A NEW ENERGY EFFICIENT CLUSTERING BASED ROUTING PROTOCOL IN WIRELESS SENSOR NETWORKS

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WIRELESS COMMUNICATION AND SENSOR NETWORKS

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CERTIFICATE

It is certified that the work contained in this thesis entitled "**A New Energy Efficient Clustering Based Routing Protocol**", by **VandanaSrivastava**(1170454008), for the award of **Master of Technology** from BabuBanarasi Das University has been carried out under our supervision and that work has not been submitted elsewhere for a degree.

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DECLARATION

I, **(VandanaSrivastava)** declare that the thesis titled "**A NEW ENERGY EFFICIENT CLUSTERING BASED ROUTING PROTOCOLS IN WIRELESS SENSOR NETWORKS.**" has been composed solely by me and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where states otherwise by reference or acknowledgment, the work presented is entirely by my own.

Signature

ACKNOWLEDGEMENTS

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ABSTRACT

Wireless sensor network is severely energy constraint .selecting an energy efficient routing is very important for such networks. In this work, we look at routing protocols, which can have significant impact on the overall energy dissipation of these networks. Based on our findings that the conventional routing protocols of direct transmission, minimum-transmission-energy, multi hop routing, and static clustering may not be optimal for sensor networks, we propose KNN based routing protocol , a inter clustering-based protocol that utilizes randomized rotation of local cluster base stations (cluster-heads) to evenly distribute the energy load among the sensors in the network. It uses a non-localized coordination to enable scalability and robustness for dynamic networks, and incorporates data fusion into the routing protocol to reduce the amount of information that must be transmitted to the base station. Simulations show that it can achieve as much higher factor of reduction in energy dissipation compared with conventional routing protocols. In addition, it is able to distribute energy dissipation evenly throughout the sensors, doubling the useful system lifetime for the networks we simulated.

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LIST OF SYMBOLS

Tx	Transmitter
Rx	Receiver
RF	Radio Frequency
D	Distance Between Transmitter And Receiver
Do	Threshold Distance
Eelec	Energy Consumed To Transmission And Reception of Electronics
Etx	Energy Consumed To Transmit K Bit At Distance

LIST OF ABBREVIATION

WSN	Wireless Sensor Network
CH	Cluster Head
LEACH	Low Energy Adaptive Clustering Hierarchy
CMs	Cluster Members
MATLAB	Matrix Laboratory
GPS	Global Positioning System

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND:

In direct conversation protocol, every sensor node sends its facts at once to the base station. Direct communication will require a huge quantity of transmit strength from each node if the base station is a ways. The 2d conventional techniques we do not forget is a “minimal-power” routing protocol. In this protocol, nodes route facts via intermediate nodes in the long run destined for the bottom station. Thus every node acts as a router for other nodes in addition to sensing the surroundings. These protocols range within the manner the routes are selected.

We can divide cluster primarily based routing protocols specifically in two components, Protocols for homogeneous environment and protocols for heterogeneous surroundings. LEACH is one of the first cluster based routing protocol. It assigns identical possibility for every node to end up cluster head. This works nicely for the homogeneous networks but no longer for the heterogeneous networks due to the unequal strength of nodes.

SEP prolongs the lifetime of WSNs with the aid of putting a percent of heterogeneous nodes. Heterogeneous WSNs include sensor nodes with different capacity, together with exceptional sensing variety and records computing power. By including these nodes we will observe unique cluster choice scheme. This will deliver higher balance to the cluster and longer time to live to tell the tale the cluster. This scheme depends on cutting-edge node strength; each node could be CH relying on its closing electricity.

Another problem happens in coping with the large quantity of facts and to bypass it over via every node of the community. To solve this problem, we want to have an efficient routing protocol that has low routing overhead and an amazing records aggregation approach to save the constrained electricity of sensing node.

1.2 OVERVIEW OF WSN:

Wireless Sensor Networks (WSNs) represent a new paradigm in wireless technology drawing significant research attention from diverse fields of engineering. WSN technology is listed in "Top 10 Emerging Technologies" that will change the world. WSNs consist of many sensor nodes. These nodes sense the changes in the physical parameters similar to – pressure, temperature, etc. The data sensed by these nodes are then transmitted to the Base Station (BS) for estimation. WSNs are used for the variety of purposes like military surveillances, habitat monitoring, forest fire detections, and landslide detections (Figure 1.1).

The main task of many researchers in this field is to develop smart surroundings with the help of WSNs containing thousands of planned or ad-hoc deployed sensors, each capable of detecting ambient conditions like temperature, sound, movements, light, or the presence of particular objects. It is very important to make these sensing nodes as cheap and energy efficient as possible and trust them to obtain high quality results. Hence, to have battery operated sensor nodes is a good option. But despite of their small sizes, these batteries must be capable of giving a longer life to these sensing nodes. The network protocol used must be very efficient to optimize the lifetime of the nodes.

We also need to focus on algorithms and physical circuitries that can make maximum out of limited power source. Some of the promising routing algorithms can be categorized into three types as direct transmission algorithms, hop to hop transmission algorithms and cluster based algorithms. In cluster based protocols, most of the energy consumption depends on cluster head selection, cluster formation and the algorithm developed for routing the information.

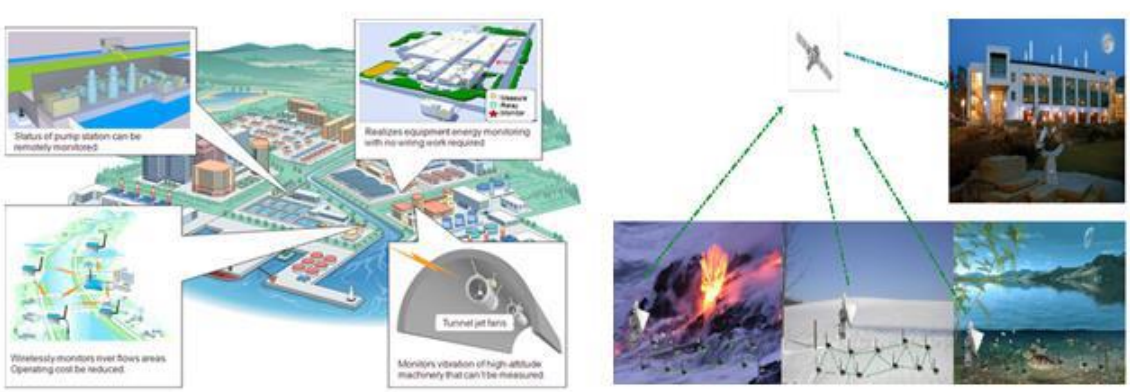

Fig 1.1: Application of Wireless Sensor Network

1.3WIRELESS SENSOR NETWORK (WSN):

Wireless sensor networks (WSNs) have won global-wide interest in recent years, specially with the proliferation in Micro-Electro-Mechanical Systems (MEMS) era which has facilitated the improvement of smart sensors. These sensors are small, with confined processing and computing assets, and they're cheaper com-pared to traditional sensors. These sensor nodes can sense, degree, and acquire facts from the surroundings and, primarily based on some neighbourhood decision manner, they are able to transmit the sensed statistics to the user.

Smart sensor nodes are low energy gadgets ready with one or more sensors, a processor, memory, a energy supply, a radio, and an actuator.1 A kind of mechanical, thermal, biological, chemical, optical, and magnetic sensors can be connected to the sensor node to measure properties of the environment. Since the sensor nodes have limited reminiscence and are generally deployed in hard-to-get right of entry to locations, a radio is carried out for wi-fi communication to switch the information to a base station (e.g., a computer, a personal hand-held tool, or an access factor to a hard and fast infra-shape). Battery is the principle strength source in a sensor node. Secondary power supply that harvests strength from the environment including sun panels may be added to the node depending on the appropriateness of the environment in which the sensor may be deployed. Depending at the application and the type of sensors used, actuators can be incorporated inside the sensors.

A WSN generally has little or no infrastructure. It consists of a number of sensor nodes (few tens to hundreds) operating together to monitor a area to attain statistics about the surroundings. There are two styles of WSNs: structured and unstructured. An unstructured WSN is one which incorporates a dense collection of sensor nodes. Sensor nodes may be deployed in an ad hoc manner2 into the sphere. Once deployed, the network is left unattended to perform tracking and reporting features. In an unstructured WSN, net-work renovation together with managing connectivity and detecting disasters is tough considering the fact that there are such a lot of nodes. In a based WSN, all or a number of the sensor nodes are deployed in a pre-deliberate way.3 The advantage of a based community is that fewer nodes can be deployed with lower network protection and management price. Fewer nodes can be deployed now considering the fact that nodes are positioned at particular locations to offer insurance at the same time as advert hoc deployment may have exposed regions.

WSNs have terrific potential for lots applications in situations together with navy target tracking and surveillance [2,3], herbal catastrophe comfort [4], biomedical fitness monitoring [5,6], and risky surroundings exploration and seismic sensing [7]. In army goal tracking and surveillance, a WSN can help in intrusion detection and identification. Specific examples encompass spatially-correlated and coordinated troop and tank actions. With herbal screw ups, sensor nodes can feel and locate the surroundings to forecast disasters earlier than they occur. In bio-scientific packages, surgical implants of sensors can assist reveal a patient's fitness. For seismic sensing, advert hoc deployment of sensors alongside the volcanic location can detect the improvement of earthquakes and eruptions.

Unlike traditional networks, a WSN has its very own layout and resource constraints. Resource constraints encompass a constrained amount of power, brief communication range, low bandwidth, and limited processing and storage in each node. Design constraints are application dependent and are primarily based at the monitored surroundings. The environment plays a key position in determining the dimensions of the community, the deployment scheme, and the network topology. The size of the community varies with the monitored environment. For indoor environments, fewer nodes are required to form a community in a limited area while outdoor environments may additionally require extra nodes to cowl a bigger place. An advert hoc deployment is desired over pre-deliberate deployment whilst the surroundings is inaccessible with the aid of humans or when the community is composed of hundreds to lots of nodes. Obstructions inside the environment also can restriction conversation among nodes, which in flip affects the community connectivity (or topology).

Current trendy sensor generation provides a technique to layout and develop many sorts of wireless sensor programs. A summary of current sensor technologies is furnished in Appendix A. Available sensors in the marketplace include commonplace (multi-cause) nodes and gate-manner (bridge) nodes. A standard (multi-cause) sensor node’s venture is to take measurements from the monitored surroundings. It may be prepared with an expansion of devices that may measure diverse bodily attributes consisting of light, temperature, humidity, barometric pressure, velocity, acceleration, acoustics, magnetic subject, and many others. Gateway (bridge) nodes collect records from widely wide-spread sensors and relay them to the base station. Gateway nodes have better seasoned-cessing capability, battery electricity, and transmission (radio) range. A combination of prevalent and gateway nodes is usually deployed to form a WSN.

To permit wireless sensor programs the use of sensor technologies, the range of duties may be extensively classified into three businesses as shown in Fig. 1.2. The first institution is the machine. Each sensor node is an man or woman machine. In order to support one of a kind utility software program on a sensor system, expendment of latest structures, running structures, and storage schemes are wished. The 2nd group is communication protocols, which permit communication between the application and sensors. They also permit communication between the sensor nodes. The closing organization is services which are advanced to beautify the application and to improve gadget overall performance and community performance.

From utility necessities and network control perspectives, it's far crucial that sensor nodes are able to self-organizing themselves. That is, the sensor nodes can prepare themselves into a network and subsequently are able to manipulate and manage themselves efficaciously. As sensor nodes are restricted in power, processing capacity, and garage, new communication protocols and management offerings are needed to fulfil these requirements.

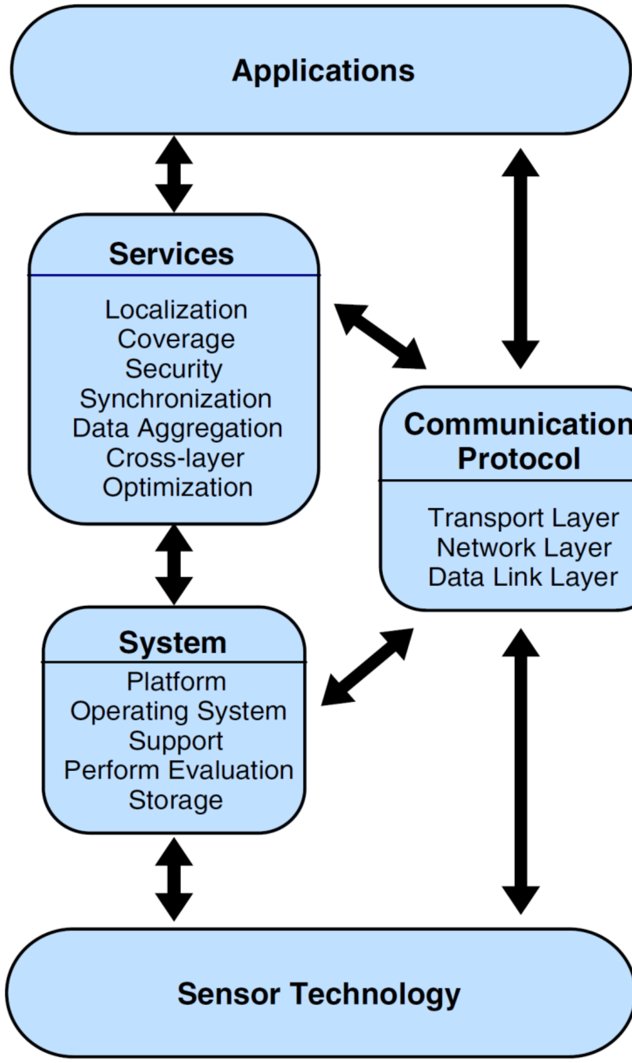

Fig. 1.2: Broad classification of various issues in a WSN.

The communication protocol consists of five general protocol layers for packet switching: software layer, transport layer, network layer, records-link layer, and physical layer. In this survey, we take a look at how protocols at unique layers deal with network dynamics and energy efficiency. Functions along with localization, coverage, garage, synchronization, protection, and information aggregation and compression are explored as sensor community services.

Implementation of protocols at exceptional layers in the protocol stack can considerably have an effect on strength intake, quit-to-quit postpone, and device performance. It is essential to optimize communication and limit electricity usage. Traditional networking protocols do now not work properly in a WSN due to the fact they're now not designed to satisfy those requirements. Hence, new electricity-efficient protocols had been proposed for all layers of the protocol stack. These protocols hire cross-layer optimization through supporting interactions throughout the protocol layers. Specifically, protocol country information at a specific layer is shared throughout all the layers to full fill the specific necessities of the WSN.

As sensor nodes function on confined battery power, energy utilization is a totally crucial issue in a WSN; and there was huge studies awareness that revolves around harvesting and minimizing electricity. When a sensor node is depleted of energy, it'll die and disconnect from the community which can considerably impact the overall performance of the application. Sensor community lifetime depends on the number of lively nodes and connectivity of the net-paintings, so strength have to be used efficaciously as a way to maximize the community lifetime.

Energy harvesting involves nodes replenishing its energy from an strength supply. Potential energy assets include sun cells [8,9], vibration [10], fuel cells, acoustic noise, and a cell supplier [11]. In phrases of harvesting strength from the surroundings [12], sun mobile is the modern-day mature method that harvest power from mild. There is likewise work in the use of a mobile electricity provider which includes a robot to refill energy. The robots might be accountable in charging themselves with energy and then delivering energy to the nodes.

Energy conservation in a WSN maximizes community life-time and is addressed thru green dependable wi-fi verbal exchange, shrewd sensor placement to obtain ok insurance, security and efficient garage manipulate , and via records aggregation and records compression. The above processes aim to fulfill both the energy constraint and provide best of service (QoS)four for the application. For dependable conversation, offerings which includes congestion manipulate, lively buffer tracking, renowned, and packet-loss recuperation are necessary to assure reliable packet delivery. Communication strength is dependent on the placement of sensor nodes. Sparse sensor area may bring about lengthy-variety transmission and better power utilization whilst dense sensor placement may additionally bring about quick-variety transmission and less energy consumption. Coverage is interrelated to sensor placement. The total quantity of sensors within the network and their placement determine the diploma of network coverage. Depending at the application, a better degree of insurance can be required to growth the accuracy of the sensed information.

1.4. TYPES OF SENSOR NETWORKS

Current WSNs are deployed on land, underground, and underwater. Depending on the surroundings, a sensor internet paintings faces extraordinary challenges and constraints. There are five kinds of WSNs: terrestrial WSN, underground WSN, underwater WSN, multi-media WSN, and mobile WSN.

Terrestrial WSNs :-

[1] typically encompass hundreds to heaps of less expensive wireless sensor nodes deployed in a given location, both in an ad hoc or in a pre-planned way. In advert hoc deployment, sensor nodes may be dropped from a plane and randomly placed into the target vicinity. In pre-deliberate deployment, there may be grid placement, top-rated placement [13], 2-d and three-d placement [14,15] fashions.

In a terrestrial WSN, reliable conversation in a dense environment may be very essential. Terrestrial sensor nodes ought to be capable of effectively talk information back to the base station. While battery electricity is restricted and may not be rechargeable, terrestrial sensor nodes but can be equipped with a secondary strength supply which include solar cells. In any case, it is crucial for sensor nodes to con-serve electricity. For a terrestrial WSN, strength may be con-served with multi-hop top-quality routing, brief transmission range, in-community facts aggregation, doing away with records redundancy, minimizing delays, and using low duty-cycle operations.

Underground WSNs [16,17]

consist of some of sensor nodes buried underground or in a cave or mine used to screen underground conditions. Additional sink nodes are positioned above floor to relay information from the sensor nodes to the bottom station. An underground WSN is greater expensive than a terrestrial WSN in phrases of equipment, deployment, and renovation. Underground sensor nodes are luxurious because appropriate system components have to be selected to make certain dependable verbal exchange via soil, rocks, water, and other mineral contents. The underground environment makes wi-fi communication a assignment because of sign losses and high tiers of attenuation. Unlike terrestrial WSNs, the deployment of an underground WSN calls for cautious making plans and electricity and cost issues. Energy is an vital challenge in underground WSNs. Like terrestrial WSN, underground sensor nodes are equipped with a restrained battery strength and as soon as deployed into the floor, it's far hard to re-price or update a sensor node's battery. As before, a key objective is to conserve power to be able to increase the life of network which may be achieved by means of implementing efficient verbal exchange protocol.

