Implementation of FTR-AHP Routing Scheme for Enhancing the Mobile Ad-hoc Networks

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Abstract- Mobile Ad-hoc Networking (MANET) is an enhanced technology in the field of wireless communication and it plays a key role over the past years due to the popularity of mobile devices and wireless network. MANET is a concept of infra-structure less wireless multi-hop communication network, which means that the networks formed and deformed on-the-fly without the need of any centralized management. Any individual node in the network can ahead the packet that is a node acts as a router to send and receive the data. Since the network has a group of autonomous wireless nodes, which can exchange data in a dynamic manner, the network structure is dynamic. Therefore the network topology changes rapidly and it takes the decision in a distributed manner. Due to the dynamic behaviour of the network, routing for MANET is a difficult task and wireless link become highly error prone. Moreover Limited bandwidth, Dynamic topology, Hidden terminal problem, Transmission error, Route changes due to mobility and Battery constrains is some of the important challenges in MANET. A variety of Routing protocols are preserved on introducing for optimized routing and overcome the problems associated in the MANET in Proactive Routing Protocols, Reactive Routing Protocols and Hybrid Protocol. But those approaches are not yet achieved a significant level. As a positive approach, this work proposes an another hybrid protocol based model called Fuzzy Topsis Rough Set Analytical Hierarchical Process (FTR-AHP). This model is developed to identify the reliable, optimal paths with the metric features like Multi-Hop, Battery power, Signal strength, Mobility and Trustworthy. The simulation results have shown that the proposed technique is better than that of the existing approaches.

Index Terms- Fuzzy Topsis Rough Set Analytical Hierarchy Process (FTR - AHP), Mobile Ad-hoc Network (MANET), Performance Rough sets, TOPSIS

1 INTRODUCTION

MANET is a self-configured, infrastructure-less, network of mobile devices connected by wireless links. MANET can also be defined as a collection of mobile wireless nodes that intercommunicate on share wireless channels. Individual devices in a mobile ad hoc network are free to move in any direction and frequently devices links changes occur. MANETs is highly suitable for applications involving special outdoor events, communications in regions with no wireless infrastructure, emergencies, natural disasters, and military operations. Routing is one of the key issues in MANETs due to their highly dynamic and distributed nature. In recent years, many routing protocols have been proposed for MANETs [10-12]. These protocols can be classified into three different groups: proactive reactive and hybrid [4].

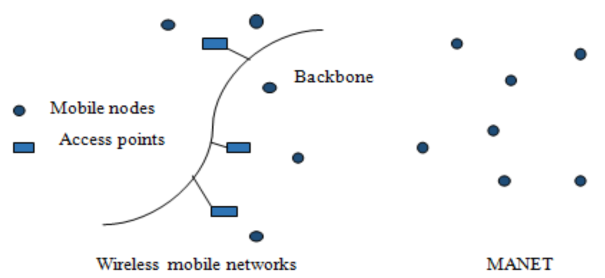

Fig.1 Mobile Ad-hoc Network.

Fig.1 depicts the difference between wireless mobile networks and MANET.

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The wireless mobile networks are a global area network (GAN) which supports mobile nodes across an arbitrary number of wireless LANs, satellite coverage areas, etc., versus, MANET is a self-configuring network of a mobile router connected by wireless links; this union form a random topology and the router moves freely.

MANET is suitable for emergency situations like natural or human-induced disasters, military conflicts, emergency medical situations etc.

2 OPTIMIZED LINK SATATE ROUTING PROTOCOL

The Optimized Link State Routing Protocol (OLSR) [13] is table-driven protocol, developed for mobile ad hoc networks. Nodes exchange topology information with other nodes of the network regularly. Nodes determine their one-hop neighbours by transmitting Hello messages and then select a set of them as "multipoint relays" (MPR).

In OLSR, only those nodes forward topological information, providing every other node with partial information about the network. MPRs provide an efficient mechanism for flooding restraint traffic by reducing the number of transmissions required. Nodes, selected as MPRs, also have a special responsibility when declaring link state information in the network. Indeed, the only requirement for OLSR to provide shortest path routes to all destinations is that MPR [9] nodes declare link-state message to their MPR selectors. Additional available link state information may be utilized, e.g., for redundancy. Nodes which have been selected as multipoint relays by some neighbour node(s) announce this information periodically in their control messages. Thereby a node announces to the network, that it has reached ability of the nodes which have selected it as an MPR. In route calcula-

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tion, the MPRs are used to form the route from a given node to any destination in the network. Furthermore, the protocol uses the MPRs to facilitate efficient flooding of control messages in the network. By these optimizations, the amount of retransmission is minimized, thereby reducing overhead as compared to link state routing protocols. Each node will then use this topological information, along with the collected Hello messages, to compute optimal routes to all nodes in the network. The protocol is particularly suitable for large and dense networks, since the MPRs technique works well in such as context [6].

