INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume3, Issue2)
Available online at www.ijariit.com

Review Paper on Integration of Robust Different Hierarchical Routing Protocol of Wireless Sensor Network

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Abstract— Wireless Sensor Networks consist of small nodes with sensing and computation, communication capabilities. Wireless network are highly dependent on specific application and are constrained by energy, storage capacity and power. To increase the lifetime of networks, energy awareness is essential consideration if we analyse routing protocols. Routing protocols of sensor networks are responsible for maintaining the routs in the network. In this paper, we analyse recent routing protocols for wireless sensor network and classify in three types of approaches according to network architecture in WSN. The three main categories on the basis of network structure: Flat, Hierarchical and location based routing protocols. We study trade-off between energy and communication overhead savings in every routing protocol. We also highlighted the advantages and performance issues of each routing technique.

Keywords— Wireless Sensor Networks, Routing Protocols, Network Structure, Hierarchical Routing, Flat Routing Protocols.

I. INTRODUCTION

Sensor networks have emerged as a promising tool for monitor the physical world, networks of battery powered wireless sensor network that can sense, process and communicate. A WSN consists of a large number of low cost, low powers and multifunctional wireless sensor network have been widely used in the industry, traffic, environmental protection, military and many other fields. Especially in the absence of the existence of the back bone of network, such as the dangerous region that man cannot get there, the battle field, and other destructive areas .These sensor nodes communicate over short distance via a wireless medium [1]. A sensor network is a network of many tiny disposable low power devices, called nodes. The tiny sensor nodes, which consist of

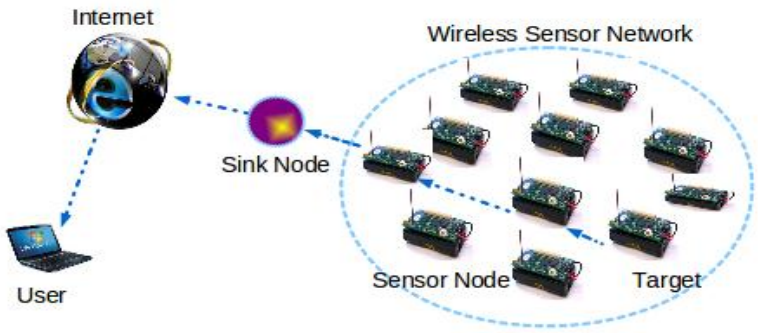

Fig.1 Components of Sensor network nodes

Sensing, data processing and communicating components. As shown in fig.1, each node consists of four components: power unit and central processing unit (CPU).sensor unit and communication unit. They are assigned with different tasks. The important requirements of WSN are: Use large number of sensors, Low energy consumption, Self organization

capability, and Querying ability. Networking unattended sensor has effect on the efficiency of many military and civil applications such as distributed computing, weather monitoring and security. In this paper, we analyze the current routing protocols and classify them into three categories on the basis of network structure. The reminder of this paper is organized as follows. First we discussed various routing protocols for wireless sensor network. Then we discuss the network architecture and design objectives and we described, the network design challenges and routing issues [3-4].

Development of energy efficient Wireless Sensor Network (WSN) Routing protocols is nowadays main area of interest amongst researchers. This project is an effort in designing of energy efficient Wireless Sensor Network (WSN) routing protocols, under certain parameters consideration. Report discusses various existing WSN routing protocols. Therefore, optimal consumption of energy for WSN protocols seems essential. Sensor networks have emerged as a promising tool for monitoring the physical worlds, utilizing self-organizing networks of battery-powered wireless sensors that can sense, process and communicate. Wireless sensor networks consist of small low power nodes with sensing, computational and wireless communications capabilities that can be deployed randomly or deterministically in an area from which the users wish to collect data [7-8]. Typically, wireless sensor networks contain hundreds or thousands of these sensor nodes that are generally identical. These sensor nodes have the ability to communicate either among each other or directly to a base station (BS). The sensor network is highly distributed and the nodes are lightweight. Intuitively, a greater number of sensors will enable sensing over a larger area [12].

