International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 06 | June 2019 www.irjet.net p-ISSN: 2395-0072

QoS Aware Manet Routing Protocol for Multimedia Traffic in an Adaptive Cross Layer Architecture

Vrinda R Patil[1], Sandhya S V[2]

[1]Dept.of CSE, SDMCET, VTU, Dharwad, India
[2]Asst.Professor, Dept. of CSE, SDMCET, VTU, Dharwad, India

---***---

Abstract - In this paper, we have introduced modified AODV protocol for routing packets in MANET. The main advantage of M-AODV protocol discover highly stable route from sender to receiver node. In this proposed protocol, changes are made in packets (Hello and RREQ) format. Sending time of packet, route stability factor and bandwidth size are considered. The source node encodes video (divide into frames). The source node sends the Route REQ (RREQ) message with required bandwidth to destination node and gets Route REP from destination node. We use NS3.26 tool for investigating the performance of M-AODV routing protocol with the metrics of throughput, packet loss and delay.

***Key Words*: MANET, Modified AODV, Video Transmission, Multimedia Traffic**

1. INTRODUCTION

Mobile Ad hoc Network (MANET) is an extensive research area for current years. Many research works have been proposed in this research due to the large number of mobile users intend to create communication and computation.

1.1 Conventional AODV

Ad Hoc On-Demand Distance Vector (AODV) routing protocol is the modified version of DSDV routing protocol. It is an on-demand routing protocol in mobile ad hoc network (MANET). MANET is defined as the group of model nodes that cooperatively involve in communication operation. It does not require any centralized authority to monitor i.e. no infrastructure. The major applications of MANET are battlefield, earthquake, earthquake, etc. In MANET routing by AODV is based on two phases: Route Discovery, Route Maintenance.

In route discovery and route maintenance operations, four different types of control messages are used such as, Route Request (RREQ), Route Reply (RREP), Route Error (RRER), and Route Reply Acknowledgement (RREP ACK). If the source node want to send data to the destination node, but route is not available on the range, then it send RREQ packets to all its neighbor nodes i.e. Route Discovery process is initiated here. When node received RREQ packet require, then its check the routing table regarding whether the route from the source to the destination node is exist or not. When node sends RREP to the source node, otherwise it continues the broadcast the RREQ packet. The destination node forwards RREP packet when it receives RREQ packet. After RREQ packet from neighbors, the source node can send packets through the route. Typically AODV has some shortcomings such as, when neighbors are suffering due to large amount of RREQ packet, and then it takes lot of bandwidth. However low bandwidth problem in MANET which tends large delay in packet transmission. In addition, RREP packet from destination node may be lost along reverse way to the source node and source node finds shortest path through RREP and RREQ packets, but we can't assure that it will be the best route. A typical example for AODV routing protocol is shown in figure1.

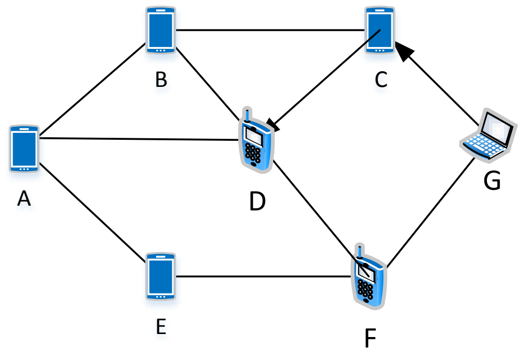

Fig -1 Example for AODV Routing

From the Fig-1, node C knows a route at node G and forwards an RREP to node D. Source Address is A, Destination Address is G and Hop Count is 1. Here the destination sequence number is maximum (own sequence number, destination sequence _# in RREQ). In general routing consists of two steps: packets forwarding to the next hop and determine how to forward packet. Packet forwarding is easy, but getting information of where to send packets is hard. To reach the destination node, reduce the number of hops (path length), reduce the delay, reduce the packet loss and reduce the cost.

