Analysis of Security Threats Analysis under LEACH Routing Protocol for WSN and DTN

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Abstract- The routing protocol is a process to select suitable path for the data to travel from source to destination. The process encounters several difficulties while selecting the route, which depends upon, type of network, channel characteristics and the performance metrics. The data sensed by the sensor nodes in a wireless sensor network (WSN) is typically forwarded to the base station that connects the sensor network with the other networks (may be internet) where the data is collected, analyzed and some action is taken accordingly. In very small sensor networks where the base station and motes (sensor nodes) so close that they can communicate directly with each other than this is single-hop communication but in most WSN application the coverage area is so large that requires thousands of nodes to be placed and this scenario requires multi-hop communication because most of the sensor nodes are so far from the sink node (gateway) so that they cannot communicate directly with the base station. The single-hop communication is also called direct communication and multi-hop communication is called indirect communication. In multi-hop communication the sensor nodes not only produce and deliver their material but also serve as a path for other sensor nodes towards the base station. The process of finding suitable path from source node to destination node is called routing and this is the primary responsibility of the network layer.

Keywords- Security Threats, LEACH Routing Protocol for WSN and DTN.

I. Introduction

The wireless sensor network is ad-hoc network. It consist a small light weighted wireless nodes called sensor nodes, deployed in physical or environmental condition. And it measured physical parameters such as sound, pressure, temperature, and humidity .these sensor nodes deployed in large or thousand numbers and collaborate to form an ad hoc network capable of reporting to data collection sink (base station). Wireless sensor network have various application like habitat monitoring, building monitoring, health monitoring, military survival lance and target tracking. However wireless sensor network is resource constraint if we talk about energy, computation, memory and limited communication capabilities.

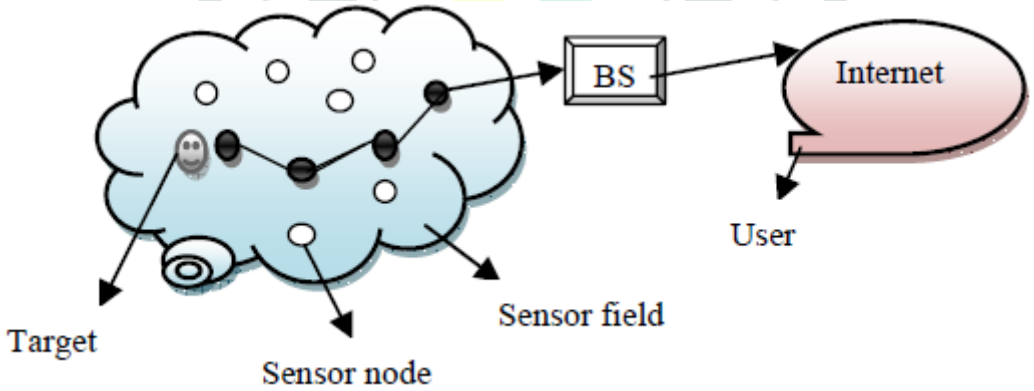


Figure 1 Architecture of the Sensor network

All sensor nodes in the wireless sensor network are interact with each other or by intermediated sensor nodes. A sensor nodes that generates data, based on its sensing mechanisms observation and transmit sensed data packet to the base station (sink). This process basically direct transmission since base station is may located very far away from sensor nodes needs more energy to transmit data over long distances so that better techniques is to have fewer nodes sends data to the base station. These nodes called aggregator nodes and processes called data aggregation in wireless sensor network.

Wireless sensor networks (WSN) are composed of a finite set of sensor devices geographically distributed in a given indoor or outdoor environment (usually predefined). A WSN aims to gather environmental data and the node devices placement may be known or unknown a priori. Network nodes can have actual or logical communication with all devices; such a communication defines a topology according to the application. For instance, there can be a WSN with both types of topologies being the same (mesh, star, etc.). However, this may not be the case for all applications. The logical

topology is mainly defined based on the nodes logical role (tasks, etc.). It can be either ad hoc or strategy based (self-organization, clustering, and pheromone tracking, and so on). The strategy is defined based on the network available resources.

