Volume 5, Issue 6, June 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

A Survey of Routing Protocols in Wireless Sensor Network

Ankit Aggarwal, Mahesh Kumar
Department of CSE, Monad University
Hapur, India

Abstract: Wireless sensors nodes are made up of small electronic devices which are capable of sensing, computing and transmitting data from harsh physical environments like a surveillance field[2]. These sensor nodes depend on batteries for energy, which get depleted at a faster rate because of the computation and communication operations they have to perform[4]. Communication protocols can be designed to make efficient utilization of energy resources of a sensor node and to obtain real time functionality[3,5]. The routing techniques are classified into three categories based on the underlying network structure: flat, hierarchical, and location-based routing. Furthermore, these protocols can be classified into multipath-based, query-based, negotiation-based, QoS-based, and coherent-based depending on the protocol operation[5,4]. In this paper, we give a survey of routing protocols for Wireless Sensor Network and compare their strengths and limitations.

Keywords: Wireless Sensor Networks; Survey; Routing Protocols.

I. INTRODUCTION

Advances in wireless communication made it possible to develop wireless sensor networks (WSN) consisting of small devices, which collect information by cooperating with each other. These small sensing devices are called nodes and consist of CPU (for data processing), memory (for data storage), battery (for energy) and transceiver (for receiving and sending signals or data from one node to another). The size of each sensor node varies with applications. .Its cost depends on its parameters like memory size, processing speed and battery [1].wireless sensor networks are widely used in the commercial and industrial areas such as for e.g. environmental monitoring, habitat monitoring, healthcare, process monitoring and surveillance[2]. For example, in a military area, we can use wireless sensor networks to monitor an activity. If an event is triggered, these sensor nodes sense it and send the information to the base station (called sink) by communicating with other nodes. The use of wireless sensor networks is increasing day by day and at the same time it faces the problem of energy constraints in terms of limited battery lifetime. As each node depends on energy for its activities, this has become a major issue in wireless sensor networks[3]. The failure of one node can interrupt the entire system or application. Every sensing node can be in active (for receiving and transmission activities), idle and sleep modes. In active mode nodes consume energy when receiving or transmitting data. In idle mode, the nodes consume almost the same amount of energy as in active mode, while in sleep mode, the nodes shutdown the
radio to save the energy[5].

II. SENSOR NETWORK APPLICATIONS

Sensor nodes can be used for continuous sensing, event detection, event ID, and local control of actuators .The concept of micro sensing and wireless connection of these nodes promise many new application areas . We categorize the applications into military, environmental, health, home, and other commercial areas.

A. Military Applications: Wireless sensor networks can be an integral part of military command, control, communication, computing, intelligence, surveillance and targeting systems[4]. The rapid deployment, fault tolerance and self organization characteristics of sensor networks make them a very promising sensing technique for military[5]. Various military applications of sensor networks are monitoring friendly forces,equipments and biological and chemical attack detection.

B. Environmental Applications: Some environmental applications of sensor network include tracking the movement of birds , small animals and insects; monitoring environmental conditions that affect crops and livestock ;macro instruments for large scale earth monitoring and planetary exploration.

C. Health Applications: Wireless sensor networks can be used to monitor and track elders and patients for health care purposes, which can significantly relieve [3]the severe shortage of health care personnel and reduce the health care expenditures in the current health care systems. For example sensors can be deployed in a patient's home to monitor the behaviors of the patient. It can alert doctors when the patient falls and requires immediate medical attention.

D. Home Applications: Home automation; as technology advances , smart sensor nodes and actuators can be buried appliances , such as vacuum cleaners , micro wave ovens , refrigerators and VCRs[5] . These sensor nodes inside the domestic devices can interact with each other and with a external network via the internet or satellite.

E. Agriculture: Using wireless sensor networks within the agricultural industry is increasingly common; using a wireless network frees the farmer from the maintenance of wiring in a difficult environment. Gravity feed water systems can be monitored[3] using pressure transmitters to monitor water tank levels, pumps can be controlled using wireless I/O devices and water use can be measured and wirelessly transmitted back to a central control center for billing.

