A Study of Wireless Sensor Networks

Danish Raza Rizvi[1], Dr. Mohd. Amjad[2], Prof. M. N. Doja[3]

[1]Assistant Professor, Dept. of Computer Engg. Jamia Millia Islamia, New Delhi, India
[2] Assistant Professor, Dept. of Computer Engg. Jamia Millia Islamia, New Delhi, India
[3]Professor, Dept. of Computer Engg. Jamia Millia Islamia, New Delhi, India

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Abstract - *A wireless sensor network is a wide area of research now a days. In older days, we have talked about the concepts of network. A communication system that consists two or more computers that are linked to share some resources and information called a network. But now a days we are talking about a concept that is a collection of some fabricated circuits known as sensors. A wireless sensor network (WSN) is a wireless network is a collection of sensors to monitor to some special physical or environmental conditions. Wireless sensor networks (WSN), sometimes referred as wireless sensor actuator networks (WSAN), because they can involve more than a single actuator on an actor point. An actor point might involve, a combination of servos and multi-geared electric motors ordered together to perform complex tasks.*

Key Words: WSN, WSAN, Sensor
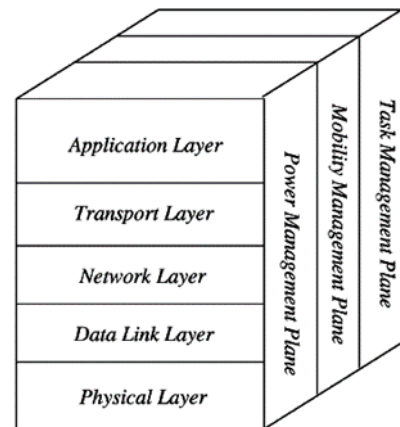
1. INTRODUCTION

A wireless sensor network (WSN) is a wireless network is a collection of sensors to monitor to some special conditions includes physical or environmental. A WSN integrates a gateway that used to provides wireless connectivity back to the wired system and scattered nodes. WSN standard includes standard radios 2.4 based on IEEE 802.15.4 or IEEE 802.11 which is for Wi-Fi standard systems or 900MHz exclusive radios [1]. A wireless sensor network may follow different architectures, but most common architecture followed by Wireless sensor network is open system interface (OSI) architecture. This architecture includes application layer, transport layer, network layer, data link layer and physical layer with three cross layers namely power management layer, mobility management layer and task management layer. All these layers of wireless sensor network are used to achieve the network and make the sensors work unruffled in order to increase the overall efficiency of the network [3].

2. WSN NETWORK DESIGN

2.1 Application Layer

Traffic management is done by application layer. Application layer is also responsible to manage software for several applications to clear data and find useful information. Sensor

networks agreed in various applications in different fields like medical, environmental, agricultural etc.

Fig.1: A wireless sensor network Design

2.2 Transport Layer

The main aim of transport layer is to control bottle neck problem and provide reliability. There are a number of protocols anticipated to offer this function are either practical on the upstream. Different techniques are used by these protocols to recognize the loss and recovery. When the system intended to contact other networks, we need transport layer. TCP is not suitable for wireless sensor network because it is less energy efficient. Generally transport layer may be divided into Event driven or packet driven. Pump slow fetch quick (PSQF), Price-Oriented Reliable Transport Protocol (PORT) and Sensor Transmission control protocol (STCP) are some standard protocols in network layer.

2.3 Network Layer

Routing is the responsibility of network layer. A sensor does not have a universal ID and it has to self-organized, so the main tasks are in buffers organization, power preserving and partial memory. The basic routing protocol concept is the explanation of reliable and redundant path which may differs from protocol to protocol. There are a large numbers of existing network layer protocol and we can classify them in hierarchal and flat routing or we can separated in to query-driven & event driven, time driven.

2.4 Data Link Layer

The main responsibility of data link layer is to ensure point to point or point to multipoint reliability. To ensure error

control, multiplexing data frame detection, MAC and data stream is also responsibility of data link layer.

2.5 Physical Layer

Bit stream transportation on a physical medium is controlled by physical layer. Physical layer is responsible for signal detection, carrier frequency selection and generation, data modulation and encryption of data. IEEE 802.15.4 is recommended as unique for low cost, power consumption, density, the range of communication to improve the battery life.

