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ELLIPTIC CURVE EFFICIENT POWER AWARE ROUTING PROTOCOL FOR MANET

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***Abstract*-Wireless networks with mobile network are in high demand for their tremendous applicability in the field of communication. They are very useful for urgent and fast deployment as well as economically efficient. With the growth in wireless technology, they have become very popular. Such type of networks is equipped to work in versatile ways, sender as well as receiver. They take energy from the battery associated with them, which is a limited source of power. The protocols currently being used for the purpose of routing are not so power efficient. In this research work, we have suggested a novel technique for routing. Our work uses an elliptic curve to give identification to the nodes which are mostly considered useless for forwarding the data packet because of their location. We take into account the unused power of the battery at each node. The results are compared with DSR, MTPR and EPAR and our work shows better performance. Analyzing and comparing the outputs reveal the delivery ratio of packets is increased and lifetime of the network is grown.**

***Keywords*-MANET, Energy-efficient protocol, wireless, networks, DSR.**

I. INTRODUCTION

MANETs are one of the members of the group of wireless communication technology. They are self-configured and highly dynamic. Central authority like a base station does not play any role in such networks and nodes are solely responsible for themselves. Applications like the military basecamps, remote area communication, disaster-prone areas, and intelligent sensor networks can use such networks to fulfill their requirements. They are fast and easy to set-up, not so expensive, and flexible. One of the issues of these networks is the lifetime which needs attention. Research works in this field has provided protocols with a better utilization of power and bandwidth as compared to the conventional routing protocols but still are in initial stages. [1]

Communication of nodes is done with the help of their neighbors if they do not come in to their radio frequency range. This is shown in figure 1 and is called multi hop communication because members of the network are transmitting by using their one hop away nodes to reach to the destination. This helping nature of others is the expectation of the routing protocol. But sometimes the neighbors are not willing to do so; they act none helping because they themselves do not have power. It is possible that after a route is chosen by the protocol between the two communicating nodes is broken. Intermediate nodes are dead because of loss of battery. This also cause problem and overhead in the network to find a new path. Thus, a need for a protocol is felt which not only efficiently choses the path for data transmission but also consider the power limitation of the network intelligently. [2]

We have presented a novel technique of elliptic curve efficient power awareness routing (ECEPAR). This technique provides a mechanism of routing with the help of boundary nodes. The network lifetime has been increased by using this technique. Elliptic curve is used to calculate the distance based on radio frequency range of the members of the network. The technique reviews the unused battery power as well. Thus participation of nodes in the routing is decided on fair basis.

The paper is outlined as follows. Section II contains the related work. Proposed algorithm is presented in section III which is further subdivided in to two sub categories, containing the details of model and the implementation. Simulation results with the help of MATLAB are listed in the next section IV. This paper is concluded in the section V.

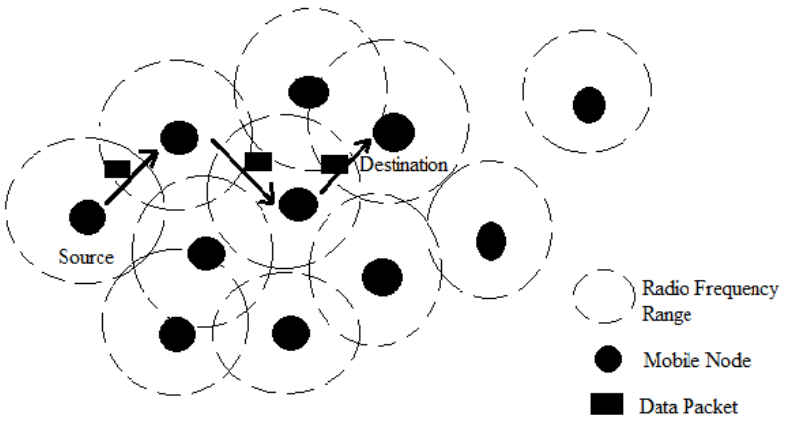

Figure: - 1 Mobile Nodes sending the Data Packet in a Multi-hop Fashion

II. RELATED WORK

DSR [3] is one of the most used protocols by the wireless networks. It falls under the category of reactive routing protocols, that is find the route only when the route is requested. Caches which are maintained at each node and request packets, have the information for the members involved in a route. There is no support for multicasting. This source based routing protocol does not evaluate the unused power of battery and thus results in poor lifetime of the network with the time [4]. Due to its unconcern for the energy left in the network, it is modified and is taken as base to improve by proposing new techniques. MTPR [5] is the initial protocol considering the energy left in the network while routing. The energy is conserved by observing per packet energy consumption.

