ACCIDENT RECOVERY USING VEHICULAR AD HOC NETWORK

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Abstract: *Now-a-days the mobility of the population increases, so there is an increase of large number of vehicles in the roads. Therefore it is an urgent need to manage the road traffic and the accidents. By the consequences of this has been a congestion of traffic, enormous accident and pollution. Accidents are the major cause of the death despite of having the sophisticated system. Hence the necessary system for managing the accident should be developed .But managing the accident is not sufficient there should be some mechanisms which help to recover the people from that accident in an optimal manner. And also designing an efficient route planning algorithm which will be accepted by globally is still a challenge. The objective of this paper is to establish an accident recovery system which makes use of vehicular ad hoc networks coupled with systems that employ cellular technology in transport vehicle. This system ensures the possibility of communication among vehicles, ambulances, hospitals, roadside units, and central servers. The amount of time required to alert the ambulance vehicle to reach the accident zone is reduced by using multihop forwarding algorithm. Moreover to reduce the incidence of vehicles being stuck on congested roads an optimal route planning algorithm is proposed. Simulations were performed on the ns2 simulator and the results were observed. Finally this system makes the ambulance to reach the accident vehicle quickly so the chance of living is increased.*

Keywords: *multihop forwarding, optimal route planning.*

1. Introduction

By the emerging concept of smart city, seek of new technology proposals and initiatives was increased to make the cities smarter. By the fact in Europe, the European Commission has established the European Initiative on Smart Cities in 2010. This makes to address the four important elements of our daily aspects in daily life: climate, building, electricity and transport. One of the main aspects of the smart city is the transport. This lead to the issue of increasing levels of road accident which is due to the increase no of vehicles .It has been proven that road accident are the one of the main cause of more than 100 deaths that was reported in united States.

And the fact states that in most of the countries in the world a major cause of accidents is poor infrastructure for managing traffic. The concept of traffic management systems refers to intelligent public transport mechanism that helps the drivers to avoid congested areas and increase safety. In the previous few years, researchers have taken advantage of the progress made in wireless sensing technology to makes this traffic management systems more effective.

Traffic congestion, as one of the major problems, has been given increasing attention. A critical results of the traffic congestion there is a delay in the arrival of emergency vehicle such as ambulance, fire services etc. because this is situation where general public depends on the arrival of these public vehicle to reach an accident zone in an efficient and shortest time. Intelligent transportation systems (ITSs) cannot yet been able to resolve the challenge of traffic congestion. There also expensive technologies but cannot able to capacity to respond with speed when there is an emergency resulting from a road accident. Therefore, it is necessary that these emergency services should be equipped with a system that can enhance the adaptability of route planning in order to collect information more efficiently to avoid traffic congestion.

The emerging vehicular ad-hoc networks (VANETs) are often used on ITS system with communication capabilities to get real-time traffic information more efficiently. vehicle-to-road side unit (V2R) and vehicle-to-vehicle communications were supported by the VANET. So the updated information can be transmitted from and to the vehicle and road side units (RSU unit). This information can be used in route planning algorithm, after collecting the information most efficient routes can be discovered .The design of the algorithm should be able to reduce the cost of running the vehicle and the network traffic.

The major contributions of the paper are listed as follows:

1) This system uses a multihop optimal forwarding algorithm which provides the optimal route between the sources (accident vehicle) and the destination (ambulance). So that the amount of time required to alert an ambulance that it is required at an accident zone can be reduced.

2) The optimal route planning algorithm was proposed which provides the optimal route algorithm from ambulance to accident vehicle and then to hospital. The proposed algorithm employs VANET communication so that vehicles can reduce the challenge of congestion.

Remainder of this paper is organized as follows. Section 2 of this paper discuss about related works on route planning, while Section 3 discusses the system model. Section 4 of the paper represents the traffic routing algorithms, while Section 5 gives a demonstration of the performance evaluation. The conclusion of the paper flows at Section 6.

