Improved routing scheme with ACO in WSN in comparison to DSDV

Meetu Galhotra[1] Dr. Rajesh Gargi[2]
[1]M.tech Student [2]Professor
[1,2]Geeta Engineering College

Abstract— Routing is the process of selecting best paths in a network in terms of energy and distance. In adhoc it is critical to collect the information in an efficient manner as it has limitations in terms of centralized congestion. In such case to perform the effective communication there is the requirement of some such routing approach that can provide the routing with optimized path. In this work, ACO based routing approach is defined to generate the optimized path in comparison to DSDV over the network. The presented approach is implemented in matlab environment and obtained results shows the effective results in terms of optimized path.

***Keywords**:* Routing, Optimized Path ACO, Effective Communication

I. INTRODUCTION

Wireless sensor networks are formed by small sensor nodes communicating over wireless links without using a fixed network infrastructure. Sensor nodes have a limited transmission range, and their processing and storage capabilities as well as their energy resources are also limited. Wireless Sensor Networks are self-configured and are without infrastructures. WSN collects data from the environment and sends it to a destination site where the data can be observed, memorized.

There is a bulk collection of the nodes in Unstructured WSN. There exists some pre-defined structure of nodes in Structured Nodes [4, 5]. Sensors can be positioned far from the actual phenomenon. Several sensors that perform only sensing can be deployed [6].

II. ROUTING SCHEMES IN WSN

A. Flat Routing Protocols

Flat routing protocols are divided mainly into two classes; the first one is proactive routing (table - driven) protocols and other is reactive (on-demand) routing protocols. Proactive routing is mostly based on LS (link-state) while on-demand routing is based on DV (distance-vector).

1) Pro-Active / Table - Driven routing Protocols

In proactive routing protocol, every node maintains one or more tables representing the entire topology of the network. These tables are updated regularly in order to maintain a up-to-date routing information from each node to every other node.

Examples of Proactive MANET Protocols include:

2) Reactive (On Demand) protocols

Reactive protocols start to set up routes on-demand . The mobility of the nodes causes the topology of the network to change constantly. Keeping track of this topology is not an easy task, and too many resources may be consumed in signaling. Reactive routing protocols were intended for these types of environments. This kind of protocols is usually based on flooding the network with Route Request (RREQ) and Route reply (RERP) messages.

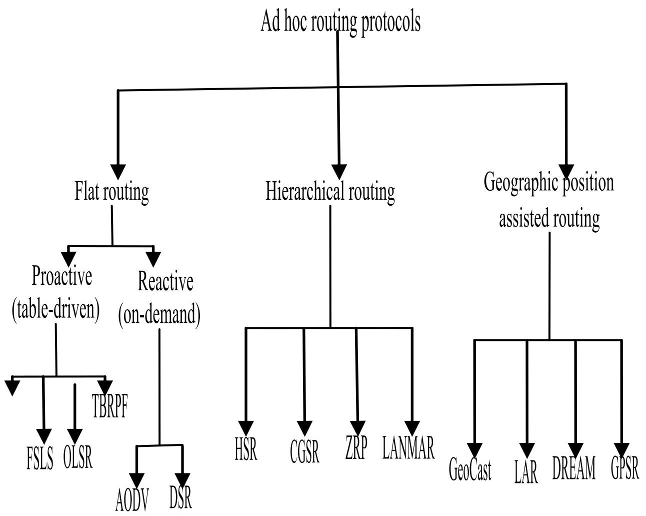

Fig. 1.1: Routing Protocols Classification

The different types of On Demand driven protocols are:

- Ad hoc On Demand Distance Vector (AODV)
- Dynamic Source routing protocol (DSR)
- Temporally ordered routing algorithm (TORA)
- Associatively Based routing (ABR)
- Signal Stability-Based Adaptive Routing (SSA)
- Location-Aided Routing Protocol

3) Hierarchical Routing Protocols

As the size of the wireless network increases, the flat routing protocols may produce too much overhead for the MANET. In this case a hierarchical solution may be preferable.

- Hierarchical State Routing (HSR)
- Zone Routing Protocol (ZRP)
- Cluster-head Gateway Switch Routing Protocol (CGSR)
- Landmark Ad Hoc Routing Protocol (LANMAR)

4) Geographical Routing Protocols

An advantage of geographic routing protocols is that they prevent network-wide searches for destinations. Examples of geographical routing protocols are:

- GeoCast (Geographic Addressing and Routing)
- DREAM (Distance Routing Effect Algorithm for Mobility)
- GPSR (Greedy Perimeter Stateless Routing)

III. DESTINATION SEQUENCE DISTANCE VECTOR

Destination sequenced distance vector routing (DSDV) is adapted from the conventional Routing Information Protocol (RIP) to ad hoc networks routing. It adds a new attribute, sequence number, to each route table entry of the conventional RIP. Using the newly added sequence number, the mobile nodes can distinguish stale route information from the new and thus prevent the formation of routing loops.

