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Efficient Detection of Relative Position for Multicasting of Warning Messages in VANET

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ABSTRACT: The Global Positioning System (GPS) is a space-based global navigation satellite system (GNSS) that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites. The Global Positioning System (GPS) is actually a constellation of 27 Earth-orbiting satellites (24 in operation and three extras in case one fails). In VANET, this location information is shared with the Roadside Units and the vehicles to determine accident affected vehicle and to send alert packets to these vehicles. Generally, in VANET, broadcasting scenario can be seen, which is not required as all the vehicles in the network are not affected when emergency event occurs. Instead, multicasting of alert packets is more useful. Therefore, in this paper proposed system is used to design and develop vehicle node having travelling direction and the location information. This node will work as a road side unit and it will manage all vehicles location information and also manage detection of failure node in the network. Once the failure node is detected it will calculate the relative position of other vehicle and multicast the messages to particular vehicle.

KEYWORDS: Global positioning system (GPS), Road Side Units (RSU's), Safety Applications.

1 INTRODUCTION

The development and wide utilization of wireless communication technologies have transformed human lives by providing the most convenience and flexibility ever in accessing Internet services and various applications. Lately, researchers conceptualized the idea of communicating vehicles, giving rise to vehicular ad hoc networks (VANETs), which are the main focus of engineers who yearn to turn cars into intelligent machines that communicate for safety and comfort purposes. A VANET is composed of vehicles that are equipped with wireless communication devices, positioning systems, and digital maps [23]. VANETs allow vehicles to connect to roadside units (RSUs), which may be interconnected with each other through a high-capacity mesh network. Current research trends for VANETs focused on developing applications that can be grouped into the following two classes: 1) improving the safety level on the road and 2) providing. The last decade has witnessed a rising interest in vehicular networks and their numerous applications. Although the primary purpose of VANET standards is to enable communication-based automotive safety applications, they allow for a range of comfort applications. Many services could be provided by exploiting RSUs as delegates to obtain data on the user's behalf. These services span many fields, from office on-wheels to entertainment, downloading files, reading e-mail while on the move, and chatting within social networks.

Due to lack of real time implementation one cannot understand the real problems and the real time scenario issues. In VANET, V-2-V is most demanded scenarios for communication but with who to communicate is the issue. As, in VANET, information sharing is the most important point but it's still a problem to define who is the exact message receiver. Human can decide to send message to particular person after looking toward its position, but machine cannot do this. Many interesting application is provided by VANET but the primary goal of VANET is to provide transportation efficiency and road safety measures where information about vehicle current speed location co-ordinates are exchanged with or without the deployment of road side infrastructure.

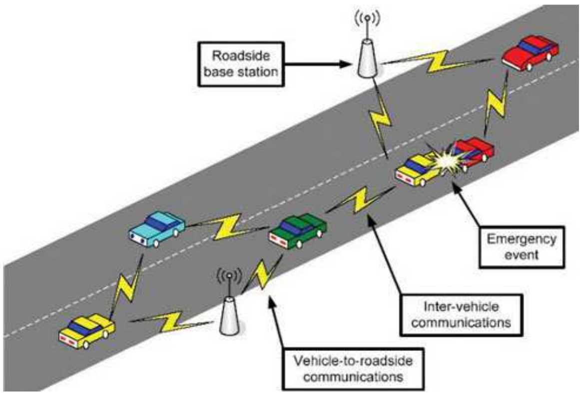


Fig. 1.1 Communication in VANET (V2V and V2I)

As shown in fig.1 Communication in VANET can be seen. In this communication takes place in two ways. Firstly, when emergency event occurs, Roadside base station will communicate with vehicles to send alert packets. Secondly, vehicles will communicate with other to exchange alert packets.

Data exchange in VANET is a challenging task as the topology is highly dynamic and constantly changing. The nodes in VANET are highly mobile and consequently network is frequently fragmented. When the emergency event occurs i.e. car accident or emergency breaking early alert message is given to the drivers which are behind it. The vehicle drivers who receive this message have enough time to react to the emergency situation because the wireless propagation delay is significantly smaller than the cumulative driver reaction. Vehicles which receive this early alert message have plenty of time to react to the situation and number of vehicle collision can be potentially reduced.

VEHICULAR ad hoc networks (VANETs) promise great enhancement to traffic safety and traffic management with wireless vehicle-to-vehicle and vehicle-to-roadside communications. Specifically, enabling nearby vehicles to wirelessly share driving states, VANETs enable various traffic safety applications such as collision avoidance and lane change assistance. In addition, in VANETs, real-time traffic data can be collected from vehicles to improve traffic management. Thus, the potential to improve traffic safety and traffic management will push VANETs to be massively deployed in the future. Furthermore, with free vehicular communications, VANETs provide a handy platform to more cost effective solutions to various value-added applications, e.g., on-road entertainment and automatic survey. Comparatively, existing cellular communications [third-generation (3G) and fourth-generation (4G)] will incur service fees to support such value-added applications.

