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# An Efficient Route Selection based on AODV Algorithm for VANET

**Nassir Sallom Kadhim[1], Muamer N. Mohammed[2*], Mazlina Abdul Majid[1], Sinan Q. Mohamd[1] and Hai Tao[1]**

[1]Faculty of Computer Systems and Software Engineering, University Malaysia Pahang, Kuantan - 26300, Pahang, Malaysia; nassal2005@gmail.com, mazlina@ump.edu.my, sinan_sn@outlook.com, haitao@ump.edu.my
[2]IBM Center of Excellence, University Malaysia Pahang, Kuantan - 26300, Pahang, Malaysia; muamer@ump.edu.my,

## Abstract

Road safety is an all-time global concern. Every day a large number of human lives are lost with many sustaining a disability as a result of their injury due to car accidents and delay in calling the rescue services. Recently, Intelligent Transportation Systems (ITS) have emerged as an efficient way of improving interpretation of transportation systems and enhancing travel safety. Accident detection systems are one of the most effective (ITS) tools. The accident detection system which based on Global Positioning System (GPS) and Global System for Mobile communication (GSM) can be accomplished though one or several sensors, the system can gather the information and coordinates of accident spot, then send this data to the rescue services center over a network link in the shortest time, In this paper, we propose an enhanced system that composed of a GPS receiver, Vibration sensor, GSM Modem and integrated with Vehicular AD-Hoc Network (VANET). The employment of (VANET) assists to increase the data delivery by providing a second path to send an emergency message to The Rescue Services Center (RSC) whenever an accident located at out of coverage area of GSM network. Simulation tested two of distance ranges among nodes (Long & Short) and the result shown that VANET modified algorithm based on average signal strength has the advantage of choosing the optimum route to deliver data and own enhanced ratio according to the distances (17.5% & 24.1%) by comparing with a maximum signal strength route.

**Keywords:** AODV, Global Positioning System, Global System for Mobile, VANET

## 1. Introduction

With the rapid economic development and general people living improvement, the utilization of vehicle is increasing hurriedly. Therefore, it is frequent for road traffic accident to take place. And it results in the lives and property of the people and nations. Indeed, governments and nations have noticed their interest in the road traffic is intense. With the occurring traffic, it can cause unimaginable consequences if there is not ability for the wounded people to present helping weft to the outside. The malignant emergency traffic incident is one of main reasons for death rate and the huge amount of traffic fatalities.

During the past decade, there is a large number of sociological and technological advancements and improvements to try to have reduce traffic fatalities. These novelties included the usage seat belt rate increases 1% while occupant fatalities rate can be reduced around 0.13%[1]. Moreover, there is the large difference for their survival rate that an injured crash victim does receive urgent medical attention and assistance each minute or not. It is shown that, in the practical analysis, one minute overtime of medical aid correlates 6% distinguish number of lives lost[2].

Therefore, for reducing traffic fatalities, there is an effective approach to response the first accident happening while medical professionals and works are sent to the accident scene on mission. There is an accident detection system which is embedded by professional sensors inside cars. The activated accident detection system can send emergency medical professionals and works on mission

* *Author for correspondence*

immediately while serious accidents have occurred. In this paper, we discussed the technologies which use in the proposed system; GPS and GSM cooperate with VANET. In addition, we studied in the related work and research papers the steps are being taken into consider the effective way to minimize the loss of life's and property despite of poor emergency facilities. We gave a brief analysis of these research papers taking into consideration some of the weaknesses. Then we explained the proposed system which based on three technologies and processing capabilities can be applied to solve the challenges of traffic accidents detection and deliver the emergency message in a short time.

## 2. Background

Nowadays, GSM and GPS technologies are applied to most vehicle detecting and tracking systems. As an important feature, the Short Messaging Service (SMS) function is embedded in all mobile phones which can be used by two users' communication with send a small amount of text. In addition, the GPS technology is a network that constitutes 24 satellites in 6 dissimilar setting 12-hour orbital paths in order to track vehicle current location and direction in the whole of world at least five of them. There are very wide applications for the GPS technology such as law enforcement, emergency response, surveying, exploration, recreation, tracking package delivery, satellite data processing, mobile commerce, roadside assistance, wildlife tracking, search and rescue, stolen vehicle recovery and resource management[3-6].

