Design Strategies for Mobile Ad-hoc Network to Prevent from Attack

Puneeta Singh[1], Atma Prakash Singh[1] and Abhilasha Gupta[2]
[1]*BBDNIIIT, AKTU University, Lucknow, India*
[2]*Department of Computer Science, AKTU University, Lucknow, India*

Keywords: LEACH Protocol, Adhoc, Clustering, Steady Phase.

Abstract: LEACH protocol is the low energy adaptive clustering hierarchy protocol consume less energy and improved the performance of data transmission from cluster head to the base station. . In this paper discussed about the alive nodes, data transmission. Leach protocol was the earliest protocol where try to reduce the energy consumption of each node in every round. Achieve load balancing, energy efficient, coverage and connectivity, scalability, robustness, data fusion, security and minimum delay. It increases the lifespan of the network under the wireless sensor network where it reduces the energy consumption of the network to ensure that our nodes to be created and maintained it. Compare this data with attack and without attack if any malicious nodes come.

1 INTRODUCTION

Ad hoc network is the self-conferring, infrastructure less (ad-hoc) network where no wired connections between source to destination. In Networking, actually there are so many nodes they all are linked and communicate to each other and transfer the information from one node to another node. In the part of networking, we are having infrastructure based network and infrastructure-less (ad-hoc) network. Basically, we are having three kinds of networks LAN (Local area network), MAN (metropolitan area network) and WAN (Wide area network). Local area network is that kind of network when same kind of network will work together. In Metropolitan area network is that kind of network when we can communicate in the organization like university, hospitals etc. Wide area network is the network when we communicate with across the world. Mobile ad-hoc network i.e. decentralized type of network where there is no centralized network. Ad-hoc networks is having two types i.e. Wireless Mesh Networks (WMN), Mobile ad-hoc network (MANET) and Wireless Sensor Network. Mobile ad hoc network is the multi-hop wireless links where all nodes are communicating to each other in multi-hop manner, we also called as distributed routing. Ad-hoc node worked on Packet-switched while cellular network working on circuit-switching. With the help of mobility frequency path will be break, they are also called cooperative nodes.

2 CHARACTERISTICS OF MANET (MOBILE AD-HOC NETWORK)

Self-configuring: In this we configure each and every node dynamically communicate or connected to each other, no need of router to send the information from one node to another node. Configure automatically connect with some other node without the need of any router.

Dynamic network topology: In mobile ad-hoc network, topology created and automatically they can find their route with the help of some routing algorithm. So, it's dynamic in nature. It automatically find the path to go.

Light weight terminal: In Mobile ad-hoc network the devices are mobile devices these are having small capability of CPU processing, less memory storage. Have capability to optimize the mathematical functions themselves.

Autonomous terminal: In Manet terminal, each and every node acts as a router or a host. Each and every mobile terminal is an autonomous node. These mobile nodes work as a switching function instead as a router.

FIG.1. depicts that all nodes are connected to each other and sending the information from one node the another node as a mesh topology with the help

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of sensors they are communicating to each other and forwarding or sending the data packet from one node to another node.

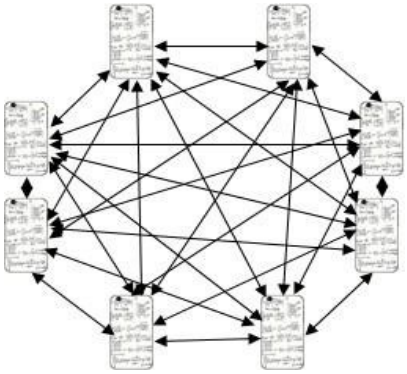

Figure1. Representation of Mobile Ad-hoc network

3 ARCHITECTURE MODEL OF MANET

The model of Manet is about to preserves the integrity of ip-addresses of every particular in this model. Basically in wireless networking, we are having two types Single hop and multiple hop. In single hop we are having Infrastructure based (hub and spoke) including 802.11, Cellular networks and 802.16 and infrastructure-less (ad-hoc) i.e. 802.11 and Bluetooth.

