INTER INTRA VEHICULAR COMMUNICATION

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ABSTRACT

CAN communication based transmission system in vehicle is used to implement an anti-collision system for vehicles that includes a speed sensor for sensing the speed of the vehicle, an ultrasonic sensor for measuring the distance of the vehicle from an object, a system for computing a anti collision distance to the object, an alarm actuated by the system when the sensed distance of the object is equal to or less than the anti collision distance compared by the system, and a brake light actuated upon the actuation of said alarm, and an alert system for driver's to shift gear of vehicle when the ideal speed is reached, and cornering head light for the vehicle. The data will be transmitted over CAN bus and will be displayed on LCD.

KEYWORDS

CAN Protocol, Anti-collision system

1. INTRODUCTION

The modern vehicles require more complex control connections, thus more electronic control units (ECU) interacting through actuators and sensors. When a driver drives the car the ECU contain information about current state of the car. But in an in-vehicle communication technology uniting these many controllers has become essential. Controller area network (CAN) is introduced to solve the problem of sending this message efficiently .This focuses on a better in-vehicle communication network used to combine these ECUs: the controller area network communication protocol, also known as Controller area network[1]. It is a serial communication protocol developed by Robert Bosch for the German car industry. The CAN protocol is an ISO 11898 standard for serial data communication[1]. In advances data communications has created efficient methods for several devices to communicate using a minimum number of system wires. The Controller Area Network (CAN) is one of these methods. CAN transmits and receives messages over a two wire bus (CAN Bus). The protocol was developed for automotive applications. Today CAN have gained widespread use and is used in industrial automation as well as in automotives and mobile machines. But it is also used for economical standard in today. The vehicular communication provide traffic management, efficient and easier maintenance, which ultimately leads to safer roads.

2. CAN PROTOCOL

2.1 CAN BUS

In 1980s, engineers at Bosch evaluated serial bus systems regarding their possible use in passenger cars and found that the available network protocols were not able to fulfill the requirements of the automotive. In February of 1986, CAN was introduced: at the SAE (Society of Automotive Engineers) congress in Detroit, the new bus system developed by Bosch was introduces 'Automotive Serial Controller Area Network'. Controller Area Network (CAN) is a serial data communications bus for real-time applications[2]. Fig.1 is the CAN network topology follows the bus network topology, which gives it the advantage that easily adding new CAN nodes to a current network. Furthermore, the standardization of the protocol means all ECUs will conform to the CAN standards when transmitting data. Note that in the Fig.1 all CAN nodes are fitted with a transceiver chip that connects it to the CAN bus. CAN protocol is a message based protocol not an address based protocol. This means that messages are not transmitted based on addresses . All nodes in the system receive message transmitted on the bus. Another feature built into the CAN protocol is the ability for a node to request information from other nodes. One benefit of this message based protocol is that additional nodes can be added to the system without the necessity to reprogram all nodes. This is called Remote Transmit Request (RTR)[2]..

