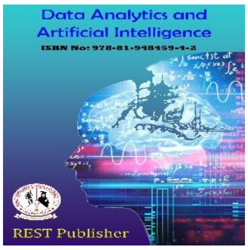
Data Analytics and Artificial Intelligence

Vol: 3(2), March 2023

REST Publisher; ISBN: 978-81-948459-4-2

Website: http://restpublisher.com/book-series/daai/

DOI: https://doi.org/10.46632/daai/3/2/34



A Performance Analysis of Wireless Sensor Networks in Recent Years

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Abstract. *Wireless Sensor networks (WSNs) have become one of the most interesting areas of research in the past few years. Undoubtedly, wireless transmission techniques are used for all node-to-node communication. Additionally, because wireless sensor networks are self- organized, independent of fixed infrastructure, and their topologies vary on a regular basis, broadcasting is the default method of communication in WSNs. But a handful of sensor nodes in long-lasting networks have dynamically accomplished it. They are autonomous systems that share common sensors, centralized nodes, and a back-end server. The real-time independent sensor data is initially transmitted by the common sensors, and finally, the back- end server receives the sensed data to do additional process and performance analysis. Wireless sensor networks (WSNs) are hybrid nodes with wireless communication interfaces, data sensing, processing, and storage capabilities that are rapidly expanding in number. It is used for many different things in daily life, including tracking vehicles, keeping an eye out for fires in the forest, finding and tracking soldiers for military usage, keeping an eye on the oceans and seas, and creating intelligent places.*

Keywords: *Wireless, Sensors, Networks, Nodes, Servers, Building, Base Stations.*

1. Introduction

The recent improvements in MEMS (micro electro mechanical systems) have given more research areas in wireless communication. The compactness, low cost, highly efficient MEMS devices as made the WSN more advanced area of research, also the processing speed, storing data and sensing have also become more useful in area of WSN. This has made the development in industries application, military application and also in civilian application such as monitoring, controlling and processing. 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. The transmitted data is then presented to the system by the gateway connection.

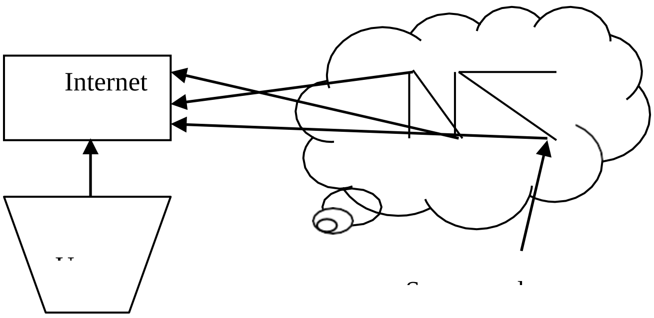

FIGURE 1. Simple diagram of sensor node process

Recent advances in hardware, sensor, and wireless networking technologies areenabling large-scale deployment of superior data acquisition systems with adjustable resolutions, by incrementing thephysical world with numerous networked micro sensors, and such systems are called wireless sensor networks. This paper aims to enhance the development of technology over wireless sensor networks where more researchers have become interested inthem recently.

2. Applications of WSNs

Data Aggregation: Data implosion and overlap are common phenomenon in a sensor network as nodes in the proximity usually hold similar data. Energy is therefore wastedwhen the same data value from multiple sources is individually routed to the sink.It is desirable to process as much data locally as possible so as to reduce the number of bits transmitted in the air, particularly over a long distance.Transmitting 1 Kb of data a distance of 100 m costs the same amount of energy as executing 300 million instructions on a general-purpose processor with a modest computing device rate of 100 million instructions per second (MIPS). Data-centric routing is eminently suited toperform operations such as data aggregation in sensor networks. Monitoring and Control Traffic: In big cities traffic congestion is one of the main problems faced in entire world. An intelligent system of transport using WSN can provide a complete monitoring of vehicle congestion in traffic roads and automatic control the signals to reduce the conjunction. This process is a real time traffic control where the data is collected every second and processed by the computer involved in this intelligent system. Locating and monitoring a particular vehicle is also possible by WSN.Thus, this area as shown much interest in developing WSN and extend its application in intelligent traffic control. Security and privacy concern: The field that paid less attention is the privacy concern on information being collected, transmitted and analyzed in aWSN. Such private information of concernmay include payload data collected by sensors and transmitted through thenetwork to a centralized data processing server. The location of a sensor initiating data communication and other suchcontext 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 pre- requisites. Privacy protection in various fields related to WSNs, such as wired and wireless networking, databases and data mining. Effective privacy preserving techniques are needed for the uniquechallenges of WSN security. Smart Office /Homes: The next era is of smart homes and smart office where the research is going to turn out. In many researchers are already have done to provide home and offices in smarter way. Now with the addition of WSN as made this simpler to achieve the goal. WSN will be providing all data collection, communication to provide a complete smart home and offices at affordable cost in recent years of now-a- days. Acoustic sensor systems inunderwater: WSN in recent research have been deployed in underwater application but thechallenges to be overcome are like mobility of node, propagation delays and every high error in underwatercommunication is high while compare to land WSNs. This makes the WSNs in underwater more challenging area of research. Once an error free UWSNs (Underwater Wireless Sensor Networks) protocol is developed numerous application can be done in underwater, few examples are acquiring oceanographic data, monitor pollution in ocean and other water bodies, prevention of disaster in ocean, assisting navigation, surveillance under water, tactical application in underwater defense along with more sensor in addition natural resourcesundersea is possible, and collectingscientific information undersea water can be achieved. Underwater sensor nodes andvehicles should be capable of coordinate their operation, exchanging their location and movement information and hencerelay monitored data to an onshore base station. A protocol named DUCS (Distributed Underwater ClusteringScheme in 2008) is a GPS free routingprotocol. It minimizes the proactive routing message exchange and does notuse flooding techniques. It also uses data aggregation to eliminate redundant information.