In multi-hop again we are having infrastructure-based (Hybrid) multi-hop including Wireless Sensor Networks and Wireless Mesh Networks and in infrastructure- less (Manet) including Car-to-Car Networks (VANETs). Basically, ad-hoc and mobile ad-hoc network both are different ad-hoc is single hop and mobile ad-hoc network is multi-hop. In Multi-hop we can forward the data from one node to another node.

3.1 Types of MANET

Vehicular Ad hoc Network (Vanet): We can communicate with another vehicles with the help of some equipment's which are placed on roadside. Intelligent vehicular ad hoc networks plays a major role for giving me some precautions on some collisions.

Hub-spoke Manet: All the sub-networks of Manet are connected to each other and they can create the geographically distributed type of network. It looks like a network where one spoke will tell to the hub and hub will give the answer via in which it looks like a hybrid kind of structure.

Internet based Mobile Ad hoc network (iManets): They can take protocols and through these protocols they are to communicate to each other. Internet based mobile ad hoc network can take and supports the TCP/UDP and IP protocols. With the help of these routing protocols we can establish the route path distributed automatically.

Smart Phone Ad hoc network (SPANC): Smart phone ad hoc network will be used without the help of any cellular network we can create the peer to peer connection. As a Bluetooth or Wi- Fi works which comes under the Smart phone ad hoc network?

Flying Ad hoc Network (FANET): with the help of drones, we can create or able to communicate in rural areas. FANET is the part of ad hoc network where their mobility was so increased as compared to MANET or VANET.

Figure 2. Architecture view of Manet (Mobile ad-hoc network)

FIG.2. depicts as a node that is able to communicate without any central device and sharing the information from one to other. It automatically or dynamically changing the topology. They have sensors and these sensors play one of the major role in mobile ad hoc network. It's has the capability of self- configure, automatically connected with neighbor nodes and starts communication.

3.2 Attacks Performed on MANET

Generally attacks means any unauthorized user can disturbed the link or tries to take the original data. In Manet, having two types of attacks.

Active attack: Any attacker or hacker or any unauthorized user tries to hack the data or tries to modify the data or disrupts the service. There are so many examples of active attack like masquerade, denial of service and replay etc. Black hole type of attack is the example of active attack.

Passive attack: passive attack is the attack when it monitors the data, there is no modification in their data. Passive attack is not much as dangerous as active attack. Third party only monitors the data it can never change or alter the data. Traffic analysis and traffic monitoring type of attack is the example of passive attack.

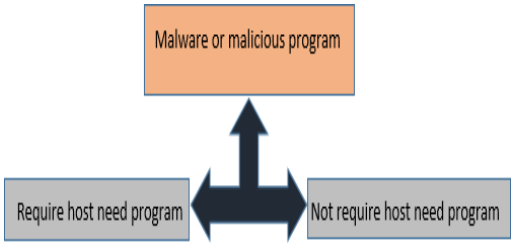

Figure 3. Representation of requirement of Malware program

Fig.3 about the malware or malicious program wants requirement of host need program to execute the program.

Threshold decision making: In this phase, we see the threshold value and fix it, after see the malicious node we will rectify via some algorithm and that algorithm is threshold decision making. There are two parameters in the network: RREQ and RREP. RREQ: When we send the packets from source to destination then that route called as RREQ (route request). RREP: When we are sending the data packets from destination to source then that route path called as RREP.

3.3 Different Clustering Algorithm

K-Means Clustering: In K-Means algorithm, we choose a number of groups (number of nodes) and choose accordingly distinct points or groupings. In this we see the closest distance between the centers of the group. This K-Means clustering is the unsupervised learning and here also it checks the points from the group.

Figure 4. Representation of K-Means clustering

Fig.4 Representation of k-means clustering in which those items whose functionality was same they are placed in one group which was named as cluster. There are so many cluster and they are to be talked with the help of cluster head. Steps of K-Means clustering:

- First we choose k points, we also called means of that.
- We calculates the value of coordinates of mean those items which are nearest.
- We do recursion means call many times until we cannot achieve our goal.

3.4 Mean Shift Clustering

This clustering which was based on sliding window, it will work on centroid based. It will see the center of the group in the network. At every time it will check the procedure where their density of data is high.