2 RELATED WORK

Earlier, broadcasting in vehicular adhoc networks (VANET) emerged as a critical area of research. One of the challenges posed by this problem is confinement of the routing problem to vehicle-to-vehicle (V2V) scenarios as opposed to also utilizing the wireless infrastructure (such as cellular networks). At a Fundamental level, safety and transport efficiency is mandate for current car manufacturers and this has to be provided by the cars on the road as opposed to also using the wireless communication infrastructure. Such applications with these real-world constraint calls for a new routing protocol for vehicular broadcasting in VANET. In this, Ozan Tonguz, Nawapom Wisitpongphan, Fan Bai, Priyantha Mudalige, and Varsha Sadekar[1] author reports the first comprehensive study on the subject whereby the extreme traffic situations such as dense traffic density, sparse traffic density, and low market penetration of cars using DSRC technology are specifically taken into account. This paper shows that our Distributed Vehicular Broadcasting protocol can cope with all of the important considerations. VEHICULAR ad hoc networks (VANETs) have emerged as one of the most successful commercial applications of mobile ad hoc networks. Much of the literature assumes radio ranging VANET CP systems, which is not viable. Here the author Nima Alam, Asghar Tabatabaei Balaei, and Andrew G. Dempster consider this technologies emerging for vehicular communication presented [2] Cooperative positioning (CP) techniques, fusing data from different sources, can be used to improve the performance of absolute or relative positioning in a vehicular ad hoc network (VANET).

In [3] Sok-Ian Sou proposes an analytical model for evaluating the performance of emergency messaging via wireless CA systems. Routing protocols developed for ad hoc wireless networks use broadcast transmission to either discover a route or disseminate information. However, the conventional broadcast mechanism may lead to the so-called broadcast storm problem.

In [4] Sok-Ian Sou and Ozan K. Tonguz analyze and quantify the improvement in VANET connectivity when a limited number of roadside units (RSUs) are deployed and to investigate the routing performance for broadcast-based safety applications in this enhanced VANET environment. In a Vehicular Ad Hoc Network (VANET), the wireless Collision Avoidance (CA) system issues warnings to drivers before they reach a potentially dangerous zone on the road.

In [5] author Aghdasi et al. suggests some applications which inherently need multicast routing protocols and introduce them .Then, precisely look over the usefulness of current multicast routing protocols for VANETs..

In [6**]** Ozan K. Tonguz et al. explores how serious the broadcast storm problem is in both MANET and VANET by examining how broadcast packets propagate in a 2-dimensional open area and on a straight road or highway scenarios

In [7], Mahmoud Abuelela et al. introduced a novel incident detection technique for non-dense traffic flow by taking advantage of communication between cars and some roadside infrastructure installed on the road every mile or so. The proposed technique can provide a great enhancement to the existing Automatic Incident Detection techniques especially under sparse traffic where most of them fail to detect non-blocking incidents. Cooperative positioning (CP) can potentially improve the accuracy of vehicle location information, which is vital for several road safety applications.

In [8] Jun Yao et al. proposed simple easily deployable protocol improvements in terms of utilizing as much range information as possible, reducing range broadcasts by piggybacking, compressing the range information, tuning the broadcast frequency, and combining multiple packets using network coding Vehicular ad hoc networks play a critical role in enabling important active safety applications such as cooperative collision warning. These active safety applications rely on continuous broadcast of self-information by all vehicles, which allow each vehicle to track all its neighboring cars in real time. The most pressing challenge in such safety-driven communication is to maintain acceptable tracking accuracy while avoiding congestion in the shared channel.

In [8] Gustavo Marfia et al. is presenting a detailed description of the greatest experiments (a few thousand throughout the streets of Los Angeles), to date, ever performed with an accident warning system specifically devised for highway scenarios. In particular, among all the possible candidate schemes, ran a few thousand experiments with the accident warning system algorithm that was proven to be optimal in terms of bandwidth usage and covered distance in realistic scenarios. The experiments confirm what has been observed before in theory and simulation, i.e., the use of such a system can reduce, by as much as 40%, the amount of vehicles involved in highway pileups.

In [9] Ching-LingHuang et al. proposes a transmission control protocol that adapts communication rate and power based on the dynamics of a vehicular network and safety-driven tracking process. In [10] and [11], Tonguz et al. proposed a distributed vehicular broadcasting protocol (DV-CAST), based on a vehicle’s connectivity the local routing decisions are made.

In [12] F. Farnoud et al. used a positive orthogonal code to distribute a transmission pattern for broadcast messages performance in terms of the success probability and the average delay in message delivery was reported.

M. Torrent-Moreno et al. [13] proposed a distributed transmit power control method based on a strict fairness criterion to control the load of periodic messages on the channel and to avoid saturated channel conditions

In [14] P. Li, X. Huang et al., the authors investigated the problem of placing gateways in VANETs to minimize the power consumption and the average number of hops from access points to gateways. Lochert et al. studied in [15] how the infrastructure should be used to improve the travel time of data dissemination over large distances.

