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PERFORMANCE EVALUATION OF QoS BY ENHANCED ACO IN HYBRID PROTOCOLS IN MANET

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Abstract :

Adhoc networks are networks of wireless connectivity between various hops, frequently changing network topology and the efficient dynamic routing protocols that are needed and plays an important role too. Proactive, Reactive and Hybrid are different classes of routing protocols. An on-demand and Hybrid routing strategy are popular routing category in mobile Adhoc networks. On comparing the other protocols the ZRP that is Zonal routing protocols the hybrid which provide best node mobility performances. Here the Ant colony optimization approach is introduced in order to get an optimal path selection in network scenario. It is essential for the tactical communication that needs the essential quality of service. By providing enhanced Ant colony optimization the pheromone value that is the behavior of ants used here are continuously updated that is enhancement by using the parameters like residual signal strength, energy, hop count, etc... to get the optimal results which helps to get a very good performance results while in a highly mobile tactical environment too. In this work an attempt has been made to study the behavior of an enhanced technique combining Hybrid routing protocol with Ant Colony Optimization (ACO) that can increase various QoS requirements.

Key Words: *ACO-AODV, FDR-PSO, FF-AOMDV, SONNET.*

I. INTRODUCTION

Wireless networks are network which are used to communicate between different nodes using radio frequency. Mobile Adhoc Networks means communicating groups of mobile nodes in a wireless media that are operating in distributed manner. Such a network is self-organized. According to the mobility of each node these networks are dynamic in nature hence topology changes frequently. Mobile Ad Hoc Networks (MANETs) are not centralized means in this network the nodes are operating in distributed manners. These are self-organized networks [3]. MANETs are infrastructure less networks because the nodes are mobile. All the nodes can move in any direction while communicating and these nodes can act as both router and host. So, these networks are dynamic in nature means can change their topology. This may cause problems like overhead traffic, memory consumption etc. MANETs also possess multi hop routing means packets are allowed to forward to destination through multiple nodes thus creating each node act as terminal as well as router.

There are some issues in MANET include limited resources, changing network topology, QOS, scalability etc. Routing is task of transferring data from source to destination while maximizing network performance. So it becomes a challenge in MANETs [10]. Because of changing topology and network density, limited resources changes paths which were initially efficient but can quickly become inefficient and infeasible. These nodes have to interconnect from source to destination via intermediate node because these networks have limited bandwidth. To overcome these problems related with MANET, a number of routing protocols have been developed for different scenario. Because of this dynamic behavior routing in Manet which is very difficult to fulfill the QoS requirements.

The main objective of the approach is that,

- Introducing new mechanism for route selection of ZRP with ACO.
- Enhanced Ant-ZRP consider the
  - Congestion ,
  - residual energy,
  - No: of hops along the path

  etc…

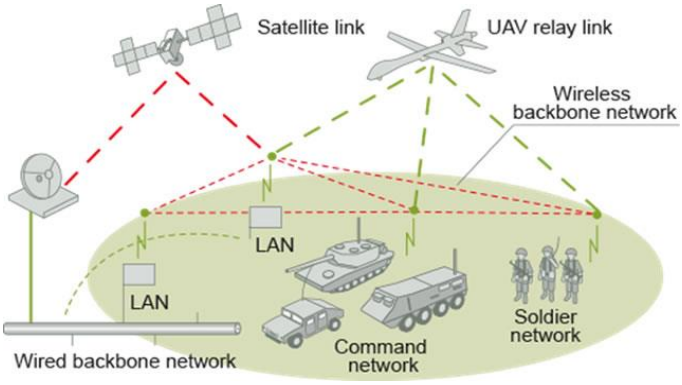

Fig1: Tactical communication

Tactical communications [35] are military communications in which particularly during the conduct of combat information of any kind, mainly orders and military intelligence, are communicated from one person, or place to another upon a battlefield. While communicating in a tactical environment there should be a multimedia data transfer so data need to be receive with a good quality of service. Ant colony optimization [25]

which is mainly based on the behavior of ants .it works on the basis of the pheromone value that secrete. Here the pheromone value is updating continously to compute the optimum path to transfer data from a sender to the destination. Paper aims to provide a better solution to QoS satisfaction by enhancement of ant colony optimization [36] in different routing protocols.

