Wireless Sensor Networks

Deepika[1], Prof. S. Niranjan[2]
[1,2] Department of Computer Science & Engineering,
Ganga Institute of Technology and Management,
Kablana, Jhajjar, Haryana, India

***Abstract*—Recent advancement in wireless communication and electronics has enabled the development of low cost sensor network. The sensor network can be used for various application areas like military, health, home. Wireless Sensor Network refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location.**

WSNs measure environmental conditions like temperature, sound, pollution level, humidity, wind speed and direction, pressure etc. WSN is a group of specialized transducers with a communications infrastructure that uses radio to monitor and record the physical condition. WSN provide a bridge between the real physical and virtual world. It allow the ability to observe the previously unobservable at a fine resolution over large spatio-temporal scales.

A sensor network consists of multiple detection stations called sensor nodes, each of which is small, lightweight, portable. Every sensor node is equipped with a transducer, microcomputer, transceiver and power source.

I. INTRODUCTION

A wireless sensor network (WSN) of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. Wireless sensor network (WSN) refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. WSNs measure environmental conditions like temperature, sound, pollution levels, humidity, wind speed and direction, pressure, etc.

WSNs were initially designed to facilitate military operations but its application has since been extended to health, traffic, and many other consumer and industrial areas. A WSN consists of anywhere from a few hundreds to thousands of sensor nodes. The sensor node equipment includes a radio transceiver along with an antenna, a microcontroller, an interfacing electronic circuit, and an energy source, usually a battery. The size of the sensor nodes can also range from the size of a shoe box to as small as the size of a grain of dust. As such, their prices also vary from a few pennies to hundreds of dollars depending on the functionality parameters of a sensor like energy consumption, computational speed rate, bandwidth, and memory.

A wireless sensor network is a group of specialized transducers with a communications infrastructure for monitoring and recording conditions at diverse locations. Commonly monitored parameters are temperature, humidity, pressure, wind direction and speed, illumination intensity, vibration intensity, sound intensity, power-line voltage, chemical concentrations, pollutant levels and vital body functions.

A sensor network consists of multiple detection stations called sensor nodes, each of which is small, lightweight and portable. Every sensor node is equipped with a transducer, microcomputer, transceiver and power source. The transducer generates electrical signals based on sensed physical effects and phenomena. The microcomputer processes and stores the sensor output. The transceiver receives commands from a central computer and transmits data to that computer. The power for each sensor node is derived from a battery.

II. RECENT ADVANCEMENT

Wireless Sensor networks (WSNs) have become one of the most interesting areas of research in the past few years. A WSN is composed of a number of wireless sensor nodes which form a sensor field and a sink. These large numbers of nodes, having the abilities to sense their surroundings, perform limited computation and communicate wirelessly form the WSNs. Recent advances in wireless and electronic technologies have enabled a wide range of applications of WSNs in military, traffic surveillance, target tracking, environment monitoring, healthcare monitoring, and so on. There are many new challenges that have surfaced for the designers of WSNs, in order to meet the requirements of various applications like sensed quantities, size of nodes, and nodes' autonomy. Therefore, improvements in the current technologies and better solutions to these challenges are required. The future developments in sensor nodes must produce very powerful and cost effective devices, so that they may be used in applications like underwater acoustic sensor systems, sensing based cyber physical systems, time critical applications, cognitive sensing and spectrum management, and security and privacy management. This paper also describes the research challenges for WSNs.

Smart Home/Smart Office

Smart home environments can provide custom behaviors for a given individual. Considerable amount of research has been devoted to this topic. The research on smart homes is now starting to make its way into the market. It takes a considerable amount of work and planning to create a smart home. There are many examples of products currently on the market which can perform individual

ISSN: 2278-0181
NCETEMS-2015 Conference Proceedings

functions that are considered to be part of a smart home. Several useful applications which take advantage of information

Military

New and emerging technologies, such as networks, support military operations by delivering critical information rapidly and dependably to the right individual or organization at the right time. This improves the efficiency of combat operations. The new technologies must be integrated quickly into a comprehensive architecture to meet the requirements of present time. Improvement in situation awareness

is must requirement. described some other important application is detection of enemy units' movements on land/sea, sensing intruders on bases, chemical/biological threats and offering logistics in urban warfare. Command, control, communications, computing, intelligence, surveillance, reconnaissance, and targeting systems are well.

