

Dynamic Cluster Head Selection Mechanism For Wireless Sensor Networks

Lakshmeesha P¹, Dr. Shiva Murthy G²

¹VTU- Center for PG Studies, Bengaluru Region, Bengaluru, India

lakshmeesha13@gmail.com

²VTU- Center for PG Studies, Bengaluru Region, Bengaluru, India

kgshivam@gmail.com

Abstract: For data transmission in wireless sensor networks (WSNs), routing is the main course. Many routing algorithm have been proposed for effective data transmission. For data transmission, dynamic cluster selection is necessary to create in the network. Dynamic cluster selection is performed based on energy level of node. Node with higher energy becomes cluster head, after cluster head node is selected; cluster head collects the data from every member of the cluster and forwards that to base station. Cluster head is rotated based on energy level. Proposed mechanism confirms data transmitted effectively and energy efficiency of the node increase. It is implemented using simulator NS2.34 along with TCL script.

Keywords: Wireless Sensor Networks, Dynamic Cluster, Energy Efficiency, Routing Algorithm

1. Introduction

In wireless sensor and actor networks (WSANs) or WSN [1] [2] [4], sensor node collects the information from the environment and send collected data to sink node through intermediate nodes. These sensor nodes have very minimum resources. Processing power, energy, data storage and transmission, these are helps for finding the low resources. In this type of networks, charging or battery replacement of the sensors might be difficult so energy efficiency is major problem. In WSN every node guaranty data delivery to base station. Furthermore these nodes can be broadcast the data in networks. Besides power utilization through sensor nodes or systems has spread the more energy of the in intermediate tranny. Applications of the WSN [2] are process management, health care, earth sensing and etc. This network is motivated to military appliances especially in battlefield. Now a days this type of network using in industries and consumer applications i.e. machine health maintaining and etc. Node having some energy that energy becomes decreases because of node energy decreasing.

Decreasing of the energy may usually explore leading to dead node. So that succeed in dealing with this problem, there is an important matter at the point of separate single device and it attempts the data routed. This route contains following way that is at the time of contact between the nodes their energy expenditure is fewer amounts to hold their respective energy, rather than path of the routing data maximize their energy expenditure. One main thing it makes networks more fault-tolerant is energy backup. Then these node having enough amount energy, itself only remove the failure, this is important thing.

These sensor nodes characteristic of minimum cost, minimum power and universal functional have been generally used in the military services, industry, traffic, environmental security and etc. domains. Specifically in the shortage of the existence of

the backbone network, including the dangerous region that man cannot make it happen, the battlefield, and other dangerous areas, the applications possible customer of wireless sensor systems surely will be great. Presently, the kinds of researchers have gained wealthy achievements. Security [16] [17] is fundamental things of the WSN and aim is to maintain freshness in data, it protects the local properties, cost usage is efficiently. Security will help when communication with false data.

SPIN [15] is the data centric protocol of WSN. It is the different approach and its focuses on spread or delivery the data through network. In DC routing [3], one node collect the all other child node data then send to destination node. SPIN protocol using same procedure. This is the adaptive protocol.

Dynamic cluster head selection mechanism guarantees the data delivery from source node to base station. Aim of the proposed scheme is to reduce the intercommunications distance between the nodes and also distances between the cluster head by means of route shorten method. For transferring the data, this scheme does not send the data packet throughout the network but clustering algorithms used for same.

This proposed scheme, executed less number of packet transmission moreover these algorithms will consume less energy and significantly benefited amount of total energy can be saved. Dynamic cluster head selection is implemented along with TCL/C++ programming language and NS2.33 simulator.

The rest of the paper has been attempts to organize as follows. In section II, describes related work. Section III describes the working of dynamic cluster for secure SPIN. Section IV describes the results discussion of the dynamic clustering. Finally, in section V concludes the paper.

2. Related Works

A brief survey of technologies explored during the past decade is given below to provide an understanding of the level of researchers interested in cluster head selection mechanism.

Scope of this paper is energy of sensor nodes is used efficiently and increasing the life-time of the networks. It reduce the inter-communications distance between the nodes and withal distances between the CH by designates of route abbreviate method.

