Distance Distribution Approach of Minimizing Energy Consumption in Grid Wireless Sensor Network

Ketki Ram Bhakare, R.K.Krishna, Samiksha Bhakare

Abstract*— A wireless Sensor Network (WSN) is a wireless network consisting of several tiny sensing nodes.Wireless Sensor Network (WSN) is an emerging technology. It is predicted that in future, WSN will change the human life totally. Energy minimization in Wireless Sensor Network (WSN)is one of the challenging issue. The sensor nodes are continuously sense and transmit the data. WSN have a wireless nature, due to this has a limited lifetime. So increase the lifetime of Wireless Sensor Network and Minimize energy cost in wireless sensor network are an important problem. To solve this problem clustering technique are always used, among the entire clustering technique grid based clustering is more efficient. Most of the work uses the average distance within the grid & between neighboring grids for calculating the average energy consumption; by using this average distance model we found that it underestimate the actual value of average energy consumption. So we propose a better model for energy consumption i.e. Distance distribution model, this model gives the accurate estimation of energy consumption. Distance distribution model can be used to optimize grid size and minimize energy consumption.

***Index Terms*— Average Energy Consumption, Clustering, Distance Distribution Sensor,Grid based Clustering, power consumption, WSN**

I. INTRODUCTION

Wireless Sensor Networks (WSNs) consist of small tiny no. of sensing nodes with capabilities- computation and wireless communications. There are no. of characteristics of wireless sensor nodes that limit their functionality. due to the use of batteries Wireless sensors have limited energy. The total network capacity is limited by the use of unsophisticated wireless links that limit the range, reliability, and throughput of communication between different nodes.

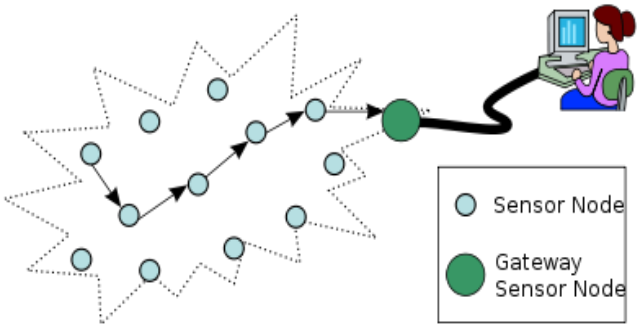

Fig. 1. Architecture of WSN

Media Wireless Sensor Networks is a sensor network consisting of several sensor connector (sensor nodes) , it is equipped with multiple cameras, microphones and other sensors that can display multimedia content. These sensor networks have a wide range of applications.

Use of Wireless Sensor Network

Monitoring the environment or the circumstances surrounding the example about: wild life, pollution, traffic.

- Detect the intruders on the battlefield
- It provide Natural disaster warning

Wireless sensor network is consist of a set of tiny sensor nodes and sink nodes which has significant application in weather forecasting, medical monitoring, military target tracking and environmental detection. Sensor nodes transmit the data through multiple hops to the sink(destination) which is located far away from the target. However, sensor nodes have a limited battery lifetime, so how to effectively save the energy of battery and increase the network lifetime has been the important research and issue in wireless sensor network. Sensor nodes have many modules; the communication module

One of the advantages of wireless sensors networks (WSNs) is their ability to operate in harsh environments in which human monitoring schemes are difficult, inefficient and sometimes infeasible. So in such a area sensors are deployed randomly by a relatively uncontrolled means, for e.g. dropped by a helicopter, and form a ad-hoc network. Sensor noder are battery powered so they have limited lifetime and these sensor nodes get damaged easily during deployment of harsh environment. So to cover a large area thousands of sesor nodes are required. Designing and operating such large size network would require scalable architectural and good management strategies.

