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DATA ACQUISITION SYSTEM IN VEHICLE USING CAN PROTOCOL

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Abstract-

Present Automobiles are being developed by more of electronic parts for efficient operation. Generally a vehicle was built with an analog driver-vehicle interface for indicating various vehicle statuses like speed, fuel level, Engine temperature etc. This project presents the development and implementation of a digital driving system for a semi-autonomous vehicle to improve the driver vehicle interface. It uses an ARM based data acquisition system that uses ADC to bring all control data from analog to digital format and visualize through LCD. The communication module used in this project is embedded networking by CAN which has efficient data transfer. It also takes feedback of vehicle conditions like Vehicle speed, Engine temperature etc. and controlled by main controller.

Keywords— **CAN (controller area network), Sensors, Embedded C etc.**

I. INTRODUCTION

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 the 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 levels 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 development of such a control frame- work for the vehicle which is called the digital-driving behavior, which consists of a joint mechanism between the driver and vehicle for perception, decision making and 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. A microcontroller based data acquisition system that uses ADC to bring all control data from analog to digital format is used. Since the in-vehicle information systems are spread out all over the body of a practical vehicle, a communication module that supports to implement a one stop control of the vehicle through the master controller of the digital driving system.

Today, the most dominant and mature of all vehicle network protocols is the CAN (Controller Area Network) protocol, which was developed by Bosch in the early 1980s for automotive applications. Since its inception, it has gained a lot of support and is now used in many more fields other than automobiles. It is now found operating lifts, controlling machine tools, monitoring engine room activity aboard ships

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and much more. It has gained its reputation from its simplicity, robustness and high level of reliability, with its ability to exchange short real-time messages at a maximum speed of 1Mbps.

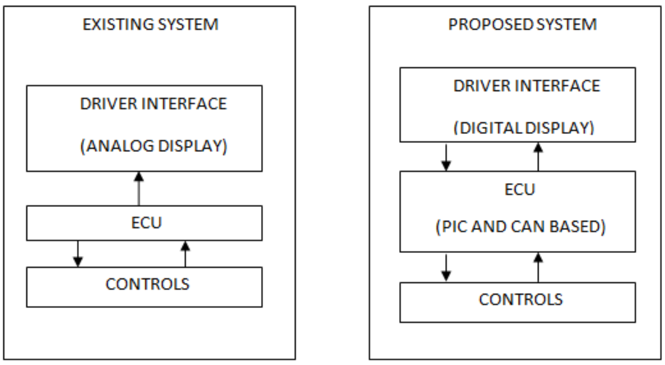

Fig 1.Existing and Purposed System

I. BLOCK DIAGRAM AND WORKING

Fig 2 shows the block diagram of CAN vehicle data acquisition system. It consists of one master node and two slave nodes.ARM as the master controller which controls the vehicle status with various sensors. Also two PIC ICs are used as slave nodes to receive the inputs of vehicle status. The communication between these sensors is done by using CAN controller. Slave controller receives the signals from vehicles like

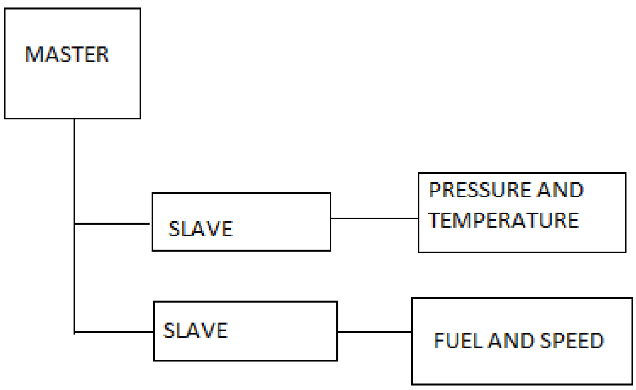

Fig 1.Existing and Purposed System

Pressure, temperature, fuel level, and IR sensor etc., send to master controller with high speed rate. Master controls the status of vehicle and sends the feedback to operator panel by providing digital information's via LCD display and Buzzer. Here Operator interface is digital type. By this operator can easily see the signals and able to control the vehicle. IR obstacle sensor helps in speed measurement of the vehicle.

Working:

The two slave unit named as Slave 1 and Slave 2. Both slave units are PIC18F4580 controller. Power supply for both slave units and other sensors are different. Slave 1 unit connected with two sensors. Temperature sensor and Pressure sensor. This sensor generates analog signal and send to Slave1 controller. Slave 1 controller converting analog signal into digital signal, then sends to ARM controller through CAN MCP2551 controller. Slave 2 unit connected with following units. IR sensor and Fuel level sensor. Slave2 perform same operation as like slave1.Data messages transmitted from any node on a CAN bus do not contain addresses of either the transmitting node, or of any intended receiving node. Instead, the content of the message is labeled by an identifier that is unique throughout the network. All other nodes on the network receive the message and each performs an acceptance test on the identifier to determine if the message, and thus its content, is relevant to that particular node. If the message is relevant, it will be processed; otherwise it is ignored.