2. REVIEWS RELATED TO DIFFERENT QOS IMPROVEMENT METHODS IN VARIOUS PROTOCOLS.

Manet has dynamic nature, hence efficient routing is difficult. Due to the nodes mobility, node failures and link breakages in the network is very high. Main issue arising in Manet is the selection of the optimal path to communicate in a wide range of nodes. Routing becomes more challenging in tactical ad-hoc network which has an application used in battle field. In tactical ad-hoc network multimedia data needs to be transmitted requires high Quality of Service (QoS). Here discussing some papers that improves the QoS in Manet.

Pinki nayak et al. proposed Energy aware routing scheme using variable range transmission for Mobile Adhoc network. The proposed algorithm is introduced to make an energy aware network. Nodes energy efficient design of the protocol can be generated by varying transmission. In a distributed manner the power level of node will be controlled for each packet and thus energy aware network can be created [2]. Z.Albayrak et al. in 2014 proposed Bee –Manet: a new swarm based routing protocol for MANET.it is a new routing algorithm for mobile adhoc network. Introduced to improve the throughput of network. The Bee- Manet, on reactive adhoc routing protocols and the bee adhoc routing protocols are also compared widely to get better results while go for large scale behaviors [3]. Accurate and energy efficient congestion level measurement in adhoc networks discussed by Yangyong Zhang et al. discussed the. Here proposes a new mechanism the congestion detection which measures the energy efficient network of having congestion level accurately. The measurement is at both node level and the flow level [6].Pankaj gupta et al. discusses about the performance measure of Drop tail and the RED algorithm. Here the mechanism trying to detect the congestion by averaging the queuing size. The router drops the packets with respect to the value of threshold and is calculated by some probabilistic distribution. If packet loss is known drop probability can be calculated and the loss is minimized by the modification of the congestion window size [12].

In [14] S Pandya et al. discussed about an Advanced AODV approach for efficient wormhole attack in Manet also detection and mitigation. It is a new approach to mitigate wormhole attack and digital signature is used to make a secure system that efficiently founds the wormhole attack. In order to analyse the behavior of the wormhole the approach uses calculation of tunneling time taken by tunnel.In [17] discussed about the Adhoc on demand distance vector routing. In order to get an efficient packet delivery introduced a novel algorithm named AODV. On compared to the DSDV algorithms AODV which stores continously updates the each nodes information and about the route. Algorithm results longer latency for route establishment. Jeba Kumar Mohan Singh et al. proposes a unified approach for detecting and eliminating selfish nodes in Manet using TBUT. Token Based Umpiring Technique (TBUT) is introduced here where every node need to participate in an adhoc network and all needs a token which is essential to participate efficiently and the other nodes acts as umpire. Approach results less congestion, less overhead, and efficient with the reduced detection time [18]. Marco fortino et al. (2010) discusses about Evaluating Energy-aware behavior of proactive and reactive routing protocols for Manet. Here analysis done under considering the residual energy of each node separately in a network. Independently lifetime of node is a serious problem when a mobile network is very dense. Discusses some protocols like OLSR that considers the energy aware metrics in order to improve its performance [19].

Benkappa S M et al. proposes a new method named Energy Efficient AODV- An efficient approach for energy conservation in Manet. It is a new routing mechanism for the energy conservation and to improve the lifetime of nodes. Uses details about the energy constraints like need of energy, energy threshold, remaining energy and future energy computation etc… to provide efficient routing mechanisms [21]. In 2017 discussed about the OEFS: On demand energy based forwarding strategy for named data wireless adhoc networks. Here considers residual energies of the nodes during a data transfer over a network. It is used to solve the security issues, scalability, complex usage etc… Here neural data network is used and provides security mechanisms to provide efficient multipath routing network [22].