1.2 Cross layer Architecture

1) Physical (PHY) Layer: Nodes consume energy in transmission and reception of the data related to routing information, the user's data and data related other network operations. In case of excessive energy consumption, the battery may be exhausted during data exchange and thus may result in link breakage. A low battery may affect the wireless transmission range also and drop the ongoing communication. Therefore, it's required to optimize the

energy consumption with respect to above discussed factors for better and uninterrupted communication

2) MAC Layer: This layer manages the access to the wireless medium and its fair utilization. It is also responsible to control the contention and collision level over the shared wireless channel. If the MAC layer fails to manage the designated operations, then a lot of packet retransmission may take place and consume more energy than required. If this fact can be passed on to PHY layer, energy consumption can be optimized. Therefore, a cross-layer solution may be used to optimize the operations for each layer.

3) Network Layer: This layer keeps the track of each link and the data rate required for communication. Due to node's mobility, the network topology changed frequently that cause the frequent updates in routing information. This frequent updates in routing information may cause frequent link breaks. Route reconfiguring may consume unwanted energy, results in depletion of node's battery. In order to send their data after route reconfiguring multiple nodes can try to access the channel at the same time, and cause collision over the wireless channel

4) Transport Layer: It controls the congestion over a network. The congested network may bring down the overall network performance. A cross-layer solution may be used for MAC and transport layer for performance optimization. By using the cross-layer interaction between layers many QoS parameters like energy, security, tree management cost and various controls overhead can be optimized for improved performance. A typical hypothetical cross-layer design can be shown as in figure 1, in which PHY, MAC, and Network layer are exchanging their information to form upper layer information, similarly, Application and Transport layer form lower layer information. And further these two cross-layer exchange their information to form cross-layer interaction.

Fig -2 shows the cross layer architecture. For all common issues of cross layer in MANET, the following solutions are considered:

- Optimal route selection is important which adopt for dynamic network topology.
- Congestion control can be mitigated for reliable communication in transport layer.
- A cross-layer solution is required for PHY layer for power optimization of wireless links.

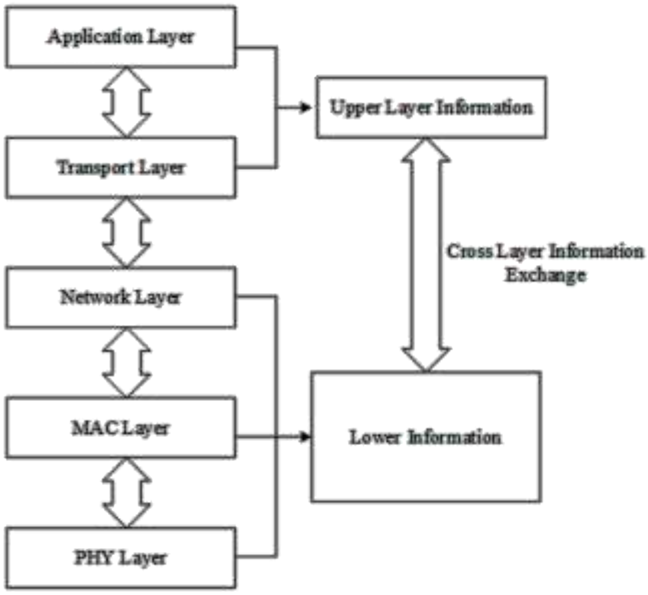

Fig -2 Cross Layer Architecture

TABLE -1 Cross Layer Architecture Characteristics in Manet

Layer Name	Status	Control	Adaptation
Physical Layer	SNR, RSS, SNIR, and Battery Status	Transmission power	Modulation coding technique
MAC Layer	The number of retransmissions	Packet Length	Error control technique
Network Layer	Route table	Route discovery and route maintenance	Routing
Transport layer	Packet loss	Sending rate	Congestion control mechanism
Application layer	Packet Error Rate	Delay, Loss, Jitter or Energy	Priority scheduling

Video transmission is one of the important challenges in MANET. In addition, improving QoS (quality of service) while transmitting video from source to the destination node

1.3 Research Issues of Video Streaming

1) Bandwidth usage: Streaming require adequate data transfer capacity to play, particularly at higher quality. For instance, Netflix's spilling administration requires an Internet speed of no less than 5 Mbps for HD quality, 7 Mbps for "Super HD" quality, and 12 Mbps for 3D gushing. While these rates are by and large accessible with most link associations, those with slower associations may encounter

issues with playback and furthermore low quality, since a few administrations will decrease video quality keeping in mind the end goal to guarantee continuous playback.

