# Improvement in Performance of a Wireless Sensor Network by Applying Hybrid Techniques

Ashwani Kumar Patel [1],Dr. Sarita Singh Bhadauria[2]
[1]Department of Electronics Engineering,[2]Department of Electronics Engineering
Madhav Institute of Technology and Science,Gwalior,India
[1]patel.ashwni3@gmail.com
[2]saritamits61@yahoo.co.in

***Abstract*—Wireless sensor networks are wireless networks that consists of sensors in large scale to collect and propagate the environmental data. The gathered data is processed and on collected information further action is executed. Wireless sensor network (WSN) helps in remotely monitoring different parameters of environment. One of major concern in wireless sensor network is to mitigate the energy consumption so as to +increase the lifetime of network. There are various parameters to measure the performance of WSN system and we have taken two parameters packet delivery ratio (PDR) and throughput for performance measurement of system. In this paper we place base station in optimum position and with clustering cluster heads are generated. AMO is used for path selection for data transmission.Newapproach increases the performance of the system and also reduces the routing overhead.**

***Keywords- Animal Migration Optimization,Clustering,Packet Delivery Ratio,Throughput,Wireless Sensor Network***

## I. INTRODUCTION

WSN is a cost friendly network which consists of many sensor nodes and a sink node also known as base station.This network can be deployed remotely and used to gather data of the environmental condition such as temperature, pressure etc.Sensor nodes sense and respond to the changes in the different environmental conditions and the communication medium between sensor nodes in WSN is radio channel. In recent time as world is talking about internet of thing ,so a network that can handle and process the data is required .there are many other application of WSN such as in military application,surveillance,disaster management,security, remote area surveillance etc.

Sensor network basically there is common channel shared by all sensor nodes. Data transfer between sensor node and the sink node depend upon the distance. If source node is far away then sensor node communicate through intermediate nodes.Sensor node must have capability to perform two tasks that is sensing the data and receiving and forwarding the information from other nodes. The lifetime of network is one of major concern in deploying WSN. Limited battery life is not able to fulfill the requirement of system for long duration and there should not be performance degradation due to the any solution. Many solutions are proposed with various routing protocol. Clustering is also help in increasing the lifetime of the system. The data security is also important in WSN. Data encryption and decryption should be done in such a manner that the data is secure and this should not result in increasing routing overhead. WSN can have simple star network topology to an advanced multi-hop topology. In this paper we discuss some important features of our implementation such as sensor nodes,Animal Migration Optimization, related work,simulation tool, performance parameters.

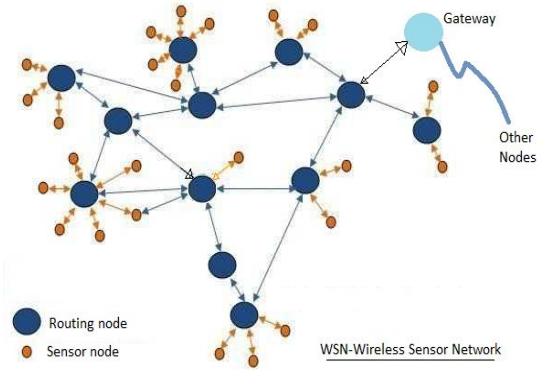



Figure1. Wireless Sensor Network Architecture

## II. SENSOR NODES

Sensor Node or Mote is most important unit of Wireless Sensor Network(WSN). The basic characteristics of sensor node or mote used in WSN are:

- Capable of gathering and processing the data.
- It can communicate with the source node and the other nodes in network.
- Node placementis based on application.
- Node placement can be of two type random (ad-hoc) and deterministic placement.
- Sensor node lifetime is dependent on battery life. So energy conservation is must.
- Sensor node must not have unexpected failure
- Nodes should be capable of informing the base station in case of communication failure.

