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# Design and Implementation of Traic Based OLTC of Transformer

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## ABSTRACT

Power quality has for quite some time been a noteworthy worry in power framework plan and task. Also, this issue is ending up increasingly basic considering the developing consideration on keen framework with shaky sustainable power source, for example, sun powered board and wind turbine. A few measures can be taken to balance out power transmission and improve control quality, for example, voltage controller, responsive power pay, substantial scale vitality stockpiling, and so forth. In the present power framework structure, the most generally utilized innovation for voltage guideline is to alter the transformer voltage through a tap changer. Conventional On-load tap-changer (OLTC) works with mechanical switches (interrupter), it has the disadvantage of wearing on electrical contacts and mechanical parts, which requires administration/redesign task; and moderately low tap changing velocity constraining its conceivable utilitarian execution. With progression of innovation things are getting to be less difficult and less demanding for us. The idea of intensity gadgets tap-change (PE-OLTC) have been proposed to address the disadvantage of conventional OLTC .by and large the PE-OLTC can be ordered into 2 noteworthy sorts, Full-PE OLTC, in which no mechanical moving part is utilized; b) Hybrid-OLTC, in which the capacity of mechanical switch and power electronic switch are consolidated for various reason. For applications requesting higher tap-evolving recurrence, the Full-PE arrangements will demonstrate more favorable position. Be that as it may, for higher voltage and power rating applications, number of semiconductor segment utilized in OLTC will assume a fundamental job influencing equipment cost just as dependability, and after that half breed OLTC gives off an impression of being increasingly appealing arrangement.

**Keywords:** Arduino Uno, Transformer, Triac

## I. INTRODUCTION

Power quality has long been a major concern in power system design and operation. And this issue is becoming more critical considering the growing attention on smart-grid with unstable renewable energy source, such as solar panel and wind turbine. Several measures can be taken to stabilize power transmission and improve power quality, such as voltage regulator, reactive power compensation, large- scale energy storage, etc. In today's power system design, the most widely used technology for voltage regulation is to adjust the transformer voltage through a tap changer. Traditional On-load tap-changer (OLTC) works with mechanical switches (interrupter), it has the drawback of wearing on

electrical contacts and mechanical parts, which requires service/overhaul operation; and relatively low tap changing speed limiting its possible functional performance. Triac is utilized as a switch. BT 136 triac can be utilized. The flag is given to the fitting tap by the microcontroller. Due this the favored tapping is chosen. In light of triac utilized as a switch the mechanical misfortunes or floods can be maintained a strategic distance from. Accordingly this is valuable circuit to give the consistent voltage on the heap side for example the auxiliary side of the transformer. Opto coupler MOC3021 is utilized as a driver. Opto coupler MOC3021 can used to trigger the static switches, for example, triac. The signs originating from the microcontroller are utilized as a contribution for the Opto coupler MOC3021.

## II. LITERATURE SURVEY

In this paper by **Gautham Ram Chandra Mouli et. all (Power Electronic Assisted OLTC for Grid Voltage Regulation, June 2015)** [1] On-load tap changing voltage controllers and sub transmission transformer use taps made of mechanical switches that can be worked under burden. Under states of intermittent voltage vacillation because of DG (circulated age) the mechanical switches experience visit mileage amid tap change because of the arcing marvel. This outcomes in lower lifetime of the switches and requires rehashed support. In any case these mechanical taps have the upside of high over-burden limit and low on-state misfortunes. Then again, electronic tap changers use semiconductor switches that don't have any arcing issues. They give adaptability in activity however experience the ill effects of a lot higher consistent state misfortunes. By consolidating the benefits of both electronic and mechanical tap changers, control electronic helped tap changers are acquired.

In this paper by **S.V.M. Bhuvanaika Rao & B.Subramanyeswar, (Fine Voltage Control Using OLTC by Static Tap Change Mechanism, Dec 2012)** [2] center is being given to control transformer with on burden tap changer where the total mechanical control is supplanted with static semiconductor changes having a place with thyristor family, for example, GTOs which are equipped for controlled turn on and off. These advanced GTO thyristor had the upsides of high power taking care of ability and long life, accordingly appropriate for use as selector. The proposed tap selector comprises of bi-directional GTOs associated in hostile to parallel, hence determination of specific tap is finished by exchanging GTOs in that individual tap. The utilization of semiconductor or strong state gadgets in planning the tap changer have favorable position of quicker reaction, nearly upkeep free and better execution when contrasted with regular tap changers.

