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A New Approach for HRARAN Protocol with Minimization of Delay in MANET

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Abstract: In the mobile ad hoc network, security is an essential parameter to provide secure communication between mobile nodes by establishing robust and unobstructed routes. The traditional methods provide less parameter to ensure the transmission securely but most of their focus was on single parameter. Consequently, a single parameter cannot assure the effective transmission due to which a new protocol has proposed in this work. The strategy of the proposed work is to intensify the relay node selection process by using various parameters such as Distance, Reputation value and Delay. On the basis of these nodes, a particular node has selected as a relay node and chosen as an intermediate node for the transmission. Moreover, another factor consider for the transmission is network availability. If source node and destination node resides in a particular defined range then source node will directly sends its data packet to the destination node without considering any intermediate node. Whereas, if both nodes are far from each other then network availability is evaluated. The fuzzy inference system is designed to evaluate the final route on the basis of three inputs i.e. network availability, reputation value and delay which is passed to the fuzzy system and then an output as a final path will be produced. This method of routing is considered to be effective, efficient, secure and reliable.

Keywords: Ad-hoc Networks, Mobile Ad-hoc Networks, Highly Reputed Authenticated Ad-hoc Network (HRARAN), Network Security

I. INTRODUCTION

The fixed infrastructure is used while sending data packets from sender to receiver side using traditional network. Nowadays the use of dedicated or fixed infrastructure gets reduced by the advancement in wireless networks [1]. By considering those factors for communication purpose the use of MANET ad hoc network has been found and in ad hoc there is no centralized communication as structure is uncertain [1]. In case of variable environment communication can be done using MANET. There are mobile routers and hosts in case of self organized MANET network so by the use of it problem of fixed environment get solved [3]. The wireless link is used for connecting available hosts in a network. The nodes, mobile devices or routers movement is the main idea behind introduction of MANET that allow nodes to move randomly [4]. The subjectively organization of wireless has changed the network topology. There is movement of data between devices until unless it not reaches at destination. In order to keep nodes connected there is automatically and instantly updation of network and according to which there is change in topology [5]. This condition also takes place while removal or linking of node in a network. The routing, forwarding of packet and other operations responsibilities of a network is taken by each node. Every node available in a wireless network is treated as router and there will be change in topology.

II. BACKGROUND

The Ad-hoc network whether it is MANETs, VANETs or FANETs is comprised of tiny mobile sensor nodes that are used to establish a communication between sender and receiver node. The ad hoc network did not follow any centralized administration. So for the communication the Routing is done. Routing means the path for transmitting the data from the source to the destination. As the security of the data is the important for the reliable communication. For this many protocols were used to enhance the security of the network, previously the routing was done with the help of the HRARAN Highly-Reputed Authenticated ad hoc network protocol. In HRARAN, high reputation value and minimum distance was used to select next node to send data from source to the destination. The term reputation value is utilized to evaluate whether the node is co-operative or not.

III. PROPOSED WORK

The downside of HRARAN protocol is that it does not consider delay parameter. The path with minimum distance and high reputation value may resultant into high delay which concluded low efficiency and effectiveness of the network. In order to resolve the problem of this protocol, there is a need to propose a new method for routing in which multiple required parameters should be considered so that the security of the system can be increased.

The existing ad hoc routing protocol has been suffering from the problem of selecting an appropriate node for the transmission of data packets. Considering this fact, new protocol has proposed in this work, where the selection of next node is performed on the basis of three performance parameters such as Distance, Reputation value and Delay. Therefore, the node with minimum distance, high reputation value and less delay is considered as a relay node used for the transmission. Moreover, network range will be considered to reduce the delay in the network. If source node and destination node resides in a particular defined range then source node will directly sends its data packet to the destination node without considering any intermediate node. Whereas, if both nodes are far from each other then network availability is evaluated. All possible paths are acquired from source to the destination and then number of available nodes is considered in that path. The route with highest availability and shortest path is selected as course of data transmission. The formula considered for the evaluation is as follows:

$$Network\ _{availability} = \frac{Available\ nodes}{Total\ nodes}\ldots\ldots\ldots\ldots(1)$$

The maximum network availability of nodes causes to choose a final path. Finally, a fuzzy inference system is designed in order to select an appropriate path rather than doing manual calculations. Three inputs i.e. network availability, reputation value and delay are passed to the fuzzy system and then an output as a final path will be produced. This method of routing is considered to be better and efficient. The impact of proposed technique is that it provides high security as the reputation value is considered as a primary parameter to evaluate the final route from source to the destination node. Moreover, the calculation of path is initiated through fuzzy inference system that enhances the quality of network with reduced delay.

