitoring of patients. A smart textile are materials and structures that sense and react to environmental conditions or stimuli, such as those from mechanical, thermal, chemical, electrical, magnetic or other sources. They are systems composed of different apparatuses and materials such as sensors, actuators and electronic devices together.

Technical textiles are defined as textile materials and products used primarily for their technical performance and functional properties rather than their aesthetic or decorative characteristics. This is one of the fastest-growing sectors of the Textile Industry, which is manufacturing high-tech, high-performance fabric designed not just to look attractive, but to present a significant added value in terms of functionality. The textile coating process is widely used in the manufacturing of technical textiles. Technical textiles are functional fabrics that have applications across various industries including automobiles, civil engineering and construction agriculture, health care, industrial safety, personal protection etc. The technological evaluation which transversally integrates human science, materials and information technology, does allow to four screen four seeing positive perspective in the approach toward the development of new products and applications.

II. Materials for technical textiles

Regular/Generic fibers...Natural fibers: Cotton, silk, wool, jute, hemp, ramie, flax

Regenerated fibers: Viscose, Lyocell. Synthetic fibers: Nylon, PET, PP, Acrylic.

Specialty variants of regular/generic fibers....Flame retardant, Super absorbent, Anti micro bacterial Ultra fine fibers etc.

High tech/high performance fibers....High chemical- and combustion-resistant organic fibres: Nomex, Kevlar.

High performance inorganic fibres....Glass, Asbestos, Carbonic

Classification of technical textile:

1. Agro Tech (Agro-textiles):

Textiles used in Agriculture are termed agro textiles. The agro tech products include shade nets, crop covers, mulch mats, anti-hail nets, bird's protection nets, and fishing nets agriculture, horticulture, forestry and Aquaculture textiles Polypropylene, polyester, polyethylene etc.

Given the increasing awareness of the environment and the specific knowledge of the various interdisciplinary technologies, special attention has been paid to unconventional technical applications, such as the use of textile structures in the agriculture and horticulture sectors to increase the quality and efficiency of agriculture and food products in terms of ensuring a healthy environment, social-economic equity, and a profitable economy.

2. Build Tech (Construction Textiles):

Textiles have in the past been predominantly confined to the interior decoration; they are now increasingly becoming part of these constructions themselves.

Textiles used in construction – concrete reinforcement, façade foundation systems, interior construction, insulations, proofing materials, air conditioning, noise prevention, visual protection, protection against the sun, building safety, architectural membranes, floor & wall coverings, scaffolding nets, awnings & canopies, HDPE tarpaulins and others.

3. Cloth Tech (Clothing Textiles):

In the textile and apparel industry, clothing components include fibre and textiles which are used as a technical component during Apparel manufacturing. Those clothing components are swing traits, wedding and interlacing and insulations.

4. Geo Tech (geo textile and soil engineering):

These are used in the reinforcement of embankments or construction of bridges, dams roads and pavements, railways and paths as well as embarrasments, cutting, dikes, rail- track bed stabilization, landfills and waste management and sub-sea coastal engineering projects.

The fabrics in geo textiles are permeable fabrics and are used with soils having the ability to separate, filter, protect or drain. The fabric used in it must have good strength, durability, low moisture absorption and thickness. Mostly nonwoven and woven fabrics are used in it.

Synthetic fibers like glass, polypropylene and acrylic fibers are used to prevent cracking of concrete, plastic and other building materials. Polypropylene and polyester are used in geo textiles and dry/liquid filtration due to their compatibility.

5. Home tech (Domestic Textiles):

Textiles used in a domestic environment – interior decoration and furniture, carpeting, protection against the sun, cushion materials, fireproofing, floor and wall coverings, textile reinforced structures/fittings, furniture fabrics, fiberfill, stuffed toys, blinds, mattress and pillow components, carpet backing cloth, mosquito nets, vacuum cleaner filters, and others.

6. Indu Tech (Industrial Textiles):

These technical textiles products are used for industrial purposes. The industrial purposes include industrial processes, incorporation of textiles into industrial products, reinforcements for printed circuit boards, seals and the gaskets and other industrial equipment. The indu tech products include conveyor belts, cigarette filter rods, drive belts, bloating cloth, AGM glass battery separators, decatising cloth, abrasives, ropes and cordages, composites, computer printer ribbon, printed circuit boards, paper making fabrics, filtration products, and industrial brushes.

