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An efficient accident notification system in VANETs using ILCRP

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ABSTRACT

An accident notification system for a vehicle includes a degree of damage predicting system that detects whether the vehicle occupant has been injured in an accident. It consists of position monitoring system that monitors the position of the vehicle. If any accident occurs, the mobile communication terminal receives the signal and it informs to the nearest hospital about the accident, so that the occupant can be rescued soon and gets treatment. This project can be used in the areas where there is no one to help the injured occupant when they are met with an accident. It also makes note of the databases of the persons in and around the accidental area. This will be helpful for the police in further investigations.

Introduction

In the last couple of years communication between vehicles has attracted the interest of many researchers around the world. In the European Union some research projects look into the potential of reducing road fatalities under the safety initiative (e.g. GST, PreVent). The same is true in other countries like the USA or Japan. Car-to-Car communication (C2CC), often referred to as Vehicular Ad hoc Networks (VANETs), enables many new services for vehicles and creates numerous opportunities for safety improvements. This project includes decision on the wireless communication standard to be used and message dissemination schemes capable of exchanging messages in many different network scenarios.

Conventionally, when an automobile causes an accident, pedestrians of the road can notify the accident to the road administrator or the like by a phone provided along the road for each predetermined interval. Also in recent years mobile or portable telephones have been widespread and when an accident happens, pedestrian can notify the accident to a police station, an emergency station or other related offices for prompt action at the accident site. At present, only location information of the accident site is sent to the nearby police station and hospital. Although this helps in saving the lives, it is not enough at the time of police investigation.

This paper focuses on sending the fleet parameters as a message. The message comprises of the location information of the accident site, speed, steering angle of the vehicle, the report of the quantum of damage to the vehicle along with the vehicle registration number and personal details of the owner which will be helpful at the time of police investigation. The GPS is used for detecting location and speed of vehicle and GSM modem is used to forward the message.

This paper is organized as follows. Section II briefly introduces related work, Section III describes the proposed work, Simulation environment are given in Section IV, and finally Section V gives the advantages Section VI concludes the paper.

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Related work:

Car - car communication:

Car-to-car communication (C2CC)[1], often referred to as Vehicular Ad hoc Networks (VANETs), enables many new services for vehicles and creates numerous opportunities for safety improvements. Communication between vehicles as shown in Fig.1 can be used to realize driver support and active safety services like collision warning, up-to-date traffic and weather information or active navigation systems [2]. However, besides enabling new services VANETs pose many challenges on technology, protocols and security which increases the need for research in this field. The cars are going to act like a data-collection probe. The car's location is anonymously transmitted to other cars and to an infrastructure and this data will be used to identify traffic flow, slippery conditions, bottlenecks and more.

Fig.1 Describes Car to Car Communication

Existing technologies in VANETs:

VANETs or Intelligent Vehicular Ad-Hoc Networks defines an intelligent way of using Vehicular Networking. VANET integrates on multiple ad-hoc networking technologies such as Wi-Fi IEEE 802.11 b/g, WiMAX IEEE 802.16, Bluetooth, IRA, ZigBee for easy, accurate, effective and simple communication between vehicles on dynamic mobility. Effective measures such as media communication between vehicles can be enabled as well methods to track the automotive vehicles are also preferred.

Routing protocols:

DSR:

Dynamic Source Routing (DSR) [3] is a routing protocol for wireless mesh networks. It forms a route on-demand when a transmitting computer requests one. DSR is a reactive routing protocol which is able to manage a MANET without using periodic table update messages. The disadvantage of this protocol is that the route maintenance mechanism does not locally repair a broken link.The connection setup delay is higher than in table-driven protocols.

AODV:

Ad hoc On-Demand Distance Vector (AODV) [4] Routing is a routing protocol for Mobile Ad hoc Networks (MANETs) and other wireless Ad hoc networks. It is capable of both unicast and multicast routing. It is a reactive routing protocol. The disadvantage of this protocol is that multiple Route Reply packets in response to a single Route Request packet can lead to heavy control overhead which leads to unecessary bandwidth consumption. In other words, the source establishes a route to a destination only on demand.

DSDV:

Destination-Sequenced-Distance-Vector Routing (DSDV) [5] is a table-driven routing scheme for Ad hoc mobile networks. The main contribution of the algorithm is to solve the routing loop problems. Each entry in the routing table contains a sequence number the sequence numbers are generally even if a link is present and an odd number is used when the link is absent. The disadvantage is that DSDV requires a regular update of its routing tables. Use of battery power and a small amount of bandwidth even when the network is idle.

