Scientific Journal of Impact Factor(SJIF): 3.134

e-ISSN(O): 2348-4470
p-ISSN(P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 2,Issue 5, May -2015

ROUTING PROTOCOLS FOR WIRELESS SENSOR NETWORKS

Prof Arvind S Kamble[1], Ms Deepika D Patil[2]

[1]Department of Computer Science and Engineering, SSDCT's Group of Institution
[2]Department of Computer Science and Engineering, SSDCT's Group of Institution

Abstract—Wireless Sensor Network is one of the emerging technologies. The recent advances and the convergence of micro electro-mechanical systems technology, integrated circuit technologies, microprocessor hardware and nano Technology, Wireless communications, Ad-hoc networking routing protocols, distributed signal processing, and embedded systems have made the concept of Wireless Sensor Networks (WSNs)[1]. In Wireless sensor network, sensor nodes are used for gathering data and transmitting to sink but sensor nodes has limited energy and communication ability. So, it is important to design a routing protocol for WSNs[2]. In this paper we have demonstrated on different types of routing protocol such as Flat protocol, Hierarchical Protocol, Location based Protocol which are mainly used for consumption of more energy as to increase the network life time.

Keywords: WSN, Sensor, Routing protocols, MEMS

I. INTRODUCTION

Recent advances in micro-electro-mechanical systems (MEMS) and low power and highly integrated digital electronics have led to the development of micro sensors[2]. Some examples include distribution of thousands of sensors and wires over strategic locations in a structure such as an airplane, such that the conditions can be constantly observed both from the inside and the outside and a real-time indication can be given when the monitored structure is about to fail. A sensor network is a network made up of smallest disposable low power devices, called nodes, these nodes are spatially distributed in such a way they are capable to perform based on application-oriented global task. These nodes themselves form a network just by communicating with all the nodes directly or through other nodes. One or more than one nodes among them will serve as sink that are capable of communicating with the user either directly or through the existing wired networks. These tiny sensor nodes, which consist of sensor on them , on board processor for data processing, and communicating components, leverage the idea of sensor networks based on collaborative effort of a large number of nodes figure 1 shows the structural view of a sensor network in which sensor nodes are present. Each node typically consists of the four components: sensor unit, central processing unit (CPU), power unit, and communication unit. They are assigned with different tasks

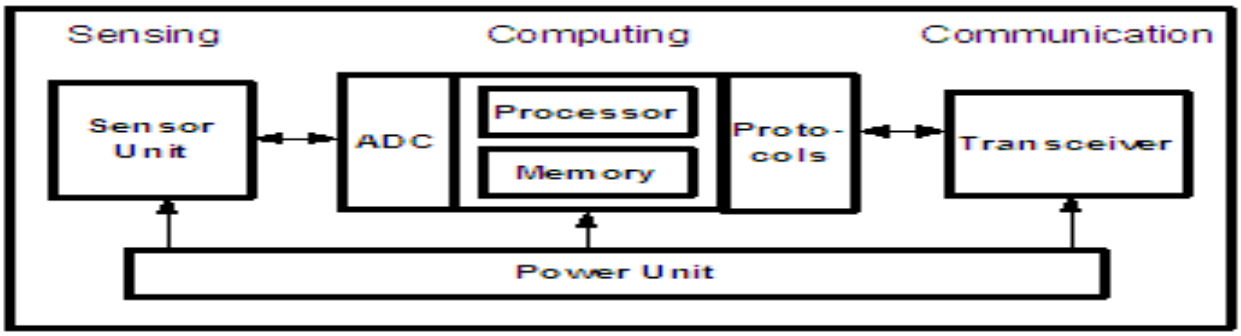


Figure 1: Structure of Sensor Node

Each node mainly consists of the four components: sensor unit, central processing unit (CPU), power unit, and communication unit. Each of this unit has assigned its own particular task. The sensor unit consists of sensor and ADC (Analog to digital Converter). The responsibility of sensor network is to collect the information from the clients as on request of the ADC, and then returning the analog data that has sensed. ADC is a translator that tells the CPU what the sensor unit has sensed, and also informs the sensor unit what to do[1]. Communication unit is tasked to receive command or query from and transmit the data from CPU to the outside world. CPU is the most complex unit. It interprets the command or query to

ADC, monitors and controls power if necessary, processes received data, computes the next hop to the sink, etc. Power unit supplies power to sensor unit, processing unit and communication unit.

