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Autonomous Wireless Mesh Network

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Abstract

Mobile Ad Hoc Network has a property to configure itself, it will make a network on requestprincipally for front line communications.In such type of applications, inter-group communication is important to the group synchronized effort.To overcome this limitation, we present in this paper another class of networkarchitecture called Autonomous Wireless Mesh Network (AWMNET). It is a suitable network topology to assure great network for both intra- and intergroup interchanges. Here we approach a distributed client tracking solution to deal with the vibrant nature of client mobility, and current techniques for dynamic topology adaptation in accordance with the mobility pattern of the clients.Our recreation results demonstrate that AWMNET is stringent against networkpartitioning and fit for giving high hand-off throughput to the mobile client.

Keywords— Mobile mesh networks, dynamic topology deployment, client tracking

I. INTRODUCTION

Wireless technology [1] has been emerging as latest trend in the field of networking in the recent years, and standout amongst the most changing and engaging innovations. Precisely, Mobile Adhoc Network (MANETs) [2] are amongst the most broadly focused on networkcommunication advancements. In such circumstances, no communicationnetwork architecture is required.The mobile nodes can apparently behave like a router, and thus helps to transfer the data from the source to destination through multi-hop. This sort of network is suitable for circumstances where an altered base is inaccessible or not viable. This network also turns out to be a cost effective solution because of the fact that it is repositionable and can be used again in more optimum places at distinctive times for diverse applications.One incredible test in planning a vigorous MANETs is to decrease network partitions. In MANET, a mobile node can move indepentantly as a result of which the network topology may change and can cause network partition [3] swiftly and unconventionally over an extended period of time, rendering the whole process unpredictable.This condition is a great disadvantage for the system which possess a problem towards communication in front line.In this paper a more advanced class of stringentmobileAd hoc networkcalled Autonomous Wireless Mesh Network (AWMNET) is proposed to overcome this issue.

Stationary mesh nodes provides routing and relay abilitiesin a standard wireless mesh network. They permit mobile mesh clients to communicate among themselves via multi-hop by forming a mesh-like wireless architecture.

Such an architecture is accessible, adaptableand also economic. In case of failure of a node at any instant caused due to channelinterference, dynamic obstacle and/or congestion, thenthat nodeis substituted by a new one; and inevitablythe mesh architecture will identify this new node and will be reconfigured. The AWMNET that is proposed in this paper has various advantages. It provides protection of the mobile mesh nodes against destruction. It helps to achieve better overall end-to-end delay.The intergroup routers that are present in AWMNET has subsequent local adaptation. It has the property to employ all free routers to track mobile clients efficiently. Since, the mobile mesh nodes move with their mesh clients, they have the capability to adaptsudden changesin thenetwork topology in order to provide optimal service along with its standard routing and relay functionality.An AWMNET promisesconnectivity to its clients by avoiding network partitioning.

The figure 1 represents topology adaptation of an AWMNET and is explained as follows:

- Fig. 1a: The mesh clients initializes the process by assuming a single cluster. All the mesh nodes align in an area to each other for supportingcommunication among themselves.
- Fig. 1b: The mesh clients tend to move towardspositive direction of the ordinate and divides into two clusters. And thus the topology of the mobile mesh node changes and aids in intergroup communications in addition to intragroup communication.
- Fig. 1c: The same mesh clients now form three clusters as it move downwards.Again the topology of the mobile mesh node changes thereby providing full connectivity to all of its clients.

To provide coverage for the whole application topography, it is not always possible for a mobile mesh network to be replaced by standard stationary mesh network as presented in fig 2. In this approach, we come across a huge application topography.

