



Comparative study on routing techniques in wireless sensor networks: A survey

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Abstract

This Spin is a flood based routing protocol in WSN, it transfer Meta data between nodes with the help of three stages ADV, REQ and DATA. ADV use for advertisement of data and when a node interested in data it reply by REQ message and get data by DATA message this method somehow remove data redundancy in network but SPIN mechanism not guarantee the data delivery and also not work for data intrusion. In our method node send a packet by which it get energy level of node or hop count of all nodes and node-id of neighbor node after that all node maintain a SEL queue (shortest energy level). With the help of that queue source node create route to base station, if there is any node in a path who is not interested in accepting data or have higher energy level than source node send a priority packet to that particular node so that it accept the data and include itself in route.

Keywords: SPIN, WSN, routing protocol, and data centric

1. Introduction

With advances in information technology, Wireless Sensor Network (WSN) is becoming a rapidly developing area in both research and application. WSN combines computing, communications and sensor technology together and has been applied in many different areas such as military, environmental monitoring, health care applications, etc. Many small wireless sensor node come together to monitor large area of physical environment or system in form of wireless network, A sensor network is composed of hundreds or thousands of static or mobile sensors, which are scattered randomly in some regions. Its purpose is to acquire process and transmit data within the geographic area covered by the network and report the monitored situations to the users ^[1]. Sensor node contain three component: a sensing subsystem for data acquisition from the physical surrounding environment, a processing subsystem for local data executing and storage, and a wireless communication subsystem for data transmission. A Energy source supplies the energy needed by the device to perform the programmed task. It energy source often consists of a battery with a limited energy budget. It is difficult to recharge the battery power, due to nodes deployed in a hostile environment ^[2]. Sensor not only communicates with each other but also communicate with base station for sharing gathered information using their wireless radio. The sensor nodes may be simple to monitor a single physical phenomenon or complex, which may combine many different sensing techniques (e.g., acoustic, optical, magnetic) ^[3]. The use of wireless sensor networks increase in last few years, because of increased ability to monitor and control physical environment from remote locations ^[4]. Illustrate the difference between ad-hoc and wireless sensor network are outlined below

- The number of sensor nodes in sensor network can be several orders magnitude than ad-hoc network.
- Sensor nodes are densely deployed.
- Sensor nodes are prone to failure.
- The topology of sensor network change very frequently.
- Sensor node mainly uses broadcast communication

where as ad-hoc use point to point communication.

- Sensor nodes are limited in power, computational, memory.
- Sensor node does not have global identification because of the large amount of overhead and large.

2. Routing

Routing in sensor network is very challenging due to lots of feature that differentiate them from current communiqué and wireless ad-hoc network. It's not possible to construct a worldwide addressing structure for the purpose of the organization of the complete no. of sensor device nodes. Therefore, classical IP address is based on protocols cannot be applied to the sensor networks. And second, in divergent to classical communication networks almost every application of sensor device networks necessitates the flow of the sensed knowledge from several regions (sources) to a specified sink. Third, produced knowledge traffic has significant idleness in it since multiple sensors may produce similar knowledge within the district of a circumstances. Such as redundancy wants to be the demoralized by the routing protocols to the purpose of the increase energy and the bandwidth operation. Fourth, sensor nodes are strongly controlled in terms of spread power, on-board energy, treating capability and storage and thus want careful source organization.

Due to such differences routing algorithm classified in three categories first one is network organization second one is route discovery and third one is protocol operation.

One of the major issues of WSN routing protocols is energy efficiency routing protocol which has significant impact on overall network. It suffers from various obstacles arising from computational power ^[5], limited energy and communication resources available to the sensors in the network.

Routing protocols in wireless sensor are dividing in three categories:

1. Flat based protocols
2. Hierarchical protocols

3. Location based protocols

3. Flat based protocol

The leading type of the routing protocols is the multi-hop flat routing protocols. In flat networks, every node classically acting the similar part and sensor nodes cooperate composed to the purpose of executing the sensing mission. Because of the extensively huge no. of such nodes, it is no feasible to then allocate a worldwide identifier to every node. This attention has led to the knowledge centric routing, where the BS sends questions to the various regions and then waits for knowledge from the sensors situated in the particular regions. Since knowledge is being requested through questions, attribute based specifying is required to specify the properties of knowledge.