The basic goals of a WSN are to: (i) determine the value of physical variables at a given location, (ii) detect the occurrence of events of interest, and estimate parameters of the detected event or events, (iii) classify a detected object, and (iv) track an object. Thus, the important requirements of a WSN are: (i) use of a large number of sensors, (ii) attachment of stationary sensors, (iii) low energy consumption, (iv) self organization capability, (v) collaborative signal processing, and (vi) querying ability [1].

Routing in sensor networks is very one of the challenging task because of its several characteristics that differentiate it from contemporary communication and wireless ad-hoc networks. First thing is that it is not possible to build a addressing scheme for a small number of sensor nodes. Therefore, classical IP-based protocols cannot be applied to sensor networks. Second, in contrary to typical communication networks almost all applications of sensor networks require the flow of sensed data from multiple regions (sources) to a particular sink. Third, generated data traffic has significant redundancy in it since multiple sensors may generate same data within the vicinity of a phenomenon. Such redundancy needs to be exploited by the routing protocols to improve energy and bandwidth utilization. The last criteria is sensor nodes are highly constrained in terms of transmission power, on-board energy, processing capacity and storage and thus require careful resource management [1].

II ROUTING PROTOCOL CLASSIFICATION

2.1. Data Centric Routing Protocol

In WSN there are different types of routing protocols which are specified based on the different task that has been provided to it. Each specific protocol is doing its task based on the distribution and collecting of data the routing protocols has been developed. The following are the routing protocols described. The figure shows the structure of classification of routing protocols

2.1.1Sensor Protocols for Information via Negotiation (SPIN):

A protocol which belongs to family of adaptive protocols called Sensor Protocols for Information via Negotiation (SPIN) that disseminates all the information at each node to every node in the network assuming that all nodes in the network are potential base-stations. Which helps user to create any node and also get the required information as soon as possible? The SPIN family of protocols uses data negotiation and resource-adaptive algorithms. Nodes running SPIN assign a high-level name to completely describe their collected data (called meta-data) and perform meta-data negotiations before any data is transmitted SPIN has other special category access the current energy level of the node and adapts the protocol it is running based on how much energy is remaining. The SPIN family is designed to address the deficiencies of classic flooding by negotiation and resource adaptation. The SPIN family of protocols is designed based on two basic ideas:

1. Sensor nodes operate more efficiently and conserve energy by sending data that describe the sensor data instead of sending all the data; for example, image and sensor nodes must monitor the changes in their energy resources.
2. Conventional protocols like flooding or gossiping based routing protocols [6] waste energy and bandwidth when sending extra and un-necessary copies of data by sensors covering overlapping areas. The drawbacks of flooding include implosion, which is caused by duplicate messages sent to the same node, overlap when two nodes sensing the same region will send similar packets to the same neighbor and resource blindness by consuming large amounts of energy without consideration for the energy constraints. Gossiping avoids the problem of implosion by just selecting a random node to send the packet to rather than broadcasting the packet blindly. However, this causes delays in propagation of data through the nodes [3].

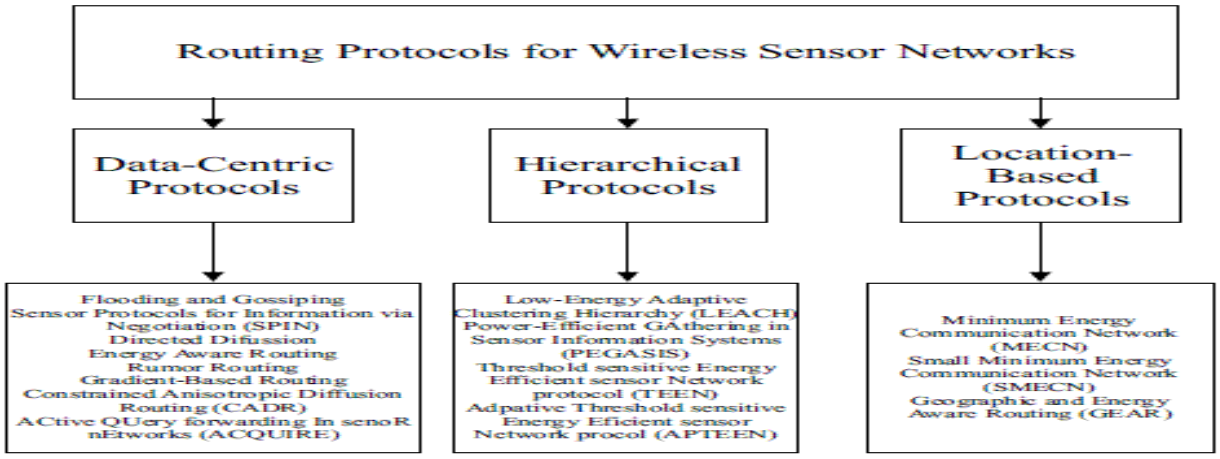
2.2 Hierarchical routing

Hierarchical or cluster-based routing, originally proposed in wireless networks, which is an techniques with some advantages related to scalability and efficient communication. As such, the concept of hierarchical or cluster-based routing, proposed in wireless networks, as a well-known techniques with advantages related to scalability and