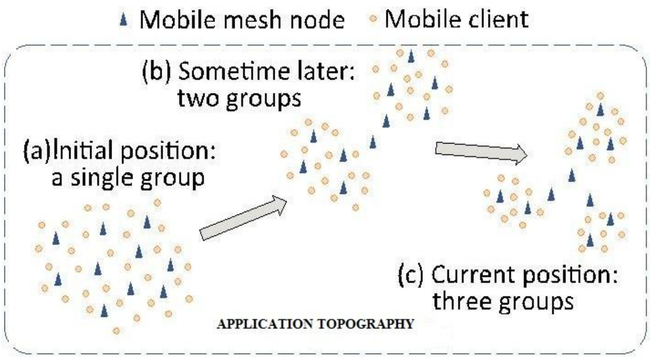

Fig. 1. Topology adaptation of the autonomous mobile mesh network under three scenarios.

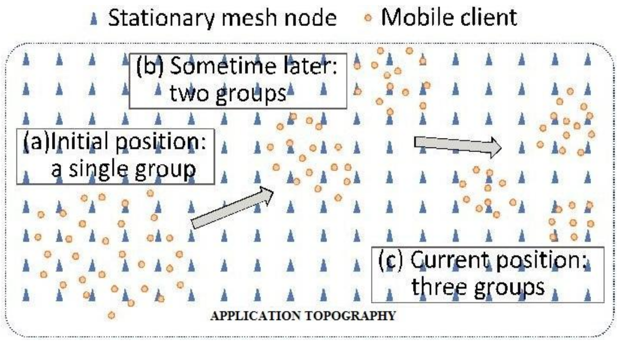

Fig. 2. Fixed grid-based square topology under three scenarios illustrated in Fig. 1.

Our challenges in designing the proposed AWMNET is to improve the data management and scalable connectivity between the mobile clients by implementing Novel SensRob technology. One of the basic services provided by a wireless detector network is monitoring the specified region. We address the problem of dynamic mobile client partitioning by applying the mobile target detection technique in mobile sensor devices. The AODV Routing convention utilizes an on-demand methodology for discovering routes, i.e., a route is built when it is required by a source node for transmitting data packets. It utilizes destination arrangement numbers to recognize the latest way.

II. TECHNICALSPECIFICATION

In order to transmit data packet from source node to the destination node, AODV Routing protocol is used which is an on-demand approach for finding routes. Tomakes use of destination sequence numbers, it has to identify the recent path. The difference between AODV and Dynamic Source Routing (DSR) [4] is concluded from the fact that DSR uses source routing in which a data packet carries the complete path information to be traversed. However, the next-hop information is stored in the source node and the intermediate nodes which helps AODV to transfer data packet to the destination. When the route for the desired destination is not available,the source node in an on-demand routing protocol, will overflow the Route Request packet in the network. It candiscoverdifferent routes to different destinations from a single Route Request. The maindissimilarity between AODV and other on-demand routing protocols is that it uses a destination sequence number (DestSeqNum) to determine thecurrent path to destination. A node updates its route information only if the DestSeqNum of the current packet received is greater than the last DestSeqNum stored at the node.

A Route Request carries the time to live (TTL) field the destination identifier (DestID), the destination sequence number (DestSeqNum), the source identifier (SrcID),the source sequence number (SrcSeqNum), the broadcast identifier (BcastID), and. DestSeqNum shows the new route that is known by the source. When an intermediate node received a Route Request, it either forwards it or organizes a Route Reply to the destination if it has a valid route. The comparison of the sequence numbers at the intermediate and destination nodes helps to determine the validity of a route for the Route Request packet. The identical copies are rejectedif a Route Request is received several times,which is specified by the BcastID-SrcID pair. All intermediate nodes having valid routes to the destination node are allowed to send Route Reply packets to the source node. Every intermediate node enters the previous node address and it'sBcastIDwhile forwarding a Route Request and also deletes this entry using a timer in case a Route Reply is not received. This also helps in storing an active path information at the intermediate node as AODV does not employ source routing of data packets.The current nodestored theInformation about the previous node, when a node accepts a Route Reply packet. Then the data packet is forwarded to the next node as it moves toward the destination.