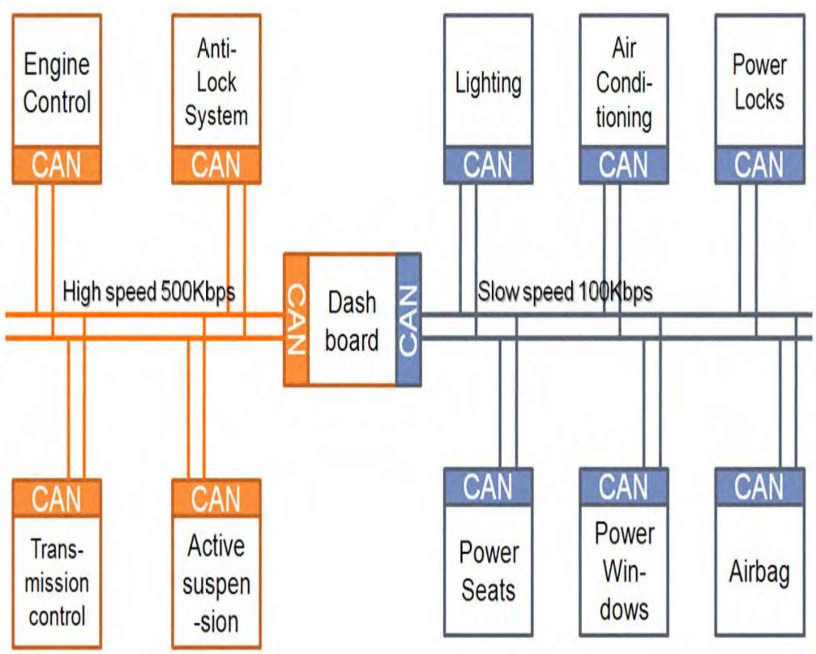

Fig .1 The CAN network topology

2.2 CAN FRAME STRUCTURE

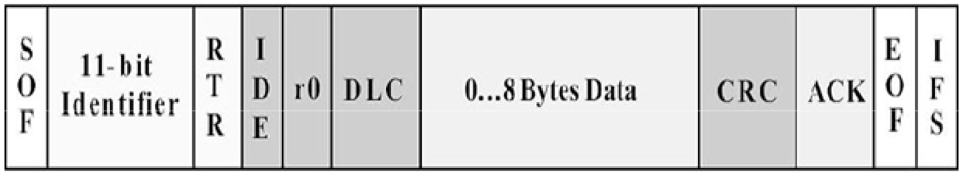

Fig.2 CAN Frame

SOF– The start of a message, it is used to synchronize the nodes on a bus after being idle.
Identifier- The standard CAN has 11-bit identifier which establishes the priority of the message. Lower the binary value, higher its priority.

Rtr–the single remote transmission request bit is dominant when information is required from another node. All nodes receive the request, but the identifier specifies the node. The responding data is also received by all nodes and used by the node interested. So, all data that is used in a system is uniform.

IDE–a dominant single identifier extension bit means that a standard can identifier with no extension is being transmitted.

R0–reservedbit for future standard amendment.

DLC–the 4-bit data length code contains the number of bytes of data being transmitted. Data up to 64 bits of application data may be transmitted.

CRC–the 16-bit (15 bits plus delimiter) cyclic redundancy check contains the checksum (number of bits transmitted) of the preceding data for error detection.

ACK–every node receiving an accurate message overwrites this recessive bit in the original message with a dominate bit, indicating an error-free message has been sent. Should a receiving node detect an error and leave this bit recessive, it discards the message and the sending node repeats the message after re arbitration. In this way, each node acknowledges the integrity of its data. ack is 2 bits, one is the acknowledgment bit and the second is a delimiter.

EOF–The end-of-frame is 7-bit field which indicate the end of a can frame (message) and disables bit-stuffing. When 5 bits of the same logic level occur in succession during normal operation, a bit of the opposite logic level is *stuffed* into the data.

IFS–The 7-bit inter frame space contains the time required by the controller to move a correctly received .

2.3. THE CAN STANDARD

CAN is an International Standardization Organization (ISO) defined serial communications bus developed for the automotive industry. Which replace the complex wiring with a two-wire bus..

The features of CAN increases its popularity in a variety of industries like building automation, medical, manufacturing etc .The CAN communications protocol, ISO-11898: 2003, describes how information is passed between devices on a network. It conforms to the Open Systems Interconnection (OSI) model that is defined in terms of layers. Actual communication between devices connected by the physical medium is defined by the physical layer of the model.

The data link and physical layers of which are normally transparent to a system operator, are included in any controller that implements CAN protocol. The connection to physical medium is implemented using a line transceiver to form like a system node .

3. IMPLEMENTATION

In this section, discuss on the block diagram, circuit and its layout .A brief idea is given on how it is implemented. Here used PIC16F73, which manages the different sensors used such as ultra-sonic sensor, speed sensor .And the data read from the sensor is passed to the receiver part where it displays the speed, distance of collision, mileage of the vehicle for current speed, and gear shift indicator for the speed specified. The program is written in Embedded C. Embedded C is a set of language extensions for the C Programming language.

Another software used in this project is MPLAB Integrated Development Environment (IDE), is a free, integrated toolset for the development of embedded applications employing Microchip's PIC® and dsPIC® micro controllers. A set of compilers and assemblers are also available with it. To begin with download and install MPLAB IDE from the website. Don’t forget to install HITECH C compiler when it asks you during the installation process. For the demonstration purpose I am using MPLAB version 8.60.

Then use Proteus it is best simulation software for various designs with microcontroller. It is mainly popular because it contains almost all microcontrollers in it. So it is a handy tool to test programs and embedded designs for electronics hobbyist. We can simulate our programming of microcontroller in Proteus 8 Simulation Software. ISIS lies at the main of the Proteus system. It combines a powerful design environment with the ability to define most aspects of the drawing appearance. Whether your requirement is the rapid entry of complex designs for simulation and PCB layout, or the creation of attractive schematics for publication, ISIS is the tool for the job.

