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ACTIVATION MATRIX ORIENTED BASE STATION IMPLEMENTATION FOR ENERGY OPTIMIZATION IN WIRELESS SENSOR NETWORKS

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ABSTRACT

Wireless Nodes or simply motes are having susceptible and vulnerable issues in terms of energy consumption and power optimization. In most of the applications, the power factor of the notes decay very frequently and these are non-chargeable. A wireless sensor node is a popular solution when it is difficult or impossible to run a mains supply to the sensor node. However, since the wireless sensor node is often placed in a hard-to-reach location, changing the battery regularly can be costly and inconvenient. An important aspect in the development of a wireless sensor node is ensuring that there is always adequate energy available to power the system. The sensor node consumes power for sensing, communicating and data processing. More energy is required for data communication than any other process. The energy cost of transmitting 1 Kb a distance of 100 meters (330 ft) is approximately the same as that used for the execution of 3 million instructions by a 100 million instructions per second/ processor. Power is stored either in batteries or capacitors. Batteries, both rechargeable and non-rechargeable, are the main source of power supply for sensor nodes. The purpose of this research work is to facilitate the research efforts in combining the existing solutions to offer a more energy efficient routing mechanism using the specialized technique of making use of the minimum distance vector from the base station of every node. In this approach, the dynamic matrix keeps track of the distance and then transfers the signals.

Keywords – Energy Optimization, Wireless Sensor Networks

INTRODUCTION

Wireless Sensor Networks (WSNs) have been widely considered as one of the most important technologies for the twenty-first century. Enabled by recent advances in microelectronic mechanical systems (MEMS) and wireless communication technologies, tiny, cheap, and smart sensors deployed in a physical area and networked through wireless links and the Internet provide unprecedented opportunities for a variety of civilian and military applications, for example, environmental monitoring, battle field surveillance, and industry process control. Distinguished from traditional wireless communication networks, for example, cellular systems and mobile ad hoc networks (MANET), WSNs have unique characteristics, for example, denser level of node deployment, higher unreliability of sensor nodes, and severe energy computation, and storage constraints, which present many new challenges in the development and application of WSNs.

Sensor nodes are often left unattended e.g., in hostile environments, which makes it difficult or impossible to re-charge or replace their batteries. This necessitates devising novel energy-efficient solutions to some of the conventional wireless networking problems, such as medium access control, routing, self-organization, so as to prolong the network lifetime. In most of the applications sensors are required to detect events and then communicate the collected information to a distant base station (BS) where parameters characterizing these events are estimated. The cost of transmitting information is higher than computation and hence it is be advantageous to organize the sensors into clusters , where the data gathered by the sensors is communicated to the BS through a hierarchy of cluster-heads. LEACH is perhaps the first cluster based routing protocol for wireless sensor networks, which uses a stochastic model for cluster head selection. LEACH has motivated the design of several other protocols which try to improve upon the cluster-head selection process by considering the residual energy of the nodes. TL-LEACH uses two levels of cluster heads instead of one in LEACH. EDAC enables cluster heads to change status asynchronously and co-ordinate energy consumption. HEED uses a hybrid approach based on residual energy and communication cost to select cluster heads. ANTICLUST uses a two level cluster-head selection process involving local communication between neighboring nodes.

APPLICATIONS OF WIRELESS SENSOR NETWORKS

A large number of potential applications of sensor networks have been reported ranging from early research investigations to commercial systems. A broad range of applications is given below -

- **Environmental Monitoring-**A widely considered area for the application of sensornetworks is in environmental monitoring. Measurement ofglacier dynamics using nodes capable of measuring location,temperature, pressure, and orientation at points insidethe glacier over a period of several years was described in. The research described in used nodes on the seabed to monitor pressure, temperature, conductivity, current,and turbidity. These nodes were connected to buoyson the surface to allow radio communication through self-organizing ad-hoc wireless networks. The Argo project uses a sensor network to observe the temperature, salinity,and current profile of the upper ocean. Nodes are attachedto free-drifting carriers which cyclically sink to adepth of 2 000m and then resurface to allow communicationwith a satellite. WSNs have been considered for precisionagricultural applications such as monitoring grape growing conditions. Here, nodes with temperature, soil moisture,light, and humidity sensors are deployed on a 20m gridacross a vineyard to provide information to guide the adaptationof water/fertilizer/pesticide supply to the needs of individual plants and to optimize harvesting.

