AN OVERVIEW OVER WSN WITH IT'S APPLICATION

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ABSTRACT

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 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.

Keyword: wireless sensor networks, MEMS, Star, Mesh.

I.INTRODUCTION

Recent advances in VLSI technology, and MEMS (Micro-Electro-Mechanical Systems), as well as in wireless communication technology or WSN made it possible to manufacture sensor networks where very large numbers of very small nodes are scattered across some environment in order to sense and report to a central node (user).
WSNs have become the one of the most interesting areas of research in the past few years. Here, we look into the recent advances and future trends in WSNs.

A WSN generally consists of a base-station (also called as gateway sometimes) that can communicate with a number of wireless sensors via a radio link. Wireless sensor nodes collect the data, compress it, and transmit it to the gateway directly or indirectly with the help of other nodes. With the help of gateway connection transmitted data is present to the system.

WSNs are usually composed of small, low cost devices and they communicate wirelessly and have the capabilities of processing, sensing and storing .WSNs have may applicable basically motivated by industrial, civilization application areas, including industrial process monitoring, machine health monitoring described by Tiwari (2007) and control described by Kay and Mattern (2004) health care application home automation ,traffic control presented well by Kay and Mattern(2004) and Hadim(2006).We will briefly describe the different types of wireless networks in order to show why sensor networks are different.

II. APPLICTION REQUIREMENT OF WSN

The objective of a typical ground surveillance system is to alert the military command to targets of interest, such as moving vehicles and personnel in hostile regions. Such missions often involve a high element of risk for human personnel and require a high degree of stealthiest. Hence, the ability to deploy unmanned surveillance missions, by using wireless sensor networks, is of great practical importance for the military. Successful detection, classification, and tracking require a surveillance system to obtain the current position of a vehicle and its signature with acceptable precision and confidence. When the information is obtained, it has to be reported to a remote base station within an acceptable latency. Several application requirements must be satisfied to make this systemuseful in realistic environments:

• **Longevity:** Military surveillance missions typically last from a few days to several months. Due to the confidential nature of the mission and the inaccessibility of the hostile territory, it may not be possible to manually replenish the energy of the power-constrained sensor devices during the course of the mission. In addition, the static nature of the nodes in the field prevents the scavenging of the power from ambient motion or vibration. The small form factor and possible lack of the line of sight (e.g., deployment in the forest) make it difficult to harvest solar power. Hence, the application requires energy-aware schemes that can extend the lifetime of the sensor devices, so that they remain available for the duration of the mission.

• **Configuration Flexibility:** It is envisioned that Vigil Net will be deployed under different densities, topologies, sensing, and communication capabilities. Therefore, it is essential to design an architecture that is flexible enough to accommodate various system scenarios. For example, the system should have an adjustable sensitivity to accommodate different kinds of environment noise and security requirements. In critical missions, a high degree of sensitivity is desired to capture all potential targets even at the expense of possible false alarms. In other cases, it is desired to decrease the sensitivity of the system, maintaining a low probability of false alarms in order to avoid inappropriate actions and unnecessary power dissipation

. • **Stealthiness:** It is crucial for military surveillance systems to have a very low possibility of being detected and intercepted. Miniaturization makes sensor devices hard to detect physically; however, RF signals can be easily intercepted if sensor devices actively communicate during the surveillance stage. During the surveillance phase, a zero communication exposure is desired in the absence of significant events.

• **Real-time:** As a real-time online system for target tracking, Vigil Net is required to cope with fast changing events in a responsive manner. For example, a sensor node has to detect and classify a fast moving target within a few seconds before the target moves out of the sensing range. The real-time guarantee for sensor networks is more challenging due to the following reasons. First, sensor networks directly interact with the real world, in which the physical events may exhibit unpredictable spatiotemporal properties. These properties are hard to characterize with traditional methods. Second, although the real-time performance is a key concern, it should be performance compatible with many other critical issues such as energy efficiency and system robustness. For example, the delays introduced by power management directly affect the maximum target speed Vigil Net can track. It is an essential design tradeoff to balance between network longevity and responsive

III. WIRELESS COMMUNICTION TECHNOLOGY

WSN physical topology and density are entirely dependent on the applications [32], so the design and deployment of a WSN should consider its environment and application. A number of sensor nodes are densely deployed to improve data accuracy and achieve better system connectivity. However, a dense deployment of sensor nodes has some disadvantages: high energy consumption, data collisions, interferences, *etc.* [33]. WSN nodes normally have three typical kinds of network topologies: star topology, cluster/tree topology and mesh topology, as shown in Figure 3.