In [23] Savitha shivani et al. discussed about Optimized swarm based dynamic Mobile Adhoc on demand routing network protocol. Proposes the ACO mechanisms to enhance the dynamic routing behavior on considering various performance parameters. Considers the distance between nodes and the density of the neighboring nodes and results a better performance in almost all performance metrics. Zulkarnain MD Ali et al. (2017) proposes based on hybrid particle swarm optimization with ant colony based energy control routing for enhancement of energy control routing protocol for Manet. According to different routing protocols movement characteristics are discussed and ACECR-PSO gives a better consumption of energy and the extended life time of network [28].Fitness –distance-ratio based particle swarm optimization [31] introduced in 2014. Algorithm introduced a velocity component too in order to update the equation. Particles moved in the direction of considered as a parameter. FDR-PSO shown to perform optimization problems.

Sanjay Mishra et al. proposes Optimum route selection using improved FF-AODV to increase network lifetime in Manet. It is a new protocol that introduced to find the best path from the availability to the destination. FF-AOMDV with dragon fly algorithmic behavior is used here for the improvement of energy consumption, network lifetime, packet delivery ratio etc… [33]. In [34] proposed about the Energy efficient multipath routing for

Manet based on hybrid ACO-FDRPSO. Here explains about the combination of both ant colony optimization and the fitness distance ratio in order to get efficient and optimized energy. In this paper the duty cycle algorithm along with the ACO helps to get a swapping behavior between active and sleep modes among the nodes. There will be no active state for a node at all time if there is no communication at all. Helps to reduce the energy and to enhance the lifetime of the node. Zeyad M Alfawaer et al. [35] proposed an enhanced multipath strategy in mobile adhoc routing protocols. Whenever a route is failed, proposed to make there is no node to be overburdened and it is distributed to other nodes by finding an alternate path. Search of Next Node Enquiry Table (SONNET) introduced to find the best neighboring nodes. Hence reduced number of hops also delay and thus maintained the quality of service.

In 2017 discussed about the Energy efficient multipath routing protocol for Mobile adhoc network using the fitness function. AOMDV protocol is discussed here on considering the fitness function. Helps to find the optimal path and to reduce the routing delay as well as the consumption of energy. Method considers several parameters to compute the fitness factor and this method performs low delay, better throughput, high packet delivery ratio etc. [36]. Navneet Kaur et al. (2018) introduced a method energy efficient and improved network lifetime multipath routing FF-AOMDV and Dragon fly topology. Introduced to solve the energy consumption problems of Manet. Fitness factor is calculated and optimum path is found to the destination in a multipath routing behavior. Results fitness function with dragon fly topology behavior improves the packet delivery ratio, end to end delayed… [38]. Marc Gilg et al. discussed about the Network life time maximization of the AOMDV protocol using nodes energy variation. Overloaded nodes and the nodes having very less remaining energy are not considered on path discovery. Considers each nodes energy to found efficient path and results an efficient path discovery and improves the packet delay ratio [39].

Dipika Sarkar et al. proposes Enhanced ant AODV for the optimal route selection in Manet. In connection to the ant biological characters the pheromone value will be calculated based on the congestion, end to end reliability, number of hops, residual energy of the nodes and considering the distance of the destination. The path having highest pheromone value will be the best efficient path for the transmission of packets [13]. In [20] proposes Enhancing AODV routing protocol to predict optimal path using Ant Colony algorithm in Manet. Here proposing an enhancement a new method to predict optimal path between mobile nodes based on different parameters using ACO. A self-organized structure of the nodes in a network and can adapt to different topology are the characteristics of Ant colony optimization algorithms. The method will reduce the link failure probability and also increase the stability of the network.

3. METHODOLOGY

Proposed Enhanced_ANT_ZRP scheme has been presented here. On considering the link quality, congestion, residual energy and number of hops along the path Enhanced-Ant-ZRP constructs an optimal route from source to destination. Each node keeps routing table about the information of path. In order to consider a node as intermediary node it must satisfy a particular value of residual energy when it becomes less than or equal to the threshold energy, it will not be considered as an intermediary node. Similarly considers threshold for received signal strength to consider for next hop.

1. SIGNAL THR: A threshold value for received signal strength.
2. RE THR: A threshold value residual energy.

By ant colony optimization it considers the pheromone value by the metrics like Received Signal Strength Metric (RSSM), Congestion Metric (CM), Residual Energy Metric (REM) and Hop-count Metric (HCM) and stores the value in its routing table.

