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## Enhancement of MANET Wireless Network Routing using Innovative Algorithms

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### ABSTRACT

Nowadays, Hoc networks have attracted much attention, since they do not require any access to networks with fixed structure, such as the transmitter antenna, that is not economical. In information transmission such as video transmission, information is transformed into a stream of packets and each packet is transmitted through a specific path. We use the video coding technique in order to make the video streams persistent. Because of the real-time video applications, their delay is very crucial. In this article, in order to enhance the routing performance in video transmission, we first code the video with the MP4 compression technique, then we use genetic algorithm with discovery and path reconstruction mechanism protocol in order to decrease the delay in moving nodes routing for video transmission in the network. Choosing the available paths in routing table which are ranked based on the delay; genetic algorithm can enhance the routing process, decrease the delay and reduce the overload in Hoc networks.

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## INTRODUCTION

Mobile Ad-Hoc network (MANET) is an independent set of moving users which communicate through wireless links (Di Caro, 2008). Node motion in MANET networks changes the network topology regularly and thus routing protocols which are proportional to these networks must be taken into consideration. Since delay, overload and correct data and information transmission play a key role in applications such as video transmission (Anju, 2012), enhancing the routing protocol could reduce the mentioned parameters by a significant degree. For cases in which the information of the video are transmitted through network, crowd must be discovered and controlled immediately, because in real-time video transmission the delay is very crucial. In the case of crowd, many packets are omitted and their retransmission provides no benefits for video applications.

Because of the unstable nature of MANET network, path identification and maintenance is of great importance. Therefore there are two important classifications in routing protocols: On-Demand or Reactive protocols such as AODV and Proactive protocols

such as OLSR (Niansheng, 2007). Using AODV genetic algorithm with discovery and path reconstruction mechanism protocol in moving nodes is very efficient for real-time video transmission (Di Caro, 2004). Therefore, AODV protocol is presented in this paper which improves the performance of video transmission. In section 1, a review of this work is presented. In section 2, the objectives of service quality backup in genetic routing are stated. In section 3, improved AODV routing using genetic is described. In section 4 and 5, simulation results and conclusion are presented, respectively.

### 1.1. Related work:

One of the new and suitable algorithms for enhancing the routing performance is the genetic algorithm. It also solves the problems of SP (Shortest Path) dynamic routing in Mobile networks (Shengxiang Yang, 2010).

The main idea of routing algorithms based on the behavior of ants (Di Caro, 2004), (Di Caro, 2008), is the simulation of ants behavior and collecting the information provided by the paths by a collective learning process and constructing paths by packet transmission similar to ants. In the presented method in (Araft, 2011), consumed energy estimation factor is used for updating the value of pheromones and routing tables instead of periodic transmission of forward packets. The proposed method (Araft, 2011) performs more efficiently than

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AODV in rate of packet transmission. In this method the change in nodes positions and nodes speeds has not been taken into account.

In reference (Niansheng, 2007), a new version of genetic algorithm for multiple destination routing based on the quantum theory named QoSMR-QGA is presented to enhance the delay, bandwidth and transmission rate. In this method, a graph of the network which considers the bandwidth limitation is created prior to the implementation of the algorithm.

The results of this algorithm shows that its optimality acceleration is much faster than other similar algorithms. However, it is not very successful in delay enhancement. In spite of the fact that this algorithm enhances the quality of service parameters such as delay, bandwidth and transmission rate, it performs the routing in a stationary and centralized way.

We analyze the genetic algorithm for real-time video transmission in Hoc network, because it solves the dynamic routing problems. In this paper an innovative genetic algorithm is proposed for enhancement of AODV protocol for video transmission.

### 1. The analysis of the purpose of service quality backup in MANET based on genetic algorithm:

A network backup for service quality shows the network ability of offering service with specific requirements. One of the most important matters in MANET networks routing is a communication with a desired service quality. Delay parameters and the dissipation rate are very important in MANET service quality. Therefore, we used the genetic algorithm to improve the optimization of the quality of service (QoS) parameter in MANET routing. Routing is the process of finding a path between two nodes which meet the qualifications of the service quality. Service Quality parameters differ from each other via the different applications. In multimedia applications, dissipation rate and delay are key factors. Routing based on backup from service quality searches for a path which meets the desired parameters such as bandwidth and delay (Kotecha, 2007).