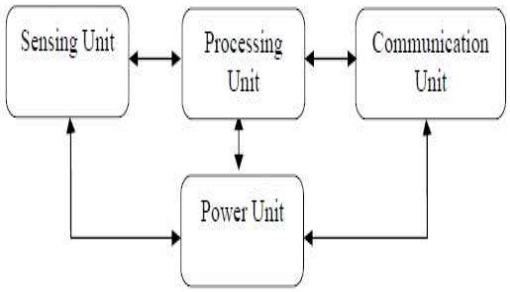



Figure2. Block Diagram of Sensor Node

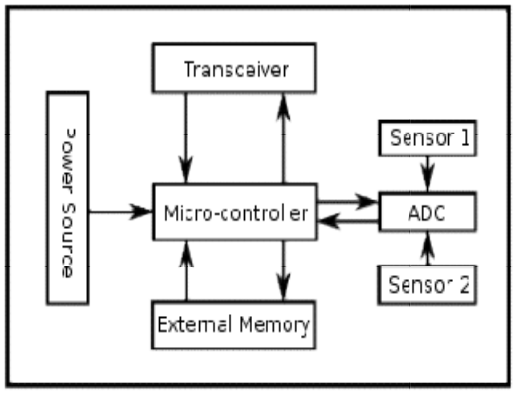



Figure3. Internal Structure of Sensor node

Figure2 shows block diagram of sensor network. It consists of sensing unit, processing unit, communication unit,power unit.

**SENSING UNIT**: This part of sensor node consists of application based sensors example vibration sensor, temperature sensor, magnetic sensor etc. the sensing units senses the parameters externally and collect data which is transferred to the processing unit. Analog data is converted to digital data with inbuilt ADC.

**PROCESSING UNIT**: In this unit of sensor node processing of data is done according feed program. Microcontroller is used for this part of node. This unit controls other unit of node. Selection of Microcontroller depends on requirement of system in aspect of speed, memory etc.

**COMMUNICATION UNIT:** Once data is processed in processing unit it has to be transferred to source node or to other sensor nodes. This is done by the communication unit of the node. Sensor node has transmit and receive mode for communication.

**POWER UNIT:** This unit supplies power to other sensor node units.

## III. CLUSTERING

Clustering is one of the methods for increasing the system lifetime in wireless sensornetworks (WSNs). In Clustering sensor nodes are grouped into cluster and election of cluster heads (CHs) for all the clusters is done. Sensor node has restrained amount of energy, so energy available should be used efficiently. This method is known as hierarchical clustering. It consists of cluster heads, sensor node and base station. Cluster head will collect the data from sensor node of the cluster and will send to the sensor node. This method saves lot of energy.

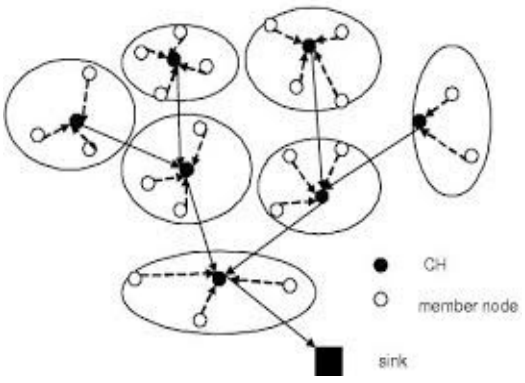



Figure4. Clustering in WSN

## IV. ANIMAL MIGRATION OPTIMIZATION

In the animal kingdom migration is a phenomenon which has always created curiosity for researcher. In the migration there is a pattern which can be observed they migrate to new habitat. Considering this behavior many optimization techniques has been proposed, AMOis such an optimization technique. The implementation of AMO is based on during migration the animal will keep itself clear from neighbor to avoid collision. The developed algorithm is based on two parts migrating process and updating process. In the migration process animal has to move such that there is no collision between two animals. One animal should follow same path as its neighbor and it should stick close to its neighbor. In the population updating process when animal leaves the group and some other animal joins the group then deporting animal will be replaced by new one with a probability. Probability is also on the basis of fitness of animals. This whole methodology is used in WSN when each cluster has to communicate to other cluster and to base station then AMO is used to select the optimal path.

