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Performance Enhancement of Mobility Models in Mobile Ad-hoc Network

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Abstract: **- Wireless networks in different forms are being used in different fields for sharing of different type of data among different users. The wireless mobile network consists of various wireless nodes moving with random speed. These nodes move from one position to other position with different speed and different angle. While moving with different speeds each node change its neighbors. Such that path list can be failed while moving the data from one node to other node. There can be different mobility models used to make nodes to move from one position to other position. These mobility models can be random walk or gauss markov model. In random walk there is random direction and random speed. In gauss markov the angle and the speed is average of previous angle and speed. Hybridization of the mobility model can enhance the performance. That means in hybrid model there can be random direction but the speed is the average of previous speed used in previous run. Parameters like End to End delay, Packet Delivery Ratio, Response time, Network Routing Load has shown the improvements.**

***Keywords*: Mobility, Random walk, Gauss Markov.**

I. INTRODUCTION

Wireless networks have become a medium of revolution in communication industry because of number of benefits it offers to the end users like convenience, mobility, ease of deployment, scalability and cost effectiveness. Wireless networks are classified into two categories: one is Ad-Hoc in nature and other is permanent in nature.

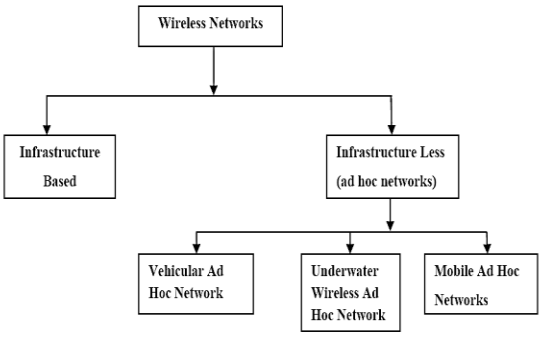

Fig. 1.1 Classification of Wireless Networks[1]

1.2 INFRASTRUCTURE BASED WIRELESS NETWORKS

In infrastructure full network each node in the network rely on the central device for making communication to either wired or wireless node of other or same network. This type of network can be in office or in home or at the airports.

1.3 INFRASTRUCTURE –LESS WIRELESS NETWORKS

Node in the infrastructure less network does not being dependent on any of the central node. Each nope part of the network communicates directly or by considering other node as relay node. This type of network has the ability to make communication between the nodes with lower bandwidth and also less memory buffers. There are three types of Infrastructure-less Wireless Networks:

Vehicular Ad Hoc Networks

This is special type of the network lies into the category of MANET. It is a infrastructure less network where large number of vehicle moving on the road communicates to other vehicle or may be to the road side infrastructure.

Underwater Wireless Ad Hoc Network

Underwater Wireless Ad Hoc Networks enable many civilian and military applications such as oceanographic data collection, scientific ocean sampling, pollution and environmental monitoring etc.

Mobile Ad Hoc Networks

MANET is a network where large number of nodes part of the network working as wireless nodes. These nodes are moving in nature transfers the data amongst each other using either FTP or CBR. This MANET is having no central controller which can control the access permission in the network. It is also called as peer to peer

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Vol 5, Issue 4, April 2018

network. Where people part of the network can both send and receive the data.

1.4 CHALLENGES OF MOBILE AD HOC NETWORK

Mobile ad hoc network face some challenges which need to be addressed as listed in Table 1.1.

Table 1.1.Challenges in Mobile Ad Hoc Networks[1]

Challenge	Explanation
Bandwidth Constraint	This type of network has very low level of spectrum in the use. So less amount of data can be sent and receive with various kind of time constraints.
Routing Overhead	there is a routing overhead. Because each node part of the network works as relay node. So with less battery power and with less transmission capacity generates the bottle neck in the network.
Security	Because they is no central controller which can control the access permission in the network. Any node can be the part of the network at any time. Such that it can malicious node which can destroys the network infrastructure.
Packet loss due to transmission error	while sending the data from one node to the other node there can be packets loss. As there is less amount of bandwidth and routing overheads.