### 2.1 Vehicle Tracking System

The vehicle tracking system is designed with the combination of the installed electronic equipment in a fleet of vehicles, or a carrier with an embedded operating system which is computer software. In the designation of this software, there is an important function to basically allow a third party or the vehicle owner for tracking the position of vehicles, collecting data information of fields and communicate with the base of operation. The modern GPS technology of vehicle tracking systems locates the vehicle for typical applications. Additionally, on an electronic map, vehicle Information can be browsed and viewed with specialized software or the Internet.

Furthermore, it is also salable for vehicle tracking systems to consume vehicles as a retrieval device or a theft protection approach. For example, these systems can assist for policemen to track and find stolen vehicles with picking up simply the system signal. Another vehicle tracking system case is the replacement or extension of the traditional car alarm. It is possible for some vehicle tracking systems to remotely control vehicles such as block engine, glasses or doors in emergency cases. The existing vehicle tracking devices can be applied for reducing the insurance cost[3].

### 2.2 VANET Overview

VANET can be considered as a wireless network. In this network, each node (vehicle), mounted by a wireless link, communicates each other[7]. In VANET, Each node can be considered as not only the candidate of the network but also the router, which nodes can communicate with other intermediate node with covering their own communication ranges. In addition, VANET can be considered as a self-organizing network which is independent of any fixed network infrastructures. Although, in Figure 1, roadside units are applied for some fixed nodes which facilitate a gateway to internet or the service of geographic data[8]. The key features of VANET can be described as quick and speed movement pattern as well as high node mobility. These rapid change characteristics produce the network topology[9]. Furthermore, VANET can be considered as a special type of MANET where vehicles play a role of nodes. Distinguishing MANET characteristics, vehicles run along with presetting roads and the speed of the vehicle relies on velocity signs, as well as traffic signals and traffic signs should be observed these vehicles[10].

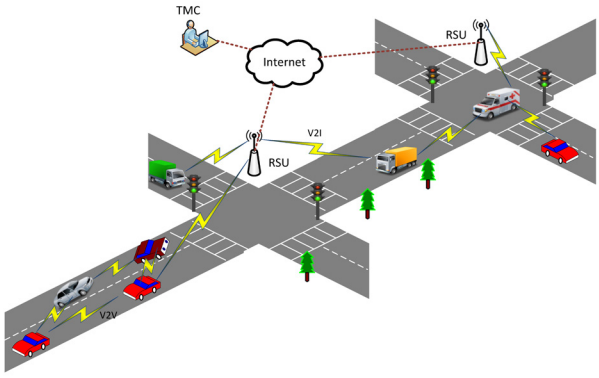


**Figure 1.** Infrastructure Application of VANET[11].

However, in order obtain reliable VANET services; it is necessary for solving a number of challenges. One of

the main issues is reliable and stable routing in VANET. Therefore, it is urgent for researches to make VANET more reliable and applicable. The high speed, dynamic behavior and rapid mobility formulate routing even more complexity[11]. The traditional MANET protocols construct VANET routing protocols in the early time such as DSR (Dynamic Source Routing) and AODV (Ad-hoc on Demand Distance Vector Routing). The DSR and AODV technologies are effective for Multi hop wireless ad hoc networks[12]. In VANET, it becomes more efficient and reliable for various proposed routing protocols.

## 2.3 Routing in VANET

Within the past few decades, the routing protocols of VANET have been extensively analyzed. The reason can be considered as its special type of ad-hoc network while the key difference between VANET and MANET is high speed movement pattern and suddenly dynamic network topology. Commonly, VANET routing protocols can be categorized into dissimilar classification according to the route update methods and their position accusation listed by Figure 2[13,14].

- Position Based Routing Protocol
- Broadcast Based Routing Protocol
- Topology Based Routing Protocol
- Geo Cast Based Routing Protocol
- Cluster Based Routing Protocol

Practically most of tracking system and the accident detection system depends on GSM and GPS technologies. The use of VANET with enhancement of routing protocol helps emergency services in finding the accident spot in a short time within a large margin the arrival of emergency message by providing a redundant path to send an emergency message.