F. Structural Monitoring: Wireless sensors can be used to monitor the movement within buildings and infrastructure such as bridges, flyovers, embankments, tunnels etc... enabling Engineering practices to monitor assets remotely without the need for costly site visits, as well as having the advantage of daily data, whereas traditionally this data was collected weekly or monthly, using physical site visits, involving either road or rail closure in some cases.

G. Other Commercial applications: Some of the commercial applications are monitoring material fatigue; building virtual keyboards ; managing inventory; monitoring product quality; constructing smart office spaces ; environmental control in office buildings ; robot control and guidance in automatic manufacturing environment; interactive toys ; interactive museums ; factory process control and automation; monitoring disaster area[2,6].

III. SENSOR ARCHITECTURE DESIGN

The main task of a wireless sensor node is to sense and collect data from a certain domain, process them and transmit it to the sink where the application lies[2]. However, ensuring the direct communication between a sensor and the sink may force nodes to emit their messages with such a high power that their resources could be quickly depleted[6].

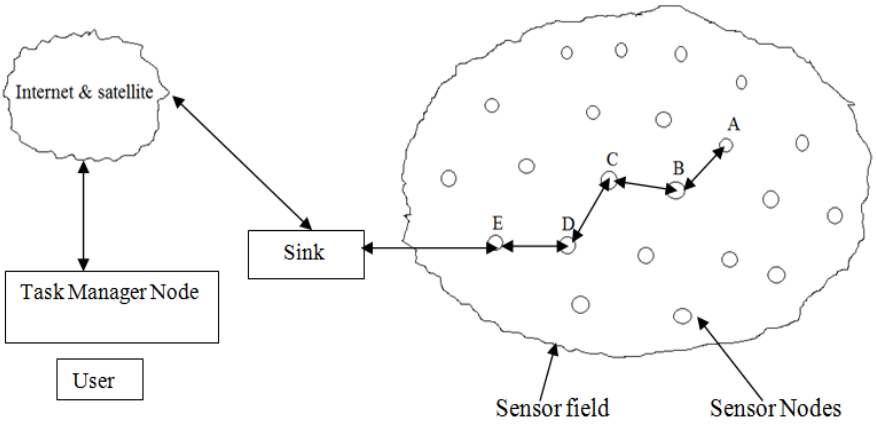

Figure 1: Communication Architecture of Wireless Sensor Networks

Therefore, the collaboration of nodes to ensure that distant nodes communicate with the sink is a requirement. In this way, messages are propagated by intermediate nodes so that a route with multiple links or hops to the sink is established [4,6]. Communication architecture of wireless sensor networks consists of user, sink, and sensor node shown in Figure 1**.** In the communication architecture, a user connects legacy networks and communicates a sink through a task manager node[6]. A sink instructs sensor nodes to carry out tasks interested by the user, and sensor nodes gather data and forward it to the sink by wireless multi-hop communication manner [3,10].

IV. ROUTING PROTOCOLS

WSN routing protocols can be subdivided into two broad categories, network architecture based routing protocols and operation based routing protocols [6, 11].

- Structure Based Routing Protocols
  - Flat Routing
  - Hierarchical Routing
  - Location-based Routing
- Protocol Operation Based Routing Protocols
  - Multi path-based
  - Query-based

A. Flat Routing: This is a routing technique in which all the sensor nodes play the same roles such as collecting data and communication with the sink, i.e. all the data collected in the remote area can be same or duplicated[7] .

B. Hierarchical Routing: In this routing technique all the routing sensors in the network are clustered and a cluster head collects and aggregates the data and checks for redundancy of the data that is collected before it is sent to the sink[5]. This saves communication and processing work and also saves energy[8].

C. Location-based Routing: In location-based protocols, sensor nodes are addressed by means of their locations[5]. Location information for sensor nodes is required for sensor networks to calculate the distance between two particular nodes so that energy consumption can be estimated[9].

*D. Multi path-based:*These protocols are efficient in handling multiple paths. Nodes send the collected data on multiple paths rather than using a single path[4]. The reliability and fault tolerance of the network increases as there is, as long as it is possible, an alternative path when the primary path fails[8].

*E. Query-based:*Query-based routing propagates the use of queries issued by the base station. The base station sends queries requesting for certain information from the nodes in the network[8]. A node, which is responsible for sensing and collecting data, reads these queries and if there is a match with the data requested in the query it starts sending the data to the requested node or the base station.