- **Animal Tracking And Control-** Tracking and controlling the movements of domesticand wild animals presents interesting challenges inWSNs. The breeding behavior of birds was considered byMainwaring et al. using sensor nodes installed inside burrows.Clusters of nodes, each capable of measuring humidity, pressure, temperature, and ambient light level, along with infrared sensors to detect the presence of the birds,form local networks and each cluster has a node fitted witha long-range directional antenna to pass cluster data to abase station. Nodes fitted to wild animals (e.g., wild horses, zebras, and lions) capable of roaming over a very largearea were considered. Each node logs theanimal'sbehavior and environment and passes data to any othernode which comes within range. At regular intervals, a mobilebase station (e.g., a car or a plane) moves through theobservation area and collects the recorded data from theanimals it passes. In the case of the WSN is used bothto monitor behavior and to control it. In this case, thepositions of cattle are monitored and "virtual fences" createdby using an acoustic stimulus to discourage an animalfrom crossing a defined line. The network of nodes is connectedto a base station so that feeding behavior can bemonitored and virtual fences adjusted to improve usage ofthe feedstock.
- **Safety, Security and Military Applications-** WSNs have been developed to assist rescue teams in saving people buried in avalanches. By monitoring heart rate, respiration activity, orientation, and blood oxygenlevel, it is possible to automate the prioritization of victimsand to guide rescuers to their location. Tracking ofmilitary vehicles using networks of nodes deployed by unmannedaerial vehicle (UAV) was considered in. Datacollected from the

nodes by a UAV was used to identifythe path and velocity of ground vehicles. Anti-tank landminescapable of self-monitoring for signs of tampering havebeen formed into networks so that, if an individual mine isdisabled, a neighboring device is able to take its place usingrocket thrusters to effect the necessary movement.Combining data from a network of acoustic sensors in orderto determine the location of a sniper and the directionof the bullet based on the time of flight of muzzle blast was considered by Simon et al. Monitoring of buildingsand emergency response personal has been considered byYang and Frederick with the aim of improving safety indealing with fires and other life threatening situations in the built environment.

- **Built Environment-** Monitoring of the internal environmental conditions andadaptation of heating, lighting, etc. in response to humanoccupancy and activity is a major potential application forsensor networks, whether based on wireless communicationsor on wired connections. A WSN was developedto monitor power consumption in large and dispersed officebuildings with the aim of detecting locations or devices that are consuming a lot of electrical power.

- **Health -** Health applications for WSNs include patient monitoring,drug administration, tracking of patients at homeand doctors in hospitals. Body sensor networks are usedin the medical sector; implanted medical devices with integratedwireless technology are used for therapeutic and diagnosticapplications. Physicians can use this technology tomonitor device performance and patient response withoutthe need for invasive surgery. Drug manufactures are alsointerested in this technology to reduce their costs when introducinga new drug. The patients can be monitored wirelesslyand data about the patients internal chemistry can be analyzed for abnormal reaction and side effects over a securelink. Yang undertook a thorough analysis of the wirelesstechnologies available and concluded that the IEEE802.15.4wireless standard with provisions for body sensor networks(BSN) in the ZigBee application layer was the most appropriatefor the body sensor networks. An analysis of theperformance of medical sensor body area networking alsoendorsed the advantage of using IEEE802.15.4 and ZigBeefor medical sensor technologies.

COMPONENTS OF SENSOR USED IN WSN

- **Sensing Unit**: Sensing units are usually composed of two subunits: sensors and analog to digital converters (ADCs). Sensor is a device which is used to translate physical phenomena to electrical signals. Sensors can be classified as either analog or digital devices. There exists a variety of sensors that measure environmental parameters such as temperature, light intensity, sound, magnetic fields, image, etc. The analog signals produced by the sensors based on the observed phenomenon are converted to digital signals by the ADC and then fed into the processing unit.

