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Automotive Security using CAN

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Abstract: *According to today's upcoming technologies vehicle is one of the important necessity of human being. A vehicle dynamics, economy and comfort are improved by traditional electronic control but some problems comp up and they are very dangerous. Hence in-vehicle networking protocol gives benefits to many faults so we can inhibit problems such as the body wiring complexity, space constraints and some reliability issues. Therefore Alarming statistics of accidents and increased number of vehicles on road demands for an intelligent safety mechanism that helps the driver in handling immediate precarious situations. The Main motivation of this proposed system is to reduce fatal incidents happen in car accident.*
Controller area network (CAN) has been widely used for in-vehicle network. The demand of data rate of in-vehicle network has risen sharply, while traditional CAN communication cannot support this demand of data rate with limited bandwidth around DC. CAN which connects the ECUs (Electrical Control Units) embedded in the automobiles. The Main motivation of this project is to reduce fatal incidents after a car accident.

Keywords: Automotive security, CAN protocol, Accident detection, Safety features, Automation

I. INTRODUCTION

1.1 Block diagram

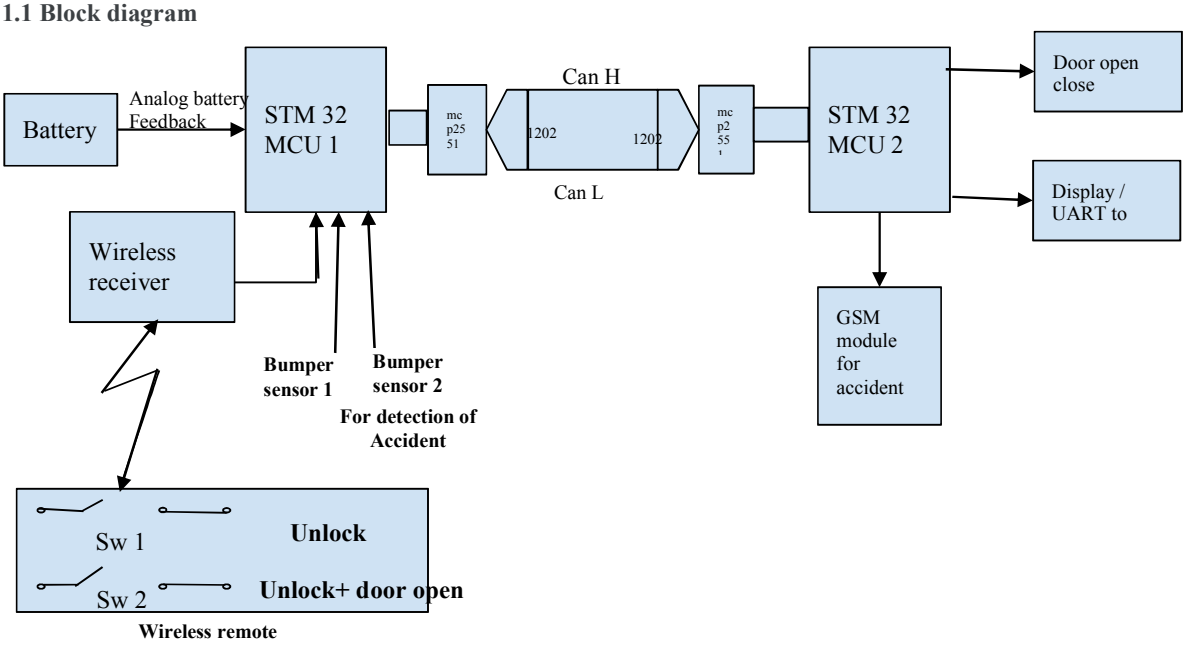

Fig: Block Diagram

1.1 Description

The proposed block diagram for CAN bus communication system is as shown in Figure. The bumper sensor is connected to microcontroller as input to detect accidents and if accident is detected then it will send a message through GSM about the accident to the emergency contact saved in the device. The various vehicle part are considered as CAN nodes and are

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connected each other with CAN bus. Different CAN nodes are connected with different sensors to collect the information and the collected information is transmitted over CAN bus to STM microcontroller. The information collected will be in the form of messages with the CAN message ID and those can be analyzed by the CAN Bus Analyzer.

In these projects we have a transmitting & Receiving circuit, which is used to communicate with each other. Initially we will start the receiver side of our project after sometime we will get one pop up message on our mobile, that GSM is started.

We are getting all these messages from the code of Arduino 1094 which is the transmitting ID of our receiver. Both messages are of 8 bits. First 2 bytes are used for sending dummy messages. Here we are sending a combination of Rf remote. There are four buttons on the remote.

- Lock
- Unlock
- Door open
- Door closed

Their combination will be received on 2nd byte. On the 3rd and 4th byte we shall receive sensor 1 output. Then on the 5th byte will get the value of sensor 2, on the 6th byte will get battery voltage. Now we are getting 3.5 V battery voltage. On the 6th byte we get 27-28-degree room temperature. On the 7th byte we get zero.