CBRP:

Cluster Based Routing Protocol [6] an on demand source routing protocol, divides cluster into nodes and decreases control overhead during route discovery. K-hop CBRP improves CBRP with increase in number of nodes and its mobility. It modifies the existing weighted clustering algorithm for the election of cluster head.

LAR:

In LAR [7] protocol the overhead of route discovery is decreased by utilizing location information of mobile nodes. Using GPS for location information LAR protocol reduces the search space for a desired route producing the search space results in fewer route discovery messages. By contacting a location service provider which knows the positions of all the nodes, the source node should first get the position of the destination mobile node when it wants to send data packets to a destination.

ILCRP:

The ILCRP[8] protocol, a stable clustering protocol ,applicable for highly mobile Ad hoc networks was proposed earlier where all the nodes in all the clusters are GPS enabled compared to few nodes in a cluster as in LACBER[9] protocol. This protocol makes use of clusters as well as location information intensively. The exact information of the nodes is known to each other with the help of GPS which increases the packet delivery ratio and reduces the control overhead and makes the route, loop free. Location information of the nodes keeps the exchange information as well as the end to end delay very low. Clusters are formed between nodes as shown in Fig.2 which are m-hops far away from the cluster head. A node with highest Node Value is selected as cluster head. Two tables namely Neighbor table and Cluster Adjacency table facilitate the formation and functioning of clusters. The Neighbor table is a conceptual data structure for formation of a cluster whereas Cluster Adjacency Table (CAT) is used for keeping information about the adjacent clusters.

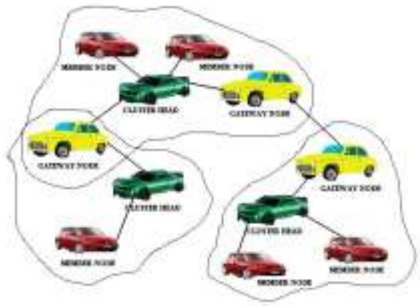

Fig.2 clustering in VANETs

The efficient routing protocol is ILCRP; This paper employs the ILCRP intrusion detection technique in order to achieve highly secured network.

Proposed work:

A Vehicular Ad-Hoc Network, or VANET, is a form of Mobile ad-hoc network, to provide communications among nearby vehicles and between vehicles and nearby fixed equipment, usually described as roadside equipment.

The main goal of VANET is providing safety and comfort for passengers. To this end a special electronic device will be placed inside each vehicle which will provide Ad hoc Network connectivity for the passengers.

This network tends to operate without any infrastructure or legacy client and server communication. Each vehicle equipped with VANET device will be a node in the Ad hoc network and can receive and relay others messages through the wireless network. Collision warning, road sign alarms and in-place traffic view will give the driver essential tools to decide the best path along the way.

Safety measures:

Safety in travel is the primary concern for everyone. This project describes a design of an effective warning system that can monitor an automotive vehicle’s condition while traveling. This project is designed to inform, about an accident that has occurred to the vehicle to the family members of the traveling persons.

This project uses a piezo-electric sensor which can detect the abrupt vibration when an accident occurred. This sends a signal to the microcontroller. A GSM modem is interfaced to the MCU. The GSM modem sends an SMS to the predefined mobile number and informs about this accident. VANET helps in defining safety measures in vehicles, streaming communication between vehicles, infotainment and telematics.

Proposed algorithm:

The Improved Location aided Cluster based Routing Protocol for GPS enabled MANET clusters is the algorithm proposed for VANETs to improve the packet delivery ratio and thereby increasing the efficiency, reduce the control overhead and reduce the end to end delay.

Inter vehicle service:

Vehicle-to-Vehicle Communication [2] can be used to disseminate messages generating their content using sensors within the vehicle.

These include accident warning, information on traffic jams or warning of an approaching rescue vehicle, etc. In addition, information of road conditions or weather conditions can be exchanged.

More elaborate inter-vehicle services are direct collision warning or intersection assistance with information obtained from intersections or road junctions or traffic check points

Methodology Used:

GPS:

The Global Positioning System (GPS)[10] is currently the only fully-functional satellite navigation system. More than two dozen GPS satellites are available for communications. Earth orbit, transmitting signals allows GPS receivers to determine the receiver's location, speed and direction. The Fig.3 describes the basic function of GPS.