Underwater WSNs

[18,19] include a number of sensor nodes and motors deployed underwater. As contrary to terrestrial WSNs, underwater sensor nodes are extra expensive and fewer sensor nodes are deployed. Autonomous underwater automobiles are used for exploration or gathering statistics from sensor nodes. Compared to a dense deployment of sensor nodes in a terrestrial WSN, a sparse deployment of sensor nodes is located underwater. Typical underwater wi-fi communications are installed thru transmission of acoustic waves. A undertaking in underwater acoustic communication is the constrained bandwidth, lengthy propagation postpone, and signal fading difficulty. Another undertaking is sensor node failure due to environ-intellectual conditions. Underwater sensor nodes should be capable of self-configure and adapt to harsh ocean environment. Underwater sensor nodes are prepared with a confined battery which cannot get replaced or recharged. The issue of energy conservation for underwater WSNs includes developing efficient underwater verbal exchange and net-operating strategies.

Multi-media WSNs

[20] have been proposed to allow tracking and monitoring of activities inside the shape of multi-media together with video, audio, and imaging. Multi-media WSNs include a number of low cost

sensor nodes ready with cameras and microphones. These sensor nodes interconnect with every different over a wi-fi connection for records retrieval, method, correlation, and compression. Multi-media sensor nodes are deployed in a pre-deliberate way into the environment to assure insurance. Challenges in multi-media WSN consist of excessive bandwidth call for, excessive power intake, best of provider (QoS) provisioning, facts processing and compressing strategies, and go-layer layout. Multi-media con-tent along with a video move calls for excessive bandwidth so as for the content to be added. As a result, excessive facts rate leads to excessive energy intake. Transmission techniques that support high bandwidth and coffee strength consumption have to be developed. QoS provisioning is a challenging mission in a multi-media WSN because of the variable put off and variable channel capability. It is vital that a certain stage of QoS must be done for dependable content shipping. In-community processing, filtering, and compression can significantly enhance network performance in terms of filtering and extracting redundant information and merging contents. Similarly, cross-layer interaction a number of the layers can enhance the processing and the transport technique.

Mobile WSNs encompass a collection of sensor nodes that could flow on their own and interact with the physical environment. Mobile nodes have the capacity experience, compute, and talk like static nodes. A key difference is mo-bile nodes have the capability to reposition and organize itself inside the community. A cellular WSN can start out with some initial deployment and nodes can then unfold out to accumulate statistics. Information accrued via a cellular node can be communicated to some other mobile node whilst they may be within range of every other. Another key difference is facts distribution. In a static WSN, statistics can be disbursed using constant routing or flooding even as dynamic routing is utilized in a mobile WSN. Challenges in mobile WSN include installation , localization, self-employer, navigation and control, coverage, strength, preservation, and data manner.

1.4.1 Base Station

Besides sensor nodes, every other fundamental object - a base station - can be observed in WSN. In assessment to sensor nodes the bottom station possesses a whole lot more computational energy, larger memory and is regularly linked to better power supply than batteries (e.g. Strength grid). One can take a look at the base station as an access factor to the WSN where the bottom station's number one purpose is to gather sensed facts from sensor nodes in WSN. Other critical goals, the bottom station has to accomplish, might be information visualization and analysis. In a few cases the bottom station additionally handles sensor network routing or node configuration.

Furthermore, base station may ahead gathered information to a faraway server software in which tons wider analysis of records from many WSNs may be performed. [22] The base station, in our case, consists of a transceiver (also referred to as a gateway node), base station software program and a number computer. We can believe a number computer as a ordinary non-public laptop. Software is to be understood as a application running at the host computer which communicates with sensor nodes through the gateway node and stores acquired records to a database. Finally, the gateway node is a special, sensorless node that's connected to the host laptop and gives interface among the bottom station and sensor community.

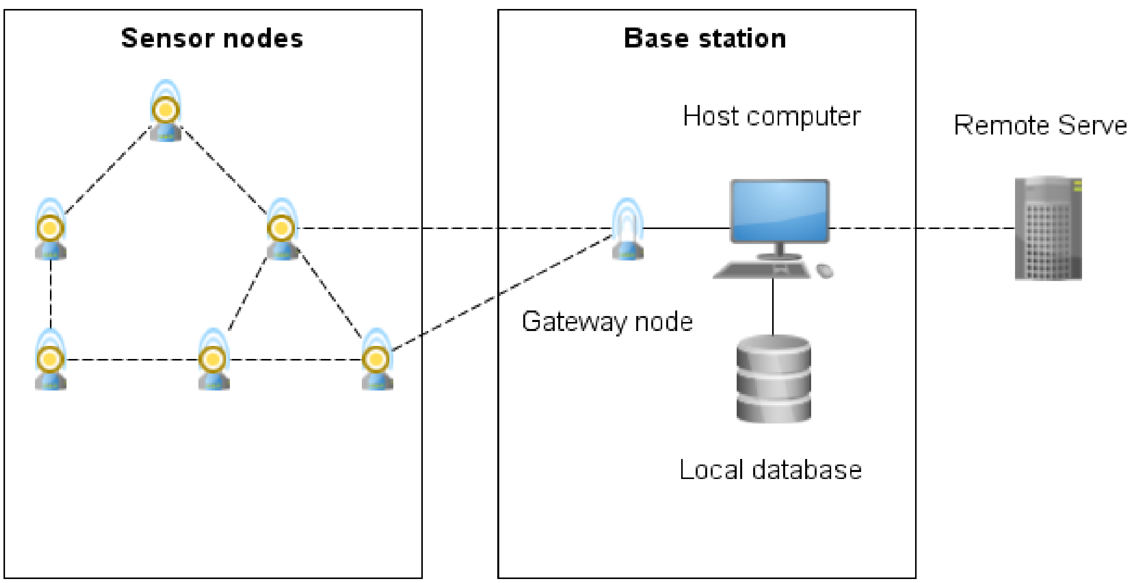

Fig 1.3: Example of aWireless sensor network

WSN's cause is to transmit sensed information to the bottom station. This means that requests (if particular WSN type supports requests) move from the base station to sensor nodes, however extra importantly, sensed records moves in the opposite way (i.e. From sensor nodes to the bottom station). In a way of talking the gateway node is a sink-hollow of the WSN. Figure 1.3 depicts an instance of WSN composed of sensor nodes, a base station and a faraway server.

1.4.2 Communication With Base Station

From the base station's point of view, information collecting can be divided into two most important fashions. One opportunity is that the base station passively listens to the gateway node and sensor nodes ship records handiest when they decide to (e.g Obligation cycle, temperature has passed defined threshold), which is referred as the frenzy model. The other possibility is that the bottom station queries sensor nodes, that's called the pull version. Both of those tactics have their blessings and disadvantages and depend, among other matters, on the chosen community layer protocol. The remaining method - the most flexible but also the maximum hard is a compound of the preceding two strategies. In instances of an regular conversation, transmission begins at the bottom station, at the same time as for warnings, push version is used. In other words if we want measured facts, we ask for them but if something high-quality happens, (e.g. Threshold handed, batteries power important) node itself informs base station approximately the scenario. Other feasible scenario is pull mode in case of latest configuration for sensor nodes (or the whole WSN) and push mode for the alternative communication.

1.5 HIERARCHICAL ROUTING PROTOCOL:

In hierarchical routing, sensor nodes are grouped into clusters. Every cluster has a frontrunner, a node dedicated to communication with more computation and power resources. Every sensor node then sends facts simplest to the cluster chief unburdening nodes from routing problems which can be moved to cluster leaders. [22] Many functions of WSN (including time synchronization, duty-cycles) have to be also contemplated in the base station implementation. Therefore, the bottom station developer must recognize the basic ideas of WSN or at least the ones associated with developing the base station. Hierarchical strategies are typically utilized in stressed out network for scalability [11, 13, 21, 24, 25]. For wireless networks, a hierarchical clustering and routing scheme based upon bodily area management was currently proposed in [6, 12]. This scheme, but, creates implementation problems that are probably complicated to solve. First, it does allocate Cluster IDs dynamically. This allocation ought to be specific - not an easy assignment in multi-hop cell environment, in which the hierarchical topology ought to be frequently reconfigured. Second, every cluster can dynamically merge and cut up, primarily based at the wide variety of nodes inside the cluster. Frequent cluster modifications may also degrade the community overall performance appreciably. In a large, cell network the trouble of locating customers and services by means of their names isn't always a trivial one. In a stressed out Internet the DNS affords a mapping among symbolic names and community addresses. The community cope with is then processed by the routing tables and leads immediately to the vacation spot. In stressed out networks with mobile radio extensions, Mobile IP became advanced to deal with the ultimate hop indirection, from Home Agent to mobile user. In multihopwi-fi networks there's no fixed Home Agent. We endorse the Wireless Hierarchical Routing Protocol (WHIRL) to attack this hassle with a ”multihop extension” of the Mobile IP concept. We will distinguish among the ”physical” routing hierarchy, dictated by means of the geographical relationship among nodes, and the ”logical” hierarchy of subnets corresponding to participants within the equal institution (e.g., tanks in the battlefield, or travelling salesman of the equal organisation). We will hold music of logical subnets the usage of a DNS hierarchy geared toward lowering manage traffic O/H. Physical MAC layer clustering [7, 4] offers the primary level of an efficient ”physical” routing hierarchy.

1.6 OBJECTIVE:

One of the emerging networking standards that gap between the physical worldand the cyber one is the WSN. In the WSN, smart objects communicate with each other, data are gathered and certain requests of users are satisfied by different queried data. The development of energy efficient schemes for the WSN is achallenging issue as the WSN becomes more complex due to its large scale the currenttechniques of other networks cannot be applied directly to the WSN. To achieve theefficient networked WSN inter cluster based routing using KNN algorithm is addressees inthis thesis with focusing energy efficiency objectives by proposing a novelrouting scheme. This objectives covers: (1) a hierarchical network routing design; (2) a model for the energy efficient WSN; (3) a minimum energy consumption transmission algorithm toimplement the optimal model using KNN application. The simulation results show that the new scheme is more energy efficient and flexible than traditional WSN schemes and consequently it can be implemented for efficient communication.

1.7 SCOPE OF THESIS:

Thus, communication between the sensor nodes and the base station is expensive, and there are no “high-energy” nodes through which communication can proceed. This is the scope for the thesis, which focuses on innovative energy-optimized solutions at all levels of the system hierarchy that can be further enhanced from the physical layer and communication protocols up to the application layer and efficient DSP design for micro sensor nodes. Sensor networks contain too much data for an end-user to process. Therefore, automated methods of combining or aggregating the data into a small set of meaningful information are required. In addition to helping avoid information overload, data aggregation, also known as data fusion, can combine several unreliable data measurements to produce a more accurate signal by enhancing the common signal and reducing the uncorrelated noise. The routing performed on the aggregated data might be performed by a human operator or automatically. Both the method of performing data aggregation and the classification algorithm are application-specific. A multipath routing protocol (MRP) is proposed, which reduces the control overhead for route discovery and increases the throughput of the network. Hence the current work if further figured out then it has multiple scope on integrating with multiple issues.this work deal with energy efficiency in routing protocol can be further extended to improving energy efficiency in MAC layer.

1.8 MOTIVATION:

This thesis work is motivated by focusing the versatile application of WSN. Wireless, multi hop, ad hoc networks are expected to play an increasingly important role in future civilian and military environments where wireless access to a wired backbone is either ineffective or impossible. The applications range from collaborative, distributed mobile computing to disaster recovery (fire, flood, earthquake), law enforcement (crowd control, search and rescue) and digital battle field communication. Some key characteristics of these systems which generate motivation for current work are team collaboration of large number of mobile units, limited bandwidth, the need for supporting multimedia real time traffic and low latency access to distributed resources (e.g., distributed database access for situation awareness in the battlefield). Scalable and efficient routing scheme plays important role in ad-hoc networks. Existing wireless routing algorithms for networks can be classified into three general categories: pre computed global routing, on demand routing and flooding. In this pre computed global routing schemes, routes to all destinations are periodically computed and maintained in the background by using KNN algorithm.

CHAPTER 2

LITERATURE REVIEW

Wireless sensor networks are composed of a large number of sensor nodes with limited energy resources. One critical issue in wireless sensor networks is how to gather sensed information in an energy efficient way since the energy is limited. The clustering algorithm is a technique used to reduce energy consumption. It can improve the scalability and lifetime of wireless sensor network.**FuadBajaber,(2011) [6]** introduce an adaptive clustering protocol for wireless sensor networks, which is called Adaptive Decentralized Re-Clustering Protocol (ADRP) for Wireless Sensor Networks. In ADRP, the cluster heads and next heads are elected based on residual energy of each node and the average energy of each cluster. The simulation results show that ADRP achieves longer lifetime and more data messages transmissions than current important clustering protocol in wireless sensor networks.When the sensor nodes use single hop communication to reach the base station, the sensor nodes located farther away from the base station have the highest energy load due to long range communication. When the sensor nodes use multihop communication to reach the base station, the sensor nodes closer to the base station have a higher load of relaying packets.

In recent years, advances in energy-efficient design and wireless technologies have enabled exciting new applications for wireless devices. These applications span a wide range, including real-time and streaming video and audio delivery, remote monitoring using networked microsensors, personal medical monitoring, and home networking of everyday appliances. While these applications require high performance from the network, they suffer from resource constraints that do not appear in more traditional wired computing environments. In particular, wireless spectrum is scarce, often limiting the bandwidth available to applications and making the channel error-prone, and the nodes are battery-operated, often limiting available energy. **Wendi Beth Heinzelman (2000) [11]**worked that this harsh environment with severe resource constraints requires an applicationspecific protocol architecture, rather than the traditional layered approach, to obtain the best possible performance. This dissertation supports this claim using detailed case studies on microsensor networks and wireless video delivery. The first study develops LEACH (Low-Energy Adaptive Clustering Hierarchy), an architecture for remote microsensor networks that combines the ideas of energy-efficient cluster-based routing and media access together with application-specific data aggregation to achieve good performance in terms of system lifetime, latency, and applicationperceived quality. This approach improves system lifetime by an order of magnitude compared to general-purpose approaches when the node energy is limited.. Advances in energy-efficient design have created new portable devices that enable exciting applications for the wireless channel. While the wireless channel enables mobility, it adds constraints that are not found in a wired environment. Specifically, the wireless channel is bandwidth-limited, and the portable devices that use the wireless channel are typically battery-operated and hence energy-constrained. In addition, the wireless channel is error-prone and time-varying. Therefore, it is important to design protocols and algorithms for wireless networks to be bandwidth- and energy-efficient as well as robust to channel errors. This can be accomplished using cross-layer protocol architectures, that exploit application-specific information to achieve orders of magnitude improvement in bandwidth and energy efficiency and improvements in application-perceived quality. The work described in this dissertation has demonstrated the advantages of application-specific protocol architectures by designing and evaluating protocol architectures for two different application spaces: large-scale, distributed microsensor networks and wireless transport of compressed video.

2.1 ROUTING PROTOCOLS IN WSNS

Various researchers have contributed in the area of the routing protocol in wireless sensor networks. Technique reported for routing protocol may be broadly.

Categorized into two groups:

1. Based on network structure.
2. Based on protocol operation.

In general, routing in WSNs can be divided into flat-based routing, hierarchical-based routing, and location-based routing depending on the network structure. In flat-based routing, all nodes are typically assigned equal roles or functionality. In hierarchical-based routing, however, nodes will play different roles in the network. In location-based routing, sensor nodes' positions are exploited to route data in the network. A routing protocol is considered adaptive if certain system parameters can be controlled in order to adapt to the current network conditions and available energy levels The classification is shown in Figure 2.1 where numbers in the figure indicates.

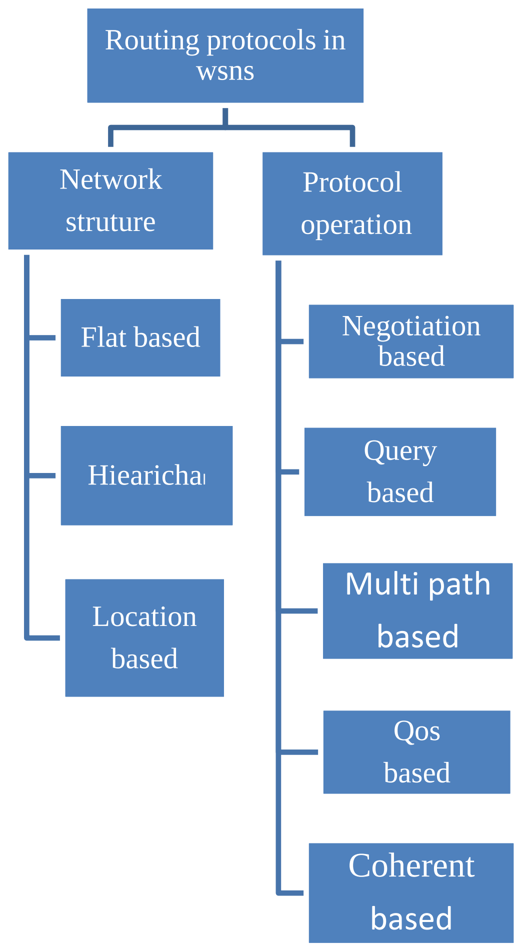

Figure No 2.1- Classification of Routing Protocols

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Furthermore, these protocols can be classified into multipath-based, query-based, negotiation-based, QoS-based, or coherent-based routing techniques depending on the protocol operation.In addition to the above, routing protocols can be classified into three categories, namely, proactive, reactive, and hybrid protocols depending on how the source finds a route to the destination. In proactive protocols, all routes are computed before they are really needed, while in reactive protocols, routes are computed on demand. Hybrid protocols use a combination of these two ideas. When sensor nodes are static, it is preferable to have table driven routing protocols ratherthan using reactive protocols. A significant amount of energy is used in route discovery and setup of reactive protocols.

Another class of routing protocols is called the cooperative routing protocols. In cooperative routing, nodes send data to a central node where data can be aggregated and may be subject to further processing, hence reducing route cost in terms of energy use. Many other protocols rely on timing and position information. In order to streamline this survey, we use a classification according to the network structure and protocol operation (routing criteria).

