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Empirical Evaluation of Economical Automated Car Safety and Control System

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Abstract: In this age of innovation every device of human life become automated. Accordinglyautomotive production companies pay more Attention towards produce cars with automatic safety feature. To provide safety to driver and passengers in car numerous types of electronics module are placed. These modules are consists of sensors and control units. These are all connected together to CAN [controller area network] serial bus asubstitute to conventional multi-wire loom.Modules produced Data reveals by collaborative communication through asmart information network called as Controller area network (CAN). This paper describe anexemplareconomical car safety and control system for car using can protocol which have given warning to driver or control the car autonomously.

Keyword: CAN protocol. Can Frames. Control system. Modules.DAS

I. INTRODUCTION

Automotive production companies day by day increase number of electronics controller, instruments and sensors in large scale. It's become headache to connect them in a point to point wiring system.due to this complicated, bulky, heavy and expensive. Bosch Companyhas invent a new network controller in the automotive industries with the intention of replacing and simplifying the wiring system This development gave rise to a new network system, called the controller area network (CAN) [1]. The CAN system was developed as a serial bus with high speed, high reliability, and low cost for distributed real time control applications.

II. CONTROLLER AREA NETWORK (CAN) PROTOCOL

The CAN communication protocol is a CSMA/CD protocol. The CSMA stands for Carrier Sense Multiple Access which means that every node on the network must monitor the bus for a period of no activity before trying to send a message on the bus (Carrier Sense)[2]. Also, on first occasion of appearance of this period of no activity, every node on the bus has an equal chance to for transmission of a message (Multiple Access). The CD stands for Collision Detection. If transmission from two nodes on the network get started at the same time, the nodes will identify the 'collision' and take the corrective action. CAN protocol basically utilizes a nondestructive bitwise arbitration method. Its meaning is that even if collisions are detected messages remain intact after arbitration is completed. Also corruption or delay threats of the higher priority message are left out of arbitration process.

There are some things that are required to support non-destructive bitwise arbitration. One of them is logic states need to be defined as dominant or recessive. Then the transmitting node must monitor the state of the bus to check whether the logic state it is trying to send actually appears on the bus or not. Logic bit 0 as a dominant bit and a logic bit 1 as a recessive bit are defined in CAN[1-2].

A dominant bit state will always win arbitration over a recessive bit state, hence the lower the value in the Message Identifier (the field used in the message arbitration process), the higher the priority of the message. For example, let two nodes are trying to transmit a message at the same time, each node will monitor the bus to make sure the bit that it is trying to send actually appears on the bus or not. At some instant the lower priority message will try to send a recessive bit and the monitored state on the bus will be a dominant. At that point this node loses arbitration and stops transmitting instantaneously. The higher priority message will continue until completion and the node which has lost arbitration will wait for the next period of no activity on the bus and try to retransmit its message.

CAN Message Frame Description

CAN protocol consists of 4 different types of messages which are known as Frames. Data Frame is the first and most common type of frame. It is used when transmission of information takes place from one node to any or all of the remaining nodes in the system. Second is a Remote Frame, which functions as a Data Frame with the RTR bit set to signify it is a Remote Transmit Request

Purpose of the other two frame types is handling errors. One is called an Error Frame and other is called an Overload Frame[2]-[3]. Error Frames are generated by nodes that identifies any one of the many protocol errors defined by CAN. Overload errors are generated by nodes that require extended time for processing the messages that are already received.

Data Frames include fields that gives additional information about the message as defined by the CAN specification. Embedded in the Data Frames are Arbitration Fields, Data Fields, Control Fields, CRC Fields, a 2-bit Acknowledge Field and an Frame-End.[2]-[4]

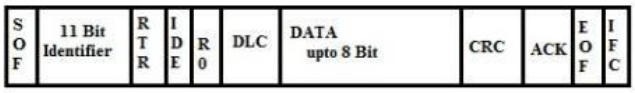

Figure: STANDARD CAN Frame Format

Figure:EXTENDED CAN Frame Format

III. AUTOMATED CAR SAFETY AND CONTROL SYSTEM

Control system starts with actual physical quantity which is to be measured viz. voltage, current, temperature, light intensity, gas pressure, fluid flow, and force. Initially, Irrespective of the type of physical property to be measured, the physical state that is to be measured must be transformed into an integrated form that can be sampled by a DAS [5].the responsibility of performing such transformations is handled by the devices called sensors.

A sensor, basically is a type of transducer (device that converts a physical property into a corresponding measurable electrical signal) viz. LDR, thermistor, IR sensor. An acquisition system to measure different properties depends on the appropriate sensors. The need of Signal conditioning is optional depending on the signal from the transducer if it is not suitable for the DAQ hardware being used. Filtering and amplification of the signal is required in many cases[5]-[6].