In [16], C. Lochert et al., the author used stationary support units to improve the refreshing rate of the information dissemination in city scenarios. In [17], Bilal Munir Mughal1 et al. evaluates techniques and highlight following major drawbacks first: using only power control techniques do not satisfy requirements of envisioned beacon-dependent safety applications, second: methods used for measuring channel usage level in transmission rate control technique may not be as effective under real world conditions.

There are number of work proposed to study DSRC technology that improves safety on road in [18] S**.** Biswas et al., gives an overview of vehicle cooperative collision avoidance application based on emerging DSRC device and improve the highway traffic safety along with demonstrating the need for data prioritization for safety critical application. Xue et al**.** proposed a communication protocol for collision avoidance and computed the MAC transmission delay [19].

Naumov et al. Studied in [20] VANET routing protocols by using mobility information that is obtained from a vehicular traffic simulator based on real road maps ratio.

In [21], Y. Zhang et al. the author focused on network fragmentation scenarios in VANETs with real-world vehicular mobility models and provided a store–carry–forward solution to routing in disconnected networks. The existing literature shows that, when the VANET is well-connected, Car accidents can be significantly reduced when traffic-related data can be successfully collected. On the other hand, in sparse VANET, two vehicles are probably disconnected and the message delivery is taken by the store-carry forward scheme.

This paper [22] proposes a position base broadcast module, named Broadcast Control Unit (BCUnit), in order to reduce the re-broadcast nodes and minimize emergent message conflict. This module can be easily implemented to WAVE/DSRC devices without any additional transmission overhead and explicit coordination among vehicles. The simulation results show significant progress in multi-hop delay.

3 PROPOSED WORK

Based on result which is reported in previous studies we find that design of early alert message advertising model with reliable routing protocol for multicast messaging that can cope with network fragmentation problem is crucial. To reduce the re-healing time for a sparse VANET and the number of re-healing hops for a dense VANET, we investigate the use of RSUs to assist the traffic safety messaging, which aims at delivering safety message alert to dedicated vehicles using relative positioning by multicasting the alert message to only those vehicle which is going to get affected by the event with high reliability, few hop counts, and low delay. Our goal is to improve the VANET connectivity for safety message delivery between the vehicles and the RSUs.

3.1 MULTICASTING OF ALERT MESSAGES

VANETs topology is highly dynamic and rapidly changing. There is temporary network fragmentation in VANET due to unique characteristics such as special mobility patterns. The transportation safety is enhanced by VANETs provide traveler information, develop comfort applications and traffic flow is improved. VANETs' routing protocol faces many new challenges based on realizing these applications. Popularity of multicast routing protocols has increased the cause is, the VANET routing protocol provides many to many and one to many communication for different application of VANET.

Most of the existing multicast routing protocols are designed to satisfy safety applications. However there are some non-safety applications that also need multicast routing protocol. In recent years vehicles role is important in human life. Since human spend plenty of time driving their cars daily. The growing number of cars within the cities and along the highways requires a precise management to improve traffic flow and decrease the number of deaths and injuries in vehicular collisions, and eventually make travels more pleasant. In the highways, the most dangerous accidents are Rear-end and Chain Vehicle Collisions that occur because of sudden speed decrease.

If any vehicle collision or anomaly event imposed a sudden speed decrease to front vehicle, all the vehicles in the risk area i.e. Region of Interest should be announced to avoid Rear-end and Chain Collisions. In case of emergency not all the vehicles get effected in the network so broadcasting of alert packet is not feasible rather it should be multicast, but defining the list of node to be considered for multicast is challenging task as every vehicle cannot hold the location information of the entire vehicle in the network. However, the communication can be interrupted when the density of vehicles is not enough. In the other words, the communication suffers the Hole Problem therefore RSU is employed to overcome this.

3.2 ENHANCING VANET CONNECTIVITY WITH EMPLOYING ROAD SIDE UNIT (RSU)

Road side unit will manage all the vehicle information and detect the failure vehicle and calculate the detail of the vehicles get affected by the failure vehicle using the relative positioning and multicast alert packet to identified vehicles as shown in Fig.2. The relative position can be found out to calculate to which vehicles the alert message should be multicast. Relative position is calculated using great circle algorithm.

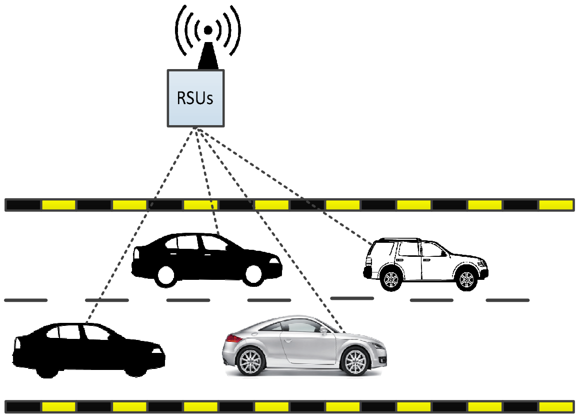


Figure 3.1: RSU communicating with affected vehicle by sending alert message by the store-carry forward scheme

Global positioning system is used to get the vehicle position and can be shared with other nodes in the network. The sparse vehicle traffic leads to network fragmentation, is challenging task for safety application. In case of emergency not all the vehicle get affected in network so broadcasting of alert packet is not feasible rather it has to be multicast, but defining the list of node for multicast is challenging task as every vehicle cannot hold the location information of the entire vehicle in the network. Calculating the list of relative vehicles position is depending on the travelling direction, bearing angle and distance. Road side unit manage all the vehicle information and detect the failure vehicle and calculate detail of the vehicles get affected by the failure vehicle.