Various automatic incident detection algorithms were proposed to respond to and detect traffic incidents as soon as possible for many traffic management systems. In the same time, lots of publications and manuscripts have explored automatic incident detection algorithms by using GSM/GPS technologies, and the other researchers focus on enhance of VANET routing protocol based on several algorithms. In the existing researches, the related publications concentrated on seeking more efficient and reliable algorithms for automated accident detection technologies to deliver emergency data and VANET routing protocol enhancement[15,16].

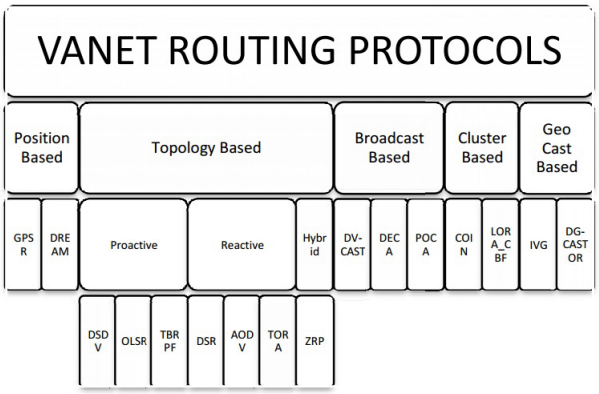


**Figure 2.** Routing protocol hierarchy.

[17]Proposed a prototype Come Safety, the main goal is to develop a Europe's set of standards to maintain a wide range of deployments and implementation for the collaboration of Intelligent Transportation Systems (ITS) deployments. In addition, its purpose is to coordinate activities to achieve road cooperation systems in Europe, and to focus on all aspects of vehicle-to-infrastructure (V2I) and vehicle and vehicle (V2V) communications. In India, these techniques are not prevalent, and so they are presented in this system[18] presented an Embedded GSM Interface for Automatic Accident Alert and Safety Systems, which is conceived to be automatic collision detection and early warning system that relies on GPS modules and GSM modems. It is safeguarded that vehicles are equipped with the system which the robustness ensures good mechanicals matching to the entire chassis. In the case of occurring accidents, the systems are able to detect it while vehicles will decelerate suddenly under such conditions. The acceleration of vehicles can be constantly monitored by an accelerometer which will track and detect the deceleration greater than presetting thresholds and deliver information to a microcontroller by an ADC. The comparison results between this value and threshold will be obtained by the controller and deliver immediately an information message to presetting numbers. By using this information, the controller will transmit the GPS coordinates of vehicles which can be received continuously by GPS module. Once occurring a traffic accident, this system will supply highly help for explore and rescue team. In[19] produced an effective model of messaging system and automatic vehicle accident detection by a GSM and GPS and modems. The purpose of this paper can be described that it tracks a vehicle

accident site with receiving a message via embedded within vehicle systems. The key function of the proposed system can be described as providing security ways with a very reasonable price to the vehicle. The biggest advantage of this system is that, without any delay, once sensors are activated, the acknowledgement can be obtained immediately from GSM modems to the mobile number stored in EEPROM. It is accurate for this system to locate the accident spot and then it realizes automotive accident detection and messaging systems[20].

## 3. Proposed Work

Accident detection system mainly focuses on exploring safety. Earlier systems lack safety assurance systems so that there will be no intimation about the accident and there will be no rescue systems to safeguard the people on the occurrence of an accident. Most Accident detection systems based on GPS and GSM technology to send the emergency messages to the rescue service center as shown in Figure 3.

