Research Article
Mobile Agent Supported on Demand Routing Method to Lessen Link Failure in MANET

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Abstract: The ultimate goal of this study is to reduce routing overhead and latency by using mobile agent to get the information about the mobile nodes. The mobile agent is a software program that able to migrate from one node to another node. The mobile agent is not executes under any controller. In this study, the mobile agent is used to get the information about link duration and the energy of the nodes. The source node accesses the information from the mobile agent by using Remote procedure call. When there exists a link between source and destination means it will directly transmit the data to the destination or otherwise transmit via relay node. The relay node is selected based on the link duration and energy of the node. So, the proposed technique reduces the link failure and routing overhead. The performance of the proposed scheme is analyzed by using the simulator NS2.

Keywords: Link failure, mobile agent, mobile node, routing, routing overhead

INTRODUCTION

The Mobile Ad hoc Network (MANET) consists of heterogeneous mobile nodes. The mobile nodes are communicated with each other via wireless link. In wireless communication, a node having the link with the nodes in their communication range. All the nodes in MANET have the capability to transmit the data to the intended node without any centralized control. The mobile nodes change its topology dynamically. So, routing the data packets to the destination without loss is a challenging task. The mobile nodes are using the cooperative communication to enable communication without the router and switches. The node in a MANET does its functions and supports other nodes to do their function properly. The node which just forwards the data towards the destination is called relay node. So, the MANET node act as transmitter, receiver and intermediate or relay node. But the problem in MANET is route failure at the middle of the communication. This causes the maximum end to end delay and degrades overall performance of the network.

There are several routing protocols to provide the routing between source and destination. The routing protocols handle the route failure by detecting reroute the destination. The routing protocol leads to routing overhead while handling the route failure. The MANET is used as mobile ad hoc wireless access network. In this network, the moving nodes are access the network from the stationary gateway. The nodes which are out of communication range of the gate way communicated in the multi hop manner by using the routing protocol Ad hoc On-Demand routing protocol (AODV). The load balancing is included with the AODV protocol to make the AODV protocol suitable for the mobile ad hoc wireless access network (Hong, 2004). Addition of load balancing technique increases the packet delivery ratio and reduces the delay in the network by filter out the unwanted routing message transmission in AODV.

The Mobile ad hoc network is more vulnerable to several types of attacks due to its dynamic nature. In MANET, each and every node is act as mobile router. The attacker tries to capture the data by act as a relay node to transmit the data to the destination. The malicious node participates in the route to capture the data packets. Sometimes the malicious nodes send the wrong route reply packets to direct the data packets in the wrong route. Radhika *et al*. (2011) proposed the mobile agent based routing to avoid the attacks in. MANET. The proposed technique provides robustness and adaptability to deal with the challenging environment of MANET.

The mobile ad hoc networks are very flexible and it does not have proper infrastructure or any centralized control. So, the MANET is attracted many application deal with temporary wireless links. The challenging task in the MANET is finding the route between source and intended destination in the dynamic environment. Gunes *et al*. (2002) proposed an ant colony based routing algorithm. The finding solution capability of the swarm is mapped with the mobile nodes to handle the

route failure in the network. This routing scheme aims to reduce the routing overhead. This scheme is provide the mechanism to handle the route failure but not try to reduce the route failure in the network.

The mobile agent is not only used to transmit the data but also used for computation. The mobile agent can able to migrate from one node to another node. The mobile agent best suited for the dynamic nature of the MANET. Bindhu (2010) Presented the mobile agent based routing protocol which uses the mobile agent to detect the route between source and destination. This protocol reduces the delay in the network and routing overhead. It uses the multi path strategy to handle route failure.

To handle the traffic in the MANET, Tatomir *et al.* (2004) proposes the dynamic routing of traffic. This scheme uses the congestion information to detect the best route in the highly dynamic environment. This study proposes an On-demand routing scheme based on mobile agent. The source node accesses the mobile agent by using remote procedure call. The source node finds out the route only on demand. It selects the relay node based on the link duration and the residual energy. This information is computed by the mobile agent. So, the proposed system will increase the lifetime of the network and reduce the route failure.

The main objective of this study is to propose a Mobile agent Supported On-demand Routing (MSOR) that efficiently determines a method to select relay nodes while communicating.

PROPOSED METHODOLOGY

The MANET is a collection of autonomous nodes connected via wireless link. The autonomous nodes in MANET are free to move in all direction. The word autonomous indicates that the nodes are independent of any external device. The autonomous nodes are inbuilt with the transmission and receiving device. The cooperative communication enables the mobile nodes to communicate with each other. The autonomous node supports other nodes by acting as relay node to communicate with the node in the out of transmission range. This is called as cooperative communication. The nodes are changing its topology dynamically hence the packet routing without link failure is a crucial factor. There are several routing protocols are available to route the data packets in MANET. The routing protocol causes routing overhead and end to end delay in MANET. The mobile agent is the software program which can move to one node to another node dynamically. The mobile agent gives the information about the topology of the nodes in MANET. In this study, the mobile agent is used to provide the information about the link duration and the energy. The source node finds the route only at the time of demand. The relay nodes are selected based on the link duration value and the residual energy of a node. The following lines presented the pseudo code for the proposed scheme.