2.2 **NETWORK STRUCTURE BASED PROTOCOLS:-**

2.2.1 **Flat Routing:-**

The first category of routing protocols are the multihop flat routing protocols. In flat networks, each node typically plays the same role and sensor nodes collaborate together to perform the sensing task. Due to the large number of such nodes, it is not feasible to assign a global identifier to each node. This consideration has led to data centric routing, where the BS sends queries to certain regions and waits for data from the sensors located in the selected regions. Since data is being requested through queries, attribute-based naming is necessary to specify the properties of data. Early works on data centric routing, e.g., SPIN and directed diffusion [18] were shown to save energy through data negotiation and elimination of redundant data. These two protocols motivated the design of many other protocols which follow a similar concept. In the rest of this subsection, we summarize these protocols and highlight their advantages and their performance issues.

SPIN (**Sensor Protocols for Information via Negotiation**): - The plan behind SPIN is to name the data using high level descriptors or meta-data. Meta-data are swapped among sensors before transmission via a data advertisement mechanism, which is the key feature of SPIN. Every node upon receiving new data publicizes it to its neighbors and interested neighbors, means those that don't have the data, retrieve the data or information by sending a request message. SPIN's meta-data negotiation resolves the classic issues of flooding such as redundant information passing, therefore achieves a lot of energy efficiency. There are 3 messages which are defined in SPIN to exchange the data between nodes. These are: ADV message which generally permits a sensor to advertise a particular meta-data, second is DATA message that carry the actual data and third id REQ message to request the specific data. In SPIN; topological changes are localized since every node needs to know only its single-hop neighbours [4]. Moreover, SPIN doesn't used for applications such as intrusion detection that need reliable delivery of data packets over regular intervals.

Directed Diffusion (DD):-

DD is another protocol which is developed after the SPIN. Directed Diffusion aims at diffusing data through sensor nodes by utilizing a naming scheme for the data. DD utilizes attribute-value pairs for the data and also queries the sensors on the demand basis by using those pairs. In order to make a query, an interest is defined using a list of attribute-value pairs such as objects name, geographical area ,duration, interval, etc. This interest is further broadcast by a sink through its neighbors. Every node which receives this interest can do caching for later use. The nodes also had the flexibility to do in-network data aggregation. The interests in the caches are then used to compare the data received with the values in the interests. The interest entry also contains various gradient fields. This gradient may be a reply link to a neighbor from which the interest was received. Hence, by utilizing interest and gradients, paths are set up between sink and sources. Several paths can be established so that one of them is selected by reinforcement. DD is much energy efficient than others because it is on demand and there is no need for maintaining global network topology [5].

2.2.2 LOCATION BASED ROUTING PROTOCOLS:-

In this kind of routing, sensor nodes are addressed by means of their locations. The distance between neighboring nodes can be estimated on the basis of incoming signal strengths. Relative coordinates of neighboring nodes can be obtained by exchanging such information between neighbors [20], [21], [30]. Alternatively, the location of nodes may be available directly by communicating with a satellite, using GPS (Global Positioning System), if nodes are equipped with a small low power GPS receiver [25]. To save energy, some location based schemes demand that nodes should go to sleep if there is no activity. More energy savings can be obtained by having as many sleeping nodes in the network as possible. The problem of designing sleep period schedules for each node in a localized manner was addressed in [33, 25]. In the rest of this section, we review most of the location or geographic based routing protocols.

2.2.3 HIERARCHICAL ROUTING

Hierarchical or cluster-based routing, originally proposed in wireline networks, are well-known techniques with special advantages related to scalability and efficient communication. As such, the concept of hierarchical routing is also utilized to perform energy-efficient routing in WSNs. In a hierarchical architecture, higher energy nodes can be used to process and send the information while low energy nodes can be used to perform the sensing in the proximity of the target. This means that creation of clusters and assigning special tasks to cluster heads can greatly contribute to overall system scalability, lifetime, and energy efficiency. Hierarchical routing is an efficient way to lower energy consumption within a cluster and by performing data aggregation and fusion in order to decrease the number of transmitted messages to the BS.

Hierarchical routing is mainly two-layer routing where one layer is used to select clusterheads and the other layer is used for routing. However, most techniques in this category are not about routing, rather on ”who and when to send or process/aggregate” the information, channel allocation etc., which can be orthogonal to the multihop routing function.

LEACH is a cluster-based protocol, which includes distributed cluster formation. LEACH randomly selects a few sensor nodes as clusterheads (CHs) and rotate this role to evenly distribute the energy load among the sensors in the network. In LEACH, the clusterhead (CH) nodes compress data arriving from nodes that belong to the respective cluster, and send an aggregated packet to the base station in order to reduce the amount of information that must be transmitted to the base station. LEACH uses a TDMA/CDMA MAC to reduce inter-cluster and intra-cluster collisions. However, data collection is centralized and is performed periodically. Therefore, this protocol is most appropriate when there is a need for constant monitoring by the sensor network. A user may not need all the data immediately. Hence, periodic data transmissions are unnecessary which may drain the limited energy of the sensor nodes. After a given interval of time, a randomized rotation of the role of the CH is conducted so that uniform energy dissipation in the sensor network is obtained.

The operation of LEACH is separated into two phase the setup phase and the steady state phase. In the setup phase, the clusters are organized and CHs are selected. In the steady state phase, the actual data transfer to the base station takes place. The duration of the steady state phase is longer than the duration of the setup phase in order to minimize overhead. During the setup phase, a predetermined fraction of nodes, p, elect themselves as CHs as follows. A sensor node chooses a random number, r, between 0 and 1. If this random number is less than a threshold value, T(n), the node becomes a cluster-head for the current round.

broadcast an advertisement message to the rest of the nodes in the network that they are the new cluster-heads. All the non-cluster head nodes, after receiving this advertisement, decide on the cluster to which they want to belong to. This decision is based on the signal strength of the advertisement. The non cluster-head nodes inform the appropriate cluster-heads that they will be

a member of the cluster. After receiving all the messages from the nodes that would like to be included in the cluster and based on the number of nodes in the cluster, the cluster-head node creates a TDMA schedule and assigns each node a time slot when it can transmit

2.3.4 ISSUES AND CHALLENGES FOR ROUTING IN WIRELESS SENSOR NETWORKS:-

In the highly dynamic and energy constraint network, it is a challenging task to develop a routing protocol. The design of the routing protocol can be affected by many characteristics possessed by the WSN. A few issues and challenges for routing in WSN are discussed below:

- **Energy constraint**: The sensor nodes are battery-powered devices, hence have limited energy. A large amount of energy is consumed during data transmission. Furthermore, a significant amount of energy is consumed during the route discovery and its maintenance phase. The lifetime of thenetwork directly depends on the total energy consumption by each node [25].If a sensor node's energy reaches below a certain level, it will become nonfunctional and affects the performance of the network.

- **Bandwidth constraint**: Generally, WSN consists of a large number of sensor nodes, which makes the bandwidth allocation for each link very challenging. Moreover, in the process of route discovery and maintenance ,an enormous amount of control packets has to be broadcasted among the sensor nodes. Thus, the network bandwidth allocation process depends on the number of links and the amount of data they can communicate.

- **Limited hardware constraint**: Sensor nodes are tiny embedded devices having limited processing and storage capacity. Therefore, the researchers have to design a light-weight routing protocol that does not have complicated computing procedures and functions. Hence, the sensor nodes can process and store the data efficiently

- **Node deployment**: The sensor node deployment entirely depends upon the applications. In some applications, structured deployment is required whereas, in some scenarios, random deployment is needed. In the random deployment, the node location is not predefined and generally, thrown from an aircraft in the hostile or unattended area.

- **Mobile node information**: After the sensor node deployment generally ,the nodes are static. However, in some applications, the nodes are mobile. There should be a proper way to locate those mobile nodes to communicate with the static node. In some applications, the sink is moving within the network for data collection. So the routing protocol should be able to informthe sink location to the nodes within the network.

- **Sensor node location**: The geographical location information of the sensor nodes is required in many applications like tracking, monitoring,event detection, etc. It is not possible to enable the GPS in every single node [25]. Instead; unknown nodes can find the location using the methodslike triangulation based positioning and GPS-free solutions. The routing protocol should be able to locate the sensor nodes using the location finding techniques.

- **Scalability**: A large number of sensors are deployed in the interested area.Further, during the operation, the network size may increase. The protocol has to be designed in such a way that the node scalability does not affect the performance.

2.3CLUSTERING IN WSN:-

Due to scarce resources in WSN, direct communication of sensor node with BS or multi hop communication of sensor nodes towards BS is not practical as energy consumption is high which results in early expiry of sensor nodes. Direct communication or single-tier communication is not feasible for large scale network as WSN cannot support long-haul communication. Direct communication has its disadvantages such as high energy consumption, duplication of data (sensor nodes that were close to each other, sending data with very small variation), and farthest nodes dying quickly. To overcome these problems, two-tier communication through hierarchical

approach is used where nodes are grouped into clusters. Leader node also called cluster head (CH) is responsible for aggregating the data and then forwarding it to the BS.

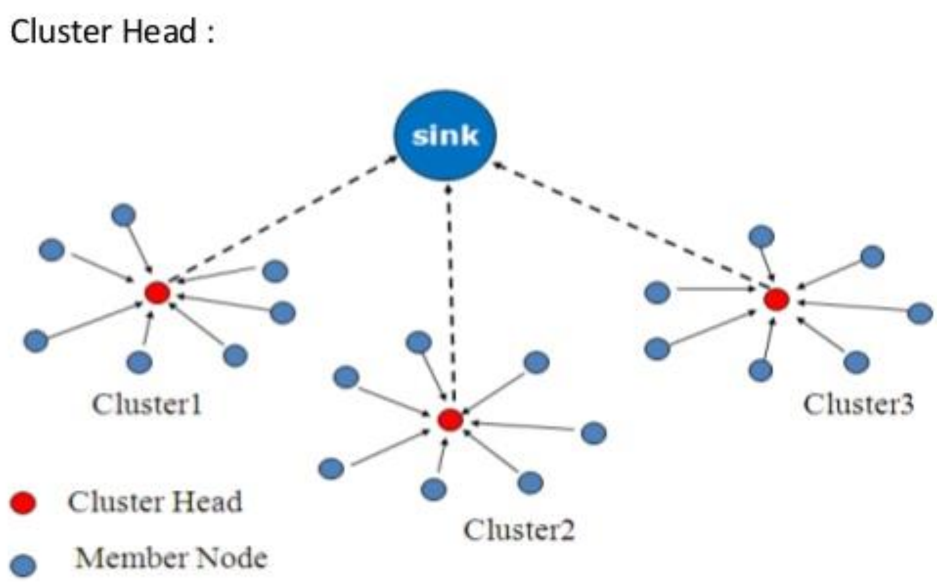

Figure No2.3- Cluster Head Formation

2.4 CLUSTER HEAD SELECTION AND CLUSTER FORMATION:-

After neighbor discovery and topology construction, the formation of thecluster is started. Initially, all nodes' energy levels are the same. After theformation of the neighbor adjacency matrix, the base station will compute andmonitor the residual energy of each node. The base station chooses a certainnumber of cluster heads in the network using the following conditions:

1. Two cluster heads should not be neighbor to each other.
2. the residual energy (Er) of each cluster head should be greater thanthreshold value.
3. The selection of a cluster head depends on two independent factors; one is theresidual energy (Er), and another is the degree of the node, i.e., the number ofneighbor nodes.

Data Transmission-

The cluster member transmits the generated data to the cluster head based onthe given time slot and then changes the operational mode to sleep mode. Thesensor node wakes up in the next time slot to transmit the data. In this way,the protocol helps in conserving the energy of the sensor nodes. The cluster headaggregates the data and sends to the base station through the selected path. Allintermediate relay nodes refer to the routing table for the next node to forward thedata. When the data reaches the base station, an acknowledgment packet is sentback to the cluster head. If the cluster head does not receive the acknowledgmentfrom the base station, it re-transmits the data. The base station monitors theresidual energy of each node in the network as it has the entire information ofnetwork topology. If base station finds the residual energy of any node below thethreshold value, it selects another available path for that cluster head.

RE-CLUSTERING AND REROUTING:-

The base station initiates the process of re-clustering and rerouting. It monitorsthe residual energy of each sensor node in the network to balance the load amongthe sensor nodes. If the residual energy falls below the threshold value, the nodeinitiates re-clustering or rerouting based on its role. If that node is a relay node ofany path, then the base station selects another available

path to exclude that node.If the node is a cluster head, then the base station selects another cluster headand the corresponding path. This method increases the lifetime of the networks.

The node is having the residual energy below the threshold, neither take part inrouting nor become a cluster head, but only operate as the cluster member.

CHAPTER 3

SYSTEM ARCHITECTURE AND PROPOSED WORK

3.1 PROBLEM STATEMENT:-

Wireless sensor networks are becoming growing field due to advancement in wireless technology. wireless sensor networks are the networks which consists of a large number of sensor nodes, which have ability to sense, communicate and some signal processing. Sensor nodes depend on battery for energy to increase the lifetime of a WSN by using the energy efficiently is a big challenge.

There are different routing techniques are used to enhance the overall network life time in WSN. From previous chapters, we can see that, many research work on to enhance the network lifetime and mange the mobile sink, energy efficient techniques are required in routing protocol.
In this work we developed a new energy efficient clustering based routing protocol to enhance the network lifetime .we have used KNN technique for localization purpose and to find the minimum energy route to send the information from source to base station.

3.2 SYSTEM ARCHITECTURE:-

Wireless sensor networks have wide range of software region which include habitat monitoring, subject surveillance, automobiles and plenty of extra. Wireless sensor networks include numerous densely deployed sensor nodes internal or very near to software vicinity. Sensor nodes work with extreme restricted assets like battery strength, bandwidth, memory and so forth. Lifetime of wi-fisensor networks dependsupon battery energy of nodes as each operation of node consumes electricity, consequently node goes out of electricity. Harsh/faraway application vicinity makes it impossible to recharge or update the battery of nodes. So, green

power consumption of nodes is the prime design difficulty for wifi sensor networks from the circuitry of sensor nodes to software stage to community protocols. Clustering algoritnms(6,7) are taken into consideration energy efficient approach for wi-fi sensor networks. Clustering divides the nodes in impartial clusters and selects a head for every cluster. Nodes ship sensed data to respective cluster head; cluster head applies facts fusion/aggregation to lessen the accumulated information to some significant statistics and sends aggregated data to base station. Communication between nodes is the main energy consuming system that relies upon the distance between the two. communication and distance of cluster head to base station and remaining electricity of nodes for cluster head selection. Simulation consequences show that proposed solution effectively optimize wide variety and choice of cluster heads and have sizeable improvement over to way of life clustering algorithms.

We have used in this work LEACH energy model to evaluate energy consumption of a cluster for a data transmission round. We use Hausdorff distance to calculate distance between two nodes and thereby find minimum energy route for data transmission. Simulation result supported by theoretical analysis shows that our technique is energy efficient.

3.2.1 Clustering:-

Clustering technique [2] [11] used in wireless sensor network in which the whole network is divided into some disjoint clusters. Each cluster contains some sensor nodes known as member nodes. Among them one is cluster head which maintains the information of the cluster and responsible for communicating with Base station. In this paper we have used LEACH [2] cluster head selection algorithm to select cluster head for a cluster. LEACH uses an election based cluster head selection algorithm to choose a cluster for a given round. The basic idea is to distribute the energy consumption load among all nodes. The cluster heads selected this way take the responsibility of transmitting aggregated data collected from member nodes to the base station [2][13]. The operation of LEACH is divided in two phases- Set up phase and steady phase. In setup phase, clusters are formed and selection of cluster heads taken place for each cluster. In steady phase data transmission to the base station occurs. During the setup phase, p fraction of sensor nodes chooses a random number between 0 and 1. Ifthis random number is less than the threshold(n) , the sensor node n is chosen as cluster head. T (n) is calculated as, T(n)=

$$\frac{p}{p * [r * mod\frac{1}{p}]}$$

if n∈ G

0 otherwise

Where$r$ is the random number and G is the set of nodes that have not being selected as a cluster head in the last llp rounds. Each cluster head broadcasts a message to all member nodes that they it becomes cluster heads for that round. Cluster members choose which cluster they would like to be in. Cluster members collects data from environment and send them to their cluster head. Cluster heads then aggregate these data and transmit them to the base station. The role of cluster head rotates among all sensor nodes. This does not strain any particular node throughout the lifetime ofnetwork.

3.4RADIO ENERGY MODEL:-

Our routing algorithm uses radio energy model similar to LEACH [2] depicted in Figure 3.1, redrawn from [2] to calculate the transmission and receiving energy of cluster head. Using this model we are able to calculate the total energy consumption for every potential alternative route from source to the base station and decide the least cost route by comparing the energy consumption in each route. Here we have given a simple overview of the energy model transmission as well as receiving ‘k’ bit message over a wireless medium in the sensor field.

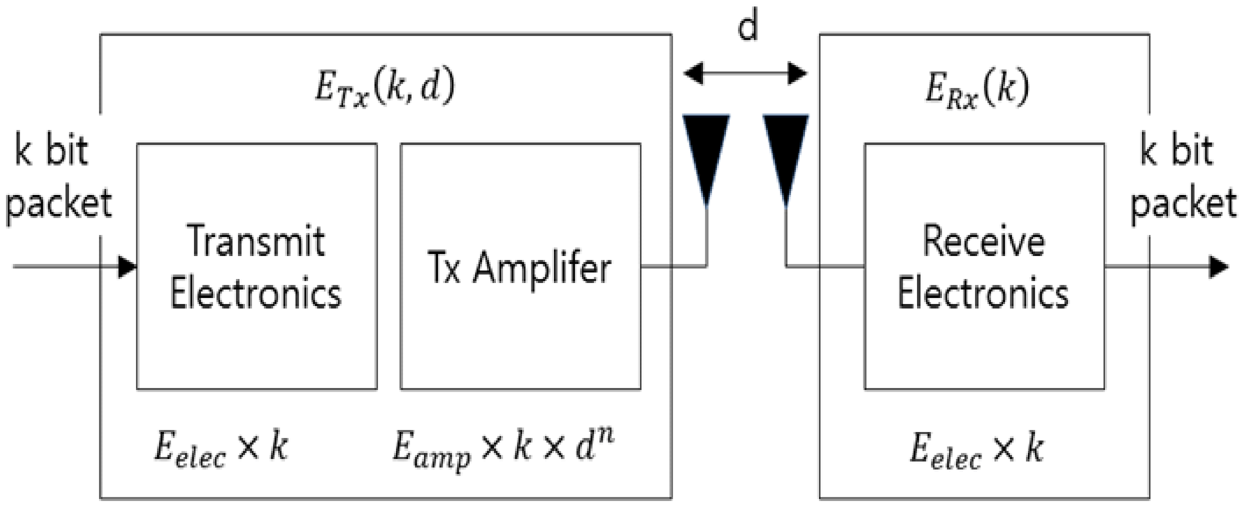

Figure No-3.1-Radio Energy Model

Transmitting a data unit from node i to node j needs,

$E_{i,j}^{T}$amount of energy where,

$$E_{i,j}^{T} = \begin{cases} E_{elec} + e_{fs} d_{i,j}^{2}, & d_{i,j} < d_0 \\ E_{elec} + e_{mp} d_{ij}^{4}, & d_{i,j} \geq d_0 \end{cases}$$

Here the transmitter dissipates energy to run the radio electronics and power amplifier. Elec is the electronics energy depends on factors like digital coding, the modulation, the filtering and the spreading ofthe signal, and e_{amp}’ is a constant for amplification for free space fading and e_{mp}’ is the constant for amplification for multipath fading. $d_0$is the threshold distance define as

$$d0 = \sqrt{\frac{e_{fs}}{e_{mp}}}$$

$e_{js}^{*} d_{i,j}^{2}$and$e_{mp}^{*} d_{i,j}^{4}$ are path loss component.