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In addition, sensors in such environments are energy constrained and their batteries cannot be recharged. Therefore, for extending the lifetime of sensors, an important factor is to design a energy-aware algorithms.[1]

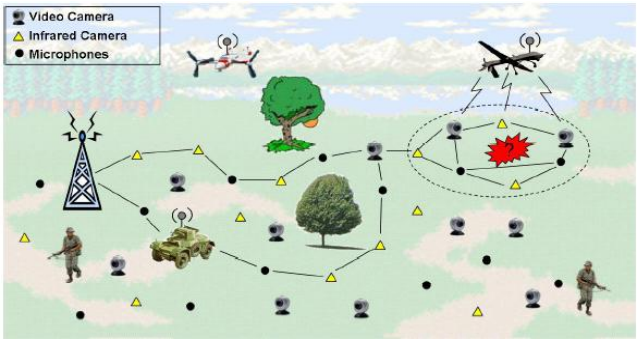

Fig 2: Architecture of WSN (a military application)

In recent years, the major advances takes place in the development process of wireless sensors and IC process technology. Because of these advances, wireless sensor networks (WSNs) have been replacing traditional network technologies. These WSNs have a large advantages over wired networks, such as ease of deployment, extended transmission range, and self-organization. There are, however, a few limitations to WSNs. These include low communication bandwidth, limited computation resources, small storage capacity, and limited device energy. In terms of energy, many researchers assume that all nodes in a sensor network are battery-driven.

Currently, WSNs are used in various types applications. Figure 2 shows a schematic of applications for WSNs. Among their many applications, they can be used, in agriculture, in transportation, in the military in manufacturing, and in smart homes. [2]

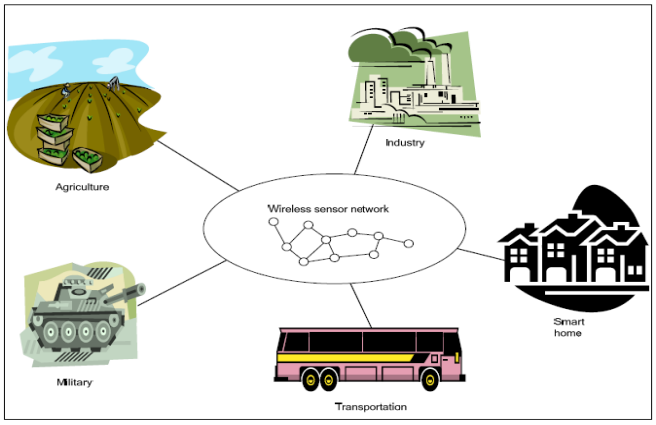

Fig 3: Wireless sensor network applications.

The main components of the sensor network is:- Sensor Node, Sensor Field, Task Manager and Sink.

- Field sensors can be considered as an area where nodes are placed in areas where we expect a certain phenomenon occurs
- Sensor node is act as a center of the network, It sense the data and forward that data to the sink
- Sink (data collector) is a sensor node receives the data from other sensor nodes.
- Task Manager or can be referred to as base station is the center of the extract control information from the deploying network control information back to the network.

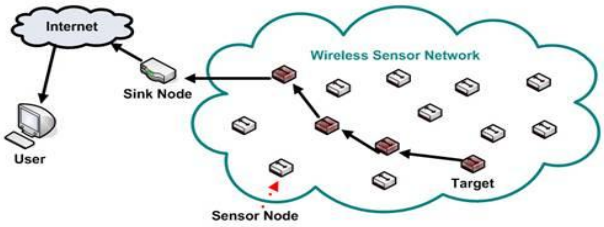

Fig 4

II. BACKGROUND AND RELATED WORK

In wireless sensor network an efficient arrangement of network topology is required for energy optimization. Clustering is an effective way of organizing sensor networks. Among all clustering grid based clustering is important and efficient due to its scalability.

A. Clustering Scheme

A WSN consists of hundreds or thousands of densely populated sensor nodes that sense the environment i.e. sense the data and propagate through the environment. They are work collaboratively to process and route sensor data. These sensor nodes send data streams to base stations either periodically or based on events and base station send the data to the destination node. One of the problem in WSN is how to create an efficient organizational structure amongst these node. Since the fundamental advantage of WSNs is the ability to deploy them in an ad hoc manner, as it is not feasible to organize these nodes into different groups. For this reason, there has been an large amount of research is going on in the field of creating these organizational structures (or clusters).

