

A Review on Wireless Sensor Networks (WSN)

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Abstract – A wireless sensor network (WSN) (sometimes called a wireless sensor and actor network (WSAN)) are spatially distributed autonomous sensors to monitor physical environmental conditions, such as temperature, sound, pressure etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring.

Index Terms – MSN, AFNS, WSN, BS

1. INTRODUCTION

A wireless sensor and actuator network (as shown in figure) is a collection of small randomly dispersed devices that provide three essential functions; the ability to monitor physical and environmental conditions, often in real time, such as temperature, pressure, light and humidity; the ability to operate devices such as switches, motors or actuators that control those conditions; and the ability to provide efficient, reliable communications via a wireless network. Since they are designed for low traffic monitor and control applications, it is not necessary for them to support the high data throughput requirements that data networks like Wi-Fi require. Typical WSN over-the-air data rates range from 20 kbps to 1 Mbps. Consequently they can operate with much lower power consumption, which in turn allows the nodes to be battery powered and physically small. WSNs are typically self-organizing and self-healing. Self-organizing networks allow a new node to automatically join the network without the need for manual intervention. Self-healing networks allow nodes to reconfigure their link associations and find alternative pathways around failed or powered-down nodes. How these capabilities are implemented is specific to the network management protocol and the network topology, and ultimately will determine the network's flexibility, scalability, cost and performance. Wireless Sensor Networks consists of individual nodes that are able to interact with their environment by sensing or controlling physical parameter; these nodes have to Collaborate in order to fulfill their tasks as usually, a single node is incapable of doing so, and they use wireless communication to enable this collaboration [5]. The definition

of WSN, according to, Smart Dust program of DARPA is: "A sensor network is a deployment of massive numbers of small, inexpensive, self-powered devices that can sense, compute, and communicate with other devices for the purpose of gathering local information to make global decisions about a physical environment".

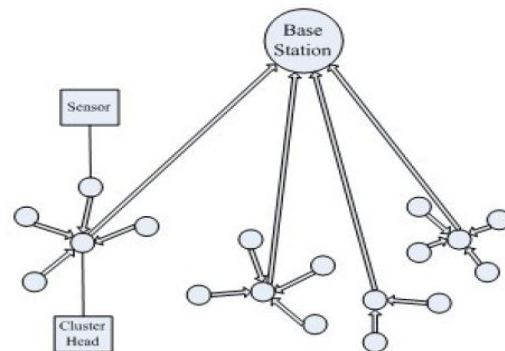


Figure 1: Wireless Sensor Network Architecture

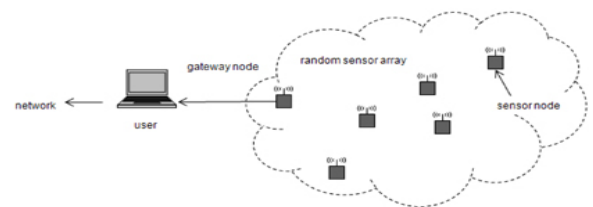


Figure 2: Wireless sensor/actuator networks

2. COMPONENTS OF WIRELESS SENSOR NETWORK

Unlike their ancestor ad-hoc networks, WSNs are resource limited, they are deployed densely, they are prone to failures, the number of nodes in WSNs is several orders higher than that of ad hoc networks, WSN network topology is constantly changing, WSNs use broadcast communication mediums and finally sensor nodes don't have a global identification tags [5].

2.1. Sensor field

A sensor field can be considered as the area in which the nodes are placed.

2.2. Sensor nodes

Sensors nodes are the heart of the network. They are in charge of collecting data and routing this information back to a sink.

2.3. Sink

A sink is a sensor node with the specific task of receiving, processing and storing data from the other sensor nodes. They serve to reduce the total number of messages that need to be sent, hence reducing the overall energy requirements of the network. Sinks are also known as data aggregation points.

2.4. Task manager:

The task manager also known as base station is a centralized point of control within the network, which extracts information from the network and disseminates control information back into the network. It also serves as a gateway to other networks, a powerful data processing and storage center and an access point for a human interface. The base station is either a laptop or a workstation.

Basically, each sensor node comprises sensing, processing, transmission, mobilizer, position finding system, and power units (some of these components are optional like the mobilizer). Sensor nodes are usually scattered in a sensor field, which is an area where the sensor nodes are deployed. Sensor nodes coordinate among themselves to produce high-quality information about the physical environment.

