Implementation of Intercommunication System using Communication Protocol in Automobiles

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ABSTRACT: *In trendy fact in which technology has made attractive advances so have the past due automobiles. These cars are greater modern than another time in current memory. They have extra speed, slicing side motors and are excessive due to those motives there's a need to modify a device that can constantly screen all the exceptional parameters of auto. So the utilizing CAN transport (Controller Area Network) which is extensively applied as a part of various fields of industry and particular in the vehicle commercial enterprise, which allow the investigation of statistics going via the delivery and era of messages. In this way the making use of CAN transporting outlining various correspondence (entomb or intra) which is inside the automobile and inside the middle of automobiles. Here, a protocol which avoids vehicle accidents is discussed. The vehicle state information is being obtained, using ultrasonic sensors, to predict potential accident and accordingly, reduces the vehicle speed. This protocol provides warning message when the distance is reduces than the safety limit.*

IndexTerms: Anti-Collision System, Braking System, Sensor, Communication Protocol.

I. INTRODUCTION

According to a report put together by National Institute of Disaster Management, in India like clockwork there is a street mischance i.e. l080 mischances every day. Human mistakes add up to 93 % of all mischances and as indicated by police, backside impact, passing the main vehicle and not understanding about right or left side moving vehicle constitute 80% of every lethal mishap. STRADA (Swedish Traffic Accident Data Acquisition) performed an examination that shows 9l% of all backsides impacts and surpass crash include trucks [1]. The most well-known backside crash and passing the main vehicle is an impact where an auto's back is smashed by an overwhelming truck. Likewise more impacts that include backside crash do happen without trying to hide with great preservability conditions on a straight street and in great climate condition however in any case terrible climate or awful preservability could likewise prompt backside impact [4]. Decreasing car crashes is one of the primary targets of any transportation framework. Mischances because of backside impacts and overwhelm driving vehicle is extremely normal and it becomes one of their inquiry wailed theme in the car segment. The late innovation patterns in the car business are incorporating so as to get more solace a vehicle mechanization procedures like impact shirking (which utilizes lasers to identify the items around the vehicle and when the vehicle gets nearer to any question, the brakes will be connected consequently), propelled security highlights, amusement gadgets and parcel more. As the innovation is adding to, the utilization of electronic control units (ECU) in vehicles is expanding quickly, making the correspondence between them extremely mind boggling. Multiplexed correspondence was in the end created to diminish the interconnections (links) and the multifaceted nature between the ECUs. Be that as it may, the multiplexed correspondence has not met the continuous correspondence prerequisites[7]. In 1980s, BOSCH, an innovation based enterprise planned a multi expert serial correspondence convention called Controller Area Network (CAN) which is strong, continuous furthermore diminishes the measure of links to be utilized for the interconnections. The CAN convention is an offbeat serial correspondence convention which takes after ISO 11898 models and is generally acknowledged in cars because of its constant execution, unwavering quality and similarity with extensive variety of gadgets. The CAN convention is a two wire, half duplex framework which has information rates up to 1Mbps and offers an abnormal state of security. Its convenience, strong, minimal effort and flexible innovation made it pertinent in different ranges of utilizations where entomb processor correspondence or disposal of extreme wiring is required. A percentage of the regions it is generally utilized are modern hardware, aeronautics, therapeutic equipment's, building mechanization and so forth [11].

II. RELATED WORK

Controller area network (CAN) provide high reliability and good real-time performance with very low cost. Due to this, CAN is widely used in a wide range of applications, such as in-vehicle communication, automated manufacturing and distributed process control environments.CAN bus is a serial data communication protocol invented by German BOSCH Corporation in 1983. CAN is a network protocol which is designed for the car industry [1].

Since data communication in car often have many sensors transmitting small data packets, CAN supports data frames with sizes only up to 8 bytesas shown in Figure 1. Meanwhile, the 8 bytes will not take the bus for a long time, so it ensures real-time communication. CAN use a large amount of overhead, which combined with a 15-bit CRC makes CAN very secure and reliable. CAN protocol use non-destructive bitwise arbitration process to access shared resource. CAN protocol define a logic bit 0 as a dominant bit and a logic bit 1 as a recessive bit, each. transmitting node monitors the bus state and compares the received bit with the transmitted bit [2]. If a dominant bit is received when a recessive bit is transmitted then the node stops transmitting (i.e. it lost arbitration).