2) Available at online only : In spite of the fact that video streaming gives moment plays back alternative and bouncing over the substance choice to client and helps proprietor from robbery the issue is if web association detached, and client or guests needs to watch it disconnected then they can't. For this situation it offers the client a decision to both stream video and download the video with duplicate security to stop piracy.

Video transmission is multimedia that constantly received by end users. There are several techniques are used for video transmission in MANET such as, multipath routing, multiple description coding (MDC), and cross layer technique. There are three major research issues in MANET that are Throughput, Delay and Packet Loss Ratio. Delay is one of the important metric in video transmission. Due to poor network bandwidth size, variation in delay is large. Thus delay is not static and it is varied between packet 1 and 2. It occurs mainly due to the following reasons. Delay in MAC layer is high due to high interface; it is due to route or link breakages, and congestion in network. Similarly multimedia traffic in MANET for video packet transmission is complex task to less power receiving from destination node, Poor communication range between two mobile nodes.

This project is based on Modified AODV routing protocol in adaptive cross layer architecture for multimedia data packet transmission. We propose cross layer architecture based video transmission to reduce the delay, and packet loss ratio and increase throughput on MANET.

2. LITERATURE SURVEY

Castellanos et al. [1] have proposed a QoS aware routing protocol for video streaming in MANET using adaptive feedback mechanism. In current years, the major challenge in time-sensitive data transmission over MANET is the achievement of high end-to-end support for QoS. Thus several approaches and improvements have been introduced previously for routing mechanisms in MANET. In this work, authors proposed a novel QoS routing protocol based on traditional AODV (AQA-AODV), which generates routes based on the application or data type. This protocol shows better performance and it was found that it satisfies QoS requirements. In this paper we presented the concept of modified AODV, which outperforms than the AODV. This mechanism provides mechanism to find the link failures in a route and re-establish the connections taking into account the constraints of QoS requirements. The simulation results reveal that the performance of the proposed has obtained better performance and effectively provide scalable video coding and supports adaptive video streaming.

Dinest et al. [2] have proposed QoS assisted cross layer multicast routing on MANET, which main intention is to achieve high QoS with reduces tree management cost since this paper proposed based on the concept of tree-based multicast routing protocol. To achieve QoS, optimization of the tree operations and tree management cost was reduced in this work. This work exploits the functionality of PHY layer, Application layer, and Routing layer, and QoS oriented communication. It is evaluated for various parameters such as throughput, delay, link cost, and energy consumption.

Sedrati et al. [3] have proposed a multipath routing scheme for video streaming over MANET. Providing quality of service (QoS) for real-time multimedia applications such as video streaming in mobile ad hoc networks (MANETs) is an important challenge. MANETs are characterized by lack of fixed infrastructure, dynamic topology, and limited resources that make more difficult multimedia applications transport and run on this networks. To overcome this challenge, video coding techniques combined to multiple routing paths (multipath) is a promising technique for supporting transmission of multiple video streams with appropriate QoS over mobile ad hoc networks. In this paper, firstly, many issues and different techniques for video streaming over MANET have been reviewed and secondly two multi paths routing protocols (M-AODV and MDSDV) have been evaluated in order to improve QoS for real-time multimedia applications. Results show that none of these two protocols is better than the other. In certain situations (throughput and load network with high mobility) is M-AODV but in others (network load and reliability for large-scale network) is MDSDV protocol which displays good performance. It is also noted that these two protocols provide between acceptable and good quality and a small jitter regardless of nodes number in medium mobility.

