PREVENTION OF ACCIDENTS IN AUTOMOBILES USING ARM7 BASED CAN

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Abstract - *Technologies should be improvised based on safety requirements. Accidents can happen anytime, hence we need to take a few safety measures. Based on the requirements of modern vehicles, in-vehicle Controller Area Network (CAN) architecture is used. CAN is suggested to reduce point to point wiring harness in vehicle automation. It offers increased flexibility and expandability for future technology insertions.*

The sensors used to measure various parameters of the car like the speed of the car, distance maintained from the other cars, alcohol detection, and so on. A warning signal is sent to the driver to avoid accidents. If accidents occur in a remote area, the bump sensor is used to detect it and an SMS is sent using GSM. If there is a car that is out of the driver's eyesight while changing lanes, the sensor detects it and sends a warning to the driver.

Key Words: (Size 10 & Bold) Key word1, Key word2, Key word3, etc (Minimum 5 to 8 key words)…

1. INTRODUCTION

Nowadays accidents occur due to negligence and mistakes done by the driver. A technology or an intelligent system should be developed to overcome the mistakes that happen. So, a system is put forward where the mistakes done by drivers are observed and it can be eliminated eventually. A monitoring system is found in intelligent cars. Antilock brakes, speed sensors, and other automatic systems are present in sports cars which is not affordable to everyone. So, a system needs to be developed which can be brought and implemented in any car. A collision avoidance system is a system that is present in the car which gives warnings about the dangers that are present ahead of us on the road. It shows how close the other car is to its surrounding cars. It checks the speed while going around a curve and gives warning accordingly.

Sensors are used for sending and receiving data from other cars. It receives signals from other cars, traffic lights, and so on and gives a signal to the driver. When the car is about to change lanes, there might be cars which are not visible to the driver, these cars are detected by the sensor and a signal is sent to the driver to avoid accidents and injuries.

2. OVERVIEW OF CAN PROTOCOL

The controller area network (CAN) provides good and high reliability and good real-time performance. Its cost is also pretty low; hence it is widely used. We can see its use in applications like in-vehicle communication, distributed process control environments and automated manufacturing. CAN bus was invented by German BOSCH Corporation in 1983. It is a serial data communication protocol. CAN is a network protocol that is designed for the car industry [1]. Since data communication in the car often have many sensors transmitting small data packets, CAN supports data frames with sizes only up to 8 bytes. Meanwhile, the 8 bytes does not allow the bus take an extended period of time. Thus, it ensures real-time communication. CAN requires a huge amount of overhead, which when combined with a 15-bit CRC makes CAN very secure and reliable.

A. CAN Bus Electrical Characteristics

CAN transmission medium is formed by the following One is called high-level transmission line CANH and another is called low-level transmission line CANL, connected to CANH and CANL pins of MCP2551 CAN transceiver. VCANH and VCANL be the voltage level of CANH and CANL lines concerning ground. Difference voltage changes among the two parameters.

A. The hierarchical structure of CAN BUS

It contains three layers based on the OSI reference model, they are the physical layer, data link layer, and application layer. SAE J1939, CANopen, DeviceNet are the different protocols present in the application layer.

Start of the frame	Arbitration Field	Control Field	Data field	CRC field	ACK field	End Of frame

Figure1. CAN Data Frame

B.Scheduling of CAN BUS

Fixed-priority scheduling of CAN messages is present in CAN protocol. A higher priority node has a lower node ID. Problems occur with traditional fixed-priority based scheduling if the available bandwidth is less. Low priority control loops may not be able to access the network all the time since high priority loops consume limited resources. Low priority control loops may be destabilized due to the tremendous delays. It is integrated to the network scheduler. Once its invoked, the urgency of each control loop is calculated by the scheduler, based on the system inputs and set points. And then, messages in different loops will be transmitted based on priorities. A new mixed traffic schedule (MTS) is based on the communication principle of controller area network and network scheduling.

C. Reliability

Reliability can be defined as the degree of accuracy of the result (measurement value, specification, etc.) obtained. CAN has a high error handling capability. This improves the system's reliability. If any error is detected by the message transmitting node, it'll terminate the transmission. Then it attempts to retransmit repeatedly until the message has been transmitted successfully. This functionality may let the CAN bus is hogged, if the node of high priority is failed. It is the designer's responsibility to ensure that no message node hogs the bus. Therefore, to avoid such a crisis, the division of the transmit error counter (TEC) and the receive error counter (REC) are initiated to diagnose the conditions of the CAN controller [7]. MCP2515 CAN controller has TEC and REC which enhances the reliability of the CAN bus system. A CAN controller can be in one of three states: error passive, error active, or bus off state. Two error counters-TEC and REC, are used to control the operating states. The CAN controller can be said to be in an error active state if TEC is less than 127 and REC is less than 127 [8]. The passive state is used if TEC is greater than 127 or REC is greater than 127 and TEC is less than 255. The bus off state is entered if TEC is greater than 255. Once the CAN has enters the bus, it must be reset by the microcontroller host to be able to continue operation.