DSR contains source routes in packet headers.Sometimes large headers can lower performance-particularly when data contents of a packet are too small; AODV tries to improve on DSR by keeping routing tables. AODV holds the desired feature of dynamic source routing, that are formed only between nodes which need to communicate. Route Requests (RREQ) are forwarded in a wayalike to DSR. It sets up a reverse path directing towards the source nodewhen a node again sends a Route Request-AODV consider symmetric links. When final destinationreceivedthe Route Request, it answers by sending a Route Reply (RREP). Route Request is forwardedwhenRoute Reply travels along the reverse path set-up. The pastidentified sequence number for the destination also include the Route Request (RREQ). An intermediate node may send a Route Reply (RREP) providing anew path than the previously path known to sender, also record the next hop to destination. A routing table entry keeping a reverse path and forward path informationis removed after a timeout interval.

Node X neighbor is considered active for a routing table entry if the neighbor sent a packet within active route timeout interval. Exchange of hello messages is sometime done between neighboring nodes. When the next hop link breaks in a routing table entry all active neighbors are informed. Destination sequence numbers is updated when link failure are broadcast by means of Route Error (RERR) messages. A RERR message is generatedwhen node X is unable to forward packet P (from node S to node D) on link (X, Y).The destination sequence number for D increases, at node X. The incremented sequence number Nincludedin the RERR. When the RERR is received by node S, it initiates a new route discovery for D at least as large as N using destination sequence number .Node D will set its sequence number to N when it receives the route request with destination sequence number N, unless it is already larger than N. In packet headers it's not necessary to include routes. Nodes maintain routing tables only for routes that are in active use. Only one next-hop per destination are maintained at each node-DSR may maintain different routes for a single destination. Sequence numbers are used to avoid old/broken routes also prevent formation of routing loops and unused routes expire even if topology does not change.

Destination sequence numbers are used to find the latest route to the destinationandroutes are established on demand. For connection setup it requireslower delay and high throughput.

AODV doesn't allow handling unidirectional links. Multiple Route Reply packets in response to a single Route Request packet can lead to heavy control overhead. Periodic beaconing leads to unnecessary bandwidth consumption.

The mobile clients have to move in different places during crisis management system or battlefield communications. Thus dynamic movement of mobile clients makes ad-hoc network unsuitable for applications, in which team players might need to work in groups scattered in the application topography. Our ultimate goal of this paper is to improve the data management and scalable connectivity between the mobile clients by implementing Novel SensRob technology.

Wireless detector network provide a basic service for monitoring the specific region. We overcome the problem of dynamic mobile client partitioning by applying the mobile target detection technique in mobile sensor devices. In our technique, the SensRob's work autonomously and collaboratively to attain the application mission. Our novel technique is slightly based on the Game theory approach. We consider two types of players in this paper, one type of players follow group mobility patterns to move toward different directions in smaller groups. And the work of second type player is to monitor and trace the first type players to ensure good connectivity for both intra- and intergroup communications.

III. NETWORK DESIGN

The network design deals with implementation of two types of network devices named as Router node and Client node creation.The Router node can move anywhere without any human effort like a quad-captor. The router node can receive the signals from the mobile users as well as from any other router node. Each router node is equipped with the GPS navigation system. The quad-captor can move from one specific location to other location with the help of this GPS position. Router has the memory to store the mobile user info as well neighbor router availability info.The Client node is the one that moves randomly with human effort.

In order to intimate the current location of the information, the client nodes can share the signal to the Router node. The client node utilizes some basic routing protocols like AODV or DSR in real time, to communicate with other client nodes present in same group. Sometimes the source client may need to get help from the Router node in case when destination client is not available.

In this paper, gentle assumptions are made that there are so many routing protocols available to make communication if there is continuous connectivity available. So there is no problem with sharing a data if connectivity is available. So in this paper, a fully concentrated on connectivity b/w routers and client nodes.

