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A Study on Applications of Wireless Sensor Networks

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ABSTRACT: Nodes in Mobile Ad Hoc Networks (MANETs) are limited battery powered. That's why energy efficient routing has become an important optimization criterion in MANETs. The conventional routing protocols do not consider energy of the nodes while selecting routes which leads to early exhaustion of nodes and partitioning of the network. This paper attempts to provide an energy aware routing algorithm. The proposed algorithm finds the transmission energy between the nodes relative to the distance and the performance of the algorithm is analyzed between two metrics Total Transmission energy of a route and Maximum Number of Hops. The proposed algorithm shows efficient energy utilization and increased network lifetime with total transmission energy metric.

KEYWORDS: Big Data, FPGA, Sensors, Zig Bee

I. INTRODUCTION TO WIRELESS SENSOR NETWORKS

A Wireless Sensor Network - WSN sometimes called as Wireless Sensor and Actor Network– WSAN. Sensors are spatially distributed autonomous devices meant for monitoring physical or environmental conditions, such as temperature, sound, pressure, etc. and thy use the network to send these data to a remote machine [1]. The Sensor node consists of radio transceiver, microcontroller, power supply and the actual sensor. There exist a spatially distributed sensor nodes throughout the region to be monitored. They form a network through wireless communication as shown in figure 1.

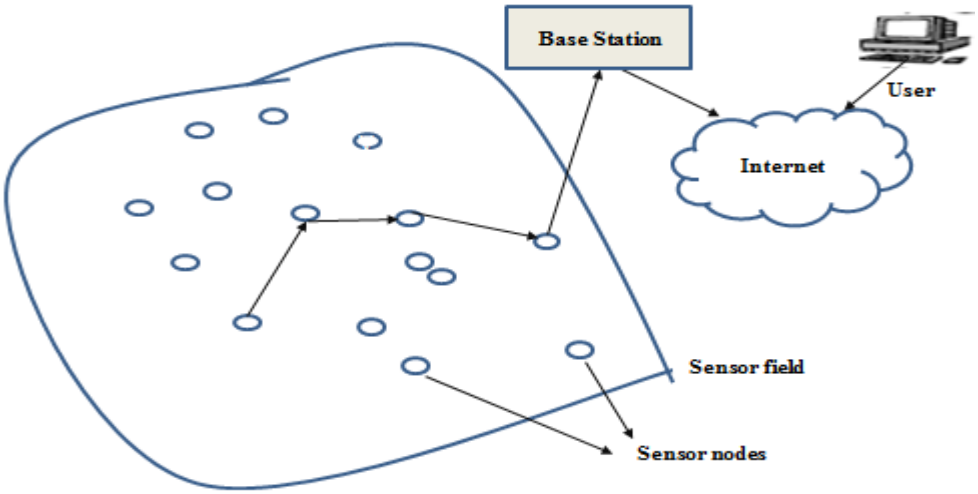

Figure1. The basic structure of wireless sensor networks

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II. APPLICATIONS

Because of advanced technology, sensor nodes are becoming smaller, cheaper and most powerful. This enables to deploy a large scale sensor networks. Sensors are linked using wireless technologies that employ ubiquitous sensor networks at low data rates, such as RFID, ZigBee, and Bluetooth; and Wi-Fi networks, cellular, and satellite communications at higher data rates. WSN applications offer great opportunities to optimize production where the use of wired networks is prohibitive.

A. Tracking chemical composition in environment

Wireless networks can be used to remotely monitor pipelines, natural gas leaks, corrosion, H2S content, equipment condition, and real-time reservoir status. An Air Pollution Monitoring System [2] is one of the applications of sensors where geo-sensor network system measures the contamination in the air. Major gases which cause air pollution are Carbon dioxide CO_2, Nitrogen dioxide NO_2 and Sulphur dioxide SO_2.Here the role of geo-sensor network is to send the measured quantity of these pollutants to the remote system where the exact processing and abstraction happens. In order to define facts, events and their relationship, this paper uses context model concept [] so that the context of the remote sensed area is understood. This paper also describes air pollution prevention model. This model defines the pollution and the potential polluted area which is based on abstracted data of the previous stage.

B. *Big Data and WSN*

Big data is a popular term used to describe the exponential growth and availability of *data*, both structured and unstructured [3]. And *big data* may be as important to business – and society – as the Internet has become. Here data is so large or complex that traditional *data* processing applications are inadequate. Challenges include analysis, capture, search, sharing, storage, transfer, visualization, and information privacy.

