

Low Energy Consumption with Secure Routing in Wireless Sensor Network

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Abstract: *Wireless sensor nodes working together in the same environment cooperatively is called Wireless Sensor Network (WSN). WSN frequently monitors surrounding environment for physiological changes and conveys the collected information to Base Station (BS) or Sink through a network of interconnected nodes. Resource utilization is major design constraint with WSN. Dividing nodes into groups to form clusters is broadly used method for prolonging network lifetime since clustering is efficient method for minimizing energy consumption. The work proposes data density based multi level cluster policy to reduce energy consumption during clustering process. However merging Sec-AODV with multilevel clustering provides secure routing of data with nearly same amount of energy consumption.*

Keywords: Cluster head, clustering, energy efficient, data aggregation, Wireless Sensor Network.

1. Introduction

Dedicated and autonomous wireless sensor nodes of WSN frequently monitor surrounding environment for physical activities such as change in temperature, humidity in air, intensity of sound, speed and direction of wind, atmospheric pressure, etc. Each sensor node has responsibility to transmit the sensed data to the base station or sink node in network, where it is processed or may be transmitted over network for processing.

Basic application of WSNs were to facilitate military applications such as battlefield surveillance; but it have since been drastically extended to machine health observation, industrial process supervision and control, and many more. Number of nodes in WSN varies from few even thousands where every node is in connection with at least one sensor (or sometimes several). The sensor approach is equipped with a small battery, a tiny processor, a radio transceiver antenna, and situate of transducers that used to congregate information that describe the changes in the environment of the sensor node [1]. The topology for WSNs can vary from a simple star or mesh network to an advanced multi-hop wireless mesh network. The propagation takes place between the hops of the network with the help of routing or flooding techniques.

In order to accomplish high energy efficiency and long network lifetime, nodes can be organized in hierarchical manner by grouping them into clusters. In clustering algorithms, sensor nodes are partitioned into several clusters, and each cluster selects a sensor node as cluster-head (CH) [2]. In clustered sensor networks, the nodes do not transmit their collected data to the sink or base station (BS), but to designated cluster heads which aggregate the data packets and send them directly or via multi-hop communication to the BS [1], [11].

2. Proposed Work

2.1 Clustering Method

In a WSN, many sensor nodes fall in data domain of their neighboring sensor nodes. If certain number of sensor nodes is close to a particular sensor node in data domain, then the same node can represent its neighbors in the data domain. Such representative sensor node is called the core sensor node of a cluster.

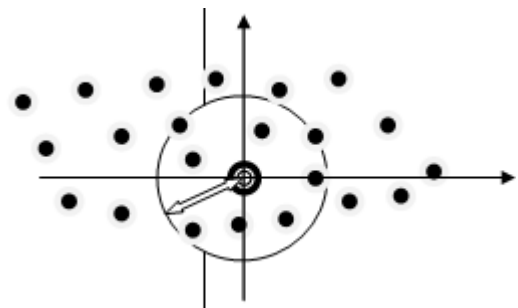


Figure 1: Density based clustering

For example, assume a sensor node v has n neighboring sensor nodes viz. v_1, v_2, \dots, v_n . And all of them fall under the same data domain D . Thus neighboring sensor nodes' data objects are respectively D_1, D_2, \dots, D_n . If there are N data objects in D_1, D_2, \dots, D_n having distances less than T_{data} and $T_{pts} \leq N \leq n$ then such a sensor node v is said to be the core sensor node. Where T_{pts} is minimum number of nodes being considered, T_{data} is the data threshold. Naturally, the larger the N is, the better representative the sensor node v is to those sensor nodes whose data objects are in T_{data} -neighborhood of D .

2.2 Multilevel Clustering

Pretension of redundant exchange of messages among sensor nodes is the Scope of multi cluster-head policy in wireless sensor networks. Clustering stabilizes the network topology

at the sensor level and thus cuts on topology maintenance. Sensors are not affected by changes at the level of cluster-head they are only concerned about connecting with their cluster-head. The cluster-head also implements optimized management strategies to further enhance the network processing and extend battery life of the individual sensors and ultimately the network lifetime.

The activities of nodes in cluster are handled by cluster head so that nodes can toggle between low-power sleep mode and wake mode to reduce the rate of energy consumption. In addition, round-robin order is use to assign tasks to sensor nodes such as sensing, transmission, routing, etc. in order to prolong network life time and improves energy efficiency.

