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Energy Efficient Routing Structure for Wireless Sensor Networks

Navnita Sakharkar[1], Kusum Sharma[2], Anil Kumar Pandey[3]
[1]*M.Tech. (Scholar),* [2, 3]*Assistant Professor, RSR Rungta College of Engineering & Technology, Bhilai, Chhattisgarh, INDIA*

Abstract: ***Wireless sensor networks have found many applications in different areas, including environmental surveillance, intelligent building, health monitoring, intelligent transportations, etc. Recent development in electronics and wireless communications has enabled the improvement of low-power and low cost wireless sensors networks.. One of the most important challenges in WSNs is to design energy (resource) efficient routing mechanism to increase the network lifetime due to the limited energy capacity of the network nodes. This Work also proposed a minimum distance based cluster formation and member nodes allotment process to enhance lifetime. Results will be in terms of Network lifetime (Number of dead sensors), Percentage dead, Network Stability, Network Energy, Network throughput, error rate and delay. The validation parameters will show that; the proposed method will outperform the existing method in [18 and 19].***
Keywords: Wireless sensor network; Energy efficient routing; Heterogeneous network; Network Stability; Location Based Routing; Connectivity Density; Distance from BS; Energy Distribution, Optimum Network Design; Multi-hop communication.

I. INTRODUCTION

1) *WSNs:* "Wireless Sensor Networks (WSNs) are a combination of autonomous devices transmitting locally gathered information to a so-called sink node by using multi-hop wireless routing."

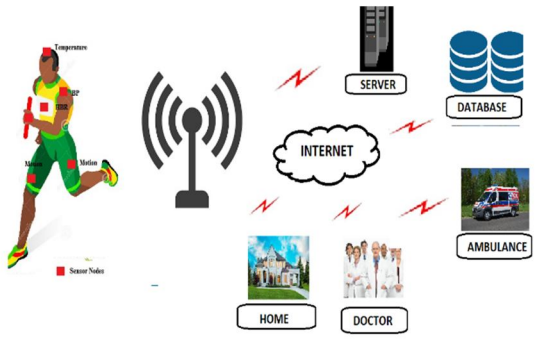

Fig: Sensors In Day To Day Life

Over the last recent year's wireless communications has become of such fundamental importance that a world without it is no longer imaginable for many of us.

2) *Growing technology in WSNs:* Ad-hoc sensor networks consist of a set of autonomous nodes communicating via radio without any additional backbone infrastructure. This fact is possible since the devices themselves provide the communications infrastructure. The communication between two nodes of the network is carried out either directly between them or through intermediate nodes relaying their message in case that both are not within mutual transmission range. On the other hand, the continued advances in micro-sensor technology have resulted in the development and deployment of small low cost and low power sensing devices with computational "sensing" and communication capabilities. These advances make economically possible the deployment of large numbers of nodes to form a WSN that monitors a specified parameter. Even though, sensor nodes are not very accurate and reliable individually, their deployment in large number enhances their accuracy and reliability. In view of the great potential of ad-hoc sensor networks in a variety of application scenarios such as disaster relief, community mesh networks, monitoring and surveillance, or data gathering, it is not surprising that there has recently been a flurry of research activity in the field. Harnessing WSN potential will provide efficient and cost-effective solution to many problems. It

will require the use of new wireless sensor techniques that make these networks practical and efficient and also take into consideration sensors' limitations.

3) *Challenges:* A Wireless Sensor Network or WSN is supposed to be made up of a large number of sensors and at least one base station. The sensors are autonomous small devices with several constraints like the battery power, computation capacity, communication range and memory. They also are supplied with transceivers to gather information from its environment and pass it on up to a certain base station, where the measured parameters can be stored and available for the end user. In most cases, the sensors forming these networks are deployed randomly and left unattended to and are expected to perform their mission properly and efficiently. As a result of this random deployment, the WSN has usually varying degrees of node density along its area. Sensor networks are also energy constrained since the individual sensors, which the network is formed with, are extremely energy-constrained as well. The communication devices on these sensors are small and have limited power and range. Both the probably difference of node density among some regions of the network and the energy constraint of the sensor nodes cause nodes slowly die making the network less dense. Also it is quite common to deploy WSNs in harsh environment, what makes many sensors inoperable or faulty. For that reason, these networks need to be fault-tolerant so that the need for maintenance is minimized. Typically, the network topology is continuously and dynamically changing, and it is actually not a desired solution to replenish it by infusing new sensors instead the depleted ones. A real and appropriate solution for this problem is to implement routing protocols that perform efficiently and utilizing the less amount of energy as possible for the communication among nodes.