Cooperative Firefighting System-CFS [4] has been implemented based on WSN and big data concepts. In this project, Big Data acted as a central station for data analysing as well as for data processing. The CFS system was best suited only in tall buildings, where it is difficult to manage fire situations. Highlights of this work are involvement of Human Agent Robot Machine Sensor, WSN, Big Data, Human Interface, and Unmanned Ground Vehicle and humanoid robots. In order to create the situation of fire and the gas leakage, the experiment was carried out by the use of the candle and the lighter. Coming to the coding part of this work, WSN microcontroller was programmed in C. One of the points says that it could be improved if it is written in JAVA. Also there is a future scope of addressing communication issues in high raise buildings.

C. Smart Transportation

Networked cameras and other sensors can be used to monitor traffic flow and reduce congestion, track vehicles on city streets for traffic violations. Sensor systems can be optimized to help people find the proper parking zones while travelling to unfamiliar city. Many WSN systems have been developed based FPGA [5]. One of such system is 'intelligent car parking system' based on FPGA. In this system IR sensors detect car entry as well as exit phenomena [6]. By facilitating an interface and hardware/software module authors gave solution to car parking issues faced in big cities. Another such system is photosynthesis smart sensor which measures carbon dioxide, humidity and temperature does photosynthesis calculation [7].

For many crops for better yield and quality, it is desirable to use a device which is capable of detecting and quantifying the impact of drought stress in plants. The experiment done by authors of [8] consists of using a set of smart sensors based on Field Programmable Gate Arrays (FPGAs) to monitor a group of plants under controlled drought conditions. Using Discrete Wavelet Transform (DWT) they explored the response of plant physiological processes to drought.

What is FPGA?

Several WSN applications with FPGA-based sensor boards are shooter localization, bridge (structural) monitoring, vehicle tracking and RF localization. Field Programmable Gate Arrays- FPGAs have large resources of logic and RAM blocks to implement complex digital computations. Advantages of FPGAs include the ability to re-program in the field to fix bugs and lower non-recurring engineering costs. Vendors can also take an advantage by developing their

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hardware on ordinary FPGAs. Low-power optimized FPGAs are able to enhance the computation of several types of algorithms in terms of speed and power consumption in comparison to microcontrollers of commercial sensor nodes. Architectures based on the combination of microcontrollers and FPGA can play a key role in the future of sensor networks, in fields where processing capabilities such as strong cryptography, self-testing and data compression, among others, are paramount.

D. Effective Irrigation system

WSN applications can be found in agriculture system also. Paper [9] focuses on microcontroller based drip irrigation system. In the proposed system soil moisture sensor are water flow meter are two major components. Microcontroller sends the sensor data to the computer through ZigBee technology [10]. Thus water body is utilized efficiently which leads to save water. Incorporating soil features namely soil pH, soil electrical conductivity; temperature etc. are possible future enhancement to this work.

What is ZigBee technology?

ZigBee is a worldwide open standard for wireless radio networks in the monitoring and control fields. The standard was developed by the ZigBee Alliance- an association of International companies. What expected from ZigBee is to provide low cost and low power connectivity for equipment that needs very long battery life as several months to several years but does not require data transfer rates as high as those enabled by Bluetooth. Also ZigBee can be implemented larger networks than is possible with Bluetooth. ZigBee compliant wireless devices are operate in the unlicensed RF worldwide (2.4GHz global, 915MHz Americas or 868 MHz Europe). The data rate is 250kbps at 2.4GHz, 40kbps at 915MHz and 20kbps at 868MHz.

E. Healthcaremonitoring systems

Earlier WSN was applied majorly for military applications, civilian applications and slowly started using it in environmental species monitoring, industrial production, smart home and health care etc. WSN based health care systems have been deployed for applications such as home monitoring for chronic and elderly patients, real-time continuous patient monitoring in hospitals , automated vital sign analysis to reduce the incidents of medical accidents due to human error, and emergency situations[11]. The wireless healthcare applications use medical sensors and environmental sensors, mobile Devices like PDA, laptop and iPhone and more especially wireless communications protocols namely IEEE 802.11, IEEE 802.15.4, Bluetooth etc. Furthermore, a backend server is used for physiological healthcare information (PHI) storage, and for offline analysis of PHIs.

III. CONCLUSION

Optimizing a wireless sensor network also bring many open issues in the network design. In wireless sensor networks, they contain a lot of constrains, such as energy limitation, decentralized collaboration, and fault tolerance. This paper gave insight of some sensor network applications and also kind of discussion about some recent research domain of WSN. So it is helpful to the beginners those who like to do work on WSN.

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