In an accident case, whenever sensor gets hit we the output is generated, and it will get high & we get the signal which is transmitted through the transmitter to the receiver side. Now we are pressing our given pressure to the pressure sensor then on the screen we get the signal & Message top “Accident” is detected. Battery voltage 3.5 V .On the remote, there will be four buttons. Here ABCD,

1. A is for door open
2. B is For unlock
3. C is for Door close
4. D is for Lock.

On the receiver side we are attaching a servo motor which shows an indication of the door. We also used the relay here. When the green LED of the relay glows then the door will be in lock position and we cannot open it directly.

To unlock we have to press B on the remote then the relay will give an indication to unlock. & LED turns off the relay. When we press D then the LED glows & it gets locked again. If we press the C door to get close and to open it we have to press the A button on the remote. We are using it as a transmitter.

II. LITERATURE REVIEW

Accidents are a major cause of death and disability. There’s one death every four minute in India due to road accident. Car network has been introduced into China for several years. The development is fast. Vehicle safety enters into a new era of main safety through the car networking technology.

Ashwini S. Shinde et al. designed controller area network for vehicle automation. This paper describes the ARM7 based design and implementation of CAN Bus prototype for vehicle automation. It based on hardware and software design of intelligent node. Hardware same as above paper but the sensors are increasing. Here LIN protocol is also used for controlling the LED lights of a car. Hardware interface circuit mainly consists of MCP2515 standalone CAN-Controller, LPC2148 microcontroller based on 32-bit ARM7 and MCP2551 high speed CAN Transceiver. MCP2551 CAN Transceiver works only in the physical layer.

Beying Deng ei al discussed the car networking application in vehicle in which they car connecting the car to the network and making iot (Internet of Things) based car. It focuses on how to prevent the collision and accidents and look on the human condition, road condition monitoring, aided scheduling, prevention of traffic accidents through the car networking means. Firstly they noted the problem of accidents due to driver. Then they had explained engine operating condition, engine temperature, tire pressure and other conditions sensors which we can say as the ECU (Electronic Control Unit) data send to vehicle terminal equipment through CAN bus and send the data to the cloud by cloud computing and give indication to the driver so we can retard every accident and save lives.lastly they given significance of the information security of car networking.

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Shane Tuohy et al. reviewed intra vehicle networks. Now days, number of vehicles are employing different networking protocols. Vehicles internal performance and dynamics is monitor by Antilock braking system (ABS) and electronic stability control are examples of systems ; whereas camera, radar, and ultrasonic sensors are being acclimated to sense the environment around the vehicle and provide drivers with more information about their surroundings. For a number of years, technologies such as Flex Ray, CAN, local interconnect network (LIN) , media oriented systems transport (MOST) , low-voltage differential signaling (LVDS) , and IEEE 1394 Firewire have been used in vehicles and their comparison is explained in this paper. Physical layer technologies, non-automotive specific standards, automotive network traffic, Ethernet and link layer topologies are also explained in this paper. IEEE 802.1Q VLAN Tagging, AVB and TT Ethernet are discussed in the link layer protocol.

Thanima Thulaseedharan et al. designed real time intelligent driver assistance system in which ARM 7 microcontroller is used in which they monitor the vehicle in two parts as engine control and driver assistance. In engine control they had monitored temperature detector, CO level detector, Fire detector, fuel status and road surface nature .Simulation had done on the Keil µVision in which UART1 and UART2 give simulation results on engine control and driver assistance. A vehicle health report that enables to know about the current condition of vehicle so as to provide a safe drive.

Jaromir Skuta et al. explained Control of car LED lights by CAN/LIN bus. This paper was focused to verification of communication algorithm and possibilities with use of PCANLAIN interface. The car lights are connected to LIN interface through separate controllers. The LIN frames are 8 bytes length. Data frame according to CAN 2.0A and data frame of LIN bus is explained thoroughly. They are controlling lights through the LIN bus. Firstly USB is connected to the CAN then CAN bus of vehicle is connected to the LIN bus and we can their simulation results through PCAN-LIN software. In this way we can control intensity of lights.

Donghyuk Jang et al. explained communication channel modelling of controller area network (CAN). The demand of data rate of in vehicle network has risen sharply, while traditional CAN communication cannot support this demand of data rate with limited bandwidth around DC. CAN with PLC and VDSL system, CAN communication systems use bus topology structure, where the bridge tap length and the main line length are limited below I m and 33m, respectively. Traditional CAN bus and bridge taps use AW G 24 twisted pair for transmission since it has a characteristic of cancelling out electromagnetic interference (EMI) from external sources. Destructive interference is generated at the intersection between a main line and a bridge tap because signal reflection occurs at the bridge tap. After that channel model is briefly explained in this paper. Based on the proposed method, we can obtain the channel frequency response which can be used for decision of suggested tap length and bandwidth without real measurements. So this channel modelling method is quiet accurate.

