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Maximize the Life of Mobile Ad Hoc Network using DSP

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ABSTRACT

In this modern era of Artificial Intelligence (AI) and Internet of Things (IoT) which are acknowledged as of the most significant areas of upcoming technology and is gaining attention from a wide range of different fields like Military application, Automation of Industries, Smart irrigation and Agriculture, e-learning platform of Education, The pandemic Tele health services, etc. IoT is a combination of different network like Wireless sensor network and Mobile Adhoc Network. In these networks the limited Battery power is very serious issue. Maintaining connectivity for the longer time is also a big challenge considering the self-organizing nature of the network topology and the dynamic change in the behaviour and position of nodes result in failures of communication link and node availability. This research paper present the kinetic energy harvesting Dynamic source of Power to supply the energy to the node battery, so that the failure of communication network will be avoided and hence it maximizes the life of Mobile Adhoc network for the reliable communication in critical situation like Military operation and Emergency rescue operation. So the overall focus of this research is to handle the challenges in MANET for prolong networks MANET. The paper deals with an analysis and experimental tests on a push to generate generator known as a Dynamic Source of Power has a built-in linear moving- coil generator with stationary magnet A Lithium-ion battery is charged to supply the power to the nodes of MANET. Analytical equations for the induced EMF, current, voltage, electromagnetic force and power have been derived. A prototype has been made and performs experimental tests on it. The results of laboratory tests have been compared with analytical calculations. The output electric power in comparison with other energy harvesting devices is high with low cost and more reliable.

Keywords : IoT, Energy, Layered routing, MANET, Power Control, Routing protocol, Reliable communication, Topology. Spur gear assembly, Electromagnetic Induction

I. INTRODUCTION

Today we are more surround ourselves by countless communication technology to run day today life and come across several electronic sensors, data and decisions for achieving various goals and targets in the field of Military application, Automation of Industries, Smart irrigation and Agriculture, e-learning platform of Education, Our daily activities and everyday lives are running smooth so long as the transition from one field of electronic to other field of electronics remains frictionless. From advanced cars to smart home, from remote to monitoring to wearable electronic, from implantable chips to smart communication devices small scale communication network permeate our lives in almost every aspects sometimes without our being fully aware of them. The advancement in communication network technology and electronics systems design affects over numerous new features including easy integrability, mobility and seamless connectivity for efficient use of resources. They also bring better way of lifestyle, strong economic impact, improved health decisions and industrial automation. The scientist and engineers are focusing on how to handle these practical challenges including, but not limited to, how to improve the performance and maximize the lifetime of these telecommunication network and related systems, how to run them for longer time period per charge cycle, how to communicate better for the long distance with the noisy channels and how to maintain and uphold the privacy of the data. In this paper the primary focus is to explore the challenges to designing efficient power delivery systems for small scale Telecommunication like Adhoc network and its application in Military operations as well as critical disaster management or rescue operation with secure use of electronics systems. More specifically, for systems those are usually operated in standalone condition and away from the commercial energy sources and hence rely either on battery powered operation or solely on harvested or generated energy.

In Mobile Ad-hoc Network (MANETs) there is no fixed infrastructure of access points, as shown in Fig-1, the nodes are mobile and move independently in a random way, the physical topology of the network and its connectivity changes dynamically, and at a given moment each node can act as a router. Different research efforts are underway to address various issues of ad hoc networks. In this chapter, we provide an adequate account of these efforts. The basic communication is carried out in MANET is by Route request messages as shown in Fig 2.While Route reply with route record is depicts in Fig 3. There are already some surveys available that have summarized the previous researches on ad hoc networks. Self-organization is an inherent property of such networks, thus allowing a seamless interconnection within a specific range or zone. Such networks are being deployed for many diverse applications, such as Vehicular communications, Military applications, emergency, Disaster operations, Search and Rescue operations, etc. [1]. The problem of network sustainability, load balancing and energy efficiency in MANETs is a topic of research since In Mobile Ad-hoc Network (MANETs) there is no fixed infrastructure of access points, as shown in Fig-1.1, the nodes are mobile and move independently in a random way, the physical topology of the network and its connectivity changes dynamically, and at a given moment each node can act as a router. Different research efforts are underway to address various issues of ad hoc networks. In this chapter, we provide an adequate account of these efforts.

The basic communication is carried out in MANET is by Route request messages as shown in Fig 1.2. While Route reply with route record is depicts in Fig 1.3. There are already some surveys available that have summarized the previous researches on ad hoc networks. Self-organization is an inherent property of such networks, thus allowing a seamless interconnection within a specific range or zone. Such networks are being deployed for many diverse applications, such as Vehicular communications, Military applications, emergency, Disaster operations, Search and Rescue operations, etc. [1].