Industrial & Commercial

Since the long time wireless transmission of data is being done in industrial applications, but recently it has gained importance. Successful use of wireless sensors in systems such as supervisory control and data acquisition has proved that these devices could effectively address the needs of industrial applications. The critical process applications of WSNs in industry are monitoring temperature, flow level, and pressure parameters.

Traffic Management and Monitoring

Every big city is suffering from traffic congestion around the world. A sincere effort is being made to solve the traffic congestion. Congestion can be alleviated by planning managing traffic. A real time automatic traffic data collection must be employed for efficient management of rush hour traffic. Research on this topic is considered as part of the Intelligent Transport System (ITS) research community. Chinrungrueng (2006) explained ITS to be the application of the computers, communications, and sensor technology to surface transportation. The vehicle tracking application is to locate a specific vehicle or moving object and monitor its movement. This work also describes design of WSN for vehicular monitoring. As the power source (battery) is limited, it is important that a design of sensor node is power efficient.

Structural Healthcare

Structures are inspected at regular time intervals, and repairing or replacing based on the time of use, rather than on their working conditions. Tiwari *et al.* (2004) has explained that sensors embedded into structures enable conditionbased maintenance of these assets. Wireless sensing will allow assets to be inspected when the sensors indicate that there may be a problem. This will reduce the cost of maintenance and preventing harmful failure. These applications include sensors mounted on heavy duty bridges, within concrete and composite materials and big buildings.

Mobility management

Mobility is one of the most important issues in next generation networks. As WSNs are becoming the next elements of the future Internet, it is crucial to study new models that also support mobility of these nodes. WSNs are applicable in variety of cases that make it difficult to produce a standard mobility scenario. Following are some cases where the mobile support is necessary presented in Camilo (2008).

Intra WSN device movement is probably the most common scenario in WSNs architectures, where each sensor node has the ability to change from its local position at run time without losing the connectivity with the sensor router (SR). In the case of inter WSN device movement, sensor nodes move between different sensor networks, each one with its SR responsible to configure and manage all the aggregated devices.

Security and Privacy Concern

The field that paid less attention is the privacy concern on information being collected, transmitted, and analyzed in a WSN. Such private information of concern may include payload data collected by sensors and transmitted through the network to a centralized data processing server. The location of a sensor initiating data communication, and other such context information, may also be the focus of privacy concerns. In real world applications of WSNs, effective countermeasures against the disclosure of both data and context oriented private information are indispensable prerequisites. Privacy protection in various fields related to WSNs, such as wired and wireless networking, databases.

III.WIRELESS SENSOR NETWORK

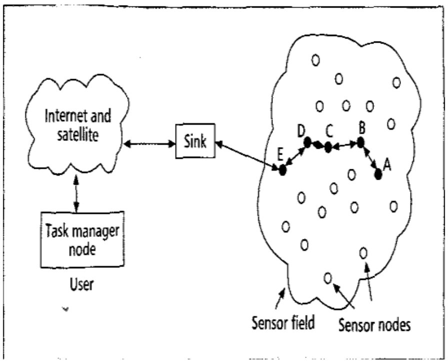

Fig. 1 Example of wireless sensor network

A wireless sensor network (WSN) of spatially distributed autonomous sensors to monitor physical or 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, and so on.

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing.

IV. APPLICATIONS

1) Process Management

Area monitoring is a common application of WSNs. In area monitoring, the WSN is deployed over a region where some phenomenon is to be monitored. A military example is the use of sensors detect enemy intrusion; a civilian example is the geo-fencing of gas or oil pipelines. Area monitoring is most important part.

2) Health care monitoring

The medical applications can be of two types: wearable and implanted. Wearable devices are used on the body surface of a human or just at close proximity of the user. The implantable medical devices are those that are inserted inside human body. There are many other applications too e.g. body position measurement and location of the person, overall monitoring of ill patients in hospitals and at homes. Body-area networks can collect information about an individual's health, fitness, and energy expenditure.

3) Environmental/Earth sensing

There are many applications in monitoring environmental parameters, examples of which are given below. They share the extra challenges of harsh environments and reduced power supply.

4.Air pollution monitoring

Wireless sensor networks have been deployed in several cities to monitor the concentration of dangerous gases for citizens. These can take advantage of the ad hoc wireless links rather than wired installations, which also make them more mobile for testing readings in different areas.