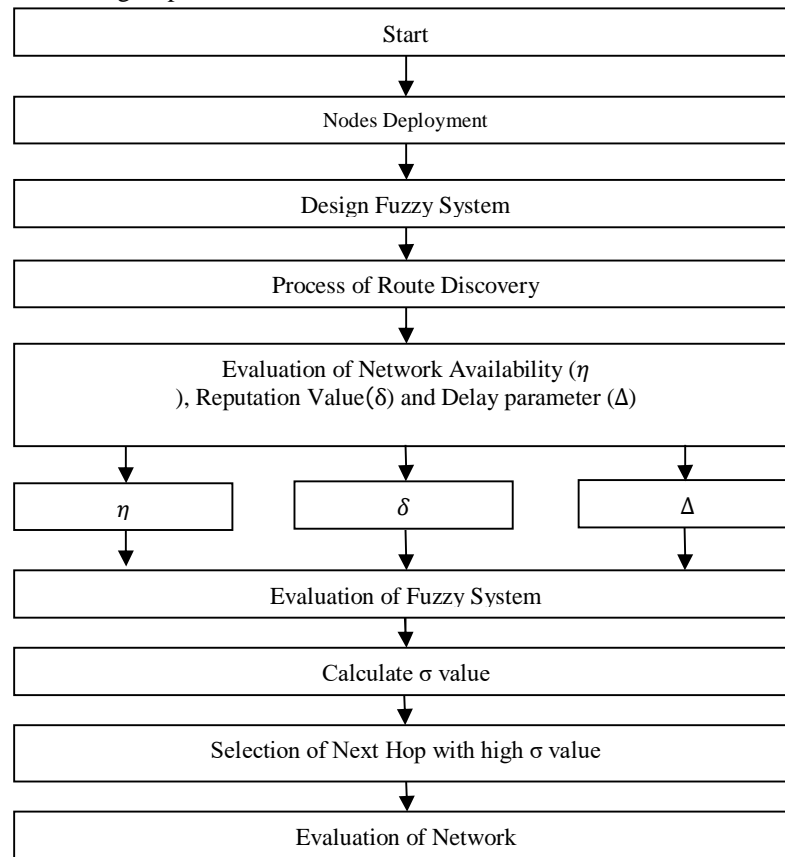In the proposed methodology, the following steps are taken:

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┌─────────────────────────────────────────┐
│                  Start                   │
└─────────────────────────────────────────┘
                    │
┌─────────────────────────────────────────┐
│             Nodes Deployment             │
└─────────────────────────────────────────┘
                    │
┌─────────────────────────────────────────┐
│            Design Fuzzy System           │
└─────────────────────────────────────────┘
                    │
┌─────────────────────────────────────────┐
│         Process of Route Discovery       │
└─────────────────────────────────────────┘
                    │
┌─────────────────────────────────────────┐
│   Evaluation of Network Availability (η  │
│ ), Reputation Value(δ) and Delay         │
│   parameter (Δ)                          │
└─────────────────────────────────────────┘
         │           │           │
      ┌──────┐    ┌──────┐    ┌──────┐
      │  η   │    │  δ   │    │  Δ   │
      └──────┘    └──────┘    └──────┘
         │           │           │
┌─────────────────────────────────────────┐
│          Evaluation of Fuzzy System      │
└─────────────────────────────────────────┘
                    │
┌─────────────────────────────────────────┐
│            Calculate σ value             │
└─────────────────────────────────────────┘
                    │
┌─────────────────────────────────────────┐
│     Selection of Next Hop with high σ    │
│                  value                   │
└─────────────────────────────────────────┘
                    │
┌─────────────────────────────────────────┐
│           Evaluation of Network          │
└─────────────────────────────────────────┘
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Fig. 1 Framework of proposed work

IV.IMPLEMENTATION

The proposed work considers HRARAN for routing and aims to elect the nodes for route creation on the basis of energy, reputation and connectivity of the nodes. The objective of the proposed work is to improve the existing HRARAN protocol by improving the list of parameters for next hop selection..

