Vehicle to Vehicle Communication using ADHOC Wireless Network

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***Abstract*—The number of road traffic related accident has risen at an exponential level. In 2014 alone, there have been distracted driving, drunken drive, night journey are few reasons to state. The objective of the paper is to design a inter vehicular communication (IVC) such as forward hazard warning and green light optimal through active traffic control. Increasing traffic efficiency with traffic congestion control results in reduced transportation time and thus contributing to improving the environment. Advanced driver assistance road safety by reducing the number of accident as well as reducing the impact in case of non-avoidable accidents. User communication and information services offering comfort and business application to driver and passengers.**

Keywords— Network, communication, ADHOC wireless network

I. INTRODUCTION

Over 1,37,000 publics were slew in road accidents in 2013 alone. There is one death every four minutes due to a road accident in India and Tamil Nadu is the state with the maximum number of road crash injuries. Hence a proper assistance is needed to avoid accidents. This work aims to provide such an assistance to vehicles by communicating among themselves about the data of events occurring around them. There have been few vehicle to vehicle communication related studies which will be discussed in this section.

Vehicles today are equipped with wireless communication functions that can facilitate vehicle-to-vehicle and vehicle-to-infrastructure communication. Increased storage capacity, computing and communications power, coupled with advances in wireless networking technology, bring a potential to enable new applications for drivers and passengers in the vehicles. WAVE/DSRC (802.11p) is an intelligent transportation system in which modern vehicles send an alert message to all the vehicles immediately after an accident has occurred using data transmission range of the chosen network [1]. This WAVE/DSRC system is then replaced by operating the inter vehicle communication on android smart phone using Wi-Fi. By using this system vehicles communicate with other vehicles within 50 to 60 meters. Though this system has shorter range communication, it has temporarily solved the 30ms round trip delay in 802.11p OBU system. Also smartphone system can be easily switched to a VANET OBU which will automatically broadcast an emergency message to inform their neighbor vehicles when detected an accident happens [1].

A unified approach for disseminating data about different types of events in a vehicle network has been proposed based on the concept of encounter probability which is computed to estimate the relevance of the events [2]. The probability to disseminating data relies on the events such as available parking spaces, obstacles in the road, information relative to the coordination of vehicles in emergency situations.

Automation in driving system for elderly person is designed with a small electric vehicle using ZigBee network [3]. The two vehicles under communication maintains a safety distance to drive in platooning works smoothly in this network. Vehicles can realize platooning of driving in a line and join in a platooning freely by guiding car by priority level [3].

Many simulation studies have been done in V2V communication system. One of them is the potential of using inter vehicle communication to extend the coverage area of roadside wireless access points [4]. VISSIM microscopic traffic simulator has been used to generate vehicle mobility trace to conduct simulation studies. The study includes the radio penetration rate and the distance between neighboring access points [4].

Centroid localization (CL) is very popular in WSN due to its simplicity and fast calculation. In VANET, vehicle speed and topology change rapidly due to this high mobility. Therefore the concept of weighted centroid localization (WCL) has been introduced by two different weighting mechanisms. First is the signal to interference-noise ratio for weighted localization (WL) and second, we add distance along with SINR in the weight calculation to get weighted localization using distance. (WLD) [5].

CVIC (cooperative vehicle Intersection Control) algorithm was designed to manipulate individual vehicles maneuvers so that vehicles can safely cross the intersection without colliding with other vehicles. By eliminating the potential overlaps of vehicular trajectories coming from all conflicting approaches at the intersection, the CVIC algorithm seeks a safe maneuver for every vehicle approaching the intersection and manipulates each of them. An additional algorithm was designed to deal with the system failure cases resulting from inevitable trajectory overlaps at the intersection and infeasible solutions [6].

II. OBJECTIVE

A. Forward Hazard Warning

If a vehicle senses an instance such as emergency braking, accident, traffic jam, slippery road, or construction zone, it enhances this data to its intermittently disseminated Cooperative Awareness Message which is sent to all vehicles in the close locality. Other cars or bikes accepts the information and decide either to warn the driver if the harmful location is on the road in front or just to broadcast the information to warn other vehicles.

B. Traffic Light Signal Advisory

The vehicle methodologies the traffic light that is presently red. Based on the received traffic light phase schedule, the vehicle calculates an approaching speed of say, 45km/hr., at which the vehicle would reach the traffic light at the opening of the next green phase. This data is existing to the driver who can avoid the unnecessary stop. If the vehicle is someway needed to stop, then the traffic light would automatically switches off the car engine and later switch On the ignition once it shows green.

C. Intersection Collision Warning

While the motorbike is riding on the main road, a car is approaching the intersection from the right-hand side. Due to a view obstacle, the car driver is supervising the approaching motorbike. When driving onto the intersection, the car driver takes a warning of the pending motorbike. The rider also receives a warning on its HMI.