In clustering scheme network is grouped into different clusters Each cluster is composed of one cluster head (CH) and cluster member nodes. The respective CH gets the sensed data from cluster member nodes, aggregates the sensed information and then sends it to the Base Station. [3]

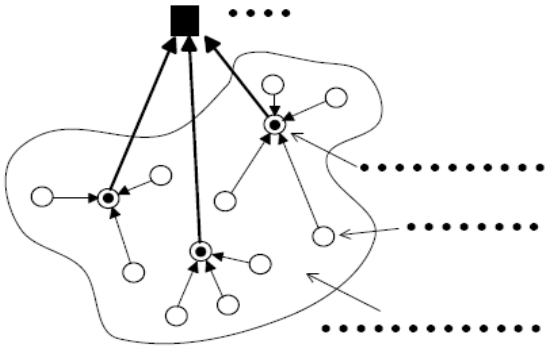

Fig 5. Cluster based model

In clustering schemes, sensor nodes are dividing into a number of small clusters. Each cluster has a coordinator or master head i.e. the cluster head (CH), and a number of cluster nodes. Clustering results in a two-tier hierarchical structure, in which if cluster node want to send data to the sink node , then instead of sending directly,

cluster nodes first transmit data to their own CH directly, while CHs collect the data and send them to the sink node through the CHs in other clusters. Meanwhile all the redundant nodes are put in a sleep nodes, since the nodes that are within the transmission rang of others node a not need to be active all t the time.

WSN use multi-hop routing between CHs to avoid long-range transmissions. clustering schemes are widely used in wireless sensor networksIn clustering, Nodes divided in virtual group according to some criteria and Nodes belonging in a different group can execute different functions from other nodes. Clustering involves grouping nodes into clusters and selecting a Cluster Head. Members of a cluster can communicate with their CH directly. Cluster Head can forward the aggregated data .

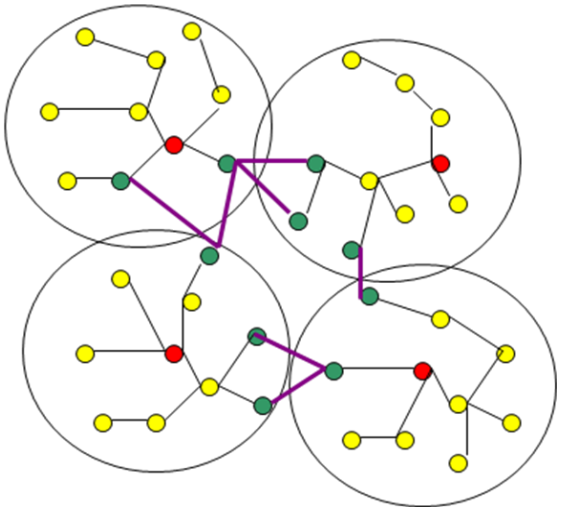

Fig 6. Cluster based model

Clustering Objectives:-

- It Allows aggregation
- Facilitate the reusability of the resources
- CHs and gateway nodes can form a virtual backbone for intercluster routing
- Limits data transmission
- Cluster structure gives the more stable network
- Improve network lifetime and reduce network traffic and the contention for the channel

B. Grid-based clustering

Among all clustering Grid-based clustering and routing schemes, in which clusters are equally-sized square grids in a two-dimension plane, have a simple structure with less routing management overhead, and all nodes in one grid are equivalent from the routing perspective.

In our proposed clustering scheme network is grouped into different clusters, In this module we are implementing the grid based clustering algorithm depending on the interest of nodes. Here, firstly we are calculating the interest of node and depending on their interest, we are forming a cluster. Fig below shows the clustering of nodes.