3.1 BLOCK DIAGRAM

Fig.3 shows the intra vehicular communication, the ultrasonic sensor measures the distance of the vehicle from an object .And the speed sensor senses the speed. This information is passed over to the receiver section through a CAN bus. Then in the receiver section the buzzer is activated indicating the collision distance has reached, and the corresponding break light indicator is activated.

The distance will be displayed on LCD. If the speed is increasing, it will command for a gear shift, which in turn helps to increase the fuel efficiency of the vehicle. The LCD display displays the speed of the vehicle. This information is given to second vehicle through RF Transmitter by encoding the data. Encoder is a parallel to serial converter. Both transmitter and receiver uses PIC 16F73.

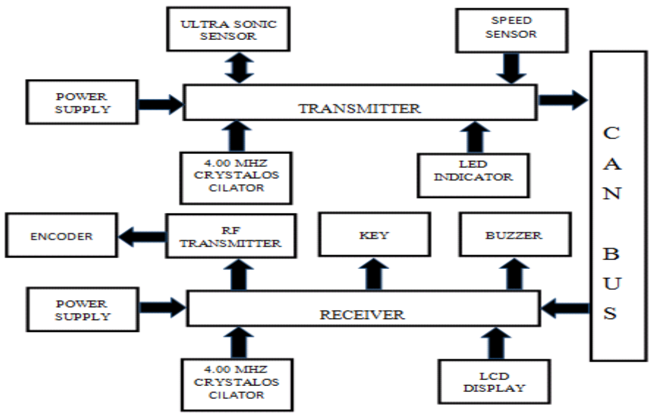

Fig .3 Intra communication

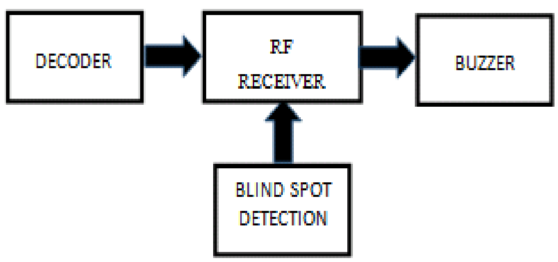

Fig.4 Inter communication

Fig.4 is used for inter vehicular communication. Data from the RF transmitter of the first vehicle is decoded by the RF receiver in the second vehicle. The decoder converts the serial input to parallel output. Then alerts the driver in the second vehicle. Using IR LED and Photodiode the blind spot of the vehicle is detected in order to inform the overtaking.

4. FLOW CHART

A flowchart is representation of the sequence of steps and decisions needed to perform a process. Each step in the sequence is noted within a diagram shape. Steps are linked by connecting lines and directional arrows. This allows anyone to view the flowchart and logically follow the process from beginning to end.

