VEHICLE CONTROL SYSTEM USING CAN PROTOCOL

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ABSTRACT

Nowadays economical automobiles are developed by more of electro mechanical parts with analog interface for efficient & cost-effective operation. Generally, a vehicle is built with an analog driver-vehicle interface for indicating various vehicle statuses like speed, fuel level, engine temperature etc. This paper presents a design & development of cost-effective solution for digital driving interface with a semi-autonomous vehicle improving the driver-vehicle interaction with increase in safety. Our designed system uses sensors to digital format and visualize them to the vehicle driver through a LCD display. The communication module used here is an embedded network bus CAN, which has efficient data transfer.

Keywords: Controller area network (CAN), Vehicle Sensors, Communication Module.

INTRODUCTION

The driving is make easier and safety and reduce human efforts. A vehicle was generally built with an analog driver-vehicle interface for indicating various parameters of vehicle status like temperature, pressure and speed etc. To improve the driver-vehicle interface, an interactive digital system is designed. According to today’s upcoming technologies vehicle is one of the important necessities of human being. With rapidly changing computer and information technology and much of the technology finding way into vehicles. They are undergoing dramatic changes in their capabilities and how they interact with the drivers. Although some vehicles have provisions for deciding to either generate warnings for human driver or controlling the vehicle autonomously, they usually must make these decisions in real time with only incomplete information so, it is important that human drivers still have some control over the vehicle. Advanced in-vehicle information systems provide vehicles with different types and level of intelligence to assist the driver. The introduction into the vehicle design has allowed an almost symbiotic relationship between the driver and vehicle by providing a sophisticated and intelligent driver-vehicle interface through an intelligent information network. The project describes the development and implementation of digital driving system for a semi-autonomous vehicle. CAN communication protocol is chosen to realize the objective.

PROBLEM STATEMENT

Vehicle control system is used to make driving easy and safe. This is being developed by electrical parts for efficient operation and development of CAN based control system is a standard protocol for reliable communication between sensors, actuator, controller and other node in real time application.

- The main objective of the proposed system is to improve the driver-vehicle interface.
- We will implement vehicle control system using controller and controller area network.
- The proposed idea contains ARM based data acquisition system that converts all control data from analog to digital.
- The architecture of the proposed system contains different hardware like LCD display, sensors, ARM, PIC microcontroller and CAN bus to implement the system to alert the driver.

EXISTING SYSTEM

Electric Vehicle Monitoring System Using MATLAB/App Designer: This paper [1] focuses on the creation of a graphical interface which enables the user to monitor the most important variables from the electric vehicle. The App Designer environment from MATLAB has been the main resource used to develop this interface because it offered an enhanced design environment and an expanded UI component set. At its current development state, it is not a replacement for GUIDE because it has a limited graphics support and some existing graphics components are not supported yet. The data acquisition has been done using the low-cost platform, NI USB 6001. Thanks to this card, the sensor signals will be transferred to the PC, so the user will be able to know what is happening with the variables to monitor. To measure some variables, the signal from the sensors is adapted to the voltage range of the data acquisition card. The usage of several adapters is therefore necessary for the circuits.

A Novel IOT Access Architecture For Vehicle Monitoring System: This paper [2] presents a prototype of the Internet of Things (IoT) is becoming increasingly important for traffic monitoring, medical treatment, and other industrial applications. With the continuous development of the IoT, more and more "things" will be able to access to the IoT. Considering a large number of heterogeneous "things", how to provide a unified access mechanism to the IoT is a fundamental and key issue. In this paper, we propose a novel IoT access architecture based on field programmable gate array (FPGA) and system on chip (SoC), which can provide a unified access to the IoT for a wide variety of low-speed and high-speed devices with associated extendibility and configurability. We have adopted an IEEE1451.2 standard for this design and applied the proposed design to vehicle monitoring system. The results indicate that the system can provide good performance in the practical application.

Smart Vehicle Monitoring System For Air Pollution Detection Using WSN: This paper [3] presents a Wireless Sensor Network (WSN) which plays an important role in the application of environmental monitoring. Mostly air pollution being major issues as cause many hazardous effects on the ecological system of human being. Therefore, the need for monitoring air pollution around the city and the public transport buses and cars are a very important problem today. Basically, environmental monitoring methods have difficulties in wired sensor network but by using WSN it is possible to achieve the challenging issues by implementing internet/intranet. This proposed research concentrates on measuring the gas level of air contamination around the cities and reduces the manpower and also increases the overall flexibility of sender and receiver. The main objective of the proposed system for the moving vehicles is monitor the NO2, Humidity, Temperature, CO levels of air contamination by using the NO2 sensor, Humidity sensor, Temperature sensor, CO sensor. In our proposed work MANET (Mobile Ad Hoc Network) routing algorithm is used which has nearly 28 mobile nodes (Vehicles) provide a coverage area of 300meters around the city. The sensor data of the vehicles will be sent to the smartphones of the appropriate drivers to monitor effectively. The result of the proposed method includes the following parameters such as data type, the speed of transmission, coverage of the system, coverage area size, and No. of vehicles to closely monitor the proposed system.

