Performance And Reliability Improvement Model For WSN

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ABSTRACT: The wide utilization of Wireless Sensor Networks (WSNs) is obstructed by the severely limited energy constraints of the individual sensor nodes. This is the reason why a large part of the research in WSNs focuses on the development of energy efficient routing protocols. Energy conservation is one of the major important issues in wireless sensor networks. In WSN communication is based on battery operated computing and sensing devices. In WSN sensor networks energy to be deployed in an Adhoc manner, with a positive approach, individual nodes can be largely inactive at idle periods of time, but when something is detected then becoming suddenly active. In WSN the major challenges for research are conservation of energy and security. Large-scale deployments will require routing protocols that scale to large network sizes in an energy-efficient way. Routing in WSNs is very challenging due to unique inherent characteristics (energy efficiency and awareness, connection maintenance, minimum resource usage limitation, low latency, load balancing in terms of energy used by sensor nodes, etc.) that distinguish this network from other wireless networks such as mobile ad hoc networks, cellular networks, and wireless mesh networks. This paper presents existing issues of WSN which can affect its performance and reliability and also proposed a reliability and performance improvement model for WSN.

Keywords: Wireless Sensor Network, Reliability, Performance, Security, Energy

1. INTRODUCTION

The emerging field of wireless sensor networks combines various features such as sensing, computation, and communication into a single tiny device [2]. Through advanced mesh networking protocols, these devices form a sea of connectivity that extends the reach of cyberspace out into the physical world. As water flows to fill every room of a submerged ship, the mesh networking connectivity will seek out and exploit any possible communication path by hopping data from node to node in search of its destination. While the capabilities of any single device are minimal, the composition of hundreds of devices offers radical new technological possibilities [3]. Wireless Sensor Network usually contains thousands or millions of sensors, which are randomly and widely deployed. Wireless sensor networks (WSNs) do not always have sensor nodes of the same type. Wireless sensor networks have at least one base station that works as a gateway between the sensor network and outside world. Sensor nodes sense the phenomenon and send the data to the base station via single or multi-hop communication. Users access the data store data base station [4]. In this research paper presents existing issues of WSN which can affect its performance and reliability and also proposed a reliability and performance improvement model for WSN. This complete paper is organized in various chapters include the introduction of WSN, its application and issues, related work, proposed model and finally covers conclusions and future work.

2. WIRELESS SENSOR NETWORK & APPLICATION

Sensor networks are dense wireless networks of small, low-cost sensors, which collect and disseminate environmental data. Wireless sensor networks facilitate monitoring and controlling of physical environments from remote locations with better accuracy. They have applications in a variety of fields such as environmental monitoring, military purposes and gathering sensing information in inhospitable locations. Sensor nodes have various energy and computational constraints because of their inexpensive nature and ad-hoc method of deployment [20]. Previously, sensor networks consisted of a small number of sensor nodes that were wired to a central processing station. Figure 1.1 shows wireless sensor network.

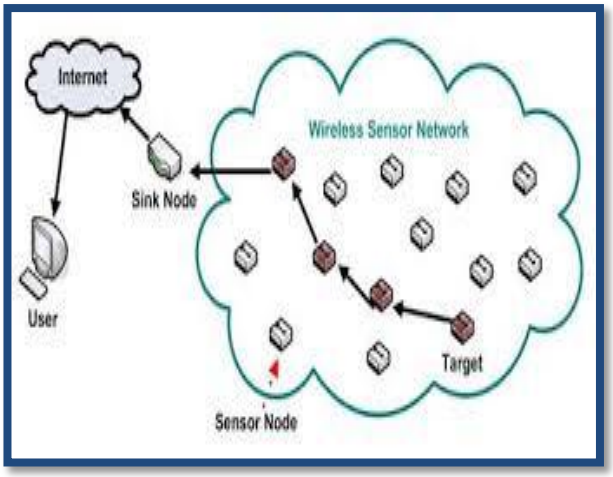

Figure 1.1 *Wireless Sensor Networks [7]*

However, nowadays, the focus is more on wireless, distributed, sensing nodes. When the exact location of a particular phenomenon is unknown, distributed sensing allows for closer placement to the phenomenon than a single sensor would permit [6]. Also, in many cases, multiple sensor nodes are required to overcome environmental obstacles like obstructions, a line of sight constraints etc.