5.Forest fire detection

A network of Sensor Nodes can be installed in a forest to detect when a fire has started. The nodes can be equipped with sensors to measure temperature, humidity and gases which are produced by fire in the trees or vegetation. The early detection is crucial for a successful action of the firefighters; thanks to Wireless Sensor Networks, the fire brigade will be able to know when a fire is started and how it is spreading.

6.Landslide detection

A landslide detection system makes use of a wireless sensor network to detect the slight movements of soil and changes in various parameters that may occur before or during a landslide. Through the data gathered it may be possible to know the occurrence of landslides long before it actually happens.

7.Water quality monitoring

Water quality monitoring involves analyzing water properties in dams, rivers, lakes & oceans, as well as underground water reserves. The use of many wireless distributed sensors enables the creation of a more accurate map of the water status, and allows the permanent deployment of monitoring stations in locations of difficult access, without the need of manual data retrieval.

8.Natural disaster prevention

Wireless sensor networks can effectively act to prevent the consequences of natural disasters, like floods. Wireless nodes have successfully been deployed in rivers where changes of the water levels have to be monitored in real time.

9. Machine health monitoring

Wireless sensor networks have been developed for machinery condition-based maintenance (CBM) as they offer significant cost savings and enable new functionality. In wired systems, the installation of enough sensors is often limited by the cost of wiring. Previously inaccessible locations, rotating machinery, hazardous or restricted areas, and mobile assets can now be reached with wireless sensors.

10.Data logging

Wireless sensor networks are also used for the collection of data for monitoring of environmental information, this can be as simple as the monitoring of the temperature in a fridge to the level of water in overflow tanks in nuclear power plants. The statistical information can then be used to show how systems have been working. The advantage of WSNs over conventional loggers is the "live" data feed that is possible.

V. CHARACTERISTICS

- Power consumption constraints for nodes using batteries or energy harvesting
- Ability to cope with node failures (resilience)
- Mobility of nodes
- Heterogeneity of nodes
- Scalability to large scale of deployment
- Ability to withstand harsh environmental conditions
- Ease of use

- Cross-layer design

VI. Networking Technologies for WSN

BLUETOOTH

IEEE standard, popularly known as bluetooth, offers moderate data rates at lower energy levels. Due to this, it is ideally suited for high end WSN applications that require higher data rates with harder real time constraints. Bluetooth is used in STAR topology because of its basic characteristics. Bluetooth devices communicate with each other using set of standard bluetooth profiles defined by standard body. Time is divided into 625 uS "slots".

Data is exchanged via "Packets" lasting one or more slot:

Fig. 1 Example of bluetooth

Wi-Fi

Wi-Fi is the name given by the Wi-Fi Alliance to the IEEE 802.11 suite of standards. 802.11 defined the initial standard for wireless local area networks (WLANs), but it was considered too slow for some applications and so was superseded by the extensions 802.11a and 802.11b, and later by 802.11g. The addition of wireless provides more choices for monitoring, control and the dissemination of information. Practically speaking, remote locations become more accessible and costs drop. The following list summarizes some of the benefits of a Wi-Fi network:

• Wireless Ethernet. Wi-Fi is an Ethernet replacement. Wi-Fi and Ethernet, both IEEE 802 networks, share some core elements.

• Extended Access. The absence of wires and cables extends access to places where wires and cables cannot go or where it is too expensive for them to go.

Fig. 2 Example of wi-fi

VII. CONCLUSION

The inherent nature of WSNs makes them deployable in a variety of circumstances. They have the potential to be everywhere, on roads, in our homes and offices, forests, battlefields, disaster struck areas, and even underwater in oceans. This paper surveys the application areas where WSNs have been deployed such as military sensing, traffic surveillance, target tracking, environment monitoring, and healthcare monitoring. The paper also surveys the various fields where WSNs may be deployed in the near future as underwater acoustic sensor systems, sensing based cyber physical systems, time critical applications, cognitive sensing and spectrum management, and security and privacy management. These application areas are being researched extensively by various people across the industry.

REFERENCES

[1] http://www.wsn Wikipedia/google.com

[2] http://www.acunetix.com/wsnsurvey papers/scanner.html

[3] http://wsn simulation/asp.info

[4] http://wirelesss sensor network technology/index.asp

[5] http://search.askme.com/info.asp