A Survey on Routing Protocol of Wireless Sensor Network and its Application

Rizwanabanu Arifmiya Bhatti

Department of Computer Engineering

Ipcowala Institute of Engineering and Technology, Gujarat Technological University, Dharmaj, Anand

Abstract— In this paper, we analyze the routing protocols. Protocol is classified according to their network structer and their operation. Routing protocol has important features. Sensor networks take these features in consideration while designing and evaluating new routing protocols for sensor networks. Routing protocol is classified according to their some criteria such as, Based on Mode of functioning and type of target applications, According to the Participation style of the Nodes, Depending on the Network Structure. Application of routing protocol is given in this paper.

Key words: Wireless sensor network, routing protocol, Application, Sensor network.

I. INTRODUCTION

Wireless sensor network is the collection or the network of sensors. Sensor network contains the collection of the sensor node. This sensor is very small is and is characterized by limited processing power, energy, communication range, memory. They are working in wireless environment to get common objective. Sensor nodes of type homogeneous and heterogeneous are communicating in wireless manner. Wsns are used in various domains like medical diagnose ,industrial process, scientific exploration, traffic safety, military, habit monitoring, medical monitoring. For example in industrial process it is applied at various area such as machine health monitoring, Data logging, Water/Waste water monitoring, structural health monitoring. Wsns protocols have added wide range of interests from both academic and industrial communities due to their diversity of applications. Wsns can be used to improve traffic safety. In traffic safety low-cost wireless sensors nodes are applied on the roadbed and they all are communicating via data transmission and work interactively to detect potential collision on the road. [1]

II. ROUTING PROTOCOLS

Wsns routing protocols impact on system performance strongly. It is important to choose specific protocol because choosing the wrong protocols may cause severe inefficiency and prevent the WSN to accomplish user need. Protocols may affect on various factor that is energy dissipation, system cost, latency, security. Routing techniques are required for sending data between sensor nodes and the base stations for communication.

Routing Protocols can be classified according to some parameters which are given below:

A. Based on Mode of Functioning and Type of Target Applications:

Based on Mode of functioning and type of target applications the routing protocols are classified in Proactive, Reactive and Hybrid protocols. Basic types of routing protocols are given in the fig.

1) Proactive Routing Protocols:

In the network each node has routing table basically for the broadcast of the data packets and want to establish connection to other nodes in the network. Information related to the all the presented destinations, number of hopes required to arrive at each destination in the routing table. In WSNs network this type of protocol is suitable for less number of nodes in the network, because they need entries of node for each and every node in the routing table of every node.i.e. Destination sequenced Distance Vector (DSDV) and the Low Energy Adaptive Clustering hierarchy protocol (LEACH) utilizes this type of protocol.
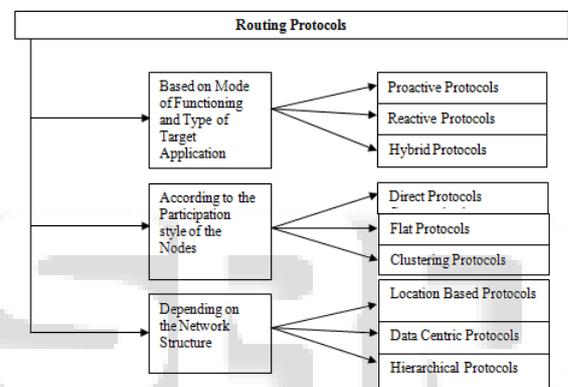

Fig.1

2) Reactive Routing Protocol:

ADHOC on Demand Distance Vector Routing (AODV):
In ADHOC it is need to broadcasts every change in the network to every node. If a link breakage does not affect ongoing transmission then no global broadcast occurs.IN ADHOC only affected nodes are informed and AODV reduces the network wide broadcasts to the extent possible.
The Threshold sensitive Energy Efficient sensor Network (TEEN) is an example of a reactive protocol.