Calculation of pheromone count

Selection of the next hop for the packet transmission which considers pheromone value for selecting next hop.

Let, there exists a link from node i to nodej.

Pheromone value of the link PCij can be calculated as,

$$\text{Pheromone} = \frac{Raz * Eaz}{Caz * Haz}$$

Raz - received signal strength at node j from node i,
Eaz - residual energy of the node j,
Caz - congestion in node j,
Haz - number of hops that the route request has traversed from the source to node j via node i.

- Hop-count metric (HCM)

Metric calculates number of hops a packet has come through along its way from the source at every intermediate node. When goes to next hop it is incremented by one.

- Received Signal Strength Metric (RSSM)

RSSM determines the reliability of the link on data transmission.

- Congestion Metric (CM)

CM can be determine by the buffer occuring . With the help of queue length among the nodes can easily detect whether there is congestion or not. Length of the queue changes according to the packet transmission.

- Residual Energy Metric (REM)

Every node has an initial energy. While transmitting packets each node losses a certain amount of energy. Thus the remaining energy after the packet transmission is called residual energy. If too low the node will not be consider for the path selection.

Performance metrics

- Throughput

Average amount of data received by the destination per unit time in network. Expressed in kilobits per second (Kbps).

$$\text{Throughput} = \frac{\text{No: of bytes received} * 8}{\text{Simulation time} * 1024} \text{ Kbps.}$$

Ratio of the total number of data packets received by destination nodes to the total number of data packets sent by source nodes in the whole network.

$$\text{Packet delivery ratio} = \frac{\text{No: of packets received}}{\text{No: of packets sent}}$$

