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Expansion in Quality of Service of MANET during Route Determination phase By Mobile Software Agent Approach

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Abstract

A software agent is not only an object of the environment that can access the members of that environment but also can be considered much intelligent than a component. Routing problem in MANET has become confronting due to its dynamics nature, node mobility, resource constraint, no fixed infrastructure makes a challenging task to find route source node to target node Taking critical multiple parameters together for finding the route is also a challenge in such environment. Mobile Agent technology is the perfect solution with increase routing performance for such surroundings with reduce network traffic and maintain load balancing. This Research paper presents routing model considering multi-objective QoS parameters with the convergence of mobile agent. Simulation work is carried out on Matlab 2017b simulator & simulation results shows that proposed routing model is better on the basis of QOS metrices in comparison of traditional hop by hop AODV routing protocol on the basis of path cost , path distance, path hop metrices also impact of node position on these QOS metrices for finding the path is also measured .

INTRODUCTION

Self-organizing, .ad-hoc networks can be formed instantly without any base station [1]. Many precise characteristics and complexities like lack of any central controlling unit, Dynamic topology, and limited battery power & lack of clear line of security make routing difficult in these networks [2]. In a comparison of the infrastructure network, MANET has more advantage like low cost, self-administration, no need of fixed infrastructure capabilities over cellular networks .With these unique characteristics it can be used in an emergency, military operation, wild animal tracking, vehicular communication, road safety, smart home and smart hospital creations. Fig-1 illustrates an example of MANET as well as a concept of multi-hop routing. MANET supports multi-hop routing as we can see in fig - 1, nodes within its radio range can communicate directly and nodes far from radio range of each other communicate through multiple hops [3]. MANET can be created not only for small local area devices but also it can be created at a large scale in structure of VANET (vehicular ad-hoc network). VANET is also a category of MANET that allows vehicles to exchange messages with roadside equipment and this equipment is connected to the internet devices. Traditional routing protocol considered only shortest path on hop and distance basis but in Real-time traffic need QoS routing with a combination of concave , multiplicative, additive QoS metrices. Delay, routing cost is relevance to additive metrices while multiplicative QoS metrices covers reliability of the network and bandwidth measurement is a type of concave metrices. Internet facility can only transfer the data for communication but it does not provide QoS routing that can not only send data with the shortest path but provide stable energy efficient and congestion free routing. Different approaches used for most important and critical QOS routing issues stability and load balancing. Mobility issue is reduced by taking velocity, queue length and distance between mobile nodes & received adaptive routing [10]. In MANET due to node mobility, the shortest path is not the best path so there is a need to search a stable path. In the absence of stability of nodes wireless links can be easily broken. Link stability provides a long communication with a stable link between two nodes. GPS is a very popular technique for finding position of mobile nodes .GPS provides continuous position and timing information under any weather condition. In Hello Packet or Pilot Signal technique each node broadcast a hello packet [12]. Many single and multipath routing techniques are provided for balancing node. Load balancing can be done using different parameters like Aggregate Interface Queue Length (AIQL)[12], degree of nodal activity [13], queue length[14], queue length of various traffic classes[15],interface queue size and MAC drops at each node[17] & congestion based on type of traffic[16].

A. Solving routing problem in MANETs

MANET routing can be categorized mainly into reactive and proactive routing as shown in fig-2. Solving routing problem in Mobile ad-hoc networks is a brutal task due to its dynamics as an effect of mobility and disconnection of mobile terminals, creates a number of troubles in designing proper routing scheme s for successful communication [4].

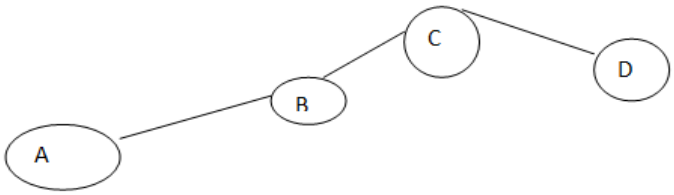

Figure 1. An infrastructure less network

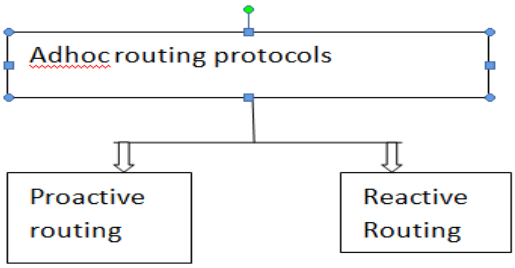

Figure 2. Classification of MANET Routing

Routing problem with more than one QoS metrices cannot be solved within polynomial time. Mobile Agent technology is the perfect solution with increase routing performance for such surroundings with reduce network traffic and load balancing [9]. For routing in MANETs their many routing protocols proposed by various researchers [4].