Elliptic curve has found its applicability for communication in wireless networks. SDRP [6] has made the use of these curves and in spite of using RSA algorithms for the routing of packets; the routing protocols based on the identification technique are used. This shift from RSA helped to reduce the overhead and the number of packets required for providing a secure communication is decremented as well. Vulnerability to several attacks thus is avoided to an extent. Link once established are not so easily disrupted. ECDSA [7] use the elliptic curve and a signature digitally signed. This technique attempts to balance the load in the network by formulating the problem as Byzantine problems [9], a lightweight protocol.

We have compared our proposed work with other protocols, out of which one is EPAR [8]. This technique of routing makes use of the energy at each node in a balanced way and thus provides increase in the lifetime of the network. It also calculates the amount of energy required ny the member nodes to relay the packet to the destination.

III. PROPOSED WORK

A. *Model*

Nodes are identified with the help of identification number of their hardware like H_id(1) for node 1. Elliptic curve based location is used to give location identification number, L_id. All the nodes which are member of the network have maintained a list, ID_List of other members along with their unused energy. The table contains the information of one hop away neighbors for routing as shown in figure 2. The proposed algorithm works in three steps: (a) First boundary members are maintained. (c) Unused battery power of the member nodes is reviewed (c) Last, route discovery by choosing intermediate nodes efficiently.

H_ID
L_ID
E

Fig. 2 ID_List for one_hop neighbors

B. Implementation

The network is parsed in order to find the hardware id, H_ID of the nodes. With the help of Elliptic curve, they are divided into various clusters. It is seen that there is confusion while using the nodes at boundary of the clusters. But when we use the curve then the radio frequency range of such nodes is considered while choosing the path. Nodes are allocated the location is based on their location in the clusters. A table, ID_List is created and the L_ID, H_ID and unused energy are entered. During the route discovery, if there is a situation that multiple paths are present then path the maximum average energy is selected. We calculate the energy of the helping nodes in the path and packet delivery ratio (PDR) by using the following formulae.

- Average energy of the path= ∑Ei/i; where E is the energy and i is the number of nodes.
- PDR=Dest_Rcvd_packets/Src_Sent_packets; where Dest_Rcvd_packets are the packets received by the destination and Src_Sent_packets are the packets sent by the source.

We set our threshold value as 0.90. We compare the PDR by the threshold value. If the PDR is lesser than it, then the network is parsed again. Energy of nodes is collected and table, ID_List is updated. Thus energy values of nodes are updated. And the route discovery process starts again using the updated table. Route discovery can be done by using any reactive routing protocol. Following is our proposed algorithm.

1. Parse the network.
2. Create clusters using elliptic curve.
   Allocate L_ID
3. Create ID_List (H_ID, L_ID, E)
4. Route Discovery
5. If PDR < threshold
   Update the ID_List.

When we use this updated information of the tables and make use of all the member nodes appropriately and effectively. The intelligent use of the member nodes increases the lifetime of the network. Simulation results presented in the next section verifies that our work outperforms other algorithms in terms of PDR, Network Lifetime and End to End Delay.

IV. SIMULATION RESULTS

MATLAB tool is used as a simulator for analyzing the results and simulating the network with mobile nodes. We have used the random way point model [] for the simulating the mobility of the member nodes. The simulation experiments are done with the help of 100 nodes in the simulated network. Various protocols are used to provide the output and get compared with the ECEPAR. Mobility of the nodes is varied from 0 to 20 meters per second. Other simulation parameters are listed in the table 1.