3. THREE TYPES OF NODES USED IN THE WSN

3.1. Micro-sensor nodes (MSNs)

The MSNs [19] can be application-specific sensor nodes (e.g., temperature sensor nodes (TSNs), pressure sensor nodes (PSNs), and video sensor nodes (VSNs)) and they constitute the lower tier of the network. The MSNs are small and low-cost. The objective of an MSN is very simple Once triggered by an event it starts to capture live information (e.g., video), which it sends directly to the local AFN. For each cluster of MSNs, there is one AFN, which is different from an MSN in terms of physical properties and functions.

3.2. Aggregation and forwarding nodes (afns):-

Data aggregation (or “fusion”) for data flows from the local cluster of MSNs, and forwarding (or relaying) the aggregated information to the next hop AFN (toward the base-station) [19]. An AFN also serves as a relay node for other AFNs to carry traffic toward the base-station. Although an AFN is expected to be provisioned with much more energy than an MSN, it also consumes energy at a substantially higher rate (due to wireless communication over large distances). Consequently, an AFN has a limited lifetime.

3.3. Base-station (BS):-

The sink node for data streams from all the AFNs in the network. In this investigation, we assume that there is sufficient energy resource available at the base station and thus there is no energy constraint at the base-station [19]. In summary, the main functions of the lower tier MSNs are data acquisition and compression while the upper-tier AFNs are used for data fusion and relaying information to the base-station.

4. BASIC GOALS OF A SENSOR NETWORK

- Determine the value of physical variables at a given location.
- Detect the occurrence of events of interest, and estimate parameters of the detected events.
- Classify a detected object and Track an object.

5. CHARACTERISTICS OF A WSN

- Power consumption constraints for nodes using batteries or energy harvesting
- Ability to cope with node failures
- Mobility of nodes
- Dynamic network topology
- Communication failures
- Heterogeneity of nodes
- Scalability to large scale of deployment
- Ability to withstand harsh environmental conditions
- Ease of use
- Unattended operation
- Self-organization capability.

6. APPLICATIONS OF WSN

On the basis of nodes that have sensing and actuation facilities, in combination with computation and communication abilities, wireless sensor networks find their application in variety of areas:

6.1. Area monitoring

WSN is deployed over a region where some phenomenon is to be monitored. A military example is the use of sensors to detect enemy intrusion; a civilian example is the geo fencing of gas or oil pipelines.

6.2. Air pollution monitoring

Wireless Sensor Networks have been deployed in several cities (Stockholm, London or Brisbane) to monitor the concentration of dangerous gases for citizens.

6.3. Greenhouse monitoring

Wireless Sensor Networks are used to control the temperature and humidity levels inside commercial greenhouses. When the temperature and humidity drops below specific levels, the greenhouse manager can be notified via e-mail or cell phone

text message, or host systems can trigger misting systems, open vents, turn on fans, or control a wide variety of system responses.

6.4. Landslide detection:

A landslide detection system makes use of a WSN to detect the slight movements of soil and changes in various parameters that may occur before or during a landslide and is makes it possible to know the occurrence of landslides long before it actually happens.

6.5. Industrial monitoring:

Wireless Sensor Networks have been developed for machinery condition-based maintenance (CBM) as they offer significant cost savings and enable new functionalities. In wired systems, the installation of enough sensors is often limited by the cost of wiring.

6.6. Forest fires detection:

A network of Sensor Nodes can be installed in a forest to control when a fire has started. The sensor nodes are equipped with sensors to control temperature, humidity and gases which are produced by fire in the trees or vegetation.

6.7. Water/wastewater monitoring:

Facilities not wired for power or data transmission can be monitored using industrial wireless I/O devices and sensors powered using solar panels or battery packs. Below is the Cluster base mechanism in WSN.

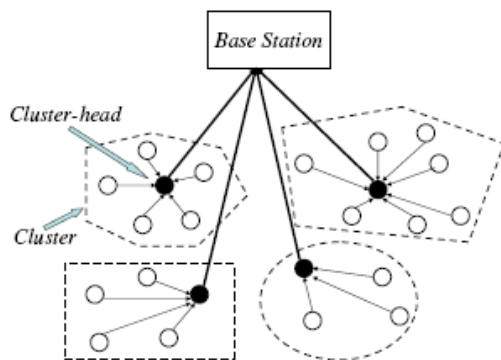


Figure 3 Clustering Mechanism in WSN

7. CONCLUSION

The proposed work is implemented on Wireless Sensor network to improve the network life in case of chain based protocol. The main problem with cluster network is to find the next neighbor for communication. Here the improvement is done for existing LEACH protocol. In this work we have include three parameters to select the next neighbor. The work is about to identify an energy efficient aggregative path to communicate over the network.

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