## V. LITERATURE SURVEY

Anita Chavan et al. [2016] In this paper a clustering routing protocol CRT2FLACO is used on the basis of type -2 fuzzy logic and ant colony optimization is used. In this paper possibility of selecting cluster head is determined considering residual energy ,neighbor node and distance from source node.

Xiangtao Li et al. [2013] In this paper AMO has been proposed. AMO is basically optimization technique bsed on the animal migration behavior. A pattern has been observed in the movement of the animal and with this algorithm has been developed which is also explained in this paper in detail.

Riya Rai et al. [2016] In this paper a review has been done of different kind of optimization technology. Animal migration optimization has been explained. In this paper drawback observed about the efficiency of the AMO is discussed .Inappropriate efficiency is due to AMO execution time and to overcome this some benchmark functions are discussed.

Deepak Shrivastava et al.[2012] In this paper energy contributive approach is used and with this approach not only energy is consumed but also improvement in performance of system parameters observed.

## VI. PERFORMANCE INDICES

**Throughput:** Throughput is average rate of successful packet delivery over a channel. The packets can be sent through network physical layer or network layer. Measuring unit for throughput is bits per second. Throughput must be as high as possible. It can be measured with respect to any quantity like variable pause time interval, simulation time variable number of nodes.

**Packet Delivery Ratio (PDR):**

$$\textbf{PDR}=\frac{\text{Number of packets received at receiver}}{\text{Number of packets transmitted at transmitter}}$$

## VII. SIMULATION TOOL

We used NS2 as simulation tool. NS2 is an open-source simulation tool. It is a discreet event simulator used at networking application and providesbacking for simulation of routing protocols and IP protocols, such as UDP, TCP etc., over wired and wireless networks.

**Basic Architecture**: NS2 works on C++ and Object-oriented Tool Command Language (OTcl). The C++ defines the internal process of the simulation objects, the OTcl sets up simulation by arranging and design the objects as well as organize discrete events. TclCL is used to link C++ and OTcL.

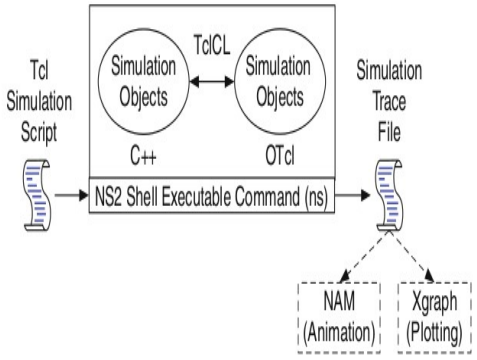



Figure5 Architecture of NS2

## VIII. IMPLEMENTATION DETAILS

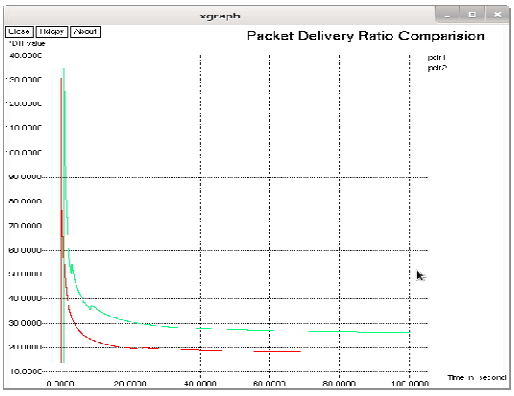
First the network is initialize network by arranging all the sensor nodes. Senor nodes are positioned in area to observe. Sensor nodes are scattered randomly in assigned area and are able to communicate to base station. Then source node (base station) is placed at the middle of the network. Clustering is done by K-Means. Then optimal path is determined using the AMO and the data is encrypted for the purpose of

security and finally after decryption data reaches to destination.K-Means clustering objective is to divide n observations into **k** clusters. In cluster each observation belongs to the cluster with the closest mean, working as a modelof the cluster. Ad hoc On-Demand Distance Vector (**AODV**) routing protocol is used.In each cluster the sensor nodes collect the data from environment and transmit it to the cluster head and then all the cluster head form a chain by selecting optimal path by AMO and through this path data is transmitted to base station.


