

## Review on Data Dissemination and Gathering in Wireless Sensor Networks

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### Abstract-

*The Wireless sensor network has number of applications but data gathering is the major application in which Wireless Sensor Network is used to periodically collect data from sensor field. Various numbers of protocols are used in order to maximize life time by efficient use of energy. Direct transmission, binary scheme, LEACH, PEGASIS are discussed in this paper. LEACH communicate by using cluster heads and PEGASIS involve leader selection.*

**Keywords-** Wireless sensor network, Data gathering, LEACH, Energy Consumption

### I. INTRODUCTION

Wireless sensor network is the collection of mobile or static nodes which are capable of communicating with each other in order to collect data accurately, autonomously. Each node deployed is capable of sensing, processing and communicating. Manufacturing of inexpensive low power sensors having computational capability is possible with the help of recent advances in field of technology. Wireless sensor network is used to collect reliable and accurate information from distant and hazardous environment such as battle field, volcano monitoring etc., major applications of wireless sensor network is monitoring and tracking [1, 2]. In National Defense, Military affairs, environment monitoring, traffic monitoring, industry monitoring, manufacturing monitoring etc. wireless sensor network is widely used.

Wireless sensor network has four basic components: processing unit, sensing unit, radio unit (communication unit), battery (power source). In order to monitoring and tracking purposes sensor nodes are expected to be deployed in large area. Data Gathering is the major application of wireless sensor network. In data gathering nodes are deployed at different specified locations which continuously collect different type of data such as temperature, light and vibration at different sampling rates. Sensor nodes send back data to Base Station (BS) which is usually location at distant locations where further processing can be done. Life time of network is determined from energy consumption by sensor nodes. So, In order to enhance life time network energy must be consumed efficiently by using efficient protocols. In this paper we first describe data dissemination and its various methods then we describe data gathering concept and various protocols used in data processing.

### II. DATA DISSEMINATION

In wireless sensor network data and queries are routed this process is called data dissemination. A node which generates data and events is called source node where event is information to be routed. Node which is interested in data called the sink node and interest is descriptor for some event that node is interested in. Event is transferred from source to sink after source receives an interest message from sink. Data dissemination is two steps process in which in first step interest of nodes is broadcasted in network and in second step nodes after receiving the request sends data having requested data. There are various data dissemination methods. We will discuss FLOODING, GOSSIPING and SPIN in detail:

#### A. FLOODING

In the flooding protocol each node receiving a data or management packet repeats the packet by broadcasting it. Only packets which are destined for the node itself or packets [3] whose hop count has exceeded a preset limit are not forwarded. The main benefit of flooding is that it requires no costly topology maintenance or route discovery. Once sent a packet will follow all possible routes to its destination. If the network topology changes sent packets will simply follow the new routes added. Flooding does however have several problems. One such problem is implosion. Implosion is where a sensor node receives duplicate packets from its neighbors'. Figure 1 illustrates the implosion problem. Node P broadcasts a data packet (P) which is received by all nodes in range (nodes Q and R in this case). These nodes then forward the packet by broadcasting it to all nodes within range (nodes P and S). This results in node S receiving two copies of the packet originally sent by node P. This can result in problems determining if a packet is new or old due to the large volume of duplicate packets generated when flooding. Overlap is another problem which occurs when using flooding. If two nodes share the same observation region both nodes will witness an event at the same time and transmit details of this event. This results in nodes receiving several messages containing the same data from different nodes. Figure 2 illustrates the overlap problem. Nodes P and Q both monitor geographic region B.

When nodes P and Q flood the network with their sensor data node R receives two copies of the data for geographic region Y as it is included in both packets. Another problem with flooding is that the protocol is blind to available resources. Messages are sent and received by a node regardless of how much power it has available. In addition

to this the number of packets generated by the flooding protocol causes a lot of network traffic and causes a large network wide energy drain across the network. This can shorten the life of the network.