D. Road Speed Limit Warning

The road speed limit adviser application allows connected vehicles to receive information that it is approaching a road along with the optional speed for the curve. This capability allows the vehicle to provide a warning to the driver concerning the road and its optional speed. In addition, if the actual speed through the curve exceeds the optional speed, the vehicle can interconnect and informs this to the traffic control unit, where the vehicle number will be showed. If the driver drives the vehicle sooner than the speed limit ignoring the warning, the vehicle unit would notify the vehicle details to the traffic control unit.

E. Emergency Vehicle Warning

While the vehicles are driving beside the road an emergency vehicle approaches from behind. This system uses information from the EV to assistance the driver on how to clear the road for the emergency vehicle even when the siren and light bar may not however be clear or noticeable. The driver/rider of the other vehicle will be advised to stop at the road side to lease the EV pass by. If the driver doesn't slow the vehicle after this warning, the vehicle details will be automatically transferred to the traffic control unit.

This work consists of three units running a wireless network among them. The control and monitoring unit has a touchscreen display and additional sensors. Vehicle parts have a compass, a graphics LCD and a warning buzzer.

III. METHODOLOGY

A. Block Diagram of Unit1

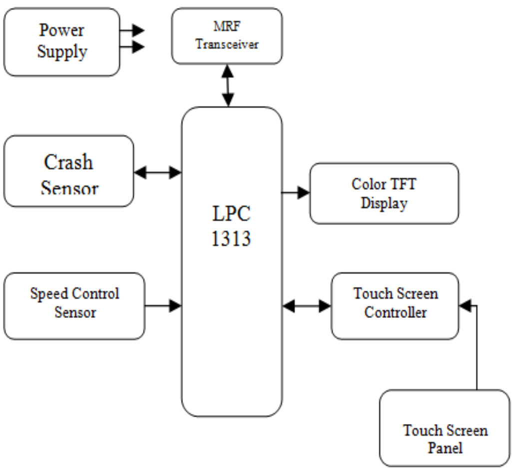

Fig. 1. Proposed block diagram of Unit 1.

The above block diagram is the on board unit of a vehicle. This unit1 acts as signal unit in case of traffic light advisory control and acts as a vehicle on board unit for other applications. This board is the source of communicating data between vehicles.

Hardware components used in the on board unit are ARM Cortex-M3 microcontroller (LPC 1313), IEEE.802.15.4 wireless network protocol, Touchscreen display, Graphics LCD, MEMS Compass used to find the direction of the moving vehicle, MEMS Accelerometer used to sense accident situation, Brake Position Sensor used to sense emergency braking situation, Vehicle Speed Control Sensor used to increase or decrease the speed of the vehicle. Buzzer used to provide warning sound to the driver, DC motor used to emulate a running vehicle driven by a motor driver circuitry, Battery used to control all the electronics and motors in the project.

B. Block Diagram of Unit 2

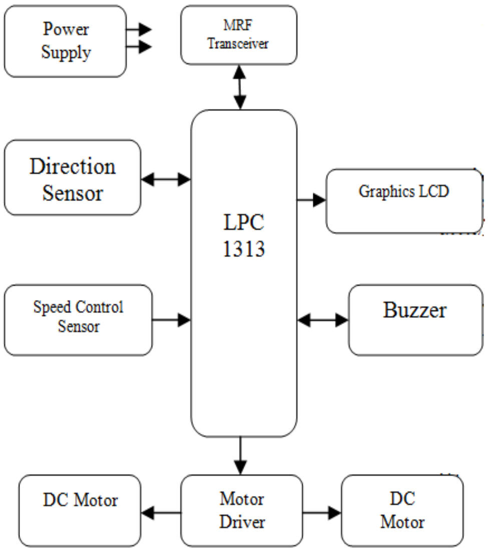

Fig. 2. Proposed block diagram of Unit 2.

This is also an on board unit of a vehicle. Similar to this unit, another unit is used in this experiment.

C. Embedded Network Protocol

ADHOC network refers to integrated control of nodes. ADHOC network protocol used here is Wireless Protocol Area Network (WPAN). WPAN focuses on low-cost ubiquitous communication between devices. WPAN is the IEEE 802.15.4 network standard protocol. Communication area of this network is around 10-100 meters. The transfer rate of data in this network is up to 250Kbit/sec. Collision avoidance in this network is through CSMA/CA. It supports secure communication. It supports peer to peer to star topology. It uses 2400-2483.5 MHz frequency band, with up to sixteen channels. It uses offset Quadrature Phase Shift Keying (OQPSK) modulation.

IV. CONCLUSION

This work has been done on vehicle to vehicle communication to provide assistance to the vehicles about the events that occur. Events here refer to the information such as forward hazard warning, traffic light signal advisory, intersection collision avoidance, road speed limit warning, and emergency vehicle warning. The information about these events are managed using an on board unit containing ARM microcontroller. Every vehicle has this on board unit in it. Network protocol IEEE 802.15.4 standard transfers the data between vehicles with high efficiency.

By analyzing the prototype developed using the components stated above, the system works efficiently in transferring the data between them.

V. FUTURE WORK

This work can be implemented practically in all vehicles with affordable cost. By doing so, many human lives can be saved in avoiding accidents and proper driving assistance.

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