Yashima et al [4] have discussed that route availability is a quality metric for improving route availability in MANET. There has been no proposal for a quality metric that models this unstable state, i.e., route nonuniformity. This paper proposes a new concept of route availability (RA) as a metric of route nonuniformity in a MANET and verifies how effectively it represents the quality of service (QoS) of a network or the quality of experience (QoE) of video streaming. They have built an environment that emulates a MANET capable of video streaming, and developed a method of measuring RA for two representative MANET routing methods: AODV (Ad hoc On-Demand Distance Vector) and OLSR (Optimized Link State Routing). They have examined the relationship between RA and conventional network QoS metrics: packet loss rate and throughput. They have also checked RA using a subjective quality assessment test.

Grewal et al. [5] have described several issues and possible solutions in the design of cross layer for MANET. An Ad-Hoc Network is a decentralised wireless network as it does not depend on any infrastructure elements like routers or switches and neither does it have an access point. Mobile and

Vehicular Networks (MANET & VANET) are two types of Wireless Ad-Hoc Networks. As the layered structure, has been successful in deployment of the internet similar solutions have been adapted for MANETs too. However, the loss in QoS in OSI model occurs due to isolation of layers from one another as there is no communication among the layers and the layers stay oblivious to the functions of one another. This leads to redundancy and eventually leads to degradation of performance. Cross-Layering communication allows the layers to communicate with each other. This design does not tamper with the functionality of the layers but allows coordination among them. Even though an extra signal is needed to communicate one layer to another which does increase overhead but the advantages that come along with cross layer design overshadow its disadvantages. The current studies present a research work on numerous cross layer issues such as network lifetime, Quality of Service (QoS), link failure, congestion/error control, cooperation issue, blackhole attack, power consumption, inefficient throughput etc. This paper focuses on cross layer design issues related to QoS, Blackhole attack, Exposed Terminal Problem, Power consumption and cooperation problem. Also, this paper presents the solutions to the discussed problems and a brief idea of different models presented/discussed by various authors which help alleviate these issues.

Rathod et al. [6] have considered the process of video streaming in MANET using routing protocol. MANET is a self-sorting out, decentralized, framework less, multi hop, remote system of cell phones. Routing protocols assume a crucial part in transmission of information over the network. Streaming video is content sent in packed frame over the Internet and showed by the viewer continuously. Mobile Ad hoc Networks are considered for some applications. Routing protocols are the most imperative component of MANET and media streaming is a very requesting assignment over MANET. Examination of directing convention which is more dependable for video streaming is specified in this paper. Some well-known routing protocols in particular Ad-hoc On-request Distance Vector (AODV), Ad-hoc On-request multipath Distance Vector (AOMDV), Enhanced Video Streaming in MANET (EVSM) have been considered and on the premise of throughput, normal network delay, packet delivery ratio these protocols are tasted in this paper.

3. PROPOSED WORK

In this project we introduced a new modified AODV for routing over MANET in multimedia traffic. To create a stable and robust for video transmission between source to the destination node, we utilize bandwidth size. In the following sub-section we describe our modified AODV in detail. Flow of the proposed work as follows:

- In this project, we create a MANET environment, which consists of set of mobile nodes and base station.
- Select the source and Destination nodes from the network.
- Detect the nearest nodes and calculate the distance between the nearest nodes.
- The source node encodes the video file [divide into frames].
- The source node send the RREQ message with required bandwidth size to the Destination nodes through the nearest nodes, and get the RREP from the Destination.
- Based on the Modified RREQ and RREP we select the efficient route between the source and destination.
- For the route selection we use the Modified AODV. Perform the simulation Packet Transmission.