The graph of Fig. 2 depicts the initialization of network which covers the area of 100×100 and also comprised of 100 nodes for communication. The nodes in the network are depicted by using black color.
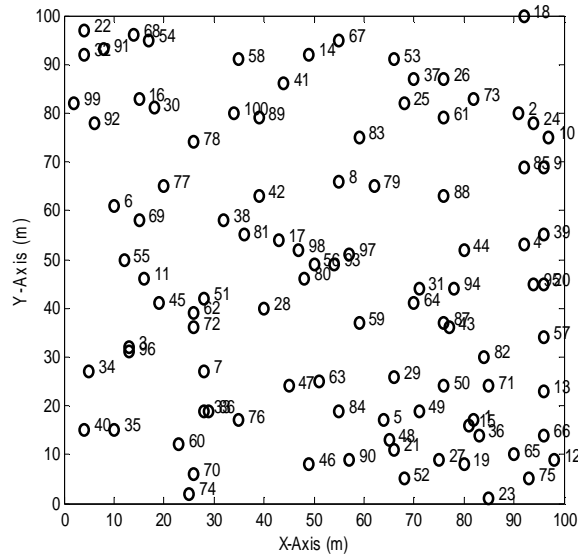
Fig. 2 Network Initialization

After creating the network, next step is to define the source and destination node from the network. The graph shown in Fig. 3 renders the network that comprised of source and destination node is shown in magenta color. Excluding magenta nodes, rest of the nodes is normal nodes of the network.
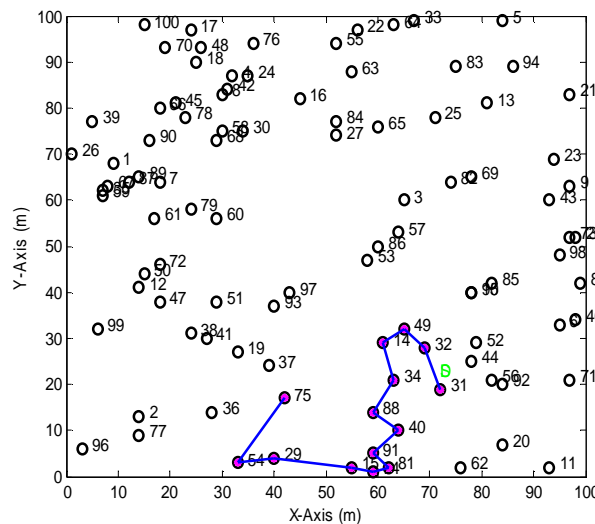

Fig. 3 Route Creation

By selecting the source and destination node from the network it is required to create a route from source node to destination node so that the communication can take place successfully. The route is created by using the rest of the nodes other than source and destination node. The node selection for path creation is done on the basis of nearest located node then by connecting all the elected nodes a shortest path has been created in the network as shown by Fig. 3.

The packet delivery ratio of the network is used to measure the rate of data packet transmission to the final node. It is evaluated by eliminating the numbe6r of received data packets from total number of sent data packets by the source node.

$$PDR = \frac{Packet_{recieved}}{Packet_{Send}} * 100 \dots\dots\dots (2)$$

The PDR is a performance parameter that replicates the level of network performance, Higher the PDR more efficient the network is. The Line graph shown in Fig. 4 represents the PDR of proposed work. The analysis of packet delivery ratio of the proposed work