B. Mobile Software Agent Technology & its Characteristics

Software agent (SA) proactively initiates activities in accord with its goal with features of autonomy, reactivity, pro-activeness, social ability [7] as shown in fig-

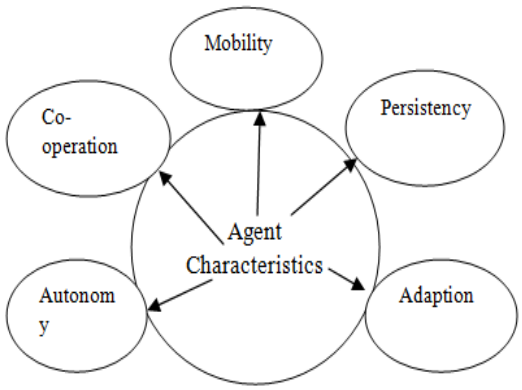

Figure 3: Uniqueness of Mobile agent

In fig 4(a), a client-server model, network load increases due to a number of interactions between client and server in form of requests and replies [8]. But in an agent-based model, the client interacts with the only agent who migrates to server region and reduces network load [6].

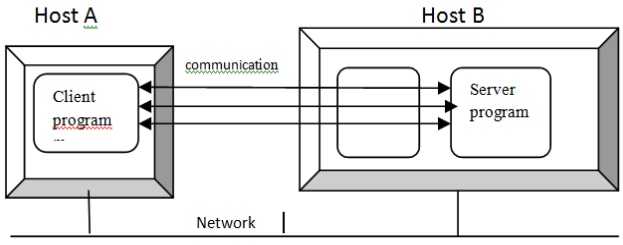

Figure 4(a): Client/Server Architecture

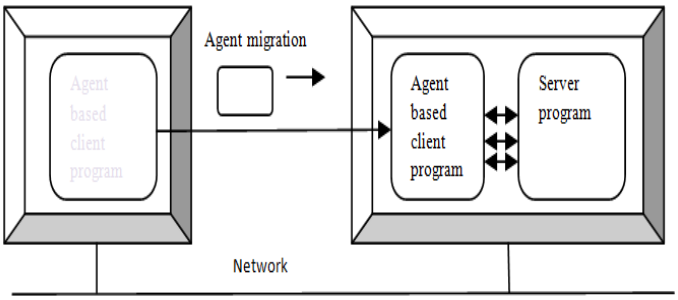

Figure 4(b): Agent-Based model Architecture

LITERATURE REVIEW

Agent-based Routing protocol with combined matrices (Load balancing or Energy, stability) in MANET

In [18], mobile agent based load balancing routing with dynamic network topology MACC-AODV proposed & improved AODV achieved. In [19], intelligent mobile agent introduced to improved AODV routing against congestion [19]. Different stability matrices are combined with energy mechanism & fuzzy based monitoring agent applied for finding stable and energy efficient routing path. In [15], intelligent agent-based QoS routing proposed and stability with energy, delay and flow of traffic in the network considered for improving performance of wireless ad-hoc network. In [23], for multi-purpose QoS ant agent based AMRQ routing purposed & delay, bandwidth and hop count are combined for finding adaptive, scalable routing path. In [30] authors proposed agent-based MOAODV, in this proposed routing model, network performance metrices like cost of path, hop count from source to destination, delay, hop distance, load, and reliability is considered for multi-objective AODV and ant based multi-objective QoS routing. Output of simulation shows that proposed mechanism better than AODV. In [26] Ant-like mobile agent based ant-aodv introduced & performs better than AODV. Stable routing based on mobile agent concept is proposed .In [27], authors proposed routing model by considering congestion, bandwidth and reliability are combined for finding the reliable path. In [28], using mobile agent reactive routing DSR extended and a secure communication using symmetric and asymmetric key is done. In[29], authors proposed mobility aware routing using mobility aware agent and modifying hello packet by adding GPS organizes to increase the throughput of the network. In [30], emergent intelligence technique is applied by using a group of agents static and mobile agents for finding QoS routing within the cluster. For this proposed technique QoS routing mechanism delay, bandwidth, packet loss rate and path cost metrices are considered for selection in the optimal routing path.

PROPOSED SYSTEM

The objective of this proposed routing model is to search a feasible path with the convergence of Mobile Software Agent (MSA) by taking multiple QoS critical parameters like link

stability, congestion, delay & remaining energy for enhancement in Quality of Service of MANET routing. A detailed description is defined in [31].