Michele Rossi [5] et al presented In-Network data aggregation is a process for gathering the information and routing between multiple networks, communicating the data between interconnection nodes it's related to reduce the resource usage by the means its increases the network life. This process using delivery of data is only in network inside. In this part divide the networks into different regions these regions are pre-defined. Every region responsible for grasp and confirming events, these are happening in a region inside at sink node/BS. In particular type of these networks sequences every node gather the data from the environment and that it send to central node. The central node implementing getting data and it send to main application.

In 2000 [6], energy having knowledge of routing protocols at the layer of the network has received an offer of consideration since it is well-setup that, cellular communication is more important use energy source in WSN. The data-routing algorithms objective is to collect and the group together information in a method for energy effective, so that network life time is normally improved.

S. Narravula [7] et al proposed grid based data aggregation in 2004 and it mainly focuses on the grid concept. In this scheme divide the regions control by the sensor nodes into many grids. In many set of sensors allocate the aggregators in fixed placed of sensor networks. The specific grid directly sends the data to aggregator of the grid so that inside sensor of the grid not communicate each other. This is same as cluster based procedure in that CH is fixed. This type data aggregators used in military and weather predicting. In 2002 [18], implementing data aggregation it's based on tree structure, by defined as tiny aggregations (TAG) approach.

K. Dasgupta [8] et al proposed cluster based data aggregation approach, whole network divided into many cluster. This cluster having many numbers of cluster member, then cluster head selected to each of cluster members. Cluster head is collecting the members of cluster and transmitting to base station.

In 2004 [9], two phase clustering technique is presented. In first phase is same as various approaches used in clustering but different in CH rotations. First phase is creates the cluster along with CH and each member within the cluster direct connect to CH. In second phase its uses the data relay point it defines every nodes in the cluster search the neighbours closer than the CH and set the link.

In 2005 [10], presented for cluster environment but this including the efficient use of energy and security concern this was proposed. Before defining this method members are sending row data to CH. After present this method this is solve the problem, here members send pattern codes to CH.

Liang Tang [11] et al and A. Passarella [12] et al in their work discussed SSPIN protocol. This protocol distributed the data from single node to all of its other nodes in networks. It is a DC routing standard protocol. This has three phases i.e. ADV,

REQ, and DATA. In the ADV stage, nodes have to distribute the data to every other node in networks. In the REQ stage, node transmits request when the node needs to receive the data. In the DATA stage, node sends the correct data to sink. This protocol defeat implosion, overlap and resources blinding. Here data delivery not guarantee and less network lifetime. So that clustering concept using to overcome these problems.

Reena Dadhich [13] et al proposed cluster secure SPIN presented in 2015. The SPIN protocol using cluster for security purpose, this cluster is collecting the data from respective members. After gathering the data then it transfers to sink/BS. Cluster act as intermediate. This method gives fewer packets transmissions.

Formerly in the previous system they used to define the cluster head on our own, which used to be static. This requires some body for assistance because of cluster head selection. This led for an idea on dynamic cluster head, wherein the cluster head selected randomly on energy levels on every node that is present in the network. It simplifies the cluster head selection in the network.

3. Dynamic Cluster for SSPIN

Dynamic cluster selection mechanism based on node energy level. Node with higher energy becomes cluster head. After cluster head node is selected, it collects the data from every member of the cluster and forwards that to base station. In each round cluster head is selected according to the energy level.

Energy model initialized with 100 J given to all nodes at beginning. Hello packet transmission done to find out energy level of all nodes present in the network. CH selection is done based on Dynamic energy at particular time. Every time CH will be changed according to present energy level. Here database not required for selecting the cluster head. After CH selection data aggregation is taken place at CH from all CM (cluster Member). Once data aggregation is done the aggregated data will forwarded to Base-station. For 2nd round transmission new CH is selected according to present energy level. Energy of all nodes is used efficiently.

The below expression show the dynamic cluster head selection,

$$\text{myrand} = [\text{expr}(\text{rand}() * (\text{max} - \text{min})) + \text{min}]$$

The myrand is the evaluation of sum of product of random function with difference of maximum and minimum value to the minimum value. Random function takes the random numbers. For every node in the network this value is calculated and recorded in a file with its node number. Later on it is sorted and cluster is created, and then higher value is selected as cluster head with the node number with myrand value.