$d_{i_j}^{2}$is the power loss due to free space fading and $d_{i,j}^{4}$ is the power loss due to multipath fading.

Receiving k bit message at nodej it require energy $E_{i,j}^{R}$ where $E_{i,j}^{R} = E_{elec}^{*} k$ and energy required for data aggregation is E_{DA}.

Energy required to transmit a k bit message to distance d is

Transmission Energy+Amplification energy i.e,

$$E_{Trans}(k,d) = E^{*}_{e/ec}k + e^{*}_{amp}k^{*}d^{2}$$

We will calculate energy consumption at all nodes including cluster head based on these equations.

3.5. PROPOSED WORK:-

The architecture of proposed routing is shown in Figure 3.2. The small black colored circles are the cluster members and the small blue colored circles are the cluster heads. Cluster member will transmit sensed data in their range to their respective cluster head. Cluster head will aggregate the received data and transmit to the base station in multi hop routing. Minimum energy path will be calculated using Hausdorff distance [7] from any of the source cluster head to the based station. Routing will be done in this minimum energy path. “Hausdorff distance between two clusters G_i&G_j is the larger of the two directed distances” [7]

$$H(G_i, G_j) = \max\,(h(G_i, G_j), h(G_j, G_i))$$

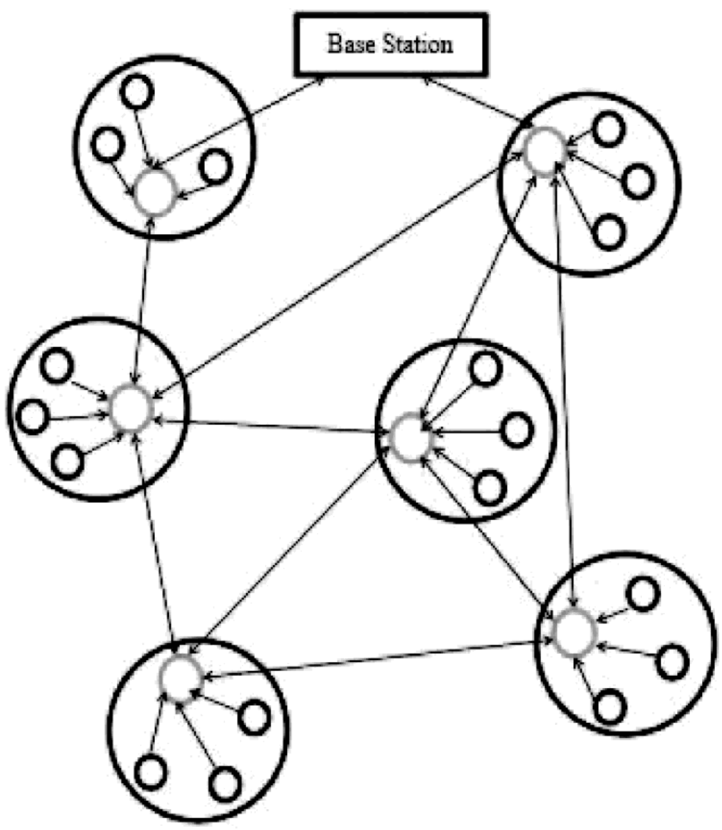

Figure No3.2- Architecture of the proposed routing

Wireless Sensor Network (WSN) is severely energy constrained. Selecting an energy efficient routing is very important for such network. In this work, we present an approach for routing in wireless sensor network to minimize the energy consumption to increase active lifetime of the network. Our approach takes the minimum energy route for transmitting data from a node to a fixed base station through a cluster head. We calculate the distance between neighboring clusters using Hausdorff distance. We evaluate energy consumed to transmit a 'k' bit message to all the neighbors from source cluster. Comparing the entire route we select the minimum energy route to transmit the data to the base station.

Let us consider the sensor network consist of n' number of sensor nodes. The network is divided into 'M' clusters; $\{C_1, C_2, C_3, ... C_M\}$.

Step 1: $Q = \{C_1, C_2, C_3 - - - - - - - - - - - - - - - - - - C_M$, SINK(S) }

Step 2: Initialize source $//In$ this case let C_1 be the source.

Step 3: $Q_1 = Q - \{C\}$

Step 4: Set energy consumption= ∞ to all other clusters which are not the direct neighbor of source (say C_1).

Step 5: $Current[i]$ ←neighbors of C_1.

Step 6: $S = Set$ of clusters already traversed Step 7: Initially $S \leftarrow \phi$

Step 8: While ($Q_1 \neq \phi$) Step 9: do

Step 10:u←Select a cluster from $current[i]$ so that energy consumption will be minimum for transmission.

Step 11: $S \leftarrow SU\{u\}$

Step 12: For (all node $v \in$ neighbor of u)

Step 13: do

Step 14: Total energy consumption from source $=$ min {pervious transmission energy, recent transmission energy+ transmission energy from $u$to v}

Step 15: Current $[i]$ ←neighbor ofu

Step 16: End for

Step 17: End While

After formation of clusters and cluster head selection our algorithm takes all clusters including the base station into a set. Source cluster is selected according to request for data message from the base station. We have taken another set Ql which includes all the clusters and the base station except the source cluster. All the neighbours ofthat source cluster are taken. Using the Hausdorff distance technique we first find out the distance of all the neighbors from that cluster. Using the radio energy model find out energy consumption when a ‘k’ bit message is forwarded to every neighbor from that cluster head. Comparing all potential paths we select the minimum energy path for routing the data. Minimum energy path is a route for data transmission which requires minimum energy among all potential routes. We have assumed the energy consumption cost to infinity to all other clusters which are not the neighbor of the source cluster. We have taken a set ‘S’ contains all the clusters which have already traversed. Initially it is empty. When the data reaches one of the higher level cluster head the same process is repeated to find the minimum energy path again but considering the previous transmission cost. In this way the data is forwarded to the base station with minimum energy. In case the minimum route is not available due to maintenance next available minimum energy route may be used for data transmission.

Since the algorithm takes minimum energy to route the data it enhances active network lifetime. The algorithm repeats every time to find the minimum energy for any source cluster to a fixed base station. We have simulated the algorithm using MATLAB and compare the performance with flooding [6], AODV [8] and directed diffusion [9] routing techniques in WSN.

KNN:

The traditional KNN text classification algorithmused all training samples for classification, so it had a hugenumber of training samples and a high degree of calculationcomplexity, and it also didn’t reflect the differentimportance of different samples.With the rapid development of internet, a large numberof text information begin to exist with the form ofcomputer-readable and increase exponentially. The dataand resource of internet take on the character of massive.

In order to effectively manage and utilize this largeamount of document data, text mining and content-basedinformation retrieval have gradually become the hotspotresearch field in the world. Text classification is animportant foundation for information retrieval and textmining, the main task is assigning text document to oneor more predefined categories according its content andthe labeled training samples [1]. Text classification hasbeen used extensively. For example, some governmentdepartments and enterprises made use of textclassification for email filtering. This kind of emailclassifiers can not only filter out junk emails, but alsodistribute emails to the corresponding departmentsaccording to the content. Text classification technologyalso widely used in web search engines, which can filterthe message that users don't concern about and supplytheir interested content. So we can take a conclusion thatin the process of information services, text classificationis a fundamental and important method, it could helpusers to organize and access to information and it hasvery important research value.Study on text classification abroad dated back to thelate 1950s, H.P.Luhn had done some ground-breakingresearch work and proposed the methodology of usingword frequency for text automatic classification. In 1960,Maron published the first paper on text automaticclassification, and then, a large number of scholars gotfruitful research in this field. So far, the text classificationtechnology in foreign country has been applied in manyfields, such as email filtering, electronic meetings andinformation retrieval. There has also developed a numberof relatively mature software, such as Intelligent MinerFor Text developed by IBM, which can classify, clusterand get summary for the commercial documents; NetOwl Extractor developed by SAR implemented thefunction of text clustering, classification and emailfiltering; and also Insight Discoverer Categorizerdeveloped by TENIS can filter out junk emails andknowledge management for the commercial documents[2].

Study on text classification in China had a late start.Professor Hou Han-Qing had done much research on textmining and introduced the conception of foreigncomputer management tables, computer informationretrieval, and computer text automatic classification in1981. Afterwards, many researchers and institutions havebegun to study the text classification.Currently, the research on text classification has beenmade a lot of development, and the common algorithms

for text classification include K nearest neighboralgorithm (KNN), Bayes algorithm, Support VectorMachine algorithm (SVM), decision tree algorithms,neural network algorithm (Nnet), Boosting algorithm, etc[2]. KNN is one of the most popular and extensive amongthese, but it still has many defects, such as greatcalculation complexity, no difference betweencharacteristic words, does not consider the associationsbetween the keywords and so on. In order to avoid thesedefects, many researchers had proposed someimprovements. On account of the fact that the traditionalmethod lacked of consideration of associations betweenthe keywords, literature [3] proposed an improved KNNmethod which applied vector-combination technology toextract the associated discriminating words according tothe CHI statistic distribution. The technology of vectorcombinationcan reduce the dimensions of the text featurevector and improve the accuracy efficiently, but it can'thighlight the key words which have more contribution toclassification. Literature [4] proposed a fast KNNalgorithm named FKNN directed to the shortcomings ofgreat calculation, but it can't raise the accuracy. In orderto reduce the high calculation complexity, this paper usedclustering method and chosen the cluster centers as therepresentative points which made the training setsbecome smaller, and for overcoming the defect of nodifference between characteristic words.

KNN Text Classification Algorithm

KNN is one of the most important non-parameteralgorithms in pattern recognition field [11] and it's asupervised learning predictable classification algorithm.The classification rules of KNN are generated by thetraining samples themselves without any additional data.KNN classification algorithm predicts the test sample'scategory according to the K training samples which arethe nearest neighbors to the test sample, and judge it tothat category which has the largest category probability.The process of KNN algorithm to classify document X is[12]:

Suppose that there are j training categoriesas C1 ,C2 ,C3.... Cj, and the sum of the training samples is N .After pre-processing for each document, they all becomem-dimension feature vector.

1. Make document X to be the same text featurevector form (X1 ,X2 ,X3.... Xm) as all training samples.

2. Calculate the similarities between all trainingsamples and document X . Taking the ith document(di1, di2,.....dim) as an example, the similaritySIM (X, di) is as following.

$$SIM(X,d_i)=\frac{\sum_{j=1}^{m} X_j \cdot d_{ij}}{\sqrt{(\sum_{j=1}^{m} X_j)^2} \cdot \sqrt{(\sum_{j=1}^{m} d_{ij})^2}}$$

3) Choose k samples which are larger from Nsimilarities of SIM(X ,di),(i= 1,2,.... ,N), and treat themas a KNN collection of X . Then, calculate theprobability of X belong to each category respectivelywith the following formula.

$$P(X,C_j)=\sum_{d_i \in KNN} SIM(X,d_i) \cdot y(d_i,C_j)$$

Where y(di ,Cj)is a category attribute function, whichsatisfied

$$y(d_i,C_j)=\begin{cases} 1, d_i \in C_j \\ 0, d_i \notin C_j \end{cases}.$$

4. Judge document X to be the category which has the largest P(X, Cj,).

The traditional KNN text classification has threedefects [13]: 1) Great calculation complexity. Whenusing traditional KNN classification, in order to find theK nearest neighbor samples for the given test sample, itmust be calculated with all the similarities between thetraining samples, as the dimensions of the text vector isgenerally very high, so its has great calculationcomplexity in this process which made the efficiency oftext classification very low. Generally speaking, there are3 methods to reduce the complexity of KNN algorithm:reducing the dimensions of vector text [4]; using smallerdata sets; using improved algorithm which can accelerateto find out the K nearest neighbor samples [5]; 2)Depending on training set. KNN algorithm does not useadditional data to describe the classification rules, but theclassifier are generated by the self training samples, thismade the algorithm depend on training set excessively,for example, it need to re-calculated when there is a smallchange on training set; 3) No weight difference betweensamples. As formula (2), the category attribute functionhas pointed out that the traditional KNN algorithm treatedall training samples equally, and there is no differencebetween the samples, so it don’t match the actualphenomenon which samples have uneven distributioncommonly.

CHAPTER 4

RESULTS AND DISCUSSIONS

In our thesis work for the algorithm development , we have used MATLAB 2015 software and developed an algorithm using programming. We have considered a simulated network of 100 randomly distributed nodes in a sensor field of 200* 200 area. The location of base station is fixed and base station ID is 101. The simulation parameters used are shown in Table 4.1

TABLE 4.1: SIMULATION PARAMETERS

No of nodes	100
Network area	100 * 100
Channel Type	Wireless channel
Source node	100 sensor nodes
Antenna Model	Antenna/Omni Antenna
Interface Queue Type	Queue/Drop Tail/PriQueue
Initial Energy of sensor nodes	.5j
Time for each round	5 sec
Transmission power	50 pj
Receiving power	10 pj
Transmission Range	40m

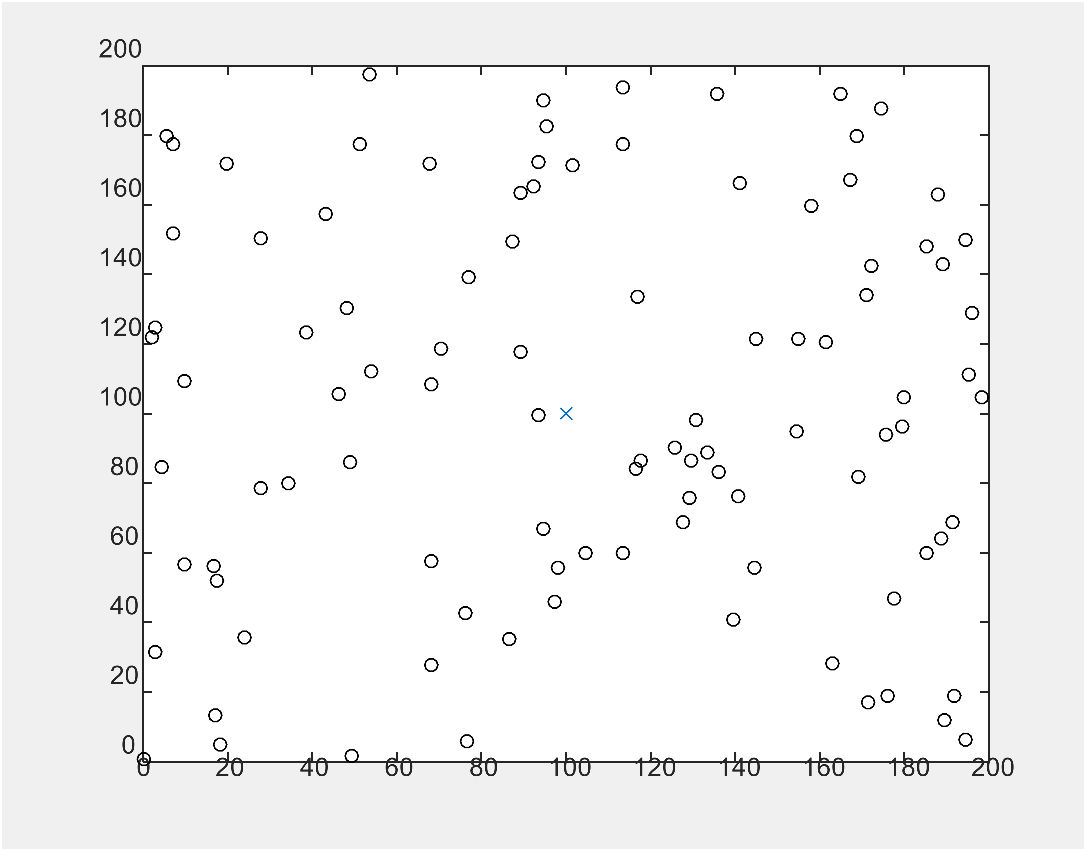

Figure 4.1 : Network Layout For Developed WSN Model

Figure 4.1 shows the network layout of developed WSN model having each node is distributed randomly over the complete area. Base station is placed at (x, y)=(50 , 50) position. Each cluster head is selected in every round. They are shown by '*' mark in above figure 4.1.These cluster heads are considered under K nearest neighborhood algorithm. Where k is the number of nearest neighbors here k is taken to be 4.

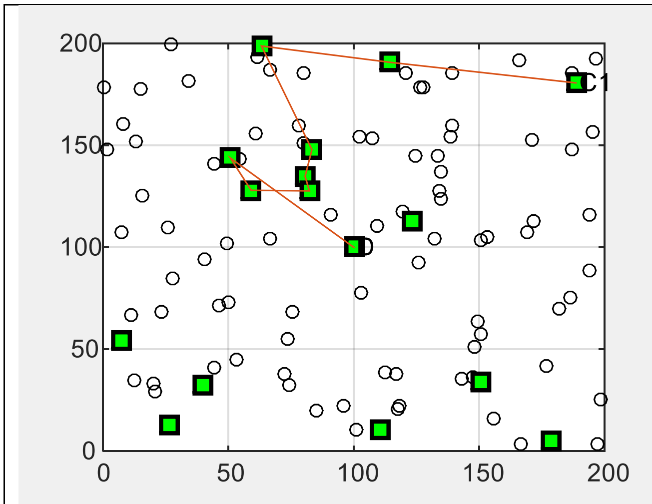

Figure 4.2 (a): Routing from cluster head C1 to base station.