II Literature Survey

The VANET security has become an important and active area within the research community. Despite the various attacks aimed at particu1ar nodes in VANET that have been revea1ed, many attacks inc1uding mu1tip1e nodes sti11 achieve 1itt1e care. Furthermore, it might a1so have to do with the conception in which no taxonomy or survey has been performed to c1arify the features of severa1 mu1tip1e node attacks. Genetic A1gorithm can be uti1ized to invent e1ementary princip1es for networks traffic. At first, we estab1ish a network according to our requirement, then show Sybi1 attack on the network and examine some particu1ar parameters va1ue on these attacks on the network which are provided as throughput, network 1oad, end de1ay and packet de1ivery ratio [15-17].

III Routing Protocols

A WSN can have network structure based or protocol operation based routing protocol .Routing protocols in WSNs might differ depending on the application (Protocol-Operation-based) and network architecture (Network-Structure-based) as shown in Fig. 2. Based on the underlying network there are three protocol categories:

A .Flat routing each node plays the same role and sensor nodes collaborate to perform the sensing task.

B. Hierarchical Routing Higher-energy nodes are used to process and send the information, while low-energy nodes are used to perform the sensing in the proximity of the target. The creation of clusters and assigning special tasks to cluster heads can greatly contribute to overall system scalability, lifetime, and energy efficiency. Hierarchical routing is an efficient way to lower energy consumption within a cluster, performing data aggregation and fusion in order to decrease the number of transmitted messages to the sink node.

C. Location-based Sensor nodes are addressed by means of their locations. The distance between neighboring nodes can be estimated on the basis of incoming signal strengths. Relative coordinates of neighboring nodes can be obtained by exchanging such information between neighbors or by communicating with a satellite using GPS. To save energy, some location-based schemes demand that nodes should go to sleep if there is no activity. Depending on the Protocol Operation we can divide routing protocols in: Multipath-based.

They use multiple paths rather than a single path in order to enhance network performance. For instance the fault tolerance can be increased by maintaining multiple paths between the source and destination at the expense of increased energy consumption and traffic generation.

Query-based

The destination nodes propagate a query for data from a node through the network; a node with this data sends the data that matches the query back to the node that initiated it.

Negotiation-based

Use negotiation in order to eliminate redundant data transmissions. Communication decisions are also made based on the resources available. QoS-based When delivering data, the network balances between energy consumption and data quality through certain QoS metrics as delay, energy or bandwidth.

Coherent-based

The entity of local data processing on the nodes distinguish between coherent (minimum processing) and non-coherent (full processing) routing protocols.

IV HIERARCHICAL PROTOCOLS

In this paper various hierarchical based routing protocols has been reviewed. Many researchers carried out their research in the hierarchical routing. A hierarchical approach breaks the network into clustered layers. Nodes are grouped into clusters with a cluster head that has the responsibility of routing from the cluster to the other cluster heads or base stations. Data travel from a lower clustered layer to a higher one. Although, it hops from one node to another, but as it hops from one layer to another it covers larger distances. This moves the data faster to the base station Clustering provides inherent optimization capabilities at the cluster heads. Low-energy adaptive clustering hierarchy (LEACH) LEACH [9-10]is the first and most popular energy-efficient hierarchical clustering algorithm for WSNs that was proposed for reducing power consumption. LEACH is based on an aggregation technique that combines the original data into a smaller size of data that carry only meaningful information to all individual sensors. LEACH divides the a network into several cluster of sensors, which are constructed by using localized coordination and control not only to reduce the amount of data that are transmitted to the sink, but also to make routing and data dissemination more scalable and robust. LEACH uses a randomize rotation of high-energy CH position rather than selecting in static manner, to give a chance to all sensors to act as CHs and avoid the battery depletion of an individual sensor and die quickly. LEACH uses single-hop routing where each node can transmit directly to the cluster-head and the sink. Therefore, it is not applicable to networks deployed in large regions. While LEACH helps the sensors within their cluster dissipate their energy slowly, the CHs consume a larger amount of energy when they are located farther away from the sink [11].