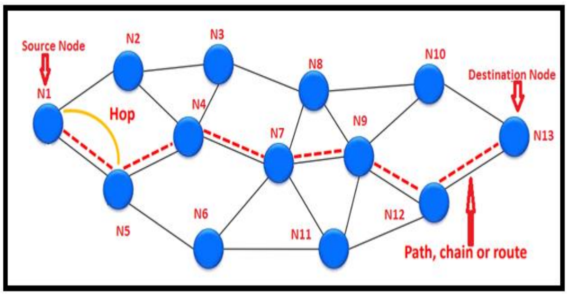

Fig. 1.1: Arrangement of Mobile Adhoc Network

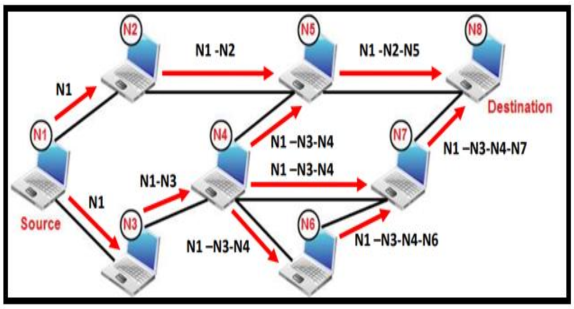

Fig. 1.2: The basic communication is carried out by Route request messages in MANET

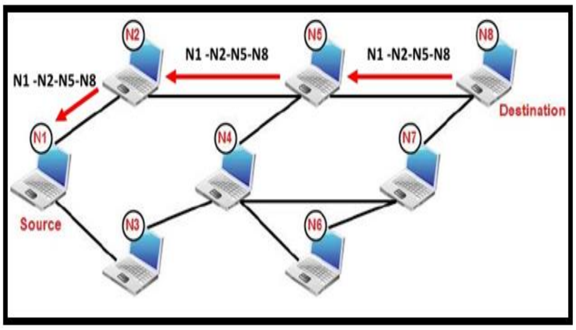

Fig. 1.3: The process of Route reply with route record in MANET

The result is a dynamically change of the topology of the network and the impossibility to predict accurately or exactly the network structure at any time. A node ensuring the communication path between source and destination can become unavailable in the next time interval; the reasons are mobility or movement out of the servicing or coverage area, a drop or exhausted of power or traffic overload. Thus for such a dynamically changing environment a dynamic routing algorithm must be deployed or to make the node with portable charger to avoid link breakage and achieve the overall better performance of the ad-hoc network structure. The strength of a node regarding its available energy becomes an important issue for the period of the selection of an intermediate node to maintain stable transfer of data between nodes. Keeping lifetime of a routing path in a network is a challenging task due to the power of the nodes which depends on the node size, the propagation model, the properties of the model, and the capacity of the battery Data traffic and storage increases exponentially in today's MANETs and result is that the energy requirements increase; while in response to this growth the energy available in the battery becomes insufficient, thus rising up the energy gap problem as shown in Fig. 4.

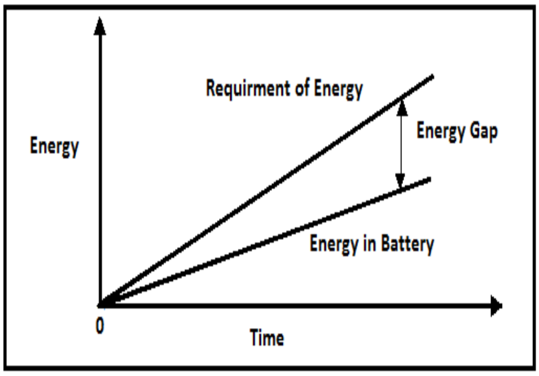

Fig.1.4 Graph of Energy gap between Energy requirement and Energy in Node battery.

The aim of this work is to make an overview of energy aware routing protocols to improve the lifetime of resource constrained ad-hoc communication networks like Mobile ad-hoc networks (MANET) by introducing of Dynamic source of Power from Human movement. It also has an important influence on the overall communication performance of the network. Our main objective is to examine, develop, and analyse the power efficient system for the emergency Military or rescue operation in remote areas.

II. METHODOLOGY

Innovative Design of Push to generate Dynamic Power Source.