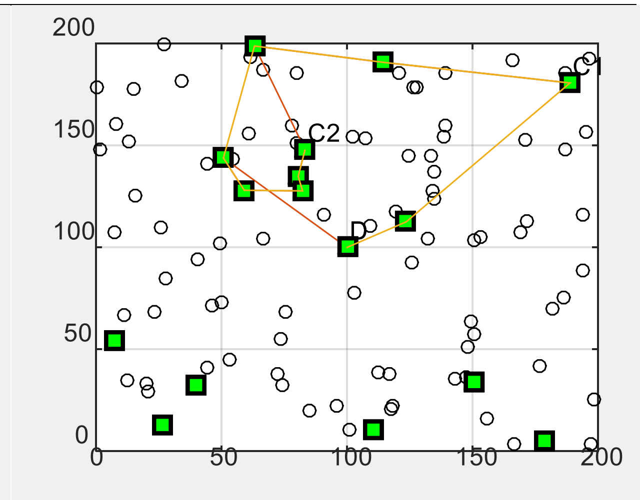

Figure 4.2 (b): Routing from cluster head C2 to base station.

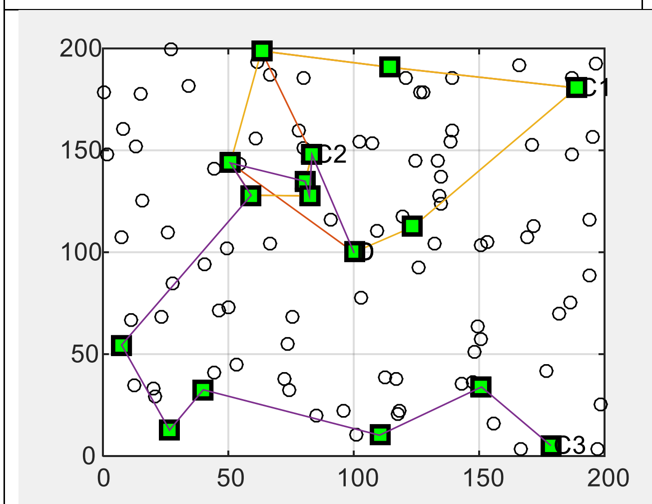

Figure 4.2 (c): Routing from cluster head C3 to base station.

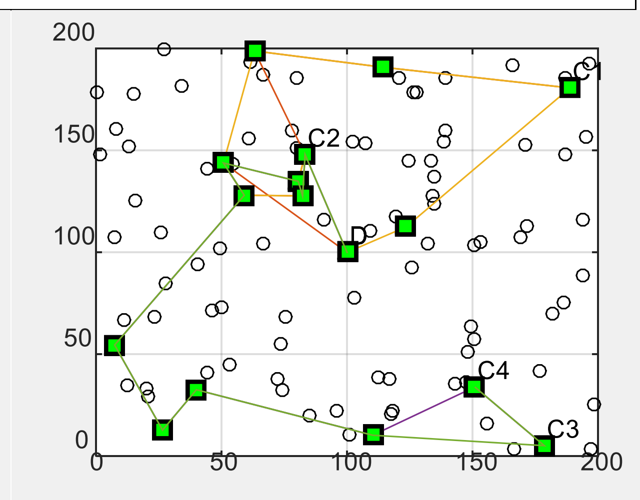

Figure 4.2 (d): Routing from cluster head C4 to base station.

Figure 4.2(a) shows the minimum energy route from clusterhead ID C1 to the base station ID 101 as destination. In this case theminimum energy taken is zero Joule. Every time thesource ischanged the minimum energy route is calculated for routing after finding out the k nearest neighbors among the selected cluster heads. Similarly 4.2 (b) shows the next route followed from cluster head C2 to base station. Similarly next routes from C3 and C4 are developed iteratively and this routing is repeated until all the routes are established from cluster heads to base station.

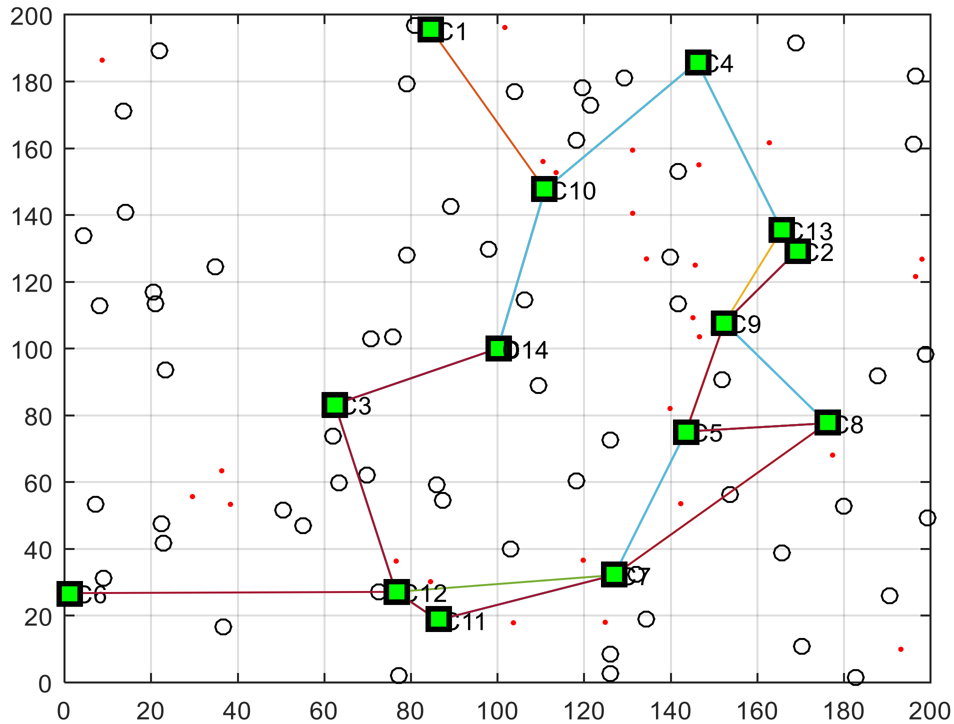

Figure 4.3 :Route established by all the cluster heads to base station at round 200.

In figure 4.3 red dot shows the dead nodes during this round and route establishment.At 200 round some nodes are dead while some nodes are alive.to keep the sensor network alive making the network more operational and efficient. Different routes are formed and then we follow the minimum energy route to send the information from source to base station which makes the low energy consumption and increase lifetime.

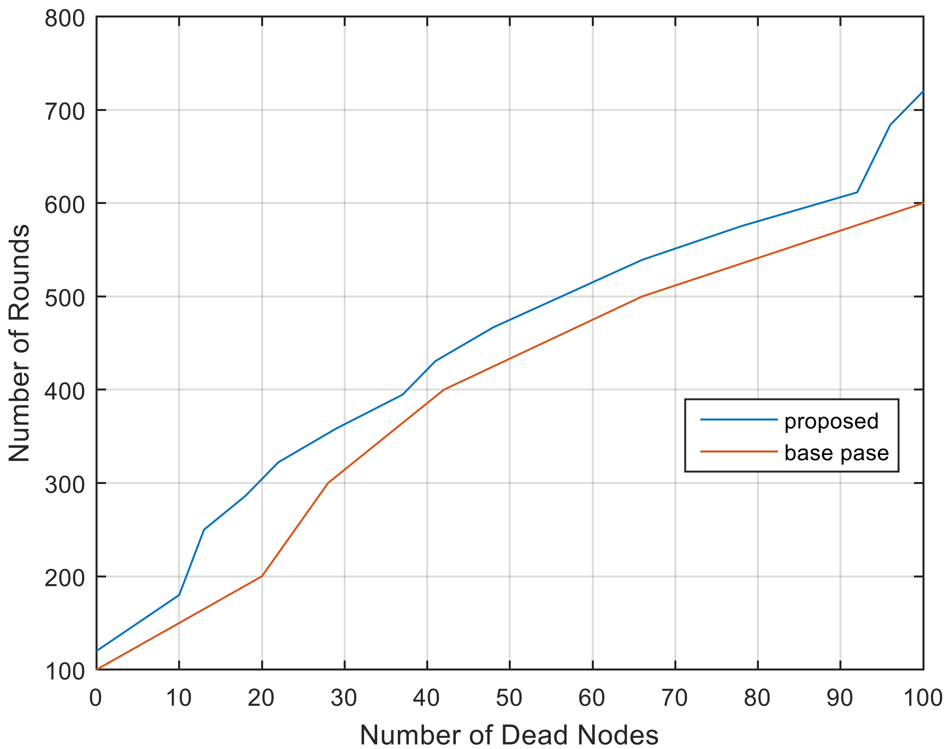

Figure 4.4: Number Of Dead Nodes W.R.T. Number Of Rounds.

The graph infigure 4.4 shows the network lifetime over a period of time.Nodes started dying after 120 rounds and After 600 rounds almostall the nodes are died.in our proposed work nodes started dying from 130 round and after 600 round some nodes are alive and lasts upto 700 round which shows the better performance from previous work. We have carried a comparative study between ouralgorithm and direct routing. Direct routing uses single hopcommunication to transmit its data from cluster head to thebase station. Energy consumption in direct routing is more thanour scheme, therefore the network lifetime is also less in directrouting. Since we use a multi-hop architecture, the energyconsumption is comparatively low. We have taken somestatistics regarding number of dead node per round. In case ofdirect routing the network last up to 130 rounds, while it last upto 600 rounds in case of our minimum energy routing (MER)scheme. Table II shows the percentage of dead nodes in bothschemes.

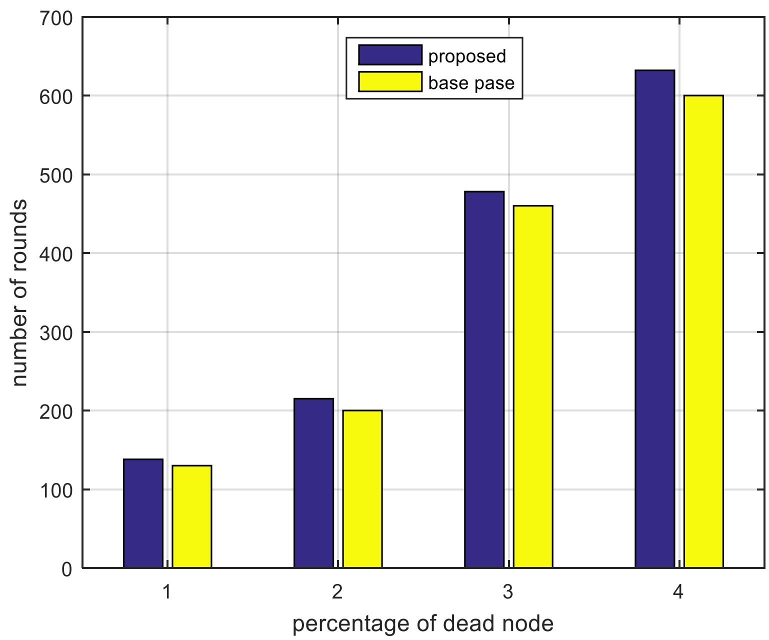

Figure 4.5: Number of Rounds and Percentage of Dead Nodes.

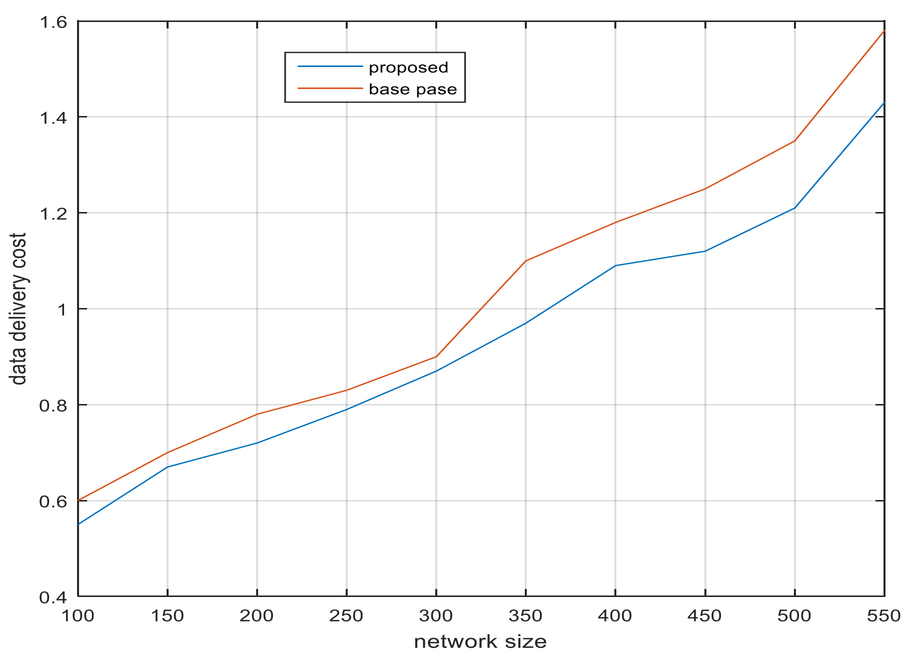

Figure 4.6:Data Delivery Cost at Different Network Size

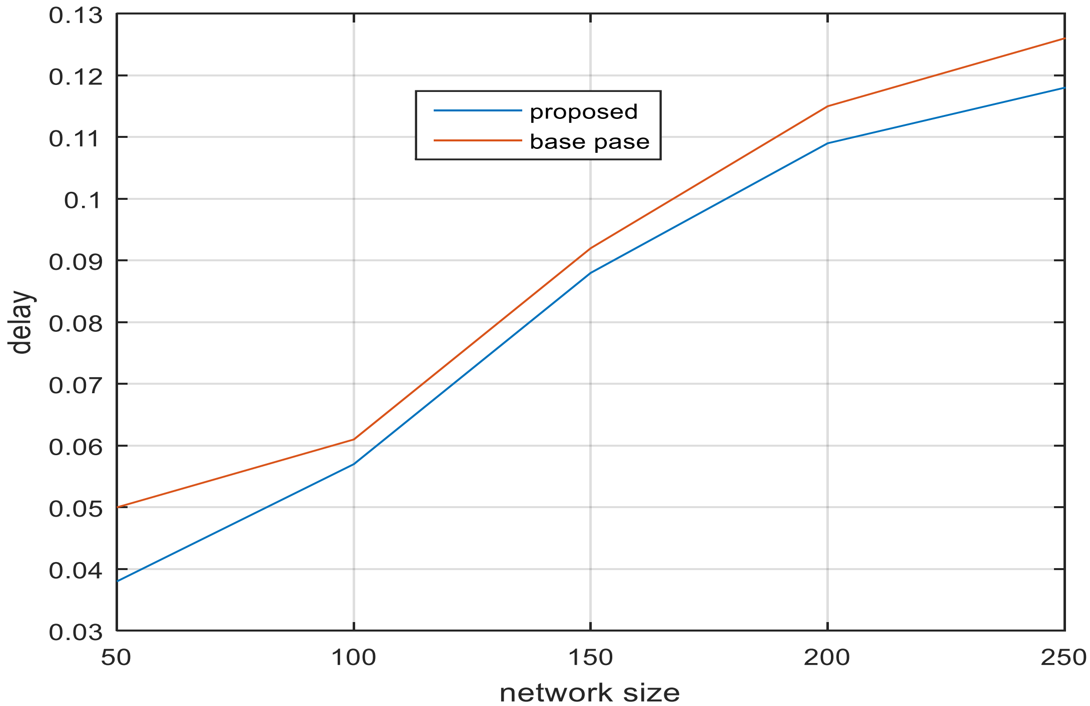

Figure 4.7:Data Delivery Delay at Different Network Size

Figure no 4.7 shows the average data transfer delay results among the different routing protocols.data packets are routed through different cluster head with minimum energy path.hence the network congestion can be avoided.

CHAPTER 5.

CONCLUSION AND FUTURE SCOPES

CONCLUSION:-

One of the key challenges in wireless sensor networks is the efficient usage of restricted energy resources in battery operated sensor nodes. Clustering remains the most effective routing approach used in WSN. Low Adaptive Clustering Hierarchy (LEACH) protocol is an efficient routing approach which has been widely adopted and enhanced to improve the lifespan of deployed sensor networks. However, latterly, clustering algorithms have shown their limitation in extending the network lifespan. In this work, we propose a new clustering approach based on a combination cluster based routing mixing with conventional protocols. The adoption of multi-hop communication instead of direct communication in cluster filed has optimized the communication in the network. The simulation results illustrate the energy efficiency of the multi-hop cluster based routing approach. The proposed method achieves significant improvement in term of network lifespan and provides enhanced energy performance for wireless sensor networks.

FUTURE WORK:-

In this thesis, we develop an energy efficient routing algorithm based on minimum energy route development for wireless sensor networks. The cluster-heads are responsible for routing received data to the base station. We evaluated the neighboring clusters ids using KNN technique and we calculate the energy required to transmit a message to all the neighbors from source cluster to the destination cluster. Comparing all possible potential routes we select the minimum energy route to transmit the data towards base station. Simulation result shows significant improvement performance of our scheme.In future such proposal can be extended to application of WSN that has been widely used in different applications such as habitat and industry monitoring, medical diagnosis, environmental monitoring and agriculture.