4.1TRANSMITTER

Algorithm

1. Start

2. Initialization
3. Check sensor speed
4. Measure distance
5. Send to receiver
6. Go to step 3

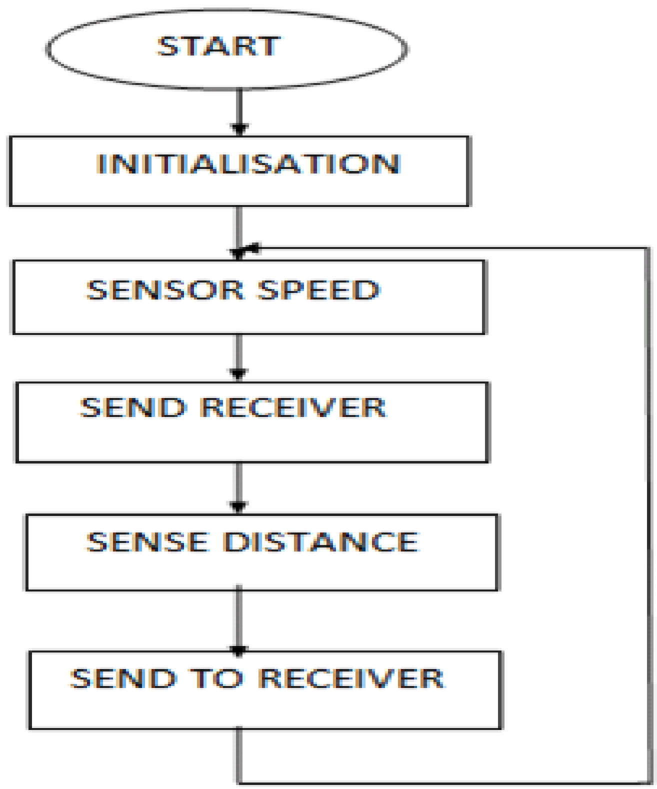

Fig 5 Flow chart of transmitter

4.2 RECEIVER

Algorithm

1. Start
2. Initialization
3. Check receiver value
4. If speed is received then display speed
5. Otherwise display distance then go to step 10
6. If the received speed is low display gear state
7. The received speed is high check whether it is increasing or decreasing
8. If the receiver speed is reducing then alarm off
9. Otherwise go to step 7
10. If distance is high go to step 14
11. Otherwise alarm on and measure distance

12. If distance is increases alarm off and go to step 14
13. Distance decreases go to step 11
14. Check the need of overtake
15. If there is a need of overtaking alarm on and displayed
16. If there is no need of overtaking check the value of s1,s2
17. If s1,s2 is equal to zero , adjust servomotor then go to step 3
18. If s1s 2 is not equal to zero then go to step 3

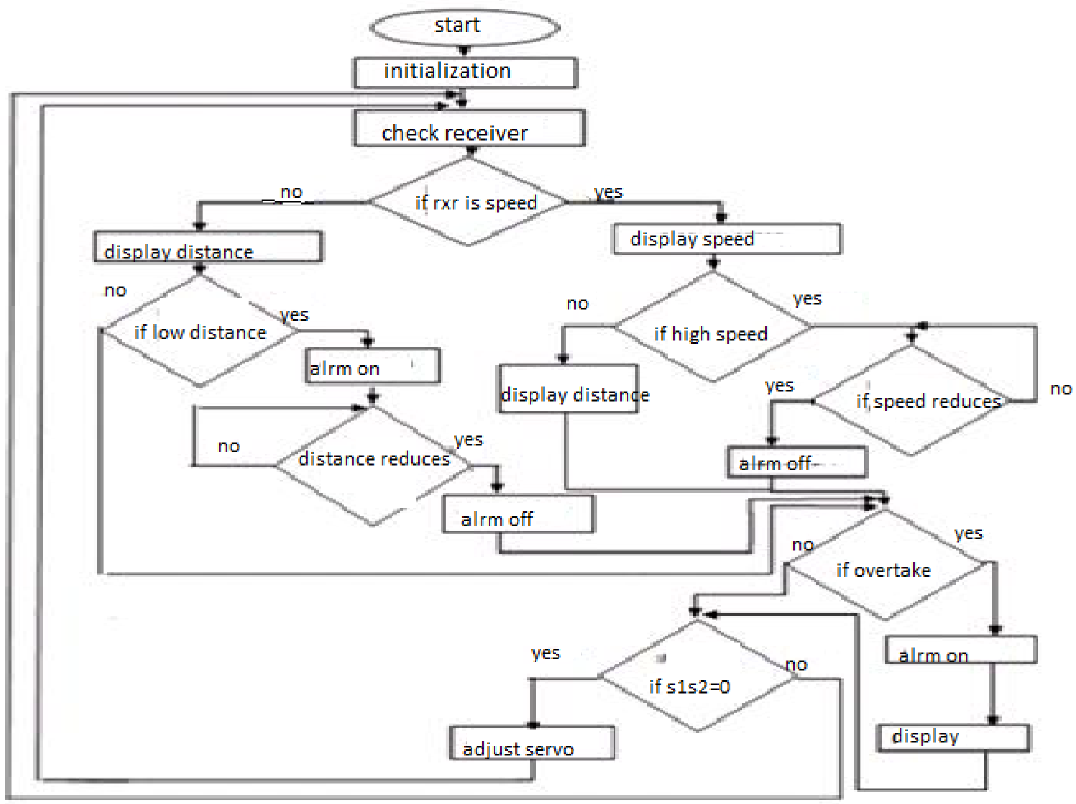

Fig .6 Flow chart of receiver

5. CIRCUIT DIAGRAM

The transmitter section consists of speed sensor, IR LED, and the photodiode. Ultrasonic sensor is used to measure the distance of collision. The ultrasonic sensor has 3 pins, GND, VCC, SIG. Port C of PIC16F73 is used to connect the ultrasonic sensor .PIN 18-RC7 is connected to the SIG of ultrasonic sensor. The port A of PIC 16F73 is used to connect the motor to sense the speed. The ultrasonic sensor used to check the distance between the two vehicles. It sends an ultrasonic signal and receives the reflected signal from other vehicle and calculate the distance,.