Pseudo code:

```
Mobile Agent based on demand Routing Scheme {
        Set s Source node
        Set d Destination node
        //Mobile agent is dynamically moving from
        one node to another node.
        Source node flood the request to mobile agent
        S (Mobile Agent) →Link duration and energy
        if (LD(d, s) >transmission time) {
        //directly transmit to the destination node
        } else {
        While (relay node = d) {
                If (LD (s, r) >transmission time &&E
                (r) >transmission power) {
                        set relay node r
                } else {
                //cannot finds the route to reach the
                destination at this time
                }
        } }
```
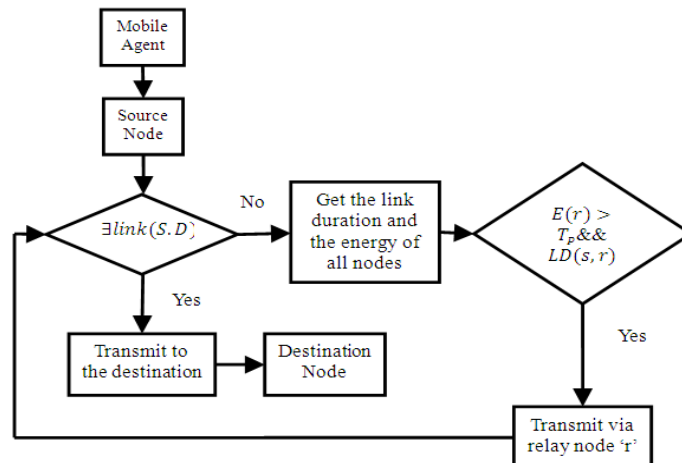

Fig. 1: Detection of route between source and destination by using proposed routing scheme

Block diagram: The steps involved in finding the route between source and destination is presented in the Fig. 1. The source node uses the remote procedure call to access the mobile agent. The Remote procedure is an inter process communication that enables the node to access computer program is run on the remote machine without explicitly connected to the remote machine. The source node gets the link duration between the nodes and the energy of the nodes from the mobile agent. If the link is exists between the source and destination and also the link duration is greater than the transmission time means the source node directly transmit to the destination node. Else find the relay node to transmit to the destination. The relay node's energy should be greater than the transmission power and the link duration should be greater than the transmission time. The process will be continued until the data reach the destination.

SIMULATION RESULTS

The performance of the proposed scheme is analyzed by using the Network simulator (NS2). The NS2 is an open source programming language written in C++ and OTCL (Object oriented Tool Command Language). NS2 is a discrete event time driven simulator which is used to mainly model the network protocols. The nodes are distributed in the simulation environment. The nodes have to be configured as mobile nodes by using the node-config command in NS2. The parameters used for the simulation of the proposed scheme are tabulated in Table 1.

The simulation of the proposed scheme has 20 number of nodes deployed in the simulation area 1000×1000. The nodes are moved randomly within the simulation area by using the mobility model Random waypoint as shown in Table 1. The nodes are communicated with each other by using the communication protocol User Datagram Protocol (UDP). The traffic is handled by using the traffic model CBR. The radio waves are propagated by using the propagation model two ray ground. All the nodes

Table 1: Simulation parameters

Parameter	Value
Simulation area	1000×1000
Number of nodes	20
Mobility model	Random way mobility model
Routing protocol	AODV
Communication protocol	User Datagram Protocol (UDP)
Traffic model	Constant Bit Rate (CBR)
Propagation antenna	Two ray ground
Antenna type	Omni antenna
MAC type	IEEE 802.11

receive the signal from all direction by using the Omni directional antenna. The performance of the proposed scheme is evaluated by the parameters packet delivery ratio, Delay and packet loss ratio. The performance of our proposed scheme is analyzed by using the data recorded in the trace file. During the simulation the network parameters are recorded in the trace file. While executing the trace file the following output has been obtained.

The packet received rate is defined as the rate at which the destination received the data packets. The rate is calculated based on the number of data packets received per time. Higher the packet received rate aggrades the performance of the network. Figure 2 show that the comparison analysis of proposed scheme with the Ant colony based routing algorithm. The proposed scheme provides better performance than the ant colony based routing scheme.

The packet loss rate is indirectly proportional to the packet received rate. The excess packet loss degrades the network performance. The packet loss rate for the proposed scheme is low when compared with the Ant colony based routing scheme (Fig. 3). The minimum value of packet loss rate indicates that the high performance of the network.