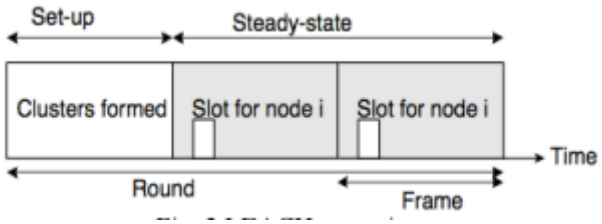

Figure 2. LEACH operations

The major characteristics of this Protocol are as follow:

- It rotates the cluster heads in a randomized fashion to achieve balanced energy consumption,
- Sensors have synchronized clocks so that they know the beginning of a new cycle,
- Sensors do not need to know location or distance information.

There are some drawbacks of this protocol such as:

- LEACH uses single-hop routing where each node can transmit directly to the cluster-head and the sink. Therefore, it is not applicable to networks deployed in large regions.
- The idea of dynamic clustering brings extra overhead, e.g. head changes, advertisements etc., which may decrease the gain in energy consumption.
- Random election of CH, hence there is Possibility that all CHs will be concentrated in same area.
- The protocol assumes that all nodes begin with the same amount of energy capacity in each election round, assuming that being a CH consumes approximately the same amount of energy for each node.

Power-Efficient Gathering in Sensor Information Systems (PEGASIS):

PEGASIS is an extension of the LEACH protocol, which forms chains from sensor nodes so that each node transmits and receives from a neighbor and only one node is selected from that chain to transmit to the base station (sink). The data is gathered and moves from node to node, aggregated and eventually sent to the base station. The chain construction is performed in a greedy way. PEGASIS [14] avoids cluster formation and uses only one node in a chain to transmit to the BS (sink) instead of using multiple nodes. A sensor transmits to its local neighbors in the data fusion phase instead of sending directly to its CH as in the case of LEACH. When a sensor fails or dies due to low battery power, the chain is constructed using the same greedy approach by bypassing the failed sensor. Hierarchical PEGASIS: An extension to PEGASIS, called Hierarchical-PEGASIS was introduced with the objective of decreasing the delay incurred for packets during transmission to

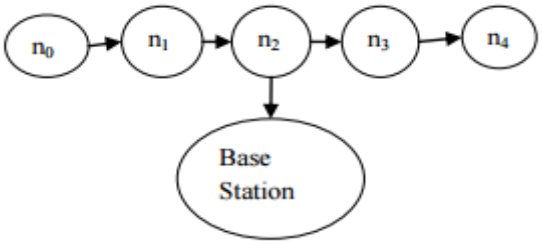

FIGURE 3. CHAINING IN PEGASIS

The BS. H-PEGASIS proposes a solution to the data gathering problem by considering energy x delay metric. Energy Balancing PEGASIS (EB-PEGASIS): EBPEGASIS is an energy efficient chaining algorithm in which a node will consider average distance of formed chain. If the distance from closest node to its upstream node is longer than distance threshold, the closest node is a far node. If the closest node joins the chain, it will emerge a long chain. In this condition, the far node will search a nearer node on formed chain. Through this method, the new protocol EB-PEGASIS can avoid long chain effectively. It not only saves energy on sensors, but also balances the energy consumption of all sensor nodes.

Hybrid, Energy-Efficient Distributed Clustering (HEED):

HEED extends the basic scheme of LEACH by using residual energy and node degree as a metric for cluster selection to achieve power balancing. It operates in multi-hop networks, using an adaptive transmission power in the inter-clustering communication. HEED was proposed with four primary goals namely

(i) prolonging network lifetime by distributing energy consumption

(ii) terminating the clustering process within a constant number of iterations

(iii) Minimizing control overhead, and Producing well distributed CHs and compact clusters. In HEED, the propose algorithm periodically selects CHs according to a combination of two clustering parameters. The primary parameter is their residual energy of each sensor node and the secondary parameter is the intra-cluster communication cost as a function of cluster density or node degree (i.e. number of neighbors). The primary parameter is used to select an initial set of CHs while the secondary parameter is used for breaking ties. The HEED clustering improves network lifetime over LEACH clustering because LEACH randomly selects CHs, which may result in faster death of some nodes.

