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Fault Finding System for vehicle Using I2C Bus

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ABSTRACT

Now a days automotive electronics is rapidly advancing in driver assistance system. Current vehicles generally use different networking protocols to integrate these driver assistance systems into vehicle, like RS 232, RS 422 and RS 485. These protocols are only used to transport the message. It is required to find the faults which occur in vehicles. Existing protocol does not meet this requirement. CAN(controller area network) is an attractive solution for it with the embedded control systems due to its low cost, light protocol management, the deterministic resolution of the contention and built-in features for error detection and retransmission. Fault confinement is a major benefit of CAN. This paper explains design and development of the CAN bus like environment using I2C bus for monitoring the vehicle's parameters like blown fuse indication, temperature and controlling.

KEYWORDS:*Controller area network (CAN), I2C Bus, Embedded System.*

I. INTRODUCTION

Several embedded systems are distributed systems which consisting the multiple microprocessors. That microprocessor communicating with networks to did the shared tasks. For example, a modern automobile system have many more microprocessors which communicate with several networks to manage entertainment and navigation functions, central locking mechanisms, lighting and other vehicle systems. Safety systems like air bags and powertrain control uses for high speed network communication and uses for communication between the engine and transmission controllers respectively [2].

Controller area network (CAN) is very useful network in the automotive and the manufacturing industries. CAN is a serial bus communication protocol which is established by Bosch in 1980s. It describes the two layers of OSI model i.e. physical layer and data link layer. There does also exist several CAN based higher level protocol which are standardized. Choice is depend on user application.

In this system, we monitor the two vehicle's parameters i.e. fuse status and temperature of the engine. Fuses are inexpensive and easy to replace. Many vehicles having two fuse boxes i.e. one under the hood and other is under the dashboard. Fuses provide important protection for sensitive electronics. If too much voltage is sent into a circuit, the fuse blows. This protects accessories (radio, headlights, dash lights, etc.) but need to replace the blown fuse before use that accessory again. The wire inside the fuse is designed to melt if the current passing through the fuse exceeds its rated amperage. When the fuse "blows", it opens the circuit and stops the flow of current to protect the circuit from the dangerous overload that might otherwise damage components or start a fire. The main causes for overheating of car engine are point out in below:-

1. Low Coolant by a Large Margin
2. Electric Cooling Fan Failure
3. Bad Radiator Fan Switch
4. Thermostat Not Opening

This paper describes the design and also development of CAN bus protocol like environment for finding the fault in vehicles using I2C bus. The fault finding system consists of two parts, i.e. software and the fault finding system itself. In this work, System monitors the parameters such as fuse status and temperature. Monitoring and controlling of those parameters was done via I2C.

This fault detection System decreases the circuit complexity because in this project I2C Bus is used (I2C Bus require only 2 wire for connection) and centralized hub (CAN Bus like environment) is developed to control and also monitors the environment of vehicles. In fault finding system, I2C bus is used. I2C bus protocol has attractive features as compare to the SPI bus as shown in below table 1. SPI is serial peripheral interface. In I2C bus, interfacing is much better than in SPI bus. It is the most popular bus over other buses. It is used for communication between a single or multiple master devices and a single or multiple slave devices. This bus is required only two bus lines. Due to this advantage circuit complexity gets reduced.

Table 1.
Comparison Between I2C Bus and SPI Bus

Sr. No.	I2C Bus	SPI Bus
1.	Require less pins	Require More pins
2.	Half-Duplex Communication	Full-Duplex Communication
3.	Bus arbitration is possible in case of I2C	Not in case of SPI
4.	Multi-master possible in I2C easily	Not in SPI
5.	I2C can connect the slaves to the master up to 128.	Not in SPI
6.	Less complexity in circuit	More
7.	Two lines (SCK AND SCL)	Four lines(MISO,MOSI,SCK,CS)

II. RELATED WORK

In this, survey of CAN (controller area network) protocol is described. CAN is used in different systems for different purposes like controlling, detecting purposes. In survey paper [4],TejasUnavane, *et al.,* have developed the application layer protocol based on CAN bus for six DOF (Degrees of Freedom) Shake table System which is control system, in this developed system two CAN protocols i. e. A and B protocols are design and also develop for transferring some data like real time acquired data, plot data, sensor data and this transformation is for controlling purpose. [5] Described the CAN-Based Automotive Systems. This automotive system is Real-Time Distributed system. In this,for Automotive Systems Security based Modeling is designed. In this work, for Automotive Systems Efficient Mapping is also done.