IV. CLIENT INFORMATION PROCESSING

In this proposed work, the Router need to track the mobile client and need to give the constant integration with less number of Router use. To utilize less number of Routers, switches need to share the client information (info) message to one another.

At the point when node (n_i) gets a CLIENT INFO packets from its past node s, it can utilize the neighbor list as a part of the CLIENT INFO packet to gauge what number of its neighbors have not been secured by the CLIENT INFO packet from s. If the node (n_i)has more neighbors uncovered by the CLIENT INFO packet forms, which implies that if node (n_i)rebroadcasts the CLIENT INFO packet, the CLIENT INFO packet can reach more extra neighbor nodes. To evaluate this, we characterize the Uncovered Neighbors set U$(n_i)$of node (n_i)as takes after:

$$U(n_i) = N(n_i) - [N(n_i) \cap N(s)] - \{s\}$$

Where $N(s)$and $N(n_i)$are the neighbors sets of node s and(n_i), separately. 'S' is the node which sends a CLIENT INFO packet to node (n_i)as per (1), we get the introductory *UCN* set. Because of broadcast attributes of a CLIENT INFO packet, node (n_i)can get the copy CLIENT INFO packets from its neighbors. Node (n_i)could further alter the $U(n_i)$with the neighbor information.

V. TOPOLOGY ADAPTION

In this section, after sharing the client information packet every router can transform the second module to compute the uncovered neighbor data. If there is no uncovered neighbors then the Router need to process the status transformation. In our undertaking we primarily separated routers into two modes one in nearby cluster routers and typical routers. We separated further free router in two modes one is global cluster router and free routers. The work of neighborhood cluster router is to interface with clients and following the client cluster. What's more, the work of ordinary routers is to check the autonomous (partitioned) clusters and if separated clusters are discovered then it have to join the clusters and that router will turn into the global cluster routers. If no isolated cluster discovered then it can get to be free routers. No need to take part in communication.

VI. ALGORITHM

In this approach we consider two sort of nodes (N_{type})one is SensRob which is indicated as $N_{sr}$and Mobile client N_{mc} each node has the clock with lapse time $T_{e_{mc}}$, every SensRob has the List of Mobile client $L_{mc} = \{\}$ "initially empty", every SensRob can work in diverse mode M_s(part is neighborhood cluster "L_g"/Global-cluster "G_g"/free SensRob "F_s"). We signify that current time asT_c, every node's current area is indicated asP_x, P_y. Also, we signify the Heart pulsated message as Mes_{Hb}. What's more, Mobile client direction information is indicated as McD_{info}, $Node \rightarrow Nav$ means the node under navigation (yes/no), every living up to expectations SensRob has the timer with $T_{e_{sr}}$ to impart the reference point message, and SensRob has Timer to check the regular portable client data with timeT_v, every SensRob has the relative SensRob's versatile client table $N_{list}(x)$ where (x) is relative SensRob.

1) Set the Mobile client $Timer \rightarrow T_{e_{mx}} = 0 + rand(time)$
2) Set the SensRob $Timer \rightarrow T_{e_{sR}} = 0 + rand(time)$
3) If $T_{e_{mc}} \leq T_c$
    a. $Update - pos(P_x, P_y)$
    b. $Pos(P_x, P_y) \cup Mes_{Hb}$
    c. Broadcast Mes_{Hb}
    d. $Timer \rightarrow T_{e_{mx}} = T_c + rand(time)$
4) If $T_{e_{sR}} \leq T_c$
    a. Send $Beacon$
        i. $L_{MC} \cup B.Pkt$
    b. $Timer \rightarrow T_v = T_c + rand(time)$
5) If $T_v \leq T_C$
    a. Foreach $M_l \in N_{list}$
        i. If $|L_{MC} - [M_l \cap L_{MC}]| = 0$
            1. $Timer \rightarrow T_{temp} = T_c + rand(time)$
            2. Set $V_{nd} = M_{L_{id}}$
6) If $T_{temp} \leq T_c$
    a. If $\exists V_{nd} \in N_{list}$
        i. Set $M_s = F_s$
7) If Pkt recv in node n &$N_{type} = N_{Sr}$
    a. Pkt is Mes_{Hb}
        i. If $Node \rightarrow Nav = true$
            1. If $Pkt.Src = id \leftarrow dir(x, y)_{id}$
                a. $Stop_{mov}$
                b. Set$M_s = L_g$
                c. Send $Alert \rightarrow (A)$
                    i. $L_{MC} \cup A.Pkt$
        ii. $Pkt.Src \notin L_{Mc}$
            1. $Pkt.src_{info} \cup L_{Mc}$