3. How does WSN works

Wireless Sensor Networks is a self-configured and infrastructure less wireless networks. Wireless sensor network contains hundreds of thousands of sensor nodes and these nodes (sensor) can communicate among themselves using radio signals [1]. Individual nodes have limited processing speed, storage capacity, and communication bandwidth. The working mode of the sensor nodes may be either continuous or event driven. Global Positioning System (GPS) and local positioning algorithms can be used to obtain location and positioning information. Wireless sensor devices acts can be "act" upon certain conditions using actuator.
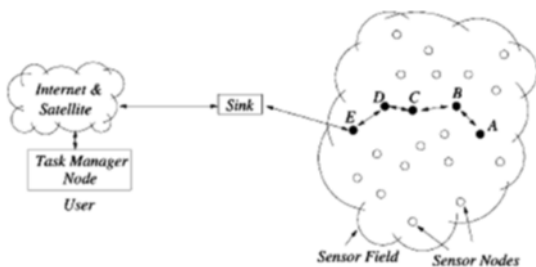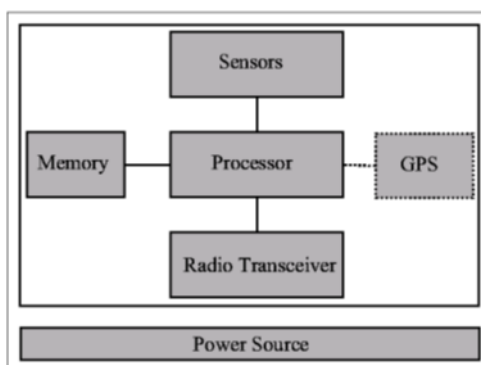

Fig.2: A typical wireless sensor network

Fig.3: Basic components of WSN

4. Node

Wireless Sensor nodes are called motes. In mote anatomy, we have a processor which may be in sleep, idle or active mode, power source that might include coin, AA batteries or solar panel, memory module which is used for the program code, radio used for transmitting the acquired data and sensors to sense light, humidity or temperature. All the communication

in WSN is taken place between source and destination. The destination is called as base station or sink. If you want to analyze some network parameters you will do it by taking source and destination into consideration. So destination, sink, base stations are just synonyms.
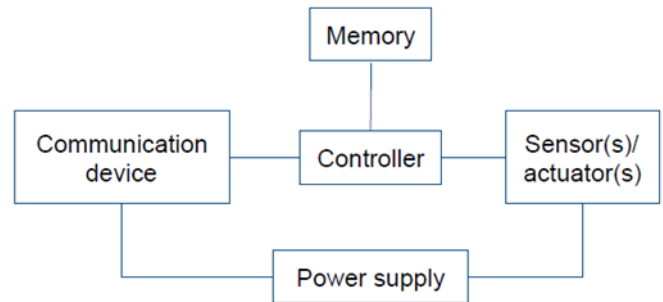

Fig.3: Mote

5. Characteristics of Wireless Sensor Network

The wireless sensor network offers a wide range of characteristics that include but not limited to:

- The wireless sensor network can limit the consumption of power for the battery driven nodes.
- The wireless sensor network is capable to handle failures including failures of nodes in the system.
- The wireless sensor network may allow some flexibility and Heterogeneity of nodes.
- The wireless sensor network Scalable to large scale of distribution
- As sensors are made for a specific environment, so a wireless sensor network ensure environment conditions very strictly.
- Wireless sensor networks are simple in use.

6. Advantages of Wireless Sensor

The wireless sensor network offers a large number advantages that include but not limited to:

- A wireless sensor network is a collection of sensor nodes so with the help of movable set-up, we can assure network measures.
- Since node communicate with each other in wireless fashion, Wireless sensor networks are suitable for tough (non-reachable e.g. rural areas, sea and mountains) and interior the places.
- Wireless sensor network is flexible in terms of situations when we need additional terminal.
- As technology is developing, the Implementation cost of wireless sensor network become cheap.
- As nodes communicate wirelessly, there is no need of heavy wiring.
- Wireless sensor network is flexible, so it can provide addition on new devices when needed.

- Wireless sensor network can be operated by using a centralized monitoring.