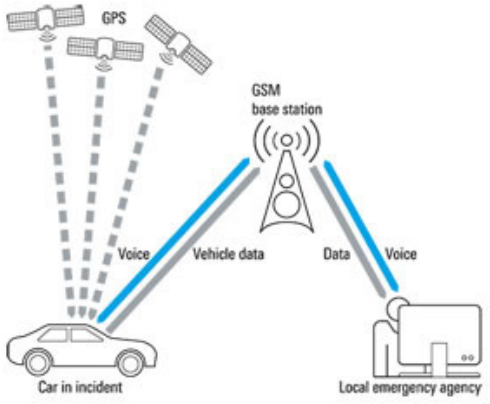


**Figure 3.** GPS, GSM Accident Detection[20].

Over the roads in the world, there are many areas have poor GSM network coverage, also inside the longest tunnel. Add to that the GSM network problem like the hand-off problem and so on. Thus, this work proposes a solution depend on providing a second path to deliver emergency messages in case of an accident happen in out of the GSM network coverage area. The suggested system achieves that by the adoption of enhanced routing method in VANET The selection of a path between the sources to the destination been through choosing a link have more stability than others across intermediate nodes. More stability paths can be selected through a measurement of signal strength (RSSI) among nodes and calculate the average values, any node have signal strength equal or close to the average values will be selected in the data send route. The advantage of this scheme is to optimize the lifetime of the network and meet the goal of this ADS system by sending emergency messages in the shortest time and guarantee the arriving to (RSC).

Consequently, high interference could occur thus affect link communication quality. The main difference in AODV-RASS is the RREQ message than standard AODV; the Header part includes the RSSI Value. Proposed Route Request message option format is constructed by adding the "Signal Strength" of the Node. The source, either communicates directly to the neighbor nodes that are in radio range of each other, without need the help of intermediate nodes to route the packets to the destination, or broadcast the RREQ check the vicinity of the adjacent nodes to know the RSSI. Subsequently, the source will start to calculate the average RSSI node by summation all RSSI values of the neighbors, then divided it on the neighbor's number to find the average value, then compare the result with each RSSI number which is stored in the buffer to check which node have equal or closest to the average RSSI to select it as a next hop node. The same process will continue among the intermediate nodes until a message arrives to the destination as shown in Figure 4.

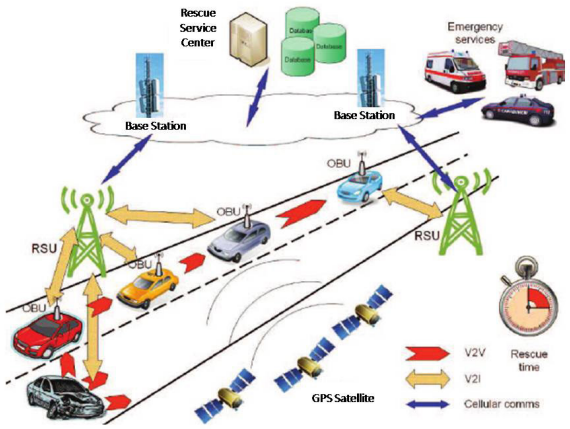


**Figure 4.** VANET use to send the emergency message in out of GSM Network Coverage area[20].

## 4. Simulation Result

The proposed algorithm has been simulated in Visual

Basic.Net. We have compared its performance with Maximum signal strength Algorithm. The simulated wireless VANET network includes 4 topology scenarios (5, 10, 15, and 20) nodes. The tested paths which have been selected are from source to destination (for example: in 20 node scenario the source node number's is 0 and the destination node number's is 19), because the aim of the proposed work is to send emergency message from the accident spot to the nearest RSU or base station beside the road then to the Rescue Services Center. Simulation examine two distributed ranges among node (short and long distance), After obtaining these results based on number of nodes which represents the path form the source to the destination, the Comparison between proposed algorithm based on average RSSI and Maximum RSSI paths have been made as shown below in Table 1 for the short distance and Table 2 for long distance.

The optimized node from the source to the destination has been reduced when implement the proposed algorithm (Average RSSI) by comparing with maximum signal strength algorithm accordingly, The overall average of enhancement ratio shown in Table 3 and Table 4 below.