In this paper by **Nikunj R. Patel et. all (Solid- State On Load Tap-Changer for Transformer Using Microcontroller, DEC 2014)** [3] Power quality is likewise one of the most imperative thing nowadays. Both the power utilities furthermore, shoppers are very worried about the nature of the control supply. This needs the provisions to be at its ideal esteem with the goal that the expense is proficient; generally issues, for example, over voltage, under voltage, voltage swell, voltage droop, clamour what's more, symphonies brought about by the aggravations in power supply could be terrible. A few techniques have been proposed and connected as the arrangement of these issues. One of the techniques is by utilizing an on-load control transformer with tap changing, where the yield voltage of the power transformer stays consistent independently to the information voltage or variety of the heap. The current mechanical on-load tape changing force transformer has few disservices as it produces arcing, requires ordinary support, administration costs,

what's more, moderate response times With the utilization of high power semiconductor gadgets, for example, triac, IGBTs, Thyristor, issues related with the mechanical on-load tap evolvingcontrol transformer have been disposed of. So as to conquer these impediments and downsides, new circuits and arrangements for tap-changers have been presented.

In this paper by **Vivek Thomas Chacko et all (Solid state on load tap changer for transformer using Arduino) [4]** Transformers have been an essential and most pivotal piece of the whole high voltage transmission and conveyance framework. The transformer jobs of venturing up and venturing down voltage relying upon the heap request and its ratings. Transformer windings have recordings drawn out of it which are utilized to change the voltage rating of transformer by certain esteem. This is done when there are unexpected burden changes. The taps can be drawn out from both info and burden side yet they are generally set on high voltage side as the current on low voltage windings is very high. The surprising voltage variances that happen at burden side are offset with assistance of tap changers present inside transformers.

**B. Kasztenny et. all (Fuzzy logic controller for on-load transformer tap-changer) [5]** this paper exhibits the new Fuzzy Logic Controller (FLC) for on-load tap change control for appropriation transformers. The model of a transformer with its tap changing instrument is given first. Next, the FLC is exhibited in subtleties. The proposed calculation is enhanced from the numerical perspective and ended up being implementable on contemporary Programmed Logic Controllers (PLCs). The re-enactment results are incorporated that contrast the proposed control calculation and the traditional converse time controller and demonstrate the effectiveness of the new arrangement.

In this paper **H. Jiang et. all (Fast response GTO assisted novel tap changer, IEEE Trans. Power Del., vol. 16, no. 1, pp. 111– 115, Jan. 2001) [6]** explain Another kind of GTO thyristor helped tap changer is laid out which tends to the issues of customary plans. The plan limits conduction misfortunes in the strong state gadgets and furthermore allows a quick reaction speed through the appropriation of quick actuator driven vacuum switches. This paper portrays a model tap changer for a low voltage 300 kVA transformer utilizing the new strategy for tap evolving. The model works at current dimensions like those at which a full scale tap changer would work. Test outcomes are introduced.

## III. METHODS AND MATERIAL

Figure 1 shows block diagram of triac based on load tap changer. It consists four main parts:-

### A. BLOCK DIAGRAM

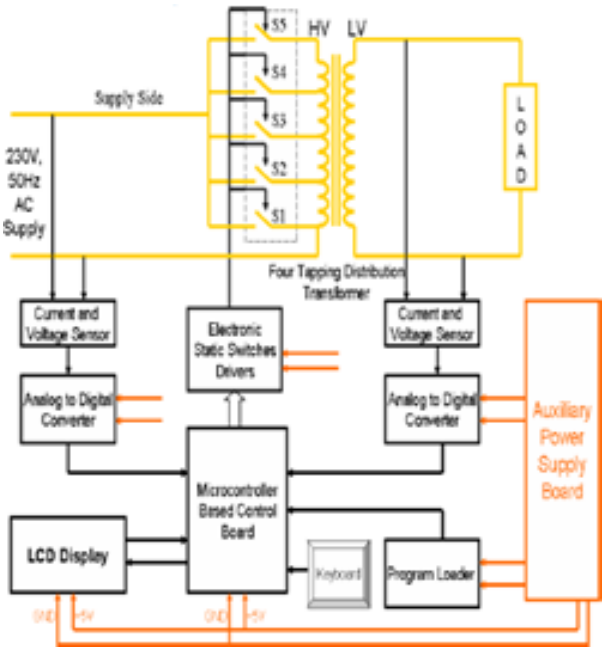



Fig.1 Block Diagram

### B. Transformer

A transformer is a static electrical gadget that exchanges electrical vitality between at least two

circuits. A shifting current in one curl of the transformer creates a changing attractive transition, which, thus, initiates a differing electromotive power over a second loop twisted around a similar center. Electrical vitality can be exchanged between the two curls, without a metallic association between the two circuits. We utilized 1KVA, 230/110 volts,1 stage venture down transformer with 5 tappings on HV side.

| Quantity | Value |
|---|---|
| No of phases | 1 phase |
| Transformer rating | 1 kva |
| If tap 1 selected at nominal vtg is | 109 |
| If tap 2 selected at nominal vtg is | 119 |
| If tap 3 selected at nominal vtg is | 131 |
| If tap 4 selected at nominal vtg is | 145 |
| If tap 5 selected at nominal vtg is | 155 |
| Rated input vtg | 230 |
| No of vtg step | 5 |
| Step to step vtg drop | Apprx 10 |
| Max output current | 9.524 approx 10rms |
| Tapping provided at | Hv side |

Specification of transformer:-

Voltage sensors (PT)

The Voltage Sensor square speaks to a perfect voltage sensor, that is, a gadget that changes over voltage estimated between two of an electrical circuit into a physical flag relative to the voltage. Associations + and – are electrical saving ports through which the sensor is associated with the circuit.

