Design and Implementation of Real Time Embedded based Vehicle to Vehicle Communication System

P. Sriram[1], M. Palanichamy[2],
G. Alexander[3], G. Vijay[4]
UG student, Electrical and Electronics Engineering Dept., Angel college of Engineering and Technology, Tirupur-641665

Mr. R. Sathish
Assist. Prof., Electrical and Electronics Engineering Dept., Angel college of Engineering and Technology, Tirupur-641665

***Abstract*— Nowadays people are driving very fast, accidents are occurring frequently while driving such as zone wise, hills area and highways. To avoid such kind of accidents and to alert the drivers about the speed limits in such kind of places the highways department have placed the signboards. But sometimes they may not be possible to view that kind of signboards and there will be a chance for accident. To intimate the driver about the speed limit and to detect crashes automatically, a smart device is placed in each and every vehicle for communication purpose with control room and with various incoming vehicles. A sensor is placed in front and back of the vehicle to alert the nearby vehicle and control room when the vehicle met with an accident. IR sensor and LCD display are used to alert and indication purpose in every vehicle. These are all controlled by using PIC controller. A smart device is used to measure the fuel level in fuel tank in terms of liters. Four types of alerting signals accident, natural disaster, road block and traffic are can be given to the driver in order to alert nearby vehicle. The alerting signals are unlocked when the vehicle travels at the speed of 30 km/hour for 10 minutes. The result of the proposed protocol achieves high potential in delivering emergency warnings and efficient bandwidth usage in stressful road scenarios.**

I. INTRODUCTION

Traffic accidents have been taking thousands of lives each year, outnumbering any deadly diseases or natural disasters. Studies show that about 60% roadway collisions could be avoided if the operator of the vehicle was provided warning at least one-half second prior to a collision. Human drivers suffer from perception limitations on roadway emergency events, resulting in large delay in propagating emergency warnings, as the following simplified example illustrates.

Among the factors considered in making that decision were V2V technology's ability to reduce fatalities and injuries from motor vehicle crashes. The practicality of the technology from the perspectives of maturity, cost, reliability, and performance; and the existence of ways to test and measure V2V technology performance objectively.

A. EXISTING SYSTEM

Currently, we are having collision avoiding system and accident identification in roads through police department, the message will be passed to the control room. The system is followed now by American Automobile Association (AAA) and U.S. department of transportation. The exsist6ing system is under testing process since many drawbacks like privacy monitoring and not instant protection due to signal traffic. Although the proposal is still being molded and finalized, Anthony Foxx, the Secretary of Transportation, estimated its implementation to go into effect around 2019, allowing manufacturers to phase in their entire fleet by 2023. And In December of 2016, the U.S. Department of Transportation (DoT) proposed a new regulation that would require new vehicles to be equipped with vehicle-to-vehicle, or V2V, communications.

B. PROPOSED SYSTEM

Operates through both GSM for communication with control room and ZIGBEE for communication with nearby vehicle. And also measuring the fuel level in fuel tank in terms of liters. The proposed system aims to standardise the format and deployment of V2V transmissions, which will enable manufacturers to efficiently spur the growth of equipped vehicles at critical mass. 2V systems will use dedicated short-range communications (DSRC), which are two-way wireless channels that enable V2V-equipped cars to communicate with each other at roughly 300 meters, and whose broadcast updates 10 times per second. DSRCs accrue and share basic safety messages (BSMs) about a vehicle's speed, direction, braking status, and position, to determine whether an alert needs to be sent to the driver.

II. BLOCK DIAGRAM

The PIC controller is the heart of our system. The ZIGBEE used to communicate with nearby vehicle at particular range. GSM is used to communicate with Control Room to alert. This module has four types of switches. S1- Accident, S2- Natural disaster, S3- Road block, S4-Break Down.

The vibration sensor is placed in front and back of the vehicle. In case of accident occur the vibration sensor initiates the GSM and ZIGBEE to communicate with nearby vehicles and control room. The level sensor is used to sense the fuel content in the vehicle in terms of liters. IR sensor used to sense the obstacles in road ways.

The LCD display is used to monitor the fuel level sensing, switching indication and indication of information from nearby vehicle. This module is used to increase the collision or any other information to reach where ever necessary on the basis of priority.

It also mainly used for distracting the vehicles from the reaching the zone of crowd.