Research of Electric Vehicle Security Assurance and Monitoring System: This paper [15]has introduced the security assurance and monitoring system of public electric vehicles' operation. An effective management system based on the GPS and 3G network was designed in this study. The system can be categorized into three parts: center management platform, vehicle terminal, wireless transmission network. The experiment results showed that the system realizedfunctions such as real-time data acquisition, processing, wireless transmission and remote monitoring on 3G network technology.

IMPLEMENTATION

The Vehicle control system uses the Microchip Technology's MCP2515 is a stand-alone Controller Area Network (CAN) controller that implements the CAN specification, Version 2.0B. It is capable of transmitting and receiving both standard and extended data and remote frames. The MCP2515 has two acceptance masks and six acceptance filters that are used to filter out unwanted messages, thereby reducing the host MCU's overhead. The MCP2515 interfaces with microcontrollers (MCUs) via an industry standard Serial Peripheral Interface (SPI).

Fig. 1 MCP2515 CAN Bus Interface

The Arduino Due has an Atmel SAM3X8E ARM Cortex-M3 microcontroller. The Arduino Due has 54 digital input/output pins (of which 12 can be used as PWM outputs), 12 analog inputs, 4 UARTs (hardware serial ports), a 84 MHz clock, an USB OTG capable connection, 2 DAC (digital to analog), 2 TWI, a power jack, an SPI header, a JTAG header, a reset button and an erase button.

Fig. 2 Arduino Duo Board

The Atmel SMART SAM3X/A series is a member of a family of Flash microcontrollers based on the high performance 32-bit ARM Cortex M3 RISC processor. It operates at a maximum speed of 84 MHz and features up to 512 Kbytes of Flash and up to 100 Kbytes of SRAM. The peripheral set includes a High-Speed USB Host and Device port with embedded transceiver, an Ethernet MAC, 2 CANs, a High-Speed MCI for SDIO/SD/MMC, an External Bus Interface with NAND Flash Controller (NFC), 5 UARTs, 2 TWIs, 4 SPIs, as well as a PWM timer, three 3-channel general-purpose 32-bit timers, a low-power RTC, a low power RTT, 256-bit General Purpose Backup Registers, a 12-bit ADC and a 12-bit DAC.

Fig. 3 DS18B20 Temperature Sensor

The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with nonvolatile user-programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply. Each DS18B20 has a unique 64-bit serial code, which allows multiple DS18B20s to function on the same 1-Wire bus. Thus, it is simple to use one microprocessor to control many DS18B20s distributed over a large area. Applications that can benefit from this feature include HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control systems.

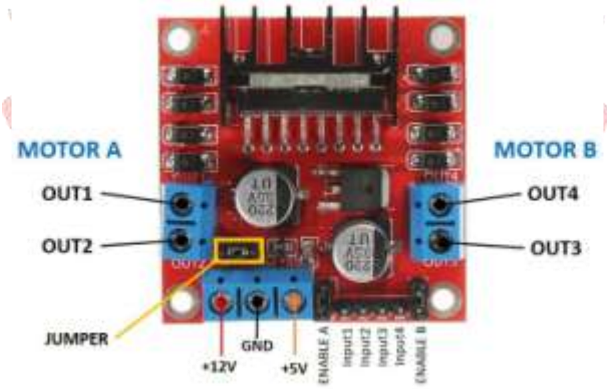


Fig. 4 L298N Motor Driver Controller Module

L298N Motor driver module is a high voltage, high current, and dual full-bridge driver. It accepts standard TTL logic level inductive loads like solenoids, relays DC motors, etc. this module controls two Dc motors at the same time in any direction and speed. There are two enable inputs, which enables or disables the device independently of the input signals. The L298 is a monolithic integrated circuit in a 15-lead Multiwatt and PowerSO20 packages. It is a high voltage, a high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC, and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The lower transistor's emitters of each bridge are connected and the corresponding external terminal can be used for external sensing resistor connection. During lower voltage, an additional power supply is provided for the logic to work properly.