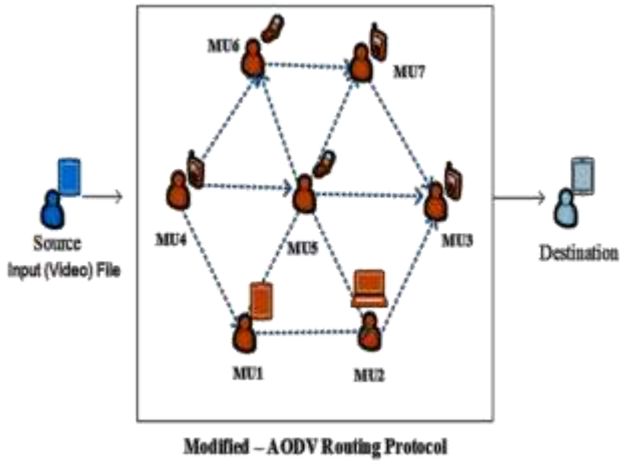

Fig -3 System Architecture

If the source node communicates with the destination node, but there is no available route information in its routing table. The source node initiates the route discovery process and disseminates this information (RREQ) to all neighbors. In modified AODV, each node receives the RREQ packet and it mentioned the required bandwidth size for video transmission to destination node. Then the neighbor attached the bandwidth size to its RREP packet and forward to the source node. In this project a new RREQ packet format is depicted in Table 2

TABLE -2 New Rreq Packet Format

Source_Address
Destination Sequence_ID
Source Sequence_ID
Available Bandwidth
Broadcast_ID
Destination_Address
Hop-Count

Bandwidth size

Bandwidth is the maximum data transfer rate of a network, which measures how much amount of data can be sent over a specific video in a given amount of time. In this project we considered bandwidth size for multimedia data transmission over the RREP nodes. In MANET, link level bandwidth is considered, which is used in Qos provision for end-to-end flow of multimedia transmission.

QoS has always been and will always remain an issue in all the existing network topologies and protocols that handle the data flow. In wireless channels, unlike wired channels, to guarantee the quality of service to a user is even more difficult as factors like unreliable node movement, shared capacity, unaccounted interferences come into play.

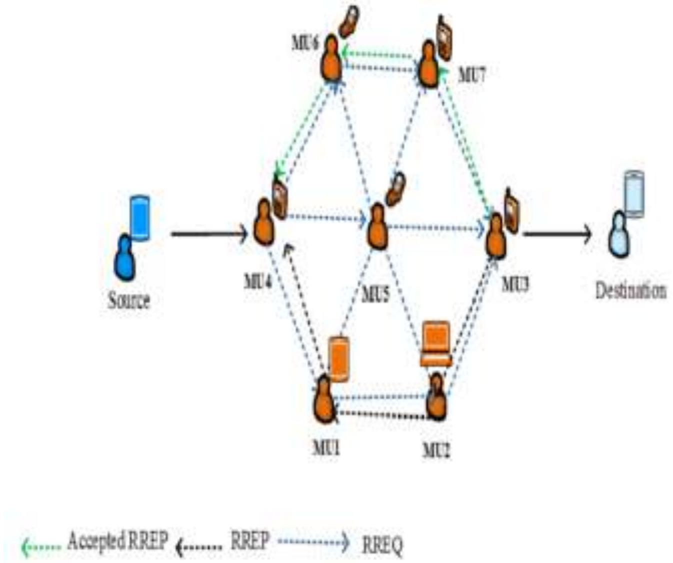

Fig. 4 M-AODV Routing

4. IMPLEMETATION DETAILS

In this section we discuss the simulation results for the proposed M-AODV protocol for video transmission.

4.1 Simulation Environment

In this project, we create a MANET environment which involves 50 Mobile Nodes and 1 Base Station (BS). We use Network Simulator 3.26 for analyzing and simulating the performance of Modified AODV. The mobile nodes distributed randomly over the environment with the area size of 1000m*1000m. Wireless transmission range of each node is 250m. The below table-3 shows the simulation parameters.

TABLE -3 Simulation Parameters

Parameters	SPECIFICATIONS
Network Simulator	Network Simulator 3.26
Simulation Of Nodes	50
Communication Range	250m
Simulation Time	100s
Mac Protocol	IEEE802.11p
Channel Type	WiFi Channel
Protocol/ Algorithm	M-AODV
Traffic	UDP
Mobility Model	Random Waypoint model
Sent Data Rate	2048 bits per second (2.048 Kbps)
Loss Model	Friss Loss Model
Node Speed	10m/s
Transmitted Power	0.05
Application Services	Video Transmission
Traffic Type	Constant Bit Rate

4.2 Performance Evaluation

In this section we present the concept our proposed model simulation performance. We plot the resultant graphs for Throughput, Delay and Packet Loss.