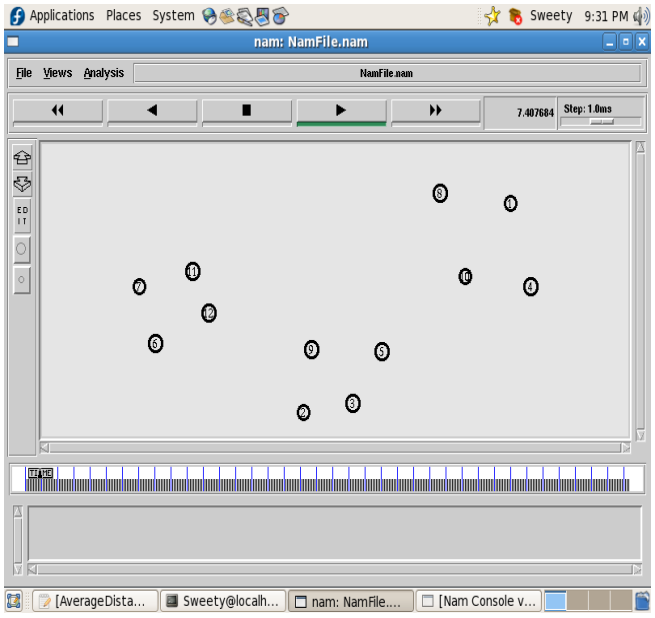

Fig 7: Showing Clustering of nodes

C. Cluster Head Selection

Each cluster has a coordinator or master head i.e. the cluster head (CH).For CH selection we can be applied any algorithm. In Cluster formation process, Firstly a cluster head is selected then with the collaboration of BS clusters are formed and finally routing is carried out.

In this module, Cluster Head is selected by comparing the weight of all the nodes present in a cluster. If the weight of a particular node from cluster is greatest as compared with other then that that particular node is considered as a Cluster Head. Fig. below shows the Cluster Head in a cluster.

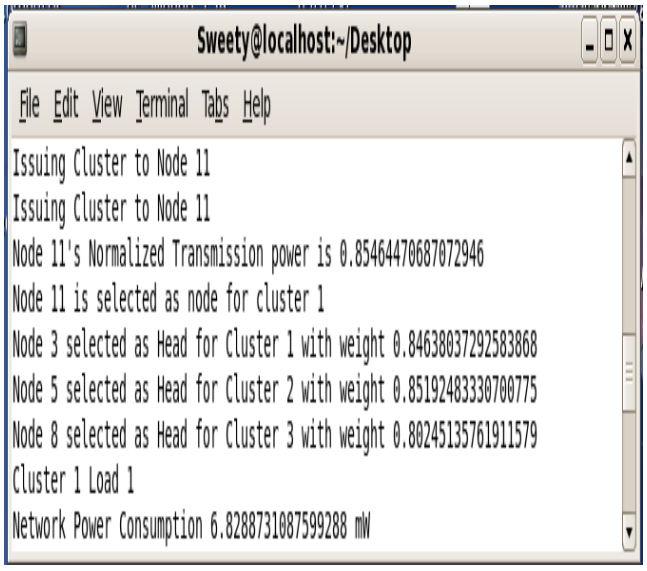

Fig 8: Showing Cluster Head

D. Advantages Of Grid Based Clustering

- It is Simple and feasible
- "Once the grid structure is established nodes can communicate locally with their grid head and reach the data processing center, or the sink node, through neighbor grids."

- They can transmit data directly, no explicitly path creation.
- Useful for Real-Time Application.

III. TOTAL NETWORK ENERGY CONSUMPTION

In this Model , we are first forming a cluster and then we are assign Transmission Power to each node. Below figure shows this thing:-

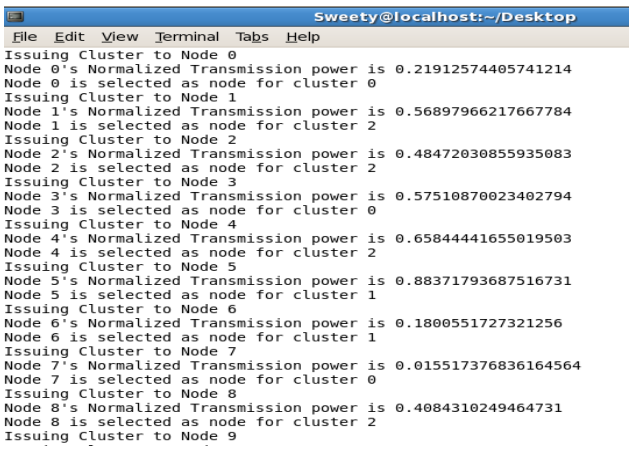

Fig 9

A. Routing And Total Network Power Consumption

After formation of cluster and assign Transmission Power to each node, we are transmitting a packets from one node to another node in a cluster. Below figure shows the Network Power consumption in each cluster at different types of load.