1.5 MOBILE AD-HOC NETWORK ROUTING PROTOCOLS

Routing protocols in the network of MANET nature is there to establish the path from source to destination. This type of routing can be done in three ways. One is reactive other is proactive and third is hybrid category. In reactive category the path will be identified at on demand. So on each occasion the new path has to be established. In proactive they are table based. Previous path will be considered for communication. New path will only be established when there is active node in the previous path. This type of technique is right for very slow or stationary type of topological network. Last is the hybrid category of the network. This type of network is having both the schemes that is reactive and proactive category.

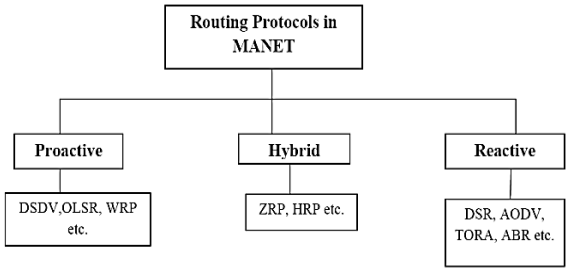

Fig. 1.2 Routing Protocols in MANET[2]

1.5.1 Proactive/Table-driven routing protocols: This category of the protocol is table based protocol where previous path already stored into the buffer. This path will be used for further communication between same source and destination. So that no extra time is wasted while setting the new path. This type of communication is suitable for slow moving network having various slow moving nodes.
Examples: DSDV, OLSR, WRP.

1.5.2 Reactive/On demand routing protocols: it is most widely used type of the protocol. This type of protocol is used for setting the path on demand. Such that new path will be established for the source by sending the route request. Against the route request route reply will be stored and identified for best path between multiple paths.

Examples:DSR, TORA, AODV.

1.5.3 Hybrid routing protocols: This type of protocol used mix of both reactive and proactive category. Depending upon the situation. When nodes are not moving very fast then the proactive category is used. But when nodes are moving with high speed then the reactive category of the protocol will be used for communication.

Examples: TORA and ZRP.

1.6 Mobility Models in MANET

In MANET wireless mobile nodes moves in random direction. The mobility depends upon the speed of the network as well as the type of the nodes and the applications in which in is involved(Loo, 2011).

The different Mobility models are

1.6.1 Random Walk Mobility Model: this type of mobility model is memory less communication. This type of network mobility model includes the nodes moves in the network without considering its previous speed and direction.

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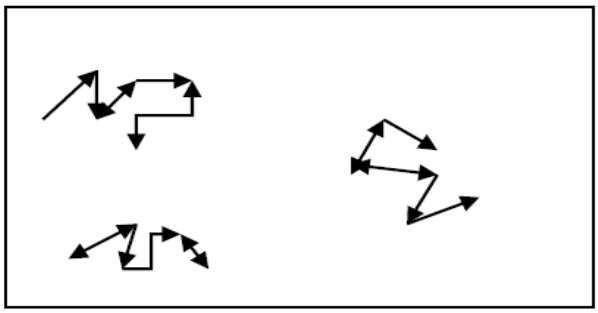

Fig. 1.3 Random Walk Mobility Model[2]

1.6.2 Random Waypoint Mobility Model: this type of mobility model is similar to the random walk. The only difference is before changing the direction and speed it take a small pause between two subsequent changes. (Loo, 2011).

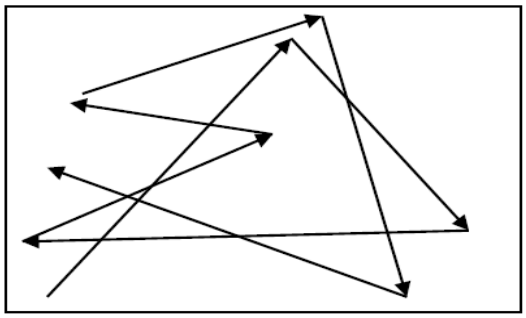

Fig. 1.4 Random Waypoint Mobility Model[2]

1.6.3 Random Direction Mobility Model: in this type of mobility model the node moves to the edge of the simulation are. Then after take and pause and take new speed and new direction to move in the network area.