1.1 Low energy adaptive clustering hierarchy (LEACH)

LEACH is a routing protocol that organizes the cluster such that the energy is equally divided in all the sensor nodes in the network. In LEACH protocol several clusters are produced of sensor nodes and one node defined as cluster head and act as routing node for all the other nodes in the cluster.

As in routing protocols the cluster head is selected before the whole communication starts and the communication fails if there is any problem occurs in the cluster head and there is much chances that the battery dies earlier as compare to the other nodes in cluster as the fix cluster head is working his duties of routing for the whole cluster. LEACH protocol apply randomization and cluster head is selected from the group of nodes so this selection of cluster head from several nodes on temporary basis make this protocol more long lasting as battery of a single node is not burdened for long.

Energy represents the main constraint in all the WSNs. Usually operating the sensor node, its data transmission and its data processing are representing the essential energy-consuming processes. Sensors are depending on limited power batteries. In most WSNs applications the ability to replace or recharge the sensor battery in this era is impossible. So, limited energy of the sensor represents a vital task in designing any WSN. Great potential research efforts were focused on such issue to increase the lifetime of these networks. The essential reason for the sensor's power consumption is due to the electronic communication processes. The energy consumed in each electronic communication is increased by increasing the transmitted data, increasing the distance between the receiver and the transmitter and the collision between nodes. The routing strategy may also apply to reduce the consumption of the energy. The Hardware devices configuration and selection may be utilized to reach low energy consumption. The good choice of protocols and communication methods can play a role in decreasing the network energy consumption.

II. Research Background

Salam & Hossen (2020), this paper introduces an energy efficient and reliable opportunistic density cluster-based routing protocol that opportunistically transmits data using a density-clustering protocol for emergency and disaster situations. Simulation results show that the proposed protocol outperforms some existing and well-known routing protocols in terms of network energy consumption, throughput and successful data transmissions.

Patel & Jhaveri 2020), in this paper, we survey various existing schemes which attempt to improve energy efficiency of different types of ad hoc routing protocol to increase network lifetime. Furthermore we outline future scope of these existing schemes which may help researches to carry out further research in this direction.

Prabha, & Selvan (2018), in this paper, the proposed algorithm is compared with LEACH, LEACH-C and SEP routing protocol to prove its novel working. The proposed EEEHR routing algorithm provides improved lifetime, throughput and less packet drop. The proposed algorithm also reduces energy hole and hotspot problem in the network.

Varshney & Kuma (2018), In this paper, they discuss the most effective hierarchical clustering protocol called as LEACH (Low Energy Adaptive Clustering Hierarchy) along with its issues and drawbacks. An exhaustive search on variants of LEACH protocol has been conducted. We present the taxonomy of various descendants of LEACH protocol and compare their performances based on metrics such as scalability, data aggregation, mobility etc.

Al-Baz & El-Sayed (2018), In this paper, they concentrate on a recent hierarchical routing protocols, which are depending on LEACH protocol to enhance its performance and increase the lifetime of wireless sensor network. So our enhanced protocol called Node Ranked–LEACH is proposed. Their proposed protocol improves the total network lifetime based on node rank algorithm. Node rank algorithm depends on both path cost and number of links between nodes to select the cluster head of each cluster. This enhancement reflects the real weight of specific node to success and can be represented as a cluster head. The proposed algorithm overcomes the random process selection, which leads to unexpected fail for some cluster heads in other LEACH versions, and it gives a good performance in the network lifetime and energy consumption comparing with previous version of LEACH protocols.

Jambli et al. (2018), In this paper, They have done the analytical study of LEACH protocol to identify to what extent LEACH protocol can perform in terms of average energy consumption and packet loss for different data rate.

Shaikh & Takale 2018), in this paper, we provide detailed analysis on the relations between clustering and routing, and then propose a Low-energy adaptive clustering hierarchy (LEACH) protocol for reliable and efficient data collection in a large-scale wireless sensor network. LEACH adopts the back off timer and gradient routing to generate connected and efficient inter-cluster topology with the constraint of maximum transmission range. The relations between clustering and routing in LEACH are further exploited by theoretical and numerical analysis. The results show that the multi-hop routing in LEACH may lead to the unbalanced cluster head selection. Then the solution is provided to optimize the network lifetime by considering the gradient of one-hop neighbor nodes in the setting of back off timer. Theoretical analysis and simulation results prove the connectivity and efficiency of the network topology generated by LEACH.

