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A Novel Routing Protocol (M-Gear) Using Gateway Based Energy-Efficient Scheme For Wireless Sensor Networks (Wsns).

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Abstract- *Wireless Sensor Networks (WSNs) have come out as research areas with an over enormous effect on practical application developments. They permit fine grain observation of the surrounding environment at an economical cost much lower than at presently possible. In an unfavorable environments where human participation may be too dangerous then sensor networks may provide an effective service. Sensor networks are designed to transmit data from an arrangement of sensor nodes to a data warehouse on a server. The advances in the addition of micro-electro-mechanical system (MEMS), microprocessor and wireless communication technology have an enabled the deployment of large-scale wireless sensor networks. WSNs has potential to design many new applications for handling emergency, military and disaster relief operations that requires real time qualified information for an efficient coordination and planning.*

Sensors are devices that produce a quantifiable response to change in a physical condition like temperature, humidity, weather forecasting and pressure etc. WSNs may consist of many different types of sensors such as temperature, seismic, magnetic, thermal, visual, infrared, humidity, acoustic, and radar capable to monitor a wide variety of surrounding conditions. Though each individual sensor may have severe resource limitation in terms of energy, memory, communication and computation capabilities; large number of them may collectively monitor the physical world, circulate information leading critical environmental events and process the information on the fly.

The issues of network lifetime and data availability are particularly important in WSNs due to their exploitation in inimical environment. The system should provide fault tolerant energy efficient real-time communication as well as automatic and effective action in emergency situations. A typical sensor network operates in five phases which are as: Planning phase, Deployment phase, Post-deployment phase, Operation phase and Post-operation phase.

1. *In planning phase: a site survey is conducted to evaluate deployment environment and its conditions to select a suitable deployment mechanism.*
2. *In deployment phase: sensors are indiscriminately operation over a target region.*
3. *In post-deployment phase: the sensor networks operators need to identify or estimate the location of sensors to access coverage.*
4. *The operation phase: involves the normal operation of monitoring tasks where sensors observe the environment and generate the data.*
5. *The post-operation phase: include closing down and maintaining the sensors for future operations or ending the sensor network.*

The sensor nodes consist of sensing, data processing and communicating components. They can be used for continuous sensing, event detection as well as identification, location sensing and control of mechanism. The nodes are deployed either inside the fact or very close to it and can operate unwanted conditions. They can use their processing abilities to locally carry out simple computations and transmit only required and partially processed data. They may be organized into clumps or collaborate together to complete a task that is issued by the users. In addition, positions of these nodes do not need to be predefined. These allow their random deployment in inaccessible topography or disaster relief operations.

The WSNs provides an intelligent platform to gather and evaluate data without human involvement. As a result, WSNs have a wide range of applications such as military applications, to detect and track inimical objects in a battle field or in environmental research applications, to monitor a disaster as for seismic vibration, typhoon, flood and industrial applications, to guide and diagnose robots, or machines in a factory, or for educational applications, to monitor developmental childhood, or to create a problem solving environment.

The wireless sensor network nodes are generally battery driven and due to their deployment in inconsiderate or inimical environment their battery is usually un-chargeable and un-replaceable. Moreover, since their sizes are too small to accommodate a large battery, they are unnatural to operate using an exceedingly limited energy budget. The total stored energy in a smart dust spot, for instance is only one. Since this small amount of energy is the only power supply to a sensor node, it plays a very important role in determining lifetime of the sensor networks. All the research works therefore have a common concern of minimizing energy consumption and it is a significant issue at all layers of the WSNs. Other key issues are scalability to large number of nodes, design of data handling techniques, localization techniques, real time communication, data availability and fault tolerance etc.

ADVANTAGES OF WIRELESS SENSOR NETWORKS:

The WSNs has revolutionized the world around us. They are becoming essential part of our lives where interconnection among nodes is done without the use of wires such as wireless local area networks (WLANs) and Bluetooth in many ways. Wireless communications networks are usually implemented by type of remote transmission system for information using electromagnetic waves, like radio frequency, waves for delivery services etc. Compared to other wireless networks, WSNs has much more nodes in a network, distance between the adjoining nodes is much shorter and application data rate is much lower also. Power consumption in a sensor network should be minimized. A smaller size makes it easier for a sensor to be surrounded in the environment it is in. The sensed data therefore need to be aggregated to decrease the number of transmissions in the network, reducing bandwidth usage and eliminating unnecessary energy consumption in both transmission and reception. More so than the present-day computers because of their numerous advantages as mentioned below:-