REFERENCES

1. Xiaohui Yuan, “A Genetic Algorithm-Based, Dynamic Clustering Method Towards Improved WSN Longevity,” 9 September 2015 / Revised: 25 March 2016 / Accepted: 7 April 2016 _ Springer Science+Business Media New York 2017
2. Mohamed Elhoseny, “Dynamic Multi-hop Clustering in a Wireless Sensor Network: Performance Improvement,” Springer Science+Business Media New York 2017
3. NitinMittal, “Modified Grey Wolf Optimizer for Global Engineering Optimization,” Journal Applied Computational Intelligence and Soft Computing archive Volume 2016, March 2016 Article No. 8 Hindawi Publishing Corp. New York, NY, United States
4. Mohamed Hadded, “A Multi-Objectif Genetic Algorithm-Based Adaptive Weighted Clustering Protocol in VANET,” 2015 IEEE Congress on Evolutionary Computation (CEC)
5. Geetha, “Clustering in Wireless Sensor Networks: Performance Comparison of LEACH & LEACH-C Protocols Using NS2,” Geetha. V. et al. / Procedia Technology 4 (2012) 163 – 170
6. FuadBajaber, “Adaptive decentralized re-clustering protocol for wireless sensor Networks,” Journal of Computer and System Sciences 77 (2011) 282–292
7. Jorge Tavares, “Application of Wireless Sensor Networks to Automobiles,” MEASUREMENT SCIENCE REVIEW, Volume 8, Section 3, No. 3, 2008
8. Ramesh Rajagopalan, “Data aggregation techniques in sensor networks: A Survey,” (2006). Electrical Engineering and Computer Science. 22.
9. Goldberg, “Genetic Algorithms and Machine Learning,” Machine Learning 3: 95-99, 1988 © 1988 Kluwer Academic Publishers - Manufactured in The Netherlands
10. Wendi B. Heinzelman, “An Application-Specific Protocol Architecture for Wireless Microsensor Networks,” IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, VOL. 1, NO. 4, OCTOBER 2002
11. I.F. Akyildiz, “Wireless sensor networks: a survey,” Computer Networks 38 (2002) 393–422
12. Wendi Beth Heinzelman, “Application- Specific Protocol Architectures for Wireless Networks,” Massachusetts Institute of Technology Date Issued: 2000

13. S. Bandyopadhyay, E.J. Coyle, An energy efficient hierarchical clustering algorithm for wireless sensor networks, in: Proceeding of INFOCOM 2003, April 2003.
14. V. Mhatre, C. Rosenberg, Design guidelines for wireless sensor networks: communication, clustering and aggregation, Ad Hoc Network Journal 2 (1) (2004) 45–63.
15. M. Ye, C. Li, G. Chen, J. Wu, EECS: an energy efficient cluster scheme in wireless sensor networks, in: IEEE International Workshop on Strategies for Energy Efficiency in Ad Hoc and Sensor Networks (IEEE IWSEEASN2005), Phoenix, Arizona, April 7–9, 2005.
16. A. Depedri, A. Zanella, R. Verdone, An energy efficient protocol for wireless sensor networks, in: Autonomous Intelligent Networks and Systems (AINS 2003), Menlo Park, CA, June 30–July 1, 2003.
17. W. R. Heinzelman. Application-Specific Protocol Architectures for Wireless Networks, Ph.D. thesis, Massachusetts Institute of Technology, 2000.
18. D. Estrin, R. Govindan, J. Heidemann, S. Kumar, Next century challenges: scalable coordination in sensor networks, in: Proceedings of the 5th Annual ACM/IEEE International Conference on Mobile Computing and Networking (MobiCom'99), August 1999, pp. 263–270.
19. L. Qing, Q. Zhu, M. Wang, "Design of a distributed energy-efficient clustering algorithm for heterogeneous wireless sensor networks". ELSEVIER, Computer Communications 29, 2006, pp 2230- 2237.
20. A. Manjeshwar and D. P. Agarwal, "TEEN: a routing protocol for enhanced efficiency in wireless sensor networks," In 1st International Workshop on Parallel and Distributed Computing Issues in Wireless Networks and Mobile Computing, April 2001.
21. A. Manjeshwar and D. P. Agarwal, "APTEEN: A hybrid protocol for efficient routing and comprehensive information retrieval in wireless sensor networks," Parallel and Distributed Processing Symposium., Proceedings International, IPDPS 2002, pp. 195-202.
22. Elbhiri, B. ,Saadane, R. , El Fkihi, S. , Aboutajdine, D. "Developed Distributed Energy-Efficient Clustering (DDEEC) for heterogeneous wireless sensor networks", in: 5th International Symposium on I/V Communications and Mobile Network (ISVC), 2010.

23. ParulSaini, Ajay.K.Sharma, “E-DEEC- Enhanced Distributed Energy Efficient Clustering Scheme for heterogeneous WSN”, in: 2010 1st International Conference on Parallel, Distributed and Grid Computing (PDGC - 2010).
24. Md. Solaiman Ali, TanayDey, and Rahul Biswas, ―ALEACH: Advanced LEACH Routing Protocol for Wireless Microsensor Networks‖ ICECE 2008, 20-22 December 2008.
25. U. Sajjanhar, P. Mitra, ―Distributive Energy Efficient Adaptive Clustering Protocol for Wireless Sensor Networks‖, Proceedings of the 2007 International Conference on Mobile Data Management, pp. 326 - 330, 2007.
26. ElbhiriBrahim,SaadaneRachid,Alba-Pages Zamora, DrissAboutajdine, ―Stochastic Distributed Energy-Efficient Clustering (SDEEC) for heterogeneous wireless sensor networks‖, ICGST-CNIR Journal, Volume 9, Issue 2, December 2009.
27. InboSim, KoungJin Choi, KoungJin Kwon and Jaiyong Lee, ―Energy Efficient Cluster header Selection Algorithm in WSN‖, International Conference on Complex, Intelligent andSoftware Intensive Systems , IEEE, 2009.
28. Ma Chaw Mon Thein, ThandarThein ―An Energy Efficient Cluster-Head Selection for Wireless Sensor Networks‖, International Conference on Intelligent Systems, Modeling and Simulation, IEEE 2009

List of Publications

1. VandanaSrivastava, “KNN based Efficient Inter Cluster Routing Protocols for WSN.”.May 2019 Volume 6 No.5,Journal of Emerging Technologies and Innovative Research.

2. VandanaSrivastava.”A SURVEY:- ROUTING PROTOCOLS CLASSIFICATION IN WIRELESS SENSOR NETWORKS.”April 2019,Volume 6 No.4,Inetrnational Journal of Advance Engineering and Research development.

PLAGIARISM REPORT

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Annexure V

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6. Thesis Preparation Guide was referred to for preparing the thesis. ☐YES ☐NO

7. Specifications regarding thesis format have been closely followed. ☐YES ☐NO

8. The contents of the thesis have been organized based on the guidelines. ☐YES ☐NO

9. The thesis has been prepared without resorting to plagiarism. ☐YES ☐NO

10. All sources used have been cited appropriately. ☐ YES ☐NO

11. The thesis has not been submitted elsewhere for a degree. ☐ YES ☐ NO

12. All the corrections have been incorporated. ☐ YES ☐NO

13. Submitted 4 hard bound copies plus one CD.

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7. Specifications regarding thesis format have been closely followed. ☐YES ☐NO
8. The contents of the thesis have been organized based on the guidelines. ☐YES ☐NO
9. The thesis has been prepared without resorting to plagiarism. ☐YES ☐NO
10. All sources used have been cited appropriately. ☐ YES ☐NO
11. The thesis has not been submitted elsewhere for a degree. ☐ YES ☐ NO
12. Submitted 2 spiral bound copies plus one CD. ☐ YES ☐NO

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KNN based Efficient Inter Cluster Routing Protocol for WSN

Vandana Srivastava,
Electronics and Communication,
BBDU, Lucknow

Abstract: In this work, we look at routing protocols, which can have significant impact on the overall energy dissipation of these networks. Based on our findings that the conventional routing protocols of direct transmission, minimum-transmission-energy, multi hop routing, and static clustering may not be optimal for sensor networks, we propose KNN based routing protocol , a inter clustering-based protocol that utilizes randomized rotation of local cluster base stations (cluster-heads) to evenly distribute the energy load among the sensors in the network. It uses a non-localized coordination to enable scalability and robustness for dynamic networks, and incorporates data fusion into the routing protocol to reduce the amount of information that must be transmitted to the base station. Simulations show that it can achieve as much higher factor of reduction in energy dissipation compared with conventional routing protocols. In addition, it is able to distribute energy dissipation evenly throughout the sensors, doubling the useful system lifetime for the networks we simulated.

Keywords: Clustering, KNN, Routing Protocol, WSN

1. Introduction:

In hierarchical routing, sensor nodes are groupped into clusters. Every cluster has a frontrunner, a node dedicated to communication with more computation and power resources. Every sensor node then sends facts simplest to the cluster chief unburdening nodes from routing problems which can be moved to cluster leaders. [2] Many functions of WSN (including time synchronization, duty-cycles) have to be also contemplated in the base station implementation. Therefore, the bottom station developer must recognize the basic ideas of WSN or at least the ones associated with developing the base station. Hierarchical strategies are typically utilized in stressed out network for scalability [11]. For wireless networks, a hierarchical clustering and routing scheme based upon bodily area management was currently proposed in [6, 12]. This scheme, but, creates implementation problems that are probably complicated to solve. First, it does allocate Cluster IDs dynamically. This allocation ought to be specific - not an easy assignment in multi-hop cell environment, in which the hierarchical topology ought to be frequently reconfigured. Second, every cluster can dynamically merge and cut up, primarily based at the wide variety of nodes inside the cluster. Frequent cluster modifications may also degrade the community overall performance appreciably. In a large, cell network the trouble of locating customers and services by means of their names isn't always a trivial one. In a stressed out Internet the DNS affords a mapping among symbolic names and community addresses. The community cope with is then processed by the routing tables and leads immediately to the vacation spot. In stressed out networks with mobile radio extensions, Mobile IP became advanced to deal with the ultimate hop indirection, from Home Agent to mobile user. In multihop wi-fi networks there's no fixed Home Agent. We endorse the Wireless Hierarchical Routing Protocol (WHIRL) to attack this hassle with a ”multihop extension” of the Mobile IP concept. We will distinguish among the ”physical” routing hierarchy, dictated by means of the geographical relationship among nodes, and the ”logical” hierarchy of subnets corresponding to participants within the equal institution (e.G., tanks in the battlefield, or travelling salesman of the equal organisation). We will hold music of logical subnets the usage of a DNS hierarchy geared toward lowering manage traffic O/H. Physical MAC layer clustering [7, 4] offers the primary level of an efficient ”physical” routing hierarchy.

In WHIRL, the complete community is divided into logical subnets. Each subnet has one primary Home Agent (HA). It will have several secondary HAs from which, within the case of primary HA failure, a new primary HA may be selected . Each node has a completely unique identifier NODEID. The deal with of the node includes components: logical. This is used to discover the logical subnet to which each node belongs and the is utilized in physical routing. In our look at, we use the Link State (LS) physical routing scheme which is on the top of MAC layer clustering defined in [7, 4] as the bodily routing infrastructure for WHIRL. However, the idea of WHIRL can be built upon any routing scheme the usage of because the bodily routing address. The key obligation of the HA is to maintain the physical clustering statistics of its logical subnet participants. HA additionally desires updates its personal clustering facts to all of the cluster heads. There are two levels within the WHIRL. The packet is routed first from the source to destination HA. Then it is routed from the destination HA to the final vacation spot. The header of the packet carries the of the destination cluster head. Initially, the is about to. The source sends the packet to its cluster head. The cluster head will look up its HA clustering desk. The cluster head will set the to be the of the vacation spot cluster head of the destination HA in the packet header in keeping with the desk. If the vacation spot HA has more than one cluster heads, it'll select the one that has the minimum distance. All the intermediate gateways and cluster heads will direction the packet according to the inside the packet header using the physical routing scheme. Once the vacation spot cluster head receives the packet, it's going to ship the packet to the HA. The HA scans its subnet member clustering table, unearths out the cluster head for the vacation spot node and units the with it. The HA will then ship the packet to its cluster head and the packet may be on the adventure to its very last vacation spot cluster head. The vacation spot cluster head will pass the the packet to destination node.

2. Related Work:

The dynamic nature of wi-fi sensor networks (WSNs) and severa possible cluster configurations make attempting to find an most desirable community shape at the- fly an open undertaking. To cope with this problem, **Xiaohui Yuan,(2017) [1]** proposed a genetic algorithmbased, self-organizing network clustering (GASONeC) technique that offers a framework to dynamically optimize wireless sensor node clusters. In GASONeC, the residual energy, the anticipated energy expenditure, the distance to the base station, and the quantity of nodes in the location are employed in search for an top of the line, dynamic community structure. Balancing those elements is the important thing of organizing nodes into suitable clusters and designating a surrogate node as cluster head. Compared to the cutting-edge methods, GASONeC greatly extends the community lifestyles and the improvement as much as forty three.Forty four %. The node density substantially influences the network toughness. Due to the improved distance between nodes, the community existence is normally shortened. In addition, while the base station is placed far from the sensor field, it is desired that greater clusters are fashioned to preserve strength.

A cluster-based totally version is leading in wi-fi sensor network because of its ability to reduce power consumption. However, handling the nodes inside the cluster in a dynamic environment is an open assignment. Selecting the cluster heads (CHs) is a cumbersome system that significantly impacts the community overall performance. Although there are several research that propose CH selection strategies, maximum of them are not suitable for a dynamic clustering environment. To keep away from this hassle, several strategies had been proposed by way of **MohamedElhoseny, (2017), [2]** primarily based on smart algorithmsalong with fuzzy good judgment, genetic set of rules (GA), and neural networks. However, these algorithms paintings better inside a unmarried-hop clustering version framework, and the network lifetime constitutes a huge trouble in case of multi-hop clustering environments. This paper introduces a new CH selection method based on GA for both unmarried-hop and the multi-hop cluster fashions. The proposed method is designed to satisfy the requirements of dynamic environments by way of electing the CH primarily based on six major functions, namely, (1) the closing energy, (2) the ate up power, (3) the variety of nearby neighbors, (four) the energy aware distance, (5) the node vulnerability, and (6) the diploma of mobility. We shall see how the corresponding consequences display that the proposed set of rules greatly extends the network lifetime.

NitinMittal (2016), [3] worked on nature-inspiredalgorithms are becoming popular among researchers due to their simplicity and versatility. The nature-stimulated metaheuristic algorithms are analysed in terms in their key capabilities like their diversity and version, exploration and exploitation, and sights and diffusion mechanisms. The fulfillment and challenges regarding these algorithms are based totally on their parameter tuning and parameter manipulate. A relatively new set of rules prompted by using the social hierarchy and hunting conduct of gray wolves is Grey Wolf Optimizer (GWO), that's a completely successful algorithm for fixing actual mechanical and optical engineering troubles. In the authentic GWO, 1/2 of the iterations are committed to exploration and the opposite half of are committed to exploitation, overlooking the impact of proper balance between these to assure an correct approximation of global most desirable. To triumph over this shortcoming, a changed GWO (mGWO) is proposed, which focuses on proper balance between exploration and exploitation that results in an top-rated performance of the set of rules. Simulations based on benchmark troubles and WSN clustering trouble reveal the effectiveness, efficiency, and stability ofmGWO as compared with the basicGWO and some well-known algorithms.

Vehicular Ad hoc NETworks (VANETs) are a primary element currently used within the development of Intelligent Transportation Systems (ITSs). VANETs have a highly dynamic and portioned network topology because of the steady and speedy motion of cars. Currently, clustering algorithms are extensively used as the manipulate schemes to make VANET topology much less dynamic for Medium Access Control (MAC), routing and security protocols. An efficient clustering algorithm must recall all of the essential records associated with node mobility. In this work, **Mohamed Hadded,(2015) [4]** proposed an AdaptiveWeighted Clustering Protocol (AWCP), mainly designed for vehicular networks, which takes the dual carriageway ID, route of automobiles, function, pace and the wide variety of neighboring motors under consideration a good way to decorate the stableness of the community topology. However, the a couple of manipulate parameters of our AWCP, make parameter tuning a nontrivial problem. In order to optimize the protocol, we define a multi-objective problem whose inputs are the AWCP's parameters and whose targets are: imparting solid cluster structures, maximizing statistics transport price, and lowering the clustering overhead. We cope with this multi-goal hassle with the Nondominated Sorted Genetic Algorithm version 2 (NSGA-II). We evaluate and examine its performance with other multi-objective optimization techniques: Multi-goal Particle Swarm Optimization (MOPSO) and Multi-objective Differential Evolution (MODE). The experiments reveal that NSGA-II improves the effects of MOPSO and MODE in terms of spacing, spread, ratio of non-dominated answers, and inverse generational distance, which are the performance metrics used for comparison. Because of the swiftly changing topology and the dearth of infrastructure, it is very challenging to installation clustering methods in vehicular networks.

Every form of network, be it stressed or wi-fi, could be prompted with the aid of several key elements for its efficient functioning. Routing difficulty, applicable to all styles of networks, is one a number of the several such key factors. Wireless Sensor Networks (WSN) has not been exception to this. Moreover, such issues are very essential due to excessive resource constraints like efficient strength usage, lifetime of community, and drastic environmental situations in WSNs. Neither hop-through-hop or neither direct attain potential is viable in case of WSNs. In this regard, many routing protocols were proposed by way of **Geetha. V.(2012) [5]** to optimize the efficiency of WSNsamidst of above cited intense aid constraints. Out of these, clustering algorithms have gained extra importance, in increasing the life time of the WSN, due to their approach in cluster head selection and information aggregation.

3. Methodology:

The conventional KNN text category set of rules used all training samples for class, so it had a massive wide variety of schooling samples and a high diploma of calculation complexity, and it additionally didn't mirror the exclusive significance of different samples. With the fast improvement of net, a big range of textual content information begin to exist with the form of pc-readable and increase exponentially. The records and useful resource of internet take on the individual of big.

In order to correctly manipulate and utilize this huge amount of report statistics, textual content mining and content-based facts retrieval have regularly come to be the hotspot studies area in the world. Text class is an critical basis for facts retrieval and textual content mining, the main project is assigning textual content file to 1 or extra predefined categories according its content material and the labeled training samples [1]. Text class has been used substantially. For example, a few government departments and businesses made use of textual content classification for e-mail filtering. This type of e-mail classifiers cannot simplest filter

out junk emails, but also distribute emails to the corresponding departments in keeping with the content. Text category generation also widely utilized in internet search engines like google, that may filter out the message that customers don't challenge approximately and deliver their fascinated content material. So we are able to take a conclusion that in the manner of information offerings, text category is a essential and vital technique, it may help users to prepare and access to information and it has very important research fee. Study on text classification abroad dated lower back to the past due Nineteen Fifties, H. P. Luhn had executed some ground-breaking studies paintings and proposed the methodology of the usage of word frequency for textual content automated type. In 1960, Maron posted the primary paper on text computerized classification, and then, a big quantity of scholars got fruitful research on this area. So far, the text type technology in foreign united states of america has been carried out in lots of fields, such as e mail filtering, digital conferences and statistics retrieval. There has additionally evolved some of extraordinarily mature software, including Intelligent Miner For Text evolved by using IBM, which can classify, cluster and get summary for the industrial documents; Net Owl Extractor evolved by means of SAR applied the feature of text clustering, category and electronic mail filtering; and additionally Insight Discoverer Categorizer advanced with the aid of TENIS can clear out junk emails and knowledge control for the commercial documents [2].