Pradhan suvendu kedareshvar et al. designed CAN protocol based embedded system to avoid rear-end collision of vehicles. Human errors amount to 93% of all accidents, rear end collision are 30% out of it. Global positioning system , vehicle to vehicle communication , Zigbee module, fuzzy logy based controllers implement different collision warning system .This paper proposed ARM Cortex m0 controller based collision avoidance system. Alert collision warning system, evaluation of deceleration levels, braking display LED array ,control system, CAS-ECU Can communication and ECU controlled DC motor are main sub points of this paper. Alert collision warning system algorithm calculates slope of response of accelerometer and transmits the level of deceleration corresponding to a sudden break to collision avoidance system to take necessary action. They had done graphical analysis of accelerometer where the slopes in the graph give intensity of brakes differentiating gradual braking from sudden change.

Vikash Kumar Singh et al. designed implementation of 'CAN' protocol in automobiles using advance embedded system. In this paper control system with network architecture have benefit over the traditional method. Two sensors that is temperature sensor and IR sensor are monitor through two different microcontroller and CAN controller but these two can connected to the CAN bus. They also explain CAN protocol in brief with its format. CAN controller MCP2510 and CAN transceiver (MCP2551) are used as Transmitter and receiver respectively .They also explained the flow chat if transmitter section as well as receiver section. Fault confinement is also a major benefit of CAN. Faulty nodes are automatically dropped from the bus that prevents any single node from bringing a network down, and gives guarantee that bandwidth is always available for critical message transmission.

Ashutosh U. Jadhav et al. done work on review of control Area Network (CAN) based intelligent vehicle system using advanced RISC machines (ARM) for driver assistance. Road accidents are tremendously happening and to prevent it they

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designed the system that is Intelligent vehicle (IV) system aims to assist drivers in any dangerous situations and save human lives. In introduction they explained the factors contributing to the the fatal accidents and its bar graph. Failure to stay in lane caused the high rate accidents than other problem issues of the accidents. In the proposed work slave ARM processor has alcohol sensors, eye blink sensors to the master, car ignition, GPS module, GSM module parameters are sensed so they made the intelligent vehicle system. Therefore these sensors are used to monitor and detect driver's behaviour to ensure road safety.

Jianqun Wang et al. explained the requirement of accuracy of communication is continuously increasing in rapid development of science technology. In this paper they briefly explained the algorithms that will used to prevent the accidents occurred due to collision of vehicles. Reliability and real-time ability of communication guarantee methods and drawbacks of conventional CAN. Synchronous acquisition is first algorithm which is explained for a user is in queue that is each code is able to receive the information others send, and moreover, once a node in bus has the requirement of bus usage, it can compete to apply. Cyber Storm is conceived if all nodes send data to bus which damages the reliability of in-vehicle network. Therefore when the number of nodes is large, the collisions of frames are severe and therefore the acquisition errors caused by arbitration are hard to calculate and control, in a word, the synchronous acquisition can hardly be achieved. Hence to overcome all these errors they used a dynamic autonomous synchronization method based on IDs of frames. A dynamic autonomous synchronization method based on IDs of frames is proposed here. The core of which is to build a sending queue in the memory of the CPU, and every node sends its data after the successful sending of its former node in the queue. In this method contains the formation of ID's and time slot of sending frames and approaches to add and delete an ID of frames queue explained briefly. So they conclude an autonomous dynamic synchronization method for CAN communication based on the queue of IDs of frames is proposed to realize a quasisynchronous communication result is best.

Mr. K. Kalaiyarasu et al designed an automotive safety system using Controller Area Network. In this paper there are two modules master and slave but both are connected to each other. Master and slave both have different CAN bus connected through 8-bit PIC16F84 microcontroller .Master and slave modules have CAN communication, USB, and Serial port communication. The coding will developed and burn through ICSP. M.

Santhosh Kumar et al. have reviewed self - propelled safety system using CAN protocol. They have taken seven sensors and connected to the 8-bit PIC16F84 microcontroller on-board system .There are two modules master and slave and first four sensors are interfaced to the master and three to the slave and display values on LCD and if the conditions are extreme then buzzer will give indication to the human. They explained CAN protocol thoroughly and given its working according to OSI model .Anti-skid braking, automatic manual transmission, gearbox control, traction control and door control also can be control told in the future scope.

III. CONCLUSION

According to review of we can prevent the fatal incidents occurs due to accident. We can automate door for our convinience. We observed that in previous paper they first monitor only two parameters but now they are increasing .we can monitor these parameters of car through can (controller area network). Through these sensors we can make the car automatic. Communication protocol has been implemented and it precedes required actions, values displayed in dashboard for driver assistance.

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