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Performance Evaluation in Situation Based Routing Protocol in Wireless Sensor Network

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Abstract- Wireless sensor networking environment provide us with a sub-divided group of smaller nodes, with the use of which we sense any situation, communication and working environment. The disposal of these sensing elements is used to sense corporal phenomena of many applications. The testing analysis in wireless sensor network has become very vigorous. To meet the specific design target the usage of network protocols of sensor networks are very significant. In this paper, we discuss LEACH and PEGASIS Protocol and how the network performance can be improved for the network according to the situation that has been occurred in the network by using both the protocols simultaneously. We will evaluate the performance in terms of assumptions, energy models and performance metrics.

Introduction- A Wireless Sensor Networks (WSN) is a set of hundreds or thousands of micro sensor nodes that have capabilities of sensing, establishing wireless communication between each other and

doing computational and processing operations. Sensor networks have a wide variety of applications and systems with vastly varying requirements and characteristics. The sensor networks can be used in Military environment, Disaster management, Habitat monitoring, Medical and health care, Industrial fields, Home networks, detecting chemical, Biological, radiological, nuclear, and explosive material etc. Deployment of a sensor network in these applications can be in random fashion (e.g., dropped from an airplane) or can be Planted manually (e.g., fire alarm sensors in a facility). For example, in a disaster management application, a large number of sensors can be dropped from a helicopter. Networking these sensors can assist rescue operations by locating survivors, identifying risky areas, and making the rescue team more aware of the overall situation in the disaster area.

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Figure 1 shows the schematic diagram of sensor node components in which sensor nodes are

shown as small circles. Basically, each sensor node comprises sensing, processing, transmission, mobilizer, position finding system, and power units (some of these components are optional like the mobilizer). The same figure shows the communication architecture of a WSN. Sensor nodes are usually scattered in a sensor field, which is an area where the sensor nodes are deployed. [6]

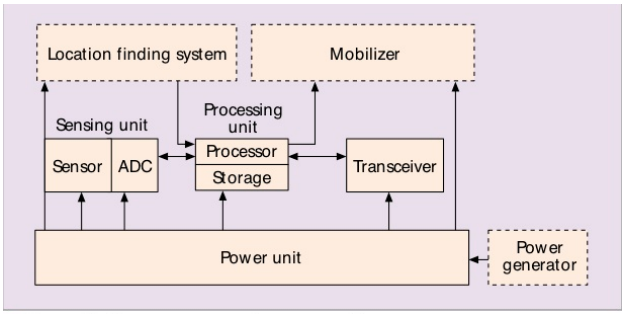

Figure 1. Structural view of sensor network [4]

Each of these scattered sensor nodes has the capability to collect and route data either to other sensors or back to an external base station(s). A base-station may be a fixed node or a mobile node capable of connecting the sensor network to an existing communications infrastructure or to the Internet where a user can have access to the reported data. [6]

In general, classification of a WSN routing methodology can be done into two main categories; based on network structure or based on the protocol operation. Depending on the network structure, different routing schemes fall into this category. A sensor network can be nonhierarchical or flat in the sense that every sensor has the same role and functionality. Therefore the connections between the nodes are set in short distance to establish the radio communication. Alternatively, a sensor network can be hierarchical or cluster-based hierarchical model, where the network is divided into clusters comprising of number of nodes. Cluster head, which is master node, within each respective cluster is responsible for routing the information to other cluster head. Another class of routing protocols is based on the location information of the sensor nodes either estimated on the basis of incoming signal strengths or obtained by small low-power GPS receivers or even by combination of the two previous methods. Location-based protocols use this information to reduce the latency and energy consumption of the sensor network. Our work in this paper is based on hierarchal

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schema to analyze the network performance.[6]

The WSN is built of nodes - from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning motes of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

