Issues & solution for Wireless Sensor Networks in acquisition and analysis of data

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Abstract: In present scenario, remote access of information and analysis of data has tremendous scope of research. wireless sensor network plays a vital role in access remote location data with the help of sensors and data acquisition and analysis is quiet easy task with the help of WSN. This paper focuses on different issues and solution for WSN in acquisition and analysis of data.

1 Introduction

Wireless Sensors Networks (WSN) can monitor wide areas of applications. It has the ability to access remote places, real-time working, and can be easily used. WSN is used in various fields likes agriculture, data acquisition and geo-physical activities around the globe like forest burning, volcano rapture analysis etc.

The uses of WSN have been increasing gradually without any kind of limitations. The different type of networks uses different types of applications which have different constraints as well as features. Apart from this some of the issues are common that makes them homogenous. The positions of the sensor node become most sensitive point while the process of deployment of nodes [2]. But sometimes coverage area of networks creates an issue because it also directly depends upon the positions of the nodes. In sniper systems, sensor network occupies an area from the snipers.

There are several applications of wireless sensor network due to which it is being used are given below [3]:

- Wireless sensor networks can be deployed in various fields like environmental tracking. For example: forest discovery, tracking of animals, detection of flood, and prediction of next day weather. WSNs are also used in commercial fields. For example: forecasting of seismic activities.

- In defence field, like tracking and environment examining supervision applications require these types of networks. From the sensor network the nodes are operated at remote locations and perform as per the requirements of user. Opponent tracking, safety detections these operations can also be performed by implementing these types of networks.

- Applications related to health issues, like monitoring of patients and these types of WSN are used by the doctors.

- Wireless sensor networks are usually used in transport system related application like supervising traffic flow, controlling dynamic routing techniques, controlling and supervising the vehicle parking area etc.

- Quick action in case of emergency, controlling the industrial activities, automatic controlling the temperature of building, ecological unit and surroundings monitoring, etc., utilize these wireless sensor networks.

So, the number of sensors to be used must be low in order to reduce the chances to be discovered. Excluding this the concerns mentioned above are not unknown in case of WSN for civilian purpose because decreasing the number of sensors used and increasing the lifetime can directly reduce the cost of network [4]. As many of WSN include bulk of nodes and many of their features cannot be measured simply, the process of selection of various geographical positions of nodes to get optimum network is known as WSN layout problem that can make it complex. It recalls the unicast set covering the problems also called as NP.

This is the reason for which metaheuristics is an option to solve this problem. In most of the problems the focus is on to reduce the energy consumption as well as nodes used in the network. The number of nodes can create a problem while covering the network. While displaying the network it has to face the various considerations [5]. The coverage has to follow some rules or restrictions and highly coverage area is preferred. The reduction of sensor nodes is not for a specific purpose it is just to reduce the cost factor. The lifetime of a network depends upon the consumption of energy so energy management is really very critical in the network.
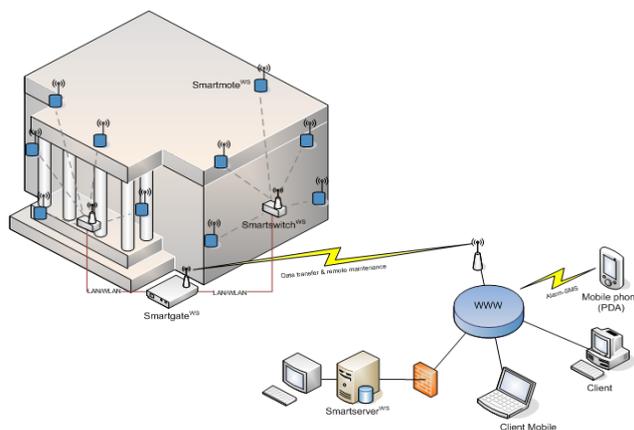
Figure 1 General Layout of WSN [6]

2 Energy Consideration in WSN

WSN are tending to spread very quickly, easy to install, and in case of early detection of failure it provides a very efficient and cost-effective solutions. EPRI funded project's output has given by WSN. This project of EPRI was contracted by University of N. Carolina. The experimental WSN is also known as Paradise Net and was installed in different phases and presently it consists of 122 sensor nodes which measures the physical quantities of various subsystems within a substation. A base station collects the data from these nodes and transfers to the database at Charlotte through internet connection. The main objective of this project was to check or test the capacity of the wireless sensors in the substation and to apply the main applications which are mandatory for monitoring of substation by making use of low power wireless sensor nodes and for design challenges to expand the network for overring the whole substation. Design of these mandatory components also represents the design issues for this network. It focuses on design in order to expand the number of nodes from 122 to 150 at least. The prominence is on energy and issues related to the lifetime of battery and new discovered consideration of field data. There is a sampling scheme for increasing node time also available known as level crossing sampling, it transfers the sensors data only when it notices any alteration in sensors values by comparing it to the predetermined values. In recent years, the practical implementation of wireless sensor network has attracted lots of interests. Wireless sensor network is used in various fields such as structural monitoring, natural-disaster forecasting, industrial process monitoring, habitat monitoring, structural monitoring ,soil and climate monitoring for use in agriculture. The capacity and effectiveness of cost of wireless sensors networks as compared to wired are indicated by above mentioned examples.

Many practical examples have been defining the various issues related to the installation of networks of large-scale such as energy consumption, network architecture, and geographical coverage. For example, to describe a network consists of 557 solar-powered nodes covering 50,000 square meters. This gateway contains a server and seven gateways. There is another example of large-scale network in which there are 50-node mobile sensor network namely Zebra Net, and the habitat monitoring network of 150-node.