4 RESEARCH METHODOLOGY

The paper proposes a system which is designed and developed to find out the relative position between multiple vehicles. In this, road side unit will manage all the vehicle information and detect the failure vehicle and calculate the detail of the vehicles which are affected by the failure vehicle using the geo positioning and multicast alert packet to identified vehicles. This will narrow down the broadcasting scenario and prevent the traffic congestion due to wrong message delivery to unwanted vehicles.

Proposed system is used to design and develop vehicle node having travelling direction and the location information. It is used to develop a node which will work as a road side unit and manage all vehicle location information and also manage detection of failure node in the network. Once the failure node is detected it will calculate the relative position of other vehicle and multicast the messages to particular vehicle. By using socket programming, logical network is established between entire nodes in the network.

The relative vehicle position is depending on three aspects:

Travelling direction: Using GPS device protocol data system can get the direction for which system need to parse & process GPS data
Bearing angle: Degree on earth co-ordinate system with respect to vertical center of earth is called as bearing angle.
Distance: The great circle algorithm is used to calculate the distance and the angle between two Geo point on the earth.

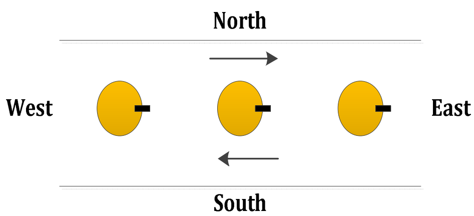


Fig.4.1 Relative position with respect to Travelling Direction

Relative position with respect to travelling direction is given in Fig.2. Travelling direction can be detected through GPS device itself but relative positioning cannot be gathered from GPS device while travelling. As Travelling direction can change the relative position.

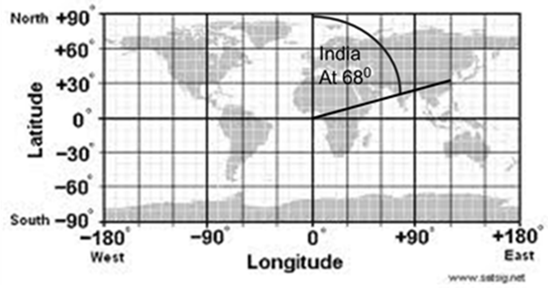


Fig.4.2 Relative Position with respect to bearing angle

Every object on earth co-ordinate stands at particular angle with respect to vertical center of the earth this can be called as bearing angle. India stands at 68 degree on the earth.

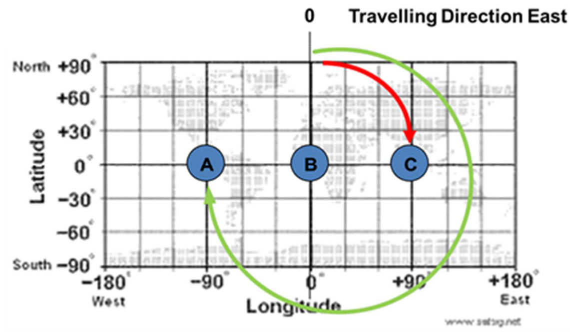


Fig. 4.3 Relative position with respect to distance

Consider a scenario, Vehicle B met with the accident and travelling direction is east so after calculating angle of 'C' and 'A' we get that 'C' is at minor angle and 'A' at major angle hence 'C' is Leading vehicle and 'A' is Following vehicle so alert will go to 'A'.

4.1 GREAT CIRCLE ALGORITHM

The scenario can be worked out by using an algorithm called **Great circle Algorithm**. The great-circle distance or orthotropic distance is the shortest distance between any two points on the surface of a sphere measured along a path on the surface of the sphere (as opposed to going through the sphere's interior). Because spherical geometry is rather different from ordinary Euclidean geometry, the equations for distance take on a different form. The distance between two points in Euclidean space is the length of a straight line from one point to the other. On the sphere, however, there are no straight lines. In non-Euclidean geometry, straight lines are replaced with geodesics. Geodesics on the sphere are the *great circles* (circles on the sphere whose centers are coincident with the center of the sphere).

Between any two different points on a sphere which are not directly opposite each other, there is a unique great circle. The two points separate the great circle into two arcs. The length of the shorter arc is the great-circle distance between the points. A great circle endowed with such a distance is the Riemannian circle.

Between two points which are directly opposite each other, called *antipodal points*, there are infinitely many great circles, but all great circle arcs between antipodal points have the same length, i.e. half the circumference of the circle, or πr, where r is the radius of the sphere.

Because the Earth is nearly spherical (see Earth radius) equations for great-circle distance can be used to roughly calculate the shortest distance between points on the surface of the Earth (*as the crow flies*), and so have applications in navigation.