Rectifier

A rectifier is an electrical gadget made out of at least one diodes that changes over substituting flow (AC) to coordinate flow (DC). A diode resembles a single direction valve that enables an electrical flow to stream in just a single bearing. This procedure is called rectification. A rectifier can take the state of a few diverse physical structures, for example, strong state diodes, vacuum tube diodes, mercury circular segment valves, silicon-controlled rectifiers and different other silicon-based semiconductor switches.

Microcontroller

The Atmega 328P is utilized as the microcontroller. It takes the voltage esteems from potential transformer through the rectifier it faculties the adjustment in the voltage and gives the relating sign to the driver and exchanging circuit for further procedure.

Electronic switches & drivers

Triac is utilized as a switch. BT 136 triac can be utilized. The flag is given to the fitting tap by the microcontroller. Due this the favored tapping is chosen. In light of triac utilized as a switch the mechanical misfortunes or floods can be maintained a strategic distance from. Accordingly this is valuable circuit to give the consistent voltage on the heap side for example the auxiliary side of the transformer. Opto coupler MOC3021 is utilized as a driver. Opto coupler MOC3021 can used to trigger the static switches, for example, triac.

**A. Hardware requirement**

- Arduino Uno (atmega 328p)
- LCD (1kva,230/110 volts,1 phase)

**B. Software requirement**

- Proteus (Simulation)
- Arduino Ide(Programming)