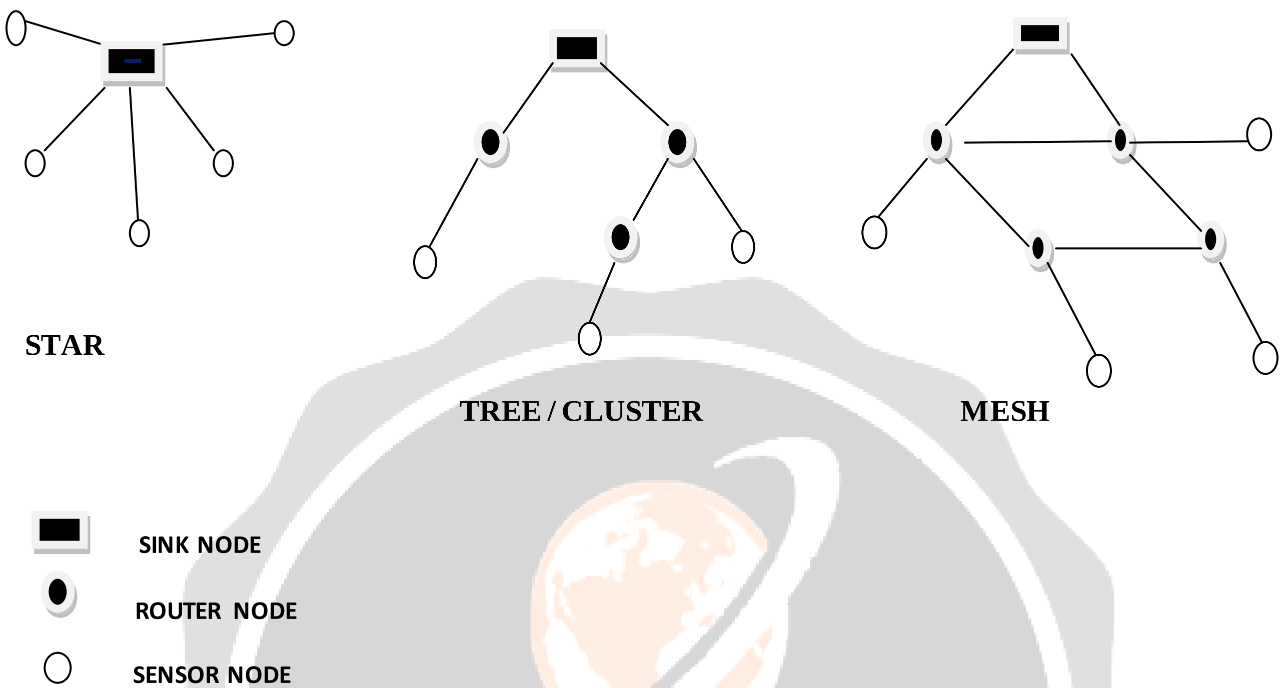

Figure 3. General WSN network topologies.

(1) Star topology: A star topology is a point-to-point single-hop architecture in which each sensor node connects directly to a sink node. It potentially uses the least amount of power among the three topology architectures.

(2) Mesh topology: A mesh topology is a one-to-many multi-hopping architecture in which each router node connects to multiple nodes. Its advantages over a star topology include a longer range distance of transmission, decreased loss of data, and a higher self-healing communication ability. However, its disadvantages are at the cost of higher latency and higher power consumptions.

(3) Cluster/tree topology: A cluster/tree topology is a hybrid star–mesh architecture. It takes advantage of the low power consumptions and simple architecture of a star topology, as well as the extended range and fault tolerance of a mesh one. However, there probably exists some latency.

The right and reasonable choice of network topology depends on the amount and frequency of data to be transmitted, transmission distance, battery life requirements and mobility of the sensor node [34]. It should be noted that a WSN physical topology may change due to available energy, Position variations of nodes, malfunction, reach ability (due to noise, severe weathers, moving obstacles, *etc.*), and task details of sensor nodes [35].

A sensor node normally incorporates a radio module for wireless communication. The transmitted distance of wireless communication can be anywhere between a few meters (Bluetooth, Zig -Bee, Wi-Fi, *etc.*) and thousands of kilometers (GSM or GPRS radio communication). Wireless communication has various standards and technologies including Bluetooth, Zig-Bee, Wi-Fi, GSM, GPRS and Wi-MAX.

IV.SENSOR NETWORK

Sensor networks consist of very small nodes (sensors) that are deployed in some geographical area. Sensor networks are used to measure temperature or pressure, or it could be used for target tracking or border surveillance. It could be also deployed in factories in order to monitor toxic or hazardous materials. It is also used to measure the weakness in building structures, or in vehicles and airplanes. It is applicable for target tracking or border of surveillance

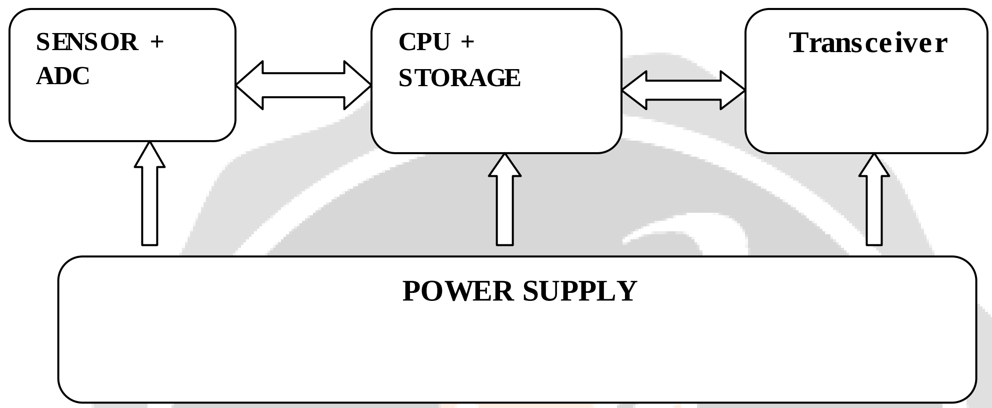

Figure 1: The architecture of a sensor node.