A. Packet Routing and Routing Table Management

In DSDV, each mobile node of an ad hoc network maintains a routing table, which lists all available destinations, the metric and next hop to each destination and a sequence number generated by the destination node. Using such routing table stored in each mobile node, the packets are transmitted between the nodes of an ad hoc network. Each node of the ad hoc network updates the routing table with advertisement periodically or when significant new information is available to maintain the consistency of the routing table with the dynamically changing topology of the ad hoc network.

Periodically or immediately when network topology changes are detected, each mobile node advertises routing information using broadcasting or multicasting a routing table update packet. The update packet starts out with a metric of one to direct connected nodes. This indicates that each receiving neighbor is one metric (hop) away from the node. It is different from that of the conventional routing algorithms. After receiving the update packet, the neighbors update their routing table with incrementing the metric by one and retransmit the update packet to the corresponding neighbors of each of them. The process will be repeated until all the nodes in the ad hoc network have received a copy of the update packet with a corresponding metric. The update data is also kept for a while to wait for the arrival of the best route for each particular destination node in each node before updating its routing table and retransmitting the update packet. If a node receives multiple update packets for a same destination during the waiting time period, the routes with more recent sequence numbers are always preferred as the basis for packet forwarding decisions, but the routing information is not necessarily advertised immediately, if only the sequence numbers have been changed. If the update packets have the same sequence number with the same node, the update packet with the smallest metric will be used and the existing route will be discarded or stored as a less preferable route. In this case, the update packet will be propagated with the sequence number to all mobile nodes in the ad hoc network. The advertisement of routes that are about to change may be delayed until the best routes have been found. Delaying the advertisement of possibly unstable route can damp the fluctuations of the routing table and reduce the number of rebroadcasts of possible route entries that arrive with the same sequence number. The elements in the routing table of each mobile node change dynamically to keep consistency with dynamically changing topology of an ad hoc network. To reach this consistency, the routing information advertisement must be frequent or quick enough to ensure that each mobile node can almost always locate all the other mobile nodes in the dynamic ad hoc network. Upon the updated routing information, each node has to relay data packet to other nodes upon request in the dynamically created ad hoc network.

IV. EXISTING WORK

Energy efficiency is the main issue of Wireless sensor networks operations because of the limited and energy supply Hence, BPNDA was proposed, a data aggregation scheme based on back-propagation network (BPN). In the BPNDA, a three-layer BP neural network was used. The input layer neurons are located in cluster members (CMs), while the hidden layer neurons and the output layer neurons are located in cluster head (CH). Only the extracted data that represented the features of the raw data will be transmitted to the sink, so the efficiency of data gathering is improved and the total energy consumption is reduced[2].

In this paper they introduce our neural network based approach which results in a more efficient routing path discovery and sensor power management. They define a set of attributes based on sensors' location and neighborhood and use them as inputs of our neural network and the output of the neural network will be used as a factor in the route path discovery and power management. They designed a simulator based on our approach and observed the effect of our method on Wireless sensor network lifetime and sensor power consumption which will be presented in this paper [3].

This paper describes the concept of sensor networks which has been made viable by the convergence of microelectro-mechanical systems technology, wireless communications and digital electronics. First, the sensing tasks and the potential sensor networks applications are explored, and a review of factors influencing the design of sensor networks is provided. Then, the communication architecture for sensor networks is outlined, and the algorithms and protocols developed for each layer in the literature are explored. Open research issues for the realization of sensor networks are also discussed.[4]

V. ANT COLONY OPTIMIZATION (ACO)

Ant Communication is accomplished primarily through chemicals called pheromones. Ants communicate to one another by laying down pheromones along their trails. Other ants perceive the presence of pheromone and tend to follow paths where pheromone concentration is higher.

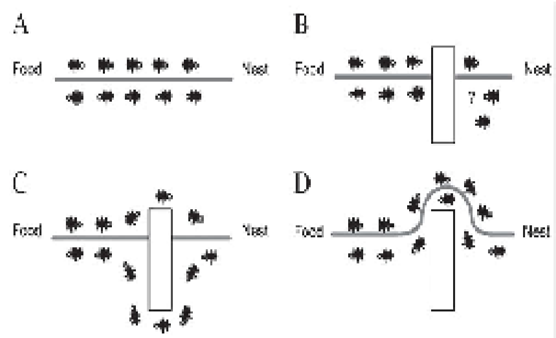

Fig. 1.2: Ant Behaviour

(1) Ants in a pheromone trail between nest and food;
(2) An obstacle interrupts the trail;
(3) Ants find two paths to go around the obstacle;
(4) A new pheromone trail is formed along the shorter path.

