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Evolution of Wireless Sensor Network in Military or Defense Applications

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ABSTRACT

Micro-electronics has made wireless sensor networks a promising technology. Classifying and designing routing mechanisms or protocols for Wireless Sensor Networks are challenging due to the some inherent characteristics that distinguish this network from the other wireless networks such as mobile ad hoc networks, cellular networks, and wireless mesh networks. Due to these unique inherent characteristics, it is a challenging task to select or propose a new algorithm for a specific WSN application for Defense or military. This contribution is basically a detail survey which is organized in two folds. In first fold focus is on issues on which WSN routing protocols has been categorized or classified. Second fold exploring the issues that are actually challenges which must be considered while selecting or designing an algorithm for routing purpose in WSNs for military. This paper is a concept of operation of wireless sensor network on military application.

Key Words: Sensor network, network routing and control, querying and tasking, sensor networks, tracking and classification, wireless networks.

INTRODUCTION:

The development of micro-electronics has made wireless sensor networks (WSNs) a promising technology not only in operations of military , such as intrusion detection, battlefield surveillance and target tracking, but also in civilian applications such as health care systems, habitat monitoring, disaster detection and environment monitoring. By the definition of a sensor network, a wireless sensor network is a network consisting of spatially distributed autonomous sensors which monitor the nearby physical and environmental conditions (e.g., temperature, sound, vibration, pressure, motion, pollutants). The sensors in a wireless sensor network perform multi-hop data communication to a network gateway called a sink. In most cases, each sensor is a constrained wireless device with low computation capability, short transmission range, and very limited energy resources stored in a small onboard battery. However, as applications of WSNs usually require sensor nodes be left unattended for a long period for time due to the high maintenance cost or difficulties in accessing the deployment area, energy efficiency becomes a major concern for methods that are used to deliver data within WSNs. The motivation behind the paper stems from the demand for a proper application based protocol for WSNs which is reliable, energy efficient, and maximizes the network lifetime.

In the past few years, an intensive research that addresses the potential of collaboration among sensors in data gathering and processing and in the coordination and management of the sensing activity were conducted. However, sensor nodes are constrained in energy supply and bandwidth. Thus, innovative techniques that eliminate energy inefficiencies that would shorten the lifetime of the network are highly required. Such constraints combined with a typical deployment of large number of sensor nodes pose many challenges to the design and management of WSNs and necessitate energy-awareness at all layers of the networking protocol stack. For example, at the network layer, it is highly desirable to find methods for energy-efficient route discovery and relaying of data from the sensor nodes to the sink so that the lifetime of the network is maximized.

1. RELATED WORK

Wireless Sensor Networks (WSN)'s are highly distributed self-organized systems. They rely on significant numbers of scattered low-cost tiny devices featuring strong

limitations in terms of processing, memory, communications and energy capabilities. Wireless sensor networks are potentially one of the most important technologies of this century [4]. Recent advancement in wireless communications and electronics has enabled the development of low-cost, low-power, multifunctional miniature devices for use in remote sensing applications. The combination of these factors has improved the viability of utilizing a sensor network consisting of a large number of intelligent sensors, enabling the collection, processing analysis and dissemination of valuable information gathered in a variety of environments. A sensor network is composed of a large number of sensor nodes which consist of sensing, data processing and communication capabilities. Sensor network protocols and algorithms must possess self-organizing capabilities. Another unique feature of sensor networks is the cooperative effort of sensor nodes. Sensor nodes are suitable with an onboard processor. Instead of sending the raw data to the nodes responsible for the fusion, they use their processing abilities to locally carry out simple computations and transmit only the required and partially processed data.

Sensor networks are predominantly data-centric rather than address-centric.so sensed data are directed to an area containing a cluster of sensors rather than particular sensor addresses. Given the similarity in the data obtained by sensors in a dense cluster, aggregation of the data is performed locally. That is, a summary or analysis of the local data is prepared by an aggregator node within the cluster, thus reducing the communication bandwidth requirements. Aggregation of data increases the level of accuracy and reduces data redundancy. A network hierarchy and clustering of sensor nodes allows for network scalability, robustness, efficient resource utilization and lower power consumption. The fundamental objectives for sensor networks are reliability, accuracy, edibility, cost effectiveness and ease of deployment.

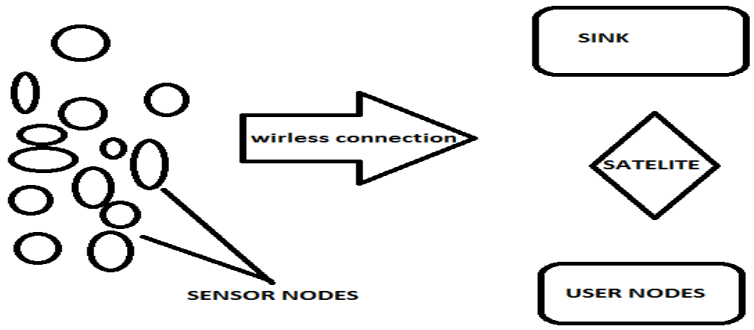

Figure 1: Wireless sensor Architecture

2. SENSOR NETWORK APPLICATIONS

WSN's are used in many fields and this sensor network has a wide range of application. Sensor network are used in controlling the temperature and in habitat monitoring. This provides a wide collection of sensing network or devices and environment conditions and fire detection in forest. These sensor nodes transfer the location of fire so that people can prevent the civilization area. Sensor nodes are used in nuclear and chemical research and also in biological research. A military application also consists of military command, control, intelligence, surveillance, and targeting systems. They can be benefited from WSNs because of rapid deployment, self-configuration, and self-healing and fault-tolerance characteristics [1].

3. EVOLUTION IN MILITARY OR DEFENCE

During the Cold War, the Sound Surveillance System (SOSUS), a system of acoustic sensors hydrophones) on the ocean bottom, was deployed at strategic locations to detect and track quiet Soviet submarines. Over the years, other more sophisticated acoustic networks have been developed for submarine surveillance. SOSUS is now used by the National Oceanographic and Atmospheric Administration (NOAA) for monitoring events in the ocean, e.g., seismic and animal activity [2].

Sensors and weapons are mounted with and controlled by separate platforms that operate independently. In network-centric warfare, sensors do not necessarily belong to weapons or platforms. Instead, they collaborate with each other over a communication network, and information is sent to the appropriate "shooters." Sensor networks can improve detection.

The recently concluded DARPA Sensor Information Technology (SensIT) program pursued two key research and development thrusts. First, it developed new networking techniques. In the battlefield context, these sensor devices or nodes should be ready for rapid deployment, in an ad hoc fashion, and in highly dynamic environments. Today's networking techniques, developed

for voice and data and relying on a fixed infrastructure will not suffice for battlefield use. Thus, the program developed new networking techniques suitable for highly dynamic ad hoc environments. The second thrust was networked information processing, i.e., how to extract useful, reliable, and timely information from the deployed sensor network.

4. CONCLUSION

Routing in sensor networks is a new area of research, with a limited but rapidly growing set of research results. This new area also consists of these military or defense application areas. In this article we present a comprehensive survey of military applications of sensors and their need in these types of applications. They have the common objective of trying to extend the lifetime of the sensor network while not compromising data delivery.

We can see that the sensor nodes having a wide range and they have a wide application in military or defense. We can make or extends many protocols for military so that our military can prevent our country using whole information through WSNs.

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