IV. DATA ACQUISITION AND SAFETY CONTROL SYSTEM

This system consist 5 CAN nodes as described below

Temperature node:-The first slave node (Temperature node) is continuously senses the temperature. Generates appropriate data which is sent to master node. When it receives control signal from master node and switches on the cooling system.This node is used to measure temperature change by relying on the change in its resistance with changing temperature.

In this automobile application the thermistor changes resistance as the engine's coolant temperature changes. This output is monitored by the engine computer to control various functions as:

- Ignition
- Fuelling
- Cooling fan operation
- Thermostat operation

Ambient light monitoring node:-The second slave node (Ambient light monitoring node) is continuously senses the light intensity in the specified area and generates appropriate data which is sent to master node. When it receives control signal from master node and switches on headlight of CAR.

Proximity node:-The third slave node (proximity node) is used as parking aid. It operates on the ultrasonic principle. It assists the CAR driver when reversing into a parking place and provides alert if the car is approaching an obstacle and the distance is below a minimum safety limit and simultaneously sends appropriate data to master node.

This node helps us to know that how much distance is left in between our vehicle and an obstacle due to which chances of getting damages to a vehicle. This is achieved by mounting ultrasonic transducers that are integrated into the rear bumper as well as in the front bumper.

The distance between the vehicle and an obstacle is measured by way of ultrasonic signals and audibly signaled by a warning tone. This tone sequence changes continuously corresponding to the distance between vehicle and obstacle, indicating to the driver the distance to the obstacle. The shorter the distance of the vehicle from the obstacle the faster the tone sequence. A continuous tone sounds at a distance of less than 25 cm. To distinguish the sounds, the pitch is different at the front and rear.

Fuel level node:-

The fourth and last slave node (fuel level node) is continuously senses the fuel level and sends fuel level information to master node.

Master node:-

The master node is continuously establishes communication with slave nodes, collects and monitors data associated with slave nodes. And displays the same for the end user to the decision making. It gives an idea to the end user that what process to select at that situation, which real time signals and the information should be transmitted to the second node that is the receiving node.

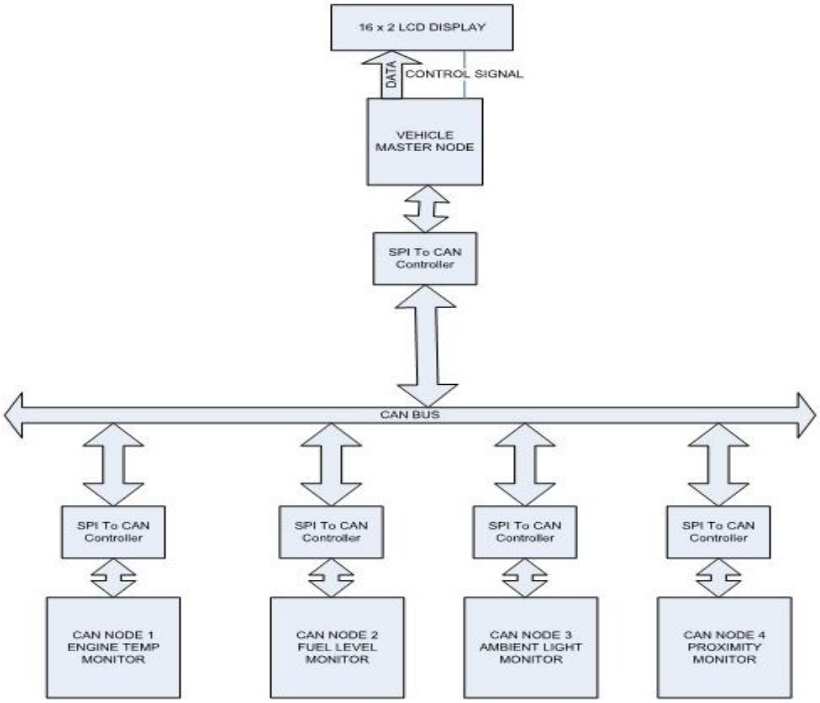

Figure: - Data Acquisition and Safety Control System Block Diagram

IV. CONCLUSION

To eliminate limitations and dimness of number of sensor node placed in vehicles, and wiring and installation cost, serial communication systems CAN-protocol based systems have been adopted by automotive industries. This paper presents a brief overview of CAN protocol network. This network is gaining high ground in many applications from automobile industry to automation and factory industriesIn this paper, the real time monitoring car safety and control system based on the CAN-bus is put forward, at the same time, the circuits of CAN controllers, safety sensor node and the measurement node are designed too. The accuracy and the reliability of this monitoring system allows an efficient transmission of data between different nodes. With its flexibility and robustness against electrical interference and also Digital control of the vehicle is an important criterion of modern carswhich is low cost, high reliability and other features to meet the needs of the modern automobile industry.

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