Arbitration is performed during the transmission of the identifier field. There are two message formats: Base frame format with 11 identifier bits and extended frame format with 29 identifier bits [3].

Figure 1. CAN Data Frame

A. CAN Bus Electrical Characteristics

CAN transmission medium formed by the two, 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 with respect to ground. The difference between them is called difference voltage Vdiff.

B. Hierarchical structure of CAN BUS

Architecture of CAN protocol based on OSI reference model is as shown in Figure 2. CAN protocol contain only three layers, physical layer, data link layer and application layer. Application layer has different protocols such as SAE J1939, CANopen, DeviceNet, etc [4].
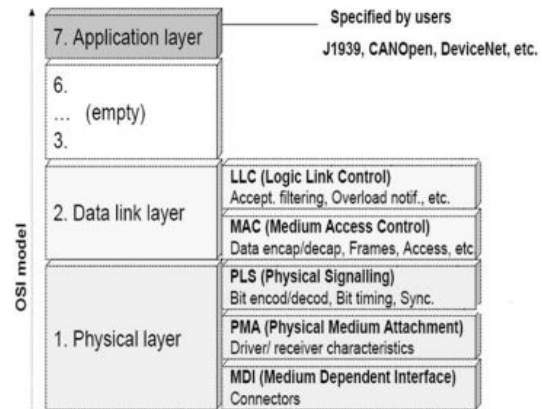

Figure 2. Hierarchical structure of CAN BUS

C. Scheduling of CAN BUS

CAN protocol implements fixed priority scheduling of CAN messages. Higher priority node has lower node ID. If available bandwidth is scarce, problems come with traditional fixed-priority based scheduling [5]. It is possible that low priority control loops cannot access the network all the time, since limited resources have been consumed by high priority loops. As a result of tremendous delays, low priority control loops may be destabilized. The problem of fixed priority is overcome using direct feedback scheduling algorithm, namely MUF (maximum urgency first) is integrated in the network scheduler.

Upon invocation, the scheduler calculates the urgency of each control loop based on the set points and current system outputs. According to the MUF algorithm, the scheduler produces new priorities based on these urgency values. And then, messages in different loops will be transmitted in accordance with the newly assigned priorities[6]. A new mixed traffic schedule (MTS) is based on the communication principle of controller area network, network scheduling and analysis of schedule.

The core idea of MTS is set the relative deadline information into the identifier. Use the earliest deadline first (EDF) message scheduling algorithm for high priority information and the RMS (rate monotonic scheduling) message scheduling algorithm for low priority information.

D. Reliability

Reliability is defined as the probability of no failures in an operational interval. High error handling capability of CAN improves system reliability. If any message transmitting node has detected an error, the node forcibly aborts transmission. Then it attempts to retransmit repeatedly until its message is transmitted successfully. This functionality may let the CAN bus be hogged, if the node of high priority is failed. It is the designer's responsibility to ensure that no any message node hogs the bus. To avoid such crisis, the faculty of the transmit

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error counter (TEC) and the receive error counter (REC) are started to diagnose the conditions of CAN controller [7]. MCP2515 CAN controller has TEC and REC which enhances reliability of CAN bus system. A CAN controller can be in one of three states: error active, error passive or bus off state. The operating state of the controller is controlled by two error counters – TEC and REC. The CAN controller is in error active state if TEC less than 127 and REC less than 127 [8]. Passive state is used if (TEC greater than 127 or REC greater than 127) and TEC less than 255. Bus off state is entered if TEC is greater than 255. Once the CAN controller has entered bus off state, it must be reset by the host microcontroller in order to be able to continue operation.