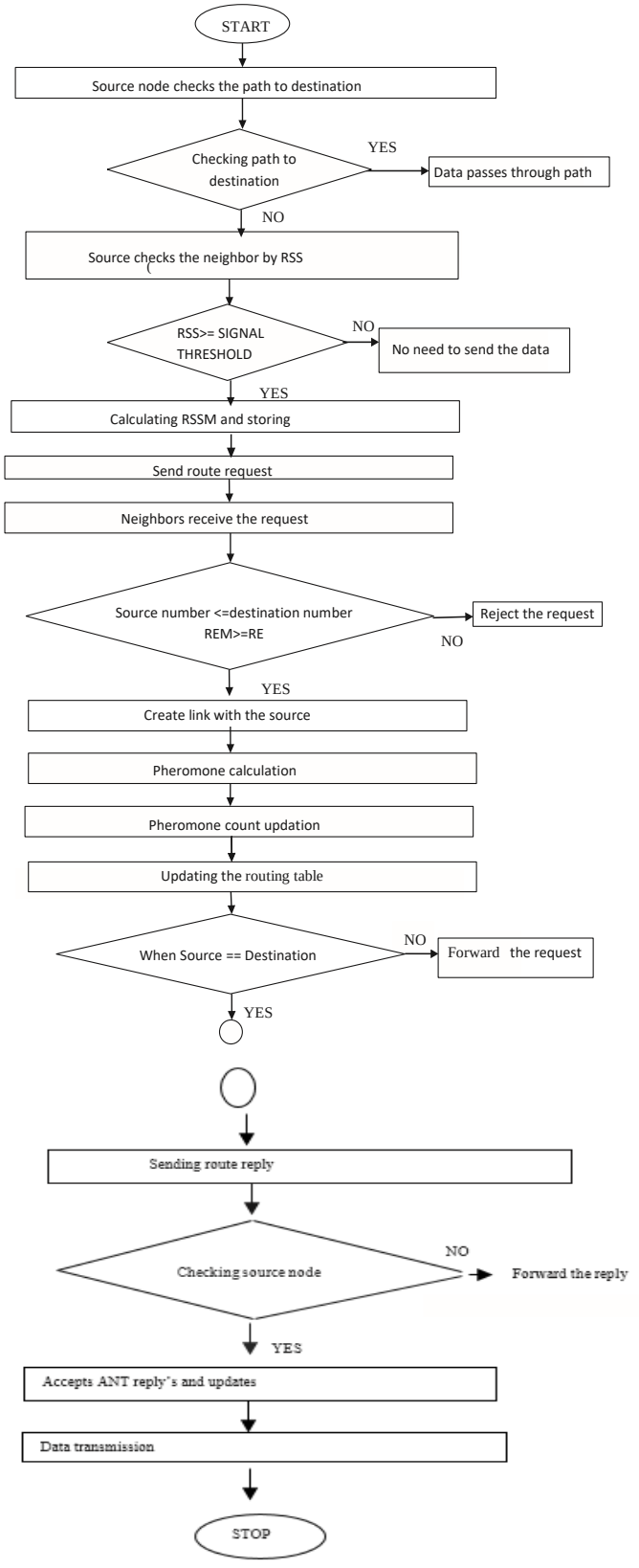

Fig 2: Method of ACO-ZRP

- Packet Delivery Ratio:

Ratio of the total number of data packets received by destination nodes to the total number of data packets sent by source nodes in the whole network.

packet delivery ratio = No: of packets received / No: of packets sent

- Average end to end delay

It is the average time required to travel from the source to destination nodes by the total packets in the netork.

- Percentage of node survived

Till the simulation end percentage of nodes that have survived out of total number of nodes in the network.

percentage of node survived = No: of nodes survived *100 / Total no: of nodes

4. SIMULATION AND PERFORMANCE EVALUATION

Simulation environment

Parameter	Value
Channel	Channel/Wireless Channel
Propagation	Propagation/two ray ground
Antenna	Antenna/Omni Antenna
Terrain Area	1800m*850m
MAC Type	802_11
Application Traffic	CBR
Routing Protocol	ACO-ZRP
Date Payload	512 Bytes/Packet
Number of nodes	100
Transmit Power	1.6 Watts
Receive Power	1.15 Watts

Table 1: simulation parameters

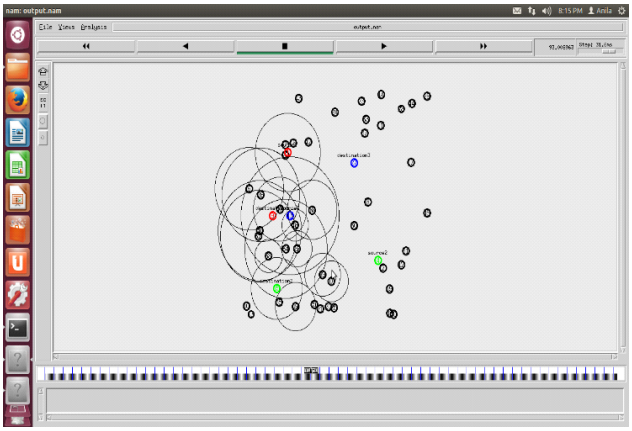

Fig 3: Source and Destination Nodes

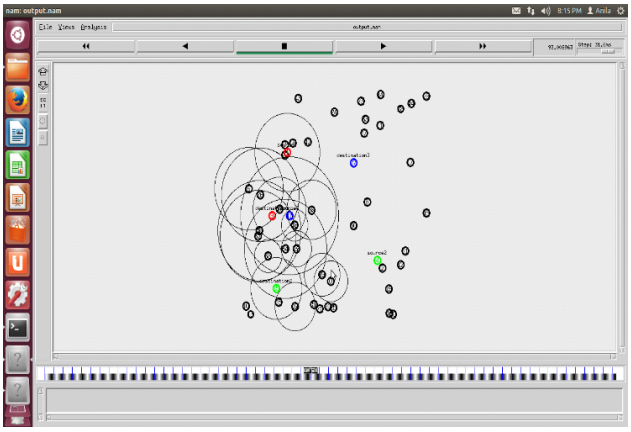

Fig 4: broadcasting

ACO-ZRP

AVERAGE DELAY (Speed v/s Delay)