II. CLASSIFICATION OF WIRELESS SENSOR NETWORKS

In this subsection a simple classification of sensor networks based on their mode of functioning and the type of target application is presented.

A. Proactive Networks

The nodes in this sort of network periodically switch on their sensors and transmitters, sense the environment and transmit the data of interest. Hence, they provide a snapshot of the relevant parameters at regular intervals. They are well suited for applications requiring periodic data monitoring. Some known instances of this kind are the LEACH protocol, some improvements on LEACH and PEGASIS.

B. Reactive Networks

The nodes of the networks according to this scheme react immediately to sudden and drastic changes in the value of a sensed attribute. They are well suited for time critical applications.

C. Hybrid Networks

The nodes in such a network not only react to time-critical situations, but also give an overall picture of the network at periodic intervals in an energy efficient manner. Such a network enables the user to request past, present and future data from the network in the form of historical, one-time and persistent queries respectively.

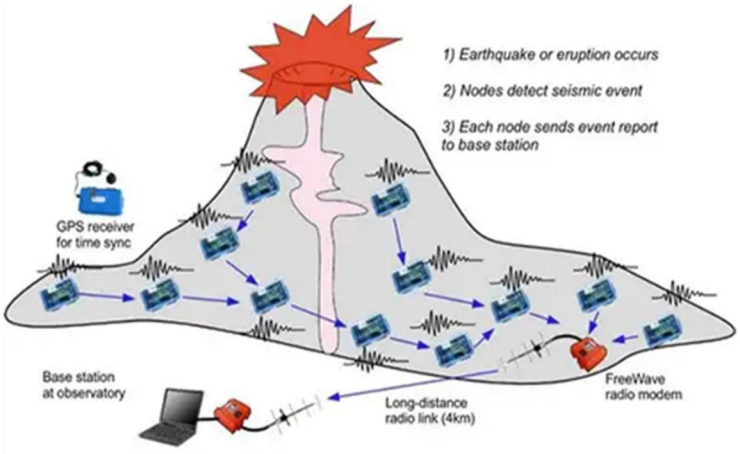

Fig: volcono motion detction by using sensors.

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III. REVIEW OF RELATED LITERATURE

Protocols for Sensor networks must be designed in such a way that the limited power available at the sensor nodes is efficiently used. Routing in WSN is quite challenging due to its inherent constraints and basic characteristics that distinguish WSN from other wireless networks. They are:

1) There is no global addressing scheme in WSN. Therefore, routing protocols of IP based networks cannot be used in WSN.
2) Characteristic of data flow in WSN is a bit different. Data from multiple nodes actually go to a single point that is a sink or base station.
3) Data from multiple sources can create significant redundancy in the data traffic.
4) Nodes are tightly constrained about resources.

There are a handful number of protocols have been proposed for WSN. These protocols can be broadly categorized into six different types namely, data-centric, hierarchical, location -aware, mobility based, heterogeneity based and quality of service (QOS).

W. R. Heinzelman, A. P. Chandrakasan, and H. Balakrishnan[1] developed and analyzeed low-energy adaptive clustering hierarchy (LEACH), a protocol architecture for micro-sensor networks. Ali HosseinAlipour, Davood KeyKhosravi, Abbas Mirzaei Somarin[2] proposed a new clustering method for increasing of network lifetime. They distribute several sensors with a high-energy for managing the cluster head and to decrease their responsibilities in network. Vivek Mhatre, Catherine Rosenberg[3] presented a cost based comparative study of homogeneous and heterogeneous clustered sensor networks. I.F. Akyildiz, W. Su*, Y. Sankarasubramaniam, E. Cayirci[4] described the concept of sensor networks which has been made viable by the convergence of micro electro-mechanical systems technology, wireless communications and digital electronics. Jamal N. Al-Karaki , Ahmed E. Kamal[5] presented a survey of the state-of-the-art routing techniques in WSNs.