To calculate the direction of movement enough to know coordinates of two consistently received landmarks. If you use the Cartesian coordinate system and adopt the longitude on the axis "X", latitude on the axis "Y" - then it is possible to calculate the vector of movement. The following image demonstrates how to calculate the vector of the movement and the angle of the vector:

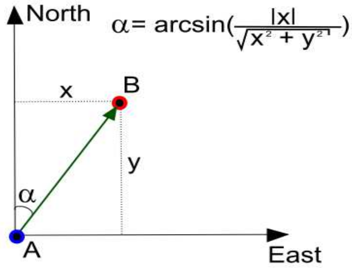


Fig. 4.4

Depending on the direction, you must perform correction of meaning angle. The following code snippet demonstrates how to calculate the angle of the movements (relative to north), knowing consistently received two landmarks.

All recreational GPS units can tell you your current bearing, e.g. North, South, East, West and all the points in between.

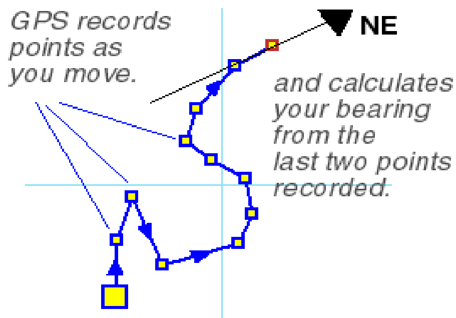


Fig. 4.5

This is an alternative way to take a bearing. You must be moving and it is essential to know your precise position so it is perfect for GPS. As you move through the countryside the GPS periodically records your position as shown in fig.4. By comparing where you were to where you are now the GPS can work out which direction you are heading and uses this to indicate the current.

4.2 Relative Position Identification

Figure 4.6 describes the intervehicular information sharing in VANET where every vehicle having location information of all vehicles in the network. The major problem in this scenario is that vehicles are not having information about relative position of all other vehicles. Consider an emergency situation if wrong message get delivered to other vehicle it may create a panic situation and hence create a traffic jam.

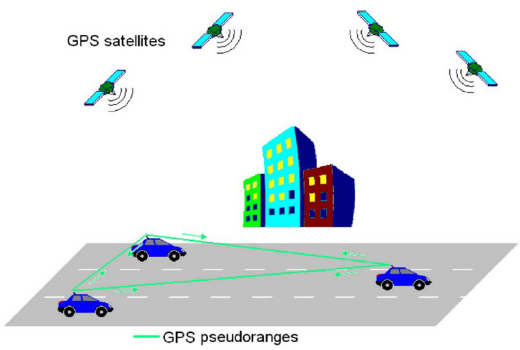


Fig. 4.6 Locations Relation Identification

Figure 5 describes the intervehicular information sharing in VANET where every vehicle having location information of all vehicles in the network. The major problem in this scenario is that vehicles are not having information about relative position of all other vehicles. Consider an emergency situation if wrong message get delivered to other vehicle it may create a panic situation and hence create a traffic jam. While finding the relative position most important aspect should be kept in consideration is the direction of travelling because that the only parameter decides the travelling time relative position between vehicles. In case of emergency like accident there is no point in sharing informing with front vehicle, it is not necessary to message front vehicle. Hence by calculating the vehicles behind the accident vehicle, system can prevent broadcasting the packet rather then it will multicast the messages. Road side unit will manage all the vehicle information and detect the failure vehicle and calculate the detail of the vehicles get affected by the failure vehicle using the relative positioning and multicast alert packet to identified vehicles.

5 Parsing the GPS Data and Displaying

The proliferation of consumer GPS products has provided engineers with a wide variety of low-cost, high-quality GPS modules that are ideally suited for embedded location and navigation applications. Embedded and hand-held GPS devices provide raw output through a serial connection in the form of comma delimited, CrLf (carriage return/line feed) terminated NMEA strings, typically at 4800 baud. Each string begins with a unique identifier and contains one or more fields; for example: $GPRMC,032606,A,3410.2358,N,11819.0865,W,0.0,207. 2,180211,13.5,E,A*32 Sample program execution to read the GPS data. GPS provide different protocols to provide different information GPS device can connect to PC using USB or Bluetooth. Both are physical connection. For programming we need Logical port i.e. COM port. O.S Map physical device to logical Application use these. Once device is connected to the system need to read data from device i.e. from COM port. As the GPS data fetched from device is in multiple line and every line holding specific information separated by ‘,’ so we need to identify the proper protocol data and parse it in order to get the exact data. Using the split()function system will parse the data. Using the Google API the parsed geo data is mapped on the Google map.