The main function of innovative Push to generate Dynamic Power Source is to collect electric energy continuously from walking process during Military operation or Rescue operation by the Military or rescue team members and at the same time to ensure the comfort of human walking. In order to achieve these functions the special type of arrangements has been made. The functional shoe mainly consists of the power generator and acquisition device which consists of a spur type gear assembly with linear generator, a storage circuit and a charging interface with power storage device like Capacitor bank or Lithium ion Battery. At the side of heel of the shoe L shape plate is fitted with help of the sole plate as shown in the above Figure 3.1. With the use of push to rotate mechanism and supporting Bearing with other end a Permanent Magnet Direct Current generator is attached which generate sufficient voltage to charge the battery. Block diagram of overall system is shown in figure 2.1, and the fabricated assembly with DC generator is shown in figure 2.2.

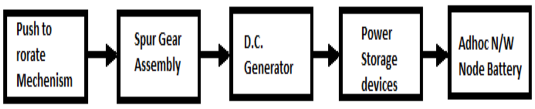

Fig. 2.1: General Block Diagram of Dynamic Power Source.

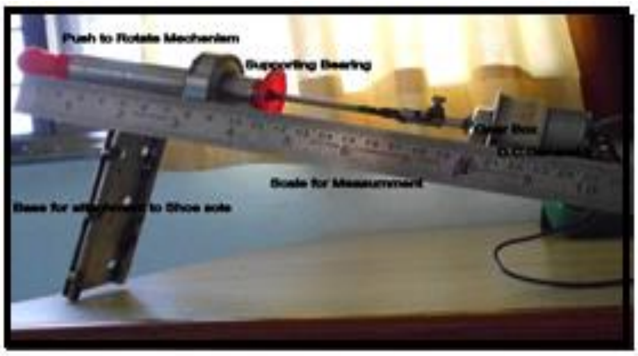

Fig. 2.2: construction of Dynamic Power Source module.

The following major steps were involved in the process:

Step 1: When force is applied with help of shoes While walking the push to rotate mechanism rotates the shaft as shown in figure 2.5.

Step 2: Due to this the stud moves vertically up.

Step 3: this rotate the spur gear assembly. In ratio 0f 1:50.

Step 4 For one full compression the shaft moves two times.

Step 5:The intermediate gear with a greater number of teeth will rotate as a result of motion of pinion.

Step 6:The generator attached to the intermediate will obtain the rotating motion, hence results is the DC waveform from Generator. And lifting the Shoes stud get release to its original position as shown in figure 2.4.

Step 7: The voltage signal thus obtained will be displayed in Digital storage Oscilloscope.

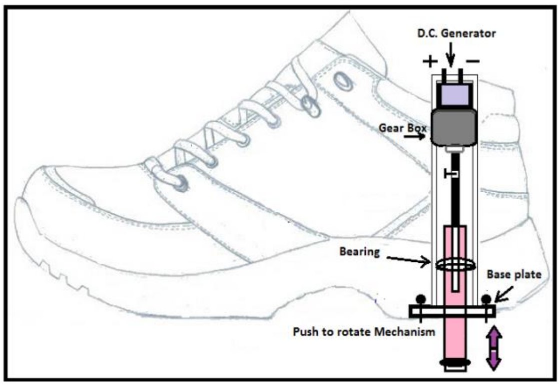

Fig.2.4: Assembly of Dynamic Power Source module with Shoe sole in lifting mode.

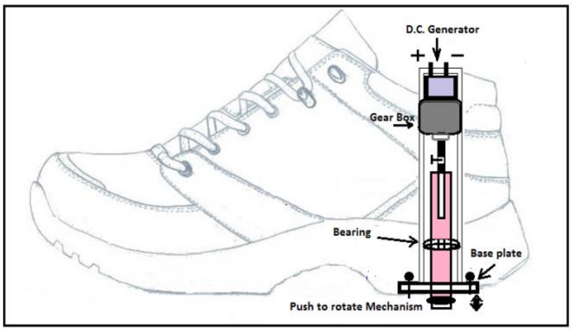

Fig.2.5: Assembly of Dynamic Power Source module with Shoe sole in pushing mode

III. RESULT AND DISCUSSION

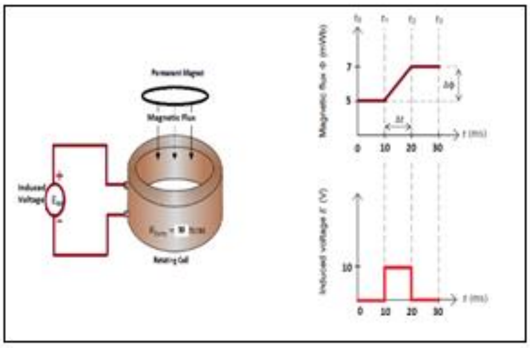

Fig 3. 1: Voltage induced in a loop exposed to a magnetic flux varying in intensity.

