IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-6, Issue-9, Sept. 2018 E-ISSN: 2347-2693

A Comparative Study of Various Mobility Speeds of Nodes on the Performance of LANMAR in Mobile Ad hoc Network

Anveshini Dumala[1*], S. Pallam Setty[2]

[1,2]Dept. of CSSE, Andhra University, Visakhapatnam, Andhra Pradesh, India

Available online at: www.ijcseonline.org

Accepted: 06/Sept/2018, Published: 30/Sept/2018

Abstract— Mobile Ad hoc Network is a wireless network that is formed for a temporary purpose. Unlike wired network, there is no centralized control over the network. So, all the devices act as both node and router and have the property of moving that leads to the dynamic change in the in the network structure. At any instance of time, there is a change in network size and speed. The moving speed of a node affects the frequency of topological changes in the networks, which in return influences the ability of routing the data packets and maintaining steady routes. These two properties have a noticeable impact on the performance of MANET. The study of effect of one of the most important parameters i.e. network size on the performance of MANET is studied while implementing LANMAR routing protocol.

Keywords— Ad hoc Network, LANMAR, Fisheye, EXata

I. INTRODUCTION

Mobile Ad hoc NETwork (MANET) is a multi-hop network where a self-organizing, infrastructure-less network of mobile devices are connected without wires [1]. It takes the help of intermediate nodes to forward the data packet from source to destination due to its limited transmission range. MANET has the properties of mobility, dynamic topology, energy constraints etc. Due to this mobility property, there is a dynamic change in the connections between nodes in the network. At any point of time, there is a change in network size and their speed in the network. The moving speed of a node affects the frequency of topological changes in the networks, which in return influences the ability of routing the data packets and maintaining steady routes. These two properties have a noticeable impact on the performance of MANET. This paper makes a try to study the effect of one of the most important parameters i.e. network size on the performance of MANET while implementing LANMAR routing protocol.

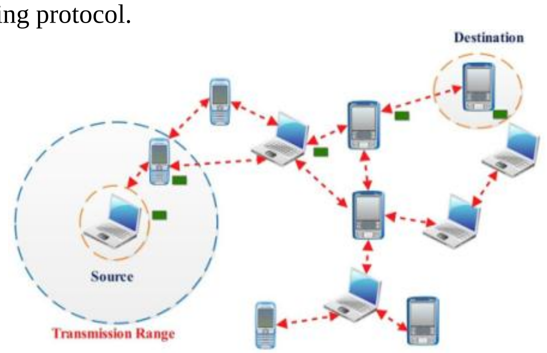

Figure 1. Mobile Ad hoc Network

Providing QoS is a challenging issue in MANETs and it is given high priority; as a result of many years of research efforts, large numbers of different schemes were proposed, but still there is no commonly tolerable protocol improves QoS in MANETs.

To provide QoS, the network is likely to guarantee a collection of qualitative and quantitative metrics like throughput, number of control packets, routing control overhead, etc.

Rest of the paper is organized as follows, Section I contains the introduction of MANET, section II presents related work of LANMAR routing protocol, section III describes routing protocols in MANETs, Section IV contains proposed methodology and simulation environment, Section V presents the experimental results and discussions and Section VI concludes research work with future directions.

II. RELATED WORK

Guangyu Pei, Mario Gerla and Xiaoyan Hong [4][5] presented a unique routing protocol called Landmark Ad Hoc Routing (LANMAR) that combines Fisheye State Routing (FSR) and Landmark routing to reduce routing update overhead. C. P. Koushik [6] suggested a LANDMARK choosing process to save the energy with group mobility and concludes that the performance of MANET routing protocols is sensitive to scalability and mobility of network.