2. Related Works

Due to the unbalanced flow of traffic there are many consequences. Route navigation and planning can reduce the challenges linked to traffic congestion [1]. The shortest-route based GPS navigation, advance route reservation, and accident duration prediction are some of the methods which are used manage and plan vehicle routes [9]. These methods lack a timely update capacity to deliver information on traffic conditions so they cannot give the accurate updates [9].

While collecting time varying traffic condition data ITS used Loop directors and cellular systems. They crash due to added congestion when too much data is transmitted through such networks [3]. Loop detectors were expensive to use. While using in short distance transmission, in accurate position in networks may cause the networks to degrade its performance [5].

VANETsV2RandV2Vmethodsofcommunicationmakes the delivery of real-time messages much quicker, more efficient, and cost-effective when compared to traditional methods, even in shorter distances and networks that are thick [2]. Many works regarding the multivehicle route planning is considers but they do not pay attention to the drivers nor the average cost of travelling [10].

Hence in this paper, a route planning algorithm is used which is optimal to assist vehicles to avoid traffic congestion as a result of accidents in urban areas.

3. System Model and Architecture

In this Section introduce about the system model and its architecture.

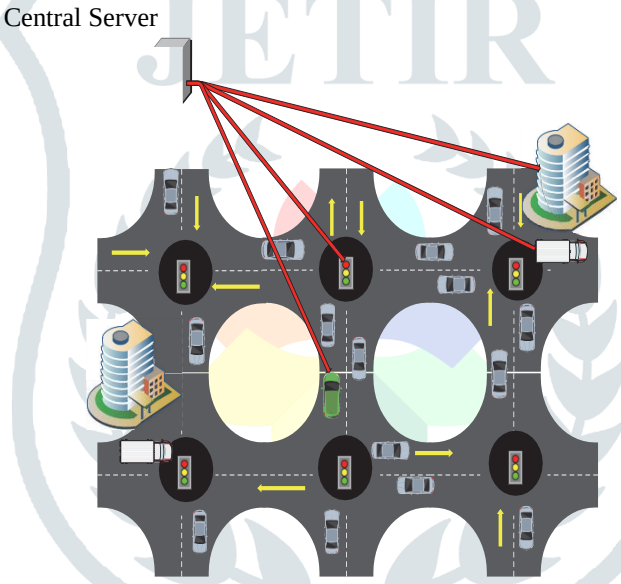

Figure 1: Model of accident recovery system

3.1 System Model

In urban environment a vehicular network consider to be intersection and their roads. Every node consider of two lanes in which the vehicles move in the opposite direction as in Figure 1.

The system consists of vehicles, ambulance, RSU unit and Hospitals. We make our Assumption that all the vehicles and ambulance have the capacity to use wireless communication. Within each ambulance and vehicles incorporates the digital map that contain the knowledge about the locations of the neighboring vehicles in terms of generalization we also make the assumptions that all vehicles have the range of transmission.

