Vehicle To Vehicle Communication for Crash Avoidance System

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***Abstract*— The Dramatic increase in the traffic flow raises demand on innovative technologies that can improve safety and efficiency of transportation systems. Road safety can be substantially enhanced by the deployment of wireless communication technologies for vehicular networks, which enable new services such as collision detection traffic management, and further communication facilities between moving vehicles. Aiming at providing reliable wireless communications for vehicular networks the RF communication will serve as an underlying protocol for future inter-vehicular applications worldwide. This paper presents an implementation of a complete vehicle to vehicle communication, designed according to the specification. In addition to this a blind spot detection system for protection against misshapen like vehicle collisions that causes loss of human lives is being implemented. The blind spot detection system will be useful while changing the lane. Ultrasonic sensors, Raspberry pi, RF module and GPS modules are used to implement the complete design.**

Keywords*— *Vehicle-to-Vehicle Communication, RF Communication, Traffic, BSD

I. INTRODUCTION

Road safety is one of the main objectives on designing assistance system. Everyone nowadays needs to have a guarantee of safer transport.Among all fatal accident 95% are caused by human error. Thus by designing the accurate assistance system, rate of accident can be reduced. As computerized technology advances, there is a push towards Vehicle-to-vehicle (V2V) Communication. An accident avoidance system is one that gives safety to the vehicular system as well as to the driver and it reduces damage. Vehicle -to-Vehicle Communication can help to get it. The main motivation for car-to-car communication systems is safety and avoiding accidents due to collisions. The vehicle-to-vehicle communication system is not designed for a particular brand or vehicle. This can be used in every vehicle with a little modification. The system is designed considering the normal car user can also use it. Automobiles have become one of the greatest commercial achievements of mankind in the past century but unfortunately during travel they are prone to accidents and become victims.

Using vehicle-to-vehicle communication, a vehicle can detect the position and movement of other vehicles up to a quarter of a kilometer away. In a real world where vehicles are equipped with a simple antenna, a computer chip and GPS (Global Positioning System) Technology, your car will know where the other vehicles are, additionally other vehicles will Know where you are too whether it is in blind spots, stopped ahead on the highway but hidden from view, around a blind corner or blocked by other vehicles. The vehicles can anticipate and react to changing driving situations and then instantly warn the drivers.

II. PROBLEM STATEMENT

Traffic congestion is the main problem of any individual nowadays and it leads to traffic accidents of thousands of people and taking thousands of people lives each year [8] [9]. There are various reasons for traffic congestion and some are too inane. People don't follow any traffic rules which are the main reason of traffic congestion. Instead of finding out the solution people start to make chaos on the road which leads to traffic jam. In the peak hours more than 60% of population gets stuck on the road due to heavy congestion. This heavy congestion in turn is affecting each and every individual's life. Apart from traffic congestion there is problem when some by mistake take a wrong road and leads to a diversion or where there is road is blocked. Studies show that these situations can be avoided if driver was provided warning some half-second before so that they can take some alternate route to avoid traffic or road.

This paper is divided into six sections. Section 1 contains introduction of the project that explains the project in general. The objectives of the project will be discussed and scope of the project is explained. Section 2 contains problem statement. Section 3 contains research methodology that explains in detail the overall project flow of V2V and BSD system. Section 4 contains hardware and software implementation and in section 5 results and analysis are discussed. Finally section 6 contains the conclusion and recommendation of the project.

III. METHODOLOGY

The generalised block diagram of V2V communication is as shown in figure 3. There are two blocks given which belongs to car1 and car2 respectively. The explanation of these blocks is given as follows.

GPS will give information about steering angle, dimension speed of vehicle, location co-ordinates, and path of the vehicle to the On Board Unit (OBU) of all the vehicles, which will process the data provided by GPS and depending on the data safety messages are generated in embedded board. It will generate the safety messages depending on the position of the vehicles. The safety messages will be transmitted and received by RF module. Basic safety messages will be displayed on the display unit.

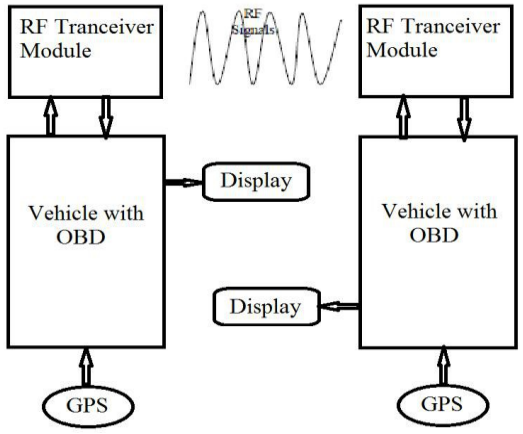

Fig.1 Block Diagram of V2V Communication

For BSD two ultrasonic sensors are connected at both the mirrors of vehicle and distances are measured and if any vehicle is in the blind zone and then a buzzer will blow to warn the drivers. The sensor transmits the ultrasonic bursts which are well above human hearing range. The times when trigger pulse pin is activated then the sensor transmits 8 cycles of 40KHz burst and wait for echo signal. When echo is received the echo pin is set with 5V and delay for a period proportional to distance.
Distance is calculated as:

$$D=0.5*C*(T1-T0)$$

Where,
D- Distance of object
C- Speed of sound (343m/s)
T1- Time at which waves transmitted
T0- Time at which waves received