When the closed circuit is n turns of coil, the instantaneous electromotive force can be expressed as:

$$E_{ind} = n\frac{\Delta\emptyset}{\Delta t} \quad (1)$$

Where, E_{ind} is the induced electromotive force generated, and its unit is V;

n is he number of turns of the coil;

$\Delta\emptyset$ is the amount of change in the magnetic flux, and its unit is Wb;

Δt is the time interval during which the magnetic flux variation occurs, expressed in seconds (s). Figure 3.1 gives an example of the voltage induced E_{ind} across a wire loop that is exposed to a magnetic flux ϕ varying in intensity. Between instants t_0 and t_1, the intensity of the magnetic flux ϕ remains constant (5 mWb), and thus, the induced voltage E_{ind} is zero. Between instants t_1 and t_2, the intensity of the magnetic flux ϕ increases at a constant rate from 5 mWb to 7 mWb, and thus, a constant voltage E_{ind} is induced in the wire loop. Between instants t_2 and t_3, the intensity of the magnetic ϕ flux remains constant (7 mWb), and thus, the induced E_{ind} voltage is zero.

Using the values given in Figure 3.1, the voltage E_{ind} induced across the coil between instants t_1 and t_2 can be calculated by using Equation (1):

$$E_{ind} = n\frac{\Delta\emptyset}{\Delta t} = 50\ turn \times \frac{0.007\ Wb - 0.005\ wb}{0.01\ Sec}$$

$$= \frac{0.002}{0.01} = 10\ Volts$$

$$E_{max} = 0.5 \times 100 \times 25^2 = 31250\mu J$$

The energy or voltage charged by the 1-step in the capacitor is:

$$E_{Cap} = 0.5 \times C \times E_{ind}{}^2$$

$$E_{Cap} = 0.5 \times 100 \times 10^2 = 5000\mu J$$

The overall performance is summarising in following table.

Human motion	Force(N) Applied	Steps per second	Voltage (E_{ind}) induced
walking	687	1	9.3
Running	600	2	10.3
Fast Run	565	3	11.1

Table 3.1 Data calculated for DSP system.

OUTPUT POWER CALCULATION,

Let us consider,

The mass of a body = 70 Kg (Approximately)

Height of spring (Stud movement) = 4cm

∴ Work done = Force x Distance

Here, Force = Weight of the Body

= 70 Kg x 9.81 = 686.7 N

Distance travelled by the body = Height of the outer stud of a generator is = 4 cm = 0.04 m.

Input Mechanical power.

P_{in} = Work done/Sec

= (686.7 x 0.04)/60 = 0.4578 Watts (For One pushing force)

The following figures indicate the measurement of generated signal with the help of Digital storage oscilloscope in different motion of Human.

Fig 3.2: Voltage induced in a slow walking.

Fig 3.3: Voltage induced in a slow running.

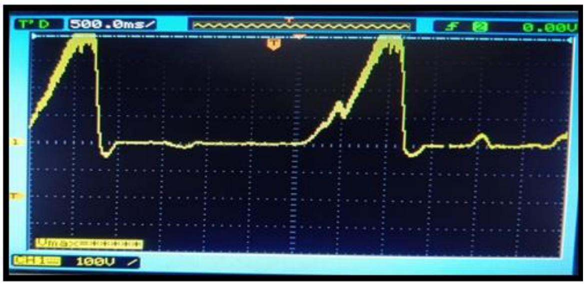

Fig 3.4: Voltage induced in a slow running.

Fig 3.5: Voltage induced in a fast running

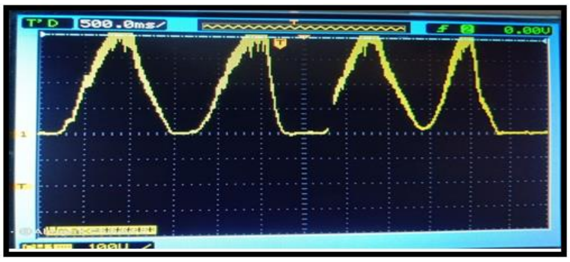

Fig 3.6: Voltage induced in a very fast running

In this process of energy generation from the Dynamic source of power the overall effect of following parameters can be improved to great extent and hence the life of Adhoc network is prolonged and helps to maximize the network life for Military and rescue operations.