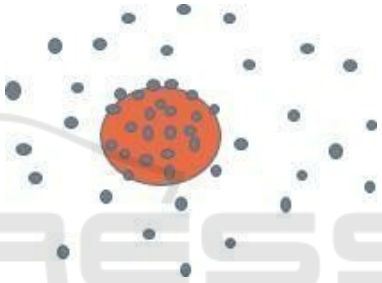

Figure 5: Representation of Mean shift clustering

Fig.5 tells that it sees the center of the group in the cluster, it always sees the maximum value from the nodes. It always calculate the mean from the cluster.

4 LITERATURE REVIEW

Prasanna, S. it tells about how any node attack the any node in network. It also tells about the how wormhole attack, black-hole attack, attacks the malicious node. They all are discussing about routing protocol i.e. routing protocols are of two types one reactive routing protocol, the other one is proactive protocol and the third one is the hybrid protocol. For achieving network security we will get three things in that: Confidentiality, availability, authentication and integrity. The data is protected from un authorised user. Availability means the resources and services are to be available, DOS that attack under the availability. Authentication means the data is should be authenticated. Integrity means whatever the message is being transmitted is not be altered.

Arulkumaran, G., & Gnanamurthy, R. K. this strategy used in military services where they want secure the data and would be transmitting in a secure channel. MANET is the dynamic topology and it create the fuzzy logic concept, with the help of this strategy we reduce the black hole attack and it improves a speed of AODV (Ad-hoc on demand vector) protocol.

Amru, M., Jabirullah, M., & Krishna, A. C. tells about the improvement of those failed nodes which are cluster head. Cluster head are to chosen when their energy is maximum. It uses LEACH protocol in which it tries to reduce the energy consumption or power consumption. Sensors are very small insize, their memory is also limited. It proposed a scheme which is based on rank.

Kassan, S., Lorenz, P., & Gaber, J. it talks about the wireless sensor nodes in which it works with the help of number of nodes, software etc. Sensors nodes are depend on limited battery but wireless sensors nodes are having unlimited energy for the usage of network.

Netyorks, V. S., Krishnakumar, A., & Anuratha, V. in this paper discuss about the cluster head in the wireless sensor network through which whatever the method was using for choosing the cluster head, it can change or modified the cluster head. It helps to increase to life of the network, we choose the highest data or value from the cluster head. Uses the concept of Fuzzy logic (FL) from super head of cluster.

Kundu, S., Karthikeyan, S., &Karthikeyan, A it studies and tell that the one algorithm QBEECH and it compare with other LEACH like Multiple LEACH, C- LEACH etc. There are disadvantage in these protocols. This algorithm tells that it will increase or enhance the life of the network.

Rahmadhani, M. A., Yovita, L. V., &Mayasari, R proposed a method of Delay tolerant network (DTN) in which when network is traffic in nature then those data packet which are transferring it will be loss. Basically LEACH algorithm will be divided into two phases set up phase and steady phase. This method will very helpful for the use of busy network and data will be dropped, reached successfully. This DTN was added into the LEACH-WSN in which data will not dropped.

Vaseer, G., Ghai, G., &Ghai, D. talks about the novel intrusion detection system and prevention for mobile ad hoc networks. Generallywe built a novel techniques to counter set of attacks i.e. active attacks like denial of service (DOS), vampire, user to root attack etc. The user give the lot of request to the system then the server blocks the whole process it causes crashes in the system. These kind of attacks can be detected using single attack and multi-attack. They are using AODV protocol Ad hoc on demand distance vector in NS2 environment Hussain, K., Hussain, S. J., Jhanjhi, N. Z., & Humayun, M. about the energy consumption it uses many approaches such as scheduling for optimal route path. In this it uses the concept of clustering algorithm in which it will decrease the distance between the two nodes in the cluster and it will optimize the energy consumption of all nodes in that cluster. It also use the concept of fundamentals of clustering i.e. set-up phase and steady phase. They also follow the routing algorithm when data should be reached to the node. It can use the concept clustering algorithm which is using to choose the routing path from one node to othernode.