In survey [6], CAN is used for the characterization of suspension systems. This characterization for the two-wheel vehicles. Because of the ISO/IEC/IEEE 21451, the data which received from sensor and sent by GPS i.e General Packet Radio Service module to PC and that implements the processing algorithm. In paper [7], for CAN a novel based IC (intermittent connection) detection method has been developed. Also monitoring method was done for CAN. Same research work was done by Yong Lei; *et al.*[8], in this system, fault detection method is done for IC problems on controller area networks. The survey paper [9], presents only the overview of current research on advanced intra-vehicle networks. The survey paper [13] G. M.Phade , et al.,gave the idea about how to control the fault which occurs in vehicles using CAN bus. In that they consider the two parameters i.e. fuse status and temp of vehicles.

III. PROPOSED SYSTEM

The proposed system consist the design and development of CAN bus protocol like environment using I2C bus for vehicle's fault finding system. This fault finding system is controlled by PC (Personal computer). Fault finding System monitors the parameters such as fuse indication status, temperature and also controlling that parameter via I2C bus protocol**.** In this fault finding system, two sensors are using, so the only temperature and blown fuse indication these two parameter are monitors.

In this system, each slave will fetch their corresponding parameters like temperature, fuse status etc. and master will have a watch on the same parameters like temperature, fuse status provided with byte information from slaves. After that master will analyses the slave's data for volitation of set point and soon it exceeds the limit immediately. A control signal will be provided by

master's digital pin which turning on relay via transistor. Thus monitoring as well as control will be fired through I2C bus is done successfully. Also monitoring output will be displayed on PC's screen using vb.net program as shown in figure 3. Also Figure 2 shows the proposed system of fault finding system.

In this proposed system, Visual studio 2005/8 software is used. VB.Net is high level language among all other computer languages. So in this system VB.Net language is used. Length of program gets reduces, so that we can increase the efficiency of the programming. VB.Net, is only non-case sensitive language, it can also reduce the time. Also reduce the complexity of programming.

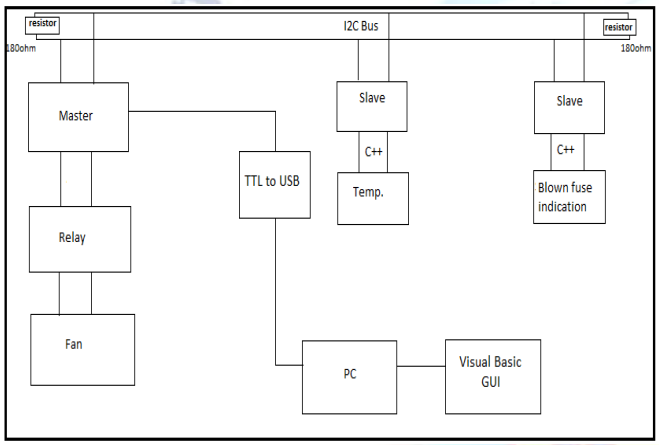

Figure 1.Fault finding System for vehicle.

Reduce the cost of system, reduce circuit complexity, develop a real time fast acting prototype, develop a centralized hub to control and monitor the environment these are the goals of proposed system.

As shown in figure 2 implementation of hardware of proposed system will be placed in vehicle. Slave 1 is for temperature will be placed in engine compartment to monitor the engine temperature. Slave 2 is for fuse box panel will be placed in fuse box panel(one is in engine compartment and another one is in vehicle's dashboard). And master will be placed in vehicle's dashboard for monitoring the parameters and controlling through I2C Bus. So in case of vehicle, vehicle's engine will act as slave 1 and fuse box in engine compartment and in vehicle's dashboard will act as slave 2 as shown in figure 2. And carputer (computer which is specially design for car) in vehicles will act as master as shown in figure 2.