A typical sensor node consists of mainly 4 parts. Power supply, sensor and analog to digital converter (ADC), processor and storage memory, finally, transceiver to send and receiver data as shown in fig.1

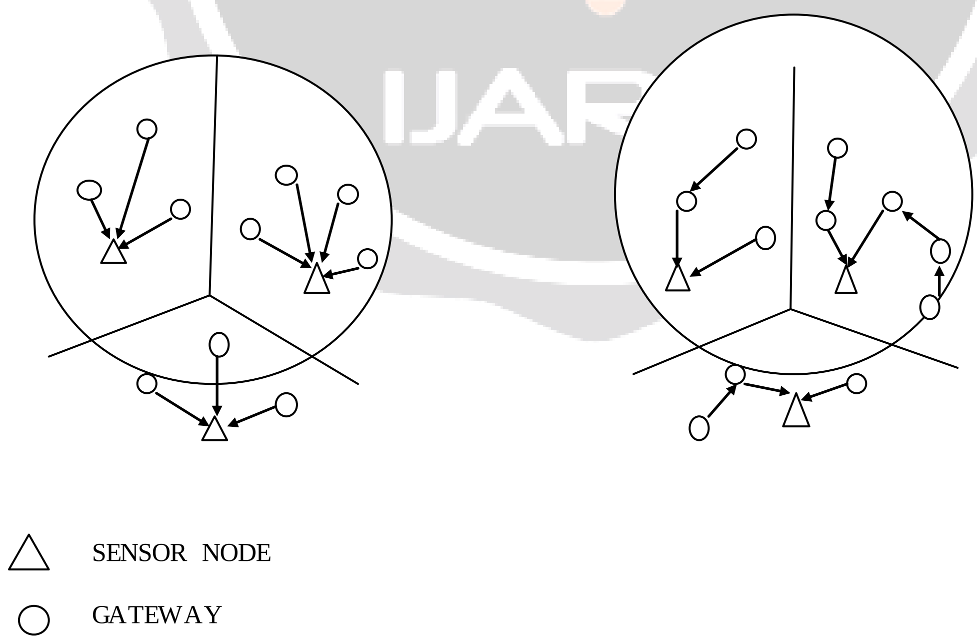

Figure 2: Two configurations for sensor networks.

V. RECENT ADVANCE

Recent advances in wireless and electronic technologies have enabled a wide range of applications of WSNs in military sensing, traffic surveillance, target tracking, environment monitoring, healthcare monitoring, and so on. Here we describe such type advances in WSN and their applications in various fields.

4.1 sensor Localization and Location –Aware services:

4.1.1 Smart Home/Smart Office

The research on smart homes is now starting to make its way into the market. Smart home environments can provide custom behaviours for a given individual. Considerable amount of research has been devoted to this topic. 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 functions that are considered to be part of a smart home. Several useful applications which take advantage of information collected by WSN are presented by Hussain *et al.* (2009).

Industrial and commercial

With the rapidly increasing technological advances in wireless technology and its subsequently decreasing prices, numerous wireless applications are being developed in industry. WSN in manufacturing industries can monitor and optimize quality control. 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. Since the long time wireless transmission of data is being done in industrial applications, but recently it has gained importance. The critical process applications of WSNs in industry are monitoring temperature, flow level, and pressure parameters.

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 .Also the new technologies must be integrated quickly into a comprehensive architecture to meet the requirements of present time. Improvement in situation awareness (Chien Chung Shen, 2001) is must requirement. Doumit and Agrawal (2002) 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 described by Akyildiz (2002).

Agriculture

Wang and Wang (2006) stated that agriculture can also be benefited by the deployment of WSN to get the information regarding soil degradation and water scarcity. With help of WSNs we can check the clean water consumed in irrigation and manage it.

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 condition based 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 (Arms *et al.* 2001), and big building.

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.

VI. APPLICATION

Home Applications，Office Applications

This is a time that we witness more and more electronic appliances enter average household, great commercial opportunities exist in home automation, smart home/office environment. Given the great market potential, breakthrough in this section will surely mark a big milestone in sensor network research.

An example application in this category is described in [24], Mani et al. present a “.Smart Kindergarten. That builds a sensor-based wireless network for early childhood education. It is envisioned that this interaction-based instruction method will soon take place of the traditional stimulus-responses based methods.

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