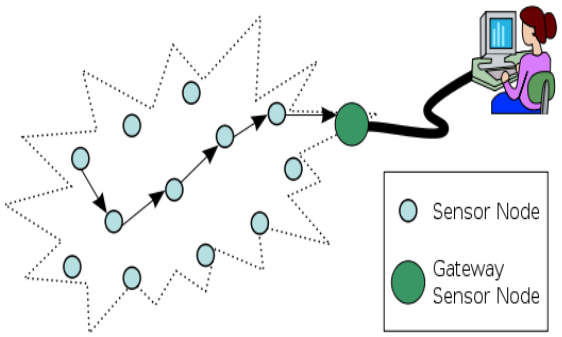

Figure1(a): Typical multi-hop wireless sensor network architecture

Problem Formulisation-After reading so many papers on LEACH and PEGASIS protocol, I have formulated that if we use Situation Based Routing Protocol the overhead in the network will decrease hence the performance of the wireless sensor nodes can be enhanced.I have taken two scenarios, in first scenario node are becoming dead in a shorter time period and in second scenario nodes are working for longer duration by enhancing their level of energy. Using Situation Based Routing Protocol in wireless sensor networks, the lifetime of the system will improve, As in this we will be using two protocols simultaneously to enhance the performance. In LEACH, if we have group of nodes then Cluster head has been elected

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on the basis of energy of nodes from it and that cluster headpasses the data of every other node to the base station.

But in PEGASIS node transmits the data to the nearest node, then elects a leader (one of the node from the group that transmit the data) out of the nodes and then data is transmitted to the base station.

But when we use Situation Based Protocol first we will apply LEACH Protocol on the nodes i.e. when cluster head send data to the base station then we will apply PEGASIS Protocol,but in this cluster head will not send data to the base station instead it will send data to the other cluster head from group of nodes and we will select a leader cluster head out of them and that will send data to the base station. This will improve lifetime of the network.

By using both the protocols we can work according to the situation that can occur in the wireless sensor network, this will reduce the overhead and lifetime of the network will improve.

Methodology-In this paper im introducing the concept of Situation Based Protocol first we will apply LEACH Protocol on the nodes i.e. when cluster head send data to the base station then we will apply PEGASIS Protocol,but in this cluster head will not send data to the base station instead it will send data to the other cluster head from group of nodes and we will select a leader cluster head out of them and that will send data to the base station. This will improve lifetime of the network.

RESULT

Simulation Scenario-

Work on Matlab- Matlab is a numerical computing environment and programming language. Matlab allows easy matrix manipulation, plotting of function and data, implementation of algorithm, creation of user interfaces and interfacing with programs.

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Threshold frequency of LEACH Protocol

In LEACH protocol we calculate the threshold frequency by the formula described below :

$$T(n)=\begin{cases}\dfrac{p}{1-p\times\left[r \bmod (1/p)\right]}, & n\in G\\ 0, & \text{otherwise}\end{cases}$$

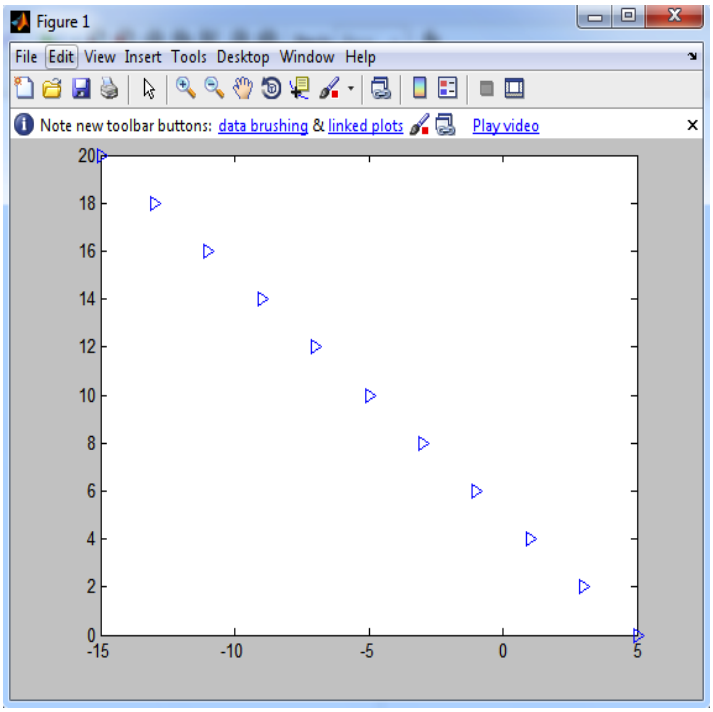

Fig. 4.1

Deployment of Wireless Sensor Nodes

In figure 4.2 number of nodes are 50 and they are deployed in a network out of which groups of nodes are formed and nodes are sending data to the cluster head.