- **Processing Unit:** The processing unit mainly provides intelligence to the sensor node. The processing unit consists of a microprocessor, which is responsible for control of the sensors, execution of communication protocols and signal processing algorithms on the gathered sensor data. Commonly used microprocessors are Intel's Strong ARM microprocessor, Atmel‘s AVR microcontroller and Texas Instruments' MP430 microprocessor. For example, the processing unit of a smart dust mote prototype is a 4 MHz Atmel AVR8535 micro-controller with 8 KB instruction flash memory, 512 bytes RAM and 512 bytes EEPROM. TinyOS operating system is used on this processor, which has 3500 bytes OS code space and 4500 bytes available code space. The processing unit of µAMPS wireless sensor node prototype has a 59–206 MHz SA-1110 micro-processor. In general, four main processor states can be identified in a microprocessor*: off, sleep, idle and active*. In sleep mode, the CPU and most internal peripherals are turned on, and can only be activated by an external event (interrupt). In idle mode, the CPU is still inactive, but other peripherals are active.

- **Communication Unit**: The radio enables wireless communication with neighboring nodes and the outside world. It consists of a short range radio which usually has single channel at low data rate and operates at unlicensed bands of 868-870 MHz (Europe), 902-928 MHz (USA) or near 2.4 GHz (global ISM band). For example, the TR1000 family from RF Monolithic works in the 800–900 MHz range can dynamically change its transmission power up to 1.4 mW and transmit up to 115.2 Kbps. The Chipcon‘s CC2420 is included in the MICAZ mote that was built to comply with the IEEE 802.15.4 standard for low data rate and low cost wireless personal area networks.

  There are several factors that affect the power consumption characteristics of a radio, which includes the type of modulation scheme used, data rate, transmit power and the operational duty cycle. At transmitted power levels of -10dBm and below, a majority of the transmit mode power is dissipated in the circuitry and not radiated from the antenna. However, at high transmit levels (over 0dBm) the active current drawn by the transmitter is high. The transmit power levels for sensor node applications are roughly in the range of -10 to +3 dBm. Similar to microcontrollers, transceivers can operate in *Transmit, Receive, Idle and Sleep* modes. An important observation in the case of most radios is that, operating in *idle* mode results in significantly high power consumption, almost equal to the power consumed in the *Receive* mode. Thus, it is important to completely shut down the radio rather than set it in the *idle* mode when it is not transmitting or receiving due to the high power consumed. Another influencing factor is that, as the radio's operating mode changes, the transient activity in the radio electronics causes a significant amount of power dissipation. The sleep mode is a very important energy saving feature in WSN.

- **Battery -** The battery supplies power to the complete sensor node. It plays a vital role in determining sensor node lifetime. The amount of power drawn from a battery should be carefully monitored. Sensor nodes are generally small, light and cheap, the size of the battery is limited. AA batteries normally store 2.2 to 2.5Ah at 1.5V. However, these numbers vary depending on the technology utilized. For example, Zinc–air-based batteries have higher capacity in Joules/cm3 than lithium batteries. Alkaline batteries have the smallest capacity, normally around 1200 J/cm3. Furthermore, sensors must have a lifetime of months to years, since battery replacement is not an option for networks with thousands of physically embedded nodes. This causes energy consumption to be the most important factor in determining sensor node lifetime.

WSN DESIGN AND CHALLENGES

The advances in wireless sensor networks, while promising, have also posed challenges, such as resource limitations, dynamic environment and various application needs. These challenges and tradeoffs are discussed as follows :

Sensor Platform

For a successful large scale deployment of wireless sensor networks, each node must have low power consumption, low operating and system cost and a small form factor. Figure 1.3 shows the top view of MicaZ sensor node without battery backup (Openautomation 2010, Crossbow 2008).

The MicaZ is a 2.4 GHz mote module used for low-powerwireless sensor network applications. The processor board (MPR2400) is based on the Atmel ATmega128L. The ATmega128L is a low-power microcontroller (MPR2400) that can be configured to run sensor applications, processing and the network/radio communications stack simultaneously.

The 51-pin expansion connector supports analog inputs, digital I/O, I2C, SPI and UART interfaces. These interfaces facilitate connects to a wide variety of external peripherals. The MicaZ (MPR2400) IEEE 802.15.4 radio offers both high speed (250 kbps) and hardware security (AES-128). Power source is provided by 2xAAbatteries. Although the limited sizes of these nodes attract numerous applications, the constraint is that it emphasizes energy efficient operations as they are battery-driven. It also limits the radio transmission range and suggests a small multi-hop transmission structure.