**Table 1.** Comparison Between Average RSSI and Max. RSSI (Short Distance)

| Number of Nodes | Path to Destination Average RSSI | Path to Destination Max. RSSI | No. of Nodes Discarded |
|---|---|---|---|
| 5 | 3 | 4 | 1 |
| 10 | 4 | 7 | 3 |
| 15 | 6 | 10 | 4 |
| 20 | 7 | 11 | 4 |

**Table 2.** Comparison Between Average RSSI and Max. RSSI (Long Distance)

| Number of Nodes | Path to Destination Average RSSI | Path to Destination Max. RSSI | No. of Nodes Discarded |
|---|---|---|---|
| 5 | 3 | 4 | 1 |
| 10 | 4 | 6 | 2 |
| 15 | 6 | 9 | 3 |
| 20 | 8 | 10 | 2 |

**Table 3.** Overall enhancement Ratio (Short Distance)

| Different in Percentage | Enhanced Percentage | Overall Average of Enhancement |
|---|---|---|
| (40-20)% | 20% | 24.1% |
| (60-30)% | 30% | |
| (60-33.3)% | 26.7% | |
| (65-45)% | 20% | |

**Table 4.** Overall enhancement Ratio (Long Distance)

| Different in Percentage | Enhanced Percentage | Overall Average of Enhancement |
|---|---|---|
| (40-20)% | 20% | 17.5% |
| (60-40)% | 20% | |
| (60-40)% | 20% | |
| (60-50)% | 10% | |

The proposed VANET routing protocol algorithm (RASS-AODV) is taken to improve the quality of the data transmission and to reduce the Link Failure (LF) .It obtains a reliable link in routing because the nodes in the selected path have average signal strength and optimum life time in the accident scenarios.

With a specific simulated performance metric, the End - End delay value is directly proportional to the number of nodes, when the nodes increase in the path, the delay also increases. The average path optimizes the number of nodes which is selected from source to destination, therefore the delay will also optimize .So it can be concluded that (RASS-AODV) is well suited in the Accident traffic scenarios.

The curve scheme which is shown in Figure 5, 6 embodies the relationship between the probability of vehicle density change and the end-to-end delay for proposed algorithm and the maximum RSSI algorithm.

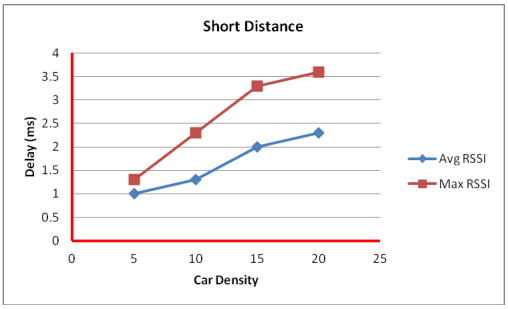


**Figure 5.** Car Density VS End – End Delay (Shot Distance).

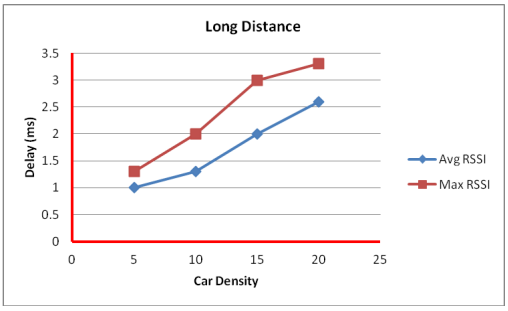


**Figure 6.** Car Density VS End – End Delay (Long Distance).

## 5 Conclusion

As the concluding part of this paper, it can be said that "Without proper action at proper time, danger awaits us with a bigger face." The medical professionals must respond immediately when people are injured. The principle of people-oriented way is very important. Otherwise, the vigor and vitality lives might be evaporated. It should be understood that lives are precious and first-aid carries are important for saving these precious lives. This research indeed is importantly helpful for common people. In whole over the world, it is the common scene for road accidents. Sometimes, traffic accidents occur far from the emergency center, which is the important reason for increasing the risk of deaths. Therefore, the accident detection system can supply the effective way to decrease the risk of deaths to a large extent. This system based on (GPS, GPS and VANET) is more reliable for the fact of accuracy for detect an accident spot and informs the rescue services center by providing two routes to deliver emergency message. From the Simulation experimental analysis, it can emphasize that the proposed algorithm RASS is very suitable to be used in the car accident scenario when the car becomes close to each other after the accident happens.

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