2.1 APPLICATION OF WSN-

Sensor Networks have following applications-

- **Area monitoring**-Area monitoring is a common application of WSNs. In area monitoring, the WSN is deployed over a region where some phenomenon is to be monitored [2].

- **Environmental/Earth monitoring**-The term Environmental Sensor Networks, has evolved to cover many applications of WSNs to earth science research [11].
- **Air pollution monitoring**-Wireless sensor networks have been deployed in several cities (Stockholm, London or Brisbane) to monitor the concentration of dangerous gases for citizens [3].
- **Forest fire detection**-A network of Sensor Nodes can be installed in a forest to detect when a fire has started [5]. The nodes can be equipped with sensors to measure temperature, humidity, and gases which are produced by a fire in the trees or vegetation.
- **The landslide detection**-A landslide detection system makes use of a wireless sensor network to detect the slight movements of soil and changes in various parameters that may occur before or during a landslide.
- **Water quality monitoring**-Water quality monitoring involves analyzing water properties in dams, rivers, lakes & oceans, as well as underground water reserves [13].
- **Natural disaster prevention**-Wireless sensor networks can effectively act to prevent the consequences of natural disasters, like floods.
- **Industrial monitoring/Machine health monitoring**-Wireless sensor networks have been developed for machinery condition-based maintenance (CBM) as they offer significant cost savings and enable new functionalities.
- **Data logging**-Wireless sensor networks are also used for the collection of data for monitoring of environmental information; this can be as simple as the monitoring of the temperature in a fridge to the level of water in overflow tanks in nuclear power plants [9].
- **Industrial sense and control applications**-In recent research a vast number of wireless sensor network communication protocols have been developed. While the previous research was primarily focused on power awareness, more recent research has begun to consider a wider range of aspects, such as wireless link reliability, real-time capabilities, or quality-of-service.
- **Greenhouses**-Wireless sensor networks are also used to control the temperature and humidity levels inside commercial greenhouses.

3. RELATED WORK

There are many emerging applications out of which environment monitoring application is very important and very popular [3]. It needs densely deployed network which has lead to the development of energy efficient and QoS based protocols. Still, there is a lot to be done to entirely exploit the benefits of wireless sensor Networks [5]. SEP (Stable Election Protocol) works for the election of cluster heads in a distributed fashion in two-level hierarchical wireless sensor networks. Election of nodes as cluster heads depends upon the starting energy of the nodes because some nodes are more powerful than the others in contrast to newly protocol (EEICCP) [14] as energy is same for all the nodes so any node can be the cluster head in starting and it is selected randomly like LEACH [2] and the HCR [3] Longevity of the network is increased by using EEICCP because energy consumption is very less in this protocol. To solve the hot spot problem a Un- equal Cluster-based Routing (UCR) protocol [6] is devised. In technical terms, the hotspot problem can be described as the isolation of the sink node from the rest of the network as a result of the power exhaustion of nodes in the hotspot area and the area in the interior of the maximum transmission of the sink node is the hotspot area. Hot spot problem arises when approximately all the data is transferred from the nodes which are nearest to the sink [19]. Those nodes bear the load of all other nodes and hence deplete their energy earlier than others which result in the death of nodes and make it difficult for the other nodes to transfer the data as with the death of nodes near to the sink will end the routing path to the sink hence network will become archaic [15]. This problem does not arise in EEICCP [8] because the role of CH and CCO [3]is rotated after one round of transferring data. One round gets accomplished when the data of all the nodes of all the clusters are sent. UCR groups the nodes into clusters of unequal sizes as a contrast to EEICCP in which all clusters have uniform size assumed of 100 nodes. In UCR Cluster heads closer to the base station have smaller cluster sizes than those farther from the base station, to save some energy for the inter-cluster communication to forward the data. This is not needed in EEICCP because there is always one CCO in each cluster (low distance from BS) above the lower cluster (higher distance from BS) which makes it less complex than the UCR. Clustering can save a lot of energy compared to not cluster organization which is the flat architecture [7]. Many energy efficient algorithms have been developed and they have proved that clustering has proved best in saving energy so cluster organization is adopted in EEICCP. Some protocols have to be determined how to select the cluster head in an optimal way and what should be the cluster size [8]. But cluster size is assumed to be static in EEICCP protocol to achieve long life for the WSN. Different techniques for the election of cluster head came into existence like coverage metric of node [9], making the protocol more com-