Network Construction and Maintenance

Two key challenges in the deployment of WSN are the large number of devices involved and the necessity to embed them in a dynamic physical environment. For example, consider a surveillance sensor network that is deployed in the Line of Control (LoC) area. Deployment of this network can be done by dropping a large number of sensor nodes from a plane. In this example and in many other anticipated applications, it is not possible to deploy the nodes in a regular fashion (linear array, 2D lattice). More importantly, uniform deployment does not correspond to uniform connectivity owing to obstructions, interference and other environmental factors. Thus the deployed network must be designed to operate under environmental dynamics while preserving reliability in the sensing coverage and network connectivity.

In some WSN applications, the large number of elements in the network coupled with the harsh environment makes maintenance operations expensive. In such context mechanisms are required to maintain the network performance and operational fidelity when sensor nodes fail or shed their limited energy.

Data Dissemination and Collection

Basic capabilities in WSN involve mechanisms like routing, tunneling, data aggregation, clustering to collect information from nodes and forward them to a sink node. Based on the size of the deployment, the number of sink nodes can be increased. Due to power restrictions and environmental dynamics of WSN, these mechanisms have to be of low power, scalable with the number of nodes and tolerant to malpractice. Moreover, some sensor nodes may fail or get blocked due to lack of power, physical damage, or environmental interference. This causes topological changes in WSN. In order to overcome these challenges, the mechanisms involved in WSN need to be adaptive.

Localization

The purpose of localization is the provision of some kind of location information to the nodes in the network. Using the location knowledge of nodes, the place of occurrence of the phenomenon can be easily determined. Further, it also helps in developing energy efficient routing algorithms. The most immediate solution is the use of a physical coordinate system enabled by equipping all nodes with a GPS (Global Positioning System) receiver. Other alternative popular techniques are based on Time of Arrival (ToA), Time Difference of Arrival (TDOA), Received Signal Strength (RSS) and Angle of Arrival (AoA).

NEED FOR ENERGY OPTIMIZATION IN WSN

The real power consumption of any device can be calculated as the product of the voltage applied to the device and the current consumed by the device, taking into account the power dissipation in the circuit. Power can also be defined as the amount of energy expended for a given unit of time. In WSN, the nodes are mostly operated using batteries. Theoutput capability of a battery over a period of time is referred to as its capacity. It is measured in ampere-hours and is mostly proportional to the voltage. Over a period of time, the capacity of a battery can be established as a function of a continuous discharging process. As the current drawn increases, the corresponding voltage, remaining capacity, available energy and expected lifetime of the battery decreases. Details of estimates of the power consumption requirements of key subsystems of MicaZ mote are shown. It can be observed that Mica family motes uses double the energy for radio related activities than processing. This necessitates the development of energy aware mechanisms that minimize the number of radio related activities, thereby reducing the energy consumption in the node and network. This research work focuses on the optimization of energy usage in the radio module by three domains namely localization, routing and transmission power control.

ROUTING PROTOCOL IN WIRELESS SENSOR NETWORKS

The classification of the various routing protocols used in WSN. Many new algorithms have been proposed for the problem of routing data in sensor networks. The routing protocols can be classified as data-centric, hierarchical or location-based. There are few distinct protocols that are also based on network flow or QoS awareness. The existing routing protocols are discussed under these categories.

LITERATURE SURVEY

AdeelAkhtar, Abid Ali Minhas, and SohailJabbar in "Energy Aware Intra Cluster Routing for Wireless Sensor Networks *states* about the three models in wireless sensor networks, which are as follows:-

One Hop Model
Multi Hop Model
Cluster Based Model

BagerZarei, Mohammad Zeynali and VahidMajidNezhad, in "Novel Cluster Based Routing Protocol in Wireless Sensor Networks" told that novel Cluster Based Routing Protocol for prolong the sensor network lifetime. CBRPclusters sensor nodes into groups and builds routing tree among cluster heads for energy efficient communication. Simulation result shows that, CBRP act better than other protocols in terms of optimizing cluster heads energy consumption, amount of data gathered, and extending network lifetime. In order to performance evaluation of CBRP protocol, wedeveloped our simulator in MATLAB. Our sensor network consists of N nodes that randomly dispersed in 100 × 100 of square fields with a single base station. All parameters of simulations are shown in Table 3. Every simulation result shown below is the average of 100 independent experiments where each experiment uses a different randomly generated uniform topology of sensor nodes.