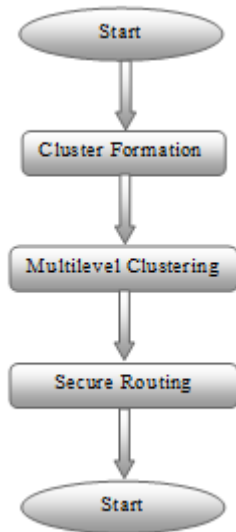


Figure 2: Research Flow Design

Sensors are deployed in large area; hence network should maintain multilevel clustering approach that enables the far distance nodes to communicate with the base station with the help of proper node scheduling. At this level a multilevel cluster in wireless sensor network is created i.e. data from one cluster heads is aggregated at 2nd level cluster head. All lower level cluster heads aggregate their data to higher level cluster head which created multi-cluster head policy in wireless sensor network. The criteria for creating multilevel are as follows:-

Whenever traffic increases in environment of wireless sensor network the single cluster head cannot be used for routing as it may cause over burden on single node. Higher level of hierarchy is created by incorporating a high level traffic area and rather low traffic areas which is in close vicinity and choose the cluster heads which is at low traffic area as the higher level cluster heads. Traffic is measured i.e. number of messages exchanged between neighboring nodes exceeds the threshold value. The cluster head in the traffic area are given a constant number T_{TH} which indicate the level of traffic more the number the cluster head is in mire traffic prone area. Higher layer of clusters are formed by keeping in mind that there is good balance between both types of cluster heads.

2.3 Secure routing

AODVSEC [15] proposed to protect AODV protocol from inner attack which launches actively forged RREP messages. In this, attacker generates one fake RREP message. It is done by means of increasing the destination sequence number in routing and/ or by decreasing the hop count to forcefully update the routing table of victim node. Fake RREQ messages are not considered in AODVSEC.

3. Results

The following graph represents time vs. energy consumption graph in normal AODV routing with multilevel clustering.

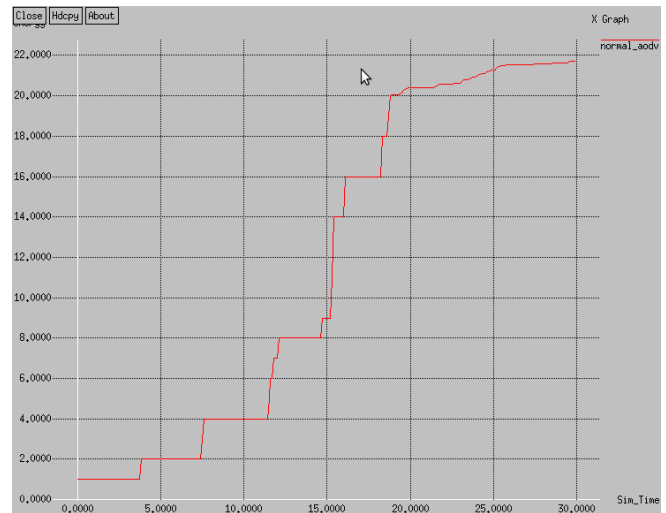


Figure 3: Energy graph of Multilevel Clustering with Normal AODV.

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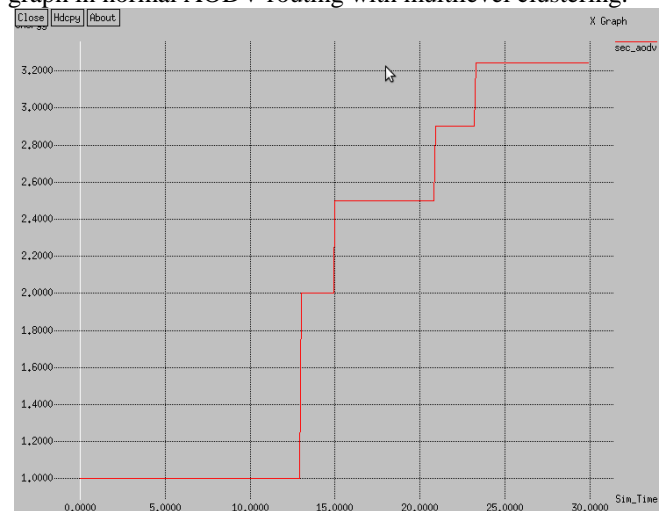


Figure 4: Energy graph of Multilevel Clustering with Normal Sec-AODV

4. Conclusion

Various clustering and aggregation techniques are studied. Stated their properties and analyzed the scope for improvement to add extra security. Results show that multilevel clustering helps to improve energy saving while

prolonging network life time. It also shows that we can provide security to routing data with nearly same amount of energy consumption. Improves the use of secure routing of mobile nodes in non mobile domain.

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