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ADVANCE AUTOMOTIVE EMBEDDED TECHNOLOGY BASED ON CAN, WIFI AND 2.4 GHZ FOR MODELLING SECURITY AND CONTROLLING

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Abstract: To reduce the human efforts and to increase the luxury of the user a new concept is proposed to control the various modules of car connected with each other through wired communication and a main controller controlling it wirelessly through a tablet device. CAN Bus is Advance Bus for the Micro Controller to communicate in harsh environment with multiple sensors and controller. If the embedded equipment is applied in control system, the cost is low and the control system has advantage in easily monitor car different sensors and control internal devices with wireless interface of tablet or smart phone.

Keywords: CAN bus, Protocol, SPI, MCP2515, MCP2551

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INTRODUCTION

I.CAN BUS OVERVIEW

Controller area network (CAN) is a one type of serial bus which is developed by Bosch Corporation to solve the problem of data interchange between multiple electronic devices of future automobile in 1980s. CAN bus has the advantages of high intelligence, fault-tolerant and reliability [1], that can support distributing real-time control [2]. CAN (Controller Area Network) is a serial bus system which is used to communicate between several embedded 8-bit and 16-bit microcontrollers. It was originally designed for use in the automotive industry but is used today in many other systems. Controller Area Network (CAN) is a serial network that was originally designed for the automotive industry, but it has also become a popular bus in industrial automation as well as other applications. It is a two-wire, half duplex, high-speed network system and it is well suited for high speed applications using short messages. Its robustness, reliability and the large following from the semiconductor industry are some of the benefits with CAN. CAN bus offers high-speed communication rate up to 1 Mbits/sec thus allows real-time control. In addition, the error confinement and the error detection feature make it more reliable in noise critical environment.

1. How do CAN bus modules communicate?

CAN bus uses two dedicated wires for communication. The wires are called CAN high and CAN low as shown in figure 2. When the CAN bus is in idle mode, both lines carry 2.5V. When data bits are being transmitted, the CAN high line goes to 3.75V and the CAN low drops to 1.25V, thereby generating a 2.5V differential between the lines. Since communication relies on a voltage difference between the two lines, the CAN bus is NOT sensitive to inductive spikes, electrical fields or other noise. It makes CAN bus a reliable choice for networked communications on mobile equipment.

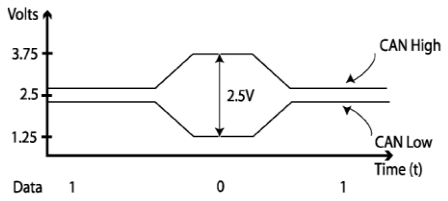

Fig.1: CAN Bus Modules Communicate [3]

II. SPI PROTOCOL

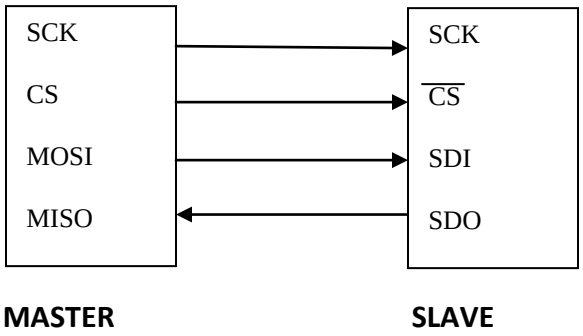

Fig.2: Single Master-Slave SPI bus Implementation

The SPI is used for a synchronous serial communication of host micro controller and peripherals. SPI requires two control lines (CS and SCK) and two data lines (SDI and SDO) as shown in Figure 2. The SPI bus specifies four logic signals:

- **SCK** – Serial Clock, provided by master
- **CS** – Chip Select, allow master to select peripheral (slave) device
- **MOSI/SDI** – Master Output Slave Input/Serial Data In
- **MISO/SDO** – Master Input Slave Output/Serial Data Out

III. BLOCK DIAGRAM OF THE SYSTEM

The main block diagram is shown in the following figure which contains a master unit with two slave units.

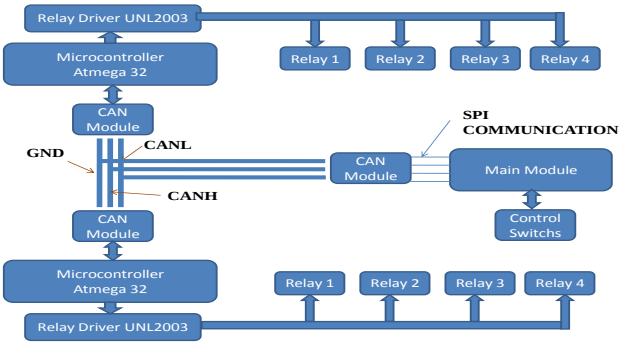

Fig.3: CAN Bus Communication Block Diagram

Figure 3 shows the master unit with the two slave modules. Both the front light module and the rear light module are connected to the main module through the CAN controller. All these three CAN controllers are connected with each other through the CAN bus. This figure shows the final block diagram of CAN communication module.