Table: 1 Simulation Parameters

Parameter	Value
Simulation Area	100*100
Elapsed Time	28.06 s
Nodes	100
Protocols Used	DSR, MTPR, EPAR
Model	Way point
Mobility	20 m/s
Simulation Time	180 s

The lifetime of the network is higher in case of ECEPAR. Figure 3 and figure 4 shows the improvement done by ECEPAR in terms of network lifetime. The former one shows that when there is an increase in the traffic size of the network, the proposed ECEPAR proves to be very beneficial as it can handle high density network effectively. And in figure 3 ECEPAR is getting quite a competition from EPAR but performing better in all the situations. On calculation of the improvement in the lifetime of the network, an improvement of 95% is observed. The ratio of packet received by the destination node to the packets sent by the source node is highest in case of our algorithm ECEPAR. EPAR provides the second highest PDR and DSR shows the lowest PDR. DSR is not able to bear the increasing number of nodes in the network. So when the number of nodes increases in the network, ECEPAR is beneficial to be used to provide an efficient way of high PDR and a secure promise of utilizing the battery power of the members of the network. Thus, ECEPAR is a technique which increases the network lifetime.

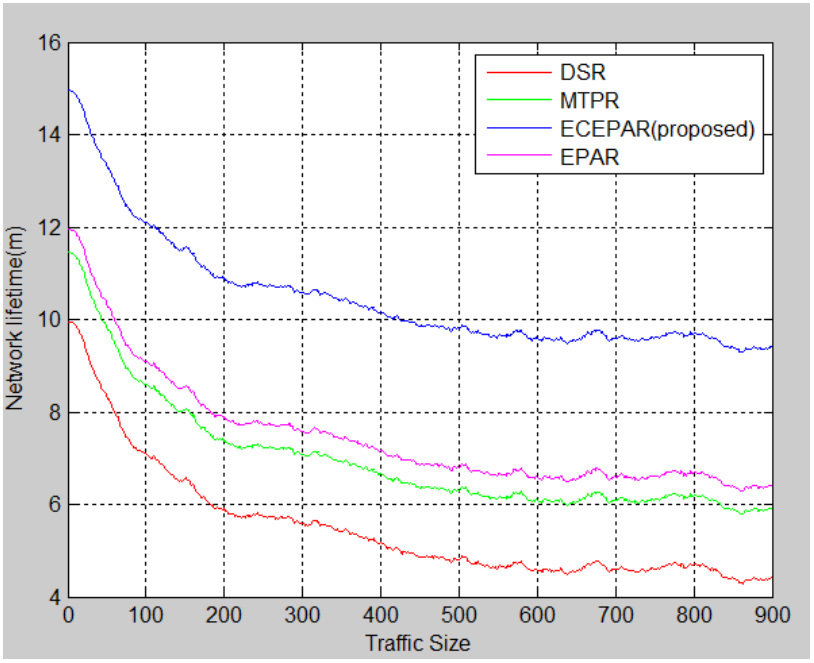

Fig. 3 Network Lifetime vs. traffic size

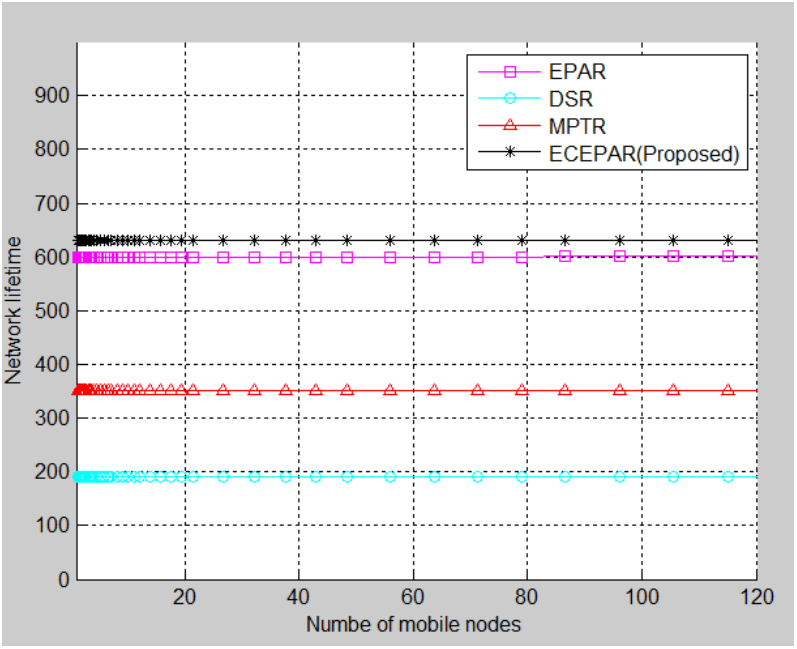

Fig. 4 Network Lifetime vs. number of mobile nodes

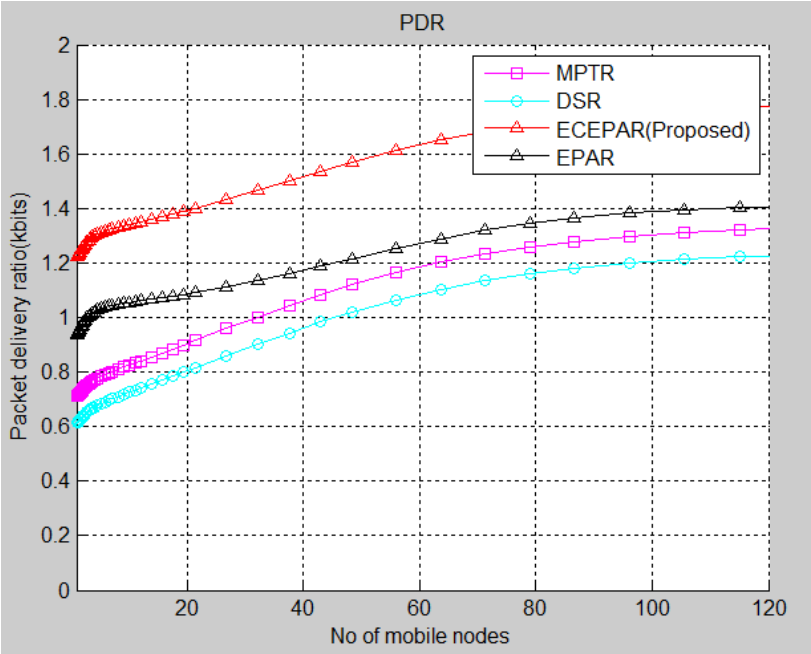

Fig. 5 PDR vs. number of mobile nodes

In fig. 6 the battery power of the nodes left unused or available to be used with the increase in the number of member nodes in the network is shown. Delay in time by which the packets are received by the destination is calculated on an average by dividing with the number of packets sent and shown in the figure 7. Delay timing is calculated in seconds. When the number of nodes is increased in the network, then MTPR shows high increase in the delay. It is shown in the figure that ECEPAR has little variations in the delay with the increase in the mobility speed of nodes.