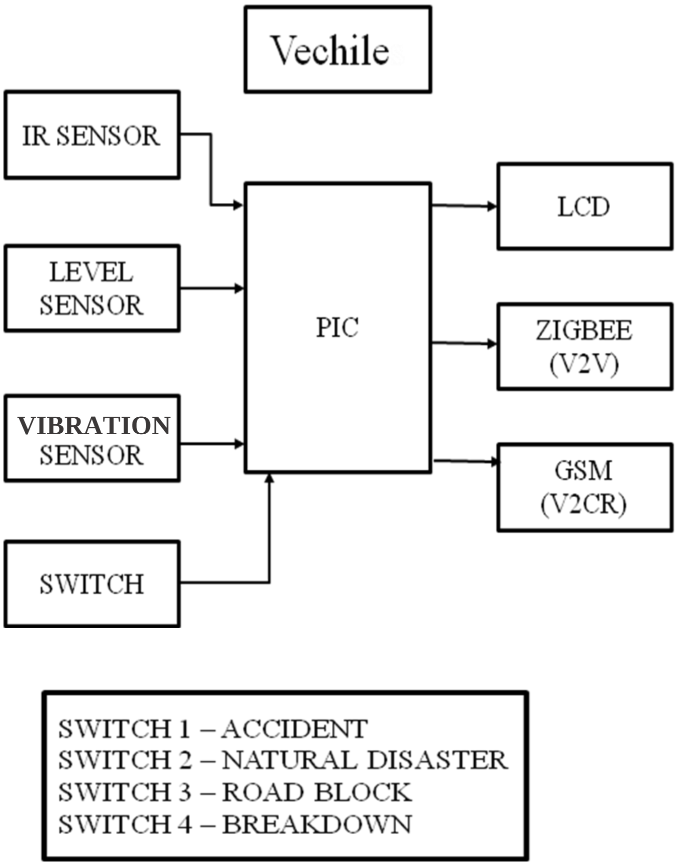

Fig. 1 Block Diagram of Vehicle to Vehicle communication protocol.

III. COMPONENTS

The main components required for the functioning of the above proposed solution are elucidated below.

A. PIC16F877A MICROCONTROLLER

The Microcontroller used here is the PIC16F877. PIC (Peripheral Interface Controller) is a family of microcontrollers. It has attractive features and they are suitable for a wide range of application. It consists of input parts, 3 timers, ROM, RAM, Flash memory and inbuilt ADC. PIC channel 10bit inbuilt ADC which convert the analog value into 10-bit digital data. PIC is programmed to convert 10-bit data into an 8-bit data and to transmit the data into a transistor driver.

FEATURES OF PIC16F877A

- Flash memory: 14.3 Kbytes (8192 words).
- Data SRAM: 368 bytes.
- Data EEPROM: 256 bytes.
- Self-reprogrammable under software control.
- In-circuit Serial programming via two pins (5 V).
- All are single-cycle instructions except for program branches (two-cycles).
- 15 interrupt sources.
- Operating speed: 20 MHz, 200 ns instruction cycle.
- 35 single word instructions.
- 33 I/O pins and 5 I/O ports.
- Brown-Out reset mode.
- Timer0: 8-bittimer/counter with 8-bitprescaler.
- Timer1: 16-bit timer/counter with prescaler, can be incremented during SLEEP mode.
- Timer2: 8-bit period register, prescaler and postscaler.

B. FUEL LEVEL SENSOR

A Float switch is a type of level sensor, a device used to detect the level of liquid(fuel) within a tank. The switch may be used to control a pump, as an indicator, an alarm or to control other devices.

Fig. 2 Ball type level sensor.

The main purpose of the Fuel level sensor is to measure the level of fuel in terms of liter and indicates when the vehicle is in out of fuel.

C. KEYPAD

A numeric keypad, or number pad for short, is the small, palm-sized, seventeen key section of a computer keyboard, usually on the very far right. The numeric keypad features digits 0 to 9, addition (+), subtraction (-), multiplication (*) and division (/) symbols, a decimal point (.) and Num Lock and Enter keys. Laptop keyboards often do not have a number pad, but may provide number pad input by holding a modifier key (typically lapelled "Fn") and operating keys on the standard keyboard. Particularly large laptops (typically those with a 17-inch screen or larger) may have space for a real number pad, and many companies sell separate number pads which connect to the host laptop by a USB connection.

D. GSM

GSM(Global System for Mobile Communications) originally from Group Special Mobile modem is a wireless modem that works with a GSM wireless network.It is worlds most famous Mobile platform. It is used to sent the information to the control room as location when accident is occurred.

E. LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

F. ZIGBEE

The ZIGBEE is a low-cost 2.4 GHz transceiver designed for very low-power wireless applications. The circuit is intended for the 2400- 2483.5 MHz ISM (Industrial, Scientific and Medical) and SRD (Short Range Device) frequency band. The RF transceiver is integrated with a highly configurable baseband modem. The modem supports various modulation formats and has a configurable data rate up to 500 kBaud. ZIGBEE provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment, link quality indication, and wake-on-radio. The main operating parameters and the 64- byte transmit/receive FIFOs of ZIGBEE can be controlled via an SPI interface. In a typical system, the ZIGBEE will be used together with a microcontroller and a few additional passive components.

Fig. 3 ZIGBEE

G. IR SENSOR

We have used IR sensor for detect the objects. Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly, IR Receiver (photo diode) is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other.

