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A Review on Energy Aware Data Dissemination Protocol for Wireless Sensor Network

TARUN BAGGA[1], MAMTA GARG[2]

[1]M.tech Scholar
Dept. of Computer Science & Engineering
B.M.S.C.E, MUKTSAR
tarunbagga07@gmail.com

[2]Asst Prof
Dept. of Computer Science & Engineering
B.M.S.C.E, MUKTSAR
Mamtagarg104@gmail.com

Abstract: *Wireless Sensor Networks (WSNs) consists of numerous tiny sensors deployed at high density in regions requiring surveillance and monitoring. Data dissemination protocols are used to transfer the data from source node to sink node. The most important issue in wireless sensor network is to save sensor node's energy. Because sensor nodes are powered by battery, they communicate over a wireless medium and consume energy during data transmission. It is possible to minimize power consumption by designing an efficient algorithm. So our main aim is to save the energy of a network and also to maintain the quality of service. In this paper we discuss the various energy efficient schemes proposed by various authors for wireless sensor network and observe the effect of transmission range over several parameters of a network.*

Keywords: *Data Dissemination Protocol, Energy Awareness, WSNs, Data Centric Protocol.*

1. INTRODUCTION

Wireless Sensor Networks (WSNs) consists of numerous tiny sensors deployed at high density in regions requiring surveillance and monitoring. These sensors can be deployed at a cost much lower than the traditional wired sensor system. A typical sensor node consists of one or more sensing elements (motion, temperature, pressure, etc.), a battery, and microprocessor, low power radio trans-receiver, and limited memory. An important perspective of such networks is that the nodes are unattended, have limited energy and the network topology is unknown. Many design challenges that arise in sensor networks are due to the limited resources and their deployment in hostile environments.

Figure1.1. Shows the complexity of wireless sensor networks, which generally consist of a data acquiring network and a data distributing network, monitored and controlled by a management center[12]. The plethora of available technologies make even the selection component difficult, let of a consistent, reliable, robust overall system alone the design of consistent, reliable, robust overall system.

The property of sensor networks is the need of the sensors to reliably disseminate the data to the sink or the base station within a time interval that allows the user or controller application to respond to the information in a timely manner, as out of date information is of no use and may lead to disastrous results.

Another important attribute is the scalability to the change in network size, node density and topology. Sensor networks are very dense as compared to mobile ad hoc and wired networks. This is due to the fact that the sensing range is lesser than the communication range and hence more nodes are needed to achieve sufficient sensing coverage. Sensor nodes are required to be resistant to failures and attacks.

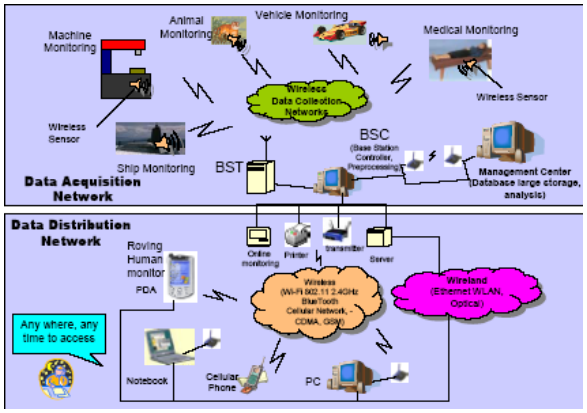

Figure 1.1: Wireless Sensor Networks

2. WIRELESS SENSOR NODES

Recent technological improvements have made the deployment of small, inexpensive, low-power, distributed devices, which are capable of local processing and wireless communication, a reality. Such nodes are called as sensor

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nodes. Each sensor node is capable of only a limited amount of processing. But when coordinated with the information from a large number of other nodes, they have the ability to measure a given physical environment in great detail. Thus, a sensor network can be described as a collection of sensor nodes which co-ordinate to perform some specific action. Unlike traditional networks, sensor networks depend on dense deployment and co-ordination to carry out their tasks.

Previously, sensor networks consisted of small number of sensor nodes that were wired to a central processing station. However, nowadays, the focus is more on wireless, distributed, sensing nodes. But, distributed, wireless sensing when the exact location of a particular phenomenon is unknown, distributed sensing allows for closer placement to the phenomenon than a single sensor would permit. Also, in many cases, multiple sensor nodes are required to overcome environmental obstacles like obstructions, line of sight constraints etc. In most cases, the environment to be monitored does not have an existing Infrastructure for either energy or communication. It becomes imperative for sensor nodes to survive on small, finite sources of energy and communicate through a wireless communication channel.