Mukherjee, P. describes the functionality of smaller nodes, these smaller nodes are cheaper in cost. These smaller nodes are the reason for transmission. For calculating the shortest path between two nodes we need Dijkstra algorithm for finding the shortest path. It will calculate value between active cluster head. It uses LEACH-VD helps for reducing the power consumption and increasing the energy with the help of dijkstra algorithm. Network will divide into clusters. Clusters make with groups of nodes. The probability of each cluster has same. These cluster head will directly connect to the base station.

Hassan, A. A. H., Shah, W. M., Othman, M. F. I., & Hassan, H. A. H. it will talk about the K-Means and fuzzy C-means algorithm to help the cluster who are removed with their position and it also increase the network life like to save the battery of sensors. When we deploy the sensors on dense area. It introduce the concept of KM and FCM with which it will improve the balanced cluster. Take several parameter for calculating and improving when we take lot of scenario together. It also tells that by their calculation it got to know that FCM is more powerful as compare to KM which is less beneficial as compare to FCM if we deploy lot of sensor on widearea.

Haque, M. E., &Baroudi, U. tells about the guarantee delivery from source to destination in which it uses energy efficient protocol with the help of this definitely data should reached. It uses the concept of DEER i.e. Dynamic energy efficient routing and they have the capability to improve or to increase the session time of the network and addition to that it is having one of the functionality added that it can easily deployed from any distance. This technique also helpful to reduce the energy

consumption and power consumption. As compare to dijkstra algorithm this DEER routing was so much helpful.

Rajesh, D., & Jaya, T. give the mathematical model for secure the cluster mobile ad hoc network. It also increase the life of network. In this very difficult to save the battery for a long time. It contains the method of shifting the cluster head of the network. It uses the methodology of ME2SC using with LEACH-C, DMSR andDMSR.

Prasad, A. Y., & Balakrishna, R. this will tell about the low energy consumption, power consumption due to when we transmit the data it wants more energy, the rate at which user transmit the data from source to destination. In this they will try to improve the energy. It will find the most suitable routing algorithm for communication. It describes the LEACH (low energy adaptive cluster hierarchy) protocol which will take low energy and power consumption between source todestination.

Kaushik, M., Gupta, S. H., & Balyan, tells about advancement in wireless sensor network. There is one technology i.e. Wireless body area network. That WBAN technology used in pets and human. In this Wireless body area network would be inserted into human body, this technology would be beneficial, it also take less energy and it's reliable. In this paper it also calculate the end to end delay, throughput etc.

Kumar, H., Chahal, V. P., &Verma, P. R. this paper tells about the advantages and disadvantages of Leach protocol. In this paper it can take the security was the main task in the network. Leach is the low energy adaptive clustering hierarchy it takes low energy from the whole nodes. Wireless sensor nodes wasthe collection of maximum number of nodes via which we are doing communication.

Rajesh, D., & Jaya, T. in this it is talking about this LEACH protocol which is implemented on dry soil i.e. the part of homogeneous. It will calculate the value of part of heterogeneous. It design a model which is using for calculating the energy. In this paper it develops a cluster head which is depend on threshold value. It calculates the value of threshold in each round. It gives the simulation which is based on performance of life in the network and how much nodes are alive ordead.

Takele, A. K., Ali, T. J., & Yetayih, K. A. in this paper they are describing how to improve the performance of small sensors which are cheap, low cost battery and small CPU. Battery are to be deployed most probably in remote locations which was the main cause of this problem. Most of the energy are to be consumed when data should be transmitted and some of the energy will lost to decide where to be deployed thenodes.

5 RESEARCH METHODOLOGY

Leach protocol is the Low energy adaptive clustering hierarchy. It will monitor the environmental type of conditions i.e. moving, temperature etc. This protocol defines reduce the energy consumption of the nodes and reduce the data transmission to the other node.

LEACH protocol based on Time Division Multiple Access (TDMA) which will divide the frequency in different time slots under the MAC protocol. The goal of LEACH protocol is that it will increase the lifetime of the network. There are two phases of LEACH protocol i.e. Set- up phase and Steady phase.