V. COMPARISON OF ROUTING PROTOCOLS:

- *LEACH (Low Energy Adaptive Clustering Hierarchy)*
- *PEGASIS (Power efficient Gathering Sensor Information System)*
- *SPIN (Sensor Protocols for Information via Negotiation)*
- *Geographic and Energy-Aware Routing (GEAR)*
- *Geographic Adaptive Fidelity (GAF)*
- Minimum Energy Communication Network(MECN)

An evaluation is done on all the protocols depending upon their operation using the sensor nodes in the network. Table-I shows the operability of protocols with regard to Latency, Scalability, Classification and Energy Awareness.

Table -I

Characteristics	**Latency**	**Scalability**	**Classification**	**Energy Awareness**
LEACH	*Low*	*High*	Hierarchical	*High uses clustering technique to save energy*
PEGASIS	*High*	*High*	Hierarchical	*High it forms chain using nodes to reach the base station*
SPIN	*Moderate*	*Moderate*	Flat	*Moderate, The nodes which have energy resources only take part in transmission*
GEAR	*Moderate*	*Moderate*	Location	*Moderate, same path used until new path is calculated*
GAF	*Moderate*	*High*	Location	*High, Node use sleep, discovery, awake states*
MECN	*Moderate*	*Low*	Hierarchical	*Moderate, constructs sparse graph for every transmission*

V. CONCLUSION

In this paper,we studied important issues of routing which influencing sensor network design Although many routing protocols have been proposed in WSNs. The main aim behind the routing protocol design is to keep the sensors operating for a long time, thus extending the network life time[3]. In this paper, we compare and classify the routing protocols into two main categories: Structure based routing protocols and Protocol operation based routing protocols.

In future, this wide range of application areas will make sensor networks an integral part of our lives[4]. An important issue for routing protocols is the consideration of node mobility .Most of the current protocols assumes the sensor nodes and sink are stationary[7].

PEGASIS and LEACH are the examples of hierarchical routing protocols they are scalable to the network lifetime. SPIN and LEACH have enhanced data aggregation capability[8]. Power Efficient Gathering Sensor Information System is best one for providing scalability in terms of network lifetime[3,7]. Hence for future perspective of this work may be well focused on modifying any of the above routing protocols such that the modified protocol could minimize energy of the sensor network.

REFERENCES

[1] Jamal N. Al-Karaki Ahmed E. Kamal Dept. of Electrical and Computer Engineering Iowa State University, Ames, Iowa 50011 "Routing Techniques in Wireless Sensor Networks: A Survey".

[2] Pallavi S. Katkar, Prof. (Dr.) Vijay R. Ghorpade *Department of Computer Science, Shivaji University Kolhapur, India D.Y.Patil College of Engineering and Technology* "A Survey on Energy Efficient Routing Protocol for Wireless Sensor Networks*".*

[3] Jamal N. Al-Karaki Ahmed E. Kamal Dept. of Electrical and Computer Engineering Iowa State University, Ames, Iowa 50011 Email: fjkaraki, kamalg@iastate.edu "Routing Techniques in Wireless Sensor Networks: A Survey".

[4] Xiaofan Jiang, Jay Taneja, Jorge Ortiz, Arsalan Tavakoli, " An Architecture for Energy Management in Wireless Sensor Networks".

[5] Giuseppe Anastasi*, Marco Conti#, Mario Di Francesco*, Andrea Passarella# "Energy Conservation in Wireless Sensor Networks: a Survey".

[6] Luis Javeir Garcia Villalba, Ana Lucila Sandoval Oroco Alicia Trivino Cabera and Claudia Jacy Barenco Abbas, "routing Protocols in Wireless Sensor Net works" Sensors2009.

[7] Gowrishankar. S, T .G.Basavaraju, Manjaiah D.H, Subir Kumar Sarkar, "Issues In Wireless Sensor Net works" WCE 2008.

[8] Ms. Parul Tyagi Ms. Surbhi Jain *Department of ECE Department of ECE JECRC, Jaipur, India* "Comparative Study of Routing Protocols in Wireless Sensor Network ".