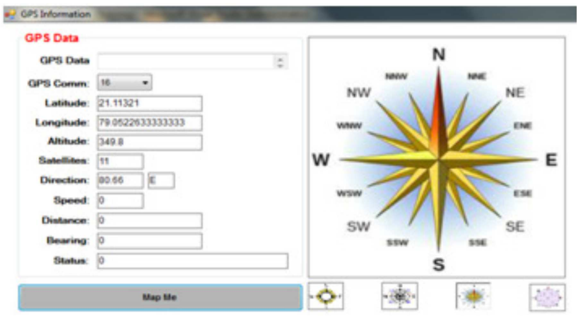


Fig 5.1.Parsing of Data

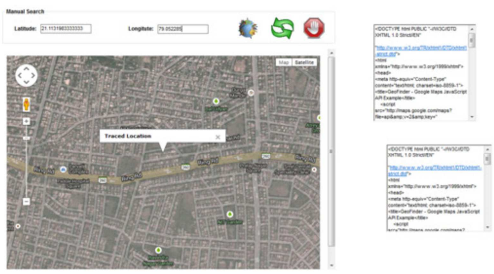
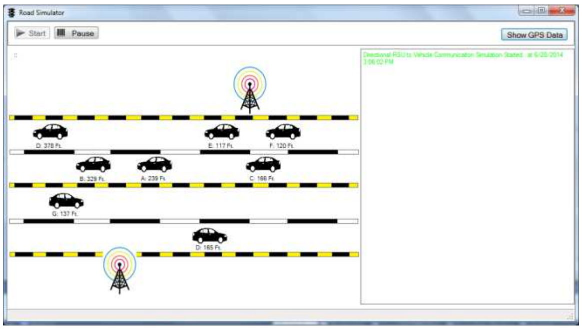


Fig 5.2 Mapping Geo Data on Google Map

Figure 5.1 shows the parsed data from the fetched data from the GPS device. After parsing the data system will get the travelling direction. Figure 5.2 shows the mapping of the parsed data from the GPS device by using the Google API. So that the vehicle will give the current location of its own, this can be shared with the RSU to notify the RSU of its current position. RSU can find the relative positioning between multiple vehicles and multicast the alert packet to identified vehicles.

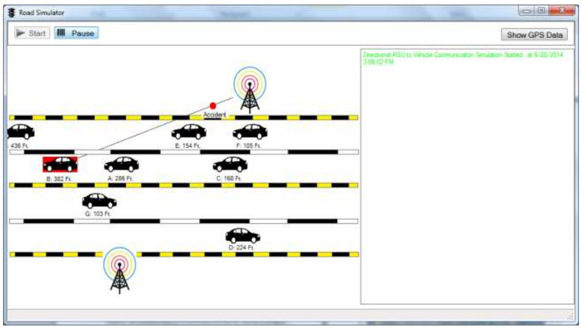
6 Result Analysis

A. Vehicle to Roadside Unit Communication



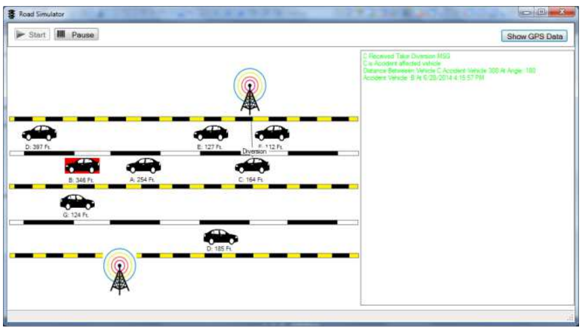
In a typical scenario of Vehicle to Roadside Unit Communication, Roadside Unit communicates with all the vehicles in the network. These vehicles have its own location information. This location information of vehicles is shared with Roadside Units in the region. When simulation starts, RSU communicates with the vehicles in the network. Next step would be to perform an accident of a vehicle, which can be done by clicking on a vehicle. When we click a particular vehicle a dialog box will appear

B. Collision Detection by RSU

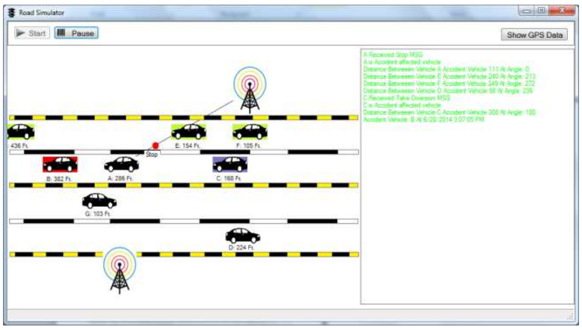


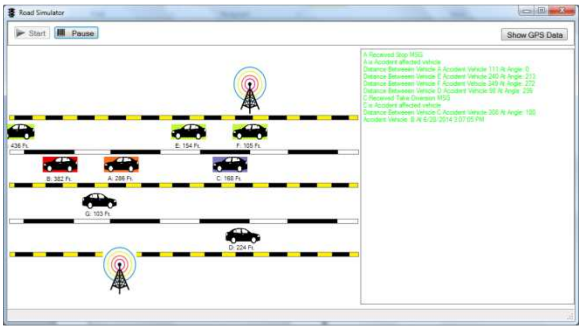
'B' met with an Accident which is shown in Red area. This B Vehicle then communicates with Road Side Unit (RSU). RSU will get all the location information through GPS. RSU then calculates the position of the vehicle by using great circle algorithm and bearing angle.