Study on textual content class in China had a past due start. Professor Hou Han-Qing had executed a good deal studies on text mining and delivered the idea of foreign laptop control tables, pc statistics retrieval, and computer textual content automatic classification in 1981. Afterwards, many researchers and institutions have all started to look at the text class. Currently, the research on textual content class has been made a whole lot of improvement, and the commonplace algorithms

for text class consist of K nearest neighbor set of rules (KNN), Bayes algorithm, Support Vector Machine algorithm (SVM), selection tree algorithms, neural community algorithm (Nnet), Boosting algorithm, etc [2]. KNN is one of the maximum popular and good sized amongst those, but it nonetheless has many defects, together with wonderful calculation complexity, no distinction among function phrases, does not keep in mind the associations among the key phrases and so forth. In order to keep away from those defects, many researchers had proposed a few enhancements. On account of the truth that the conventional method lacked of attention of institutions among the keywords, literature [3] proposed an stepped forward KNN approach which carried out vector-combination technology to extract the related discriminating phrases consistent with the CHI statistic distribution. The era of vector combination can reduce the size of the textual content function vector and improve the accuracy effectively, but it can't spotlight the important thing phrases that have more contribution to type. Literature [4] proposed a fast KNN set of rules named FKNN directed to the shortcomings of incredible calculation, but it could't improve the accuracy. In order to reduce the high calculation complexity, this paper used clustering technique and selected the cluster facilities because the representative factors which made the education sets grow to be smaller, and for overcoming the defect of no distinction among feature phrases.

3.1 KNN Text Classification Algorithm

KNN is one of the most vital non-parameter algorithms in pattern recognition subject [11] and it's a supervised studying predictable type set of rules. The classification guidelines of KNN are generated by using the schooling samples themselves with none extra data. KNN category set of rules predicts the take a look at pattern's class in line with the K schooling samples which are the closest neighbors to the test pattern, and choose it to that class which has the largest category probability. The technique of KNN set of rules to categorise file X is [12]:

Suppose that there are j training categories as C1 ,C2 ,C3.... Cj , and the sum of the training samples is N . After pre-processing for every document, all of them become m-size characteristic vector.

1. Make record X to be the same text feature vector shape (X1 ,X2 ,X3.... Xm) as all training samples.
2. Calculate the similarities among all education samples and record X . Taking the ith file (di1, di2,.....Dim) as an example, the similarity SIM (X, di) is as following

$$SIM(X, \quad) = \frac{}{\sqrt{(\sum_{=1} \quad)^2} \cdot \sqrt{\sum_{=1} \quad)^2}}$$

3) Choose k samples which are larger from N similarities of SIM(X ,di),(i= 1,2,.... ,N), and treat them as a KNN collection of X . Then, calculate the probability of X belong to each category respectively with the following formula.

$$(, \quad) = \sum_{\in} (, \quad) . (, \quad)$$

Where y(di ,Cj) is a category attribute function, which satisfied

4. Judge document X to be the category which has the largest P(X, Cj,).

The traditional KNN text classification has 3 defects [13]: 1) Great calculation complexity. When using traditional KNN type, if you want to locate the K nearest neighbor samples for the given take a look at pattern, it have to be calculated with all of the similarities between the training samples, as the size of the text vector is typically very high, so its has exquisite calculation complexity on this method which made the efficiency of textual content type very low. Generally speaking, there are 3 techniques to lessen the complexity of KNN set of rules: reducing the size of vector text [4]; the usage of smaller records units; the usage of stepped forward algorithm that could accelerate to find out the K nearest neighbor samples [5]; 2) Depending on training set. KNN algorithm does not use extra data to explain the classification rules, but the classifier are generated by way of the self education samples, this made the set of rules depend on training set excessively, for instance, it want to re-calculated when there may be a small exchange on education set; 3) No weight distinction among samples. As system (2), the category attribute characteristic has mentioned that the conventional KNN algorithm dealt with all education samples similarly, and there is no distinction among the samples, so it don't suit the actual phenomenon which samples have choppy distribution usually.

4. Result and Discussion:

In this paper for the algorithm development we have used MATLAB 2015 software and developed an algorithm using programming. We have considered a simulated network of 100 randomly distributed nodes in a sensor field of 100* 100 area. The location of base station is fixed and base station ID is 101. The simulation parameters used are shown in Table 1

Table 1: Simulation Parameters

No of nodes	100
Network area	100 * 100
Channel Type	Wireless channel
Source node	100 sensor nodes
Antenna Model	Antenna/Omni Antenna
Interface Queue Type	Queue/Drop Tail/PriQueue
Initial Energy of sensor nodes	.5j
Time for each round	5 sec
Transmission power	50 pj
Receiving power	10 pj
Transmission Range	40m

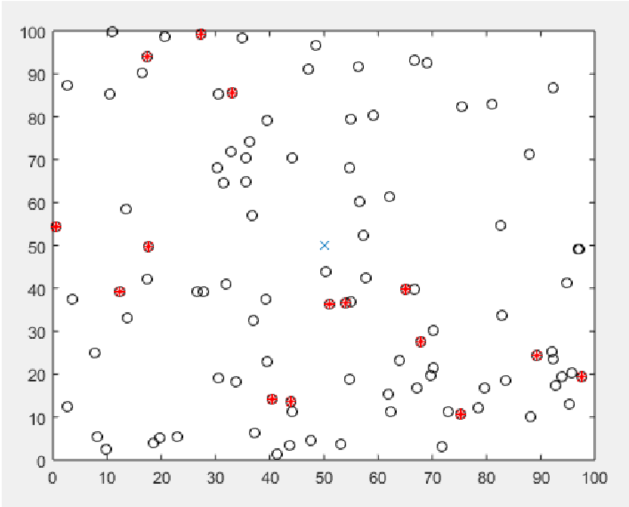

Fig 1: Network layout for developed WSN model

Figure 1 shows the network layout of developed WSN model having each node is distributed randomly over the complete area. Base station is placed at (x, y)=(50 , 50) position. Each cluster head is selected in every round. They are shown by '*' mark in above figure 1.These cluster heads are considered under K nearest neighborhood algorithm. Where k is the number of nearest neighbors here k is taken to be 4.

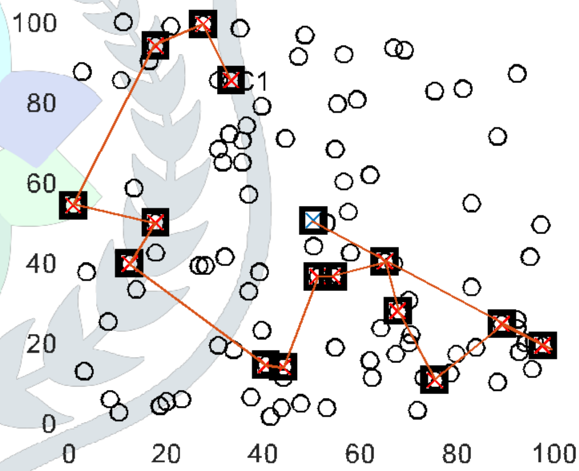

Fig 2: Routing from cluster head C1 to base station.

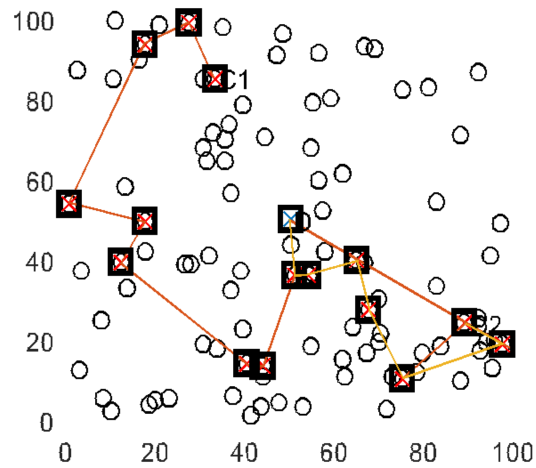

Fig 3: Routing from cluster head C2 to base station.

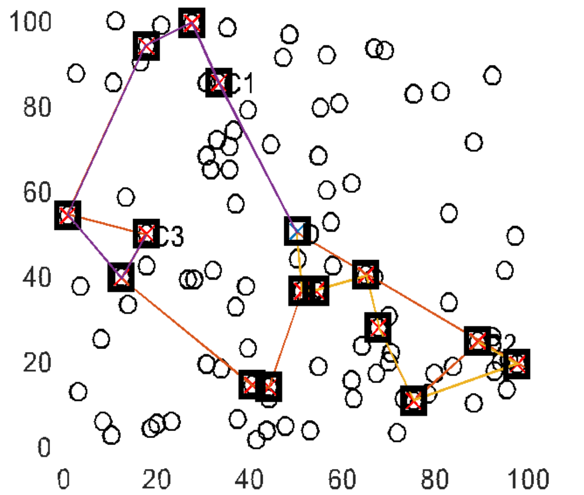

Fig 4: Routing from cluster head C3 to base station.

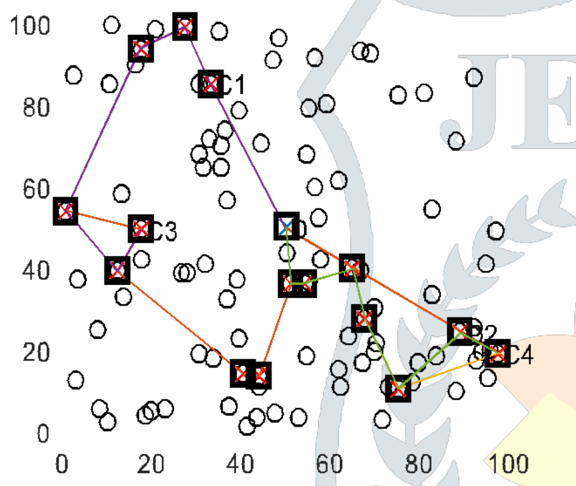

Fig 5: Routing from cluster head C4 to base station.

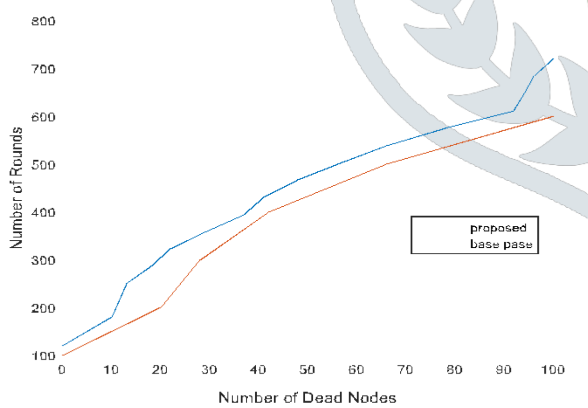

Fig 6: Number of dead nodes w.r.t. number of rounds.

5. Conclusion:

In this paper, we develop an energy efficient routing algorithm based on minimum energy route development for wireless sensor networks. We have used multi-hop architecture in between CH to base station for data transmission. The first step of routing is clustering, where the whole network is divided into some disjoint clusters having some member nodes and a special node known as cluster head. Each cluster head for a particular cluster performs data aggregation and necessary computation. The cluster-heads are responsible for routing received data to the base station. We evaluated the neighboring clusters ids using KNN technique and we calculate the energy required to transmit a message to all the neighbors from source cluster to the destination cluster. Comparing all possible potential routes we select the minimum energy route to transmit the data towards base station. Simulation result shows significant improvement of performance of our scheme.

References:

[1] Xiaohui Yuan, "A Genetic Algorithm-Based, Dynamic Clustering Method Towards Improved WSN Longevity," 9 September 2015 / Revised: 25 March 2016 / Accepted: 7 April 2016 _ Springer Science+Business Media New York 2017

[2] Mohamed Elhoseny, "Dynamic Multi-hop Clustering in a Wireless Sensor Network: Performance Improvement," Springer Science+Business Media New York 2017

[3] NitinMittal, "Modified Grey Wolf Optimizer for Global Engineering Optimization," Journal Applied Computational Intelligence and Soft Computing archive Volume 2016, March 2016 Article No. 8 Hindawi Publishing Corp. New York, NY, United States

[4] Mohamed Hadded, "A Multi-Objectif Genetic Algorithm-Based Adaptive Weighted Clustering Protocol in VANET,"2015 IEEE Congress on Evolutionary Computation (CEC)

[5] Geetha, "Clustering in Wireless Sensor Networks: Performance Comparison of LEACH & LEACH-C Protocols Using NS2," Geetha. V. et al. / Procedia Technology 4 (2012) 163 – 170

[6] Fuad Bajaber, "Adaptive decentralized re-clustering protocol for wireless sensor Networks," Journal of Computer and System Sciences 77 (2011) 282–292

[7] Jorge Tavares, "Application of Wireless Sensor Networks to Automobiles," MEASUREMENT SCIENCE REVIEW, Volume 8, Section 3, No. 3, 2008

[8] Ramesh Rajagopalan, "Data aggregation techniques in sensor networks: A Survey," (2006). Electrical Engineering and Computer Science. 22.

[9] Goldberg, "Genetic Algorithms and Machine Learning," Machine Learning 3: 95-99, 1988 © 1988 Kluwer Academic Publishers - Manufactured in The Netherlands

[10] Wendi B. Heinzelman, "An Application-Specific Protocol Architecture for Wireless Microsensor Networks," IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, VOL. 1, NO. 4, OCTOBER 2002

[11] I.F. Akyildiz, "Wireless sensor networks: a survey," Computer Networks 38 (2002) 393–422

[12] Wendi Beth Heinzelman, "Application- Specific ProtocolArchitecturesforWirelessNetworks," Massachusetts Institute of Technology Date Issued: 2000

[13] S. Bandyopadhyay, E.J. Coyle, An energy efficient hierarchical clustering algorithm for wireless sensor networks, in: Proceeding of INFOCOM 2003, April 2003.

[14] V. Mhatre, C. Rosenberg, Design guidelines for wireless sensor networks: communication, clustering and aggregation, Ad Hoc Network Journal 2 (1) (2004) 45–63.

[15] M. Ye, C. Li, G. Chen, J. Wu, EECS: an energy efficient cluster scheme in wireless sensor networks, in: IEEE International Workshop on Strategies for Energy Efficiency in Ad Hoc and Sensor Networks (IEEE IWSEEASN2005), Phoenix, Arizona, April 7–9, 2005.

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A SURVEY:- ROUTING PROTOCOLS CLASSIFICATION IN WIRELESS SENSOR NETWORKS

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Abstract:- *Wireless sensor networks consists of hundreds and thousands number of small minute nodes with sensing,computations and wireless communication capabilities. The sensor node screens the physical and environmental condition, such as temperature, pressure, motion, fire, humidity and many more .wireless sensor network is applicable to many areas like environment & wildlife monitoring, security & military surveillance, healthcare and many more. the limited battery lifeof sensor nodes in wireless sensor network is a challenging issues.so to increase the energy of sensor nodes routing protocols play a vital role in wsns.in this paper we present a survey of dissimilar routing protocols in WSNs. We first guess the design challenges for routing protocol in WSNs and further discuss different routing protocols.*

Keywords:- *sensor node, WSNs, routing, base station, energy*

INTRODUCTION

wireless sensor network contains a large number of sensor nodes that is used to monitor areas ,collect and report data to the base station .these sensor have the ability to communicate either among each other or directly to an external base station. a greater number of sensors allows for sensing over larger environmental regions with greater accuracy[1]. A base station is a source-rich device having unlimited power, communication and storage capability. It may be a static node or a mobile node based on the applications and scenarios[2]. It can communicate with the sensor nodes, to assemble the data and sends to the user via existing communication system or the Internet.

A WSN is a collection of sensor nodes which are deployed in a sensor fields which collect and route data packets to the Base Station. A sensor node can be scattered into four basic parts, viz. the sensor unit, a processor unit, a transceiver unit, and a power unit [7][8]. Localization is the heart of the routing principle in WSN. The position finding system helps the sensor A node to discover its position in the environment. The power unit gives the constant power supply to the sensor nodes which is the prime objective area of the intruders.

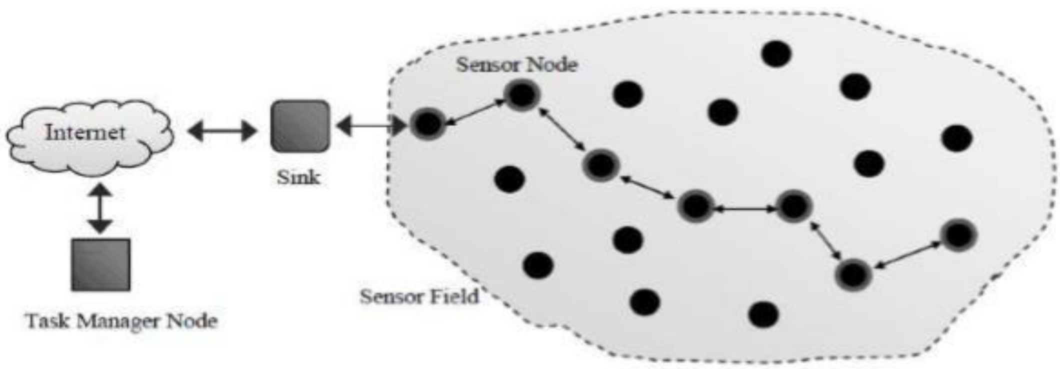

Fig. 1: Architecture of WSN

1.1Wireless sensor network architecture:

In WSNs network architecture involves of four main parts sensor nodes, sink, task manger, and security manager.

Sensor Nodes: These are the heart of the network. They are in-charge of collecting data and route this information back to asink.

Gateway/Sink: A gateway enable to the communication between the sensor nodes (Field devices).The gateway are alsocalled access points.

Task manager: A task manager is managing the operation, administration, security, and maintenance of all sensor nodes in anetwork.

Security manager: the security manager is responsible for the security of nodes in a network and management of keys[4].

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2. ROUTING IN WSNs

Routing in WSNs is very stimulating due to its inherent characteristics that distinguish these networks from other wireless networks like mobile ad hoc networks or cellular networks[3] .first, due to the moderately large number of sensor nodes.it is not possible to build a global addressing pattern for the deployment of a large number of sensor nodes as the overhead of ID maintains is high thus traditional IP based protocols may not be useful to WSN.