Algorithms for Cluster Head Selection

Step 1: Defining the all nodes

Step 2: Initialing source and destination

```

if (current node < number of nodes)
{
    Initialing source and sink
}

```

Step 3: Selecting CH (cluster head)

Generating the random number (min, max)

```
{
myrand = [ expr (rand() * ( max - min )) +min ) ]
return myrand
}
```

Selecting CH

Step 4: Data transmission from source to sink.

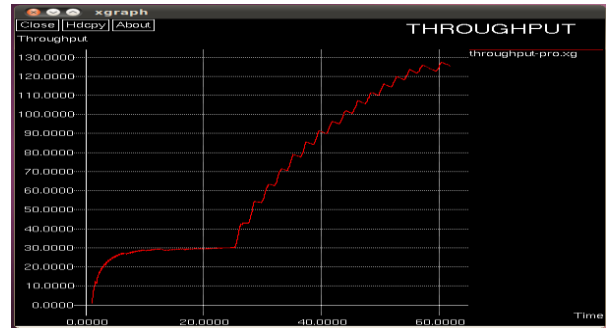


Figure 1: Throughput

3.1 Data Aggregation

Data is aggregated from cluster gets collected at the cluster head. Data is forwarded to base station. Creation of the cluster based on energy and followed by selecting the node with maximum energy as cluster head. Performing the intra clustering as follows, the cluster head aggregates the packet from cluster members. Then cluster head forwards packets to base station.

The main objectives of this paper are to propose wireless sensor networks (WSNs) with effective dynamic cluster head selection mechanism and to design a mechanism to reduce energy consumption in the networks.

4. Results and Discussion

In this section we are discussing the performance parameter which evaluates the effectiveness of the proposed system, along with the simulation setup.

This is defines the node density as the number of nodes position in 200*200m square area. 100 randomly connected topologies for each node. The node transmission range is set to 50m. MAC type for proposed method is IEEE 802.11. The performance of proposed scheme is assessed by using network simulator (NS-2). Using TCL language the paper is being implemented. Here considered type of traffic is Constant Bit Rate (CBR) and agent type is UDP. Two ray Ground used as propagation model and using SSPIN as routing protocol. Then initial energy 100J given to every node.

3.1 Performance Parameters

Here using different kinds of xgraphs, it shows the accurate results of the simulation. Here explaining about different graphs which are used in this paper.

Throughput means average rate of accomplished message convey over a correspondence channel. This information might be conveyed over a wired or remote connection, or may go through a specific system customer. The throughput is for the most part measured in bits consistently (bit/s or bps). Throughput is measure of information got by the collector.

In above Figure 1 shows X- axis represents the time and Y-axis represent the (sum/time). Sum is calculated by sending and receiving packet at the instance. In the notable time how many processes of segments of information it can be measured is calculated. The throughput is calculated with respect to time. This paper presents an energy efficient routing scheme for throughput improvement in WSN. The proposed scheme exploits multilayer cluster head rotation. To improve throughput, rotate the role of cluster head among various nodes based on energy levels. This graph shows the throughput with respect time using the energy. As the packet transmission, initialized from 1 to 25 sec the hello packet as to sent. After 25 sec the cluster works. As the energy increases in clustering node the throughput increases with respect to time.

PDR is the packets delivery ratio. It is proportion of number of received packets and number of delivering packets. The greater value of PDR means better performance of protocol.

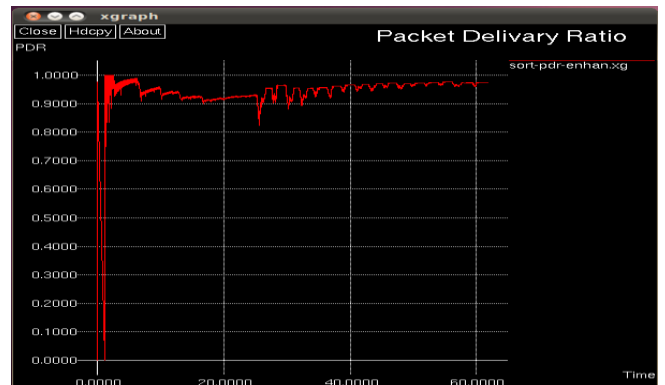


Figure 2: Packet Delivery Ratio

In Figure 2 show the PDR graph of this paper and in that graph X-axis shows the time and Y-axis show the proportion of received and sent packet. Packet delivery ratio is calculated by ratio of packet received by the destination nodes to those generated by the source nodes. Hence the node density increases, the packet delivery ratio of dynamic CH SSPIN also increases. Observing SSPIN protocol's, showcases of above 96% packet delivery ratio on average.