III. ROUTING PROTOCOLS IN MANETS

Based on the network structure the routing protocols in MANETs are categorized into flat, hierarchical and

geographical routing protocols [2] [3]. In flat routing, all the nodes in the network work at the same level with same routing functionality. Flat routing is simple and efficient for small networks. When the network becomes large, the volume of routing information will be large and it will take a long time for routing information to arrive at remote nodes. This makes flat routing not suitable for scalable routing.
Hierarchical routing Protocols are best suitable for efficient scalable routing in High mobile ad hoc networks. One of the examples of hierarchical routing protocols is LANMAR routing protocol.

A. LANMAR Protocol

LANMAR Protocol [4] [5] adopts the idea of logical groups in which the nodes move as a group [6] [7] [8] [9] in a coordinated fashion. Every logical subnet as shown in Figure 1 has a header node (LANDMARK header), which serves for that subnet. Such LANDMARK header maintains subnet data.

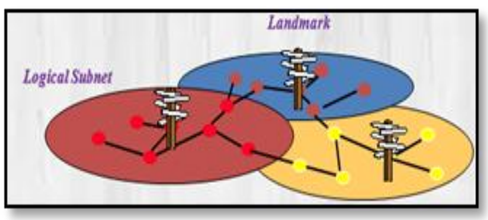

Figure 2. LANMAR routing protocol

The LANMAR protocol uses Fisheye as the local scope routing protocol in which scope is measured in hop distance as shown in Figure 2. The scope or a range of covering most of the subnet members depends upon placement of Landmark header. If the form of a subnet is likely to be a round, all members of the subnet are covered by the scope of the centre node. By means of electing this primary node as landmark requirement of the protocol is completely satisfied. The landmarks locations are distributed by a distance vector mechanism. All nodes maintain a distance vector for headers in all scope.

The number of entries in distance vector table is identical to the number of logical subnets inside the network. If a landmark does not discovered at the centre of the scope, some nodes will drift off from its scope. The landmark will preserve a hint of the nodes in distance vector which drifters from the group.

Always there is an exchange of the distance vectors of landmark nodes and the drifters by a continuous periodical updates. The LANMAR is a proactive routing protocol that has the necessary routing data of the nodes inside the scope. For routing inside the scope, each node periodically interchanges the routing information to its one hop neighbours. In each update, the node includes all the routing table entries and sends to the nodes present in the scope.

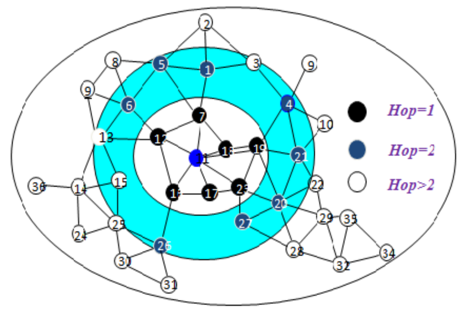

Figure 3. Scope: measured in hop distance

When a node needs to transmit a packet to the destination node within its scope it refers the routing table, the packet will be forwarded straight away by Fisheye State Routing (FSR) [10] protocol. A landmark is dynamically elected in each group. Every node in fisheye scope uses FSR to route packets to the landmark header that directs the packet to the corresponding landmark of the destination node. The transmission between the landmark headers is done by Landmark routing protocol with respect to their scope ID.

The eye of a fish captures with high detail the pixels near a focal point. The detail decreases as the distance from the focal point increases. In FSR [11], each node gradually slows down the update rate for destination with growing hop distance. Consequently, entries related to nodes within a smaller scope are broadcasted to neighbour nodes with a greater rate. As an end result, a large fraction of topology table entries (corresponding to far away destinations) are suppressed, hence reducing line overhead.

The various timing parameters used in LANMAR are shown in **Table 1**. LANMAR timing parameters values have worked well for high mobile large networks. The timing parameters should be administratively configurable for different network sizes at different mobility speeds dynamically either experimentally determined values or dynamic adaptation.