One module is connected to the other module through the CAN module. First of all the data or the control commands are transferred from the control switches to the microcontroller of the main module. ATmega32 will be used as the microcontroller of the main module. Then the CAN controller receives this data from the ATmega32 microcontroller by using the SPI protocol. Here MCP2515 will be used as the CAN controller. SPI protocol is used for the communication between the CAN controller and the main controller. After receiving the data by the CAN controller MCP2515, this data will go to the respective CAN module through the CAN bus. Here CAN protocol is used for the communication between the various modules. Then through the CAN bus, the data will be received by the respective CAN controller of the CAN module. CAN controller MCP2515 will give the received data to ATmega32 microcontroller and at last the devices will be either on or off according to the received data by the microcontroller. Both the modules are separately shown in the following figures.

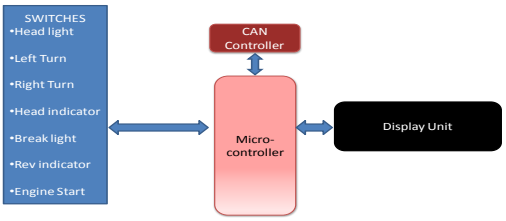

Fig.4: Master Unit

The slave unit consists of the front light module the rear light module. The block diagram of front light module and rear light module are shown in figure 5 and figure 6 respectively.

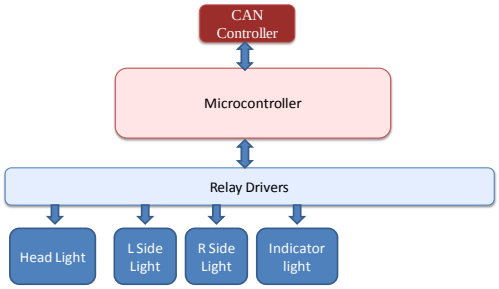

Fig.5 Front Light Module

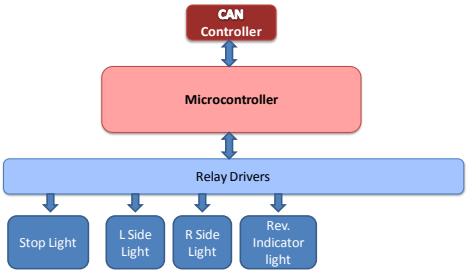

Fig.6 Rear Light Module

IV. SCHEMATIC OF CAN MODULE

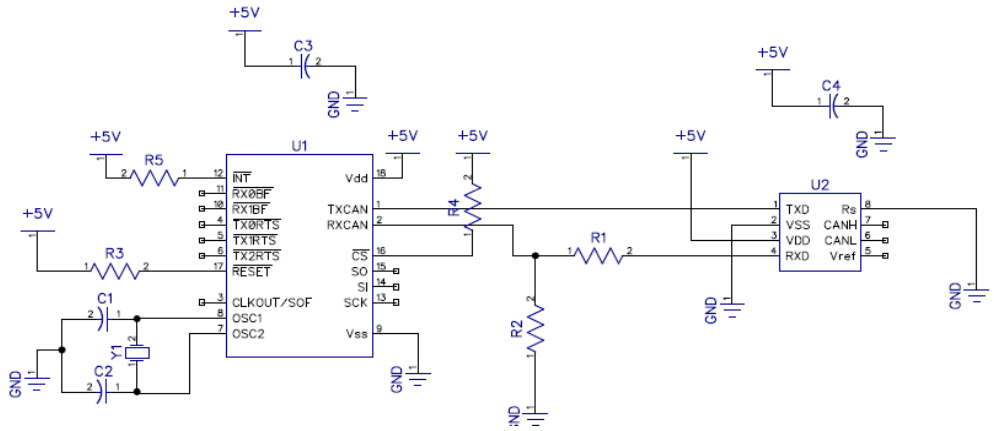

Fig.7: Schematic of CAN module

V. CONCLUSION

Compared with the traditional manual operation or point-to-point interconnection, the use of CAN-bus technology may reduce wiring significantly, as well as a simple body structure. CAN protocol is faster as compared to the processing speed in other protocol, since CAN supports faster data rates for long communication. Also the communication is found to be error free, which can ensure the safety of the user. Since, the whole system contains a number of controllers, working together in a single car, synchronization is very important. This is possible by using CAN bus. Though, the components used in developing a CAN based system are quite costly, the safety of passengers should be kept at higher priority.

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