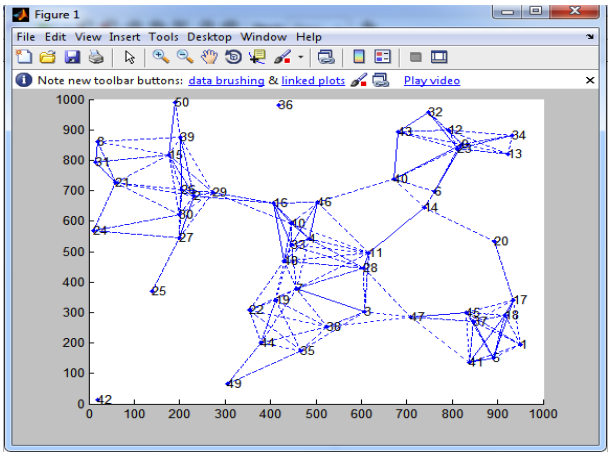

Fig. 4.2

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In the figure 4.3 random pattern of nodes have been generated in which nodes are sending data to the base station, the base station is the cross mark at the center, out of these node with the highest energy is chosen as the cluster head which can send data to farther places.

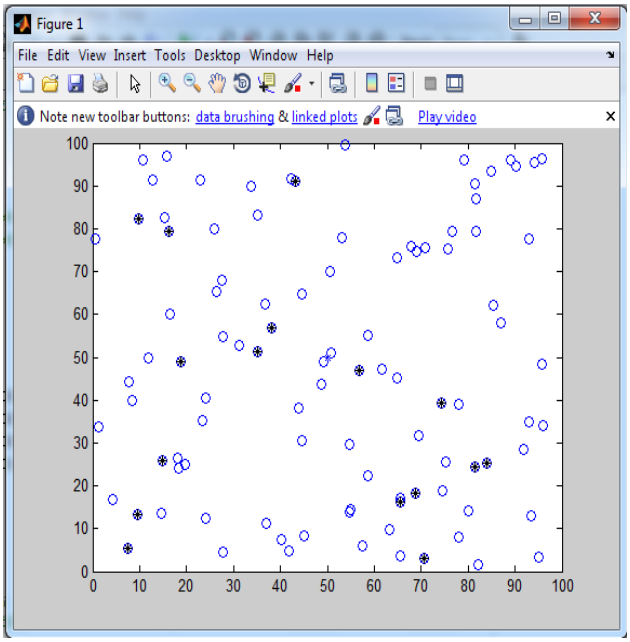

Fig.4.3

In figure 4.4 we can see that pattern of nodes is changing as all the nodes are sending to the base station.

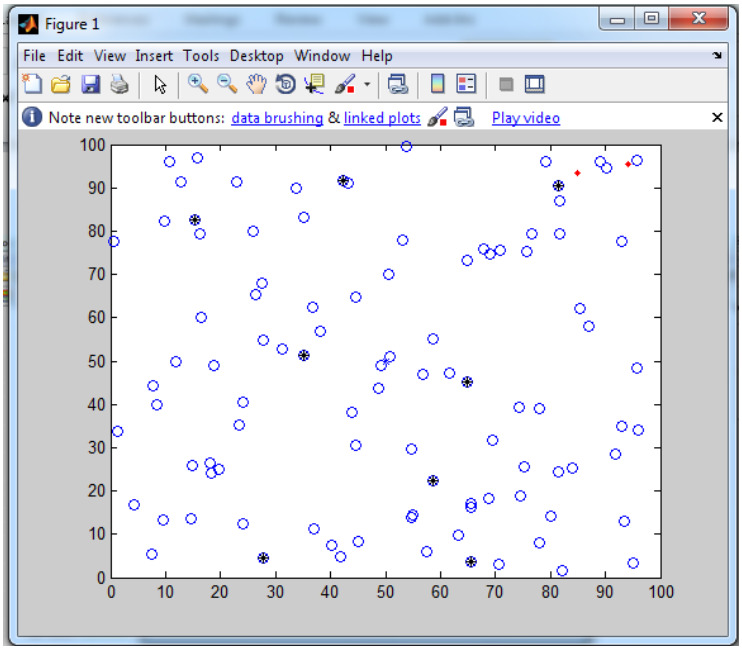

Fig. 4.4

In figure 4.5 cluster head is sending data to the base station and the node whose energy is decreasing is becoming dead. In the figure below few of the nodes are becoming dead.