Table 1. LANMAR Routing Protocol Timing Parameters

Timing Parameters	Default Value
MINIMUM_MEMBER_THRESHOLD	8
APHA	1.3
LANDMARK_UPDATE_INTERVAL	4s
NEIGHBOR_TIMEOUT_INTERVAL	6s
MAXIMUM_LANDMARK_ENTRY_AGE	12s
MAXIMUM_DRIFTER_ENTRY_AGE	12s
FISHEYE_SCOPE (HOPS)	2
FISHEYE_UPDATE_INTERVAL	2s
MAXIMUM_FISHEYE_ENTRY_AGE	6s

where minimum member threshold- States the least number of neighbours in order to be considered a landmark., alpha- Specifies the multiplication factor required to update the landmark., landmark update interval- Specifies the landmark update interval., neighbour timeout interval- Specifies the landmark neighbour timeout interval., maximum landmark entry age- Specifies the maximum age for landmark entries., maximum drifter entry age- Specifies the maximum age for drifter entries., fisheye scope- Specifies the Fisheye scope for local routing., fisheye update interval- Specifies the routing table update frequency within the Fisheye scope., maximum fisheye entry age- Specifies the maximum age for Fisheye entries.

IV. METHODOLOGY

The existing methods for assessing the performance of protocols in a network include mathematical analysis, direct measurement and computer simulation. After taking all of the limitations into consideration, mathematical and computer simulation [12] [13] are appropriate for our research. There are numerous benefits of mathematical evaluation like cost, time and the potential of presenting fine predictive results.

The direct measurement as a choice of technique will be high priced however an alternative to simulation. In direct measurement the evaluation is to be achieved on an operational network which could lead to disruptive condition and an operation network could be very costly in terms of configuration complexity. The benefit of direct measurement is accuracy in results.

A. Simulation Environment

SCALABLE was founded in 1999 by Dr. Rajiv Bagrodia. Various versions: QualNet [14], EXATA (2008) EXATA/Cyber (2010). EXATA [15] is a widespread collection of tools for simulating and emulating different wired and wireless networks. It develops tests and evaluates, and train users on cyber war and network security technologies. It maps physical devices using EXATA, applications, EXata simulator/emulator 5.41 is used to create a simulation environment. The simulation parameters are presented in the following table.

Table 2. Simulation Parameters

Simulation parameters	Values
Simulation Platform	Exata
Number Of Nodes	20, 40, 60, 80, 100
# Of Logical Groups	4
Simulation Area	1000 x 1000 Sq-Meters
Traffic Resources	Constant Bit Rate
Link	Wireless
Radio Range	150m
Item To Send	512 bytes
Start Time	1sec
End Time	0sec
MAC Layer	IEEE 802.11
Antenna Model	Omni Directional
Data Rate	2mbps
Energy Model	Generic
Pause Time	0 sec
Minimum Speed	10 m/s
Maximum Speed	10 m/s
Transport Layer Protocol	UDP
Routing Protocol	LANMAR
Simulation Time	900 Sec
Mobility	Reference Point Group Mobility Model

In table 2, the specification of mobility models parameters and its values for the variable network size are shown.
In group mobility models the nodes are prearranged into 4 different groups (0-3groups) each group has equal no. of nodes with different mobility speeds.

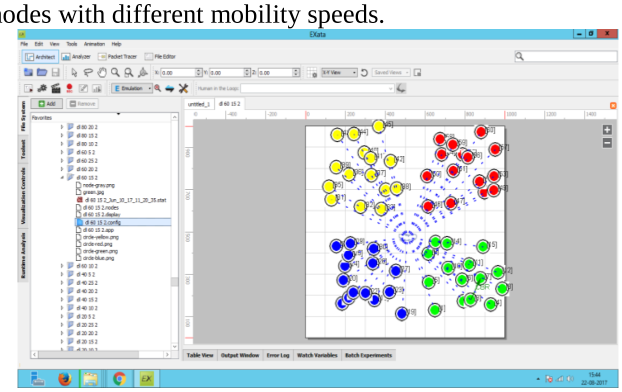

Figure 4. Snapshot of Simulation environment of LANMAR protocol before simulation starts

The MANET scenario is created with different network sizes (20, 40, 60, 80, and 100) by dividing the nodes into 4 groups (group 0, 1, 2 and 3). Each colour represents different group. Number of mobile nodes as created and they are connected through wireless links in 1000X1000 square meters terrain. All the nodes are set to move in 'reference point group mobility' fashion.