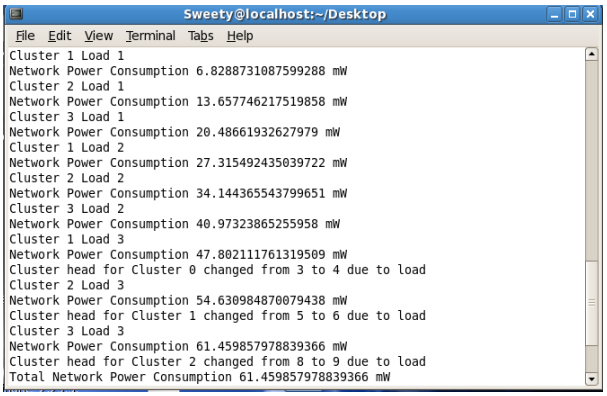

Fig 10

When the load in each cluster increases, the cluster head is change from one node to different node. And finally calculating Total Network Power Consumption. Below figure shows the changes in Cluster head and Total Network Power Consumption

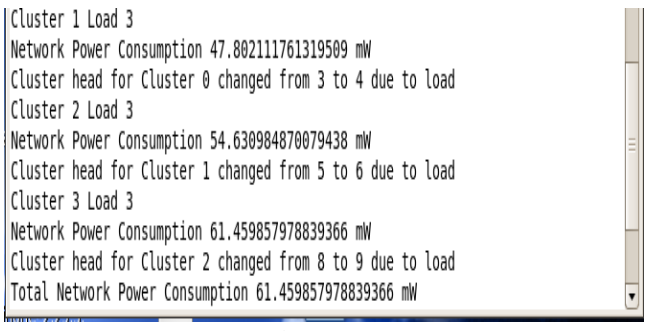

Fig 11

In this method all nodes are communicate with each other and finally we calculate Total Network Power Consumption. But this metod consume more network power. So that the the lifetime of Wireless Sensor Network get decreases. Our aim is to find the Best approach for energy consumption .So we propose a better model for energy consumption i.e. distance distribution model, this model gives the accurate estimation of energy consumption. Distance distribution model can be used to optimize grid size and minimize energy consumption. The model is Described below.

IV. DISTANCE DISTRIBUTION MODEL OF ENERGY CONSUMPTION

A critical constraint on sensors networks is that sensor nodes employ batteries. A second constraint is that sensors will be deployed unattended and in large numbers, so that it will be difficult to change or recharge batteries in the sensors. Therefore, all systems, processes and communication protocols for sensors and sensor networks must minimize power consumption. So to minimizing energy consumption,Here we are describing Probabilistic Distance Distribution approach .

In this Module, we are firstly initialize the whole network, Here we define the 5 nodes network. In this we are first find average distance between nodes and depending on that distance we are calculating energy required for the transmission of packet from one node to other node

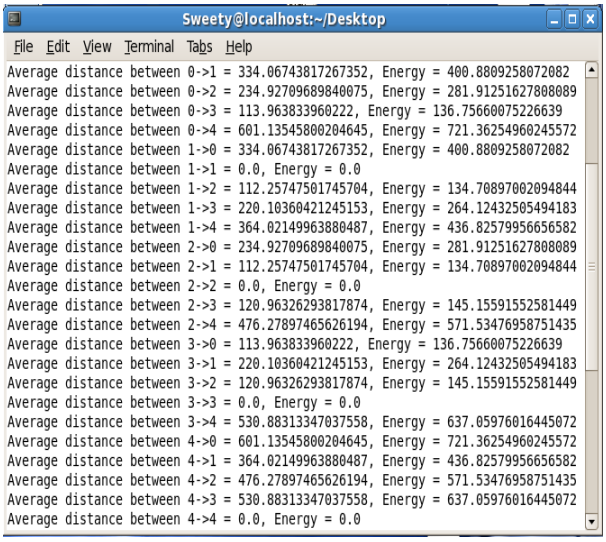

Fig 12

After forming the connection, we are asking the user at how much power u want to run or set up a network, then user enter the approximate grid power. After entering this power , we are forming a new connection of network which will run at that user entered power . As shown in the figure, here user enter the 1000 Mw, at 1000 mw power, only 0→1 , 1→ 3 and 1→0 connection is possible, then we initialize the new connection.