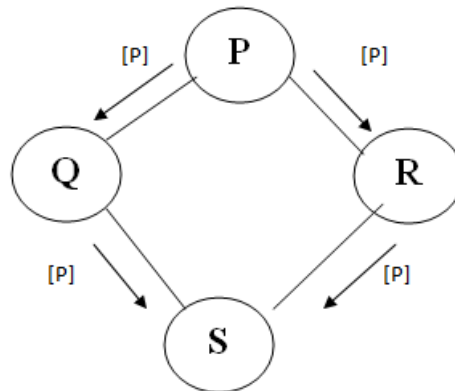


Fig. 1

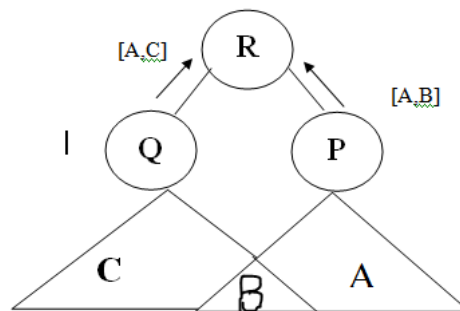


Fig. 2

### B. GOSSIPING

The Gossiping protocol is based on the flooding protocol [3]. Instead of broadcasting each packet to all neighbors the packet is sent to a single neighbor chosen at random from a neighbor table. Having received the packet the neighbor chooses another random node to send to. This can include the node which sent the packet. This continues until the packet reaches its destination or the maximum hop count of the packet is exceeded.

Gossiping avoids the implosion problem experienced by flooding as only one copy of a packet is in transit at any one time. However the protocol does take a long time to deliver a packet to its destination as the hop count can become quite large due to the protocols random nature.

### C. SPIN

The SPIN family of protocol is an enhancement of the flooding protocol which is based on data-centric routing [4]. Classic flooding as previously mentioned has three problems: implosion, overlap and resource blindness. In order to overcome the problems of implosion and overlap the SPIN family of protocols use a 3 way negotiation before sending data. When a node detects an event it advertises (ADV) the event by transmitting a description of the event. This avoids transmitting the full details of the event. This advertisement is picked up by neighboring nodes and if they are interested in the data they reply requesting the data (REQ). When the original node receives a request it sends the data to the requesting node. The receiving node will then repeat the process by advertising the data. This prevents nodes from receiving duplicate packets (implosion) as data is only sent when requested. Also as data is described in the advertisement message the problem of overlap can be overcome by checking to see if the node has already received similar data relating to that event.

The protocol described above is SPIN-1. SPIN-2 is an extension of SPIN-1 which attempts to overcome the resource blindness problem. Before taking part in the above protocol nodes poll their resources. If their resources fall below a threshold the node will not send or relay data packets.

## III. DATA GATHERING

The sensor nodes are deployed in the area continually collect data from area and forward to Base Station. The main purposes of data gathering algorithm is efficient use of energy in order to maximize the life time of network by increasing number of rounds (When BS collects data from all nodes is one round). Various protocols are used for efficient use of energy in order to maximize life time of network. Various protocols for data gathering are:

#### A. DIRECT TRANSMISSION[9]

Number of nodes is deployed in field and there is a Base Station to which they send the sensed data. In the direct transmission method the nodes directly send sensed data to BS. The Scenario of Direct transmission is as shown in figure 3. The sensing nodes are at different location from BS so this scenario will cause different amount of energy dissipation. Every time when nodes have data to send to BS, BS have to communicate with each and every node which leads large amount of energy consumption of BS as compared to others. So this method is not efficient when life time of BS is critical. This Method is useful BS lies in the Sensor network and when BS is at distant location then this method will leads to shorter life time of the network.

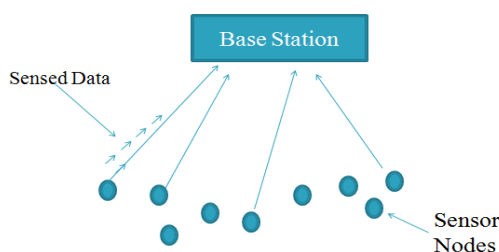


Fig. 3

#### B. BINARY SCHEME

This is chained based scheme in which nodes are classified into different levels. In this all nodes receive the message and forward to other. At each level number of nodes reduced by half. Figure 4 describes the scenario in which we have 7 nodes and each level number of nodes are reduced by half at each level and at last level 4 node N7 send data to Base Station.