Proposed Routing Model

In RREQ packet is sent to its one-hop neighbours and this RREQ packet selects the shortest path towards the destination. Routing information is updated using RREQ packet for traveling towards destintination node. Now source node 1 selects the path with max PSI cost. RREQ packet moves towards Path P1, P2……hop by hop manner is broadcasted to its all one-hop neighbours than to forward RREQ to its intermediate nodes. RREQ is used same as AODV routing but in addition, PSI value is added to the packet [30]. Let n1, n2, n3……ni, are the neighbours of source node Si. Si sends data packet based on PSI (Path Selection Index). Where LS represents link stability, RE represents remaining energy and CL denoted congestion level, as well as QD, is used for queuing delay etc. for this system the values of LS, RE, CL and QD[24] is considered between 0 to 1.

The value of PSI is calculated using below formula:

$$PSI\ max = 1/N \sum_{i=1}^{N} (LSi \times REi \times (1-CLi) \times (1-QDi)) \quad \ldots\ldots\ldots\ldots (1)$$

Where N=total number of nodes in selected route.

SIMULATION RESULTS & DISCUSSION

In this simulation work, inputs are defined in table-1. Simulation work compares proposed routing model and hop by hop AODV (Ad-hoc on-demand Routing) using matlab2017a in different scenarios. Table-1 shows simulation input parameters & all parameters can be changed as per requirement. Node trust values for node stability, remaining energy, delay, and congestion are to be considered within a range of 0 to 1. The number of nodes and well as node positions can be changed. Scenario-1 consider all input defined in table-1 but in scenario-2 position of nodes 9 &node10 has been changed to ((10, 5) & (10, 8)) respectably. In scenario-3, the position of node 5 has been changed to (7, 6).

Performance measure metrices

Hop count: Hop count is the sum of the numeral of nodes, except for source node and a destination node that is part of a particular route. A route with a smaller hop count means it traversed through fewer nodes (although that does not guarantee a shorter path since the distance between the nodes could be high). Hop count helps gauge which path could consume more energy. If the hop count is low, then fewer nodes had to transmit data, resulting in a lower consumption of energy, and vice versa.

Path distance

The path distance tool primarily used to form the least cost path connecting a source node and destination node.

Table 1. Table input parameters

Input Parameter	Value
Total number of nodes used	10
Index of source node	1
Index of source node	10
Node transmission range	5
Node X-coordinates	1, 2, 4, 4, 8, 6, 7, 9, 10 ,10
Node Y-coordinates	6, 2, 5, 8, 5, 1, 10 ,2 ,8 ,5
Nodes stability value	1 ,1.0 ,1.0 ,1.0 ,1 ,1, 1.0 ,1, 1, 1
Nodes delay value	1, 1.0, 1.0, 1.0, 1, 1 ,1.0 ,1, 1, 1
Nodes congestion value	1 ,1.0, 1.0, 1.0, 1, 1 ,1.0, 1 ,1, 1
Nodes Remaining Energy	.3, 1.0, 1.0, 1.0 ,1 ,1 ,1.0, 1 ,1, 1

Table 2. Table for senario-1 Comparision of hop by hop aodv model with proposed mode

Parameters	**(Hop by Hop) routing AODV**	**Proposed model**
Selected Routing Path	hopbyhop_trusted_path – 1-2-3-4-5-6-8-10	proposedmodel PSI_trusted_path 1 3 5 10
Path Cost	hopbyhop_cost - 0.8750	proposedmodel PSI_cost - 0.6667
Path Hop	hopbyhop_trusted_path_hops – 7	proposedmodel PSI_trusted_path_hops- 3
Path Distance	hopbyhop_trusted_path distance-26.5253	proposedmodel PSI_trusted_path_distance- 9.1623

Table 3. Table for senario-2 Comparision of hop by hop aodv model with proposed mode

Parameters	(Hop by Hop) routing AODV	Proposed model
Selected Routing Path	hopbyhop_trusted_path – 1-2-3-4-5-6-8-10	proposedmodel_trusted_path 1 3 5 10
Path Cost	hopbyhop_cost - 0.8889	proposedmodel PSI_cost - 0.6667
Path Hop	hopbyhop_trusted_path_hops – 8	proposedmodel PSI_trusted_path_hops- 3
Path Distance	hopbyhop_trusted_path distance-29.5253	proposedmodel PSI_trusted_path_distance- 10.7678

Table 4. Table for senario-3 Comparision of hop by hop aodv model with proposed mode

Parameters	(Hop by Hop) routing AODV	Proposed model
Selected Routing Path	hopbyhop_trusted_path – 1-2-3-4-5-6-8-10	proposedmodel PSI_trusted_path 1 3 5 10
Path Cost	hopbyhop_cost - 0.8750	proposedmodel PSI_cost - 0.6667
Path Hop	hopbyhop_trusted_path_hops -7	proposedmodel PSI_trusted_path_hops- 3
Path Distance	hopbyhop_trusted_path distance-24.8086	proposedmodel PSI_trusted_path_distance- 9.1623