1. Ease of deployment: A sensor network contains hundreds or even thousands of nodes and can be deployed in remote or dangerous environments. Since these nodes are small and economical, throwing of hundreds or thousands of micro-sensors from a plane flying over a remote or dangerous area allows extracting information in ways that could not have been possible otherwise.
2. Extended range of sensing: Single macro-sensor nodes can only extract data about events in a limited physical range. In contrast, a micro-sensor network uses large numbers of nodes enabling them to cover a wide area.
3. Improved lifetime: The nodes located close to each other will have correlated data therefore they can be grouped together. Only one of the nodes in a round robin fashion from the group therefore needs to be in active state at any instance of time keeping other nodes in sleep state. It will enhance the network life time.
4. Fault tolerance: In WSNs several sensor nodes are close to each other and have correlated data, it makes these systems much more fault tolerant than single macro-sensor system. The macro-sensor system cannot function if macro-sensor node fails, whereas in case of micro-senor network even if smaller number of micro-sensor nodes fails, the system may still produce acceptable qualitative information.
5. Improved accuracy: While an individual micro-sensor's data might be less accurate than a macro-sensor's data. The data from nodes located close to each other can be combined since they are gathering information about the same event. It will result in better accuracy of the sensed data and reduced uncorrelated noise.
6. Lower cost: Even though, to replace each macro-sensor node several micro-sensor nodes are required they will still be collectively much cheaper than their macro-sensor counterpart due to their reduced size, simple as well as cheap circuitry and lesser accuracy constraints. As a result protocols that enable micro-sensor networks to provide necessary support in sensing applications are becoming more popular.
7. Actuation: Actuation can dramatically extend the capabilities of a sensor network in two ways. **First,** it can enhance the sensing task, by pointing cameras, aiming antennae or repositioning sensors. **Secondly,** it can affect the environment – by opening valves, emitting sounds or strengthening beams.
8. Collaborative objective: Perhaps the most important aspect of sensor networks that differentiates them from other wireless networks is their objective. Typically, objective of a sensor network is monitoring a specific signal of interest and informing a central base station or a sink about activities in the region being sensed. Since a sensor network is deployed for achieving a certain system-wide goal, nodes collaborate instead of competing with each other.
9. **Guarantee of Delivery:** all types of data and message are guaranteed to be delivered regardless of where a user is located or the user's status. Even if the portable device is turned off, when it is turned on again, the user will see a new message.
10. **Energy conservation:** most of wireless network nodes have limited power supply and no capability to generate their own power. Energy efficient protocol design is important for prolonged existence of the network.

CHALLENGES IN WIRELESS SENSOR NETWORKS:

In order to design good applications for wireless micro-sensor networks, it is essential to understand factors important to the sensor network applications. Although WSNs share some commonalities with existing wireless ad-hoc networks they pose a number of technical challenges different from traditional wireless ad-hoc networks. The protocols and algorithms that have been proposed for traditional wireless ad-hoc networks are therefore not well suited for the application requirements of the sensor networks. To illustrate this point, differences between sensor networks and traditional networks are outlined below:

1. **Energy:** The sensor nodes are generally inaccessible after deployment and normally they have a finite source of energy that must be optimally used for processing and communication to extend their lifetime. It is a well known fact that communication requires significant energy. In order to make optimal use of energy, therefore communication should be minimized as much as possible.

2. **Redundancy**: Due to the frequent node failures and inaccessibility of failed nodes, WSNs are required to have high redundancy of nodes so that the failure of few nodes can be negligible.
3. **System Lifetime:** The WSNs should function as long as possible. Their system lifetime can be measured by using generic parameters such as time until the nodes die or by using application specific parameters like time until the sensor network is no longer providing acceptable quality results.

4. **Scalability**: In WSNs, each sensor node obtains a specific view of the environment. A given sensor's view of the environment is limited both in range and accuracy; it can only cover a limited physical area of the environment. The WSNs therefore, deploys sensor nodes that have a short transmission distance in large numbers to monitor the entire area.

5. **Adaptability**: The WSN system should be adaptable to changes such as addition of more nodes, failure of nodes, environmental conditions and thus unlike traditional networks, where the focus is on maximizing channel throughput or minimizing node deployment, the major consideration in a sensor network is to extend the network lifetime besides system robustness.

6. **Application Awareness**: A WSN is not a general purpose network. In order to deploy it for specific application, the WSN protocols should consider application-specific trade-offs in terms of complexity, resource usage and communication patterns to improve network efficiency.

7. **Lack of Global Identification**: Due to large number of sensor nodes in a sensor network the Global Identification (GID) is generally not possible. Although in some cases, the Global Positioning System (GPS) provides positioning information to sensor nodes but it requires line of sight to several satellites, which is generally not available inside of buildings, beneath dense foliage, underwater, when jammed by an enemy or during MARS exploration etc.

8. **Storage, Search and Retrieval**: The sensor network can produce a large volume of raw data such as continuous time series of observations over all points in space covered by the network. Since the data source is continuous traditional databases are not suitable for WSNs.

9. **Data centric processing**: The naming schemes in WSNs are often data-oriented for example an environmental monitoring system may requests temperature readings through a query like "collect temperature readings in the region bounded by the rectangle (x1, y1, x2, y2)", instead of a query "collect temperature readings from a set of nodes having addresses x, y and z."

10. **Production cost**: The cost of a single node is very important to justify overall cost of the network; since the sensor networks consist of a large number of sensor nodes therefore cost of each sensor node has to be kept low.

11. **Node deployment**: Node deployment is application dependent and affects performance of the protocol. The deployment is either deterministic or self-organizing. In deterministic situations, the sensors are manually placed and data is routed through pre-determined paths. However, in self organizing systems, the sensor nodes are scattered randomly creating an infrastructure in an ad-hoc manner.