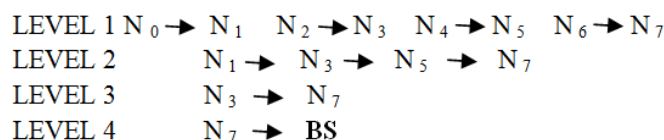


Fig. 4

#### C. LEACH

LEACH is Low Energy Adaptive Clustering method. In this each clusters and cluster heads are formed. Clusters are collection of nodes. Clusters Heads collects data from the cluster nodes within the cluster and then forward the collected data to Base Station as shown in figure 5. Cluster Head can be Static or Dynamic. The static Cluster Heads which does not change for different rounds it remains same and dynamic cluster head is which changes with time[6,9]. In static cluster heads scheme energy consumption of single CH will be more because Static CH have to communicate with whole cluster nodes throughout the network life but in dynamic cluster clusters are randomly selected which leads to balanced energy dissipation. Various scheduling schemes can be adopted such as ACTIVE and SLEEP [8]. By using these scheduling schemes energy efficient is increased near to 50% than LEACH protocol.

LEACH algorithm details[6]:

The steps in the LACH are

- Advertisement Phase
- Cluster Setup Phase
- Schedule Creation
- Data Transmission

TL-LEACH [5] is enhancements of LEACH in which primary and secondary clusters are formed. Primary cluster communicate with secondary clusters and in turn secondary cluster communicate with clusters. Primary clusters directly communicate with Base Stations (BS).

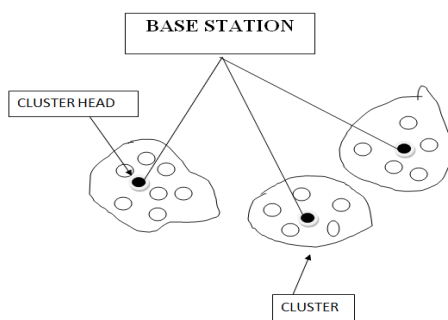


Fig. 5

#### D. PEGASIS

PEGASIS is Power-Efficient Gathering in Sensor Information Systems. PEGASIS form open chain starting from node which is farthest from Base Station .PEGASIS assume that global information is available. This algorithm uses greedy algorithm for chain construction. Before first round of communication chain formation is done [8].During formation of chain care must be taken so that nodes already in chain should not revisited . When a node die then chain is reconstructed by bypassing that node. In data gathering cycle each node forms a data packet of its own in network. For each data gathering cycle leader is elected among all nodes in network. Each node in network receives a data packet and fuses it with its own data and forwards it to other neighboring node. PEGASIS uses a simple token passing approach which is initiated by leader to start data transmission from ends of chain.

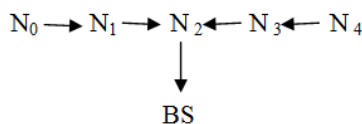


Fig. 6

Let us assume that the network has only 5 nodes In Figure 6, node N<sub>2</sub> is the leader, and it will pass the token along the chain to node N<sub>0</sub>. Node N<sub>0</sub> will pass its data towards node N<sub>2</sub>. After node N<sub>2</sub> receives data from node N<sub>1</sub>, it will pass the token to node N<sub>4</sub>, and node N<sub>4</sub> will pass its data towards node N<sub>2</sub>.The leader elected in a particular cycle receives the fused data packets of the nodes in the network from its two neighbors, fuses it with its own data packet and finally this single data packet is transmitted to the base station [7,9]. In PEGASIS the nodes are successively selected as leaders. For example if there are 'N' nodes then each node will become a leader once every 'N' data gathering cycles.

#### IV. CONCLUSIONS

Data gathering is the process of collecting information from sensor nodes at the Base Station. This paper describes various data dissemination methods and data gathering methods. LEACH uses clusters and more efficiently consume energy as compared to direct method .PEGASIS is most efficient as compared to both Direct and LEACH. In PEGASIS chain construction is done by using Greedy algorithm. By using ACO and PSO it also gives better performance as compared to previous one.

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