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ROUTING CHALLENGES IN WIRELESS SENSOR NETWORK

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ABSTRACT: Wireless Sensor Network is a highly distributed network of small and lightweight sensing nodes which are deployed in a large number at multiple locations. These networks are helpful in monitoring the system or environment. These sensor nodes performs sensing, processing and then communicating. Now a day's these networks are applied in various fields like military, defence, forest fire, medical, crisis management etc. The wireless senor network is important for today's world it is beneficial for many industries military, weather forecasting the review on various routing protocol is discussed.

Keywords: [WSN, Routing, Clustering, Energy Consumption, Aggregation]

1. INTRODUCTION

Wireless sensor network (WSN) is wide considered as one of the most necessary technologies for the twenty-first century. In the past decades, it has received tremendous attention from both academic and industry all over the world. WSN network is cheap network to establish capabilities. These sensor nodes communicate over short distance via a wireless medium and collaborate to accomplish a typical task, as an example, setting watching, military surveillance, and industrial process control. To sensor node is limited, the aggregate power of the entire network is sufficient for the required mission.

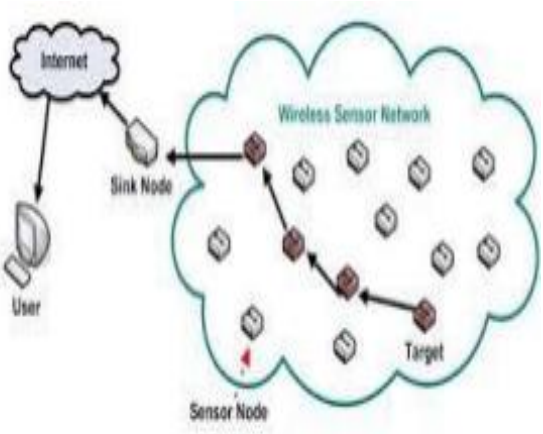

Figure 1: Wireless Sensor Network

Terrestrial Wireless Sensor Networks (TWSNs): Most generally the Terrestrial WSNs contains hundreds to thousands of cheap wireless sensor nodes which are installed in a specified geographical area. The deployment can be in an adhoc network or in pre-planned net-works based. In the case of Ad-Hoc networks, the sensor nodes can be released from plane and arbitrarily place

them into the area of target. In the case of pre-planned, there are four different placements as followed, Grid, Optimal, 2 -D and 3-D placement models. Thus, the unique characteristics and constraints present many new challenges for the development and application of WSNs. All sensing nodes in the wireless sensor network interact with each other directly or by intermediate sensor nodes. A sensor node that produces data based on its sensing observations and transmit sensed data packet to the base station (sink). This process basically involves direct transmission because the base station may locate very far away from the location of sensor nodes. More energy is required to transmit data over long distances so that a robust technique is to have fewer nodes send data to the base station. These nodes called head nodes and perform data aggregation in wireless sensor network. A Careful management of resources is needed to increase the lifetime of the wireless sensor network. Routing is main challenge faced by wireless sensor network. Due to dynamic nature of WSNs; routing is complex. Quality of routing protocols depends upon the amount of data (actual data signal) successfully received by Base station from sensors nodes deployed in the network region.

2. ROUTING PROTOCOL IN WSN

1. Low-Energy Adaptive Clustering: Cluster formation can be either distributed or centralized. A key challenge in both of these approaches is the selection of the best set of CHs. The CHs can be selected based on parameters such as node ID node degree residual energy, or probabilistically, Lowest ID clustering, Distributed Clustering Algorithm (DCA) and Max-Min d-clustering are solutions that are relatively simple to implement, yet not directly applicable to WSNs . LEACH and HEED are two distributed cluster formation solutions that achieve longer network lifetime by probabilistically selecting CHs based on residual energy of nodes and data aggregation. LEACH does not actually measure the residual energy of a node instead assumes uniform energy consumption for all the CHs.

2. Distributed Weight-based Energy-efficient Hierarchical Clustering protocol: (Nodes that are outside the i-band of any CH later join the closest CH, if it is within the o-band of that CH. FLOC forms none overlapping and approximately equal size clusters. In ACE (Algorithm for Cluster Establishment), CHs are selected using an iterative process based on neighbourhood information. ACE clusters are more circular and has properties closer to hexagonal packing. However, iterative messages significantly increase the overhead of ACE. **Location based routing:** Routing on different location is called Routing decisions are not based on network addresses and routing tables; instead, messages are routed towards a destination location. With knowledge of the neighbour's location, each node can select the next hop neighbour that is closer to the destination, and thus advance towards the destination. Such as wireless ad hoc.

3. Efficient Route: Sensor node deployments in sensing regions are so huge, running into hundreds or maybe thousands upon thousands sensor nodes, so it can work with maximum amount of nodes and additional must be flexible or dynamic enough to rapidly adjust to and response to changing environmental conditions or amendment to other sections of the network. Most sensor nodes may be allowed to be in sleep mode until when required re-awake again, with only a few supplying hard quality works.

3. FACTORS AFFECTING WSN'S

Following are some of the major factors which affect the wireless sensor networks.

