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Smart routing for Vehicle at optimal position with Ant Colony Optimization and AQRV in VANET

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Abstract

The Coimbatore is one of the leading tier two cities in India. Vehicles in this city are increasing day by day. The VANET is a self-organizing network between vehicles. There are so many interesting issues in VANET. So many routing protocols are already availing in the market. In this paper, we put forward an adaptive quality of service (QoS) based smart routing for VANETs with ant colony optimization algorithm find a smart route in Coimbatore city. This smart routing protocol is to adaptively choose the connections in the various available nodes, through which data packets clearance to reach the destination. The selected smart route should fulfill with the QoS constraints and satisfy the best QoS in terms of three metrics, namely connectivity, probability, packet delivery ratio and delay. The AQRV and Ant colony algorithm was simulated. The comparative result was studied at various optimal positions in the city.

Keywords: Smart route, RSR, Best route, Local QoS Models (LQM) of A Road Segment.

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1. Introduction

The VANET is one of the emerging technologies that are derivative of the MANET and WSN. [21]A MANET is a type of network that can alter positions and organize itself on the flutter. [22] A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. The VANET is used to communicate between the V2V. In VANET [14] the authentication is the one of the important process that takes place between the establishments of connection between V2V. [15] Road safety is the one of the great issue in modern world. Due to increase in number of vehicle in day to day life the accident also gets increased. The road safety can be done with the help of V2V communication. [16] Automatic emergency braking systems are included in safety applications. On the other side the traffic information system like direction changer, cooperative entertainment, toll service, Internet access falls under the Non-Safety applications. Vehicular ad hoc networks are a subdivision of mobile ad hoc networks (MANETs). The smart route finding is done by node movement and it is controlled by factors like road course, encircling traffic and traffic protocols. The smart route finding depends on both moving and stationary node that are associate for route finding. The immovable structure will be organized at important area like roads, service stations, dangerous intersections or places well-known like signals.

The VANET communicates by means of DSRC standard that employs the IEEE 802.11p standard for wireless communication. The smart route finding first we need to set the source and destination node (starting place to reaching place). smart route will identify the congestion level in the path where the destination is located. Based on the congestion level the vehicle will detect the alternate path for avoiding road traffic. Once the smart route is identified the vehicle will travel in particular path. The traffic level in the city is unpredictable. In case any unexpected things happen while travel. The traffic level in the travel will be predicted by using RSR and other vehicle movements. In this paper i found a smart path from particular location in the Coimbatore city and destination in the same city. The existing methods has given so many issues few of them are given. The QoS of route is not accurate. The routing exploration algorithms are not effective and adaptive. The routing selections are implemented by means of the incomplete or local QoS. The smart route finding along with AQRV and ACO had improved the overall QoS. It improves routing stability. It adaptively copes with topology changes. It decrease network overhead.

The algorithm which we developed will find out the no of signal points in that route, the path in which the vehicle will reach the destination. The travel path of the vehicle is first designed. The AQRV and ACO will used to find the optimized path for finding the traffic congestion from source to destination node.The main idea of VANET is to protect vehicle from road accidents. This can be achieved by smart rout finding.

2. System Architecture

The Figure 1 represents the path which we have selected to set the system architecture. Starting point is HOPE College a location in Coimbatore city and destination is Stanes School. There are totally 8 signals available from source to destination node. The system architecture is designed for three signals. The total distance from source to designation is 6 KM.

he time taken to travel is 25 to 30 minutes in normal traffic. The City traffic level is unexpected. In this paper we have predicted the five different levels of traffic. They are No traffic (NT), less traffic (LT), average traffic (AT), high traffic (HT), unpredictable traffic (UT). In NT and LT situations we use the vehicles movement to predict the traffic level in the city. During AT, HT and UT we used both vehicle movements and RSR (Road Side Receiver) for predicting the traffic level in the city. The RSR is designed to hold the movements of any car, bus, truck etc…. position in which it is waiting in particular location. It is

found that any break down vehicle is found if the RSR is still looking the same vehicle. The wrong waiting time will be sent to the smart vehicle. For the smart route is used to find the route form source to destination by every 3 to 5 minutes auto refreshing.

