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Wireless Sensor Network - A Study

P. Muruga Priya[1], Dr. E. S. Samundeeswari[2]
[1]*Research Scholar, Department of Computer Science, Vellalar College for Women, Erode*
[2]*Associate Professor, Department of Computer Science, Vellalar College For Women, Erode*

Abstract: With the development of embedded system and network technology, there has been growing interest in providing fine-grained metering and controlling of living environments using low power devices. A wireless sensor network (WSN) is a collection of nodes organized into a network. A group of sensor nodes work collaboratively to perform a common application. These nodes are spatially distributed self-configurable sensors, perfectly meet the requirement. In many WSN applications, the sensor nodes are battery driven and they are often very difficult to recharge or change the batteries. To maintain the lifetime of network is a critical issue in the network design. Sensors often take long period between transmissions (e.g., in seconds). Thus, a good WSN design needs to be energy efficient. One of the main challenges in WSNs is to decrease the cost and size.

Keywords: Wireless Sensor Networks, Network lifetime, Energy Efficient.

I. Introduction

With the development of embedded system and network technology, there has been growing interest in providing fine-grained metering and controlling of living environments using low power devices. Wireless Sensor Networks (WSNs), which consist of spatially distributed self-configurable sensors, perfectly meet the requirement. The sensors provide the ability to monitor physical or environmental conditions, such as temperature, humidity, vibration, pressure, sound, motion and etc, with very low energy consumption.

A wireless sensor network (WSN) is a collection of nodes organized into a network collaboratively to perform a common application. It is built of several hundreds or even thousands of "sensor nodes". The sensors also have the ability to transmit and forward sensing data to the base station. Most WSNs are bi-directional, enabling two-way communication, which could collect sensing data from sensors to the base station as well as disseminate commands from base station to end sensors.

The topology of WSNs can vary among star network, tree network, and mesh network. Each node has the ability to communicate with every other node wirelessly, thus a typical sensor node has several components: a radio transceiver with an antenna which has the ability to send or receive packets, a microcontroller which could process the data and schedule relative tasks, several kinds of sensors sensing the environment data, and batteries providing energy supply.

A sensor node might vary in size. Each sensor node is capable of only a limited amount of processing. 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. 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 many 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. In many WSN applications, the sensor nodes are battery driven and they are often very difficult to recharge or change the batteries. Prolonging network lifetime is a critical issue. Sensors often have long period between transmissions (e.g., in seconds). Thus, a good WSN design needs to be energy efficient.

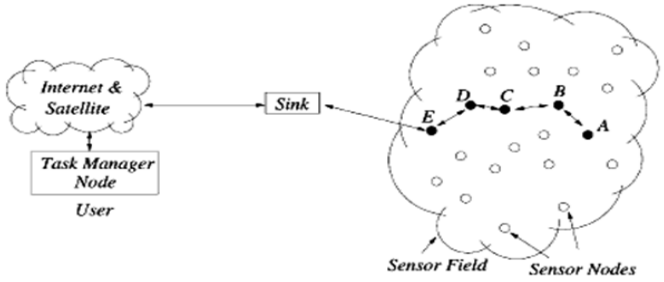

Figure 1 A typical Wireless Sensor Network

II. Overview of WSN

The diagrammatic representation of the Overview of Wireless Sensor network (Fig 1.)

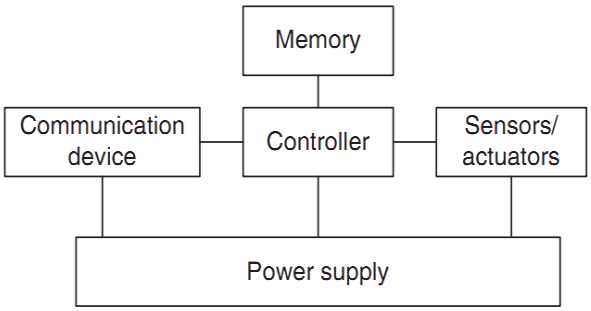

Fig 1. Overview of WSN

Controller: processes collected data from various sensors and execute the code by using the collected parameter.
Memory: is used to store program and processed data .
Sensor and Actuators: senses the environment and performs control operation on the collected data.
Communication device: is used to send and receive information over a wireless channel.
Power Supply: provides energy which maintains sensor in active mode.[2]