Network Characteristics

Network formed by the tiny sensor nodes can be homogenous or heterogeneous. Homogenous WSNs is composed of same

level of devices & comprising the same hardware capabilities using the same policy. The functionality of a homogenous network serves the purpose of gathering the sensed data and sending it to a central location which is beneficial for real time & environment application. Whereas heterogeneous WSNs use various ranges of different devices which are able t cooperate in order to achieve a global goal by combining the individual capabilities of the nodes.

Energy Consumption

Energy is an important attribute of WSNs because each sensor nodes have a limited amount of battery lifetime. Moreover energy is consumed in following things: i. Each sensor node consumes energy for sensing communicating & cluster formation. ii. Each Cluster Head spends energy in different domains for receiving aggregating & transmitting the signals. iii. Energy is also invested in the process to listen the channel for any incoming packets.

Routing

Routing is the main challenge faced by wireless sensor networks because of dynamic nature of WSNs. Quality of routing protocols depends upon the amount of data i.e. actual data signal successfully received by base station from sensor nodes deployed in the network region. Routing protocols may be either: i. Flat Routing protocols, ii. Hierarchical routing protocols, iii. Location based routing protocols.

Routing can be single hop or multi hop. Multi hop routing is used because when data is sent directly in between Cluster Head & Base Station then due to increased distance can lead to the path loss exponent due to multipath fading.

Scalability

Scalability of routing protocols used in wireless sensor networks (WSNs) is a critical issue due to the extremely high node numbers and relatively high node density. A good routing protocol should be scalable and adaptive to the runtime changes in the network topology. Hence protocols must perform well as the network grows larger or as the workload increases.

Fault Tolerance

Fault tolerance is one of the very important among several challenges in these networks. Fault tolerance improves wireless sensor networks (WSN) with reliable collection and dissemination of data with preserving limited resources in sensor nodes, especially power. However data redundancy achieves the goal of fault tolerance in the data-centered network infrastructure of WSN as, it also incurs security concerns by making data available in several locations. More attention needs to be paid when WSN as are deployed in hostile environments where sensor nodes are easy to be captured for deleterious use by an adversary. In this context, cryptographic keys are of low efficiency for protecting data not involved in communication.

Reliability

Reliable transmission of data is one of the major characteristic of most of the existing transport protocols in traditional networks or WSNs. Reliability evaluation of wireless sensor networks (WSN) is a critical step in WSN design. Reliability is defined as the amount of packets received by the sink to the total number f packets generated by the end nodes.

Timeliness

Timeliness refers to obtaining the collected data from the WSN in a timely manner such that control actions can be taken depending on the status of the system. Wide spread use of wireless sensor networks (WSNs) in sensitive applications shows the importance of Quality of service (QoS) in these networks. Timeliness is also one of the QoS parameters which have big importance in real time applications such as earthquake detection. Multiple routing protocols have been proposed for WSNs which provide QoS support in this domain. Most of these protocols use onehop neighborhood information to perform routing decisions. Timeliness may be improved by using multi-

hop neighborhood nodes information which may add extra control overhead and decreases network lifetime. In other words, the choice of two-hop neighborhood information is a tradeoff between timeliness and control overhead.

Mobility

Among the many ways of improving the performance of a wireless sensor network (WSN) in terms of crucial metrics such as its lifetime and data latency, exploiting the mobility of some of the network components has been recently observed to be among the most promising. For example we can reduce communication cost by sink mobility. Sink moves randomly by changing its position after every round. This uniforms energy consumption and increases network lifetime.

Data Aggregation

A fundamental challenge in the design of wireless sensor networks (WSNs) is to maximize their lifetimes. Data Aggregation has emerged as a promising approach in WSNs in order to reduce the number of transmissions of sensor nodes, and hence decreasing the overall energy consumption in the network. Data aggregation is affected by many factors, such as the placement of aggregation nodes, the aggregation function, and the density of sensor nodes in the network. The determination of an optimal selection of aggregation nodes is thus extremely important.

Delay

Wireless sensor networks prove useful in many delay-sensitive applications, e.g., emergency response and plant automation. In such networks, delay measurement is of key importance for a number of reasons, e.g., real-time control and abnormal delay detection. There are mainly four factors that affect the end-to-end delay in WSNs:

i. Transmission delay. It is limited by the link bandwidth

ii. Competition of the radio channel. Especially under a contention based MAC, a packet has to compete for the access of the channel and wait for transmission until the channel is idle.

iii. Queuing delay. A large queue will seriously delay packets;

iv. Path length. Generally, the more hops a packet travels, the large propagation delay it will suffer.

CONCLUSION

WSN applications help both civilian and military people. One major challenge is to design an efficient routing strategy. A routing protocol should be energy efficient, load balancing, fault tolerant, scalable and should provide high level of security but still it is a challenging task. One of the challenging tasks is to maintain the energy level in sensors. The main limitation of these networks is that the quantity of energy consumption. The lifetime of a Wireless sensor Network depends on its node's energy level. In most of sensor networks there's no way to recharge node's battery because of its unattended nature; thus efficient use of the available energy sources of the node is important. The routing protocol should consider the link quality and the possible interference and the noise level of the link before choosing a next hop node for communication. Wireless sensor Networks, which can be spread over a vast geographical area, have their applications in several fields. There's need of approaches which may manage these WSNs in higher way possible.

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