4. CHALLENGES IN WSN

Wireless Sensor Networks have following issues-

- **Power Consumption** – Power aware routing and Maintenance of power must be taken into consideration. To learn about the power consumption the communication-related functions should be optimized for most of the light-weight mobile terminals [6].
- **POWER AWARENESS**-Since the nodes in an ad hoc network typically run on batteries and are deployed in hostile terrains, they need rigorous power requirements. This means that the underlying protocols must be designed to conserve battery life.
- **Addressing scheme**-The network topology keeps changing dynamically and hence the addressing scheme used is very important.
- **Network Size**-The ability to enable commercial applications such as voice transmission in conference halls, meetings, etc., is an attractive feature of WSN [13].
- **Network Congestion**-When the aggregate demand for resources (e.g., bandwidth) exceeds the capacity of the link, congestion results. Congestion is

characterized by delay and loss of packets in delivery [5].

- **Packet delay and drop**-A poor network performance can be offered due to congestion, e.g. high dropping and queuing delay for packets, low throughput and unmaintained average queue length which may not prevent the router buffers from building up, then dropping packets [2].
- **Degradation of the throughput**-Degradation of throughput is an important issue in Wireless networks, due to congestion throughput degraded. It is the ratio between the numbers of sent packets vs. received packets [7].
- **Routing-** Routing is the method of discovering routes in between source and destination.
- **The mobility-t**he presence of mobility implies that links make and break often and in an in a deterministic fashion. The classical distributed Bellman-Ford routing algorithm is used to maintain and update routing information in a packet radio network.
- **Internetworking**-Harmonious mobility management is a challenge in the mobile device due to the coexistence of routing protocols [8].
- **Security and Reliability**-An Wireless Sensor Networks has its particular security problems due to e.g. nasty neighbor relaying packets in spite of accumulation to the frequent vulnerabilities of wireless connection [13].
- **The quality of Service (QoS)**-It will be a challenge on providing various qualities of service levels in a persistently varying environment.

5. PROPOSED MODEL

This research work presents an **"Energy efficient & secure routing model (EESRM)",** to improve the lifetime and performance of the wireless sensor network. The proposed EESR model works more effectively on two layers MAC and Network layer. This research work reveals the correlations between nodes various performance issues, node components, and energy. Energy conservation, life time and security issues in WSN can resolve by proposed EESR model.

Proposed EESR Model is based on three phases. First phase of the research work presents **(Energy efficient routing model) EERM**. Proposed EERM mainly covers how to save the energy and how can improves the network life time and the Second phase presents **ESRM (efficient secure routing model).** Proposed ESRM model covers how to make secure communication in WSN. The third phase of the works combined first phase (EERM) and second phase (ESRM) schemes and proposed (EESRM) which provides a better lifetime of the network means less energy consumption with reliable and secure communication.

6. CONCLUSIONS & FUTURE WORKS

The need of the wireless sensor network (WSN) came into existence with the military applications which are now used in environmental monitoring, health care applications, industrial process control, security applications etc. Sensors can collect the data about the temperature, humidity and move objects, which are battery, operated and can't be recharged after deployment. This limitation of sensors leads to the failure of the network when their energy is depleted, affecting the reliability of the network. This paper discussed various existing works in the field of wireless sensor network issues of WSN. It also covered various application and issues of WSN. Mainly described various parameters can affect its performance and reliability and also proposed a reliability and performance improvement model for WSN. In future work, we will develop our proposed EERSM method and will compare it with various existing methods based on different performance measurement parameters such as delay, packet delivery ratio, packet drop ratio, network lifetime.

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