is done by considering various cases in which the number of nodes varied from each other. From the graph (Fig. 4) it is observed that the value of PDR is getting high with an increment in number of nodes.
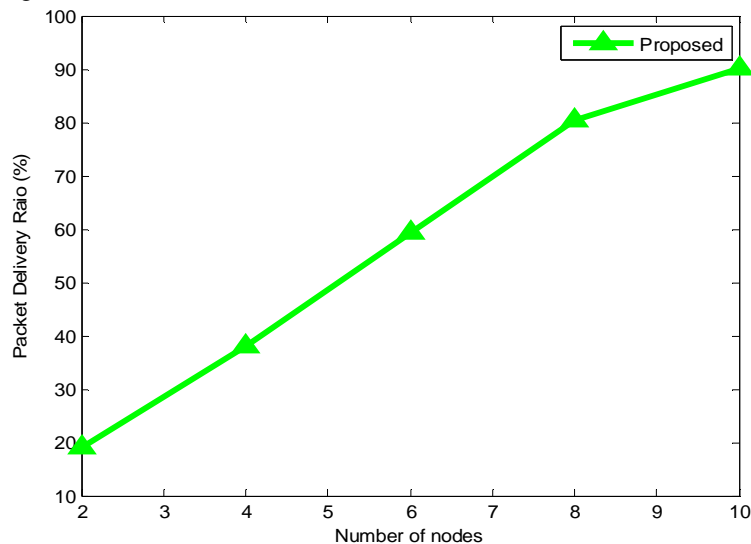