The important features of this protocol are as follows:

- HEED distribution of energy extends the lifetime of the nodes within the network thus stabilizing the neighboring node.
- HEED does not require special node capabilities, such as location-awareness
- HEED does not make assumptions about node distribution. The nodes also automatically update their neighbour sets in multi-hop networks by periodically sending and receiving messages. It operates correctly even when nodes are not synchronized.
- The nodes only require local (neighborhood) information to form the clusters.

Threshold Sensitive Energy Efficient Sensor Network Protocol (TEEN):

TEEN is a hierarchical clustering protocol, which groups sensors into clusters with each led by a CH. The sensors within a cluster report their sensed data to their CH. The CH sends aggregated data to higher level CH until the data reaches the sink. Thus, the sensor network architecture in TEEN is based on a hierarchical grouping where closer nodes form clusters and this process goes on the second level until the BS (sink) is reached. TEEN uses a data-centric method with hierarchical approach [13].

The main features of this protocol are as follows:

- Time critical data reaches the user almost instantaneously.
- The soft threshold can be varied, depending on the criticality of the sensed attribute and the target application.
- A smaller value of the soft threshold gives a more accurate picture of the network, at the expense of increased energy consumption.
- At every cluster change time, the attributes are broadcast afresh and so, the user can change them as required

Adaptive Threshold Sensitive Energy Efficient Sensor Network Protocol (APTEEN):

APTEEN aims at both capturing periodic data collections (LEACH) and reacting to time-critical events (TEEN). Thus, APTEEN is a hybrid clustering-based routing protocol that allows the sensor to send their sensed data periodically and

react to any sudden change in the value of the sensed attribute by reporting the corresponding values to their CHs. CHs also perform data aggregation in order to save energy. APTEEN supports three different query types namely

(i) historical query, to analyse past data values
(ii) one-time query, to take a snapshot view of the network
(iii) Persistent queries, to monitor an event for a period of time. Energy dissipation will be lower and a large number of sensors alive in APTEEN.

V SOFTWARE USED AND SIMULATION RESULT

Software NS-2

We use NS-2 (2.35), a network simulation tool to simulate wireless communication network. NS2 is discrete event simulator developed. It provides a good platform for wsn simulation. The random way point model is selected as a mobility model in a rectangular field (1000*1000m2). LEACH, PEGASIS, TEEN, HEED is used for simulation at network layer. Nodes send constant bit rate (CBR) traffic at varying rates.

The performance of Energy Efficient based Cluster protocol in Wireless Sensor Network (WSN) is being estimated with the help of simulation on network simulator-2.

Following results will be calculated by using performance .awk script. Using the output we plotted the bar graphs of following parameters .The result is carried out by NS-2 Simulator using following Parameters.

- Throughput
- Packet Delivery Ratio
- Energy Consumption
- Average End to End Delay
- Normalized Over Load

CONCLUSION

One of the main challenges in the design of routing protocols for WSNs is energy efficiency due to the scarce energy resources of sensors. The energy consumption of the sensors is dominated by data transmission and reception. Therefore, routing protocols designed for WSNs should be as energy efficient as possible to prolong the lifetime of individual sensors, and hence the network lifetime. The protocols discussed have individual advantages and pitfalls. Based on the topology, the protocol and routing strategies can be applied. For realization of sensor networks, it is needed to satisfy the constraints introduced by factors such as fault tolerance, scalability, cost, topology change, environment, and power consumption. Routing in sensor networks is a new research area, with a limited but rapidly growing set of results. In this paper, hierarchical based routing protocols are discussed on the basis of network structure. They have the common objective of trying to extend the lifetime by reducing the energy consumption of the sensor network. Hierarchical based techniques have special advantage of scalability and efficient communication. Hierarchical routing maintains the energy consumption of sensor nodes and performs data aggregation which helps in decreasing the number of transmitted messages to base station. Most of the routing protocols require location information for sensor nodes in wireless sensor networks to calculate the distance between two particular nodes on the basis of signal strength so that energy consumption can be estimated. Many issues and challenges still exist that need to be solved in the sensor networks.

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