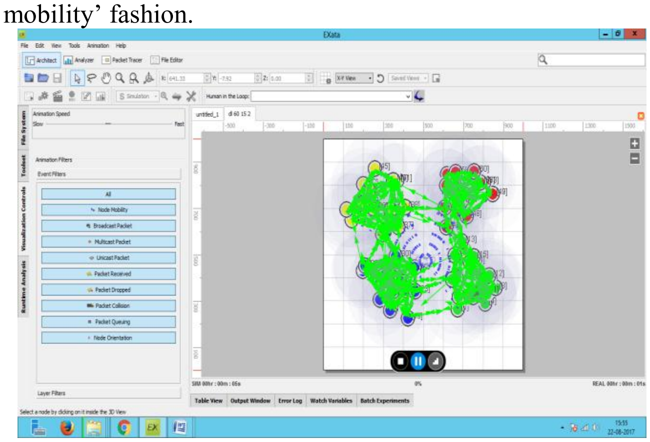

Figure 5. Snap shot of MANET scenario of LANMAR routing protocol during simulation

The figure shown above Fig.8 is during simulating the created network scenario. During simulation, the mobile nodes of different groups in the terrain region start transmitting data by moving in a 'reference point group mobility' fashion with different mobility speeds.

V. Results and Discussion

To assess the performance of routing protocols, the following metrics are considered.

1. Throughput (bits/s): The number of bits sent in the network during the simulation.

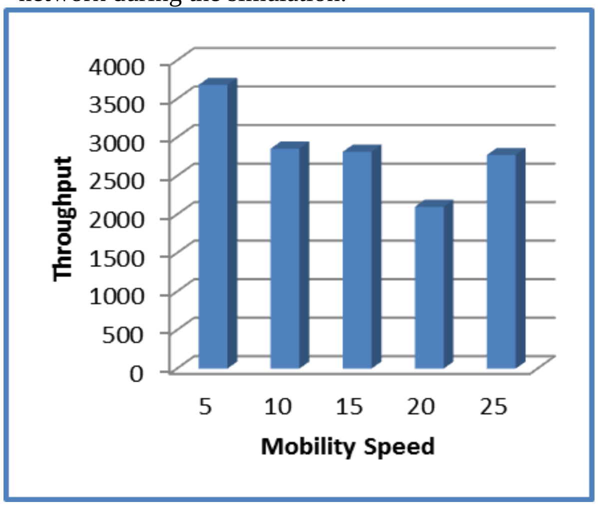

Figure 6. Graph for Variation in throughput with respect to Mobility Speed.

In the above graph, maximum throughput is achieved when the mobility speed of nodes is very low i.e., 5m/s.

2. End-to-End Delay(s): The average time it takes a data packet to reach the destination.

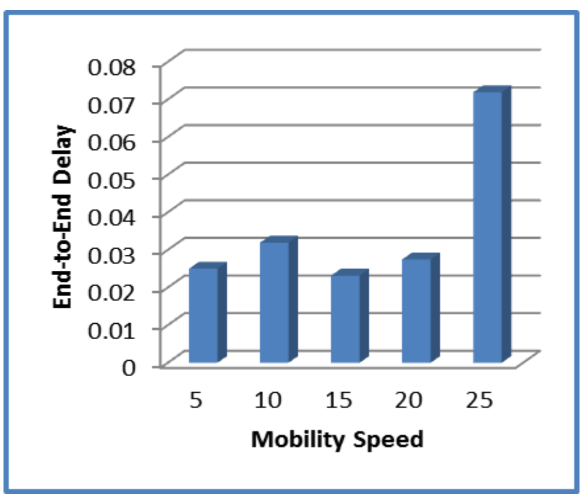

Figure 7. Graph for Variation in End-to-End Delay with respect to Mobility Speed.