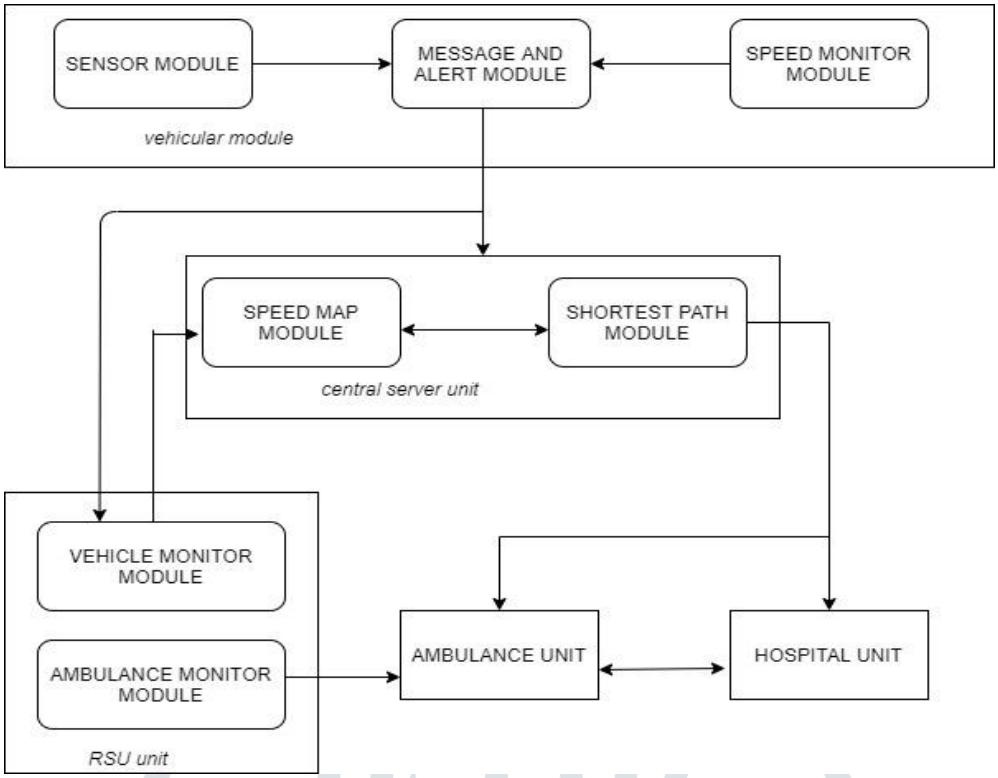

Figure 2: System architecture

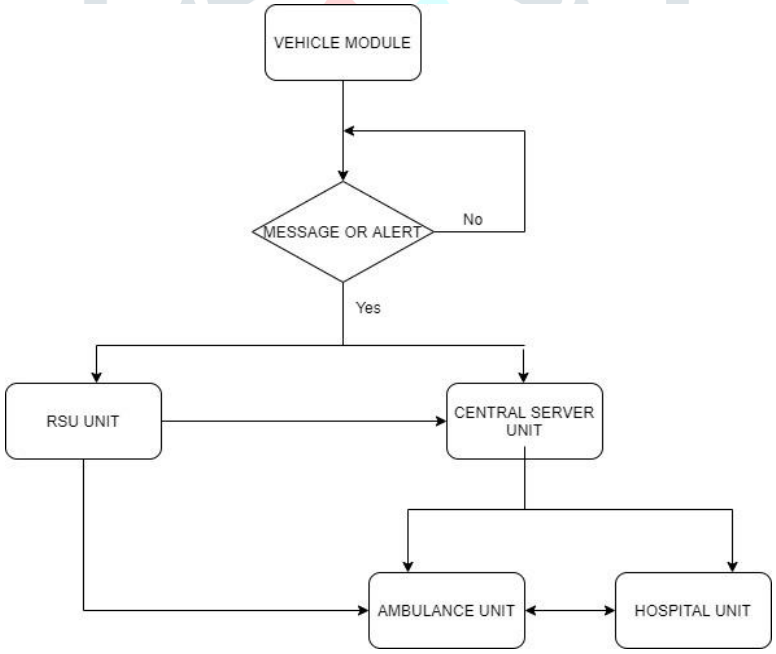

Figure 3: Flowchart

3.2 System Architecture

This system consists of five units: Vehicular, central server, RSU unit, ambulance and hospital.

3.2.1 Vehicular Unit

The vehicular unit is to manage the overall activities of the vehicles, detection of accidents and also maintaining communication with other units, each vehicular unit consists of three modules.