In this it is comparing the network lifetime of three protocols CBPR, LEACH and HEED.

Energy Aware Routing Protocol- EAR

Energy aware routing protocol is a reactiveprotocol that aims to increase the lifetime of the network. This protocol seeks to maintain a set of paths instead of maintaining or enforcing one optimal path at higher rates, although the behavior of this protocol is similar to directed diffusion protocols. These routes are selected and maintained by a probability factor. The value of this probability depends on the lowest level of energy achieved in each path. Because the system has several ways to establish a route, the energy of a path cannot be determined easily. Network survivability is the main metric of this protocol. The protocol assumes that eachnode is addressable through a class-based addressingscheme which includes the location and the type ofnodes. When the protocol starts, there is a process of flooding, which is used to discover all the routes between various source/destination pairs and their costs. This will allow creating routing tables, where high-cost paths are discarded. By using these tables, data is sent to its destination with a probability that is inversely proportional to the cost of the node. The destination node performs a localized flooding in order to maintain the paths that are still operative. Compared to other protocols, the energy aware routing protocol provides an overall improvement of 21.5% in energy savings and increases the network life by about 44%. However, having to collect location information, and the establishment of the steering mechanism for nodes, complicates the path settings.

Low Energy Adaptive Clustering Hierarchy- LEACH

Heinzelman et al. presented in [29] a hierarchical clustering algorithm for sensor networks called Low Energy Adaptive Clustering Hierarchy (LEACH). It is a clustering based protocol that includes the formation of distributed groups. It randomly selects a few nodes as cluster heads (CHs) and rotates this role to evenly distribute the energy load among the nodes of the network. In LEACH, CH nodes compress the data arriving from the nodes in their respective groups, and send summary packets to the base station. This reduces the amount of information transmitted to the base station. Data collection is centralized and is carried out periodically. Therefore, this protocol is appropriate when constant monitoring of the WSN is needed. The operation of LEACH is separated into two phases, the setup phase and the steady-state phase. In the setup phase the groups are organized and certain fraction of nodes are elected as CHs. In the steady-state phase, data transfer to the base station occurs. All elected CHs announce to the other nodes of the network, through a broadcast message, that they are the new CHs. All non-CH nodes, after receiving this notice, choose the group they want to belong to. This decision is based on the intensity of the warning signal. Non-CH nodes inform the appropriate CHs that it is a member of their group. After receiving all messages from the nodes that wish to be included in the cluster, the CH node creates a TDMA program and assigns to each node a time slot to transmit data. This program is broadcasted to all nodes in the cluster. During the steady state, the sensor nodes can sense and transmit data to the CHs. The CH node, after receiving all data, adds its information and sends it to the base station. After some time, which is determined a priori, the network returns to the setup phase again and starts another round of new CHs election. Each group communicates using differentCDMA codes in order to reduce interference with nodesthat belong to other groups. Although LEACH is able to increase the network lifetime, there are still a number of questions about the assumptions used in this protocol. LEACH assumes that all nodes have enough transmission power to reach the base station and each node has the computational power to support different MAC protocols. Therefore, it is not applicable to networks deployed in large regions. It also assumes that nodes always have data to send, and nodes that are located close to each other have correlated data. It is unclear how the CHs are uniformly distributed over the network. Therefore, it may happen that the elected CHs are concentrated in one part of the network, so some nodes may not have a CH in their surroundings. Moreover, the idea of dynamic clustering can result in an extra overhead that can increase the energy consumption. Finally, the protocol assumes that all nodes start with the same amount of energy in each round of election, and assumes that a CH consumes approximately the same amount of energy.