- A. Sensor Protocols for Information via Negotiation (SPIN)
 - a. SPIN-BC
 - b. SPIN-PP
 - c. SPIN-EC
 - d. SPIN-RL
- B. Directed Diffusion
- C. Rumor routing
- D. Minimum Cost Forwarding Algorithm (MCFA)
- E. Gradient-Based Routing
- F. IDSQ

A. Spin

Sensor nodes function much efficiently and the conserve energy by the sending document that is define the sensor document instead of transfer every the document for example, sensor nodes and image must monitor the modifications in their energy resources. Other Conventional protocols similar gossiping or flooding which is based on routing protocols [6] unwanted energy and the Bandwidth when sending additional and unwanted duplicates of document by the sensors wrapper overlapping parts. The disadvantages of the overflowing include the implosion, which is the produced by matching data sent to the similar node, overlap when the two nodes sensing the similar region will send same packages to the similar neighbor and resource blindness by consume huge quantities of the energy without Consideration for energy restraints. Gossiping avoids the problem of the implosion by the just choosing a random node is to send the packet to the rather than distribution the packet blindly. However, this is causes delays in propagation of document through the nodes.

B. Directed Diffusion

It contains various components, document is named using attribute-value pairs, a sensing mission is spread throughout sensor network as attention for named document, this dissemination sets up gradients within the network planned to "draw" occasions, occasions starting flowing towards the originators of interests along multiple ways, sensor network reinforces one, or a minor no. of these ways.

C. Rumor routing

The Rumor Routing procedure is intended to fill the region between question flooding and occasion flooding. It is simply useful if the no. of questions compared to the number of occasions is between the two joining points. An application that knows about this ratio use a hybrid of Rumor routing and flooding to apply the best available power. For those, reliable

delivery is not an issue, can use the application algorithm to trade off quality of service versus required energy.

D. Minimum cost forwarding algorithm (MCFA)

Minimum Cost Forwarding has been proposed by Ye *et al.* [7] as an efficient protocol appropriate for simple WSN with limited resources. The aim of MCF is to establish a means of de along a minimum cost path to an interested client node or base station. MCF exploits the fact that the direction of routing is permanently well nodes towards a base station. A sensor node not assential possess a unique ID nor store a routing table. The cost of forwarding a message to the base station is the sole information required by a node to implement the MCF protocol. The simplicity of the MCF is an advantage for sensor nodes with limited processing capability and/or memory.

E. Gradient-Based Routing:

The key idea in the GBR is to remember the no. of hops when the attention is dispersed through the entire network. As such, all nodes can analyze a parameter known the height of the node, which is the smallest no. of hops to reach the base station. neighbor is considered the gradient on that link. A pack is the forwarded on the link with the major gradient. GBR uses few supplementary methods such as document aggregation and traffic distribution in order to regularly distribute the traffic over the particular network. When multiple way pass through a node, which performances as a communicate node, that communicate node may combine document.

F. IDSQ

CADR goals to be a common form of directed diffusion. The key knowledge is to the demand sensors and the route document in the network such that the knowledge improvement is max while latency and bandwidth are min. CADR disperses questions by applying a collection of knowledge conditions to select which sensors can find the document. This is obtained only by activating the sensors that are closed to the specific event and dynamically adjusting data routes. The main modification from absorbed dispersal is the consideration of knowledge collection in totaling to the communication cost. In CADR, all nodes assesses data/cost objective And routes document based on the local data/cost incline and end-user supplies. Approximation philosophy was applied to perfect knowledge utility measure. In IDSQ, the quizzing node can control which node can provide the greatest valuable knowledge with the extra benefit of balancing the energy cost. However, IDSQ does not specifically define how the question and the knowledge are routed between sensors and the base station.