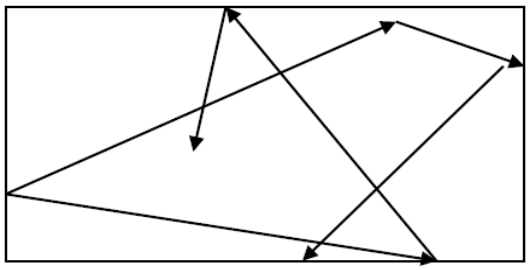

Fig. 1.5 Random Direction Mobility Model[2]

1.6.4 Gauss-Markov Mobility Model: this type of mobility model is best type of model. Where large number of nodes moves with random speed and random direction. But the speed and direction is taken based on previous peed and direction..

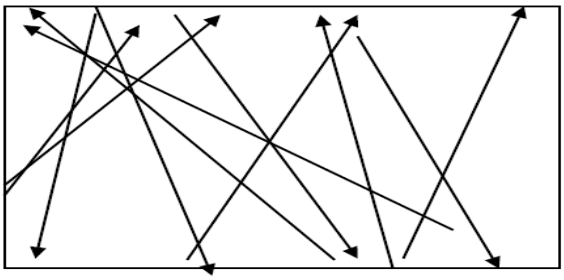

Fig. 1.6 Gauss-Markov Mobility Model[2]

II. LITERATURE SURVEY

Andrea Lupia, 2015 Author has defined a MANET as infrastructure less network. Where various mobile nodes can be put in hostile environment.. nodes moves in random direction. Because it is infrastructure less network has higher chances of security threats. Less infrastructure will make network to suffer from various kinds of attacks.

HarounBenkaouha, 2015 the author has proposes the network situation where failure is detection using AFDN type of technique. It is accurate fault detection protocol. Where large number of nodes will be monitored for detecting the failure. So that in the network area no node should failed.

Pham Thi Minh Thu, 2015 During the requesting process if source node does not identify the path in given zone. Then they forward the request to other zone. This mechanism of path identification using guarantees the better path either in one zone or other zone. Priority is always given to nearest zone compared to the far away zone. Various performance parameters like delay and packet delivery ratio has shown the improvement.

JianyuNiu,2015 this paper has performed working on the use of directional antenna. This way the frequency reuse in the network area is becoming optimal. But by keeping directional Antenna can produce great challenges like hidden terminal, and deafness problem. But by having various techniques of caching and angle of arrival techniques can improve the results. Caching also removes the deafness problem. It is required for solving high density and high traffic load.

KirtiAniruddhaAdoni,2015 MANET is a self organizing network. Where there is no central controller. Each node is liked to each other using wireless channel. This wireless channel will be used for intercommunication. This communication can be either direct communication or indirect communication. In both the cases some intermediate node can be considered. This relay node will collect the data from one side and send to other side. So some amount of energy will get wasted while relaying

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the data packets. This research paper has taken OLSR type of pro active protocol for establishing the path between source and destination.

VishwaNand Chandra,2015 has processed the research for MANET behavior. MANET is mobile Ad-Hoc Networks is the collection of various mobile nodes. This mobile network has various nodes lying in the network moving from one position to other position.

Jean-AimeMaxa, 2015 This paper has proposed a technique called as UAV and Ground control Station. This paper has presented the challenges of this type of network like mobility degree, network connectivity pattern, delay-sensitive applications and network security. This paper also has mentioned the effect of the mobility on the network path stability. What happens when the nodes moves from one position to other position with specified speed. Also how the effect of the random direction has on the network path stability.

III. FLOWCHART

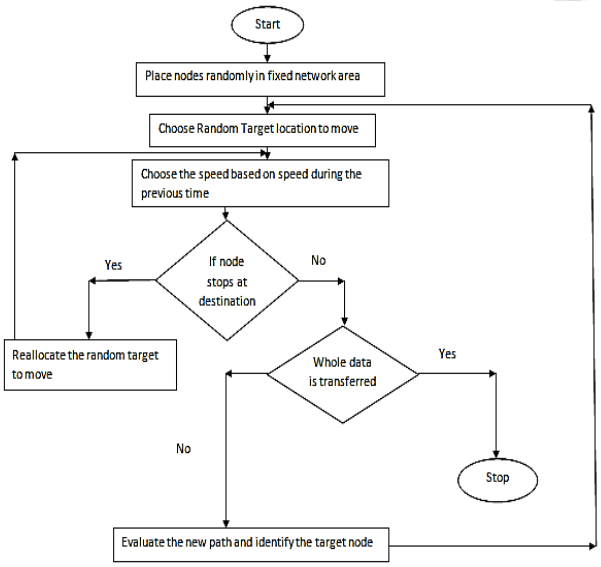

Fig. 1.7 Flowchart

IV. ALGORITHM

Step1 at first step nodes are placed randomly in the network area. Each node has the position independent to each other.