2. Send $Alert \rightarrow (A)$
    a. $L_{mc} \cup A.Pkt$
3. $McD_{info}(Pkt.Src) \leftarrow Mob(Pkt_{ino})$
4. Set $L_{expire}(Pkt.Src)$

iii. Else if $Pkt.Src \in L_{Mc}$
1. $McD_{info}(Pkt.Src) \leftarrow Mob(Pkt_{ino})$
2. $Update(L_{expire}(Pkt.Src))$

b. Pkt is Req_{Nav}&$Pkt.dst = n$
i. $Pkt.McD_{info}(id) \rightarrow dir(x,y)_{id}$
ii. Set $Node \rightarrow Nav = true$
iii. Start Navigation $dir(x,y)_{id}$
iv. Set $N_{type} = Pkt.n_{type}$

c. Pkt is $Beacon$
i. $Update(N_{list}(Pkt.Src))$
ii. $McD_{info}(Pkt.src) \leftarrow Mob(Pkt_{info})$

8) if $N_{type} = N_{Sr}$&$L_{expired}(id)$
a. set $Nav = 1$
b. Foreach $Neig \in L_{Mc}$
i. if $Neig.N_{type} = F_s$
1. gen $Req_{Nav} \leftarrow McD_{info}(id)$
    a. if $id.N_{type} = N_{sr}$
        i. $Req_{nav}.n_{type} \leftarrow (req)G_g$
    b. Else
        i. $Req_{nav}.n_{type} \leftarrow (req)L_g$
2. set $Nav = 0$
3. break

c. if $Nav = 1$
i. Send Req_{nav} to G_g

VII. RELATED WORK

A. Anchor-Node-Based Distributed Localization with Error Correction in Wireless Sensor Networks

Taeyoung Kim et. al. [5] proposes a plan to improve localization as far as precision and transmission overhead in wireless sensor networks. This plan begins from an anchor-node-based distributed localization (ADL) utilizing network examine with the data of anchor node inside two-hop separation. Despite the fact that the localization accuracy of ADL is higher than that of past plans (e.g., DRLS (Distributed without range Localization Scheme)), estimation errors can be broadcast when the ratio of anchor node is low. Hence, after every normal node evaluates the initial position with ADL, it checks whether the position needs to be corrected on account of the lacking anchors two-hop separation, that is, the node is in scattered anchor area. In the event that amendment needs, the beginning position is re-situated utilizing hops advance by the data of anchor nodes found a few hops away so that error broadcasting is reduced (REP); the hop advancement is an expected hop separation utilizing probability based on the density ofsensor nodes.Results through simulation shows that ADL has around 12% higher localization accuracy and around 10% lower message transmission cost than DRLS. Moreover, the localization accuracy of ADL with REP is around 30% higher than that of DRLS, despite the fact that message transmission expense is expanded.