2. Hierarchical protocols

Hierarchical or cluster-based routing saves total energy consumption of WSN. In the architecture of hierarchical routing, cluster is formed as head node and is assigned to every cluster. The head nodes lead in their group having responsibilities to collect and aggregate data from their respective clusters and forwarded the aggregated data to the base station. This aggregation of data will greatly minimize consumption the energy in the network that will lead to increase the life time of sensor network The main idea of developing cluster based routing protocols is to reduce the network traffic towards the sink [8, 21]. The routing techniques

based on hierarchical protocols are :

- a. LEACH
- b. PEGASIS
- c. TEEN
- d. SMECN

a) Leach protocol

It is one of the most popular energy efficient clustering algorithm in wireless sensor network (WSN) for decreasing the power consumption. It includes distributed cluster information, in which leach arbitrarily select few cluster heads (CHs) and rotated this node to distribute the energy load in network. Leach performs on two tasks.

1. Selecting the cluster head(nodes),call the set up phase.
2. Maintaining the cluster during transmission of data, called steady phase.

b) Pegasis

It is an improved protocol over the Leach protocol, where the algorithm creates chains of sensor nodes, not making multiple nodes in clusters. Each node transmits and receives only from one of its closest node of its neighbors on the basis of their structure. By this, power of transmissions between the nodes is managed. The node performs data aggregation and send it the node in the chain that communicates with the sink. Every time in round a node is selected from the chain to communicate with the sink. With this the chain is build with a greedy algorithm.

c) Threshold-sensitive energy efficient protocols (Teen)

Teen^[42, 43] is a hierarchical clustering protocol, which groups sensors into clusters with each lead by a CH. The sensors within a cluster report their sensed data to their cluster head.

The CH forward aggregated data to higher level CH until the data reaches the sink. In TEEN, the sensor network architecture rely on a hierarchical grouping where closer nodes form clusters and this process goes on the another level until the base station (sink) is reached. *Small Minimum Energy Communication Network:*

3. Location based protocols

In this kind of routing protocols, the position of sensor nodes is used to route the data among network. Sensor nodes in the network are addressed by their locations. Information about locations helps in finding, selecting and maintaining the optimal route to forward data packets. It also depends on the frequent calculations of distance between nodes and the prediction of consumed energy level. This also depends on the location information of nodes i.e. frequently updated. In location based routing Power management process are useful For reducing the energy consumption level and prolong network life time by some nodes into sleep modes to its deactivation status. The benefits of location information based routing algorithm is the ease and optimization to manage the network as well as the control overhead of the network. The main disadvantage of location information based routing is the designing complexity of nodes in sleep mode. Location based routing is divided as GEAR and GPSR. GEAR (Geographical and Energy Aware Routing) [20] is an energy-efficient routing protocol proposed for routing queries to target regions in a sensor field. GPSR (Greedy Perimeter Stateless Routing) protocol is based on the algorithm that combines the greedy packet forwarding and parameter forwarding method. This protocol send the data packet in wireless datagram networks

Table 1: Classification and Comparison of routing protocols in WSNs.

Routing Protocols	Classification	Power Usage	Data Aggregation	Scalability	Query Based	Over head	Data delivery model	QoS
SPIN	Flat / Srcinitiated/ Data-centric	Ltd.	yes	Ltd	yes	Low	Event driven	No
DD	Flat/ Datacentric/ Dstinitiated	Ltd	yes	Ltd	yes	Lo w	Demand driven	No
RR	Flat	Low	yes	Good	yes	Low	Demand driven	No
GBR	Flat	Low	yes	Ltd	yes	Low	Hybrid	No
CAD R	Flat	Ltd	yes	Ltd	yes	Low	Continuously	No
ACQUIRE	Flat/Datacentric	Low	yes	Ltd	yes	Low	Complex query	No
Leac H	Hierarchic al /Dst- initiated /Node-centric	High	yes	Good	No	High	Cluster- head	No
Teen &Apteen	Hierarchic al	High	yes	Good	No	High	Active threshold	No
PEGASIS	Hierarchic al	Max	No	Good	No	Low	Chains based	No
VGA	Hierarchic al	Low	yes	Good	No	High	Good	No
SOP	Hierarchic al	Low	No	Good	No	High	Continuously	No
GAF	Hierarchic al /Location	Ltd	No	Good	No	Med	Virtual grid	No
SPAN	Hierarchic al /	Ltd	yes	Ltd	No	High	Continuously	No