- **Energy Consumption.** The average of the total consumed energy of all the nodes of the network. It is measured in Joules. So if we add the extra energy from harvester the node will more time without fail.
- **Packet delivery ratio (PDR).** Packet delivery ratio is defined as the ratio of data packets received by the destinations to those generated by the sources. In this parameter if the process is improved with extra cost of energy than the drop of packets will minimize,
- **Throughput.** Throughput is the number of bytes or bits arriving at the sink over time. It is generally measured in bits per second. So if the range is increased with efficient Antenna with more power than these parameter further increases with more reliability.
- **Dropped Packets.** It is the number of data packets that are not successfully sent or forwarded to the destination. The dropping of a packet can occur during a collision/error or another failure in the routing process. As the life of network and range of communication increases this will lead to minimize.
- **Routing Load.** It can be defied by the ratio of the number of routing messages propagated by every node in the network and the number of data packets successfully delivered to all destination nodes. This will also balance the network routing load by making the strong data communication strategies.
- **Network throughput.** which is the average rate of successful message delivery over a communication channel. Usually, the larger the routing traffic used by a routing protocol, the fewer throughputs is available for actual data traffic good put. Overall network throughput is affected.
- **End-to-End Delay.** This is average time interval between the generation of a packet in a source node and the successfully delivery of the packet to the destination node. This time will reduce with high efficiency.

IV. CONCLUSION AND FUTURE WORK

This work studies the various energy harvesting mechanisms related to MANET. Various approaches and techniques are evolved to save and energy harvesting in MANET. The essential services in MANETs are routing, connectivity, and end-to-end communication.

This also will reduce the overall number of broadcasts on the network and ensures a reliable and energy efficient connection,. The aim should be better Connectivity, reliable End-to-End Communication, Secure and energy efficient routing to improve network lifetime in homogeneous as well as heterogeneous MANETs. Future work could be related to the higher end long lasting connectivity for network to achieve the define objective with more powerful energy generators.

V. REFERENCES

[1]. Manohar Chaudhari,"Energy Efficient ustainable Routing Architecture for MANET" Technical research organisation India. Vol.4, Issue-1 2017. pp. 84-94,

[2]. Baghbani, M. Ashoorirad "A Power generating system for mobile electronic devices using human walking motion." Computer and Electrical Engineering, ICCEE Second International Conference, IEEE Transactions, Vol. 2, 2009, pp. 385-388.

[3]. Bonisoli, E., Repetto,M.,Manca, N., and Gasparini, A. (2017). Electro-mechanicaland electronic integrated harvester for shoes application. IEEE/ASME, pp.1921–1932.

[4]. Amirtharajah R., Collier J., Siebert J. Zhou B. and Chandrakasan A., "DSPs for Energy Harvesting Sensors: Applications and Architectures", IEEE Pervasive Computing, vol. 4(3), pp. 72-79, 2005.

[5]. Shivendra Nandan, Rishikesh Trivedi Design And Fabrication Of Mechanical Footstep Power Generator" International Journal of Engineering Applied Sciences and Technology, 2019 Vol. 4, Issue 05, ISSN No. 2455-2143, Pages 214-222.

[6]. Xu B and Li Y " Force Analysis and Energy Harvesting for Innovative Multi-functional Shoes." September 2019 | Volume 6 | Article 221.

[7]. Yang Kuang, Tingwen Ruan, Zheng Jun Chew, Meiling Zhu. Energy harvesting during human Walking to power a wireless sensor node" Sensors and Actuators A 254 (2017) pp. 69–77.

[8]. M. Conti, S. Giordano, "Mobile ad hoc networking: milestones, challenges, and new research directions," IEEE Communications Magazine, vol. 52, pp. 85-96, 2014.

[9]. Deepak Gadde;M.S.Chaudhari,"Survey on routing protocol for low-power and lossy networks." IEEE International Conference on Computational Intelligence and Computing Research (ICCIC), India.pp.1-5, 2015.

[10]. Munaswamy B., Prudhvi Ch., Srikanth V., Kirankumar B., Kumar Er. Pradeep, (2018) Mechanical Footstep Power Generation, India International Journal of Engineering Trends and Applications (IJETA) – Volume 5 Issue 2, Mar-Apr 2018.

[11]. Jacek F. Giera, Adrian Kucharski1, Jozef Piechowski' Performance Characteristics of a Shake Flashlight" 2017 IEEE International Electric Machines and Drives Conference, pp, 998'

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