1) Sensor module: The monitoring and controlling of different sensors attached to vehicle is done by the sensor module. This system uses two kinds of sensors: biomedical sensors and vehicle sensors. Biomedical sensors are used to detect individual hart rate, temperature and pressure, whereas vehicle sensors monitor acceleration, vibration and the deployment of the air bag. Both sensors have strength and weakness in order to reduce these challenges These sensors can be used simultaneously all the readings are provided by the sensors are measured and delivered to the local processor in the vehicle unit. The processor is to check the reading of the sensor against the threshold

value, once any abnormal value is detected from both the biomedical sensors and the vehicular sensor, then the accident is confirmed by the processor, then the information about the accident is then send to the alert module by the local processor and also that local processor obtains the information regarding the location of the on board GPS.

2) Speed monitor module: The travelling sped and the average speed of the vehicle is recorded in this module and this message is transmitted to the message alert module.

3) Message and alert module: The communication among RSU unit, central server unit and ambulance. It gets information about the travelling speed and average speed of the vehicle from the speed monitor module and then it is transmitted to the RSU unit.

3.2.2 Central Server Unit

The central server unit has the connections to all the entity units. This unit manages the traffics It consists of two modules:

1) **Speed map module:** It creates the roadmap by using the average speed of the vehicles.

2) **Optimal path module**: It is used to compute

3) The best path that an ambulance can reach the accident vehicle and to reach the hospital.

3.2.3 RSU Unit

This unit is used to manage and monitor the traffic and also consists of two modules.

1) **Vehicle monitor module**: It collects the average speed of the vehicles in the adjacent section of the road.

2) **Ambulance monitor module**: It is used for tracking the ambulance in order to reduce the time an ambulance has to wait. Each road segment assigned with a distinct road id. And all this information is sent to the central server unit.

3.2.4 Ambulance unit:

The accident information and the optimal route information are provided by the vehicular unit and the central server unit. By using this information and the GPS the ambulance selects the best route. While travelling ambulance sends an alert message containing two fields the current and next road id to the RSU unit and its sets traffic light to allow the ambulance to go.

3.2.5 Hospital Unit:

The connection is between hospital, ambulance and the central server unit. From the ambulance the health updates about that situation are transmitted to the hospital so that the treatment can be started soon. Since the location of the ambulance is updated the hospital can estimate at which time the patient will reach the hospital.

4. Proposed Traffic Routing Algorithms

Traffic routing algorithms consists of two proposed algorithms. The multihop Optimal Forwarding algorithm and Optimal route planning algorithm.

4.1 Multihop Optimal Forwarding Algorithm

This algorithm is based on V2V communication and it gets details about how the source vehicle identifies the optimal route to attain its destination vehicle (ambulance).

The source sends a packet to its nearest ambulance in case of accident. From all intersections with both destinations the accident vehicle selects the destination whose path length is short. Based on this criteria it ensure connectivity the accident vehicle choose the path. The accident vehicle keeps on forwarding the vehicle to the next candidate vehicle. This process that continues until the packet reaches its destination. It not only provides fast progress but also minimal traffic in the network.

4.2 Optimal Route Planning Algorithm

The optimal route planning algorithm is to provide the optimal route from the ambulance to the accident vehicle and then to the hospital to avoid the traffic congestion and to reduce the average cost of travelling.

It has been seen that each vehicle planned a route from its journey where it started and where it terminated. And the route is also depends on based on the choice of the driver. The driver is also need to follow the same route until there is an alert stating that there is congestion. Once the accident or congestion occurs the central server is responsible for selecting the optimal route for an ambulance.

The optimal route planning algorithm is used to manage the avoidance of congestion and to reduce the cost of travelling. At the moment the central server gets the intimation of the accident warning message through VANET and RSU unit by the aim of reducing the cost of travelling and improving the spatial utility the optimal route planning algorithm will be computed.

5. Performance Evaluation

In order to execute these scenarios the Ns2 simulation environment is taken. The nodes were created and the communication between the vehicles and ambulance and the hospital nodes were established.