C. Multicasting of Warning Messages to Affected Vehicles



When RSU receives Accident Alert from a vehicle, it has all the location information of that vehicle through GPS. When RSU will get the location information it will identify other vehicles position by calculating their positions by Great Circle Algorithm and Bearing Angle. In the above scenario fig 7.4, RSU will multicast an alert message to the vehicles which are affected by the accident. C will get an alert message "Take Diversion" as C is less affected by the accident, and it can change its route. A will get an alert message as "Stop" as this vehicle is more affected by the accident so this vehicle cannot change its route instead it has to stop.





The simulation results shows the distance between the vehicle and bearing angle which met with an accident and the affected vehicle. Thus, giving the relative position of the vehicles as shown in the output screen. In the fig 7.6 we can see four different colored zones to show the status of the vehicles in the network. These four different colored zones are RED, ORANGE, and PURPLE, GREEN.

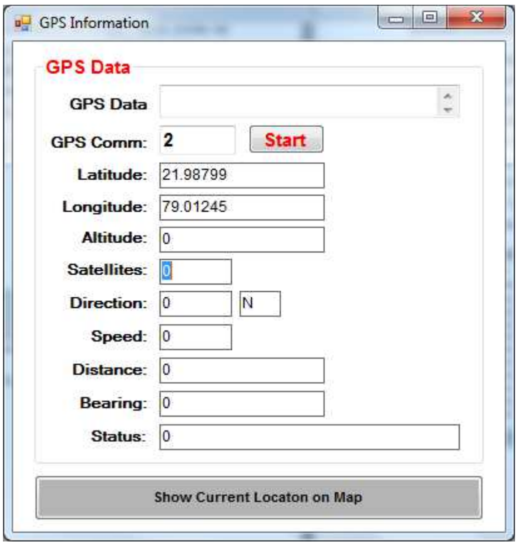
1) RED Zone vehicles are the ones which met with an accident.
2) ORANGE Zone vehicles are the ones which are highly accident affected vehicles.
3) PURPLE Zone vehicles are the ones which are less affected by the accident so they can change their routes or may slow down.
4) GREEN Zone vehicles also called as Safe Zone vehicles are the ones which are not at all affected by the accident.

RSU calculate the relative position on the basis of Great circle algorithm i.e. on basis of every vehicle location and the distance between each other. RSU will take the decision on the basis of travelling direction and the every vehicle location and calculate the relative position between all the vehicle. RSU can find the relative positioning between multiple vehicles and multicast the alert packet to identified vehicles. Even after GPS device having its own few meters of error term but, as system is working in open air so it is expected that the system will calculate the exact relative vehicle position and identity and send proper messages to dedicated vehicle.

We can see that the vehicle 'B' met with an accident. So, A and C are the accident affected vehicles. Therefore Roadside Unit will send an alert message to accident affected vehicle for e.g. 'Danger Ahead' or 'Change the Route'.

Therefore, the simulation result gives the distance and the bearing angle between the vehicle which met with an accident and the accident affected vehicle in the network. It can be given as: "Distance between Vehicle A Accident Vehicle 111 at Angle: 0", "Distance between Vehicle E Accident Vehicle 240 at Angle: 213".

D. Parsed Data from GPS



This information is the location information of a particular vehicle. This information from GPS is given the form of Latitude, Longitude, Altitude, Satellites, Direction of the vehicle, Speed of the vehicle, Distance from the RSU, Bearing angle, etc. This information is used by RSU to detect the accident affected vehicle. After detecting RSU multicasts alert messages to particular vehicles. We can see there is a button which reads “Show Current Location on Map. After clicking on that button, a Location Tracker will open which will give the exact location of the vehicle.

7 Conclusion

One promising aspect of VANET is that it can considerably improve road safety and travel comfort. In case of emergency not all the vehicle get affected in network so broadcasting of alert packet is not feasible rather it has to be multicast. This will narrow down the broadcasting scenario and prevent the traffic congestion due to wrong message delivery to unwanted vehicles in highway scenario. The number of vehicle collisions can potentially be reduced. Reduce the number of fatal roadway accidents by providing early Alert message.

Results show improved VANET connectivity for safety message delivery between the vehicles and the RSUs which is possible with the use of RSUs to assist the traffic safety messaging, which aims at delivering safety message alert to dedicated vehicles using relative positioning by multicasting the alert message to only those vehicle which is going to get affected by the event with high reliability, few hop counts, and low delay.

As a final remark, the impact of RSU deployment and multicasting on the performance of safety applications for VANETs in highway scenarios has been investigated in this paper and further research is needed to extend this model to urban scenarios, where the occurrence of accident are not distributed uniformly on the road, because of the complication of traffic intersection, and more prone to accidents

References

[1] O. K. Tonguz, N. Wisitpongphan, F. Bai, P. Mudalige, and V. Sadekar, “Broadcasting in VANET,” in Proc. IEEE INFOCOM MOVE Workshop, May 2007, pp. 7–12

[2] Nima Alam, Asghar Tabatabaei Balaei, and Andrew G. Dempster**, “**Relative Positioning Enhancement in VANETs: A Tight Integration Approach,” IEEE 2012.