3) Hybrid Protocols:

APTEEN (Adaptive Periodic Threshold-sensitive Energy Efficient Sensor Network Protocol):

Hybrid routing protocol (APTEEN) allows for comprehensive information retrieval. The nodes in such a network not only react to time-critical situations, but also give an overall picture of the network at periodic intervals in a very energy efficient manner. Such a network enables the user to request past, present and future data from the network in the form of historical, one-time and persistent queries respectively. [3]

Hybrid Protocols

CEDAR, ZRP, ZHLS, PLBR, OSLR, APTEEN

B. According to the Participation style of the Nodes

Based on Mode of functioning and type of target applications the routing protocols are classified in Direct Protocols, Flat Protocols, clustering protocol.

1) Direct Protocols:

In Direct Communication Protocols, any node can send information to the BS directly. When this is applied in a very large network, the energy of sensor nodes may be drained quickly .Its scalability is very small. SPIN is an example of this type of protocol.

Sensor Protocols for Information via Negotiation (SPIN):

Wireless sensor network will be widely deployed in the near future. While much research has focused on making these networks feasible and useful, security has received little attention. A suite of security protocols optimized for sensor networks: SPINS. SPINS has two secure building blocks. Problems related to flooding protocol such as implosion and overlap is improved by the SPIN protocol. The SPIN protocols have resource aware and resource adaptive type of properties. The energy consumption required to compute, send, and receive data over the network is computed by the sensors running the SPIN protocols. So that informed decisions for efficient use of their own resources can be made by them. The SPIN protocols are worked on two key mechanisms namely negotiation and resource adaptation. SPIN apply the negotiate method so that they can avoid injecting non-useful and redundant information in the network. SPIN uses meta-data which contain the descriptors of the data that the sensors want to disseminate. It is noticed that size of meta-data should definitely be less than that of the corresponding sensor data. The notion of meta-data avoids the occurrence of overlap given sensors can name the interesting portion of the data they want to get. Contrary to the flooding technique, each sensor is aware of its resource consumption with the help of its own resource manager that is probed by the application before any data processing or transmission. This helps the sensors to monitor and adapt to any change in their own resources. There are two protocols in the SPIN family: SPIN-l (or SPIN-PP) and SPIN-2 (or SPIN-EC).

2) Flat Protocols:

In the case of Flat Protocols, if any node needs to transmit data, it first searches for a valid route to the BS and then transmits the data. Nodes around the base station may drain their energy quickly. Its scalability is average. *Rumor Routing* is an example of this type of protocol. [4][5][6][7]

3) Clustering Protocol:

According to the clustering protocol, the total area is divided into numbers of clusters. Each and every cluster has a cluster head (CH) and this cluster head directly communicates with the BS. All nodes in a cluster send their data to their corresponding Cluster Head .The Threshold sensitive *Energy Efficient sensor Network (TEEN)* is an example of a clustering protocol

C. Depending on the Network Structure:

Based on Mode of functioning and type of target applications the routing protocols are classified in Location Based Protocols, Data – Centric Protocol, Hierarchical Protocols.

1) Location Based Protocols:

Location based protocol calls the location information based routing protocol uses location information to guide routing discovery and maintenance as well as data forwarding, enabling directional transmission of the information flooding in the entire network.

Location Based Routing Protocols

MECN, SMECN, GAF, GEAR, Span, TBF, BVGF, GERAF

TBF Trajectory-Based Routing Protocol:

TBF (Trajectory-Based Routing) is proposed as a middle-ground between SBR and greedy forwarding techniques. In TBR, source encodes trajectory to be traversed and embeds it into each packet. Upon the arrival of each packet, an intermediate node decodes the trajectory and employ greedy forwarding techniques such the packet follows its trajectory as much as possible.