III. Requirements of WSN

A system comprising of Wireless sensor node should be:
1. Fault tolerant: the system should be robust against node failure.
2. Scalable: The system should support large number of sensor nodes to cater for different applications.
3. Long life: The node's life-time entirely defines the network's life-time and it should be high enough. The node's communication, computing, sensing and actuating operations should be energy efficient .
4. Programmable: the reprogramming of sensor nodes in the field might be necessary to improve flexibility.
5. Secure: the system should support the following:
a. Access Control
b. Message Integrity.
c. Confidentiality
d. Replay Protection
6. Affordable: the system should use low cost devices since the network comprises of thousand of sensor nodes, tags and apparatus. [3]

IV. Types of Sensor Network

The types of sensor networks is discussed here: [4]

S. NO	TYPES	PURPOSE
1.	Terrestrial WSN	Sensor placed to monitor the geographical location.
2.	Underground WSN	Sensor is placed in the underground or cave to monitor underground conditions.
3.	Underwater WSN	Underwater vehicles are used for gathering data from sensor nodes. It is used to sense the condition of ocean.
4.	Multimedia WSN	Multi-media sensor nodes are deployed in a pre-planned manner into the environment to guarantee coverage.
5.	Mobile WSN	can be useful in the dynamic environment to track the person or some other issues

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V. Characteristics Of WSN

The characteristics of WSN are: [4]

- Minimum Power consumption
- Ability to cope with node failures (resilience)
- Heterogeneity of nodes
- Mobility of nodes
- Communication failure
- Scalability to large scale of deployment
- Ability to withstand in unfavorable environmental conditions
- Cross-layer design
- Ease of use

VI. Communication Structure of A Wireless Sensor Network

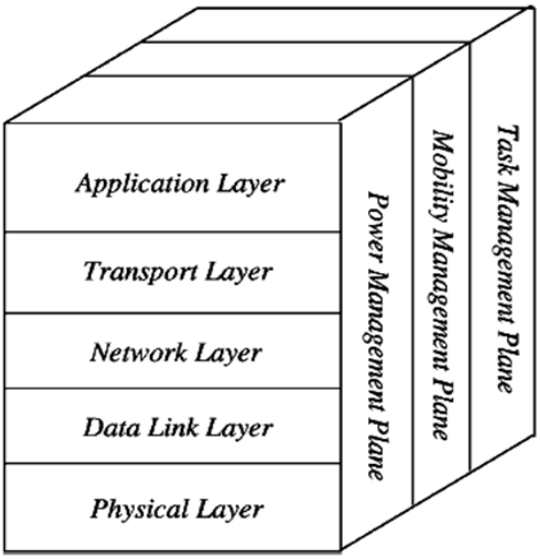

Figure 2. Wireless Sensor Network protocol stack

The sensor nodes are usually scattered in a sensor field as shown in Fig.2. Each of these scattered sensor nodes has the capabilities to collect data and route data back to the sink and the end users. Data are routed back to the end user by a multi-hop infrastructure-less architecture through the sink. The sink may communicate with the task manager node via Internet or Satellite. The protocol stack used by the sink and the sensor nodes is given in Fig. 2. **This protocol stack** combines power and routing awareness, integrates data with networking protocols, communicates power efficiently through the wireless medium and promotes cooperative efforts of sensor nodes. The protocol stack consists of the application layer, transport layer, network layer, data link layer, physical layer, power management plane, mobility management plane, and task management plane.

Different types of application software can be built and used on **the application layer** depending on the sensing tasks. This layer makes hardware and software of the lowest layer transparent to the end-user.

The transport layer helps to maintain the flow of data if the sensor networks application requires it.

The network layer takes care of routing the data supplied by the transport layer, specific multi-hop wireless routing protocols between sensor nodes and sink.

The data link layer is responsible for multiplexing of data streams, frame detection, Media Access Control (MAC) and error control. Since the environment is noisy and sensor nodes can be mobile, the MAC protocol must be power aware and able to minimize collision with neighbors' broadcast.

The physical layer addresses the needs of a simple but robust modulation, frequency selection, data encryption, transmission and receiving techniques.

The power, mobility, and task management planes monitor the power, movement, and task distribution among the sensor nodes. These planes help the sensor nodes coordinate the sensing task and lower the overall energy consumption.[3].

VII. Applications of WSN

Military Applications: WSN is used to monitor the resources, track enemies and targets, to assess the damage, detection of attacks such as nuclear, biochemical etc.

Environmental Applications: WSN is used to monitor the weather conditions, soil conditions, in precision agriculture, forest fire detection, and Volcano, Flood and pollution detection.