Figure 4: Implementation that shows the formation of the ad-hoc network and all other modules

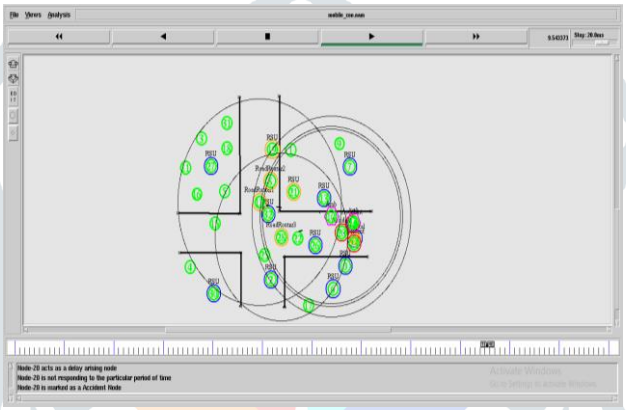

Figure 5: Implementation that shows the ambulance reaching the hospital.

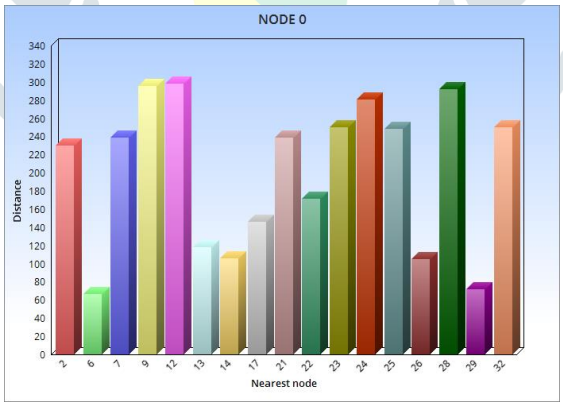

Figure 6: Graph that shows the distance calculated between node 0 and it nearest nodes

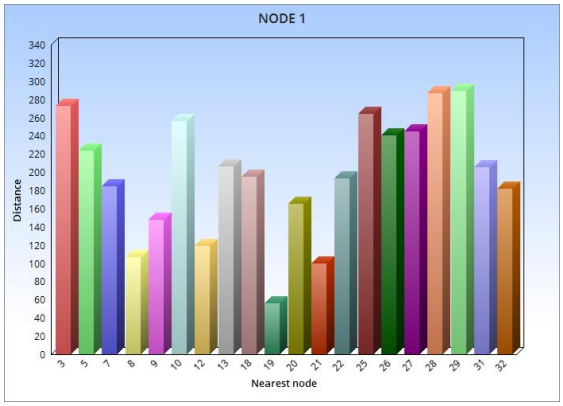

Figure 7: Graph that shows the distance calculated between node 1 and it nearest nodes.

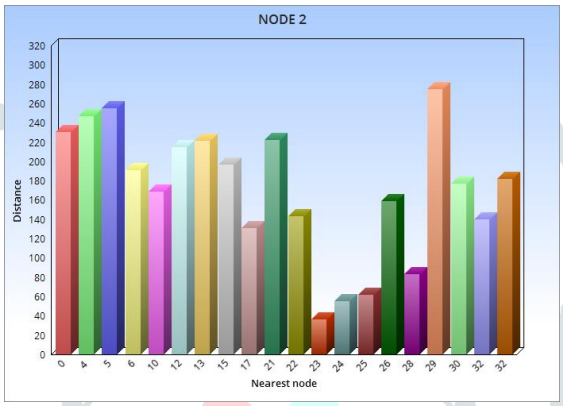

Figure 8: Graph that shows the distance calculated between node 2 and it nearest nodes.

6. Conclusion

Our system is mainly useful on NH roads where the accident recovery is tedious. This system can be implemented on real time upcoming emerging technologically developed internet vehicle, for example MG Hector Cars, where it is made up of inbuilt of internet connection. Finally in the future the upcoming vehicle technology is 5G technology vehicles our system makes it easier for the ambulance to quickly make their way through traffic congestion so that the chance of saving the lives is increased.

7. Data Availability

There is no data set available related to our work.

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