Various Schemes for Enhancing the Network Life in Wireless Sensor Networks

Deepati1, Ajay Khokhar2
Research scholar1, Head of the Department2
Department of ECE
S.P.G.O.I., Rohtak, India

Abstract:
The purpose of Wireless sensor network is to serve the finding of surrounding parameters like sound, temperature, pressure, motion and vibration etc. All the nodes in wireless network are inter linked by wireless connections. They all are tiny and have limited energy, operation of these nodes take place in hostile condition and thus replacement and recharging is difficult. Energy management and conservation is the prime importance. Clustering, data aggregation and optimal routing are the basic techniques used to increase the lifetime of the network. This paper argues different substantial outlines and protocols which have been proposed till now and makes an overall evaluation among them based on several parameters like network lifetime, energy efficiency, power efficiency, multi hop data transmission, average delay etc.

Keywords: Wireless sensor networks, routing, network lifetime, clustering, cluster head selection, energy management

I. INTRODUCTION
A wireless sensor network (WSN) can be treated as a cooperative network of small size, low power, smart devices named as Nodes or Motes, which have the capability of sensing a physical phenomenon (like temperature, humidity, pressure, vibration…etc) and relay the same or processed information to a sink via wireless links possibly with multiple hops between these nodes. The unique characteristics of WSN such as small size, low power consumption, autonomous, mobility, dense in volume, self healing and self-organizing poses some constraints in terms of power consumption, storage, processing capabilities and bandwidth requirement. A wireless sensor network consists of spatially distributed autonomous sensors to cooperatively monitor physical or environmental conditions such as pressure, temperature, sound, vibration motion or pollutants.

Wireless sensor networks are self organising systems comprising of a large number of sensor nodes used for monitoring as well as gathering information related to the environment. They have a wide range of applications like environment and habitat monitoring, military operations, target tracking and surveillance system, health care, disaster management, pollution control system etc. The sensor networks were first proposed by researchers at the Defence Advanced Research Projects Agency (DARPA). These sensors were to be used for various purposes like detecting tanks, poisonous gases etc. Hence, it was required that the sensor nodes be of very small size and economical too.

II. CONSTRAINTS AND CHALLENGES IN WIRELESS SENSOR NETWORKS
The various technical challenges are energy, bandwidth, memory and computational resources. Optimal deployment of nodes, localization, energy aware clustering and data aggregation are some of the very basic issues which need to be considered. These are discussed as under

A. Localization of the nodes
It implies creating location awareness in deployed nodes which helps in optimal routing. This is achieved with the help of localization algorithms because the traditional GPS system can’t be used here due to size, cost and power constraints.

B. Energy Efficient routing technique
The main motive of the routing is to suit the best available route between the sources that sense the events and base station i.e. sink hence routing is the phenomenon of determining a path for a packet from a source node to a sink. A WSN’s lifetime largely depends on how efficiently it carries a data packet from its source to destination. In hierarchical routing nodes are clustered into groups. So clustering technique is the one of the best technique to find out the energy management. Hence this method is generally used for energy conscious routing in WSNs.

C. Data Collection and Aggregation Technique
Since a large no of sensors are deployed in a given confined area so there is a general problem of data redundancy. Hence large scale deployment of sensors results in lots of redundant data. Thus, data aggregation is the method used for combining the data originating from multiple sources such that the communication overhead is minimized and the results are more concise and reliable.

D. Energy Efficient Clustering
Clustering is the method which involves grouping the sensor nodes to form clusters, where each cluster has a cluster head. This cluster head carries over all the data from other nodes of its cluster towards the base station. As we know, communication is the most energy expensive activity a node performs. Thus, this technique helps in lowering the energy consumption and hence the term energy aware clustering has been used.

E. Optimal WSN deployment
Optimal deployment means determining positions for sensor nodes as well as base stations such that coverage, connectivity and energy efficiency are maximised with minimum number of nodes. This ensures adequate quality of service and longer network life.
III. ENERGY EFFICIENT ROUTING PROTOCOLS

The main purpose of the energy efficient routing protocol is to find out the best suited path between the source and destination in terms of the energy efficiency. It has been discussed earlier that efficient routing plays an important role in saving energy. So, here we describe in brief a few protocols of this category.

1. **ERSS: Efficient Received Signal Strength Based Localization Algorithm**

   The one of the important step in providing energy efficient solutions for routing is the concept of localization. With the help of this algorithm the location of a sensor node using the log normal shadowing path loss model can be achieved and the ITU indoor attenuation model. It has two phases: (a) distance estimation phase, (b) coordinate estimation phase. Anchor nodes are used to determine the location of unknown nodes. The results achieved by this method are comparable to traditional GPS method. The accuracy of this algorithm is 7.25% less as compared to existing hop distance algorithm. The time complexity is of the order of \((n^*I)\), where ‘n’ is the number of nodes and ‘I’ is the number of iterations. The power optimization achieved is nearly 25.07%.

2. **CBLMR: Cluster Based Localized Multicast Routing**

   This scheme combines clustering mechanism with multicast routing. Clustering involves two phases: cluster head election phase and cluster formation phase. The nodes are then categorised as cluster heads and cluster members. Multicast routing means that data is to be forwarded to multiple sink nodes. It involves source node, destination node and relay nodes (forwarding nodes). The average power consumption is 50.44% less as compared to position based multicast routing. The complexity, similar to LAEER, is a function of the times taken to broadcast packets, receiving packets, finding cluster head and cluster member. In addition to these, complexity is also a function of the time taken in forwarding data to multiple destinations.

3. **Distance Based Transmission Power Control (DBTPC)**

   This scheme dynamically controls the transmission power level in the sensor nodes based on the distance information obtained from a neighbour discovery process. Hence, the power optimization achieved is 60.88% lesser compared to the existing schemes. It involves two phases, namely, the localization phase and the self configuration phase. The log normal shadowing path loss model has been used here. The optimal transmission power is a function of both distance as well as residual energy of node. The transmission power increases as distance between the nodes increases. The computational complexity is of the order of \((n^*L)\), where ‘n’ is the number of nodes and ‘L’ is the number of transmission power levels. The average energy consumption is 33.12% lesser than other existing schemes.

IV. COMPARISON AMONG ABOVE PROTOCOLS

To understand this comparison table, a set of notations is firstly listed in table 1.

![Fig. 1 Comparison in terms of power optimization](image-url)
REFERENCES