2) Data – Centric Protocol:

Cougar approach:

Cougar approach is to tasking sensor networks through declarative queries. Given a user query, a query optimizer generates an efficient query plan for in-network query processing, which can vastly reduce resource usage and thus extend the lifetime of a sensor network.[11]

Data- Centric Protocol

SPIN, Directed Diffusion, Rumor Routing, COUGAR, ACQUIRE, EAD, Information-Directed Routing, Gradient Based Routing, Energy aware Routing, Information-Directed Routing, Home Agent Based Information Dissemination

3) Hierarchical Protocols:

Hierarchical Protocols

LEACH, PEGASIS, HEED, TEEN, APTEEN

Low-energy adaptive clustering hierarchy (LEACH): LEACH is one type of the hierarchical clustering algorithm and it is widely used for the reducing power consumption. It is the basic and most popular energy-efficient hierarchical clustering algorithm. LEACH is relayed on the aggregation technique in this it combines the original data into smaller size of data. This smaller size data carry only meaningful information towards all individual sensors. When this type of the protocol is used, the network is the combination of or the cluster of the sensors. This cluster is formed as all are coordinating locally. Data are transmitted to sink is controlled and reduced in the amount of size by this protocol. [2]

Power-Efficient Gathering in Sensor Information Systems (PEGASIS):An extension of the LEACH protocol is PEGASIS protocol. In PEGASIS chain of sensor node is formed, so that each element of chain takes part and transmits and receives from its neighbor and among this, one node is selected to transmit to the base station. The data which is gathered in chain by nodes is aggregated and eventually sent to the base station.   The chain construction follows the greedy way for their performance. Custer form used in the LEACH is avoided in PEGASIS and it utilizes chain structure, in which it uses only one node to transmit to the BS (sink). In LEACH it sending data to its CH directly where in PEGASIS sensor transmit to its local neighbors all this done in the data fusion phase. The same greedy approach is used for bypassing the failed sensor when a sensor fails or dies due to low battery power and reason chain is constructed for this reason. [2]

Hierarchical PEGASIS

Hierarchical-PEGASIS is an extension to PEGASIS,   was introduced with the objective of decreasing the

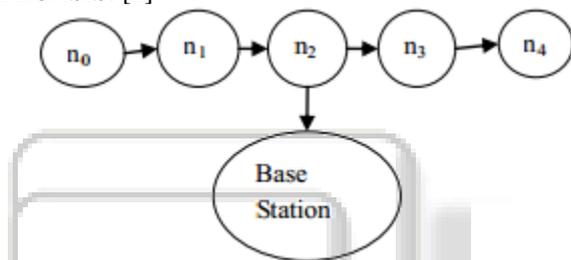Delay incurred for packets during transmission to Chaining in PEGASIS. [2]

Fig.2 Hierarchical PEGASIS:

III. APPLICATION

A. Military Applications:

Concept of wireless sensor networks is used in Military applications. It is used in wartime and peacetime such as property protection and surveillance, border patrol homeland security and the track of a chosen moving object is continually sensed, it minimizing any information gaps about the track that may occur.[8][9][10]

B. Environmental Monitoring:

Another area in which WSNs is applied, it is environmental monitoring. It works in three area, first Indoor environmental monitoring and emergency services and second outdoor Monitoring – Application to Ecology, third *outdoor Monitoring – Applications to agriculture.*

C. Support for logistics:

In big companies inventory control is major problem.
Management of assets (pieces of equipment, machinery, Different types of stock or products) can be a predicament.
As these companies expand all over the world, the problem is highly distributed. The use of RF ID tags and wireless sensor networks to asset tracking and cope with this problem.

D. Human-Centric Applications:

The health care and Health science system apply the wireless sensors technique. Retina prosthesis it gives human vision restoration another medical application which utilize WSNs.

E. Applications to robotics:

In robotics coupling motes and robots have been proposed. For example, Robmote is a tiny robot Developed by the USC Center for Robotics and Embedded Systems to promote research in large-scale sensor network where robots participate [12]. Applications already implemented [13] are the detection of level sets of scalar fields (like isothermal or isobar curves) using mobile sensor networks and imitation of the function of bacteria for seeking and discovering dissipative, gradient sources[14].

IV. CONCLUSION

In this paper we have given the basic detail of wireless sensor network. Working of network element in the system is given and it gives the basic idea about the working of element. Classification of the Routing protocol is given in this paper .Routing protocol is classified based on their operation and their network structure. We have given the overview of all the basic type of protocol which is used in the wireless sensor network. After all this we have given some application of routing protocol. Various application of routing protocol in different area is given.

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