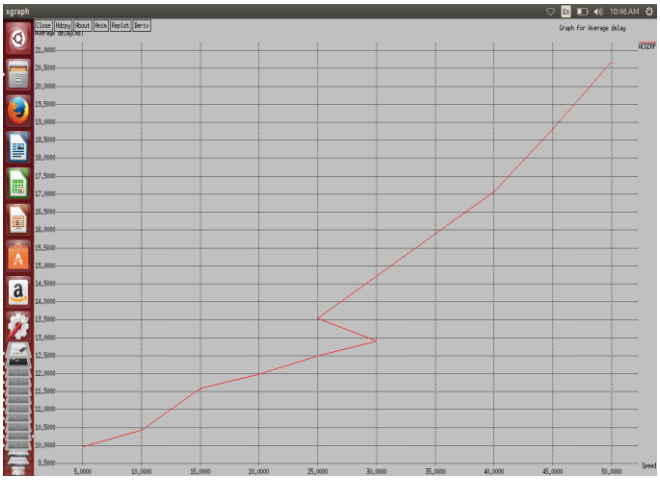

Fig 5: Average delay with respect to mobility

AVERAGE DELAY (No: of node v/s Delay)

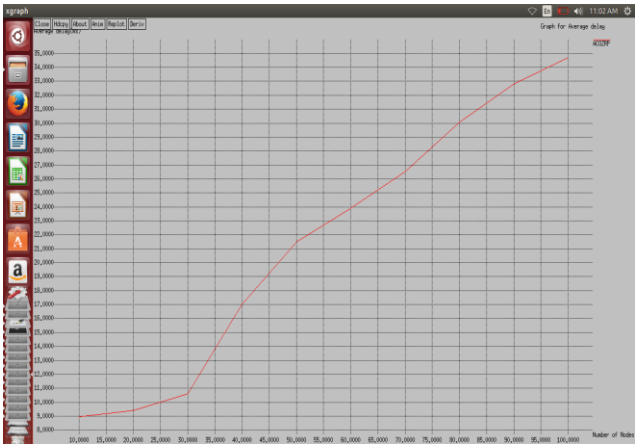

Fig 6: Average delay with respect to number of nodes

NODE SURVIVED (speed v/s node survived)

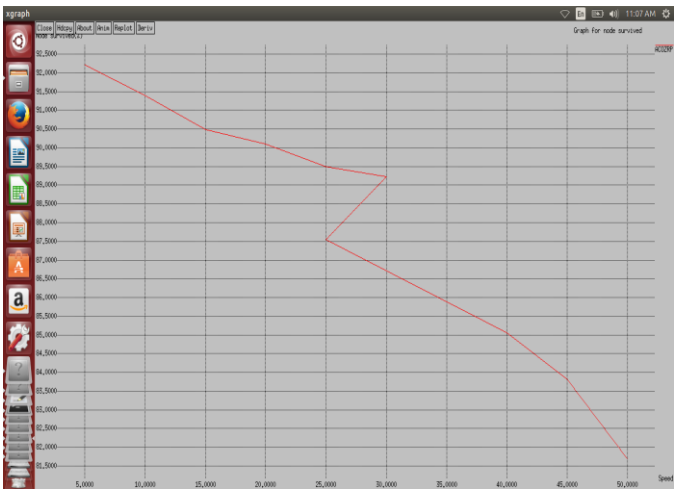

Fig 7: Node survived with respect to mobility.

PACKET DELEVARY RATIO (speed v/s PDR)

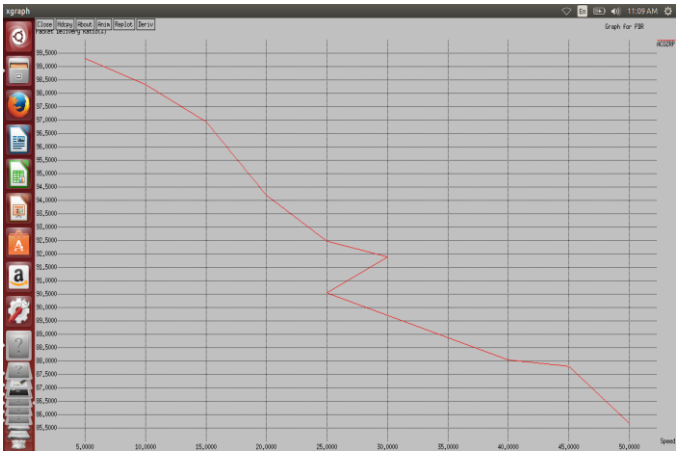

Fig 8: Packet delivery ratio with respect to mobility

PACKET DELEVARY RATIO (No: of node v/s PDR)