The End to End delay is the time difference between the last packets received time and the current packet received time. The delay in the network degrades the performance of the network. Figure 4 shows that the delay of the proposed scheme is low when compared with the ant colony based routing scheme.
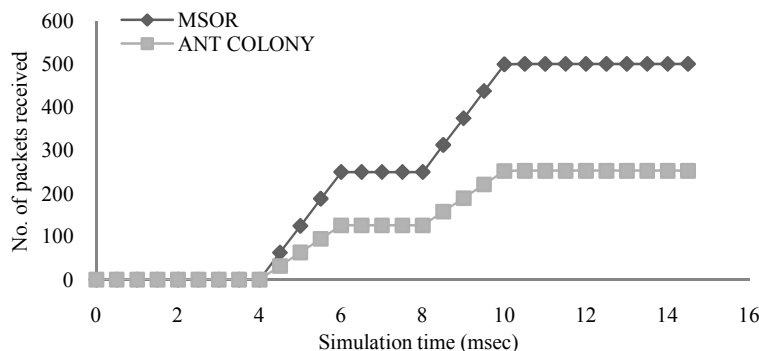

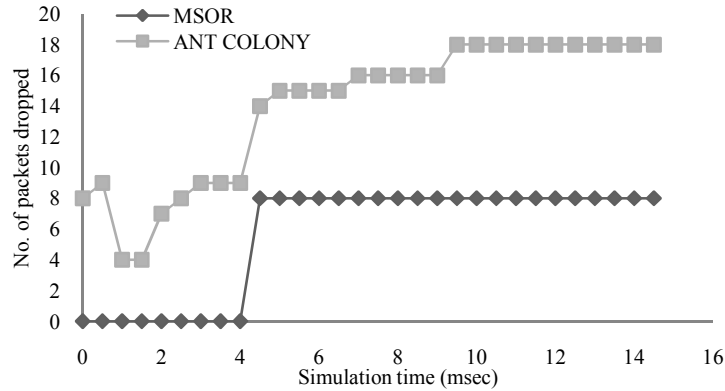Fig. 2: Packet received rate analysis
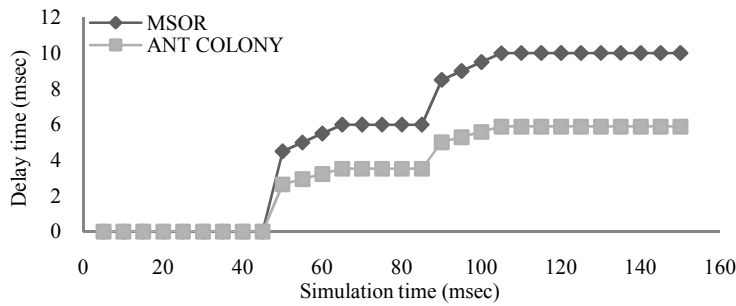
Fig. 3: Packet loss rate analysis
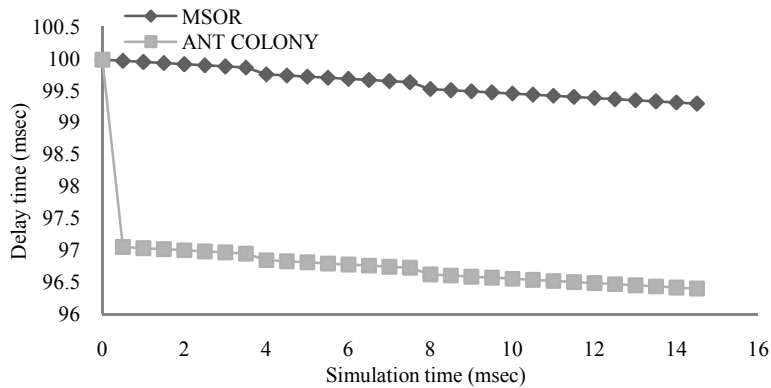

Fig. 4: End to end delay analysis

Fig. 5: Energy efficiency analysis

The proposed scheme considers the energy of the node while routing the data packets. If the node's residual energy is enough to transmit the data only can become the intermediate node in the route. So, the proposed scheme transmit the packets in the energy efficient way. Figure 5 shows that the average residual energy of the network is high for the proposed scheme when compared with the ant colony based routing scheme.

CONCLUSION

The Mobile agent Supported On-demand Routing (MSOR) scheme is proposed in this study. The routing protocols designed for the MANET requires handling the route error message by reconstructing the route to reach the destination. The construction of reroute causes an overhead and route failure causes delay. But the proposed scheme uses the mobile agent to get the information about the node in the network. The source node selects the relay node based on the link duration and the energy of the node. The proposed routing scheme reduces the delay in the network and route failure between the source and destination. The Mobile agent supported on demand routing scheme provides high throughput and increases the life time of the network by the consideration of energy while choosing the relay node.

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