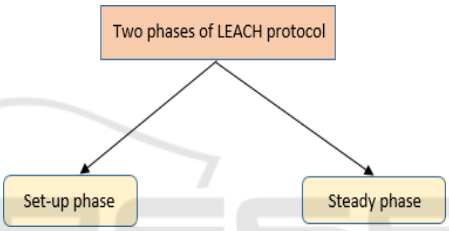

Figure 6. Representation of Phases

5.1 Operation on Leach Protocol

Leach protocol contains so many rounds and in each round include these two phases i.e. Set- up phase and steady phase which is used for reducing the energy consumption.

In Fig.6. In the case of set-up phase, the aim is to discover the cluster, we select the cluster on the basis of that nodewhoseenergy is maximum. In this phase, we send the packet to inform the all the nodes which are clustered that our own self is also a cluster, calculate on the basis of thisformula:

$$T(n) = R/\ 1-R*(r \bmod R-1)$$

where R is the probability of cluster head, n is the number of nodes, T (n) is the threshold valueThe number (n) which is lessor than threshold value, then that value will be cluster head. When that cluster becomes cluster head, then it never becomes cluster head again. It give only one chance in the network that node will become cluster head once. In this case set-up phase has 3 fundamentals i.e. cluster head advertisement, cluster set up and creation of transmission line.

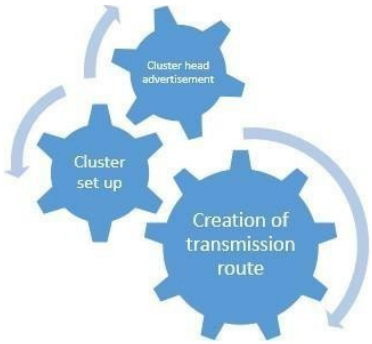

Figure 7. Representation of three fundamentals set- up phase

SET-UP PHASE:

In Fig.7. In cluster head advertisement, the packet is forwarded to all the nodes with the help of this advertisement, it will advertise to all the nodes. If that node whose energy is maximum then that energy will become the cluster head. All the nodes is having only one chance for making cluster node. This strategy is useful for saving the energy consumption. Those nodes which are not cluster head in the current round, it will send the join request to the cluster head and tell that we are the parts of cluster head because of this reason in the second round they will also get a chance to makecluster.

In the last step in the set-up phase that the cluster head will maintain the route path with the other nodes of that cluster. TDMA based MAC protocol will work on those nodes which are in cluster.

STEADY PHASE:

In the case of steady phase, those nodes which are in cluster i.e. cluster nodes were only talk to cluster head. There is no multi-hop routing allowed only single hop routing possible. With the help of this if one cluster node can communicate to other cluster node reach up to base stations. The working of cluster head is that it will collect all data in their cluster head and afterwards they are able to transmit with otherdata.

All the nodes in one cluster, from that cluster one node is cluster head which is deciding with the help maximum energy in first round. In the second round all those nodes who do not participate in first round to make cluster head in the second round. With the help of cluster node we are able to transmitting the data from one cluster node to another cluster node. In the network there are so many clusters, data should be transmitted in a secure channel.

Machine learning has a clustering technique in which it has so many data points with the helpof this algorithm we can easily find out the which node in which group it belongs. Those nodes which are in same cluster there are having similar properties and functionalities. As compare to other cluster it is having different functionalities. In machine learning, we have two things supervised learning and unsupervised learning. Supervised learning is useful for data collection and it give the output from our previous experience but in the case of unsupervised learning it will find out the unknown data patterns. Clustering is the unsupervised learning and it also helps in the field of data analysis and this was used in many otherfields.

In Figure 8, was the representation of clusters in which data should be transmitted from one to another node. It will use clustering algorithm in which we are able to reduce the energy consumption and transmissiondelay.