Figure6. Flow chart of implementation

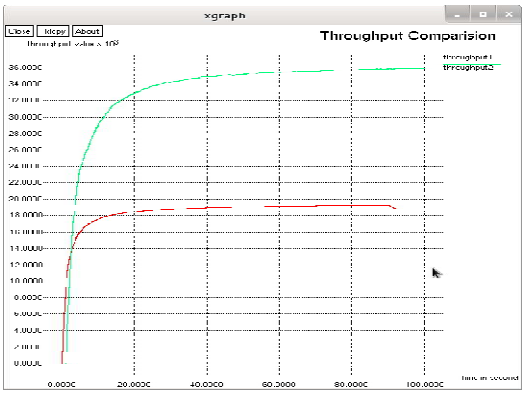
## IX. RESULTS AND DISCUSSION

For analyzing the performance indices mentioned in this paper simulation is peformed in NS2. Simulation is done by analysing NAM files and trace root files. Result outcome are shown below are result of xgraph simulation.




Graph1. PDR Comprasion

Above graph is obtained in simulation performed in NS2. Graphs are generated by xgraph simulation .In the graph the PDR value is shown with respect to the time .In the graph PDR is compared .We can observe improvement by our implementation as PDR2 line.




Graph2. Throughput comprasion

Similarly above graph is also result of xgraph simulation in NS2. Here we can see improvent in the through put value shown by throughput2 line by our implentation.

## X. CONCLUSION

Wireless sensor network is one of the major part of the recent global trend internet of things . Application of WSN network depend upon its lifetime. Reduction in energy consumption without affecting the performance is one of major issue in WSN. Consumption ofenergy can be reduced by proper utilaztion of enegry. Packet delivery ratio and throughput should be high for a WSN Network. AMO is one optimization technique which is help in selecting optimum path and increase performance. AODV Routing protocol also provide better performance .In this paper performance is analysed on PDR and throughput . WSN network performance can be analysed on other performnce indices such as network energy , sleep time etc.

## XI. REFERENCES

[1] Anita Chavan, Simran khiani " Securely Energy Aware Routing in WSN with Efficient Clustering " , (ICACCCT), 2016 ,ISBN No. 978-1-4673-9545-8

[2] Xiangtao Li, Jie Zhang, Minghao Yin " Animal Migration Optimization : An Optimization Algorithm Inspired by Animal Migration Behavior" , neural comput & applic (2014) 24:1867-1877

[3] Shefali Aggarwal, Deepak and Naveen Goel "A Review of Energy Aware Routing Protocols for WSN" International Journal of Computer Science and Mobile Computing, IJCSMC,September 2014, Vol. 3, Issue. 9, September 2014, pg.478 – 481.

[4] Sneha Kamble and Tanuja Dhope "Reliable Routing Data Aggregation using Efficient Clustering in WSN" 2016 International Conference on Advanced Communication Control and Computing Technologies (ICACCCT), ISBN No.978-1-4673-9545-8.

[5] Soumita Sen, Chandreyee Chowdhury Sarmistha Neogy "Design of Cluster-Chain based WSN for Energy Efficiency" 978-1-5090-2399-8/16/$31.00 c 2016 IEEE

[6] Riya Rai , Virendra Singh Kushwah, "Animal Migration Optimization: A survey ,(2016) IJCSE , Volume -4 Issue -12,E-ISSN :2347-2693

[7]Hector Kaschel, and Johanna Ortega "Energy efficiency in routing protocols applied to WSN" 9781509011476/16/$31.00©2016IEEE.

[8] Siyu Li, Hongju Gao , Dan Wu "An Energy-balanced Routing Protocol with Greedy Forwarding for WSNs in Cropland" 2016 IEEE International Conference on Electronic Information and Communication Technology (ICEICT 2016).

[9] Deepak Shrivastava ,Akshita Rana " Enhancing Performance of a Wireless Sensor Network by Applying an Energy Contributive Approach", IJSETR ,november 2012,volume 1, issue 5,november 2012 ,ISSN:2278-7798

[10] www.wikipedia.com

[11]http://www.tutorialsweb.com/ns2/NS2-1.htm