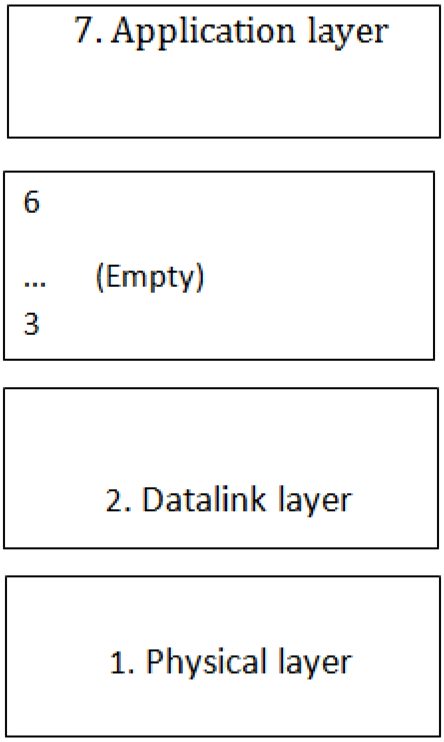

Figure 2. The hierarchical structure of CAN bus

3. HARDWARE DESIGN

Here, the ultrasonic sensor is mounted at the front and on the backside of the car for measuring the distance between the two cars and if this distance is less, an accident warning signal will be sent to the driver on the LCD the alcoholic sensor will sense whether the driver is drunk or not and if the driver is drunk then the driver will not be allowed to start the car. If the car accidentally changes its lane then it will be detected using an IR sensor and buzzer will be turned on. The speed sensor will monitor the speed of the car and if found high then a warning will be given to the driver using an alarm. The sensors will be communicating with the output devices using CAN (Control Area Network) protocol which is implemented with the help of AVR controller

A. Ultrasonic sensor

The ultrasonic sensor is adapted to measure the distance corresponding to the nearest car. The distance is measured while it's in motion, and the warning signals are given to the driver actively.

B. Alcoholic sensor

Alcoholic sensors monitor the person in the car. If the person appears to be drunk the transmission will be automatically turned off.

C. Speed sensor

A speed sensor is used to monitor the speed of the car. If the speed is found to be more than the prescribed level, a warning signal is sent to the driver.

D. Lane sensor

Lane sensor will detect whether the car is in the same lane it is traveling and if accidentally the car changes its lane then accordingly a warning will be given to the driver.

E. Bump Sensor

The bump sensor detects accidents and if the accident is detected then a message is sent to hospital and police station about the location of the accident

F. Microcontroller

The controller takes input from the sensors and depending on these inputs, the output devices will be driven to their best abilities.

An inbuilt CAN controller is present in the LPC 1768. The two microcontrollers will communicate with one another using the CAN communication protocol. LPC 1768 is a Cortex M-3 controller for embedded applications which features a higher level of integration and low power consumption, also wherein System enhancements such as enhanced debug features, higher level of support block integration, etc.

G. Host Microprocessor

The host processor decides the meaning of received messages and takes action on output devices accordingly, i.e., the host processor is the connection between the output devices.

H. Transceiver

CAN transceiver MCP2551 is used to adapt the signal from bus level to a level that can be understood by the CAN controller. It has protective circuitry that protects the CAN controller. It also helps in converting the transmit-bit signal received from the CAN controller into a signal that can be sent onto the bus.

I. Output Devices

Warning signals are given to the driver from various sensors to decrease the speed of the car or to check the turning of the lane. When accidents occur, GSM is used to send SMS. CAN specification, version 2.0B is inbuilt. It transmits and receives standard and extended data and remote frames. Six acceptance filters and two acceptance masks are present to filter out unwanted data. Two receive and three transmit buffers with prioritized message storage is present. A device that converts digital signals is present. A maximum of 112 nodes is allowed to be connected and a nominal termination resistor value of 120ohm.

4. CONCLUSION

In the following paper, CAN bus communication is used for accident avoidance. Wiring system can be reduced using CAN. CAN is more reliable and flexible. It is also good for real time applications. Hence it can be effectively used in automobile field. ARM 7processor is used, which enables fast operation. It is available for low cost and it has high efficiency. It also consumes low power and has good performance.

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