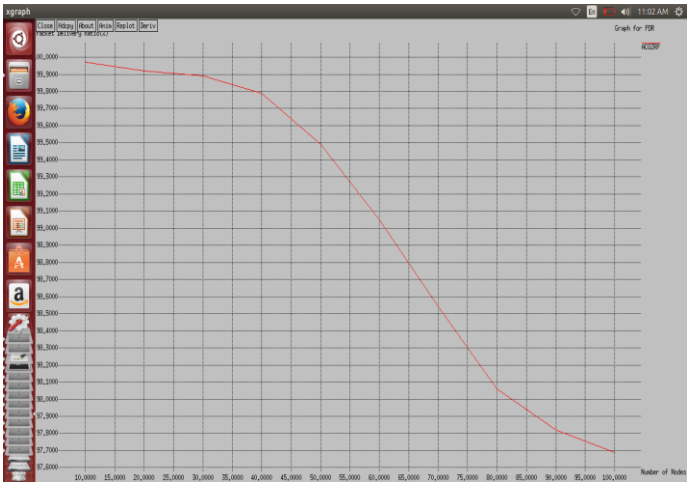

Fig 9: Packet delivery ratio with respect to number of nodes

THROUGHPUT (No: of node v/s Throughput)

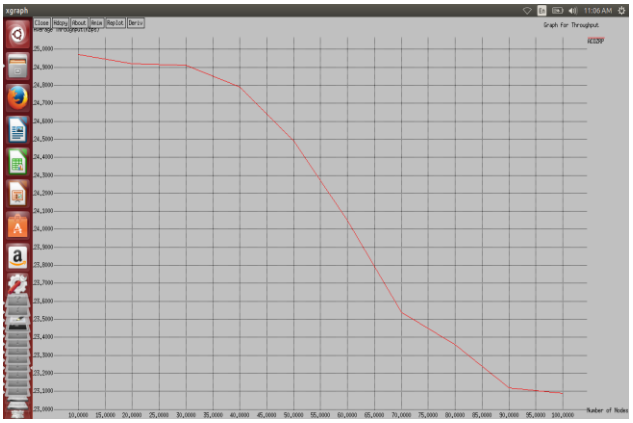

Fig 10: Throughput with respect to number of nodes

THROUGHPUT (Speed v/s Throughput)

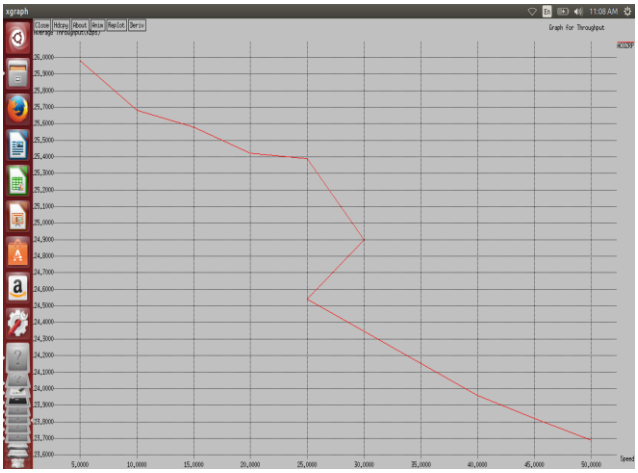

Fig 11: Throughput with respect to mobility

Figures shows that the performance of ACO-ZRP which gives better performance matrices like the packet delivery ratio, throughput, node survived, and the end to end delay. The protocol performing along with ant colony optimization and according to the updating of pheromone value the optimal path is chosen to the destination. Different performance matrices are plotted above using network animator.

5. CONCLUSIONS

Here new routing mechanism for optimal path selection is proposed and implemented. Mechanism involves use of Energy, and pheromone value updating which will provide an energy efficient optimal path selection mechanism in MANET. Simulations were done using NS 2.35. Results are shown above and it was found that the proposed ACO-ZRP provides better parameter metrics like throughput, Packet Delivery Ratio, nodes survived and end to end delay in the network. Routing mechanism can be used in various optimal path selection in tactical MANET applications.

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