ACO is basically the optimization approach that is basically used to speed up the algorithmic process. In wireless network the ACO is basically used to optimize the communication process. According to this approach a node generate the ant to find the optimized path over the network. These ant place the pheramons on this located path so that all other nodes can follow these pheramons to communicate on this optimized path. The formost step of ant communication is the identification of pheramon location and to place them at appropriate location. More time it takes for an ant to travel down the path and back again, the more time the pheromones have to evaporate. A short path gets marched over faster, and thus the pheromone density remains high as it is laid on the path as fast as it can evaporate.

VI. PROPOSED WORK

In this present work we have improved the routing approach by improving the existing path selection algorithm with the inclusion of Ant Optimization approach. The first step is to setup the network with specific parameters. These parameters includes:

(1) Number of Packets: This property represents the number of successful packet delivery for a specific communication.
(2) Number of Packet loss: Due to the congestion or any block node there are the chances of the data loss over the network. This parameter will analyze the packet loss over the transmission. It is the decision parameter that will perform the analysis the next node is a valid node or not.
(3) Packet Delivery Ratio: This parameter is basically defines the ratio of packets transmitted and the packet successfully arrived to the destination. The packet delivery ratio we have analyzed on 4 intermediate nodes to identify the problem area over the network.
(4) Time Delay: It defines the delay in the communication. The delay will occur because of congestion over the network.
(5) Energy: As each node in the communication is a sensor node, because of this each node is defined with specific energy we have defined 5 Jule to each node. With each communication over the network some energy is lost. If the energy is less then minimum required energy or 0 the node will be dead itself.
(6) Turn Around Time : It is the actual time taken to perform the communication over the network.

i. Define N Number of Sensor Nodes in the WSN with specific parameters in terms of energy, transmission rate etc.
ii. Each Node Ni start Moving in Direction of Specific Direction Di
iii. Find M Neighbor Nodes of Nodes Ni and Maintains the respective Information
For (j=1 to M)
{
MaintainFormation (Ni,Nj)
}
iv. if DataLoss(Ni)>Threshold and TimeDelay > Threshold1
/* If Bad Node or Congested Node Occur on Node i*/
{
For i=1 to Mi
{
CollectInformation(Ni, Neighbor(Ni));
}
v. implement Forward ANT to find the alternate path in each Direction of Neighbour(N(i)).
vi. Set the Pheramon on Each Hop and Identify the Possible Path
vii. Implement Backward ANT to inform Neighbour Nodes about Backup Path
viii. Trace the Pharamons and Commmunicate of New Path
ix. Perform the Normal Communication
}

The description of the Ant concept is presented here

(1) At regular interval any node Source is selected to send data to some destination node.
(2) Each forward ant selects the next hop node using the routing table information. The next node selected depends on some random scheme. If all nodes already visited a uniform selection will be performed
(3) If the selected node is some damaged node or it is not currently available. The forward ant waits to turn in the low priority node from the queue.
(4) It will identify any of the next non visited node and pay some delay on it.
(5) If some cycle detected the ant is forced to turn on the visited node.
(6) When the ant reaches the destination node a backward ant is generated to transfer all its memory.
(7) Backward ant uses same path generated by forward ant.

By default route is chosen on the basis of Path selection formula and i.e. we will choose the lowest energy path. It means every time the selected path is using lowest energy. In case there is problem in the selection of the path then we apply the Ant Colony Algorithm the purpose of which is to continue sending data using the previous

VII. RESULTS

The presented work is implemented in Matlab environment under different scenarios.

As we can see the network of 60 nodes. These nodes represents the mobile nodes and represent the initial position of the nodes. We are implementing the Aggregative path on this network

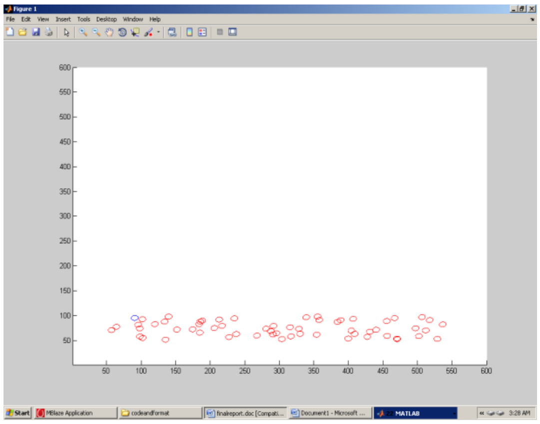

Fig. 1.3: Initial Network Design (60 Nodes)