B. Accurate Anchor-Free Node Localization in Wireless Sensor Networks

There has been a developing enthusiasm for the utilizations of wireless sensor networks in unattended situations. In such applications, sensor nodes are typically deployed differently in an area interest. Information of accurate node area is fundamental in such network setups to relate the assembled information to the cause of the sensed phenomena and guarantee the significance of the reported information. Also, consciousness of the nodes positions can enable employing efficient management strategies, for example, geographic routing and conducting important investigation, for example, node area properties. Adel Youssef et. al. [6] introduce an effective anchor free protocol for restriction in wireless sensor network. Every node finds its neighbors that are inside its transmission range and evaluations their ranges. There calculation wires nearby range estimations to form a network wide brought coordinate systems while minimizing the overhead incurred at the deployed sensors. Versatility is attained to through cluster sensors into clusters. Evaluation results demonstrate that the proposed convention attains to exact limitation of sensors and keeps up predictable error margins. Furthermore, it shows the impact of slip collection of the node's ranges and network's size and connectivity on the general accuracy of the unified coordinate system.

C. Optimal Route Selection Method with Satellite System for Cognitive Wireless Network in Disaster Information Networks

Noriki Uchia et. al.[7] introduce Satellite System for optimal transmission control technique in Cognitive Wireless Network keeping in mind the end goal to consider with extreme fiasco. Initially, as their past study, legitimate wireless link and route selection is held by Extend AHP and Extend AODV with Min-Max AHP esteem techniques for optimal transmission control in Cognitive wireless Network. At that point, check-alive function, substitute data transmission function, possible option route suggestion, furthermore, network reconfiguration are acquainted with their proposed Disaster Information Network by utilizing Satellite System. In simulation, ns2 are utilized for the computational results to the viability of the proposed transmission techniques in the hybrid arrangement of cognitive wireless and satellite network architecture.

D. Movement-Assisted Sensor Deployment

Sensor deployment is an essential issue in outlining sensor networks. Guiling Wang et. al. [8] outline and evaluate distributed self-deployment protocols for mobile sensors. After finding a coverage hole, the proposed protocols figure the target positions of the sensors where they ought to move. We utilize Voronoi diagrams to find the coverage hole and outline three movement assisted sensor deployment protocols, VEC (VECtorbased), VOR (VORonoi-based), and Minimax based on the principle of moving sensors from densely deployed regions to sparsely deployed regions. Evaluation results demonstrate that there protocols can give high coverage inside a short deploying time and restricted movement.

VIII. SIMULATION

In the simulation, ns2 (Network Simulator 2) [9] was analyzed to assess the overhead, packet delivery ratio, packet delay and throughput. Fig. 3, demonstrates the comparing analysis between the existing system and the proposed system for Overhead. This message overhead increments with the number of groups, i.e., the number of inter-group routers along the connecting systems. The result shows that proposed system has a very less overhead than the existing system.

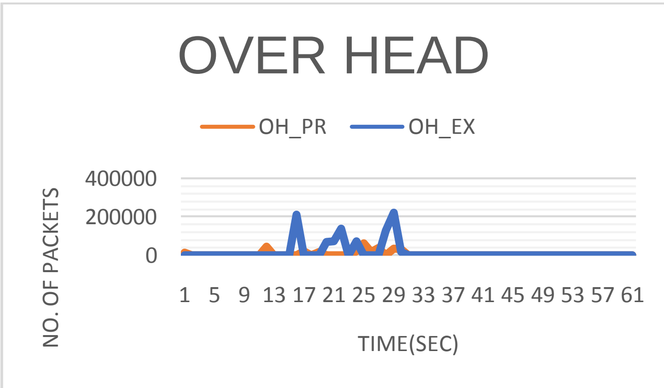

Fig.3 simulation result for the overhead between the proposed system and the existing system.