*Hierarchical Power-Aware Routing (HPAR)*Another example of hierarchical protocol is presentedby Q. Li et al. in [29]. The Hierarchical Power-AwareRouting (HPAR) protocol bases its operation on thedivision of the network into groups of sensors. Eachgroup is formed by geographically close sensors coveringa zone. Each zone is treated as an entity. In order toperform the routing between nodes, each zone is allowedto decide how a message is routed through the otherareas, so maximizing the battery life of the nodes.Messages are routed along the path that has the maximumvalue on all the remaining minimum power values. Thisroute is called max-min path. In order to send a messagethrough an area, the route through the area and thesensors involved in estimating the power level of the areashould be found. Each message is routed through theareas with the information about the estimation. The roleof area management for message routing is assigned to anode. This protocol is based on the idea that the use ofhigh residual energy nodes can be more expensive thanthe path with minimum energy consumption. Theprotocol seeks a balance between minimizing the totalpower consumption (using Dijkstra algorithm to find thepath with least power consumption) and maximizing theminimal residual power of the network.

Power-Efficient Gathering in Sensor Information Systems – PEGASIS

In [30], an enhancement over LEACH protocol wasproposed. The protocol, called Power-Efficient Gathering in Sensor Information Systems (PEGASIS), is a near optimal chain-based protocol. The basic foundation ofthis protocol is that nodes need only to communicate withtheir nearest neighbors, taking turns to communicate with the base station. When all nodes have established a connection with the base station, a new round will start and so on. This type of communication between nodes reduces the power required to transmit data through a path and ensures power distribution in all nodes. Therefore, PEGASIS has two main objectives. On the one hand, PEGASIS increases the lifetime of each node using collaboration techniques and, as a result, the network lifetime is extended. Moreover, the protocol allows only local coordination among close nodes, so the bandwidth consumed in communication is reduced. In addition, PEGASIS assumes that all nodes maintain a comprehensive database of the location of other nodes. To set the distance that each node has to its neighbor, the protocol uses the received signal strength to subsequently adjust the intensity of the signal in order to hear just one node. By contrast, PEGASIS requires adjustments to dynamic topologies in order to know where to find the destination node and in order to know where to route their data. Simulation results show that PEGASIS is able to double the network lifetime in comparison to using LEACH protocol.

SYSTEM MODEL

Source Code of MATLAB herewith is having existing and proposed approach implementation. Biograph Toolbox, Plotting Library is used with Core Programming of MATLAB to perform the implementation

OBJECTIVES COVERED IN THE IMPLEMENTATION

- Generation of a Dynamic Graph based on the locations of Wireless Sensor Nodes
- Implementation of Multiple Base Stations in the form of Activation Matrix.
- The process of Sleep Awake implemented with the base stations.
- Using Euclidean Distance Formula, the distance of sensor nodes will be calculated from all of the base stations
- The nearest base station shall be activated depending on the request of the sensor node.
- In this way.... there will be very less energy consumption by the sensor node as it will transfer signal/data to the nearest base station.
- 2000 Iterations are performed for the implementation of existing and proposed approach.
- Our proposed approach is better in terms of Less Execution Time and Less Energy Consumption.
- In Classical approach, the node is dying in 1717 rounds of execution.
- In proposed approach, the node is dying after 3000 rounds of the execution.
- The proposed energy consumption is around 40% of the classical approach.

The activation and sleeping shall be applied to each base station depending upon the requirement of the signals

A Simulator / Virtual TestBed developed for generation and investigation of random motes (nodes) in the area where the sensor nodes shall be deployed

The Algorithmic Approach shall keep track of the movement of the sensor nodes regarding energy transfer and conservation

The energy level of each wireless node (mote) shall be detected by the simulator / testbed

The Simulator will be able to process N number of motes and will produce the detailed report

The Simulation Tool will be selected carefully so that better and efficient results can be obtained on some parameters

Source Code of MATLAB Attached herewith having existing and proposed approach implementation. Biograph Toolbox, Plotting Library is used with Core Programming of MATLAB to perform the implementation

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- The proposed energy consumption is around 40% of the classical approach.
- The activation and sleeping shall be applied to each base station depending upon the requirement of the signals

EXECUTION OUTPUT AND SCENARIOS

Current Energy Levels of the Sensor Nodes

```
nodeenergy =

   760   714   643   713

randomnode =

    4
```