There is another design issue also excepting scalability like development of general layout for industrial use and it reports the implementation in two different target applications. Oil platform in the North Sea is one

among them and another is semiconductors manufacturing unit. One more industrial implementation Boeing Company plant motors states were monitored by wireless sensor networks. In health monitoring, this work was also purposive to estimate energy costs. This work is also suggestive to find out estimated costs in health monitoring.

3 Lifetime issue and Energy Consumption

To design an effective wireless network the most important aspect is energy consumption. Finite electrical energy in each sensor node, "is defined by the capacity of the onboard battery" [9]. Solar energy governed nodes have to face problem of regular power supply due to variation in solar radiance, size and cost and limitation due to rechargeable battery. Therefore, all facts related to energy conservation must be included in all design related features of wireless sensor nodes. After detection, its radio keeps itself to receive the signal. The consumption of energy in radio transmission is very high. Actuation current and sensing are other parameters which effects the energy use and these parameters are important for some applications like gas density and vibration sensing.

4 Energy Conservation by using Level-Crossing Sampling

For re-configuration of route, XMesh needs nearly 8 times interval of route update, in order to maintain the route reconfiguration time period less than 24 hours each and every node in ParadiseNet were programmed with TRUI = 7200s. Thus, the frequency of data packet transmissions is reduced so that the current consumption reduces. In various monitoring applications, it is not easy to measure the minimum fixed sampling rates without information related to features of sensed signal like bandwidth [10]. Generally, the monitoring signals doesn't vary from one sample to another but sponsors define the interval in data sampling of TD = 900s. As the monitoring signal doesn't vary so level-crossing sampling (LCS) scheme can be used, in this the data is transferred when set of levels are crossed which are predetermined. LCS comes under non-uniform sampling and it is used for transmission of signals with long inactivity period or burst signals. Selection of fixed uniform sampling rate is also abolished by this scheme and which is not easy in case of unknown signals. The statistics of the signal and the selection of level have great impact on errors between and rearranged signals using sand the savings the large number of samples. The samples are saved in data packets and then these data packets are transmitted by using uniform (LCS) level crossing scheme. These results were captured from data from a surrounded temperature sensing node in Paradise Net and a C level-spacing gives approximately 75% savings during transmissions of data under such conditions. Node is part of a single cluster; cluster heads the distributed in a proper manner.

5 Deployment of nodes

With a rapid growth in wireless communication, sensors, MEMS (micro electro mechanical systems), integrated circuits etc. The technology used for acquisition of data through sensors using MEMS, its integration and therefore wireless sensor network becomes more mature [11]. It consists of many sensor nodes

by making the use of radio communication, for this sensor are collected together to receive the live data gathered for targeted application by detection part of network then this information is transferred to that object which requires it. Hence, the network of wireless sensors can be affected by the deployment of node.

Good network node deployment decreases the redundancy of nodes and also protracts the service lifetime of the network. For instance, if we take the case of traffic lights alarming model, gathering of every information related to traffic resulting in affecting the system to make a good quality control system.

Hence, using wireless sensor network to gather the traffic information requires coverage of sensor nodes operation in such a way that it can use effective and efficient node deployment in order to maximum coverage and also provide excellent connectivity while using minimum energy. Three nodes namely management node, single sensor source and sink node are required to create a WSN traffic monitoring system for roads (shown in figure below).
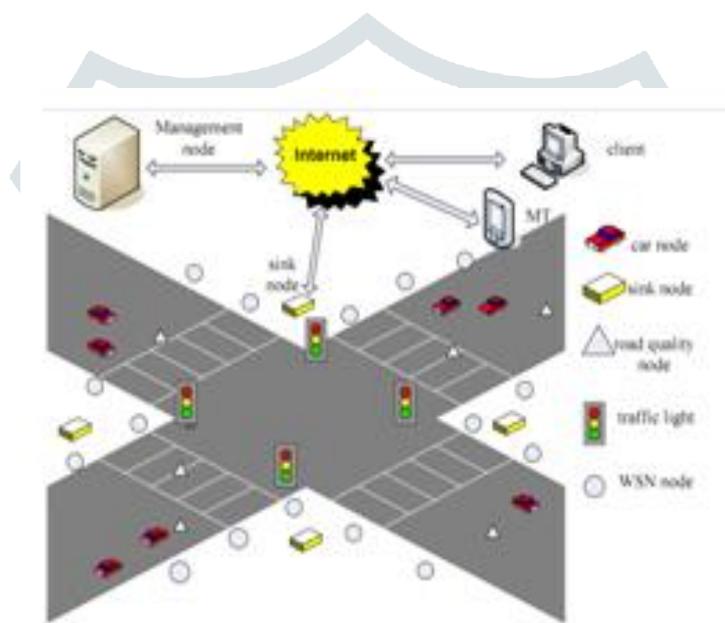

Figure 2. Example of a wireless network for intelligent traffic [11]

The workings of these three nodes are as follows [12]:

- Management Node: firstly, data is collected from internet and then stored in database and then records are maintained to provide the search services.
- Sink Node: information related to road, people and traffic flow received by sink node, and it sends detailed information to the management node.
- Single Node: It consists of vehicle and fixed nodes. Fixed nodes generally deployed inside roads and on both sides of road to check the state of road of the road and also collect data related to traffic on the road.

The mobile terminals and client are required to perform the operations on gathered data. An integrated evaluation function is also used in some systems to achieve the sensor node deployment; it is based on energy conservation, connectivity and coverage.

6. Conclusion

This paper introduces various issues of wireless sensor networks in terms of energy consideration, lifetime issue and energy consumption and provide solution using level-crossing sampling method. In this paper we introduce the efficient way of deployment of WSN nodes.

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