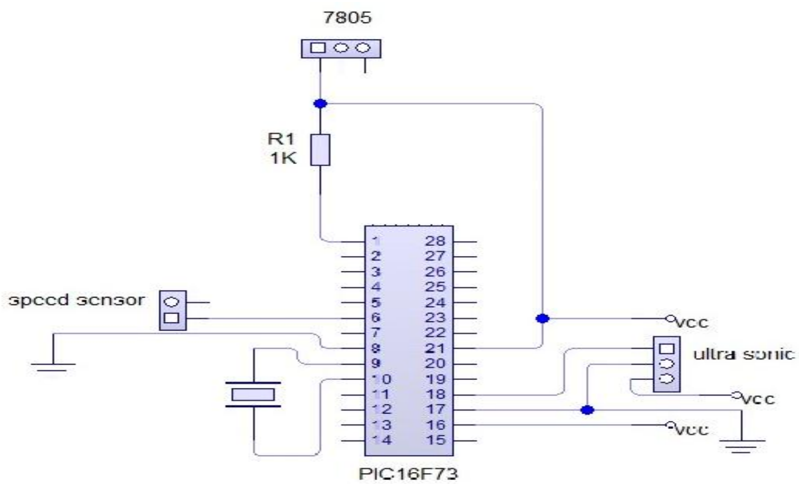

Fig 7 Main board transmitter section

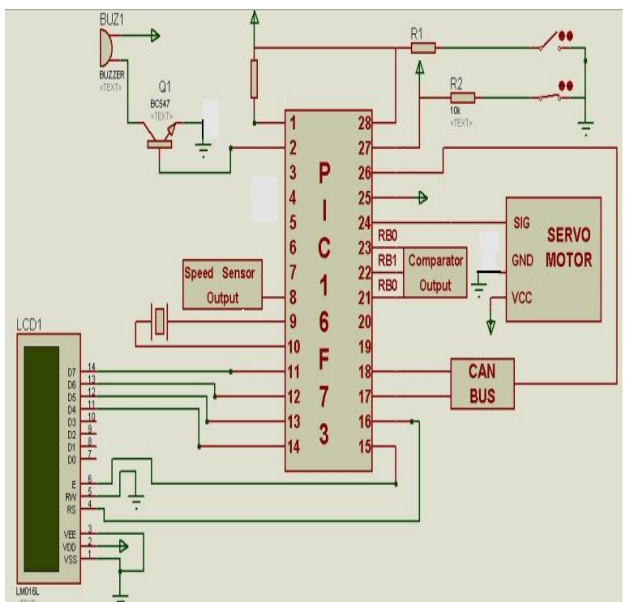

Fig 8 Receiver section

Fig 8shows the receiver section which has servo motor, comparator section, speed sensor output and LCD. The distance measurement value is obtained through CAN bus and the distance measured is displayed on the LCD display. The buzzer is actuated only when the measured distance is less than 1m. The transistor connected to buzzer amplifies the input signal to actuate the buzzer. The measure of speed, distance and gear status are displayed on LCD, the two switch connected to PIC16F73 controls the servo motor as part of cornering headlight A servomotor is a rotary actuator that allows for precise control of angular position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors

6. CONCLUSION

In the near future, automobile manufacturers are considering to use wireless ad hoc networks to improve traffic flow and safety, as they proves to be more cost effective than continually undertaking massive construction projects, which have only limited success. Consequently, future developments in automobile manufacturing will include new communication technologies that offer more effective spacing and collision avoidance systems, gas mileage (less braking),less pollution (cars are in movement), more information and entertainment, etc. In order to reduce communication costs and guarantee the low delays required to exchange data between cars, inter-vehicle communication (IVC) systems, based on wireless ad-hoc networks, represent a promising alternative for future road communication scenarios, as they permit vehicles to organize themselves locally in ad hoc networks without any pre-installed infrastructure.

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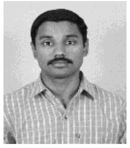

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