III.   PROPOSED FRAMEWORK

Following Fig.1 show the system architecture block diagram including the lpc 2148 processor based development board, MCP2515 CAN controller, Ultrasonic Sensor and motor controlling Door (motor driving card), LCD and related hardware.
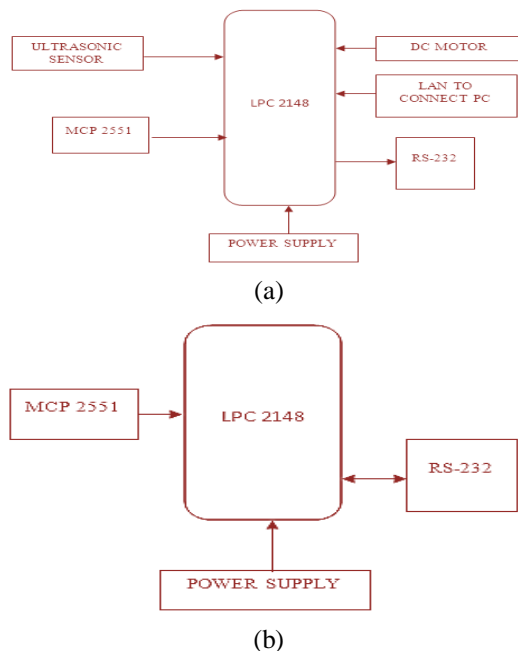

(a)

(b)

Fig.1 (a) Transmitter (b) Receiver unit of System architecture block diagram

A dominant state occurs when the differential voltage between CANH and CANL is greater than a defined voltage (e.g., 1.2V). A recessive state occurs when the differential

F. Microcontroller

ARM7 Microcontroller: The LPC2148 microcontroller is based on a 32/16 bit ARM7TDMI-S CPU with realtime emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32kB to 512kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30% with minimal performance penalty. The System Control Block includes several system features and control registers for a number of functions that are not related to specific peripheral devices. These include the Crystal Oscillator, External Interrupt Inputs, Miscellaneous System Controls and Status, Memory Mapping Control, PLL (Phase Locked Loop), Power Control, Reset, VPB Divider, Wakeup Timer. Each type of function has its own register(s) if any are required and unneeded bits are defined as reserved in order to allow future expansion. Unrelated functions never share the same register addresses.

The microcontroller will increase/decrease DC speed via Pulse width modulation. The microcontroller will increase or decrease the ON time and OFF time of the entire pulse time. If we decrease the ON time then the voltage applied to the DC motor will reduce and the speed of the DC motor will be reduced.

Ultrasonic Sensor: Ultrasonic sensors are basically used to measure the distances between the obstacle / object and the sensor. The ultrasonic sensor works on Doppler Effect. It consists of a ultrasonic transmitter and a receiver. The transmitter transmits the signal in one direction. This transmitted signal is then reflected back by the obstacle and received by the receiver. So the total time taken by the signal to get transmitted and to received back will be used to calculate the distance between the ultrasonic sensor and the obstacle. In the present model four Emergency keys are included. Actually these keys may represent ambulance service, brake fail, emergency and addresses respectively.

IV.   RESULTS AND DISCUSSIONS

Algorithm for the proposed system is divided in two parts as follows: Transmitter and Receiver

A. Transmitter

Algorithm for transmitter side which consists sensors, AVR microcontroller and CAN (MCP2515) is as follows:

1. Initialize SPI (Serial Peripheral Interface).
2. Initialize LCD.
3. Initialize CAN (MCP2515).
4. Provide impulse to ultrasonic sensor.
5. Measure distance from other car and display on LCD.
6. Transmit distance via CAN (MCP2515).
7. If lane cutting detected send Y else go to step 8.
8. Sense speed and if speed goes beyond range send Z else go to step 9.
9. Check for impact and if impact detected send A else go to step 4.

B. Receiver

Algorithm for transmitter side which consists output devices, AVR microcontroller and CAN (MCP2515) is as follows:

1. Initialize SPI (Serial Peripheral Interface).

2 . Initialize LCD.

3 . Initialize CAN (MCP2515).

4 . Send acknowledgment to the transmitter.

5. Receive distance data from CAN of transmitter and if distance is less then display warning signal on LCD.

6. If X is received then display "Car cannot be started" else go to step 7.

7. If Y is received then display "Wrong" else go to step 8.

8. If Z is received then turn on buzzer else go to step 9.

9. If A is detected then send data to webpage through LAN else go to step

V.   CONCLUSION

Here, the car is equipped with an ultrasonic sensor, which will continuously tracks for any obstacles from the front side. If the obstacle is detected, then the microcontroller will continuously compare the distance given by the ultrasonic sensor. If the distance goes on reducing indicating that, the front car is coming closer to the current car then the microcontroller program will start reducing the speed until the distance is within safe limit.

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