3. Network Architecture Design:

Network architecture design is important for studying about the network organization for data communication in a sensor network as it affects the way nodes can make configuration themselves for data communication, monitoring, self-addressing and thus corresponding impact on MAC layer design and security issues need to be looked at very carefully. There are two main architectural alternatives: Hierarchical and Flat Network Organization. Hierarchical Network Organization: Hierarchical networks have beenused extensively in MANETs to eliminate the overhead involved in updating the network about the global topology. Flatnetworks rely on popular techniques of data centric routing paradigm such as directed diffusion that exploits tree-based structure for data gathering and aggregation. Although the hierarchical network architecture is energy efficient forcollecting and aggregating data from the entire sensor network or all nodes within a large target region. Some of the protocols are used for hierarchical network such as TEEN, APTEEN, LEACH and so on. Flat Network Organization: Flat network architecture is more suitable for transferring data between certain source-destination pairs separatedby a large number of hops using knowledge of their relative locations. We now differentiate between hierarchical and flat sensor networks and describe protocolsrecently developed for these two different modes of data communication. In that, all nodes are equal and connections are set up between nodes that are within each other’s radio range, although constrained by connectivity conditions and availableresources. Route discovery can be carried out in flat networks using reactive floodingthat does not require global maintenance of network topology. During flooding, each node broadcasts the data packets till all the nodes in the network receive the packet, therefore it is energy exhaustive as nodes could receive multiple or duplicate copies of the same data packet as they have common neighbors sensing similardata due to high density of nodes.

4. Routing

Routing is the process of path selection in any network. A computer network is made of many machines, called nodes, and paths or links that connect those nodes. Communication between two nodes in an interconnected network cantake place through many different paths. Some of the routing methods based on location, energy-aware, multipath and leverage of nodes. Location Based Routing: In many cases, sensor data are useful if the location of their source is known. The basic idea is to route packetsin a manner such that the next hop is geographically closer to the destination. The decisions are completely local as information about immediate neighbors is adequate. The effect of location errors on geographic routing that is even moresignificant if a sensor network consists of mobile nodes. Their study is based on freshness of location information, the speed of mobile nodes, and the mobility pattern of mobile nodes. Energy-Aware Routing: Energy efficiency and energy balancing are crucial research issues in routing path designing for self- organized WSN. Energy Efficient routes are computed between a source-sink pair based on the energy available at intermediate nodes and the transmission energy required to reach them. Possible steps that consume energy while routing is topology discovery overhead, routing protocol overhead, actual transmission of data, and idle radio listening energy. Besides the actual workload, size density and fluctuations in the topology are other factors that affect energy consumption. Some popular energy metrics areminimum transmission energy, which usually yields the shortest route from the source to the sink, and a path withmaximal residual energy path is chosen. A shortest-path algorithm finds a pathcontaining the minimal cost between two nodes in the Wireless Sensor Network. Multipath Routing: Multipath routing is used to spread the traffic uniformly over an increasing number of nodes; achieve improved load balancing and enhanced resilience to node failure. Traffic spreading avoids penalizingfew nodes connecting the source directly to the destination in a manner that maximizes the time at which the first node runs out of its battery power. This multipath routing is also actively used in sensor networks to provide robustness to node or link failure though maintenance ofdisjoint multiple paths so that alternate paths may be substituted on failure of the primary path. Partially disjoint alternate paths or braided is another variation of multiple path routing used to maintain back-up routes. Sometimes duplicate copies of data are simultaneously routed through multiple routes to improve the likelihood of essential information being routed to the destination. Computation of parallel multiple routes have also been proposed as a mechanism to provideQuality of Service in sensor networks. Leverage Nodes Routing: In case the sensor network has some mobile nodes, a node that is moving away from a location of an event may choose to pass on the responsibility of monitoring to a close by node as it drifts away. The idea is to buffer the informationat static nodes and transfer it to the mobile nodes when they are in the proximity, so that the mobile nodes may disseminate information while they move around in thenetwork. If the observer's or the sink's motion can be predicted, large power savings can be obtained over a networkwith node mobility. The data is pulled by the observer by waking up the nodes when it is close to them. Since nodes only transmit when the observer is close to them, the power requirements are significantly reduced. In a real time setting mobility can be used to facilitate network connectivity and saving communication energy spent between sensor nodes and data repository.

5. Conclusion

Nature of Wireless Sensor Networks makes them deployable in a variety of circumstances. They have thepotential to be everywhere on roads, in ourhomes and offices, disaster areas, and evenunderwater in oceans. Sensor Networks seems to be very useful for programmable applications where it is desirable to have self-organizing characteristics, coupledwith sensed attribute and easy aggregation of data while minimizing energy consumption. This paper concludes withthe development required in wireless sensor network in future applications.

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