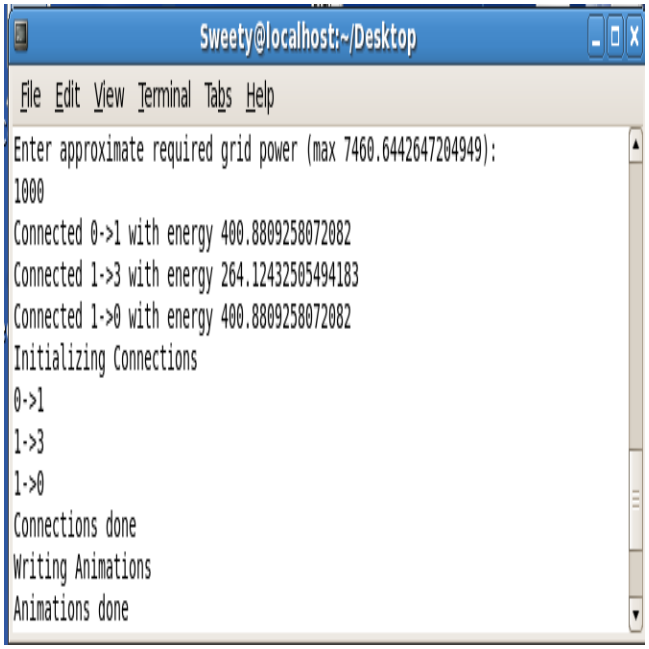

Fig 13

Below Fig shows the output on the Nam. Figure shows the 5 node in a network.

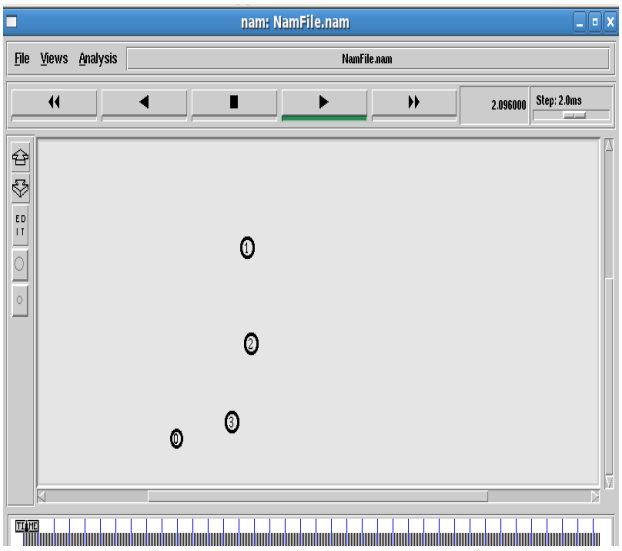

Fig 14

As I say earlier, in this module user enter the approximate grid power and according to that the connection takes place. , here user enter the 1000 Mw, at 1000 mw power, only 0→1, 1→3 and 1→0 connection is possible. And routing i,e packet transmission is takes place only between those nodes in which connection get established.

Below figure shows the packet transmission between node 0 and 1.

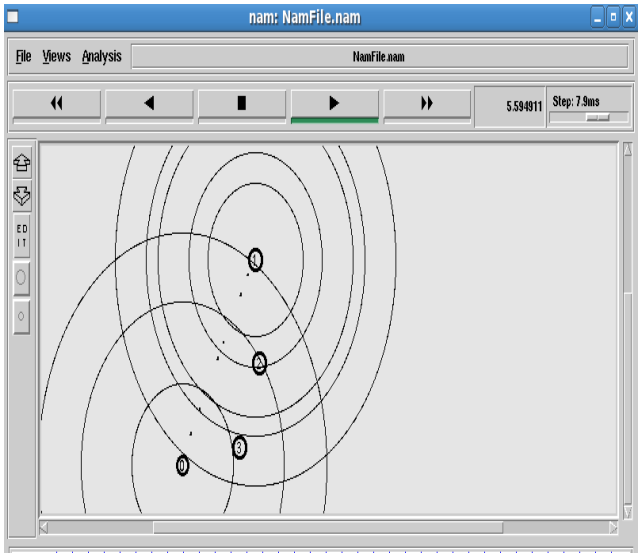

Fig 15

Below figure shows the packet transmission between node 1 and 3.