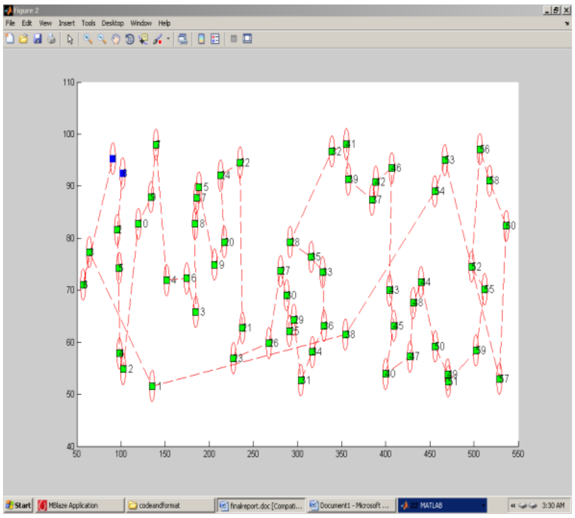

Fig. 1.4: Aggregative Path (DSDV Protocol)

The figure shows the initial path driven from the existing path selection routing.

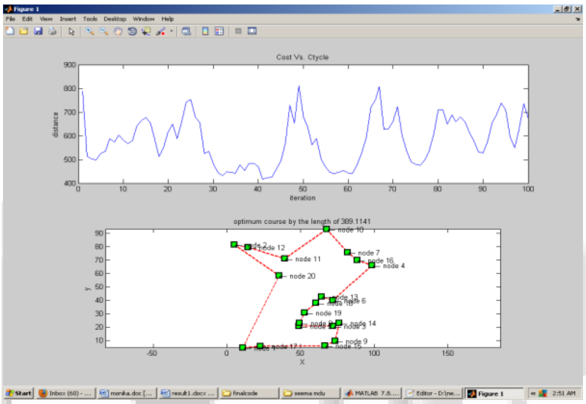

Fig. 1.5 : Optimized Path

Figure 1.5 is showing the optimized path after implementation of proposed ACO based approach. As we can see the output is showing the node sequence in which the nodes are being visited. In the subplot one the optimization process is shown and in sub plot 2 the optimized path obtained from the approach is shown.

VIII. Conclusion

In this work, an improved routing approach is presented that gives the effective route generation in terms of energy, distance. The approach will provide the safe path so that the effective communication is expected from the network.

References

[1] Walters, J. P., Liang, Z., Shi, W., and Chaudhary, V., (2007) "Wireless sensor network security – A survey", Security in Distributed, Grid, Mobile, and Pervasive Computing, Auerbach Publications, CRC Press.

[2] K. Akkaya and M. Younis, "A survey on Routing Protocols for wireless sensor networks" Ad hoc networks, 2005- Elsevier.

[3] Stephan Olariu, "Information assurance in wireless sensor networks", Sensor network research group, Old Dominion University.

[4] Fernandes, L. L., (2007) "Introduction to Wireless Sensor Networks Report", University of Trento. http://dit.unitn.it/~fernand/ downloads/iwsn.pdf.

[5] Y.-C. Hu, A. Perrig, D.B. Johnson, Packet leashes: a defense against wormhole attacks in wireless networks, in: IEEE Infocom, 2003.

[6] Perrig, R. Szewczyk, V. Wen, D. Culler, J. Tygar, SPINS: security protocols for sensor networks, in: Proceedings of Mobile Networking and Computing 2001, 2001.

[7] J. N. Al-Karaki and A. E. Kamal. "Routing techniques in wireless sensor networks: A survey". IEEE Wireless Communications, vol. 11, issue 6, pages 6–28, 2004.

[8] Prabhudutta Mohanty, Sangram Panigrahi Nityananda Sharma and Siddhartha Sankar Satapathy "Security Issues in wireless sensor network data gathering protocol: A Survey", Journal of Theoretical and Applied Information Technology- 2010.

[9] Jian Yin and Sanjay Madria "SecRout: A Secure Routing Protocol for Sensor Networks" doi.ieeecomputersociety.org/10/1109/AINA.2006.297 -314

[10] Rampur Srinath, A. Vasudev Reddy and Dr. R.Srinivasan "AC: A Cluster-based Secure Routing Protocol for WSN" Third International Conference on Networking and Services (ICNS'07) 2007.