3 SYSTEM DESCRIPTIONS

3.1 SYSTEM MODEL

The optimal Routing Path Prediction has been a major cause of concern because of ever increasing broad network operations in present day to day life in multiple areas. Further the prediction of optimal, reliable routing paths has immense importance for the Mobile Ad-hoc Network (MANET) [1]. The Prediction of reliable paths is very complex and highly differential in nature as it depends upon many complex factors such as the network is in dynamic with no fixed infrastructure, mobility nature, limited battery energy, variable signal strength and trustworthiness with self-configuring and self–healing nature.

In determining optimal paths, the recent key existing models like Genetic Algorithm (GA) [7] and Ant Colony Optimization Models (ACO) [5] are used. But these models are in hierarchical, hop distance and also generate optimal paths with high time complexity without trust establishment of the routing paths. So the FTR-AHP model is hierarchical in nature, determining the routing paths in minimal time with trust establishment, in rank wise compared to other above existing models. On top of it, routes are classified rank wise, so it simply overcomes Dynamic Traffic Routing Problem [8] in MANET.

According to TOPSIS technique the best alternative can be determined with two features. One is nearer to positive-ideal solution, second is that farthest from the negative ideal solution (0, 0, 0). The positive ideal solution reduces the cost criteria to a minimal level and negative ideal solution enhances the cost criteria to a maximal level. So this TOPSIS technique is used in determining the order of the ranks among a set of routing paths. Optimized models play an important role in determining routing paths for efficient data communication in wireless networks. The AHP technique is used to determine reliable optimal routing. It's based on the path costs computed from the nodes weights, routing tables should be updated rather than on number of hops, and should also include path costs to the destination. address instead of the number of hops, where path cost is define as the sum of the intermediate nodes' weights along the path. And this technique will give the order of the rankings for optimal paths also in best and worst order unlike other models. After Filtering the path the source node can transfer the message to the destination node through the selected path. This method is based on three principles.

1. Organization of the model
2. Comparative judgment of the criteria and alternatives
3. Synthesis of the priorities.

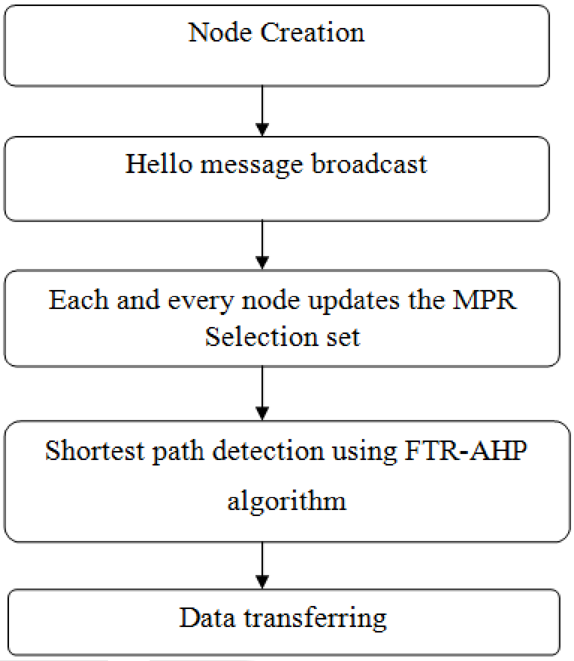

Fig.2 Flow Diagram

3.2 PERFORMANCE INPUT METRICS FOR MODELS

The following metrics play an important role because, especially, the parameters like Battery power signal Strength, Trustworthiness and Mobility play major role in determining the strength of the MANET.

The five performance input metrics considered in this work:

3.2.1 Number of Hops

Number of hops or edges is involved in the path from the source to the destination. Hop or edge is defined as a link between two nodes.

3.2.2 Battery power

The capacity of the power of a node to do any operation in the network is known as battery power of a node in the network at any instant of time

3.2.3 Signal strength

The energy of a node to access their neighbour nodes for data transfer is called as the signal strength of the node.

3.2.4 Mobility

The mobile node moving area with respect to surrounding nodes in a particular interval of time is known as mobility of a node.

3.2.5 Trustworthy

Trustworthy of a node can be defined as the amount of trust to accept data transfer along the node, that is, the node can't drop more packets.

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4 SIMULATION RESULTS

We considered three performance metrics to evaluate this proposition, which are:

• Average Node Residual Energy: total residual energy [J]/number of nodes

• Packet Delivery Ratio (PDR): the ratio of the number of packets, delivered to the destination nodes over the number of packets sent by the source nodes.

• Network Lifetime: the time until the battery of a mobile node depletes [1].

Energy consumption is the amount of energy consumed by the nodes depends on its activity.Fig.3 shows the comparison of energy saving of nodes for OLSR and FTR-AHP. In OLSR Residual energy for 100 nodes at 120 Sec is 260J but in FTR-AHP 340J that is FTR-AHP saves more energy.