According to the aforementioned, for a better routing, we used the genetic algorithm for MANET routing. The genetic algorithm works on the coded format of the problem instead of working on the problem parameters.

#### 2.1. Chromosome Coding:

Binary coding is the simplest type of coding and the best conversion for genetic operators in which each string of coded chromosomes builds a path for creating the initial population. The population members are converted into strings of 0s and 1s. The second basic component of the genetic algorithm is fitness function, that computes the quality response of any chromosome.

#### 2.2. Analysis of Path Quality:

In any stage, a sample pair is selected for the combination, either randomly or based on the gen transmission, and next generations are made. In the proposed technique, the members of the current generation, which are the paths of the motion of the nodes, are classified in the routing table based on their value from the best to the worst. The property function is based on the lowest delay. Chromosome proportion is calculated from equation (1).

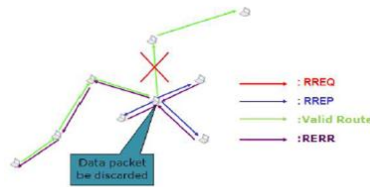
$$F(CHI) = \left[ \sum_{l \in p(s,r)} Cl + Cd \right] \quad (1)$$

#### 2.3. Backup routing design:

Based on least delay condition, the generation process is stopped and genetic. Genetic algorithm searches for various paths and ranks them according the delay. Therefore, the first path is the best one and the other paths can be used as backup paths.

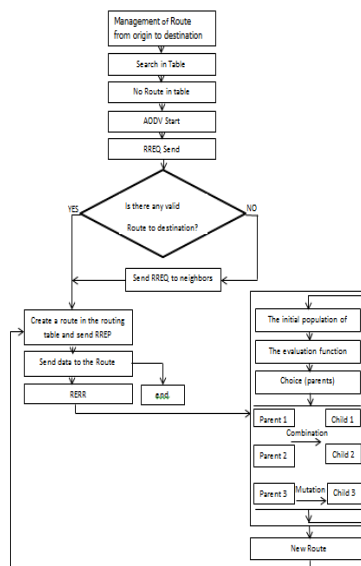
### 2. Routing by AODV protocol based on genetic algorithm:

The genetic algorithm performance is through the combination of the available path in order to create new paths and choose the path which is more efficient in achieving the goals of quality of service (QoS) backup. AODV protocol is based on the table and on the demands. Nodes which are not located on the active paths, do not attend in routing information maintenance or in routing tables transmission (Perkins, 2003). Besides, as long as two nodes are not required to establish a connection with each other, they will not have to discover and maintain a route. Route discovery steps in AODV protocol are done by sending the RREQ request and creating inverse routes and creating direct routes and transmitted routes (Fig.1). We defined a vector in AODV protocol which is located on RREQ packet header and saves the number of passing nodes and thus saves a route in routing table. When the request packet is transmitted to the destination node, the route of the message transmission, from the source node to this node, is specified by this vector in which unlike the AODV protocol, the source node will be notified of the whole path. RERR message will be sent only when link detachment leads to unavailability of one or more destinations for some adjacent nodes.



**Fig. 1:** The transmitted route detachment and error message delivery to origin.

Genetic algorithm initiates the information exchange when the origin node receives the RERR. Population diversity is used not only for having a set of backup routes in case of saturation of the new route, but also for increasing the probability of hybrid generation and the generation of a new suitable route (Based on the utility function). Unlike other innovative approaches, genetic algorithm works on a number of responses in each repetition instead of working on an individual response (chromosome). The general process of the route discovery and maintenance mechanism based on the genetic algorithm is shown in figure (2).



**Fig. 2:** The proposed algorithm using genetic algorithm.

*Simulation:*

In Simulation, nodes move according to a model called the random stations model. For our simulation, the random motion pattern is created using the setdest section of NS2.29. Besides, a virtual medium of 200\*200 meter with time steps of 200 seconds is provided.