Packet drop is same as packet loss. One or many packets communicating but it fail to meet destination is known as packet drop or loss.

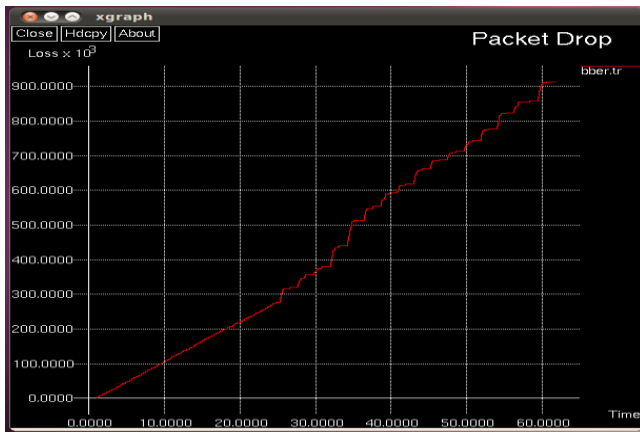


Figure 3: Packet Drop

The above Figure 3 graph shows X-axis represents the time and Y-axis represents the packet loss in K/sec. Initially when packet of data transmission is pretty high hence loss of which is gradually increasing. Then after this the packet of data losses increases accordingly. Until 25s there is almost low packet drop. But then during transmission packet dropped is as shown above.

Control overhead is sending payload data beyond communication network, it requires to sending the strong payload data. I can be achieve trusted communication of the data, when it sending the control or outstanding data.

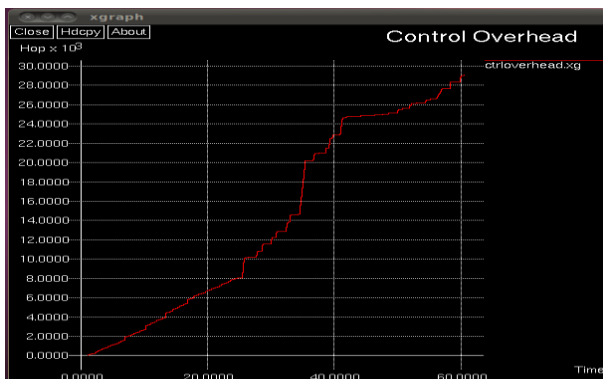


Figure 4: Control Overhead

In Figure 3 shows the graph of control overhead this is used in this paper. Here X-axis represents time and Y-axis represents overhead. Initially number of packets transmitted increases gradually, Hence the control overhead of the system increases with it. During certain time there is almost only little number of packets transmitting hence during which graph shows stable. After this, control over head increases due to increase in number of packets of data.

5. Conclusion

The proposed method creates dynamic cluster using secure SPIN protocol. The drawbacks of SPIN method are overcome here. This scheme attempts to provide the guarantee the data to base station along with stability and better network life time. Energy of sensor nodes is used efficiently. So thus proposed system doesn't yet provide that much required efficiency. We must be able to define a system which will be able to provide

that in future. Along with that the network must be stable for lifetime and improve the effectiveness of the system.

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Author Profile

Lakshmeesha P completed B.E with Computer Science and Engineering in Sambhram Institute of Technology (SaIT), Bangalore and pursuing M.Tech with Computer Science and Engineering in VTU- Center for PG Studies, VIAT, Muddenahalli, Bangalore region, India.

Dr. Shiva Murthy G completed B.E (CSE) and M.E (CSE) from Bangalore University. He Received Ph.D from National Institute of Technology Karnataka (NITK). He has published his publications IEEE Journals Currently he is working as Associate Professor and Head, Dept of MCA, VTU Center for PG Studies, Bangalore Region, Muddenahalli.