In the above graph, maximum End-to-End Delay is observed when the mobility speed of nodes is very high i.e., 25m/s.

3. Average jitter (s): The variance of minimum and maximum delay is jitter.

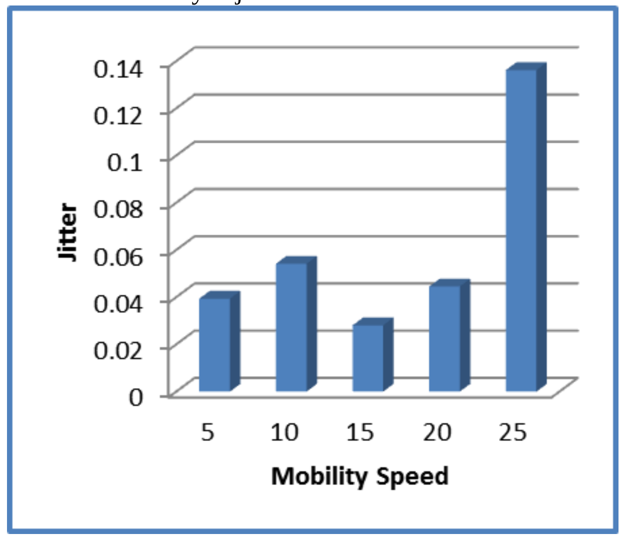

Figure 8. Graph for Variation in Average jitter with respect to Mobility Speed.

In the above graph, maximum jitter is observed when the mobility speed of nodes is very high i.e., 25m/s.

4. Control Overhead (bytes): Total number of bytes sent as control packets.

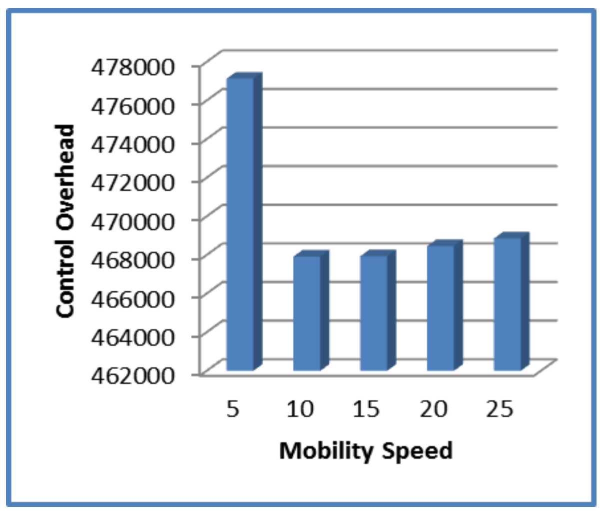

Figure 9. Graph for Variation in control overhead with respect to Mobility Speed.

In the above graph, control overhead is high when the mobility speed of nodes is very low i.e., 5m/s.

5. Number of Control Packets: Total number of control packets sent.

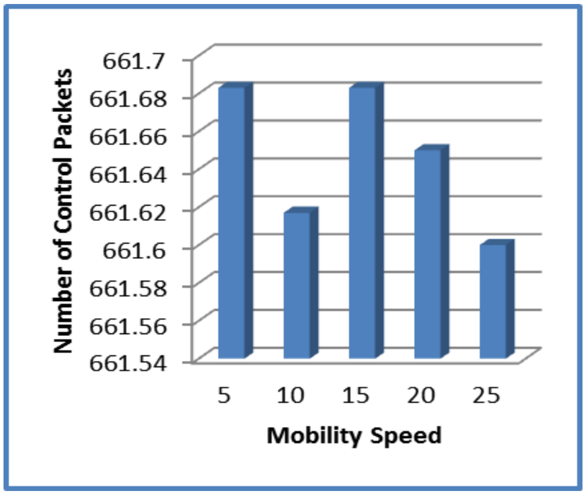

Figure 10. Graph for Variation in number of control packets with respect to Mobility Speed.