## CIRCUIT DIAGRAM

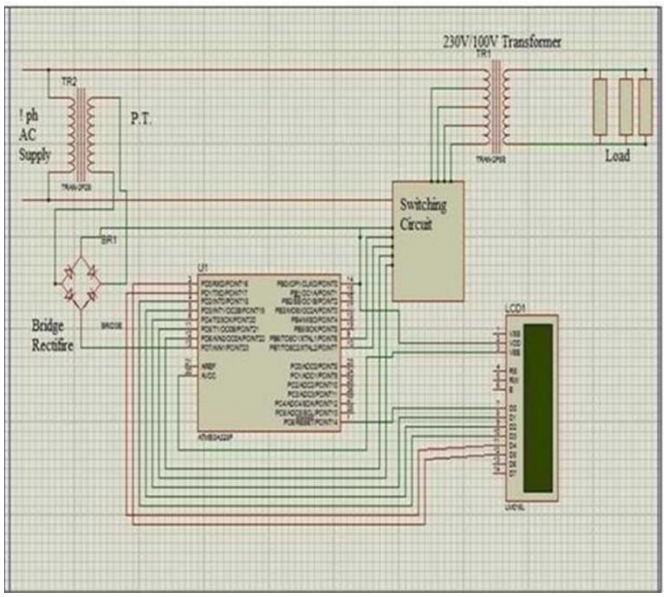



Fig 2. Circuit Diagram

## ALGORITHM

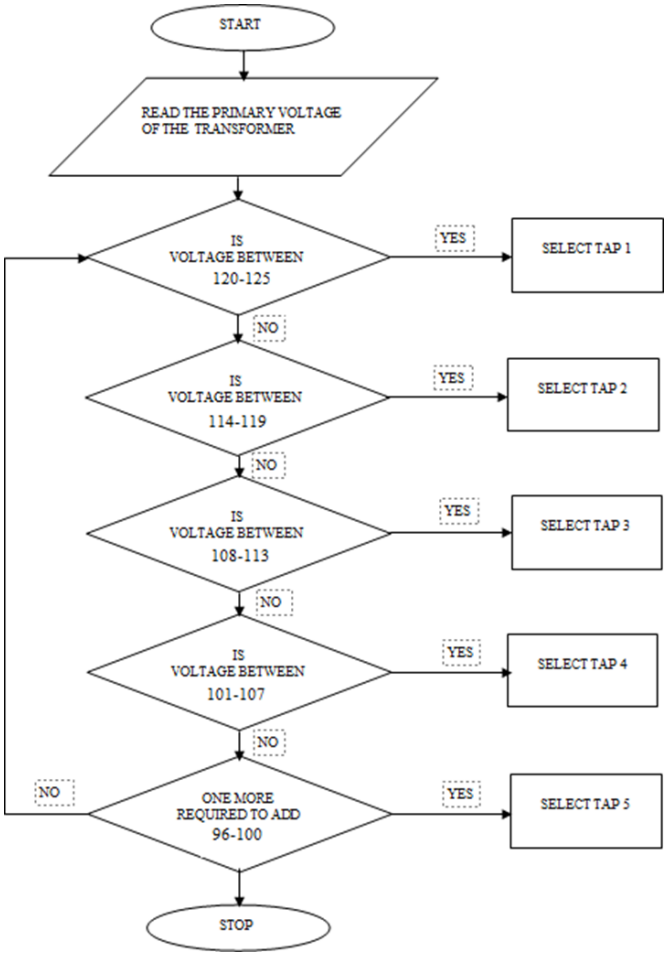



Fig 3. Flow Diagram

## IV. RESULT

### HEROTICALLY

1. OPEN CIRCUIT & SHORT CIRCUIT TEST

| Tap | V0 | I0 | W0 | VSC | IS C | WSC | % n |
|---|---|---|---|---|---|---|---|
| 5 | 230 | 0.12 | 12 | 34 | 4.2 | 140 | 86.5 |
| 4 | 230 | 0.15 | 18 | 41 | 4.2 | 168 | 84.8 |
| **3** | **230** | **0.21** | **30** | **48** | **4.2** | **192** | **81.83** |
| **2** | **230** | **0.32** | **42** | **57** | **4.2** | **228** | **78.74** |
| 1 | 230 | 0.62 | 54 | 66 | 4.2 | 268 | 74.64 |

2. LOADING TEST

| TAP | SEC NO LOAD VTG | SEC FULL LOAD VTG | % REG |
|---|---|---|---|
| 1 | 126 | 117 | 7.6 |
| **2** | **137** | **127** | **7.8** |
| **3** | **150** | **138** | **8.7** |
| 4 | 163 | 151 | 7.9 |
| 5 | 182 | 168 | 8.3 |

PRACTICALLY

| Load | i/p vtg | o/p vtg | Tap | % n | % reg |
|---|---|---|---|---|---|
| 0.21 | 230V | 118 | 2 | 84 | 8 |
| 0.3 | 230V | 116 | 2 | 79 | 9 |
| 0.4 | 230V | 115 | 2 | 77 | 10 |
| 0.88 | 230V | 112 | 3 | 75 | 12 |
| 0.98 | 230V | 110 | 3 | 73 | 13 |
| 1.02 | 230V | 108 | 3 | 67 | 14 |

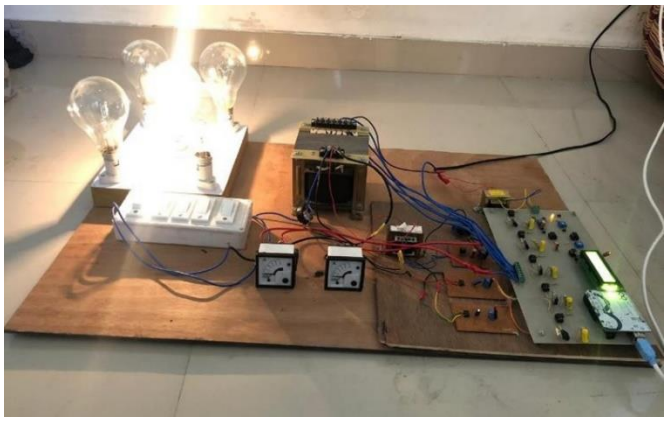
**LCD display setup**

**For tap 2** **For tap 3**


**Inupt/output voltage**


**Input/output current**


**% regulation & Efficiency**

Experimental setup

## V. CONCLUSION

In existing framework we utilized mechanical sort on burden tap changer having constraint and disadvantages like arcing, high support, administration cost, misfortunes in exchanging, moderate reaction of mechanical taps. These variables cause a few unsettling influences and vacillations in the framework lessening the dependability and unwavering quality of the framework. Because of this the life of switches gets abbreviated and cause arcing issues. In our framework as we use control electronic gadgets for example TRIAC there are no mechanical misfortunes, decrease in arcing issues, quicker reaction for exchanging expanding the dependability and steadiness of the framework. TRIAC is utilized as upkeep cost is low. In our framework TRIAC triggers the proper pair of against parallel thyristors for change in the appropriate recordings of the transformers improving the power quality and solidness of the framework giving a quicker reaction than the regular tap changers. Any variety in the yield voltage of the transformer is detected by the voltage detecting gadget and the fitting triac and the tap will get chose. As TRIAC is a static gadget it has a few points of interest. Utilization of a power electronic gadget for example TRIAC it will take out the contact wear making the exchanging procedure lighter, quicker and progressively proficient.

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