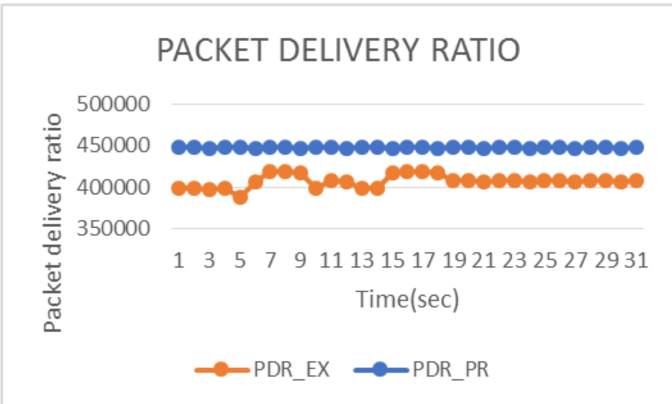

Fig.4 simulation result for the Packet delivery ratio between the proposed system and the existing system.

Fig. 4, demonstrate the comparing analysis of packet delay ratio for both existing and proposed system. This graph shows the successful delivery of packets to the destination to that of total number of packets sent by sender. The result shows that packet delivery ratio for the proposed system is very high then that of the existing system. Fig. 5 demonstrate the comparing analysis between the existing system and the proposed system for throughput. The result clearly shows that the proposed system has a high throughput than that of the existing system. Fig. 6, demonstrate the graph for packet delay for both existing and proposed system. Result shows that the packet delay for proposed system is less than that of the existing system.

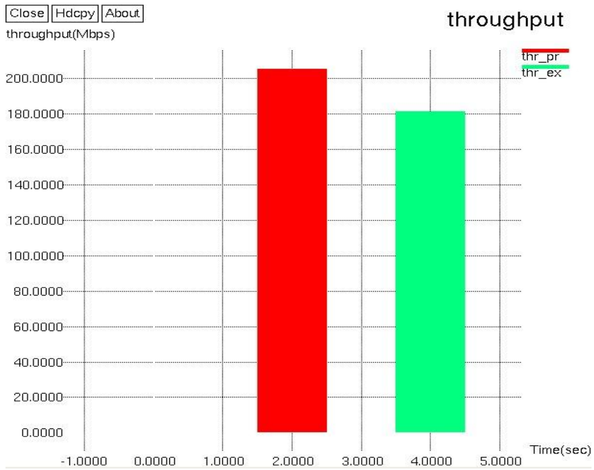

Fig.5 simulation result for the throughput between the proposed system and the existing system.

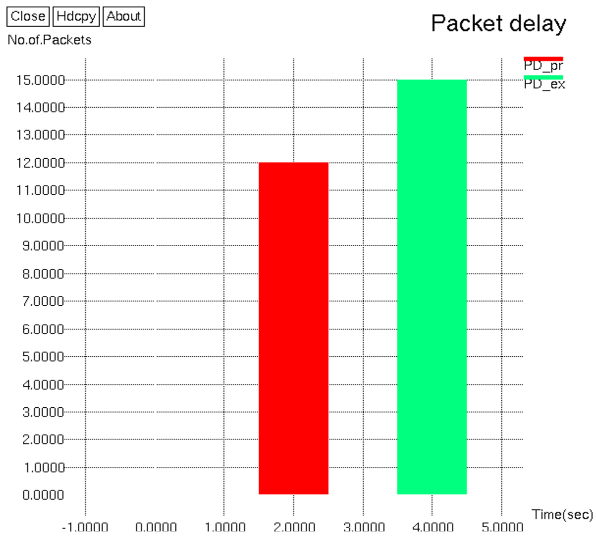

Fig.6 simulation result for the packet delay between the proposed system and the existing system.

IX. CONCLUSION

In this paper AWMNET, we overcome the problem of network partitioning with help of wireless router moving in a mesh network along with the mobile node. It helps to communicate from source to destination by selecting the shortest path. AWMNET also tracks the route when the packet is send from source node to destination node, at the time when network is dynamically changed. Little changes in AODV routing protocol helps to update its location with source and destination client in order to send the data packet to its destination address following the shortest path to it. ThusSimulation result proves that the AWMNET is better than the existing system with less overhead, less packet delay, high throughput and high packet delivery ratio. Search for disappear mobile node and utilization of nonoverlapping channels can be leave for future research.

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