H. VIBRATION SENSOR

Piezoelectric sensors have proven to be versatile tools for the measurement of various processes. They are used for quality assurance, process control and for research and development in many different industries. Although the piezoelectric effect was discovered by Pierre Curie in 1880, it was only in the 1950s that the piezoelectric effect started to be used for industrial sensing applications. Since then, this measuring principle has been increasingly used and can be regarded as a mature technology with an outstanding inherent reliability. It has been successfully used in various applications, such as in medical, aerospace, nuclear instrumentation, and as a pressure sensor in the touch pads of mobile phones. In the automotive industry, piezoelectric elements are used to monitor combustion when developing internal combustion engines. The sensors are either directly mounted into additional holes into the cylinder head or the spark/glow plug is equipped with a built in miniature piezoelectric sensor.

IV. CIRCUIT DIAGRAM

The circuit consists of PIC controller unit, fuel level sensor, IR Sensor, Vibration Sensor, ZIGBEE, GSM and LCD display unit. The input sources are ZIGBEE, Level sensor, IR sensor, GSM and Vibration sensor. The outputs are LCD display, ZIGBEE, GSM and switches. The outputs and inputs are controlled by PIC16F877A micro controller as automatic or manual. Here MAX-232 is used to connect the circuit with TTL components.

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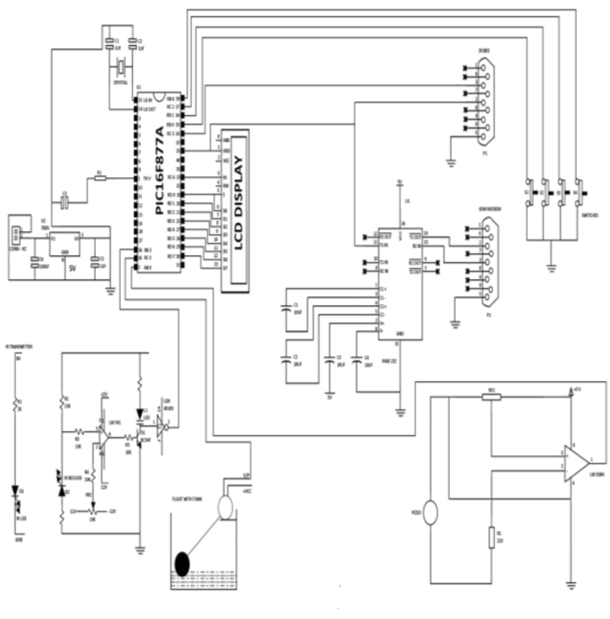
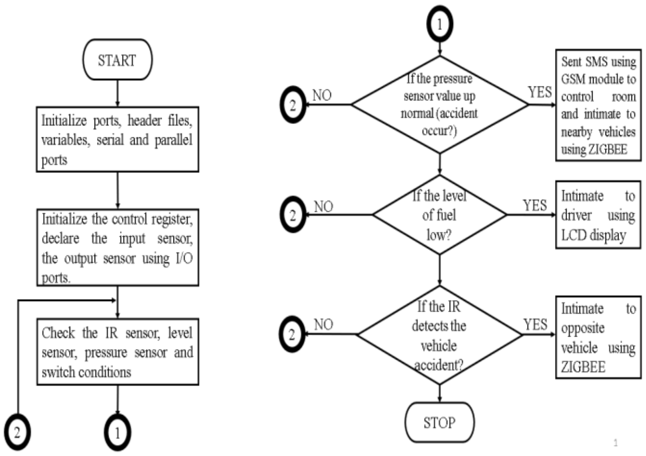


V. FLOWCHART



VI. SOFTWARE DESCRIPTION

A. PROTEUS

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly used by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards. The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables its use in a broad spectrum of project prototyping in areas such as motor control, temperature control and user interface design. It also finds use in the general hobbyist community and, since no hardware is required, is convenient to use as a training or teaching tool. Support is available for co-simulation.

B. KEIL

The MicroVision IDE combines project management, run-time environment, build facilities, source code editing and program debugging in a single powerful environment. It supports multiple screens and allows to create individual window layouts anywhere on the visual surface.

VII. CONCLUSION

In today's world accidents are occurring more to avoid and to stop raising of accidents it is very necessary to use the vehicle to vehicle communication. Today's modern cars are becoming more and more connected to the online world through "the cloud", an internet-based system of software and services that can be accessed through a variety of method so, the usage of this technology is very simple.

VIII. FUTURESCOPE

V2V communication is expected to be more effective than current automotive original equipment manufacturer (OEM) embedded systems for lane departure, adaptive cruise control, blind spot detection, rear parking sonar and backup camera because V2V technology enables a ubiquitous 360-degree awareness of surrounding threats. V2V communication is part of the growing trend towards pervasive computing. The idea to be proposed are,
Emergency electronic brake light (alerts drivers of abrupt deceleration ahead), Forward collision warning (imminent threats ahead), Blind spot/lane change warning (alerts during unsafe lane changes), Do-not-pass warning (warns drivers when not to make a passing maneuver), Vehicle turning right in front of bus warning and V-X communication (Vehicle to anything communication).

IX. REFERENCE

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