3. DATA DISSEMINATION PROTOCOLS

Data dissemination is the process by which queries or data are routed in the sensor networks. Data dissemination has many problems including; data propagation, energy balance, power savings. Proposed solutions for these problems are application-specific paradigms, which facilitate efficient delivery of sensed data to inquiring destination. Data centric approach is based on this concept. Different data dissemination protocols are discussed in rest of this chapter.

Goals of Robust Data Dissemination Protocols

- Fault tolerant
- Minimize energy drain on batteries
- Reduce redundant energy transmissions
- Distribute data between nodes as quickly as possible

3.1 Data Centric Protocols

In data-centric routing, the sink sends queries to certain regions and waits for data from the sensors located in the selected regions[13]. Since data is being requested through queries, attribute based naming is necessary to specify the properties of data. SPIN is the first data-centric protocol, which considers data negotiation between nodes in order to eliminate redundant data and save energy.

Later, directed diffusion has been developed and has become a breakthrough in data-centric routing. Then, many other protocols have been proposed either based on directed diffusion or following a similar concept. Data-centric protocols can be classified as:

- **Push Based**: Sensors push the data proactively towards the sink periodically.
- **Pull Based**: Sink queries sensors and asks for data.
- **Hybrid Push and Pull Based**: Sensors may indicate that it has the data (like push), interested nodes query for the data (pull), the data sources then send the data to the interested nodes.

3.2 Directed Diffusion

Directed diffusion is a data-centric communication paradigm where a sink (node requesting a service) sends out a request for data by broadcasting an interest to its neighbouring nodes. An interest refers to a named description of a service that a sink node requires. The neighbours subsequently broadcast the interest to their respective neighbours and this process is repeated until a “source” node, which is capable of servicing the request comes across the interest. As interests diffuse throughout the network, a node that receives an interest from a neighbouring node forms a gradient pointing to the sending node that indicates the direction in which data from a source node will eventually flow. The source node then generates data messages using its sensors, which propagate, back to the sink following the gradients formed along the paths through which the interests originally traversed. Every sink that receives data messages from more than one neighbour reinforces a particular neighbour so that subsequent data messages arrive only from the chosen neighbour. This chosen neighbour also performs the same procedure on its neighbouring nodes it received a data message from. This process is repeated until data messages propagate only along the reinforced path from source to sink. If the quality of data transmission from a certain neighbour deteriorates, a node can opt to negatively reinforce its current under-performing neighbour and reinforce another better-performing neighbour instead, in order to cope with varying network dynamics.

3.3 Flooding

In the flooding scheme, sources flood all events to every node in the network[4]. Flooding is a contrary case for directed diffusion, if the latter does not perform better than flooding does, it cannot be considered viable for sensor networks.

3.4 Omniscient Multicast

In the omniscient multicast scheme, each source transmits its events along a shortest path multicast tree to all sinks. Analysis of omniscient multicast, as well as do not account for the cost of tree construction protocols. Rather centrally compute the distribution trees and do not assign energy costs to this computation. Omniscient multicast instead indicates the best possible performance achievable in an IP-based sensor network without considering overhead. Omniscient multicast offers the

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advantage that it is not dependent on fixed multicast trees, as could be defined in fixed, wired topologies, but routes packets based on definition of information sinks. At each node, when the router layer receives a packet, it decides whether to pass the packet up the stack based on the sink table it maintains.

Omniscient multicast is unrealistic in that it assumes all route information is available at no cost.

4. RELATED WORK

- I.F. Akyildiz et al [1] present recent advancements in wireless communications and electronics, which have enabled the development of low–cost sensor networks. The sensor networks can be used for various application areas (e.g., health, military, home). For different application areas, there are various technical issues that researches are currently resolving. The current state of the art of sensor networks is discussed in this paper.

- A.Bharathidasan et al. [2] present various issues in sensor networks like energy efficiency, routing and localization. Authors describe various schemes and also propose future work in the areas of media access control, security and privacy.

- C.Intanagonwiwat et al[3] provide enhancement in processor, memory and radio technology that enable small and cheap nodes capable of sensing, communication and computation. Networks of such nodes can coordinate to perform distributed sensing of environmental phenomena. Authors explore the directed diffusion paradigm for such coordination. Directed diffusion is data centric in that all communication is for named data. All nodes in a directed diffusion-based network are applications-aware. This enables diffusion to achieve energy savings by selecting empirically good paths and by caching and processing data in-network. Explore and evaluate the use of directed diffusion for a simple remote-surveillance sensor network.