In the above graph, number of control packets is more when the mobility speed of nodes is very low i.e., 5m/s.

Energy Efficient Routing Algorithms not only reduces the total energy consumption of the route but also increases the network lifetime. The main purpose of energy efficient algorithm is to make the network functioning last long. In MANETs energy consumption takes place in transmitting, receiving and sleeping modes. Nodes consume more energy to transmit. Nodes are idle in sleep state, neither transmits nor do they receive any signals.

6. Energy consumption in transmit mode (mj): Energy consumed by a node when it sends data packet to other nodes in network. The transmission energy can be formulated as:

$$Tx = (330*Plength)/2*106$$

Where Plength: is length of data packet in Bits.

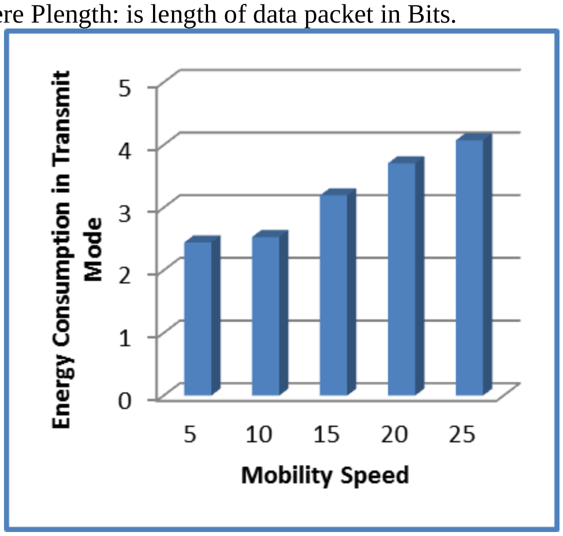

Figure 11. Graph for Variation in energy consumption in transmit mode with respect to Mobility Speed.

In the above graph, high energy is consumed in transmit mode when the mobility speed of nodes is very high i.e., 25m/s.

7. Energy consumption in receive mode (mj): Energy consumed by a node when it receives a data packet from other nodes in network then it said to be in Reception Mode and the energy consumed to receive packet is called Reception Energy (Rx). Then Reception Energy can be given as:

$$Rx = (230* Plength)/2*106$$

Or

$$PR = R x / Tr$$

Where PR- Power consumed to receive packet, Rx- energy consumed to receive packet, Tr-time taken to receive data packet and Plength-length of data packet in Bits.

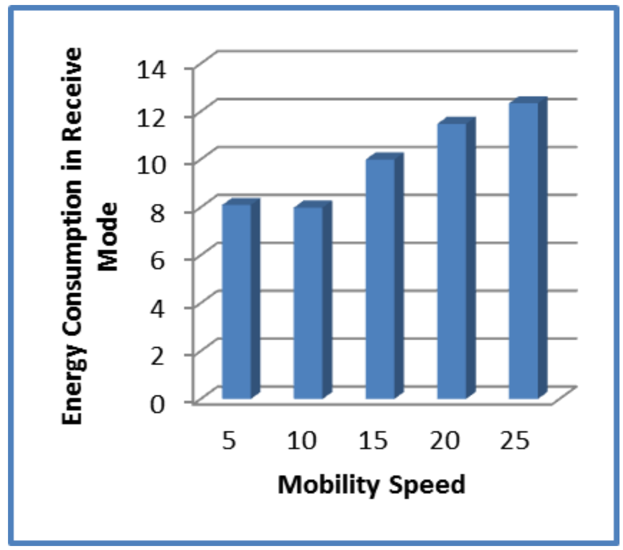

Figure 12. Graph for Variation in energy consumption in receive mode with respect to Mobility Speed.