The lifetime of a wireless sensor network (WSN) is defined as the duration until any sensor node dies due to battery exhaustion Network lifetime can alternatively be defined as the 'time until the first node dies'.

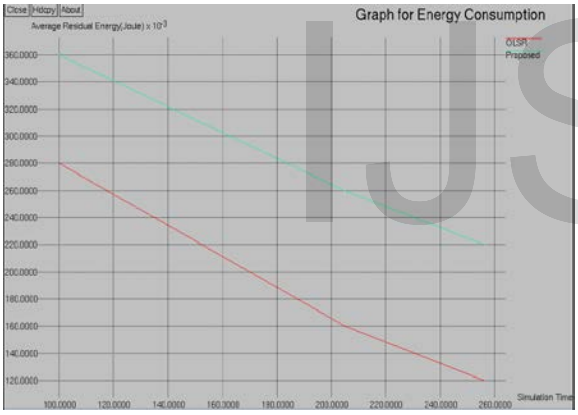

Fig.3 Graph of energy Vs time

The easiest to capture point out of this metric is the maximum per-node load, where a node's load corresponds to the number of packets sent from or routed through the given node.

Fig.4 shows the comparison graph of network lifetime at low, medium and high mobility of nodes.

1. At low mobility: When the nodes send 11 packets/sec, it lifetime is 416sec and it decreases to 395sec when it sends 16 packets/sec.

2. At high mobility: When the nodes send 11 packets/sec, it lifetime is 452sec and it decreases of 410sec when it sends 16 packets/sec.

3. At medium mobility: When the nodes send 11 packets/sec, it lifetime is 442 Sec and it decreases to 407sec when it sends 16 packets/sec.

Throughput: It is the number of packets/bytes received by source per unit time. It is an important metric for analysing network protocols. Packet Delivery Ratio (PDR): It is the ratio of actual packets delivered to total packets sent.

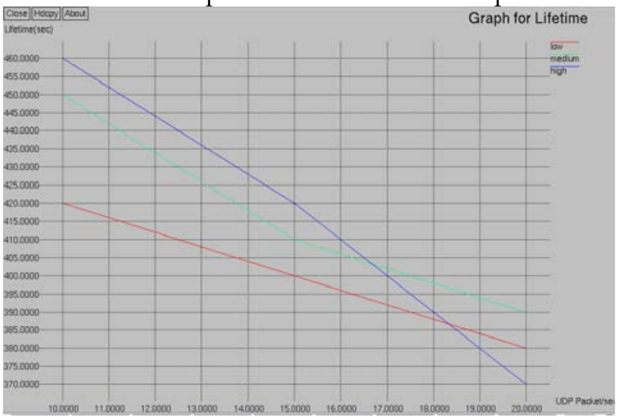

Fig.4 Graph of network lifetime Vs UDP packets

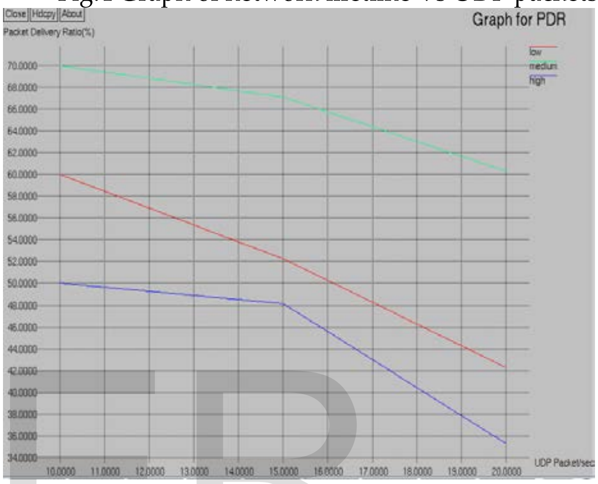

Fig.5 Graph of PDR Vs UDP packet

Fig.5 shows the comparison graph of the packet delivery ratio at low, medium and high mobility of nodes.

1. At low mobility: When the node sends 11 packets/sec, it's PDR is 60% which decrease to 50% when it sends 16 packets/sec.

2. At high mobility: When the nodes send 11 packets/sec, it's PDR is 50%

Which decrease to 45% when it sends 16 packets/sec.

3. At medium mobility: When the node sends 11 packets/sec, it's PDR is 68%

Which decrease to 66% when it sends 16 packets/sec.

5 CONCLUSION

The network lifetime decreases in MANET due to its mobile nature. OLSR routing protocol uses an MPR selection algorithm and FTR-AHP algorithm to improve the network lifetime by considering various parameters. MPR selects the best node for data transmission based on energy, capacity and the threshold level of each node. FTR-AHP selects the best path between the selected nodes for efficient packet delivery, depending upon the mobility,

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signal strength, battery power, trustworthiness and nodes Lifetime and QoS increases for medium mobility of nodes
With minimum number of hops. In FTR-AHP the network and the energy consumption decreases to 40% when compared with MPR.

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