Rhim et al. (2018), Emerging technological advances in wireless communication and networking have led to the design of large scale networks and small sensor units with minimal power requirements and multifunctional processing. Though energy harvesting technologies are improving, the energy of sensors remains a scarce resource when designing routing protocols between sensor nodes and base station. This paper proposes a multi-hop graph-based approach for an energy-efficient routing (MH-GEER) protocol in wireless sensor networks which aims to distribute energy consumption between clusters at a balanced rate and thus extend networks' lifespans. MH-GEER deals with node clustering and inter-cluster multi-hop routing selection. The clustering phase is built upon the centralized formation of clusters and the distributed selection of cluster heads similar to that of low-energy adaptive clustering hierarchy (LEACH).

Khan et al. (2018), their protocol consists of a routing algorithm for the transmission of data, cluster head selection algorithm, and a scheme for the formation of clusters. On the basis of energy analysis of the existing routing protocols, a multistage data transmission mechanism is proposed. An efficient cluster head selection algorithm is adopted and unnecessary frequency of clustering is exterminated. Static clustering is used for efficient selection of cluster heads. The performance and energy efficiency of our proposed routing protocol are assessed by the comparison of the existing routing protocols on a simulation platform. On the basis of simulation results, it is observed that our proposed routing protocol (EE-MRP) has performed well in terms of overall network lifetime, throughput, and energy efficiency.

III. Simulation and Result

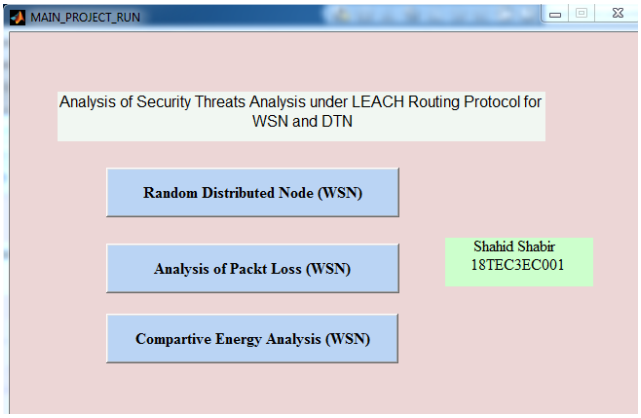
Energy consumption in WSN

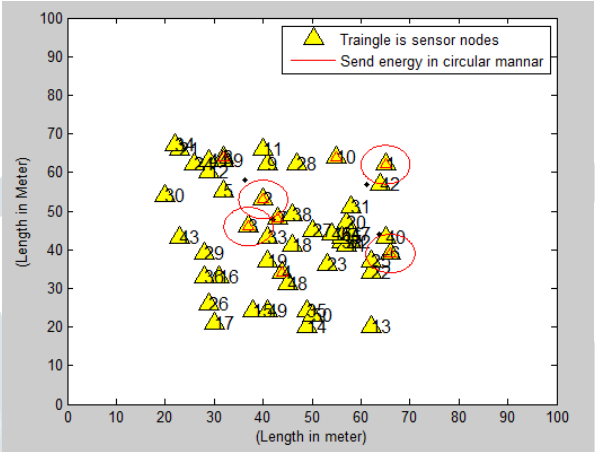
The main energy consumer in each sensor network was proved to be due to its radio transmission and reception processes. The process of data communication in WSNs spends greatest amount of energy. Minimizing the communication overhead will also reduce the energy consumption. Managing the process of configuring the MAC and networking layer, Data reduction and data aggregation may also help in saving energy. The sensing unit, communication unit (transceiver) and the processing unit represent the essential units to consume energy in each sensor node