1) Throughput: Throughput is defined as "The sum of bits per unit of time forwarded by the network from source to the destination node." It does not consider protocol overhead and retransmitted data packets. In other words, it is defined as the amount of digital data (audio, video, text) that is delivered over a logical or physical link.

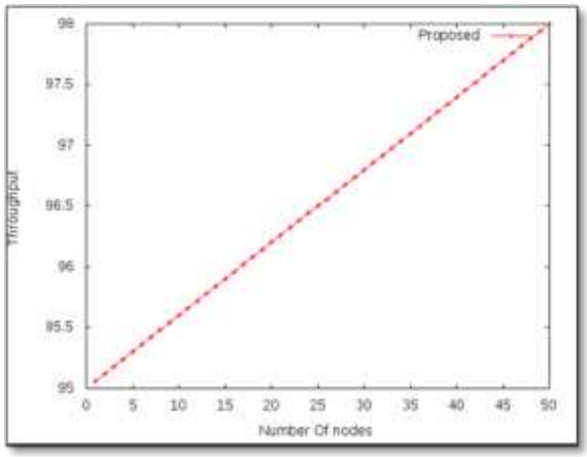

Chart -1: Throughput vs No. Of Nodes

TABLE -4 Performances Of Throughput Vs. No of Nodes

Number of nodes	Throughput (Kbps)
5	95.2
10	95.5
15	95.7
20	97
25	97.2
30	97.4
35	97.6
40	97.8
45	97.9
50	98

Table 4 And Chart 1 describes the throughput arising while number of nodes participated for video transmission in MANET. A larger throughput shows the better network performance, when a node send packet transmission to the MANET. In the multimedia video transmission, throughput is less due to insufficient bandwidth. But we send video based on the required bandwidth size. Thus throughput is improved.

2) Packet Loss: "Packet Loss is estimated by the rate of data packets does not delivered to the destination node by the total number of packets sent by the source node." Fig. 6 shows the performance packet loss ratio for our proposed M-AODV routing.

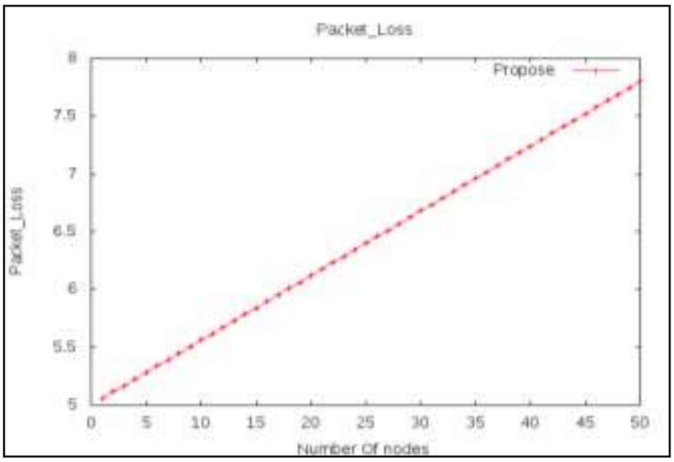

Chart - 2 Packet Loss vs. No of nodes

TABLE -5 Performances Of Packet Loss Vs. No of Nodes

Number of nodes	Packet Loss
5	5.25
10	5.5
15	5.75
20	6
25	6.25
30	6.50
35	6.75
40	7
45	7.25
50	7.5

Table 5 and Chart 2 describe the Packet Loss arising while number of nodes participated for video transmission in MANET. A minimum throughput shows the better network performance, when a node send packet transmission to the MANET. In the multimedia video transmission, packet drop rate is high due to insufficient bandwidth. But we send video based on the required bandwidth size. Thus, packet loss is decreased.

3) Delay: "Delay is the average time taken for video transmission from source to the destination node." It increases when network congestion increases.