7. Medi-Tech (Medical textiles):

These are commonly used in bandages and sutures (stitching the wounds), surgical dressings, contact lenses, artificial implants, baby diapers, incontinence diapers, sanitary napkins, surgical sutures, surgical disposables, and others. Medical textiles also cover surgical gowns and drapes. . Polyester, Cotton, polypropylene, silk and their use is best on several typical basic textile properties like softness and lightness, flexibility, absorption,

filtering etc. Traditional applications include wounds care products, diapers braces, prostheses and outhouses', wipes, breathing mask, bedding, and covers, ropes, and belts etc

8. Mobi Tech (Textiles used in transport):

Technical textiles used in automobiles, aircraft, railways, and ship building, such as nylon wire cord fabrics, seat cover fabric/upholstery, seat belts, cabin filters, tufted carpet, helmets, insulation felts, automotive interior carpets, sun visors / sunblind's, headliners, airbags, seat belt webbing, car body covers, airline disposables, aircraft webbings and others. The automotive sector has been improving its existing market share and creating innovative products through new developments, consequently increasing the demand for technical textiles.

9. Oeko Tech (Environmentally friendly textiles):

These types of technical textiles are used for the protection of the environment and ecology. Do this type of technical textile overlaps with several other areas such as industrial textiles, geo textiles and agricultural textiles it's not a well defined segment yet.

10. Patch tech (Packaging textiles):

There are some key uses of technical textiles as packaging and containment such as manufacturing of sacks and bags, traditionally from cotton, flex, and jute but increasingly from polypropylene and glass fibers. In the modern packaging market especially in the food industry, lighter weight nonwovens and knitted structures for a variety of working and protection applications. On the other hand tea and coffee bags used wet-laid nonwovens.

Besides these vegetables meals and fruits are now frequently packed with a nonwoven insert to absorb liquids, whereas fruits and vegetable products are supplied in knit or knitted net.

11. Pro tech (Protective textiles):

Protection against heat and radiation for firefighter clothing, against molten metal's for welders, for bulletproof jackets etc, all these things are obtained by usage of technical textiles with high-performance fibers high altitude clothing, ballistic protective clothing, fire retardant apparel, high visibility clothing, industrial gloves, and others.

12. Sports Tech (Sports textiles):

The various products used in sports application are included in it such as playing turf of hockey, etc. Ground, net used in various games like football, tennis, table tennis, basketball, hockey etc. The sports tech also includes the different types of protective materials used in various games such as gloves, helmets, safety pads etc. Also, the playing equipment such as Tents, swimwear, footwear components, sports nets, sleeping bags, hot air balloons, parachute fabrics, artificial turf, sports composites, and rackets, balls of various games like football, tennis, cricket, volleyball etc Polyester, nylon, spandex, glass fibers are used for Sport and leisure

Uses of Technical Textile:

Pidilite products are extensively used across many industries in a wide range of technical textile companies in India. These include technical textile uses in segments like Homotech, Packtech, Indutech, Geotech, Sportech,

Medtech and Protech etc. Applications consist of apparel, protective textiles, transportation fabrics, home furnishings, window treatments, soft luggage and a range of other technical textile applications for woven, non-woven and knit fabrics. Our portfolio of water-based, multi-functional coatings improves a broad range of functional and aesthetic properties, including flame retardance, abrasion and wash durability, water repellence, chemical resistance, thermal regulation and stretch resistance.

A Smart Textiles:

A smart textile are materials and structures that sense and react to environmental conditions or stimuli, such as those from mechanical, thermal, chemical, electrical, magnetic or other sources. They are systems composed of different apparatuses and materials such as sensors, actuators and electronic devices together. Textile science today stands on a novel unexplored and a fantasy-filled horizon.

Classification of smart textiles:

Passive smart textiles:- The first generations of smart textiles, they are only able to sales the environment user, based on sensors.

Active smart textiles:- The second generation have both actuators and sensors. Textiles which adopt their functionality to changing environment automatically are active smart textiles. Active smart textiles are shape memory, chameleonic, water resistant and vapor permeable, hate storage thermo regulated vapor absorbing and heat evolving fabric and electrically heated suits.

Ultra smart textiles:- Very smart textiles are the third generation of smart textiles, which can sense, react and adopt themselves to environmental conditions or stimuli.

Functions of smart textiles:-

Five functions can be distinguished in the intelligent suit namely sensor, data processing actuators, storage and communication. They all have a clear roll, although not all intelligent suits will contain all functions. The functions may be quite apparent or maybe an intrinsic property of the material or structure. They all require appropriate materials and structures and they must be compatible with the function of clothing. Comfortable, durable, resistant to regular process and so on.