Step2 The node chooses a random target location to move. The node moves in a straight line to chosen location.

Step3 after the elapse of fixed time period node takes the speed taken in the previous time. During the previous time with little randomness incorporated in the calculation.

Step4 Calculate the location of node based on time(interval) because it approximately moves at fixed speed.

Step5 Calculates the network performance parameters to measure the performance.

V. RESULTS AND DISCUSSIONS

Network Configuration

For setting up the network under NS2 requires basic setting of the network. So that various nodes can be kept and make them to communicate to each other in real like situation. The outcome will be assumed to be real like situation.

Table 5.1 Network Parameters

Parameter	Value
Number of Nodes	40
Routing Protocol	AODV
Communication Protocol	TCP,UDP,TCP RENO,TCP SACK
Application	FTP,CBR
If Queue Length	50
Packet Size	512 Bytes
Delay	2 ms

The basic configuration settings includes the value settings for different parameters like Number of nodes, Routing protocol, Communication protocol, Application, Queue length, Packet Size,Delay etc.

Performance Parameter

a) End to End Delay: It is the total delay that has been produced while sending the data packet from source to the destination. It is generally the difference between the receive time and the sent Time.

End to End Delay= Receive time - Sent time

b) Throughput: It is the number of packets received per unit interval of time..

Throughput= Packets received/Time

c) Network Routing Load: It is the success rate at which packets are being sent from source to the destination.

Network Routing Load= Total Number of Hop Count/Packets

d) Response Time: Time taken by node to respond against root request.

Response Time=Time of reply-Time of request

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Nam Animation Of MANET

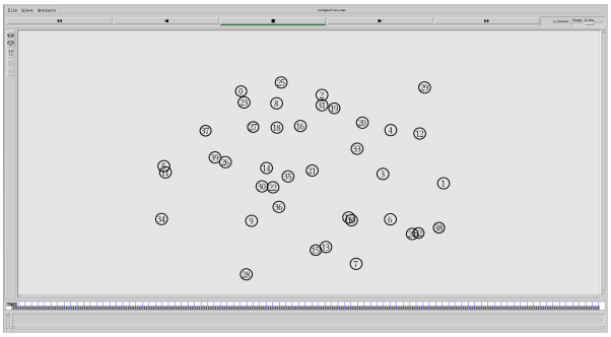


Fig. 1.8 Snapshot of Network

This snapshot shows the 40 nodes network. These nodes are wireless nodes. Inter communicates to each other. We can consider any node as source node and other as destination node.

Nam Animation For Communication Between Nodes

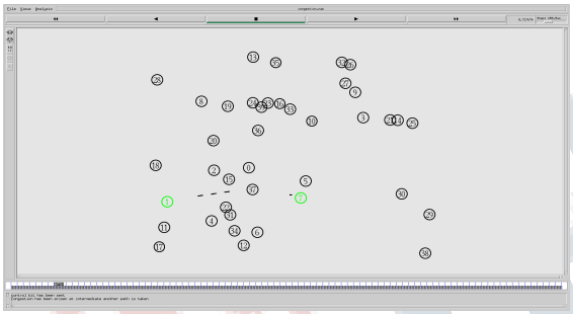
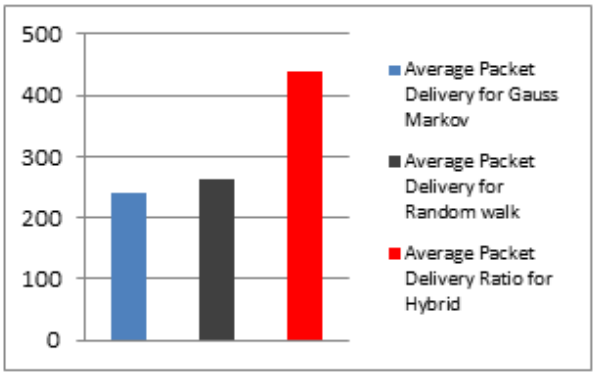


Fig. 1.9 Snapshot of Communication between nodes

In this snapshot it is clear that one node has been considered as source node and other node as destination node so that source node through either directly or through relay node sends the data to the destination node. In doing this there can be congestion in the network such that intermediate node can have more traffic compared to the capacity.