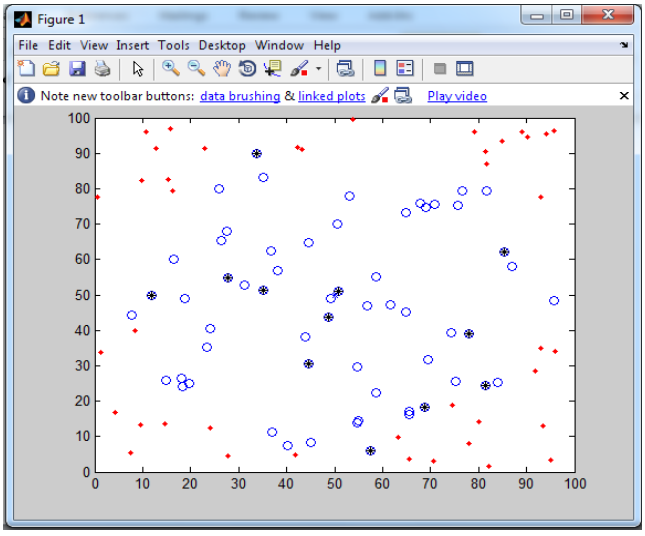

Fig. 4.5

In figure 4.6 all the nodes are dead after sending the data, the node with the highest energy become dead in the last.

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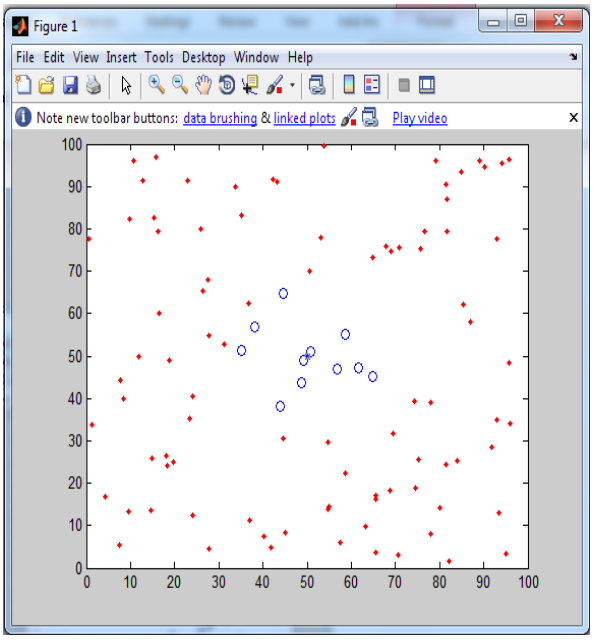

Fig. 4.6

In figure 4.7 the graph depicts that all the nodes after a certain time are becoming dead, it is a slow process as we can see that the graph is declining slowly and after that all the nodes reached the dead point.

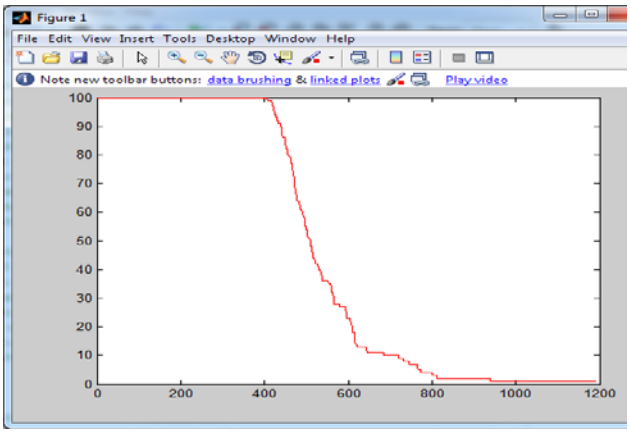

Fig. 4.7

Conclusion and Future work-Routing in sensor networks is a new area of research, with a limited but rapidly growing set of research results. In this article we present a comprehensive survey of routing techniques in wireless sensor networks that have been presented in the literature. They have the common objective of trying to extend the lifetime of the sensor network while not compromising data delivery. This will reduce the overhead and improve lifetime of the network. Although many of these routing techniques look promising, there are still many challenges that need to be solved in sensor networks. We highlight those challenges and pinpoint future research directions in this regard. In future we can introduce heterogeneity in terms of energy in which some percentage of the nodes will have more energy than other nodes using both the protocols. We can enhance the performance of the network by increasing the energy of some nodes in the network which will help to increase the lifetime of the network.

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