In the above graph, high energy is consumed in receive mode when the mobility speed of nodes is very high i.e., 25m/s.

8. Energy consumption in idle mode (mj): In this mode, the node is not transmitting or receiving any data packets. But because the nodes have to eavesdrop the wireless medium constantly in order to detect a packet that it should receive the energy is consumed.

$$PI= PR$$

Where PI is power consumed in Idle Mode and PR is power consumed in Reception Mode.

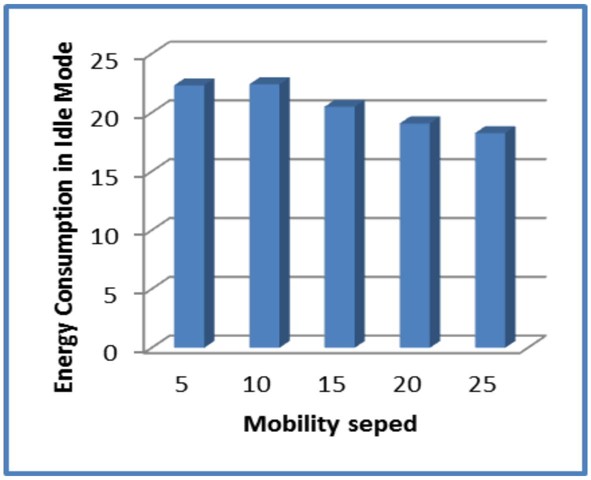

Figure 13. Graph for Variation in energy consumption in idle mode with respect to Mobility Speed.

In the above graph, high energy is consumed in idle mode when the mobility speed of nodes is very low i.e., 5m/s.

9. Total Energy consumption (mj): sum of all the energy consumptions in transmit, receive and idle modes.

$$= \frac{\sum \begin{matrix} (\text{energy consumed in transmit mode,} \\ \text{energy consumed in receive mode,} \\ \text{energy consumed in idle mode)} \end{matrix}}{3}$$

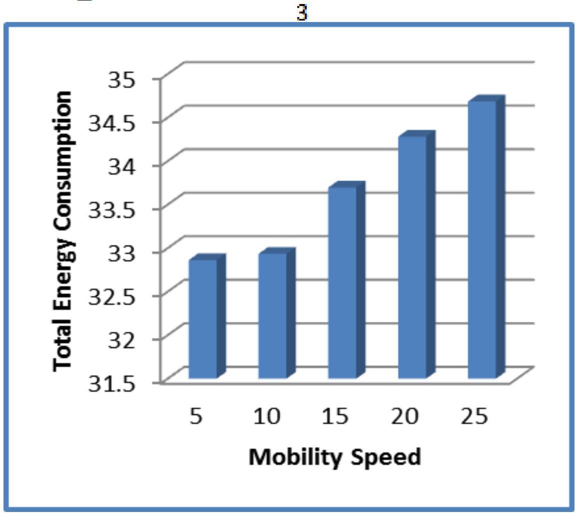

Figure 14. Graph for Variation in total energy consumption with respect to Mobility Speed.

In the above graph, total energy consumed is maximum when the mobility speed of nodes is very high i.e., 25m/s.

VI. CONCLUSION AND FUTURE SCOPE

This paper brings forth the impact of mobility on the performance of LANMAR routing protocol. This work can be extended to the other routing protocols.