[3] Sok-Ian Sou**, “**Modeling Emergency Messaging for Car Accident over Dichotomized Headway Model in Vehicular Ad-hoc Networks,**”** IEEE 2013.

[4] Sok-Ian Sou and Ozan K. Tonguz, “Enhancing VANET Connectivity Through Roadside Units on Highways,” IEEE 2011

[5] Aghdasi, H.S. Torabi, N. Rahmanzadeh, A. Aminiazar, M. Abbaspour, M. , “Usefulness of multicast routing protocols for vehicular Ad-hoc networks,” IEEE 2012.

[6] Ozan K. Tonguz*, Nawaporn Wisitpongphan*, Jayendra S. Parikh, Fan Bai, Priyantha Mudaliget, and Varsha K. Sadekart , “On the Broadcast Storm Problem in Ad hoc Wireless Networks,” IEEE 2006

[7] Gustavo Marfia, Marco Roccetti, Alessandro Amoroso, and Giovanni Pau. “Safe Driving in LA: Report from the Greatest Intervehicular Accident Detection Test Ever” IEEE 2013.

[8] Mahmoud Abuelela Stephan Olariu Gongjun Yan “Enhancing Automatic Incident Detection Techniques Through Vehicle To Infrastructure Communication,” Proceedings of the 11th International IEEE Conference on Intelligent Transportation Systems Beijing, China, October 12-15, 2008

[9] Jun Yao, Asghar Tabatabaei Balaei, Mahbub Hassan, Nima Alam, and Andrew G. Dempster “Improving Cooperative Positioning for Vehicular Networks”IEEE 2011

[10] Ching-LingHuang, Yaser P.Fallah, and Raja Sengupta Hariharan Krishnan “Adaptive Intervehicle Communication Control For Cooperative Safety System”.

[11] Ozan k. Tonguz and Nawaporn Wlisitpongphan, Fan Bei. “DV-Cast: A Distributed Vehicular Broadcast Protocol for Vehicular Ad-Hoc Networks” IEEE 2010

[12] M. Torrent-Moreno, J. Mittag,P.Santi, and H.Hartenstein,“Vehicle-to -vehicle communication: Fair transmit power control for safety-critical information,”IEEE Trans. Veh. Technol., vol. 58, no. 7, pp. 3684–3703, Sept. 2009.

[13] F. Farnoud and S. Valaee, “Reliable broadcast of safety messages in vehicular ad hoc networks,” in Proc. IEEE INFOCOM, Apr. 2009,pp. 226–234.

[14] P. Li, X. Huang, Y. Fang, and P. Lin, “Optimal placement of gateways in vehicular networks,” IEEE Trans. Veh. Technol., vol. 56, no. 6, pp.3421–3430, Nov. 2007

[15] C. Lochert, B. Scheuermann, C. Wewetzer, A. Luebke, and M. Mauve,“Data aggregation and roadside unit placement for a vanet traffic information system,” in Proc. 2008 ACM International Workshop Veh.Inter-Netw., pp. 58–65

[16] C. Lochert, B. Scheuermann, M. Caliskan, and M.Mauve, “The feasibility of information dissemination in vehicular ad-hoc networks,” in Proc. 2007 Conf. Wireless Demand Netw. Syst. Services, pp. 92–99.

[17] Bilal Munir Mughal1, Asif Ali Wagan2, Halabi Hasbullah. “Efficient Congestion Control in VANET for Safety Messaging” IEEE 2010

[18] S. Biswas, R.Tatchikou, and F. Dion, “Vehicle-to vehicle wireless communication protocols for enhancing highway traffic safety,” IEEE Commun. Mag., vol. 44, no. 1, pp. 74–82, Jan. 2006.

[19] X. Yang, J. Liu, F. Zhao, and N. H. Vaidya, “A vehicle to-vehicle communication protocol for Cooperative collision warning,” in Proc. 2004 International Conf. Mobile Ubiquitous Syst.: Netw. Services, pp. 114–123.

[20] V. Naumov, R. Baumann, and T. Gross, “An evaluation of inter vehicle ad hoc networks based on realistic vehicular traces,” in Proc. 7th ACMMobiHoc, 2006, pp. 108–119.

[21] Y. Zhang, E. K. Antonsson, and K. Grote, “A new threat assessment measure for collision avoidance systems,” in Proc. 2006 IEEE Intelligent Transportation Syst. Conf., pp. 968–975, Sept. 2006

[22] Cheng-Wei Fan, Ke-Chian Su, Hei-Min Wu, Wei-Lin Chang and Yao-Hsin Chou “An Effective Multi-Hop Broadcast Control Mechanism for Emergency Alert Message in VANET,” IEEE 2012 12th International Conference on ITS Telecommunications.

[23] Khaleel Mershad and Hassan Artail “A Framework for Secure and Efficient Data Acquisition in Vehicular Ad Hoc Networks” IEEE Transactions on Vehicular Technology, VOL. 62, No. 2, Feb. 2013.