3. Related Works

1. An Appraisal of Efficient Routing Protocols in Wireless Sensor Networks Sakshi, Dr. Rajiv Mahajan In wireless sensor network, sensor nodes has limited energy and communication ability in routing protocol. Routing protocol helps to increases network lifetime of wireless sensor network. This paper contains various existing routing protocol techniques.
2. An Efficient Routing Protocols for Canvassing Energy In Wireless Sensor Networks SAKSHI .This paper presents a review of well-known routing protocols. Due to limited energy of sensor nodes in Wireless sensor networks, It is important to design a routing protocols.

Routing protocol increases network lifetime. This paper discusses various existing routing protocol techniques.

3. Dependable SPIN in WSN: A Review Jitender Grover Wireless sensor network (WSN) is appropriate well-known since of its make use of in different applications of different areas such as background, protection, health check, home, medium and teaching. WSN is a arrangement without charge set of connections anywhere condition of request decide the network construction, topology and direction-finding protocols. Data communication in sensor network is achievable by means of the make possible of routing protocols. At this time are various routing protocols in WSN which make

available professional data release but dependability is unmoving a key limitation of WSN. At what time data is transmitted beginning foundation node to the go under the surface or Base Station (BS), some information packets possibly will misplaced due to a quantity of motivation such as breakdown of node, deceased node. Sometime node is not interested in forwarding data and drops the data packet. Different energy efficient protocols have been proposed but they do not ensure reliability. This paper studies the reliability issue.

4. Data Centric Based Routing Protocols for WSN: A Survey A. G. Gokula Kumar Sensor network are reasonably different beginning conventional networks in dissimilar ways: sensor networks contain strict power concerns, unnecessary low down-rate information, and a lot of-to-one flows. Routing protocols urbanized for additional ad hoc networks cannot be practical in a immediately procession in WSN for the reason that of the power restriction of the sensor nodes. Information-centric technologies are desirable to complete in-network aggregation of information to give way power-professional broadcasting Sensor networks are worn in numerous applications approximating location monitoring, physical condition, manufacturing organize units, and services applications in addition to in the an variety of computing environment. Because sensors the complete sensor nodule are succession automatic procedure, authority disbursement of nodes throughout show or behavior of packets affects the natural life of the whole network. In this paper us representation information-centric direction-finding and contrast its presentation with conventional nonstop direction-finding schemes.
5. A Survey on Routing Protocol of Wireless Sensor Network and its Application, Rizwanabanu Arifmiya Bhatti In focus on paper, we investigate the routing protocols. Protocol is classified according to their network stricter and their operation. Routing protocol has important features. Routing protocol is descriminate 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.
6. Survey on sensor protocol for information via negotiation (SPIN) protocol Vidhi S. Patel. Wireless sensor network is a collected works of sensor nodes which sense function specific data and send it to sink to execute some task. One of the major issues due to energy constraint in WSN is information broadcast. A lot of direction-finding protocols till day contain been projected to direction data capably in arrange to improve network natural life. Sensor Protocol in facilitate of in sequence via Negotiation (SPIN) is single of the frequent established information centric dissemination protocols. It professionally disseminates information among other nodes in the network. This protocol uses meta-data in favor of cooperation and eliminates the communication of the unfashionable information throughout the set of connections. This paper survey issues in SPIN protocol and give details on the subject of potential development of SPIN protocol.

4. Conclusion

Wireless sensor network is different from wireless network.

The routing techniques are classified into three categorized: flat, hierarchical, and location based routing protocols. Routing in WSN attracted most of the researchers. Because wireless sensor network is made up of thousands nodes which communicate with one another using hope by hope data transmission in network and having minimum amount of energy. In this paper a survey on routing techniques in WSN with review of various researchers is presented. The basic aim of the routing protocol is to transmit data from source to sink but sometimes data got lost in between the path. This originates the issue of reliability. A data centric protocol known as SPIN protocol is explained in this paper with its different versions which fulfill the offspring of energy, overlap, implosion and resource blindness. The enhancement done by the researchers are highlighted to make a protocol more reliable.

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