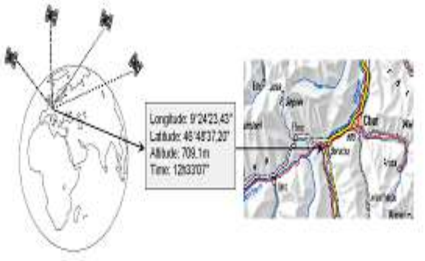

Fig.3 The basic function of GPS

Calculation of the Position from the GPS Satellites

GPS determines the distance between a GPS satellite and a GPS receiver by measuring the amount of time taken by a radio signal (the GPS signal) to travel from the satellite to the receiver. Radio waves travel at the speed of light, which is about 186,000 miles per second. So, if the amount of time taken by the signal to travel from the satellite to the receiver is known, then the distance from the satellite to the receiver (distance = speed x time) can be determined. If the exact time of the transmission and reception of the signal are known, the signal's travel time can be determined.

Cluster formation:

Every vehicle (node) in the VANET has to rely upon the other vehicles for routing their packets. The need to store complete routing details for an entire network topology raises scalability issue.

The clustering algorithm is proposed in VANETs to address scalability issues. Clustering [11] algorithms can be performed dynamically to adapt to node mobility. VANET is dynamically organized into groups called clusters to maintain a relatively stable effective topology. All the vehicles in a cluster will move relative to each other and in the same direction and on average have the same velocity. Each group is represented by a cluster head .The formation of the clusters is determined by the mobility pattern of vehicles to ensure maximum cluster stability [12]. It has been observed that vehicles in VANET may move in groups in the same direction. This is known as group mobility.

Data transmission:

In this paper we consider vehicles as nodes and the packets are continuously transmitted between the nodes and the cluster head will keep monitoring its member nodes. When a packet loss occurs (i.e. accident occurs), the cluster head will immediately send the information about the packet loss (i.e. accident) to the nearest hospital node and immediately the ambulance (i.e. another node) is dispatched to the accidental area. Simultaneously the information (i.e. ID) of the other nodes in and around the accidental area will be noted and forwarded to police headquarters as this piece of information will be useful for further police investigation.

Network simulator-2:

This paper is implemented by using NS2 [13].Network Simulator (NS) is an object–oriented, discrete event simulator for networking research. NS provides substantial support for simulation of TCP, routing and multicast protocols over wired and wireless networks. The simulator is a result of an ongoing effort of research and development. Even though there is a considerable confidence in NS, it is not a polished product yet and bugs are being discovered and corrected continuously.

NS is written in C++, with an OTcl interpreter as a command and configuration interface. The C++ part, which is fast to run but slower to change, is used for detailed protocol implementation. The OTCL part, on the other hand, which runs much slower but can be changed quickly, is used for simulation configuration. One of the advantages of this split-language program approach is that it allows for fast generation of large scenarios

Simulation environment:

Several VANET specific simulation scenarios have been considered using GrooveSim [14] and CARISMA [15]. Most of these simulators use digital maps as a basis for the node mobility model. In Fig 4 a VANET simulation on a real map can be seen. The figure shows both wireless equipped and regular vehicles as well as the wireless communication links. The information on node positions and wireless links are used as input to Network Simulator (e.g. NS-2).The NS2 generates simulation results based on realistic mobility patterns.

Fig.4 VANET simulation on real map

Simulation parameters:

The following parameters are defined like the type of antenna, the radio-propagation model, the type of ad-hoc routing protocol used by mobile nodes etc.

Channel type : Wireless Channel
Radio-propagation model: Two Ray Ground model.
Antenna type: Omni Antenna
Link layer type: Link layer
Interface queue type: priority queue
Max packet in queue: 50
Network interface type: Phy/WirelessPhy
MAC type: MAC/802.11
Number of mobile nodes: 49

Simulation results:

The Figure 5 shows how the nodes (i.e. vehicle) transmit the information in case of emergencies.

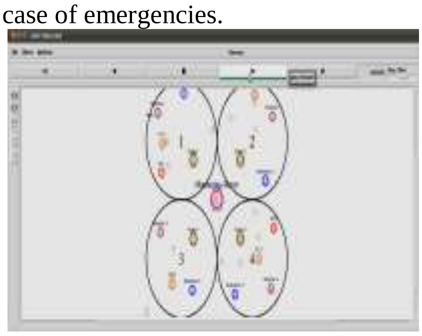

Fig.5 Simulation results using NS2

Advantages:

- Advanced security
- Monitors all hazards and threats

- Alerts message to mobile phone for remote information
- Ease of investigation.

Conclusion:

At present, only location of the accident is sent to nearby police station and hospital. Even though this helps in saving human lives, it is not enough for investigating the actual reason of accidents. Thus in this paper, a fleet of information parameters are transmitted for investigation which will not only save lives of human beings but also explain the cause of the accidents.

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