- C.Intanagonwiwat et al [4] explore directed-diffusion paradigm for designing distributed sensing algorithms. Many topics for preliminary evaluation of diffusion. First, directed diffusion has the potential for significant energy efficiency. Even with relatively unoptimized path selection, it outperforms an idealized traditional data dissemination scheme like omniscient multicast. Second, diffusion mechanisms are stable under the range of network dynamics considered. Finally, for directed diffusion to achieve its full potential, design of sensor radio MAC layers.

- M.Ditzel et al. [5] combine the advantages of data centric routing protocol like SPIN, directed diffusion and energy–efficient MAC protocols strengths are its energy-efficiency and its simplicity messages are transmitted using broadcasting only, reaching as many nodes as possible with the least energy. Furthermore, D3 easily accommodates energy–depended traffic balancing and data aggregation, crucial to prolong the lifetime of a sensor network.

- N.Hu et al. [6] compare the process a source routing directed diffusion (SR-DD), which is an improved directed diffusion, in order to avoid hotspot in the wireless sensor networks. The sink nodes make a choice in different paths based on the residual energy of nodes in these paths. The choice considers the energy consumption, which achieves the energy balance of the network. In the implement of SR-DD, the idea of label switching is introduced to avoid strong all node identifiers along the path, which reduces the overhead of transmitting information for path selecting to much low level, and finally shows that SR-DD outperforms directed diffusion in uniform energy utilization.

- L.Zhiyu et al[7] provide analysis of GRE-DD algorithm retains the function of conventional DD without any other extra control overhead. On the basis of this, by setting the maximum gradient diffusion depth, the influence of interest message flooding on the interest propagation stage is greatly reduced, which help to reduce the transmitted data of the network by setting the minimum node remaining energy, the probability of each node to be selected to perform transmission task is increased, which help to prolong the average working time of node, improve the network load balance, reduce the average end-to-end delay of data message and the energy consumption of network, and help to extend the entire network lifetime.

- C.Zhi-yan et al. [8] compare the performances of several broadcast schemes combining with directed diffusion and propose an energy-aware broadcast scheme adapting to directed diffusion.

  This scheme combines the advantages of distance-based and counter-based broadcast schemes, and considers the remainder energy of sensor node. Inspired by directional back off concept in border-aware broadcast scheme, segment delay is proposed which is associated with distance and remainder energy. In the future, sleep schedule policy combining with DD will be considered.

- K.Casey et al[9] propose real–time directed diffusion (RTDD), a real time communication protocol for directed diffusion using the mechanisms provided by directed diffusion and implementing prioritized scheduling policy over diffusion with extension. RTDD significantly enhances the directed diffusion protocol, allowing time critical flows delivery more packets on time. And also

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propose two new scheduling polices which do not require knowledge and finally shows RTDD delivers significantly more packets on time directed diffusion alone.

- Hee-Sook Mo et al [10], a grid-based virtual infrastructure is proposed for efficient data dissemination to mobile sink group considering multiple sources. A localized virtual infrastructure termed a 'pipe' is used as the rendezvous point between a source and the moving sinks as a group. The member sinks in the group retrieve data directly from the pipe allocated for each source within the group region while roaming. Compared with other schemes that support mobile sink group, the proposed scheme greatly decreases the energy consumption because it eliminates the retransmission caused by flooding and it significantly reduces the path for the data delivery using localized virtual storage.

- Hee-Sook Mo [11], the flooding based approach termed MGeocasting was proposed for a mobile sink group. This is a group dissemination protocol that combines traditional geocasting with flooding in order to support group mobility. The sink that represents a group periodically performs broadcast flooding in order to search for its members within the group area. It can thereby secure the current information of the group location and then registers the location change as representative information. The source node directly disseminates data by flooding the data into the group region, where the mobile sink group is located, when it senses an event. However, M-geocasting suffers from the problem that flooding causes excessive energy consumption in the sensor node, which has limited battery resources.

5. CONCLUSION & FUTURE SCOPE

In this paper, we have reviewed the energy efficient data dissemination protocols that use to improve the performance of the Wireless Sensor Network. The battery powers of nodes are very limited. so in future we can work for energy saving of a network. By default; the transmission range of a node is very high so by varying the transmission range of a node we can find the best suitable range that can help in minimization of energy dissipation and also maintain the quality of services that can lead to network life prolongation.

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