*4.1.Evaluation:*

In the proposed algorithm, the akiyo.cif, standard video, was coded by MPEG4, standard coding, for transmission through the network. The akiyo.cif characteristics are specified in table 1.

**Table 1:** General Characteristics of akiyo Video with CIF format.

Duration (s)	Number of frames	Resolution (whight*hight)
20	300	352*288

The simulation results, such as delay, overload, PSNR are provided for different network conditions, like, number of nodes, network topology and speeds of nodes. The value of simulation parameters are shown in table 2.

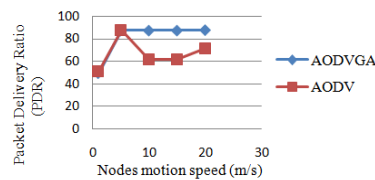
Figure 3, shows the simulation results for, packet delivery ratio (PDR), for AODVGA and AODV algorithm, so AODVGA has better performance.

Also the proposed AODVGA protocol has less delay in video packet transmission compared to AODV protocol as shown in fig.4.

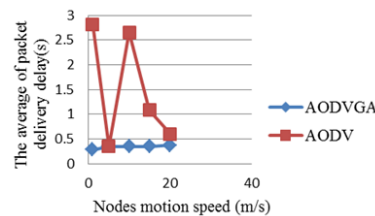
We performed the simulation for various speeds of moving nodes and in all of these speeds a decrease in the number of the missed nodes in AODVGA protocol was observed (Fig 5).

**Table 2:** The Value of Simulation Parameters.

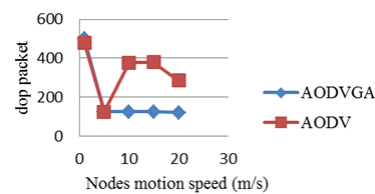
Type of parameter	Parameter
Video	Traffic
<b>1024</b>	Packet size
<b>1000</b>	The maximum packet transmission
AODV	Routing Protocol
GA	Routing algorithm
Channel/WirelessChannel	Channel type
Propagation/TwoRayGround	Radio propagation models
Phy/WirelessPhy	Network relationship
Mac/802_11	MAC
Antenna/OmniAntenna	Antenna
20,50,80,100	Number of nodes
200x200	Network size
1,5,10,15,20	Nodes motion speed (m/s)
1	Step mobility of node
<b>200</b>	Simulation time(s)
0.3	Antenna height



**Fig. 3:** Packet Delivery Ratio versus the nodes motion speed.

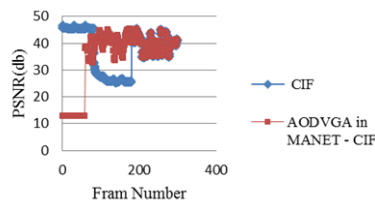


**Fig. 4:** The average of packet delivery delay versus the nodes motion speed.



**Fig. 5:** The number of missed nodes versus the nodes motion speed with maximum of 100 nodes.

Figure 6 shows the comparison of PSNR coded and decoded video without passing through the network and with passing through the MANET network, using AODVGA protocol. The average value of PSNR has decreased in initial frames due to passing through the network, but it has enhanced significantly from 50 to 299 frames in comparison to the main video.



**Fig. 6:** PSNR versus frame number, with & without passing through the MANET.

The data rate is yielded 36Mbits/s according the below equation:

$$\text{Data Rate} = (N * S * 8)/T \quad (2)$$

In which, T is the total data transfer time, S is the size of transferred packets and N is the summation of number of the nodes sense in the network.

#### *Conclusion:*

In video transmission, with CIF format and MPEG4 video standard coding, Packets delivery ratio (PDR) increased 13.27% in routing based on AODVGA compared to the AODV protocol. Also, in AODVGA delay, overload and missed nodes decreased 80%, 72.7% and 39.61%, respectively. In both routings, AODV & AODVGA, PSNR was about 37 decibel, which is a suitable value.

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