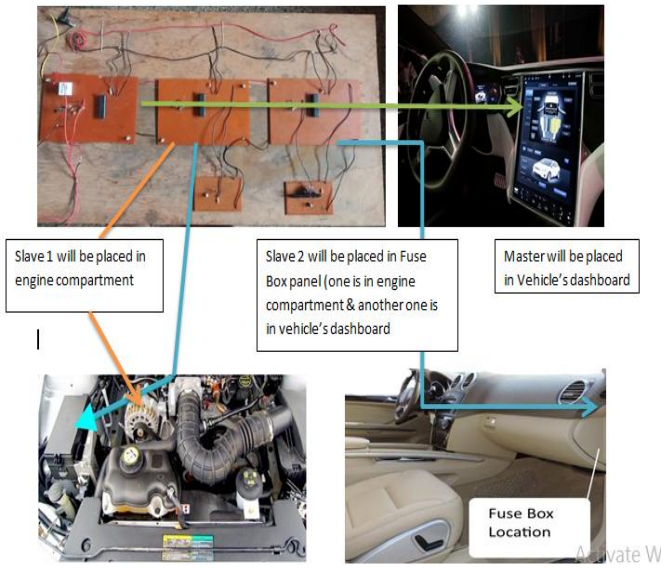

Figure 2. Hardware Implementation

IV. RESULTS AND DISCUSSION

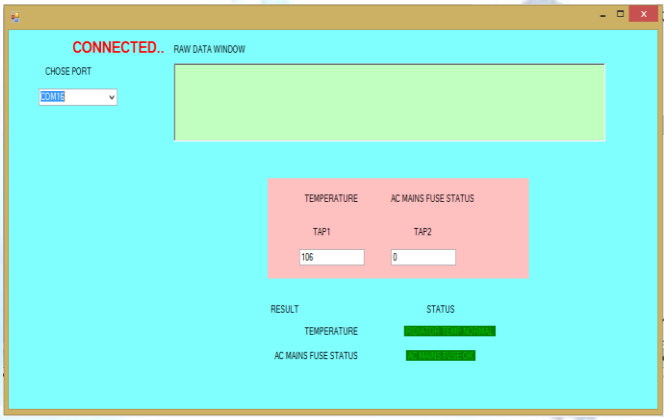

Figure 3. Monitoring Panel at Normal condition

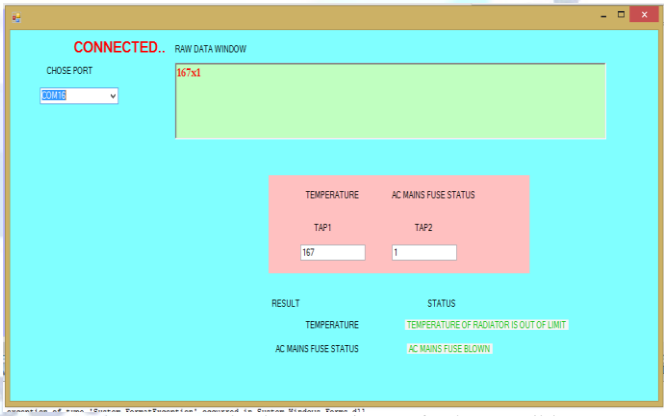

Figure 4. Monitoring Panel at Defective condition

Above figure 3 and figure 4 shows the monitoring panel at normal and at defective condition respectively. Temperature of the AC is 150 degree Celsius then it will show the status that temperature is normal as shown in above figure 3 and if it is excesses the range of temperature, it will shows the status that temperature is out of limit as

shown in above figure 4 and then relay from the controller will automatically start the fan. And if fuse is not blown then results will shows the digital 0, also shows the status that AC Mains fuse is ok as shown in above figure 3. Else it will shows digital 1 and also shows the status that AC Mains fuse is blown as shown in above figure 4.

Fault finding system will implement in vehicle after that monitoring panel at normal and at defective condition as shown in figure 3 and figure 4 will be display on vehicle's carputer (computer which is specially design for car) as shown in figure 5. These results will also display on LCD screen.

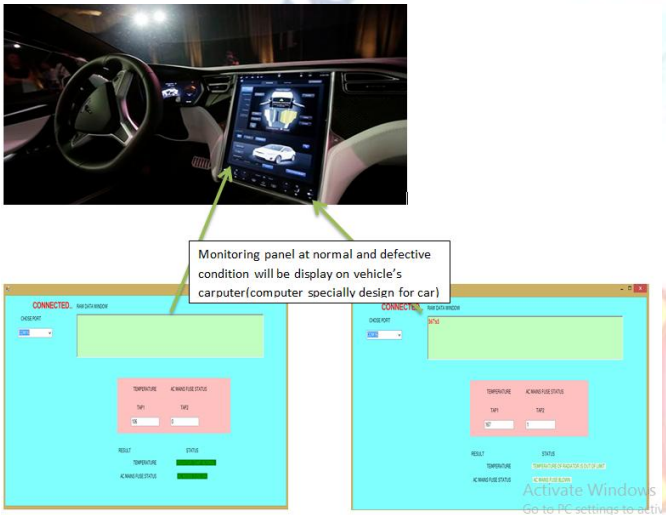

Figure 5. Results Display on Carputer

V. CONCLUSION

In current vehicles many driver assistance systems are available like adaptive light control system, automatic braking system, automatic parking system, collision avoidance system and also blind spot detection system. But these systems are not useful for finding the faults which occurs in vehicles. Therefore, authors made CAN bus like environment for finding the faults which occurs in vehicle. This fault finding System monitoring the parameters like blown fuseindication (if wire inside the fuse is melt because current passing through the fuse exceeds its rated amperage then fuse is "blown") and temperature. Also, controlling those parameters through I2C bus. This System reduces the circuit complexity because I2C Bus requires only two wires (serial data line and serial clock line) for communication and develops a centralized hub (CAN Bus like environment) to control and monitor the vehicles environment. Future work includes the development of fault finding system by adding extra sensors for monitoring other parameters of vehicles.

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