7. Area of Application

Wireless sensor networks may contain of several different types of sensors like visual, seismic, low sampling rate, infrared, and acoustic, which are intelligent to monitor a wide collection of ambient conditions. Sensor nodes are used for continuous sensing, event ID, event detection & local control of actuators. There are a large numbers of applications of wireless sensor network that includes:
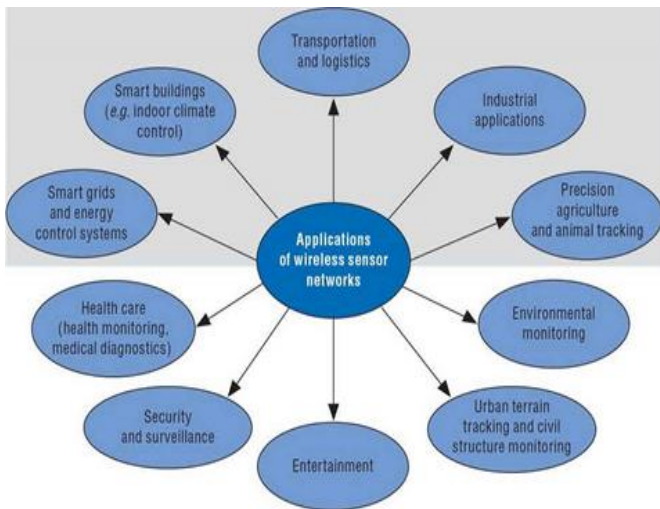

Fig.4: WSN Application

7.1 Area monitoring

The most common application of WSN is area monitoring. In area monitoring WSN, the WSN installed over a region where some phenomenon is to be monitored, for example geo-fencing.

7.2 Health care monitoring

There may be several types of health care monitoring medical application like wearable, implanted etc. The implantable medical devices are those that are implanted inside human body. Wearable devices are used on the body surface of a human or just at close proximity of the user. Possible applications include body position measurement, location of persons, overall monitoring of ill patients in hospitals and at homes.

7.3 Environmental Applications

There are the following few applications in monitoring environmental parameters. They share the extra challenges of harsh environments and reduced power supply.

- Air pollution monitoring
- Landslide detection
- Natural disaster presentation
- Forest fire detection
- Water quality monitoring

7.4 Industrial Monitoring

Industrial monitoring includes the following types of monitoring:

- Machine health monitoring
- Waste water monitoring
- Data logging
- Structural health monitoring
- Wine production monitoring
- Data center monitoring

8. Limitations & Current status

- A wireless sensor network is less secure because hackers can move in the access point and get all the material.

- Due to wireless communication, a WSN has low speed in comparison with normal network.

- The configuration of WSN is more complicated in comparison with wired network.

- Wireless communication has its own problems like signal blockage due to distance, microwaves and other surroundings). These problems also effect WSN.

- Wireless sensor network could not regulate circulation of waves, so it is easy to hack.

- Because of using wireless communication, a sensor node may confused by Bluetooth like element.

- As the technology is growing very fast today, the cost of different electronic components are reduced but still they are costly. It is an important issue to reduce cost as much as possible to build a large wireless sensor network

9. Conclusion & Future Developments

For designing a for Wireless sensor network designing, we need to study different factors such as the flexibility, energy efficiency, fault tolerance, high sensing fidelity, low-cost and rapid deployment, above all the application requirements. We hope the wide range of application areas will make sensor networks an integral part of our lives in the future.

However, understanding of sensor networks needs to fulfill several limitations such as scalability, cost, hardware, topology change, environment and power consumption. Since these limitations are highly close-fitting and specific for sensor networks, new wireless ad hoc networking protocols are required. To meet the requirements, many researchers are involved in developing the technologies desirable for different layers of the sensor networks protocol stack. Upcoming research on WSN will be focused towards maximizing area throughput in clustered Wireless Sensor Networks designed for temporal or spatial random process estimation, accounting for radio channel, PHY, MAC and NET protocol layers and data aggregation techniques, simulation and experimental verification of lifetime-aware routing, sensing spatial coverage and the enhancement of the desired sensing spatial coverage evaluation methods with practical sensor model. Future work will focus on the important problem of identifying activities of multiple users using a

wireless body sensor network. WSN research will put a great impact on our daily life.

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