VI. RESULTS

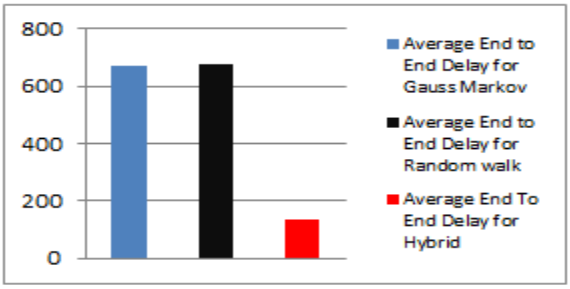
Comparison of Packet Delivery Ratio for Guass markov, Random Walk and Hybrid Model.



Graph 1.1 Comparison of Packet Delivery Ratio

This graph 1.1 shows the comparison of all the mobility models for packet delivery ratio. Such that hybrid scheme which is mix of two types of mobility models like random walk and gauss markov model has shown the improvement in packet delivery ratio.

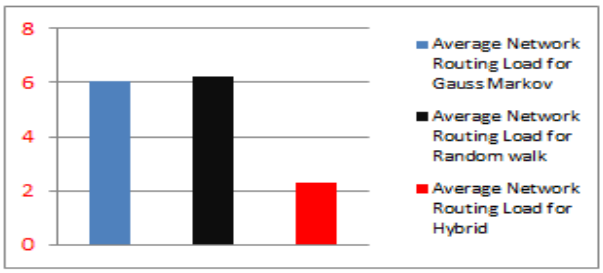
Comparison of End to End Delay for Guass markov, Random Walk and Hybrid Model.



Graph 1.2 Comparison of End to End Delay

This Graph 1.2 shows the average End to End Delay for all three like Random walk, Gauss Markov and Hybrid approach. There is a marked improvement in the average End to End Delay for Hybrid Approach.

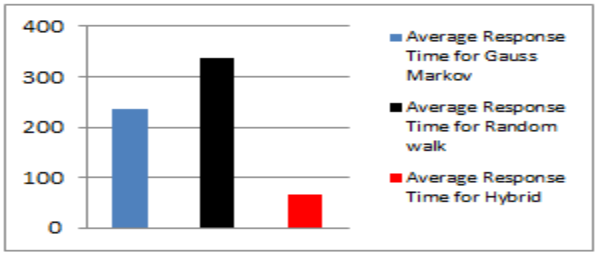
Comparison of Network Routing Load for Guass markov, Random Walk and Hybrid Model.



Graph 1.3 Comparison of Network Routing Load

This Graph 1.3 shows Network Routing Load for all three scenarios like Random Walk, Gauss Markov and Hybrid Approach. Hybrid Approach has shown the improvement in Network Routing Load.

Comparison of Response Time for Guass markov, Random Walk and Hybrid Model.



Graph 1.4 Comparison of Response Time

This Graph 5.1 shows the Average Response Time for

all the schemes like Random Walk, Gauss Markov and hybrid approach. The is marked improvement in Hybrid Approach for Average Response Time.

V. CONCLUSION

In context to mobility pattern of the MANET will decides how nodes moves from one position to other position with which speed. Random walk and gauss markov models are best suited model for mobility for MANET. In gauss markov model the angle and the speed used by the node is taken as previously used. But in random walk the nodes moves in direction by taking angle taken from the range and also the speed is taken from the range. Both the approach can be hybrid so that advantages of both the models can be enhanced for improving the performance. All the parameters like response time, packet delivery ratio, throughput and delay has substantially improved compared to random walk and gauss markov model.

VI. FUTURE WORK

In current research two mobility models are used one is random walk and other is gauss markov model. In future this work can be enhanced by taking another mobility models.

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