Gaurav Gupta, Mohamed Younis[6] focused on efficient way to enhance the lifetime of the system is to partition the network into distinct clusters with a high-energy node called gateway as cluster-head. M. Bani Yassein, A. Al-zou'bi, Y. Khamayseh, W. Mardini[7] presented a new version of LEACH protocol called VLEACH which aims to reduce energy consumption within the wireless network. Mortaza Fahimi Khaton Abad, Mohammad Ali Jabraeil Jamali[8] introduced an energy efficient clustering algorithm for sensor networks based on the LEACH protocol. Wan Norsyafizan, W.Muhamad, Kaharudin Dimyati, Roslina Mohamad, Rosmalini Abd Kadir[9] presented the development of an energy efficient routing protocol which consumes significantly less power compared to existing routing protocol for Wireless Sensor Network. C.Intanagonwiwat, R.Govindan, D.Estrin [10] explored and evaluated the use of directed diffusion for a simple remote surveillance sensor network.Wendi Rabiner Heinzelman, Amit Sinha, Alice Wang, and Anantha P. Chandrakasan[11] provided models for predicting quality and energy and show the advantages of trading off these two parameters.Timothy J. Shepard[12] introduced model that more closely approximates communication theory and the underlying physics of radio communication. Stephanie Lindsey, Cauligi S. Raghavendra[13] proposed PEGASIS (Power-Efficient Gathering in Sensor Information Systems), a near optimal chain-based protocol that is an improvement over LEACH. Wendi Rabiner Heinzelman, Joanna Kulik, and Hari Balakrishnan[14] suggested a family of adaptive protocols, called SPIN (Sensor Protocols for Information via Negotiation), that efficiently disseminates information among sensors in an energy-constrained wireless sensor network. Adrian Perrig, Robert SZewczyk, J.D. Tygar, Victorwen and David E. Culler[15] described suite of security protocols optimized for sensor networks: SPINS. Joanna Kulik, Wendi Heinzelman, Hari Balakrishnan[16] discussed family of adaptive protocols, called SPIN (Sensor Protocols for Information via Negotiation), that efficiently disseminate information among sensors in an energy-constrained wireless sensor network.

Arati Manjeshwar, Dharma P. Agrawal[17] defined a hybrid routing protocol (APTEEN) which allows for comprehensive information retrieval.

IV. APPLICATION DOMAIN

The continued advances in micro-sensor technology have resulted in the development and deployment of small low cost and low power sensing devices with computational “sensing” and communication capabilities. These advances make economically possible the deployment of large numbers of nodes to form a WSN that monitors a specified parameter. Even though, sensor nodes are not very accurate and reliable individually, their deployment in large number enhances their accuracy and reliability.

The interest in the research and development of WSNs is due to their numerous advantages in front of other wireless technologies. They are easier, faster and cheaper to deploy than wired networks or other forms of wireless networks. They have a large coverage area and longer range. In addition, they have higher degree of fault tolerance than other wireless networks since a failure of one or few nodes does not affect the operation of the network. Another feature of these networks is that they are mostly unattended to, and finally, they are self-configuring or self-organizing, the security and lifetime of these sensors network are important issues for a wireless sensor network, and our scheme should provide best solution for the listed issues.

V. CONCLUSION AND FUTURE WORK

A. This work proposed an amend implementation on cluster based routing protocol which will further compare by Hop based Protocol proposed by [19] and CHEERS protocol proposed by *Zain Murtaza* in [18]. This protocol is used for efficient wireless communication and to determine optimal cluster formation & routing in WSNs. Simulation results will show in terms of network lifetime, since the use of the optimal probability yields optimal and efficient clustering. Many concepts are also proposed.

B. Our protocol will successfully extend the stable region by being aware of heterogeneity through assigning probabilities of cluster-head election weighted by the relative initial energy of nodes. Proposed algorithm is implement using MATLAB. Simulations will be carry in MATLAB R2016b and compatible with GNU Octave.