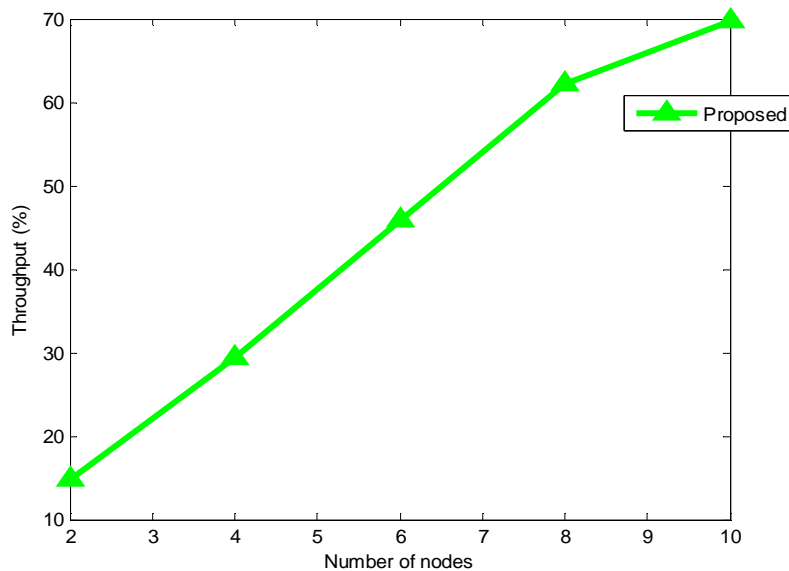FIG. 4 PDR OF PROPOSED WORK

Fig. 5 Throughput of Proposed Work

The throughput of the network defines that how much time is taken by the nodes to deliver the data packets effectively to the base station. The Fig. 5 renders the graph which shows the throughput which is evaluated on the basis of various cases by considering different number of nodes in each and every case. It is derived from the graph (Fig. 5) that proposed work poses the effective throughput of the network that means the packets are delivered to the destination node within in feasible time or by taking less time. In order to prove the proposed work, the results of proposed work are compared with the results of traditional techniques i.e. HRARAN. The graph in Fig. 6 presents the comparison on the basis of packet delivery ratio of the network in case of HRARAN and Proposed Work. The comparison is done by considering different cases by changing the number of nodes every time. Here in graph (Fig. 6) the x axis shows the number of nodes in the network and y axis represents the value regarding packet delivery ratio. The bar with green color represents the HRARAN and the bar in brown color is for proposed work. Hence the graph clarifies that the PDR of Proposed work is higher in each and every cases that are considered whereas the HRARAN is quite lower as compare to proposed work. Therefore it is proved that the PDR of proposed work is higher and better than the traditional methods.
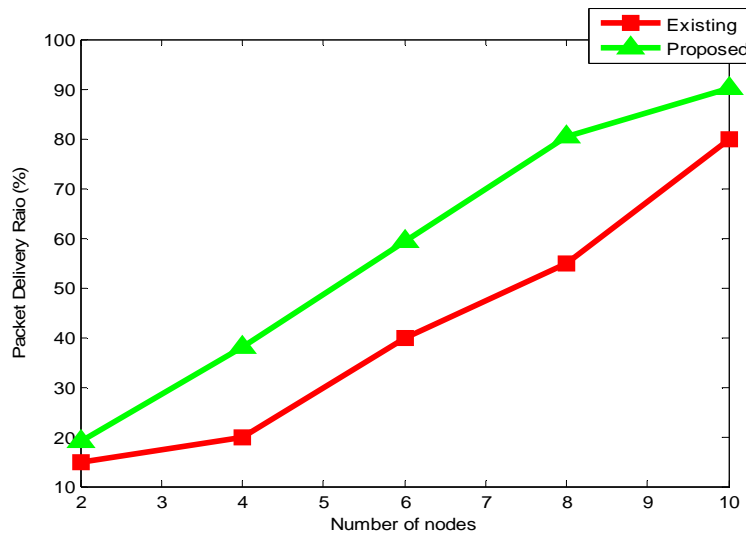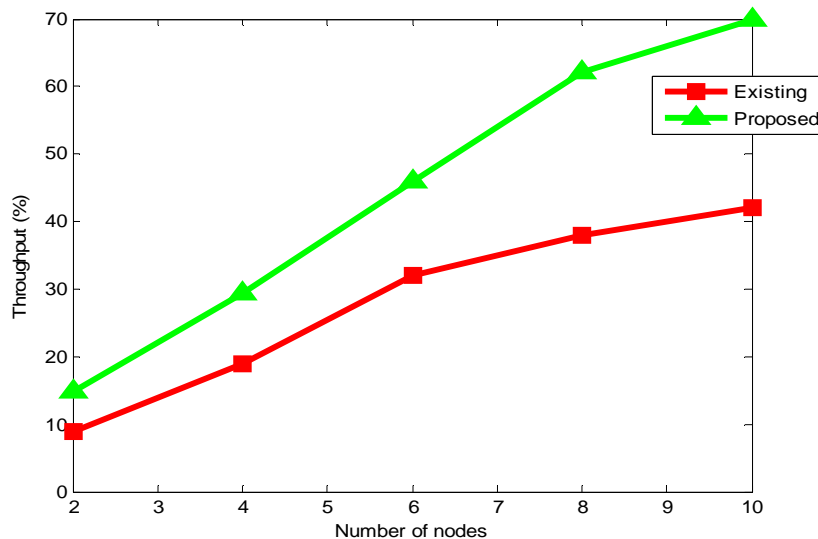
Fig. 6 Comparison of PDR

Fig. 7 Comparison of Throughput

The comparison graph in Fig. 7 collates the HRARAN and proposed work on the basis of throughput. The x axis in graph depicts the number of nodes and y axis depicts the value of throughput. The graph proves that the throughput of proposed work is higher as compare to traditional works. The table 1 delineates the facts that are observed from the resultant graphs corresponding to the PDR and throughput of the proposed work and HRARAN.

Table1 PDR and Throughput

Technique	PDR	Throughput
HRARAN	80	42
Proposed Work	90.2	69.8

V. CONCLUSIONS

MANETs are Mobile A hoc Networks that suffers from various issues and no doubt solutions are also available in the market but it is not possible that all of the techniques can perform better in each and every mean. The security is the major concern in today's technology because the whole data travels over the internet to reach the destination. Ad hoc networks also suffer from this issue, therefore in order to secure the data various security routing protocols had been developed in last few years.

This study develops a new and enhanced mechanism for next hop selection in MANETs by improvising the parameters list of traditional HRARAN protocol. Along with this the fuzzy inference system is also implemented.

The simulation of the proposed work is done by using MATLAB. The results are evaluated in terms of PDR and Throughput of the network and a comparison has been drawn between HRARN and proposed work. The evaluated PDR of proposed work is 90.2, of HRARAN it is 80 and similarly, the throughput of the proposed work is 69.8, for HRARAN it is 42. Hence, it is proved that the throughput of the proposed work is higher in comparison to the traditional work.

There are various issues that can be accounted in future studies of routing in MANETs. As present work focuses on the next hop selection for route creation on the basis of three various parameters thus more amendments can be done in the domain of fault tolerance in case when delay increases.

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