12. **In-network processing**: In general transport protocols used in wired and wireless networks has assumed end-to-end approach guaranteeing that data from the senders have not been modified by intermediate nodes until it reaches a receiver. However, in WSNs data can be modified or aggregated by intermediate nodes in order to remove redundancy of information. The previous solutions did not accommodate concept of in-network processing, called data aggregation or diffusion in WSNs.

13. **Latency**: Latency refers to delay from when a sender sends a packet until the packet is successfully received by the receiver. The sensor data has a temporal time interval in which it is valid, since the nature of the environment changes constantly, it is therefore important to receive the data in a timely manner.

14. **Fault tolerance:** Sensor nodes are fragile and they may fail due to depletion of batteries or destruction by an external event. Realizing a fault-tolerant operation is critical, for successful working of the WSN, since faulty components in a network leads to reduced throughput, thereby decreasing efficiency and performance of the network.

Standards Of Wireless Technology

Because there are multiple technology standards for wireless networking, it pays to do your homework before buying any equipment. The most common wireless technology standards include the following:

- **802.11b:** The first widely used wireless networking technology, known as 802.11b (more commonly called wireless fidelity (Wi-Fi), first debuted almost a decade ago, but is still in use.
- **802.11g:** In 2003, a follow-on version called 802.11g appeared offering greater performance (that is, speed and range) and remains today's most common wireless networking technology.
- **802.11n:** Another improved standard called 802.11n is currently under development and is scheduled to be complete in 2009. But even though the 802.11n standard has yet to be finalized, you can still buy products based on the draft 802.11n standard, which you will be able to upgrade later to the final standard.

All of the Wi-Fi (Wireless Fidelity) variants (802.11b, g and n products) use the same 2.4 GHz radio frequency, and as a result are designed to be compatible with each other, so you can usually use devices based on the different standards within the same wireless network. The catch is that doing so often requires special configuration to accommodate the earlier devices, which in turn can reduce the overall performance of the network. In an ideal scenario you'll want all your wireless devices, the access point and all wireless-capable computers, to be using the same technology standard and to be from the same vendor whenever possible

RESEARCH METHODOLOGY:

We proposed a multi hop approach for data routing. This will consume less energy in long distance communication. In our methodology we propose gateway nodes which lie between cluster heads and main station so will consume less energy than previous single hop protocols. Because the distance between cluster heads and base station is reduced by adding gateway nodes. So we know as distance decrease the energy consumption by nodes for transmission decreases so lifetime also increases.

As reviewed, WSNs when sensor are deployed in unstructured environment sensor nodes are typically powered by irreplaceable batteries with a limited amount of energy supply then we generally required sensor network to perform maximum. So to achieve this transmission with less power or energy consumption is essential.

A single-hop clustering algorithm can reduce energy consumption since only a fraction of the nodes, called cluster heads, communicate with the sink in one hop. A number of single hop routing algorithms have been introduced to find the best way of getting shortest way to data transmission.

In a wide coverage area, a number of nodes are established and are called as sensor nodes. These sensor nodes communicate to the base station for transmission of the data. Which node will transfer the data first is decide on the distance basic.

The node with the least distance and so on will communicate first to the base station and similarly in receiving the data from base station. But this method was having the numerous amounts of limitations such as following:

- ✓ Distance from each node was very large to the base station, which increase the energy consumption and delay of data transmission.
- ✓ Power requirement was at a hike.
- ✓ Life time of the nodes decrease continuously in the network.

As per previous work many algorithm for routing has been proposed Low energy adaptive clustering hierarchy as LEACH, Hybrid Energy Efficient Distributed Protocol as HEED, Power – Efficient Gathering in Sensor Information System as PEGASIS, Stable Election Protocol as SEP etc. but all these algorithm are single hop routing protocols.

We have to design a system which has more lifetimes, less power or energy consumption and a new approach to transfer data from nodes to base station effectively and decreases the energy consumption and power consumption also, Moreover it should be lead to increment in the life time of the nodes also.

THE MAIN OBJECTIVES OF RESEARCH WORK:

1. That Study of all previous wireless sensor networks energy efficient topologies and routing algorithms.
2. To compare these routing algorithms for formative the benefits and drawbacks along with the applications.
3. To arrange Wireless Sensor Network by initializing the parameter.

4. After deploying the network design the proposed routing protocol (M-gear) using multiple hops data transmission of wireless sensor networks (WSNs).
5. To implement the same routing protocol using Mat Lab software for the finding of life time of wireless sensor networks.
6. To evaluate the performance and observing the comparative analysis of this proposed algorithm with previous protocols on the basis of parameter like throughput, energy and lifetime etc.

CONCLUSION

One of the most energetic and dynamic fields today is that of wireless networks. Energy conservation in wireless networks is a moderately new in the field of research. As per this proposed work this is concluded that it will bring a revolutionary change in field of wireless communication. This proposed system has more lifetimes, less power consumption and a new approach to transfer data from different nodes to base station effectively.

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