IV. HARDWARE DESCRIPTION

A. Raspberry Pi 2 Model B

The Control unit consists of Raspberry pi. It is a small sized single board computer. It is having size 85.60mm x 56mmx21mm. The raspberry pi consists of Broadcom BCM2836R SOC, which is operating at 900MHz. The Raspberry pi 2 model B has memory 1GB RAM, 40GPIO, 4 USB port 2.0,Ethernert port, HDMI port, Audio jack, Camera interface, Display interface, micro SD slot. The device is powered by 5V micro USB. The O.S. boots from micro SD card with version of Linux operating system such as Raspbian, Debian.

Fig.2 Raspberry Pi Board

B. Sensor Module/Ultrasonic Sensor

The sensor used here for Blind Spot detection is HC-SR04.The range of measuring is 2cm-400cm. It has 4pins namely VCC, TRIG, ECHO, GND. HC-SR04 provides a wide range measurement from 2cm-400cm, non contact. Accuracy of HC-SR04 is 3mm.The assembly consists of Tx, Rx and control unit. Here we are using two sensors i.e., Left and Right sensor side.

C. Audible Alarm

As soon as detection of object is confirmed within danger/hazardous zone an audible alarm gets activated giving signal of detection.

D. GPS Sensor

SiRF-3 based GR-301 is an easy-to-use G-Mouse receiver with SiRF latest single chip that consumes 42mA lower power and provides good sensitivity -159 dBm during tracking. GR301 is available in RS-232 interface with PS/2 connector, or USB interface for easy use.

E. RF Module

The nRF24L01 is a highly integrated, ultra low power (ULP) 2Mbps RF transceiver IC for the 2.4GHz ISM (Industrial, Scientific and Medical) band. With peak RX/TX currents lower than 14mA, a sub µA power down mode, advanced power management, and a 1.9 to 3.6V supply range. The nRF24L01 integrates a complete 2.4GHz RF transceiver supporting a high-speed SPI interface for the application controller.

V. RESULTS AND ANALYSIS

To reduce the probability of collision on the road we demonstrated Blind spot detection. The hardware platform is shown in figure 3. The results obtained after implementing the system are depicted in figure 4. The ultrasonic sensor measures the distances and predicts if any vehicle is in blind spot region.

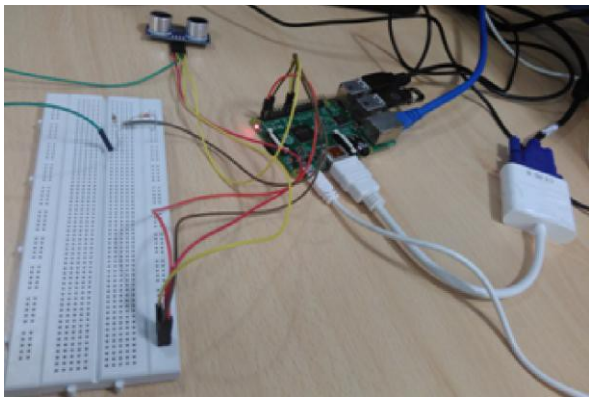

Fig. 3 Hardware of Blind Spot Detection

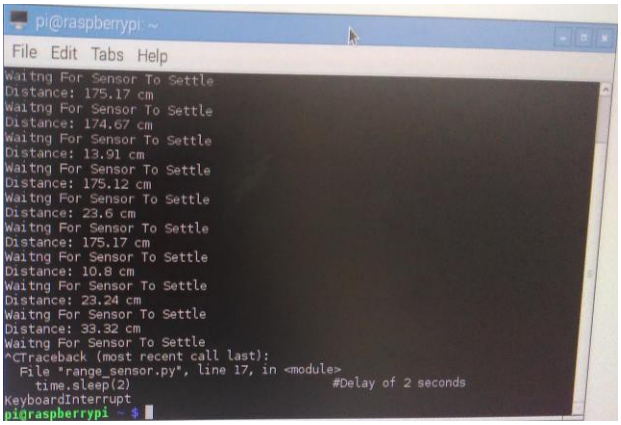

Fig. 4 Ultrasonic Sensor Result

VI. CONCLUSION AND FUTURE SCOPE

Communication has offered many new opportunities for the automotive industry. This paper proposes a technology to improve traffic congestion and road safety. Also we have analyzed situations like collision, delay and redundancy etc. which can be improved or overcome with simple warning message transmission. GPS is used so that V2V system processor can identify the speed, direction and location of the other vehicle.

More sensors can be included for better working and accuracy. Future cars will be more intelligent which can make its own decision for the safety purpose. Quick help will be provided by knowing the location if the advance system also embedded in ambulance.

VII. ACKNOWLEDGEMENT

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