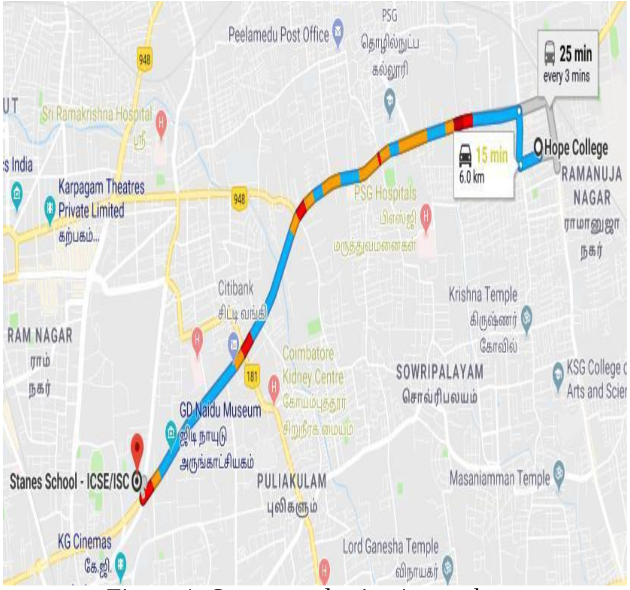

Figure 1: Source to destination path

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The Figure 2 shows the system architecture model with 3 signals working, The various positioning of RSR, Vehicle and signal location are clearly shown. Based on the NT, LT, AT, HT, UT the vehicles at each signal is approximately NT 30 vehicle, LT 100 vehicle, AT 250 vehicle, HT 1000 vehicle, UT more than 15000 vehicle.

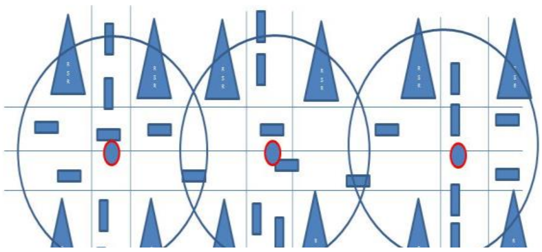

Figure 2: System architecture

3. Smart Route

The Coimbatore city consists of five major roads. In that we have taken path from HOPE College to Stanes School. The five major roads are shown in Figure 3.The initial path selection for smart route we planned is from the highways. It helps the vehicles those come from various parts of India to reach Coimbatore and also to know about the current traffic level in various location of their journey.

The smart route is simulated between HOPE COLLEGE (HO) to STANES SCHOOL (ST). In this simulation the distance between each RSR is about 250 meter. Total distance is 6 KM (HO to ST), therefore onside of the road consists of approximately 24 RSR is placed. The RSR stores the vehicles movement and sends the information to the requesting vehicle.

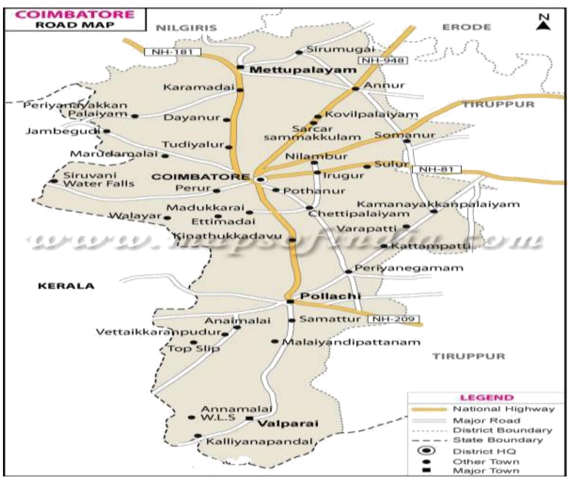

Figure 3: Coimbatore road map

The simulation is shown in Figure 4. In this we have specified total no of RSR nodes and where it's placed. The simulation is done in onside of the road.

We used (GPS) facility in each vehicle, digital map and navigation system, which provide the vehicles information (including vehicle speeds, moving direction and geographical positions), the positions of intersections and the length of road segments.

