An Existential Review of Wireless Sensor Networks

Sandeep Singh[1], Amandeep Kaur Virk[2]

[1]SGGSWU, Fatehgarh Sahib, India
syan.sandeep026@gmail.com

[2]Assistant Professor, SGGSWU, Fatehgarh Sahib, India
anu_virk10@yahoo.co.in

Abstract: ***A WSN typically has little or no infrastructure. It consists of a number of sensor nodes working together to monitor a region to obtain data about the environment. Recent advances in WSNs have led to many new protocols specifically designed for sensor networks. By using different routing protocols, the data are routed from one node to another. There are number of routing protocols for WSNs. The paper introduces wireless sensor network concepts and gives the brief idea about routing protocols in WSNs.***

Keywords: wireless sensor network, routing protocol, connectivity

1. Introduction

Wireless sensor networks (WSNs) are a particular type of ad hoc network which consists of number of sensor nodes deployed in an unsupervised environment with the capabilities of sensing, wireless communications and computations. Sensor networks are composed of nodes with sensing capabilities which perform distributed sensing task. Wireless sensor networks allow real time data processing at a minimal cost [9].

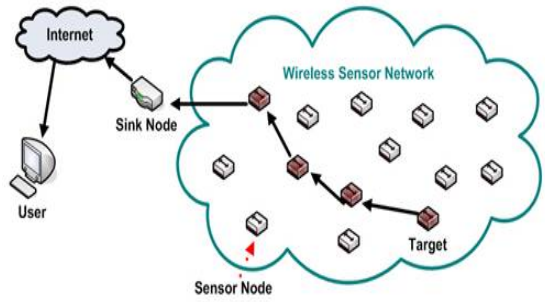

Figure 1: Wireless Sensor Network

Wireless sensor networks (WSN's) are useful for military, environmental, and scientific applications such as vehicle tracking, habitat monitoring, forest surveillance, earthquake observation, biomedical or health care applications and building surveillance, monitoring, disaster recovery, home automation and many others [5],[6].Wireless sensor networks are used in highly dynamic, and hostile environments without human existence.

By using the appropriate nodes placement, we can improve parameters of networks such as coverage, communication, energy consumption and optimize system performance according to our budget. In wireless sensor networks Coverage is the most active areas of research [1],[2]. Coverage is a fundamental issue in wireless sensor [4]. Coverage in wireless sensor networks is defined as a measure of how well and for how long the sensors are able to observe the physical space [7], [3]. It is important for a sensor network to maintain connectivity. Connectivity provides supportive networking conditions. Connectivity can be defined as the ability of the sensor nodes to reach the data sink [3].

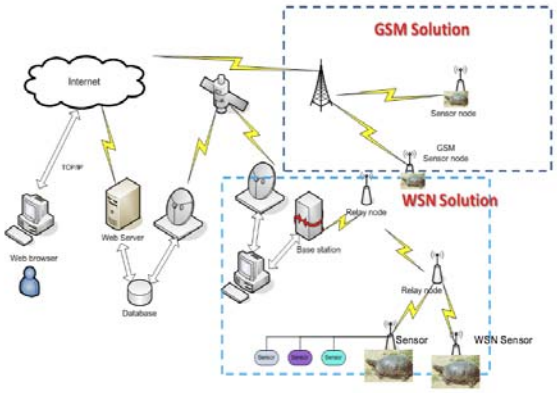

Figure 2: Example of WSN

2. Types of Wireless Sensor Networks [8]

There are five types of WSNs: Underground WSN, Terrestrial WSN, Underwater WSN, Multi-media WSN, and Mobile WSN.

2.1 Underground WSNs

They consist of wireless devices that operate below the ground surface. These devices are either placed within a bounded open underground space like roads, subway tunnels and mines or buried completely under dense soil.

2.2 Terrestrial WSNs

They typically consist of thousands of inexpensive wireless sensor nodes deployed in a given area, either in a pre-planned or in an ad hoc manner. In a terrestrial WSN, reliable communication in a dense environment is very important.

2.3 Underwater WSNs

They consist of a number of sensor nodes and vehicles deployed underwater. Underwater WSNs can be used to perform pollution monitoring; to detect extreme temperature gradients (thermocines), monitoring ocean

currents and winds improves weather forecast, biological monitoring and other possible applications.

2.4 Multimedia WSNs

They consist of a number of low cost sensor nodes equipped with cameras and microphones. They must provide relatively low end-to-end delay and jitter and high throughput while being energy efficient. Multi-media WSNs have been proposed to enable tracking and monitoring of events in the form of multimedia such as video, audio, and imaging.

2.5 Mobile WSNs

Applications include environment monitoring, target tracking, search and rescue, and real-time monitoring of material. There are basically two sensing modes for mobile wireless sensor networks, local sensing and remote sensing. Mobile Wireless sensor networks are believed to have more channel capacity as compared to others.

3. Routing Protocols in WSNs

3.1 Flooding

In flooding, each sensor receiving a data packet ant then broadcasts it to all of its neighbors and this process continues until the packet arrives at the destination or the maximum number of hops for the packet is reached. This method guarantees the delivery of the packet to the destination [8].

3.2 Gossiping

Gossiping is a slightly enhanced version of flooding where the receiving node sends the packet to a randomly selected neighbor, which picks another random neighbor to forward the packet. This technique assists in energy conservation by randomization. The implosion problem can be solved by gossiping [8].

3.3 SPIN

SPIN is called as “Sensor Protocols for Information via Negotiation”. Nodes running SPIN assign a high-level name to their data, called *meta-data*, and perform meta-data negotiations before any data is transmitted. SPIN is more energy-efficient than flooding or gossiping.

3.4 LEACH

LEACH is called “Low Energy Adaptive Clustering Hierarchy”. A centralized version of this protocol is LEACH-C. LEACH is designed for sensor networks where an end-user wants to monitor the environment. Some features of LEACH are: Localized coordination and control for cluster set-up and operation, Randomized rotation of the cluster "base stations" or "cluster heads", Local compression to reduce global communication [8].

3.5 Direct Diffusion

This protocol is useful in that case where the sensor nodes themselves generate request/queries for data sensed by other nodes instead of all queries arise only from a base station. The main goal is to diffusing data through sensor nodes by using a naming scheme for the data. Directed diffusion is most effective data dissemination and aggregation protocol [8].

3.6 Greedy Perimeter Stateless Routing (GPSR)

GPSR is a geographic routing protocol in which nodes make local packet forwarding decisions according to a greedy algorithm.

3.7 GAF

GAF is known as “Geographic Adaptive Fidelity”. GAF is a topology control protocol designed for use in ad- hoc networks. In this energy is conserved by turning off unnecessary nodes in the network without affecting the level of routing fidelity. GAF is implemented both for non-mobility (GAF-basic) and mobility (GAF-mobility adaptation) of nodes.

3.8 PEGASIS

PEGASIS is “Power-Efficient Gathering in Sensor Information Systems”. It is an improvement of the LEACH protocol. PEGASIS is based on two ideas i.e. Chaining and Data Fusion. This algorithm forms chains of the sensor nodes, rather than classifying nodes in clusters. Each node transmits to and receives from only one closest node of its neighbors [8].

3.9 SAR

SAR is “Sequential Assignment Routing”. It is one of the first protocols for wireless sensor networks that provide the notion of QoS routing criteria. SAR maintains multiple paths from node to sink.

4. Conclusion

Wireless Sensor Network technology offers significant potential in numerous application domains. In this paper we overviewed few routing protocols suitable for WSN. Other possible future research for routing protocols includes the integration of sensor networks with wired networks (i.e. Internet).

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