Clustering algorithm using set-up phase and steady phase:

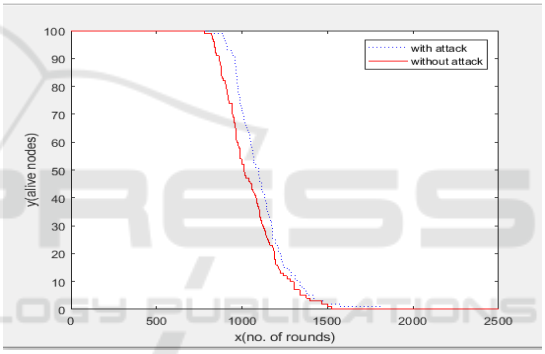

Figure 8. Representation of clusters In the case of Set-up phase:

Contention of cluster head: From this, it works from base station, in the starting stage base station or sink was provide some percentage (per), from this percentage it will calculate the cluster head (ch) from each round. Any kind of number or random number (ran num) will be generated in between 0 and 1. We will see the percentage if it is less, then it will be choosing a cluster head otherwise it was just a node which is sensing node. Those nodes who cleared this phase send a data packet to all with a value called threshold (n). The calculated value based on some sensor nodes and their average speed. The speed was based on some transmission range. All those nodes are in pattern and it should receive some signal within that pattern it will help to choose a cluster node. It is the solution of this to take coverage ofnetwork.

ran number (0, 1) < per

threshold (n) = (w1 *Sn) + (w2 * Ern)

Election of cluster head: In the phase of cluster head (ch) those who follow the statement of (2) will participate in the process of cluster head. It calculate the value of threshold (n) based on (3) and it also sees the any data packet it received from other sensing nodes. If the value of threshold (n) will be less than those nodes who are receiving packet, then those nodes as elected as a cluster head.

5.2 Association Ofcluster Head

In the based on this, sensor nodes are the responsible to make cluster head on the basis of criteria of association of cluster head. Whatever the speed comes from other cluster head and it will calculate the distance and their speed, then it will be the part of cluster head.

6 RESULTS AND DISCUSSION

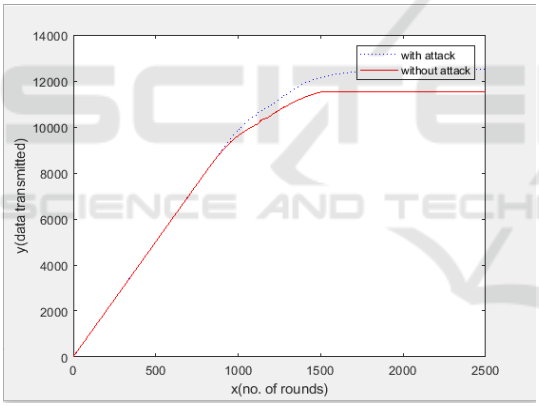

Figure 9. Representation of alive nodes with attack and without attack

The values are in tabular format and take the values of alive nodes with attack and without attack. All are the GUI form of LEACH implementation and in panel of Implementing Leach Protocol there are three block, first is Leach Implementation, Leach GUI Implementation and GUI Implementation. In this section we are having the result of alive nodes, data transmission, energy consumption and cluster head using the matlab simulation tool and compare with attack and without attack.

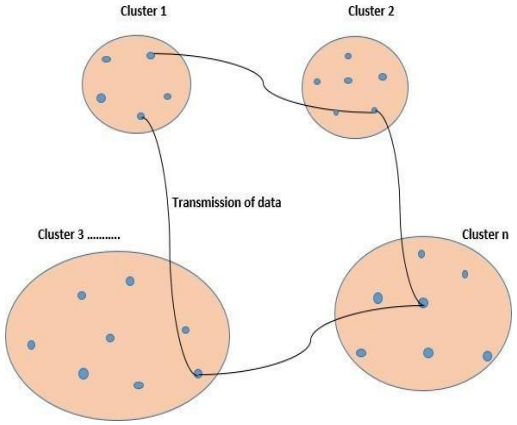

Figure 10. Data transmission from nodes to cluster head

7 CONCLUSION

Leach protocol contains so many rounds and in each round include these two phases i.e. Set- up phase and steady phase which is used for reducing the energy consumption. In wireless sensor network, there are small nodes and these small nodes having limited energy. Leach protocol was the earliest protocol and it works on energy consumption. This will reduce the energy who has maximum energy. In leach protocol there are having two phases we already described and there are having so many rounds and in each round cluster head will changed via each cluster head will get chance once. In this protocol there is having some pros and cons via this we can try to modify the leach protocol like c-leach, q-leachetc.

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