C. The Results will be in terms of Network lifetime, Percentage dead, Network Stability, Network Energy, Network throughput, error rate and delay. The validation parameters will show that; the proposed method will outperform the existing method of [19 and 18].

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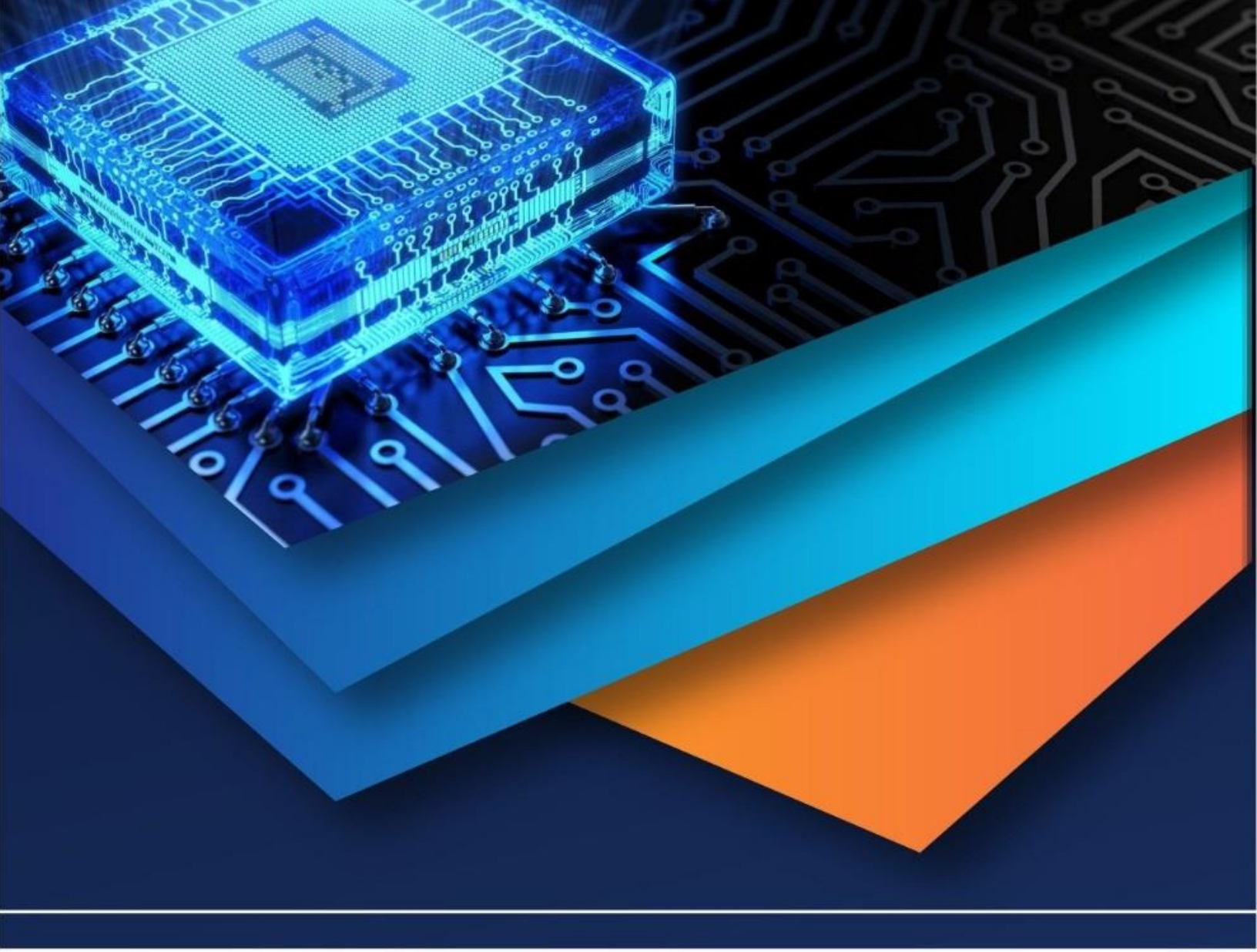

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