In the above Table-2, 3, 4 a comparative analysis on the basis of simulation is done between hop by hop AODV model and proposed model. Table-2,3,4 shows the comparative analysis on the basis of different QoS parameters like path cost, path hop and path distance in each scenario 1,2,3 proposed model performs better than hop by hop AODV. The proposed model selected fewer hops and less path distance from the source to destination node. Snapshots of fig-4, 5, 6show two different Snapshots of fig-4, 5, 6show two different routing paths. One path is indicated using red colour line selected using hop by hop routing and other path is indicated by using green line selected by our proposed model measured bypath distance, path cost, and path hop, of hop by hop routing.

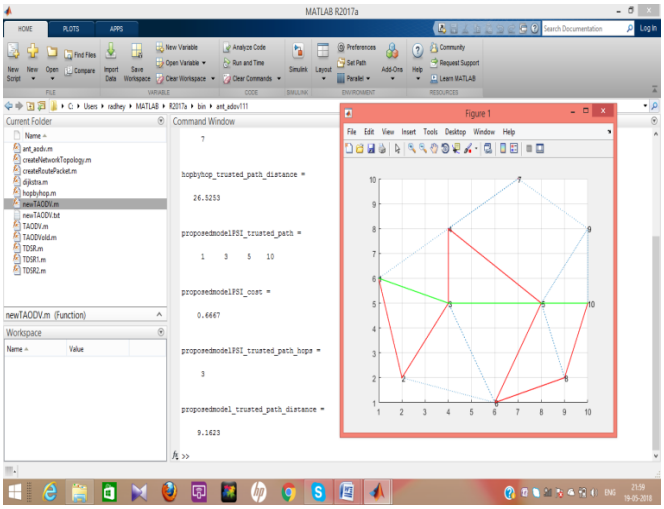

Figure 5: Senario-1, Selected path between hop by hop AODV routing and proposed routing model with path value of hop by hop routing.

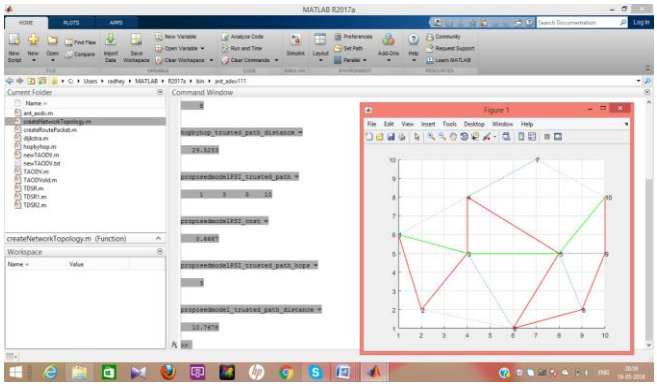

Figure 6: Senario-2, Selected path between hop by hop AODV routing and proposed routing model with path value of hop by hop routing

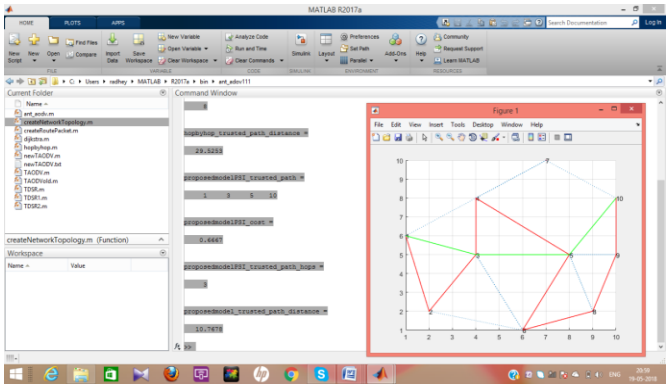

Figure 7: Senario-1, Selected path between hop by hop AODV routing and proposed routing model with path value of hop by hop routing.

CONCLUSION

On the basis of the experimental result, we can conclude that proposed model provides a feasible solution to discover the best path on the basis of combined critical multiple QoS parameters stability with consideration of energy, load balancing, and delay. With changes of node position in scenario-2 & scenario-3, it is clear node position effects the QoS matrices path cost, path distance and path hop for in MANET (mobile ad-hoc networks). So, with the selection of shortest path we can save much more battery of the mobile nodes and can avoid network partition because mobile nodes have limited battery power & many nodes are not able to forward path in the lacking of battery power.

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