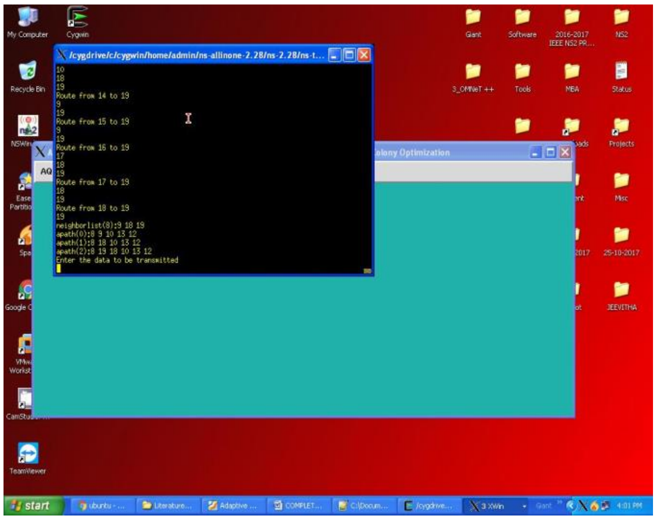

Figure 4: Smart route nodes

4. RSR Node Placement

The RSR node placement is the primary objective of Smart route finding in VANET. The Figure 5 shows the some of the RSR node placement in NS-2 for simulation. The distance between each RSR node is 250 meters therefore 1KM its four devices should be place. The total distance between HO to ST is 6KM.

- In common for1KM no of RSR required is 4
- N KM the RSR required is N*4

The connection between each RSR should be exchanged at certain point. It will be achieved with the help of direction in which the vehicles moves and the next RSR node located.

4.1 RSR Placement Algorithm

Step 1: Select Path (P)

Step 2: Get Distance (D)

Step 3: Assign 1Km= 4 RSR nodes, K=1000, T=250

Step 4: If (D==0)

Go to 2

Else

Repeat D<=0

Step 5: Node =D*K/T

Step 6: Got to 1

Figure 5: RSR node placement

5. Optimal Route Establishment

The ACO-based algorithm is an expert in addressing such as nonlinear optimization problems in multifaceted and lively systems.

5.1 Client Path

Once the smart route is fixed terminal intersections for destination ST are selected, respectively, HO firstly sends a routing request to RSR. If the routing information (agreeable with QoS requirements) towards HO to ST. The path will be set; else it will send a negative response to client. The RSR will receive the signals from all the vehicles.

Request form client is: R
Node placement: NP
Destination is: D
Client path: CP
The path from source to destination is the sum of path finding from one RSR to another.

CP= R+NP1+NP2…+D --- 1

Path from R to NP1 = IR, Path from NP1 to NP2 = I1………………..ID ---2

Using 1 and 2,

CP=IR+I1+…..+ID ---3

CP = $\sum$ I from (R to D) ---4

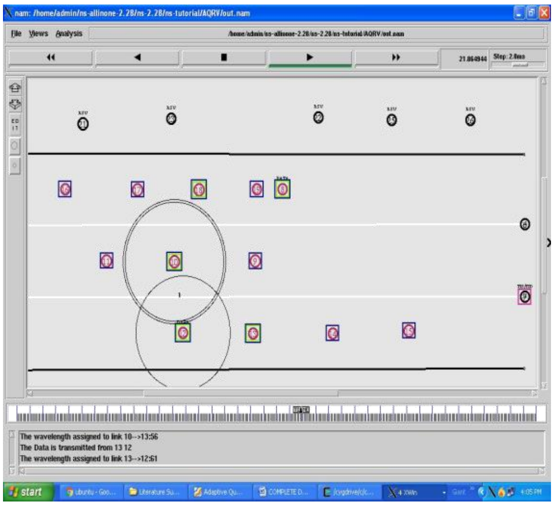

Figure 6: Client Path

5.2 Best Smart Route

With the help of reverse ANT colony optimization algorithm path from destination to source is again recalculate to find the best smart route. The Figure 7 shows the best smart route. The RSR node placements for the reverse calculation are given below

.

Request form client is: R
Node placement: NP
Destination is: D
Client path Reverse: RCP
The path from destination to source is the sum of path finding from one RSR to another.