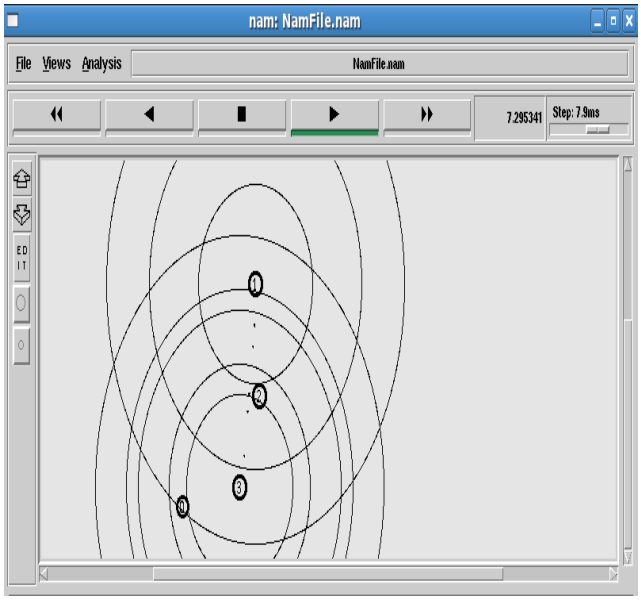

Fig 16

In this network, each node has a queue which stores the packets. Queue can store 50 maximum packets. The queue is of type Drop Tail, so if the packet size get increases, queue will drops the extra packets. Fig below shows the dropping of packet by queue.

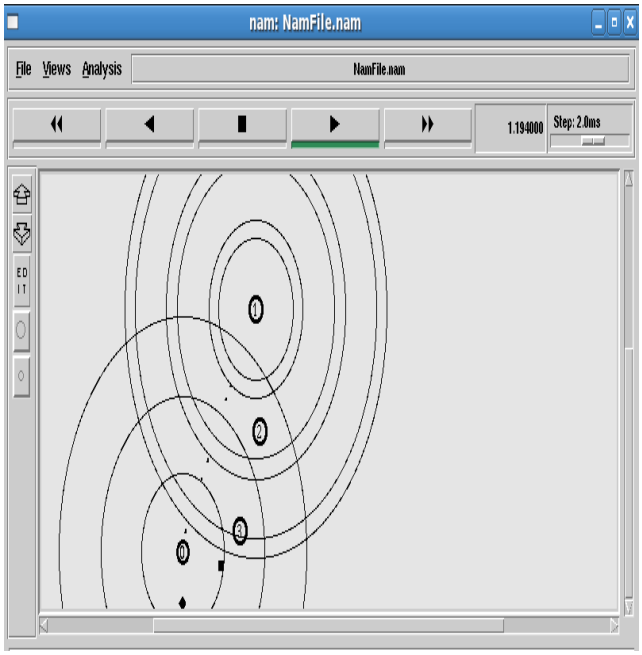

Fig 17

V. CONCLUSION

WSN is a collection of different tiny sensor nodes. Sensor Nodes are battery powered. Due to Battery powered nature WSN have limited lifetime . So the most two important issues are Minimizing energy consumption in wireless Sensor Network and increase lifetime has been a challenging issue. In General methods all nodes are communicate with each other and finally we calculate Total Network Power Consumption. But this metod consume more network power. So that the the lifetime of Wireless Sensor Network get decreases. Our aim is to find the Best approach for energy consumption .So Here we propose a better model for energy consumption i.e. distance distribution model, this model gives the accurate estimation of energy consumption. And the result shows that it decrease the Total Energy Consumption in network . So that the Lifetime of WSN increases.

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