Sensors:-

The basis of the sensor is that it transforms a single signal into another signal that can be read and understood by predefined readers which can be a real device or a person. As for real devices ultimately most signals are being transformed into electric ones. Textile materials cover a large surface area of the body. Consequently, they are an excellent measuring tool.

Data processing:-

Data processing is one of the components that are required only when active processing is necessary. The main bottle neck at present is the interpretation of the data. Textile sensors could provide a huge number of data, but what do they mean? Problems are large variations of signals between patients complex analysis of stationery and time dependency signals lack of objective standard values lack of understanding of complex inter relationship between parameters. Apart from this, the textile material in itself does not have any computing power at all.

Actuators:-

Actuators respond to an impulse resulting from the sensor function, possibly after data processing. Actuators make things move, they release substances, make noise, and many others. Shape memory materials are the best-known examples in this area. Shape memory alloys exist in the form of threads. Because of its ability to react to a temperature change, a shape memory material can be used as an actuator and link up perfectly with the requirements imposed on smart textiles.

Storage:-

The smart suit offer needs some storage capacity. Storage of data or energy is most common, sensing, data processing, actuation, communication; they usually need energy, mostly electrical power. Efficient energy management will consist of an appropriate combination of energy supply and energy storage capacity.

Communication:-

For intelligence textiles, communication has many faces; communication may be required within one element of the suit, between the individual elements within the suit, from the wearer to the suit to pass instructions, from the suit to the wearer or his environment to pass information.

Application of smart textiles... Health...

The development of wearable monitoring systems is already having an effect on healthcare in the form of "Telemedicine". Representative examples are Wireless-enabled garment with embedded textile sensors for simultaneous acquisition and continuous Monitoring of ECG, respiration, EMG, and physical activity. The "smart Cloth" embeds a strain fabric sensor based on piezoresistive yarn and fabric electrodes realized with metal based yarns. Sensitize vest including fully woven textile sensor for ECG and respiratory frequency detection and a portable electronic board for motion assessment, signal pre- processing, and Bluetooth for connection of data transmission. The wearable sen garment that measures human sitized garment that measures human heart rhythm and respiration using a three-lead ECG shirt. The conductive fibre grid and sensors are fully integrated (knitted) in the garment (smart shirt).

Life belt:-

Life belt plays a significant role in medical sector. It's a valuable decision support tool.

Basically life belt is a trans-abdominal wearable device. To avoid the frequent visit of additional patients the remote health monitoring provided by this. It is also time consuming to take individual care of every patients. So it becomes easier when hospitals use Life Belt which improves significantly patient's living and health conditions.

Phase change materials:-

Nowadays, face change materials are highly applied in the field of textiles for different kinds of products such as apparel, underwear, socks, shoes , bedding accessories and sleeping bags. For multifunctional products also are applicable in the specialty items like anti- ballistic vests, automotive, medical or for other industrial applications.

III. CONCLUSIONS

The textile industry is not only experiencing clothing application but also continuing a major outlook towards the non-clothing application of textiles known as Technical textiles.

The distinctiveness and confrontation of technical textiles lie in the need to understand and apply the principles of textile science and technology to give solutions, in the main leading technological problems but also often to engineering problems as well.

The fabrics of the future will be entirely re-conceptualized; researchers all over the world have been quizzed about the products that will be appearing on the market over the coming decades, and their belief is that there will be materials capable of repairing themselves when damaged, fabrics with built-in digital devices, smart textiles with nano materials and much more. With textiles it will be possible offer innovative solutions for global problems, such as pollution, health issues, transports, protection, communication, and so on. Smart textile is so much useful for human being. So we should have proper knowledge in this field. It should have high strength, high chemical and combustion-resistant organic fiber, high modulus organic fiber, It can be Ultra-fine fiber and novelty fiber, and high performance inorganic fiber

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Cite this Article

Dr. Vandana B. Wankhede , "Technical and Smart Textiles and their Applications", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 488-494, January-February 2022.

Journal URL : <https://ijsrst.com/IJSRST2215413>



**International Journal of Scientific Research in
Science and Technology**

(International Journal Bimonthly Publication)

www.ijsrst.com

Published by :
TechnoScience Academy

Web Site : www.ijsrst.com

Email : editor@ijsrst.com