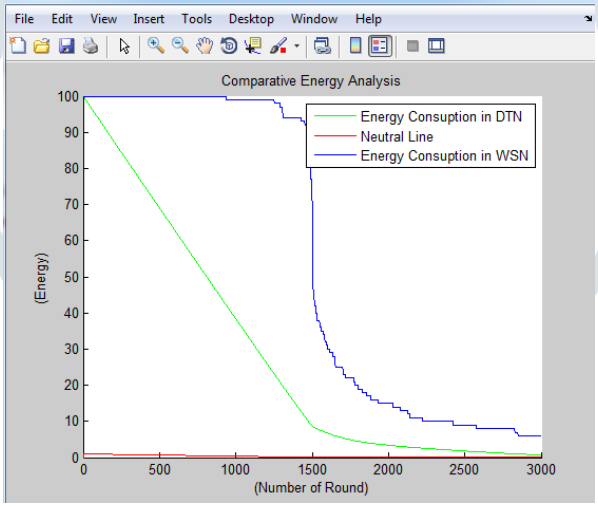
Packet Loss in WSN

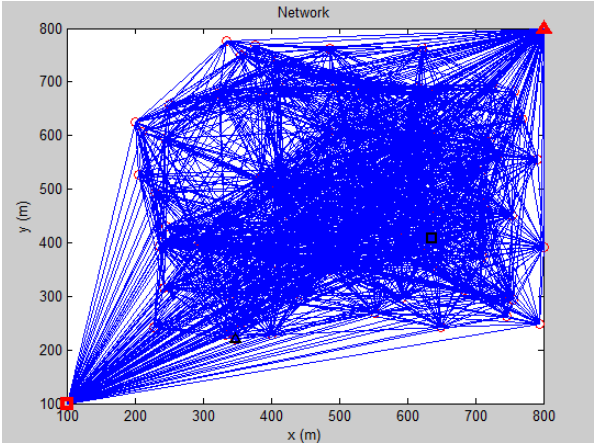
Packet loss is the failure of one or more transmitted packets to arrive at their destination. Packet loss minimizes the Packet Delivery Ratio. Packet loss can be caused by a number of factors including signal degradation over the network medium due to multi-path fading. Packet loss is possible in wireless sensor network. So that the intruders can be easily capture the data .Identifying the dropping packet and misbehaving activities are the most necessary measures for secure transmission in it. Without a certificate a node cannot participate in the transmission.

Packet delivery performance is of high importance in energy constrained networks as it translates into a network lifetime indicator. The possibility of wireless communication makes WSNs the ideal monitoring solution for a variety of environments which are sometimes harsh and inaccessible and which will exhibit considerable multi-path communication. Packet delivery performance is mostly a function of the environment, the chosen coding scheme and of the individual characteristics of the transceiver circuit.









DTN Configuration (0) WSN with AI Based (1) Press = (0/1): 1
Number of packets (max=500)? 200

```
Message Postponded because of low security!
Packet Remaining: 63
Message Postponded because of low security!
Packet Remaining: 63
Packet Remaining: 62
Packet Remaining: 61
Packet Remaining: 60
Packet Remaining: 59
Packet Remaining: 58
Message Postponded because of low security!
Packet Remaining: 58
Message Postponded because of low security!
Packet Remaining: 58
Message Postponded because of low security!
Packet Remaining: 58
Packet Remaining: 57
Message Postponded because of low security!
Packet Remaining: 57
Message Postponded because of low security!
Packet Remaining: 57
Packet Remaining: 56
Packet Remaining: 55
Packet Remaining: 54
Message Postponded because of low security!
Packet Remaining: 54
Message Postponded because of low security!
Packet Remaining: 54
Message Postponded because of low security!
Packet Remaining: 54

stolen_rate =

     0


Total_Time =

  418.8239


Total_Energy =

   1.4912e+03


Packet_Delivery_Rate =

   100
```

IV. Conclusion and Future Scope

The routing protocol is a process for selecting the appropriate path to travel from source to destination. The method encounters many difficulties when choosing the route depending on network size, channel characteristics and efficiency metrics. Usually, the data sensed by the sensor nodes in a wireless sensor network (WSN) is transmitted to the base station that links the sensor network to other networks (may be internet) where data is processed, analyzed and some action is taken accordingly. In very small sensor networks where the base station and motes (sensor nodes) are so close that they can communicate directly with each other, but in most WSN applications the coverage area is so large that thousands of nodes need to be placed and this scenario requires multi-hop communication because most sensor nodes are so far from the sink node. Single-hop communication is also called direct communication, and indirect communication is called multi-hop. In multi-hop communication, sensor nodes not only generate and distribute their data, but also serve as a route to the base station for other sensor nodes. The process of finding suitable path from source node to destination node is called routing and this is the network layer's primary responsibility.

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