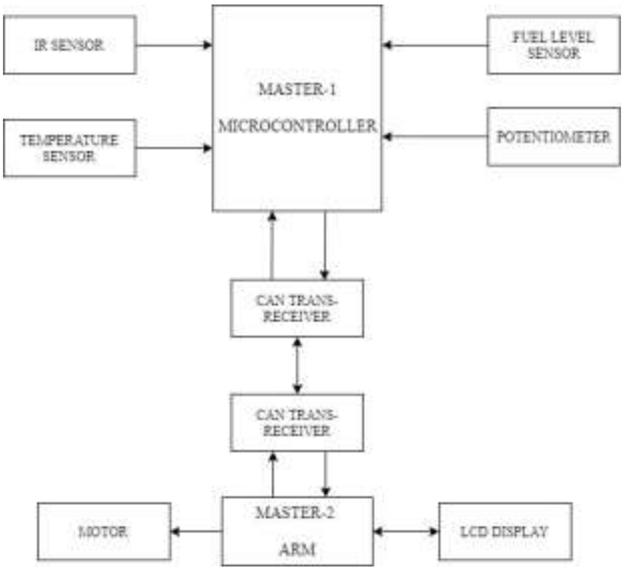


Fig. 5 Block Diagram of Vehicle control system

It consists two master controller that is Microcontroller ATMEGA328 as master1 and ARM as master2 respectively, which controls the status with various sensors. The Microcontroller ATMEGA328 is used to receives the input of vehicle status. The communication between these sensors is done by using CAN controller. Microcontroller ATMEGA328 receives the signals from the vehicle like speed, temperature, fuel level and ultrasonic obstacle detector etc, send to master controller with high-speed rate. Master controls the status of the vehicle and sends the feedback to operator panel by providing digital information via LCD display and alarm. In this block diagram these are four parameters such as temperature sensor, fuel level sensor, speed sensor and obstacle sensor. These sensors are interface with microcontroller and data transfer through CAN bus. These sensors continuously sense the information to the microcontroller. If hazardous condition is occurred then microcontroller controls it automatically.

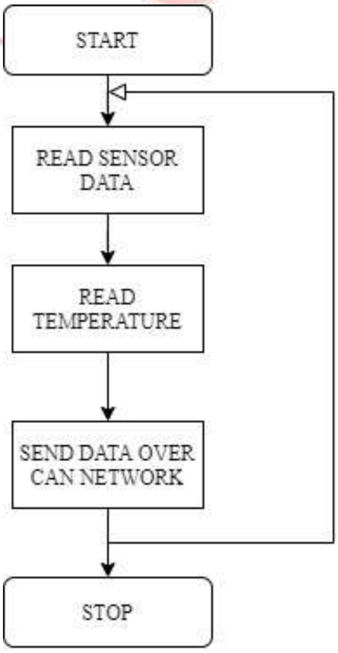


Fig. 6 Sender Side Flowchart

Sensor side microcontroller reads all data from sensors like fuel level engine temperature, IR sensor status after collecting all data it sends over CAN bus to the master controller.

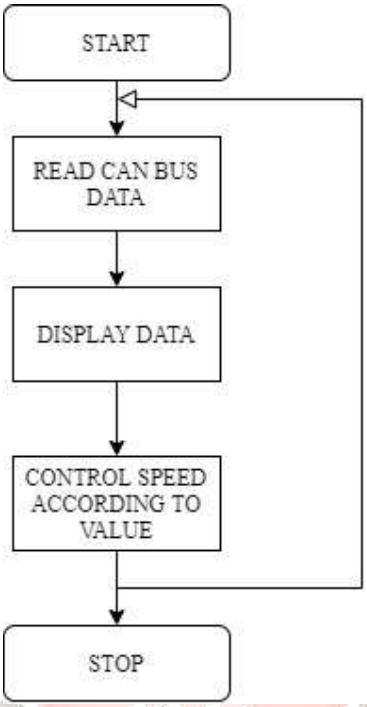
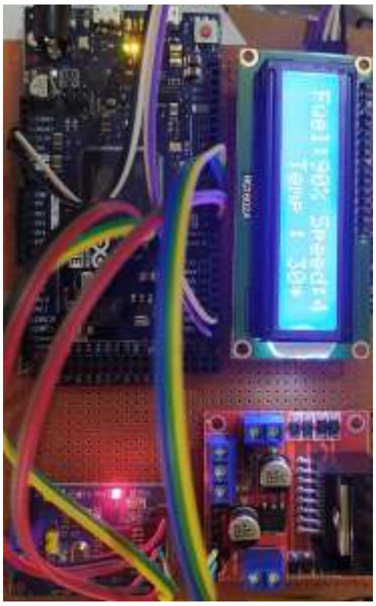


Fig. 7 Receiver Side Flowchart

The master controller receives data from CAN bus, process it and display message information on the LCD. It also controls speed of motor according to received data from sensor.

RESULTS

The Vehicle control system using CAN protocol is helps the driver to control over the vehicle and check the parameter in vehicle on screen at the same timing of driving, parameters like temperature, fuel.



CONCLUSION

We see everyday thousands of road accidents in this accident as many as thousands of peoples injured in a world. More than hundreds of people die and many people are disabled for live life normally this is a result of lack of speed control and violating the road rules. The highlighted interaction of several factors like lack of experience of drivers, low awareness of measures, broken rules, excessive speed of vehicle, ignore the temperature of engine. Vehicle control system helps the driver to control over the vehicle and check the parameter in vehicle on screen at the same timing of driving, parameters like temperature, fuel. This system is based on CAN based control system is a standard protocol for reliable communication between sensors, actuator, controller and other node in real time application.

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