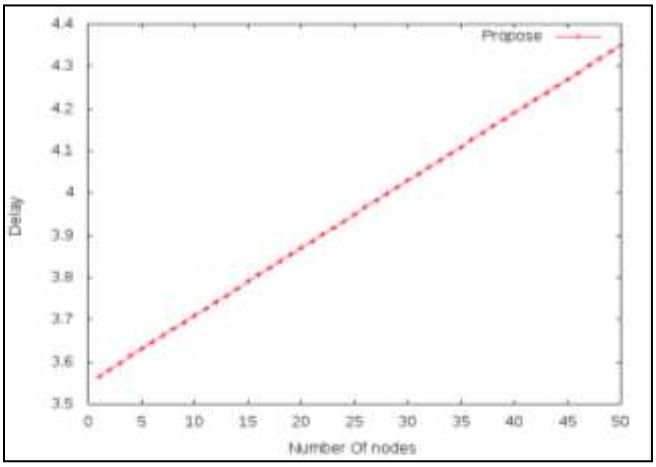

Chart – 3 Delay vs. No of Nodes

TABLE -6 Performance of Delay Vs. No of Nodes

Number of nodes	Delay
5	3.7
10	3.75
15	3.78
20	3.8
25	3.9
30	4
35	4.1
40	4.2
45	4.3
50	4.4

Table 6 and Chart 3 describe the delay arising while number of nodes participated for video transmission in MANET. A minimum delay shows the better network performance, when a node send packet transmission to the MANET. In the multimedia video transmission, packet delay is high due to insufficient bandwidth. But we send video based on the required bandwidth size. Thus, delay is decreased.

5. CONCLUSIONS

The proposed work gives the conclusion that the input video is split into "n" frames and transmitted in nodes based on bandwidth availability. The source and destination for video transmission is visible. Video is transmitted from the source node to the destination node. In this project we introduced a modified AODV routing for multimedia data transmission in MANET based on available bandwidth size. In this new AODV version, QoS is improved in terms of throughput, packet loss ratio and delay. We newly included bandwidth size in M-AODV and allow it to keep record the packet transmission time of video transmission by all nearest nodes from the source node in the shortest time. The destination node is waiting to gather some statistics in order to choose the most stable (high available bandwidth) route carried in the packets of RREQ. At the end of this project, we performed simulation of our proposed modified AODV, which is carried and investigated using NS3.26. Based on the results, it can be determined that the Modified ADOV outperforms than the conventional AODV and it improves throughput, and reduces delay and packet loss ratio.

In future this proposed work can be enhanced for the multiple inputs; considering multimedia traffic. And also this work can be incorporated for the queue management system.

ACKNOWLEDGEMENT

We are thankful to the president Dr D Veerendra Hegade of Shri Dharmasthala Manjunatheshwara College of Engineering and Technology, Dharwad for their encouragement. We are very grateful to Principal of Shri Dharmasthala Manjunatheshwara College of Engineering and Technology, Dharwad for motivating us also we are thankful to Head of Computer Science and Engineering Department for providing facilities. Lastly I would like to thank all the people who have guided and helped me directly or indirectly.

REFERENCES

[1] Castellanos, W. E., Guerri, J. C., &Arce, P. (2016). *A QoS-aware routing protocol with adaptive feedback scheme for video streaming for mobile networks. Computer Communications*, 77, 10–25.

[2] Chander, D., & Kumar, R. (2018). *QoS Enabled Cross-Layer Multicast Routing over Mobile Ad Hoc Networks.*Procedia Computer Science, 125, 215–227.

[3] Sedrati, M., &Benyahia, A. (2017*). Multipath Routing to Improve Quality of Service for Video Streaming Over Mobile Ad Hoc Networks.Wireless Personal Communications,* 99(2), 999–1013.

[4] Yashima, T., &Takami, K. (2018). *Route Availability as a Communication Quality Metric of a Mobile Ad Hoc Network.Future Internet,* 10(5), 41.

[5] Ajaykaran Singh Grewal,Cross-layer Design in Mobile (Vehicular) Ad Hoc Networks: Issues and Possible Solutions, SYSC 5408 – *Cross-Layer Design for Wireless Multimedia Networks* – Term Paper (Fall 2016)

[6] Rathod, N., &Dongre, N. (2017). *MANET routing protocol performance for video streaming*. 2017 International Conference on Nascent Technologies in Engineering (ICNTE).