RCP= D+NP1+NP2…+R ---- 5

Path from D to NPN = ID, Path from NPN-1 = NPN-1 to NPN-2 = I1………………..IR ---- 6

Using 1 and 2,

CP=ID+I1+…..+IR ----7

CP = $\sum$ I from (D to R) ----8

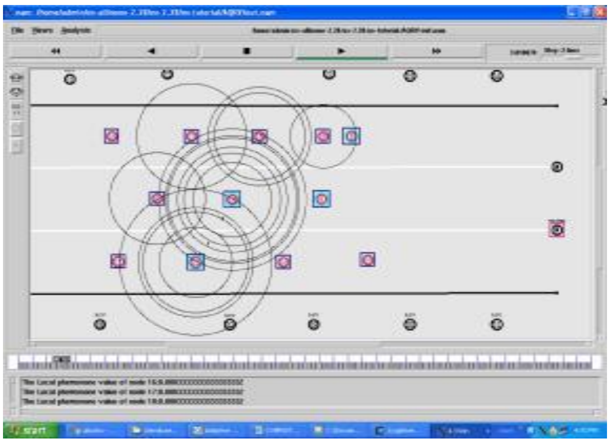

Figure 7: Best smart route

6. Local QoS Models (LQM) of a Road Segment

We propose the local QoS models for 1-lane road segment scenarios, and these models play an important role in routing selections for urban environments. We choose connectivity, packet delivery ratio and delay to evaluate the QoS of road segments, as these metrics are closely related to the communication parameters such as wireless channel fading effects, communication ranges, road segment length, vehicle densities, distributions and so on, all of which reflect the almost complete traffic conditions of road segments. Note that these three metrics may be antagonistic in different VANET scenarios. For example, the ascending vehicle density is advantageous to the link connectivity improvement and delay reduction, but may aggravate end-to-end packet delivery ratio due to more influences from channel fading and interferences. To this end, we propose mathematical models for connectivity probability, packet delivery ratio and delay, respectively, so as to evaluate the comprehensive and real-time local QoS of 1-lane road segments.

7. Simulation Results and Analysis

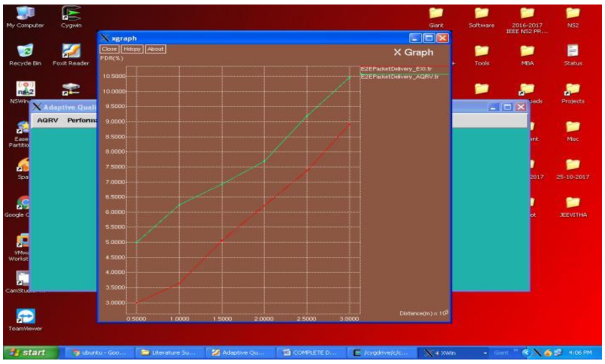

Figure 8: Connectivity

The Figure 8 shows connectivity between the RSR nodes and vehicles. The X graph shows the improved connection between the various vehicle and RSR. The Figure 9 with X graph shows the improved portability of the system.

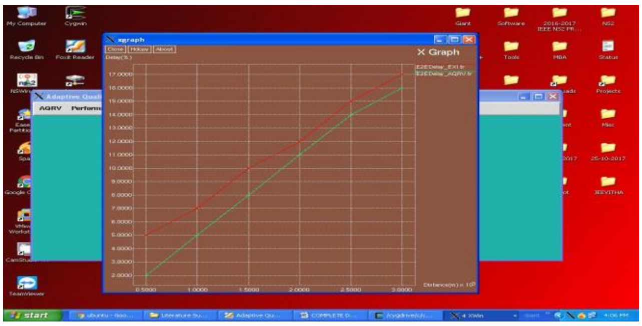

Figure 9: Probability

The Figure 10 shows the reduction in time delay and packet delivery ratio.

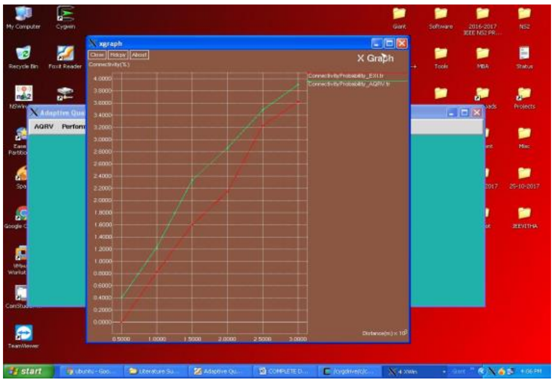

Figure 10: Packet Delivery Ratio and Delay

8. Conclusion

In this paper, we have proposed smart route for vehicles in Coimbatore city. We used ACO Optimization and AQRV in VANET for achieving the best smart route with best connectivity between the RSR nodes and vehicles, the portability of the smart route is increased. The packet delivery ratio and delay is reduced while find the best for the city. In future we will expand this work by finding current the pollution level in city, will it be maintained for next few decades with smart route finding.

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