Node transferring request for signal

Calculation of Distance of Sensor Node from Tower

n1 =

4 6

bs1 =

1 0

ed1 =

6.7082

bs2 =

5 4

Calculation of Distance of Sensor Node from Tower

ed2 =

2.2361

bs3 =

7 6

Calculation of Distance of Sensor Node from Tower

ed3 =

3

Generation of Distance Vector

d =

6.7082 2.2361 3.0000

Minimum Distance of Node from Base Station

dmin =

2.2361

Base Station with Minimum Distance is Selected for Routing and Transfer of Signals

energylossnode =

2

Current Energy Levels of the Sensor Nodes

nodeenergy =

760 714 643 711

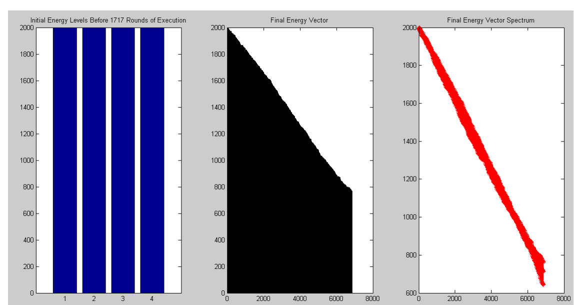

Figure 1 – Performance of Existing and Proposed Simulation

Energy Preserved		
Nodes	**7**	**9**
Proposed	61.75	73

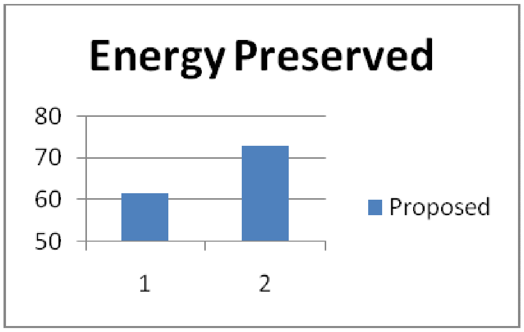

Figure 2 – Performance of Existing and Proposed Simulation

Execution Time	
Proposed	3.7
Existing	4.9

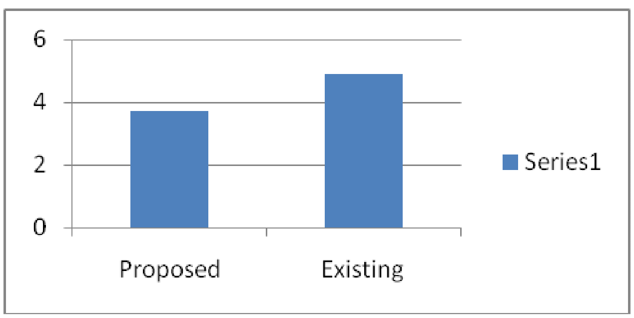

Figure 3 – Execution Time of Existing and Proposed Simulation

CONCLUSION

Sensor networks are formed from a collection of sensing nodes which communicate with one another, typically through wireless channels, in order to collect spatially distributed data about their environment. Such networks have the potential to provide better quality data than single or small numbers of individual sensors in applications such as natural and built environmental monitoring, process monitoring, security and surveillance. Wireless sensor networks (WSNs) may be considered as the third wave of a revolution in wireless technology. They promise to have a significant beneficial impact on many aspects of our human existence. These benefits include more efficient utilisation of resources, better understanding of the behaviour of humans, natural and engineering systems, and increased safety and security. Pervasive computing also has some possible negative environmental impacts, particularly in physical waste and energy consumption. In order to be cost effective in many applications, the sensor nodes must be low cost and low maintenance. In this power efficient routing technique, before transferring packets the routes are analyzed and the routes with minimum distance to the source node are utilized for transferring packets, so that power required to amplify the signal to the nodes far from the source node is reduced. This technique manages the battery backup for all nodes participating in a network. This presents challenges in terms of sensor calibration, packaging for survival in harsh environments and, particularly, the efficient supply and utilisation of power. While the performance of battery technology is gradually improving and the power requirements of electronics is generally dropping, these are not keeping pace with the increasing demands of many WSN applications. For this reason, there has been considerable interest in the development of systems capable of extracting useful electrical energy from existing environmental sources. Such sources include ambient light, thermal gradients, vibration and other forms of motion. In this paper, we provide an overview of the energy sources available for energy harvesting or scavenging and a summary of the main methods considered for converting these energy sources into a form suitable for use in WSN nodes. Using the proposed algorithmic implementation better and efficient results are obtained. These results can be further improved using grid based parallel algorithms by which optimality can be achieved.

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