2.1 DESIGN ISSUES AND CHALLENGES FOR ROUTING IN WSN

In the highly dynamic and energy control network, it is a challenging task to develop a routing protocol. The design of the routing protocol can be aff ected by many characteristics influenced by the WSNs.e.g. .limited energy supply, limited computing power and limited bandwidth of the wireless links connecting sensor nodes[8]. These factors must be astounded before efficient communication can be achieved in WSNs. A few issues and challenges for routing in WSN are discussed below:

Energy Constraint:-

amount of energy is consumed during the route discovery and its conservation phase. The lifetime of then network directly depends on the total energy depletion by each node [7].If a sensor node's energy reaches below a certain level, it will become nonfunctional The sensor nodes are battery-powered devices, hence have limited energy. A large amount of energy is consumed during data transmission. Furthermore, a significant and affects the performance of the network.

Node Deployment:-

The sensor node deployment entirely depends upon applications and affects the performance of the routing protocols. .The deployment can be either deterministic or randomized.in deterministic deployment, the sensors are manually placed and data is routed through pre-determined paths[5]. In the random deployment, the node location is not predefined and generally, thrown from an aircraft in the hostile or unattended area.

Mobile Node Information:-

After the sensor node deployment generally ,the nodes are static. However, in some applications, the nodes are mobile. There should be a proper way to locate those mobile nodes to communicate with the static node. In some applications, the sink is moving within the network for data collection. So the routing protocol should be able to inform the sink location to the nodes within the networks.

Sensor Node Location:-

It is one of the design issues of routing protocol the location of sensor node is required in many applications like monitoring, tracking event detection etc. Most of the suggested protocols assume that the sensors either are fortified with global positioning system (GPS) receivers or use some localization technique [10] to learn about their locations.

Scalability:-

The number of sensor nodes are deployed in sensing area. a routing scheme must be able to work with this large number of nodes .sensor network routing protocols should be accessible enough to respond to events in the environment.

Data Aggregation:-

Data aggregation is the combination of data from different resources according to a certain aggregation functions like, identical suppression, minima maxima and average. Data aggregation technique has been used to attain energy efficiency and data transfer optimization in a number of routing protocols. For this technique signal processing methods are used.

Fault Tolerance:-

Some sensors nodes may be fail or be blocked due to lack of power, physical damage or environmental implication. If number of nodes are failed MAC and routing protocols must accommodate to formation of new links and routes to the data collection base stations.

ROUTING PROTOCOLS IN WSNS:-

Routing in wireless sensor networks is different from conventional routing in fixed networks in various ways. There is no infrastructure, wireless links are unreliable, sensor nodes may fail, and routing protocols have to meet strict energy saving requirements[9]. Many routing algorithms were developed for wireless networks in general.in orto

streamline this survey we use a classification according to the network structure and protocol operation. This classification is shown in the figure.

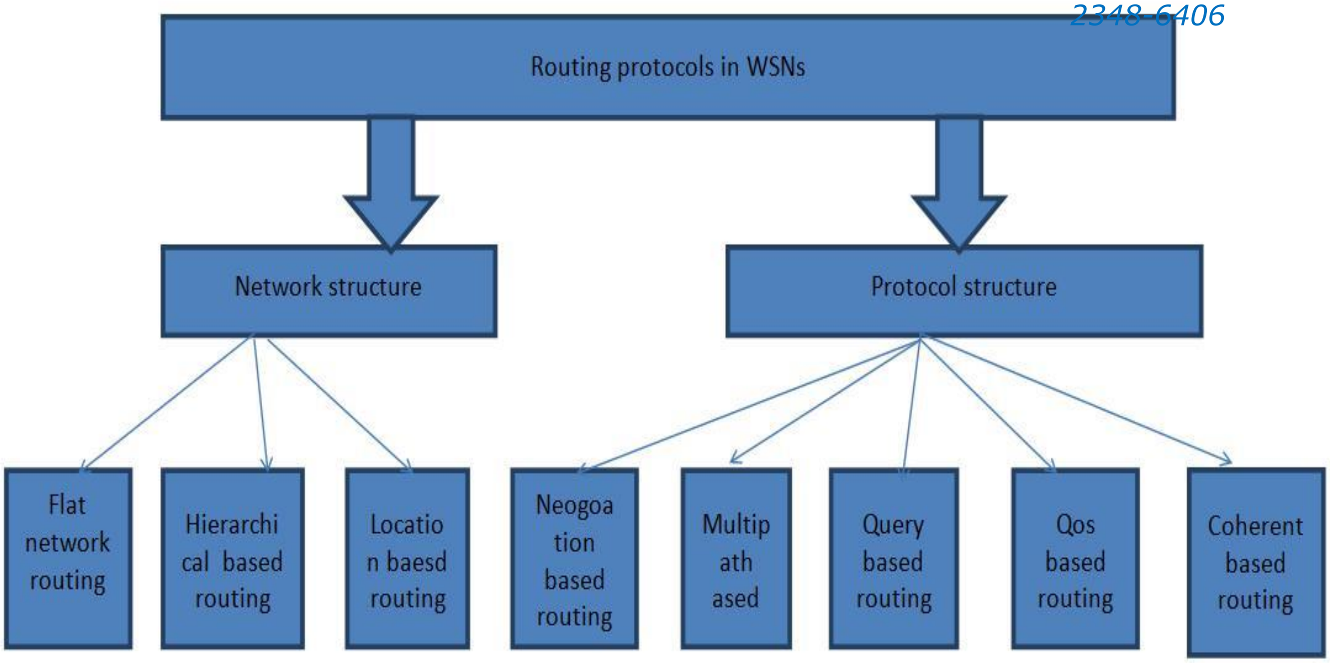

figure no-2classification of routing

In the rest of this section we present an overview of the main routing paradigm in WSNs. We start with network based protocols.

3.1Flat Routing Protocol:-

In flat networks, every node usually plays a similar role and further collaborate together to perform the sensing task. This state further led to the data centric routing, where the BS sends queries to certain regions and waits for data from the sensors located in the selected regions. spin and directed diffusion are two protocols .

SPIN (Sensor Protocols for Information via Negotiation):

The plan behind SPIN is to name the data using high level descriptors or meta-data. Meta-data are swapped among sensors before transmission via a data advertisement mechanism, which is the key feature of SPIN.Every node upon receiving new data publicizes it to its neighbors and interested neighbors, means those that don't have the data, retrieve the data or information by sending a request message[5]. SPIN's meta-data negotiation resolves the classic issues of flooding such as redundant information passing, therefore achieves a lot of energy efficiency

Directed Diffusion (DD):

is another protocol which is developed after the SPIN. Directed Diffusion aims at diffusing data through sensor nodes by utilizing a naming scheme for the data. DD utilizes attribute-value pairs for the data and also queries the sensors on the demand basis by using those pairs.In order to make a query, an interest is defined using a list of attribute-value pairs such as objects name, geographical area ,duration, interval, etc. This interest is further broadcast by a sink through its neighbors. Every node which receives this interest can do caching for later use. The nodes also had the flexibility to do in-network data aggregation.

3.2Hierarchical Based Protocols:-

In hierarchical protocols, nodes are grouped into clusters with a cluster head. A cluster head mainly has the responsibility of routing from the cluster to the other cluster heads or to the base stations. Data routes from a lower clustered layer to a higher one. Even though, it hops from one node to another and covers larger distances. This approach moves the data faster to the base station.

Low-energy adaptive clustering hierarchy (LEACH):

LEACH [8] is the most popular energy-efficient hierarchical. Based protocol .LEACH is a cluster-based protocol, which includes scattered cluster formation. LEACH randomly selects a few sensor nodes as cluster heads (CHs) and rotate this role to equally distribute the energy load among the sensors in the network. In LEACH, the cluster head (CH) nodes compress

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data arriving from nodes that belong to the respective cluster, and send a collected packet to the base station in order to diminish the amount of information that must be transmitted to the base station.

Power-Efficient Gathering in Sensor Information Systems (PEGASIS):

In [11], an enhancement over LEACH protocol was proposed. The protocol, called Power-Efficient Assembly in Sensor Information Systems (PEGASIS), is a near optimal chain-based protocol. The basic idea of the protocol is that in order to extend network lifetime, nodes need only communicate with their closest neighbors and they take turns in communicating with the base-station.

Threshold-sensitive Energy Efficient Protocols (TEEN):

In TEEN, sensor nodes sense the medium continuously, but the data transmission is done less frequently. Thus, the sensor network design in TEEN is based on a hierarchical grouping where closer nodes form clusters and this process goes on the second level until the BS (sink) is reached. TEEN is useful for applications where the users can control a trade-off between energy efficiency, data accuracy, and response time energetically. TEEN uses a data-centric method with hierarchical approach. Important features of TEEN include its correctness for time critical sensing applications.

APTEEN:-

APTEEN [4] is an improvement to TEEN to overcome its limitations and aims at both capturing periodic data collections (LEACH) and reacting to time-critical events (TEEN). Thus, APTEEN is a mixture clustering-based routing protocol that allows the sensor to send their sensed data periodically and react to any sudden change in the value of the sensed characteristic by reporting the corresponding values to their CHs. APTEEN guarantees lower energy dissipation and a larger number of sensors alive [4].

3.3Location Based Protocol:-

The location based routing protocol uses location information to guide routing discovery, for maintenance as well as for data forwarding. It further enables directional transmission of the information and avoiding information flooding in the whole network[9]. Location information is required in order to calculate the distance between two particular nodes so that energy consumption can be estimated and reduced. Alternatively, the location of nodes may be offered directly by communicating with a satellite, using GPS (Global Positioning System), if nodes are fortified with a small low power GPS receiver.

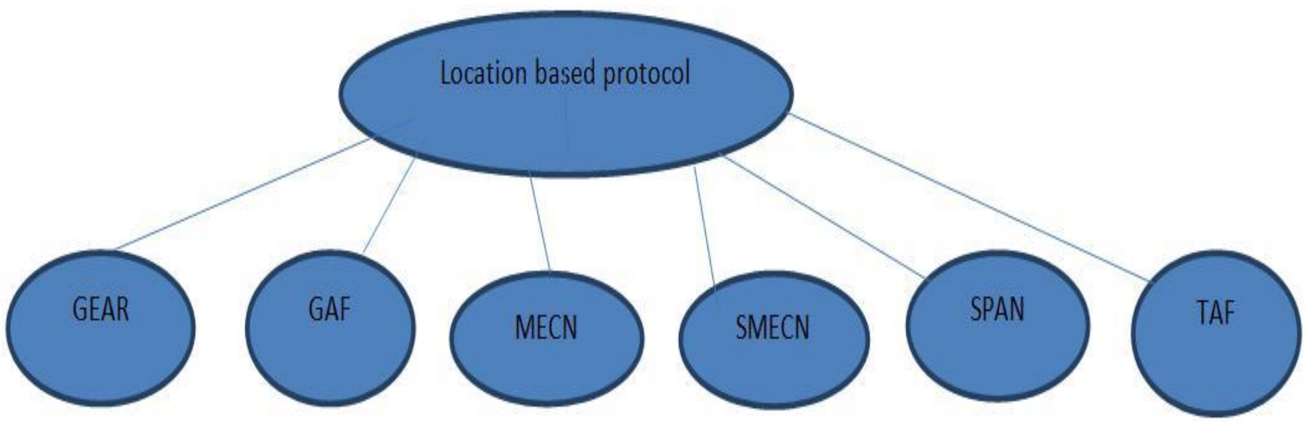

Fig no.3 classification of protocol

Geographic Adaptive Fidelity (GAF)

GAF [2] is an energy-responsive location-based routing algorithm designed primarily for mobile ad hoc networks, but may be applicable to sensor networks as well. The network area is first divided into fixed zones and form a simulated grid. Inside each zone, nodes work together with each other to play diff erent roles.

Geographic and Energy Aware Routing (GEAR):-

The protocol, called Geographic and Energy Aware Routing (GEAR), uses energy aware and geographically-informed neighbor selection heuristics to route a packet towards the destination region. The key idea is to curb the number of interests

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in directed diff usion by only in view of a certain region rather than sending the interests to the whole network. By doing this, GEAR can conserve more energy than directed diff usion.

SPAN:-

Another position based algorithm called SPAN [3] selects some nodes as coordinators based on their positions. The coordinators form a network backbone that is used to forward messages. A node should become a coordinator if two neighbors of a non-coordinator node cannot reach each other directly or via one or two coordinators (3 hop reachability.

Minimum Energy Communication Network (MECN):

In a protocol is proposed that computes an energy-efficient sub network, namely the minimum energy communication network (MECN) for a certain sensor network by utilizing low power GPS. MECN identifies a relay region for every node.

3.4 Routing Protocol Based On Protocol Operations:

In this classification, we review routing protocols which are further based on the protocol operation.

Routing Protocols Based on Protocol Operations	Main Quality	Examples
Multipath based	Used in single paths, fault tolerance will be increased at the expense of augmented energy consumption	Direct Diffusion.
Query based	Propagate a query for data from a node through the network.	DD and RR protocol.
Negotiation Based	Use high-level data or information descriptors to remove redundant data transmissions through negotiation.	SPIN protocols.
Quality Based	Balances between energy consumption and data quality.	(SAR) and SPEED Protocols
Coherent Based	Forwarded to aggregators after processing like duplicate suppression.	Multiple winner algorithms.
Non Coherent Based	Locally process the raw data before sent to another nodes for further processing.	Single Winner Algorithm (SWE)

Table no.1

4. CONCLUSION

Routing in sensor networks is an emergent areas of research with a limited, but rapidly growing set of research results. The ultimate objective behind the routing protocol design is to keep the sensors operating for as long as possible, thus prolonging the network lifetime.

In this paper we have surveyed a detail description of routing protocols in wireless sensor networks. Generally, the routing techniques are separated into network structure and protocol operation based routing protocols. In network structure, routing protocols are classified into three categories such as Flat based, hierarchical based and location based routing protocols. Furthermore, some protocols are also classified into multipath-based, negotiation-based, query-based, coherent based, QoS-based and non-coherent based routing techniques based on the protocol operation. Although many of these routing techniques look promising, there are still many challenges that need to be solved in the sensor network

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REFERENCES

4) W. Heinzelman, A. Chandrakasan and H. Balakrishnan, ”Energy-Efficient Communication Protocol for Wireless Microsensor Networks,” Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS ’00),
January 2000.
5) C. Intanagonwiwat, R. Govindan, and D. Estrin, ”Directed diff usion: a scalable and robust communication paradigm for sensor networks,” Proceedings of ACM MobiCom ’00, Boston, MA, 2000, pp. 56-67

[3] W. Heinzelman, J. Kulik, and H. Balakrishnan, ”Adaptive Protocols for Information Dissemination in Wireless Sensor Networks,” Proc. 5th ACM/IEEE Mobicom Conference (MobiCom ’99), Seattle, WA, August, 1999. pp. 174-85.

5. I. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, ”A survey on sensor networks,” IEEE Communications Magazine, Volume: 40 Issue: 8, pp.102-114, August 2002.
6. A. Perrig, R. Szewzyk, J.D. Tygar, V. Wen, and D. E. Culler, ”SPINS: security protocols for sensor networks”. Wireless
Networks Volume: 8, pp. 521-534, 2000.
7. S. Hedetniemi and A. Liestman, “A survey of gossiping and broadcasting in communication networks”, IEEE Networks,
Vol. 18, No. 4, pp. 319-349, 1988.

[7].S.K. Singh, M.P. Singh, and D.K. Singh, “A survey of Energy-Efficient Hierarchical Cluster-based Routing in Wireless Sensor Networks”, International Journal of Advanced Networking and Application (IJANA), Sept.–Oct. 2010, vol. 02, issue 02, pp. 570–580.

[16] Ivan Stojmenovic and Stephan Olariu. Data-centric protocols for wireless sensor networks. In Handbook of Sensor Networks, Chapter 13, pages 417–456. Wiley, 2005.

[9]Wiley,2010 Fundamentals of Wireless Sensor Networks - Theory and Practice. [2]Shio Kumar Singh, M.P. Singh and D.K. Singh, “Routing Protocols in Wireless Sensor Networks-a survey” International Journal of Computer Science & Engineering Survey (IJCSES) Vol.1, No.2, November 2010.

[10]Ankita Joshi, Lakshmi Priya M, “ A Survey of Hierarchical routing Protocols in Wireless Sensor Networks”, MES journal of Technology and Management.

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I want to utilize my knowledge &skills on various technologies to make progress in my career, along with to share my knowledge with students and gain more experience into the education and teaching field.

Academic Credentials: -

Qualification	Board/University	Year	Percentage
M. Tech (Wireless communication and sensor networking)	BBD University, Lucknow	2017-2019	Awaiting result 72% so far
B.Tech (Electronics and Communication Engineering)	Uttar Pradesh Technical University, Lucknow	2008-2011	68.9%
Diploma (Electronics Engineering)	Govt. Polytechnic, Gorakhpur	2005-2008	79%
Intermediate/10+2	Uttar Pradesh Board	2005	72%
High School/10^{th}	Uttar Pradesh Board	2003	68%

Summer Internship Program/Trainings undergone-

Organization Name: DOEACC Computer Society, Gorakhpur
Project Title: Embedded system design
Role: Overview of embedded system, 8051 micro-controllers, RTOS. Also involved in basic c programming

Organization Name: Bharat Sanchar Nigam Limited, Gorakhpur
Project Title: Introduction to exchanges, facilities of exchange
Role: Involved in electronic exchange (telephoning system, power plant)

Organization Name: Eastern Railway, Gorakhpur
Project Title: Types of electronic exchange, unreserved tickets system, passenger
Role: Involved in auto exchange, main exchange, to know the essentials environment for electronic exchange, implementation of UTS in N.E. railway with help of manuals, analysis and preparing reports.

IT Proficiency: -

- Good control over Microsoft Office Package Word, Excel etc.
- Basic knowledge on C and C++
- Hands on experience on MS Operating system Windows 7/10
- Pursuing Data Science course from Microsoft Online University

Academic Projects: -

Involved designing and implementation of below projects during my engineering courses -

- Bidirectional Automatic Railway Gate Controller.
- Public Address System.
- Light Operated switch.

Interpersonal Skills: -

- Ability to rapidly build relationship and set up trust.
- Confident and Determined to achieve goals
- Ability to cope up with different situations.

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Interest & Hobbies:	Listening songs, badminton and reading novel

Declaration: -

I do hereby declare that the above information is true to the best of my knowledge.

Place: ______________ **Vandana Srivastava**

Date: **(Signature)**