REFERENCES

[1] Mehran Abolhasan., Tadeusz Wysocki, Eryk Dutkiewicz., "A review of routing protocols for mobile ad hoc networks", Faculty of Engineering and Information Sciences, 2004.
[2] Neeraj Verma., Sarita Soni.," A Review of Different Routing Protocols in MANET", International Journal of Advanced Research in Computer Science, Volume 8, No. 3, 2017.
[3] P. Koushik., P. Vetrivelan., R. Ratheesh., "Energy Efficient Landmark Selection for Group Mobility Model in MANET", Indian Journal of Science and Technology, Volume 8, 2015.
[4] G. Pei., M. Gerla., X. Hong., "LANMAR: Landmark Routing for Large Scale Wireless Ad Hoc Networks with Group Mobility", Proceedings of IEEE/ACM MobiHOC 2000, Boston, MA, 2000.
[5] P. F. Tsuchiya., "The Landmark Hierarchy: a new hierarchy for routing in very large networks," In Computer Communication Review, volume 18, pp. 35-42, 1988.
[6] Mario Gerla., "Landmark Routing Protocol (LANMAR) for Large Scale Ad Hoc Networks", Internet Draft, draft-ietf-manet-lanmar-05.txt, work in progress, 2003.
[7] Yeng-Zhong Lee., Jason Chen., Xiaoyun Hong., Kaixin Xu, Teresa Breyer., Mario Gerla., "Experimental Evaluation of LANMAR, a Scalable Ad-Hoc Routing Protocol", "MINUTEMAN" project, 2003-08.
[8] Xiaoyan Hong., Kaixin Xu., Mario Gerla., "Scalable Routing Protocols for Mobile Ad Hoc Networks", IEEE Network Magazine, pp. 11-21, 2002.
[9] G. Pei., M. Gerla., T.-W. Chen., "Fisheye State Routing: A Routing Scheme for Ad Hoc Wireless Networks", Proceedings of ICC 2000, New Orleans, LA, Jun. 2000.
[10] M. Gerla., "Fisheye state routing protocol (FSR) for ad hoc networks", Internet Draft, draft-ietf-manet-fsr-03.txt, work in progress, 2002.
[11] G.M.Tamilselvan, "Performance Analysis of Coexistent Heterogeneous Networks for various Routing Protocols using Qualnet Simulation", International Journal of Computer Theory and Engineering, Vol. 2, No. 2 April, 2010.
[12] Bharti Vermani., Naveen Sharma., Bhupender Yadav., "Performance Comparison of Wireless Mobile Ad-Hoc Networks on the basis of Various Simulation Parameters", International Journal of Latest Trends in Engineering and Technology (IJLTET), Volume 1, Issue 2, 2012.
[13] Chingrace Guite, Kamaljeet Kaur Mangat, "*A Study on Energy Efficient VM Allocation in Green Cloud Computing*", International Journal of Scientific Research in Computer Science and Engineering, Vol.6, Issue.4, pp.37-40, 2018.
[14] Anurag Singh, Rajnesh Singh, Sunil Gupta, "*Evaluating the Performance of TCP over Routing Protocols in MANETs Using NS2*", International Journal of Scientific Research in Network Security and Communication, Vol.6, Issue.4, pp.1-4, 2018.

Authors Profile

Ms. Anveshini Dumala received her UG degree in Information Technology from RVR & JC College of Engineering, Guntur, Andhra Pradesh. She received her PG degree in Information Technology from Andhra University, Visakhapatnam. She is doing research in Andhra University under the supervision of Prof. S. Pallam Shetty. Her area of interests is ad hoc network and soft computing.

Mr S. Pallam Shetty was born in 1961. He received his UG, PG and Ph.D. degrees in Computer Science from Andhra University; Visakhapatnam. He has 28 years of teaching experience and presently he is working as a Professor in the Department of Computer Science and Systems Engineering of AU College of Engineering, Andhra University. He has guided 25 Ph.D.'s and right now he is guiding 8 Ph.D. scholars. He has guided more than 250 M.Tech projects. He has been the member for many expert committees, member in Board of Studies for various colleges and universities. He visited Berkley University, USA.