efficient communication. As such, the concept of hierarchical routing is also utilized to perform energy efficient routing in WSNs. In a hierarchical architecture, the nodes can be used to process the data and send the information while low energy nodes can be used to perform the sensing. This means that creation of clusters and assigning special tasks to cluster heads can greatly contribute to overall system scalability, lifetime, and energy efficiency. Hierarchical routing is one of the efficient way to lower energy consumption within a cluster and by performing data aggregation and fusion in order to decrease the number of transmitted data in the form of messages to the Base Station. Hierarchical routing is mainly two-layer routing where one layer is used to select cluster heads and the other layer is used for routing. However, most techniques in this category are not about routing, rather on "who and when to send or process/aggregate" the information, channel allocation etc., which can be orthogonal to the multihop routing function routing is also utilized to perform energy efficient routing in WSNs. In a hierarchical architecture, higher energy nodes can be used to process and send the information while low energy nodes can be used to perform the sensing in the proximity of the target. This means that 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 and by performing data aggregation and fusion in order to decrease the number of transmitted messages to the BS. Hierarchical routing is mainly two-layer routing where one layer is used to select cluster heads and the other layer is used for routing. However, most techniques in this category are not about routing, rather on "who and when to send or process/aggregate" the information, channel allocation etc, which can be [3].

2.2.1Power-Efficient Gathering in Sensor Information Systems (PEGASIS):

In an enhancement over LEACH protocol was proposed. The protocol, which is as called Power-Efficient Gathering in Sensor Information Systems (PEGASIS), is a one of the optimal chain-based protocol as such. The main idea of the protocol is to increase network lifetime, nodes need only communicate with their closest neighbors and they take turns in communicating with the base-station. When one of the rounds of all nodes communicating with the base-station ends, a new round will start and so on. This reduces the power required to transmit data per round as the power draining is spread uniformly over all nodes. Hence, PEGASIS has two main objectives. First, increase the lifetime of each node by using collaborative techniques and as a result the network lifetime will be increased. Second, allow only local coordination between nodes that are close together so that the bandwidth consumed in communication is reduced. Unlike LEACH, PEGASIS avoids cluster formation and uses only one node in a chain to transmit to the BS instead of using multiple nodes [3].



2.3 Location Based Protocols

In this routing, sensor nodes are given addresses with respect to their locations. The distance between neighboring nodes is estimated on the basis of strength of incoming signals. Relative coordinates of neighboring nodes can be obtained by exchanging such information between neighbors [2], [3], [4]. Alternatively, the location of nodes may be available directly by communicating with a satellite, using GPS, if nodes are well equipped with a small low power GPS receiver [25].In a view to save energy, the location nodes can go to sleep if there is no activity to be done. More energy savings can be obtained by having as many sleeping nodes in the network as possible. The problem of designing period schedules for each node in a localized manner was addressed in.

2.3.1Geographic and Energy Aware Routing (GEAR):

This is one of location based routing protocol the use of geographic information while disseminating queries to appropriate regions since data queries often include geographic attributes. The protocol, called Geographic and Energy

Aware Routing (GEAR)[5], uses energy aware and geographically-informed neighbor selection heuristics to route a packet towards the destination region. The key idea is to restrict the number of interests in directed diffusion by only considering a certain region rather than sending the interests to the whole network. By doing this, GEAR can conserve more energy than directed diffusion. In recursive geographic forwarding approach, the node that first receives the query request within the target region splits the target region into several sub-regions and forwards the query request to the centers of all sub-regions. Similarly, the node nearest to the center of a sub-region, upon receiving the query request, further splits the sub-region into several smaller ones and forwards the query request. This recursive splitting and forwarding procedure is repeated until a node finds itself the only one inside the sub-region. After the forwarding procedures in all sub-regions finish, the entire recursive procedure terminates. This approach is better suitable for the applications where the nodes are densely deployed [10].

III CONCLUSION

The routing algorithms based on location information are an important subject in the research of routing protocols. In this paper, the concept explained is Routing protocols in wireless sensor networks. The Ad hoc network contains the sensors whose main purpose is to sense the information coming inside in form signals to process the data. Here in wireless network the sensor purposes and function and different types of routing protocols and the application of this protocol are explained.

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