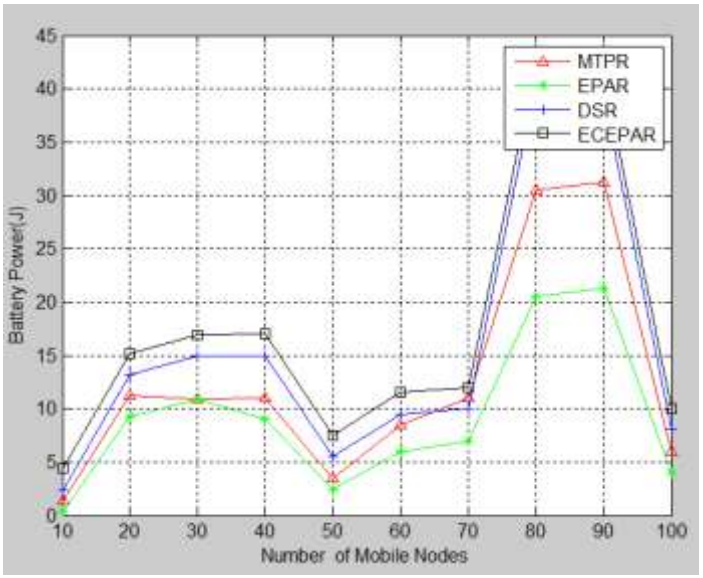

Fig. 6 Battery power vs. number of mobile nodes

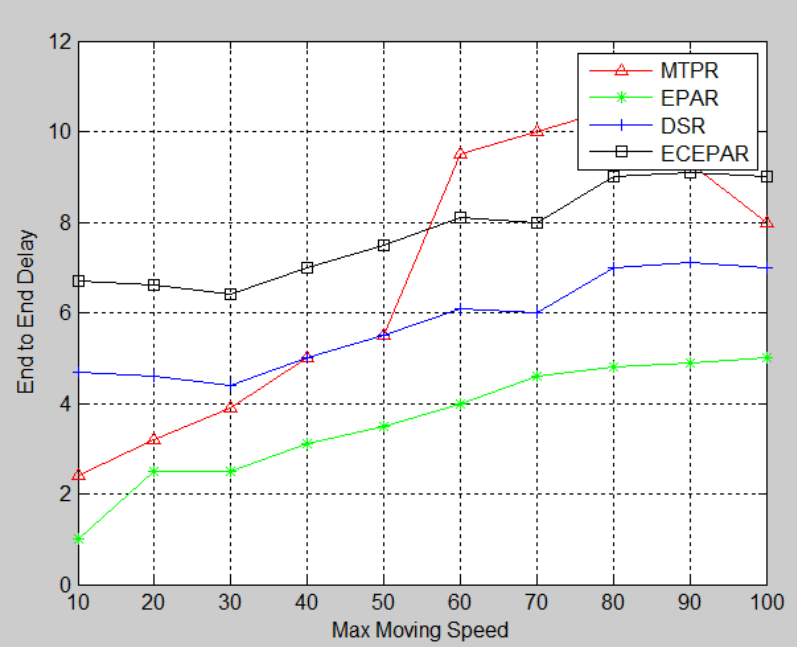

Fig. 7 End to End Delay vs. max moving speed

V. CONCLUSION

MANET is in great need for protocols which are efficient in power-consumption of the nodes because they have constrained power with them. In this paper we have put forward a novel technique for improving the lifetime of network. We have discussed the metrics by comparing it with other existing protocols and produced the results using the MATLAB simulator. ECEPAR outplays other protocols like DSR, MTPR and EPAR. The packets received by the node taken as destination is highest according to the simulation results. Nodes which are about to die are not taken in the route. Also the boundary nodes in the clusters which are generally overlooked by the routing protocol are asked to participate in the routing operations. Thus, efficiently all the nodes are utilized in the network which results in the improvement of network lifetime. In future, battery power of individual nodes needs more attention. Also the delay in time for receipt of packets can be decreased further.

REFERENCES

[1] Fife, Leslie D., and Le Gruenwald. "Research issues for data communication in mobile ad-hoc network database systems." ACM SIGMOD Record 32.2 (2003): 42-47.
[2] Giordano, Silvia. "Mobile ad hoc networks." Handbook of wireless networks and mobile computing (2002): 325-346.
[3] D.Johnson, Y. Hu and D.Maltz, , "The dynamic source routing (DSR) protocol for mobile ad hoc network," IETF MANET Working Group, Internet Draft, RFC 4728, February 2007.
[4] Sinha, Prasun, RaghupathySivakumar, and VaduvurBharghavan. "Enhancing ad hoc routing with dynamic virtual infrastructures." INFOCOM 2001.Twentieth Annual Joint Conference of the IEEE Computer and Communications Societies.Proceedings.IEEE.Vol. 3.IEEE, 2001.
[5] Tonguz, Ozan K., and Gianluigi Ferrari. Front Matter.John Wiley & Sons, Ltd, 2006.
[6] Ghosh, Uttam, and RohitDatta. "SDRP: secure and dynamic routing protocol for mobile ad-hoc networks." Networks, IET 3.3 (2014): 235-243.
[7] Xu, Jiawei, et al. "Byzantine fault-tolerant routing for large-scale wireless sensor networks based on fast ECDSA." Tsinghua Science and Technology20.6 (2015): 627-633.
[8] Suresh, HosahalliNarayanagowda, GollaVaraprasad, and GuruswamyJayanthi. "Designing Energy Routing Protocol with Power Consumption Optimization in MANET."Emerging Topics in Computing, IEEE Transactions on 2.2 (2014): 192-197.
[9] B. Vandiver, Detecting and tolerating Byzantine faults in database systems, PhD dissertation, MIT, USA, 2008.