Home Applications: Sensors are buried in the appliances to help automate and monitor these appliances explicitly.

Vehicle Tracking: to track the location and the estimation of the vehicles distance is calculated..

Structural and Industrial Monitoring Applications: To monitor the condition of the structures, bridges, tunnels, machinery used in industry. To estimate wear and tear of machine.

Business and Inventory Control Applications: Inventory monitoring, to keep track of the items in the inventories and to check the supply chain system.

Medical Applications: The Sensors can be implanted or attached to the patient to observe the physiological parameters and other conditions and provide appropriate treatment at the right time.[5]

VIII. WSN Constraints

The constraints of WSN are classified into three:

1) **Deployment Constraints:** The WSN nodes are ad-hoc in nature and once deployed the nodes self-organize. The nodes are deployed in unattended environment and managed remotely. The deployment can be fixed or random.

In fixed deployment the position or location of node placement is predetermined and in random deployment the nodes are deployed randomly in the network and location is not predetermined.

2) **Communication constraints:** The WSN links have limited bandwidth and due to its wireless channels they are unreliable and prone to attacks. The links due to dense deployment of nodes will have more collisions and more delay.

3) **Device Constraints:** The node limited memory storage, limited power as they are battery operated and limited processing capability.[5]

IX. Advantages of Wireless Sensor Networks

Robustness to Withstand Rough Environmental Conditions

The shrinking size of sensor nodes have the ability to communicate through a lot of materials and also designed to withstand in harsh weather conditions. WSNs can be used in a huge variety of applications in environment like forest fire detection or seismic monitoring.

Ease of Deployment

In a sensor network hundreds or thousands of nodes can be deployed in remote or dangerous environment. Since these nodes are small in size and economical, throwing of hundreds or thousands of sensors from a plane over a remote or dangerous area allows extracting information is such a way that could not have been possible otherwise.

Ability to Cover Wide and Dangerous Areas

In many areas, infrastructure and economic conditions prevent wired networks from being used.

Self Configurable

When sensor nodes are deployed in the sensing field, they have the ability to self configure in network discovery and multi hop broadcast in small amount of time.

Mobility of Nodes

In the last few years, mobility of nodes has been used to trace the event for permanent tracking. Recently developed protocols and architectures are able to handle these real shifting to maintain further routing.

X. Research Areas in WSN

WSN is very latest and sensitive topic of today's research. So we have identified various research areas in it and they can be summarized as below:

- Routing Protocols
- Energy/Lifetime enhancement.

- Key Management.
- Security Protocols.
- Data Gathering & Processing.
- Quality of Service.
- Deployment of nodes.
- Clustering of nodes.
- MAC protocols for WSN.
- Real time delivery of data for multimedia application in WSN.
- Reliability.
- Congestion Control in WSN.

XI. Conclusion

WSN is a promising future technology and presently used in range of application that requires minimum human intervention. In this paper we have surveyed the WSN technology. We have also presented the WSN mode evaluation based on its key technical specifications. Although researchers have already designed a number of network configurations like heterogeneous and single-hop which uses WSN technology but in such configurations most of the processing is carried out at the server end. It would be good if in-network processing capability will be incorporated at node's end. By this way the node preprocesses the data and sends wirelessly the compact form of the extracted information to the sink.

References

[1]. P.S.Sathish1, E.Annal Sheeba Rani A Study on Wireless Sensor Network, Protocol, Application, Challenges, International Journal Of Engineering And Computer Science ISSN:2319-7242 Volume 3 Issue 10, October 2014 Page No. 8482-8486.

[2]. Wireless Sensor Networks: A Survey, 2009 International Conference on Advanced Information Networking and Applications Workshop.

[3]. Overview of Wireless Sensor Network, Chapter 1- "Wireless Sensor Networks - Technology and Protocols", book edited by Mohammad A. Matin, ISBN 978-953-51-0735-4, and Published: September 6, 2012

[4]. Yogesh Kumar Fulara, Some aspects of wireless sensor networks, International Journal on AdHoc Networking Systems (IJANS) Vol. 5, No. 1, January 2015

[5]. Sanjeev Kumar Gupta, Poonam Sinha,Overview of Wireless Sensor Network: A Survey, International Journal of Advanced Research in Computer and Communication Engineering,Vol.3,Issue1,January 2014

[6]. Amit Rathee Department of CSE PIET, Panipat, India,Randeep Singh Department of CSE IEC University, HP, India, Abhishilpa Nandini, Wireless Sensor Network- Challenges and Possibilities