The unique identifier also determines the priority of the message. The lower the numerical value of the identifier, the higher the priority. In situations where two or more nodes attempt to transmit at the same time, a non-destructive arbitration technique guarantees that messages are sent in order of priority and that no messages are lost. CAN use NonReturn to Zero (NRZ) encoding (with bit-stuffing) for data communication on a deferential two wire bus. The use of NRZ encoding ensures compact messages with a minimum number of transitions and high resilience to external disturbance. The two wire bus is usually a twisted pair (shielded or unshielded). Flat pair (telephone type) cable also performs well but generates more noise itself, and may be more susceptible to external sources of noise. CAN will operate in extremely harsh environments and the extensive error checking mechanisms ensure that any transmission errors are detected [4] [5]. There are two types of CAN implementations depending in the size of the identifier fields are The Standard CAN protocol (version 2.0A), also now known as Base Frame Format, supports messages with 11 bit

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identifiers. The Extended CAN protocol (version 2.0B), also now known as Extended Frame Format, supports both 11 bit and 29 bit identifiers. Most 2.0A controllers transmit and receive only Standard format messages, although some (known as 2.0B passive) will receive extended format messages - but then ignore them. 2.0B controllers can send and receive messages in both formats.

II. HARDWARE DESIGN

A.PIC (18f4580) Microcontroller:-

We use microcontroller as PIC (18F4580), this family of devices offers the advantages of all PIC18 microcontrollers namely, high computational performance at an economical price with the addition of high-endurance, Enhanced Flash program memory. In addition to these features, the PIC18F4580 family introduces design enhancements that make these microcontrollers a logical choice for many high-performances, power sensitive applications.

B. CAN Transceiver:-

The MCP2551 is a high-speed CAN, fault-tolerant device that serves as the interface between a CAN protocol controller and the physical bus. The MCP2551 provides differential transmit and receive capability for the CAN protocol controller and is fully compatible with the ISO-11898 standard, including 24V requirements. It will operate at speeds of up to 1 Mb/s.Typically each node in a CAN system must have a device to convert the digital signals generated by a CAN controller to signals suitable for transmission over the bus cabling (differential output). It also provides a buffer between the CAN controller and the high-voltage spikes that can be generated on the CAN bus by outside sources (EMI, ESD, electrical transients, etc.).

C.Instrumentation Amplifier:-

The output of each sensor is in kilovolt, so as per ADC requirement such as resolution, reference voltage, and number of bits. We want to amplify it up to the reference voltage of ADC. The AD620 is a low cost, high accuracy instrumentation amplifier that requires only one external resistor to set gains of 1 to 1000. Furthermore, the AD620 features 8-lead SOIC and DIP packaging that is smaller than discrete designs, and offers lower power (only 1.3 mA max supply current), making it a good fit for battery powered, portable (or remote) applications. The AD620, with its high accuracy of 40ppm maximum nonlinearity, low offset voltage of 50Vmax and offset drift of 0.6V per degree max, is ideal for use in precision data acquisition systems, such as weigh scales and transducer interfaces.

D. Sensors:-

D.1 Fuel Level Sensor:-

In our system we are using a level sensor which operates on the principle of voltage divider. Its output voltage is change accordingly to change in variable resistance. The sensor output is given to ADC pin of microcontroller.

D.2 Pressure Sensor:-

We are going to select pressure sensor i.e. The MPXM2202 device is a silicon piezoresistive pressure sensor providing a highly accurate and linear voltage output directly proportional to the applied pressure.

D.3 Temperature Sensor:-

Normally, in vehicle engine temperature is rises up to 250 per degree. So we are going to select T-type thermocouple sensor which has range up to 400 degree Celsius. The sensitivity of T-type thermocouple is sensitivity is about 41.5 mV per degree Celsius. A temperature change can be measured, but actual temperature is still an unknown. Adding a second junction and holding it at a known reference temperature allows an unknown temperature at the other junction to be found. Since the circuit is a continuous loop in which current flows it can be opened and a meter inserted. The voltmeter has a high internal resistance and produces a voltage proportional to the current. Keep in mind that the voltage is strictly dependent upon temperature, the relation between seebeck voltage and temperature is fixed.

III.SOFTWARE DESIGN

Software design is through MPLAB IDE with the help of embedded C.The algorithm related to the project is given below

Algorithm:

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1. Start.
2. Initialize input output port.
3. Initialize LCD and CAN protocol.
4. Read the status of input pins.
5. If any of change the input state.
6. Yes, then any one of the slaves ready to transmit the message.
7. If no, then repeat from step 4.
8. If arbitration occurred.
9. If yes then message is displayed on the LCD.
10. if not, then according to the priority message is sent on the bus.
11. Then messages are displayed on the LCD.

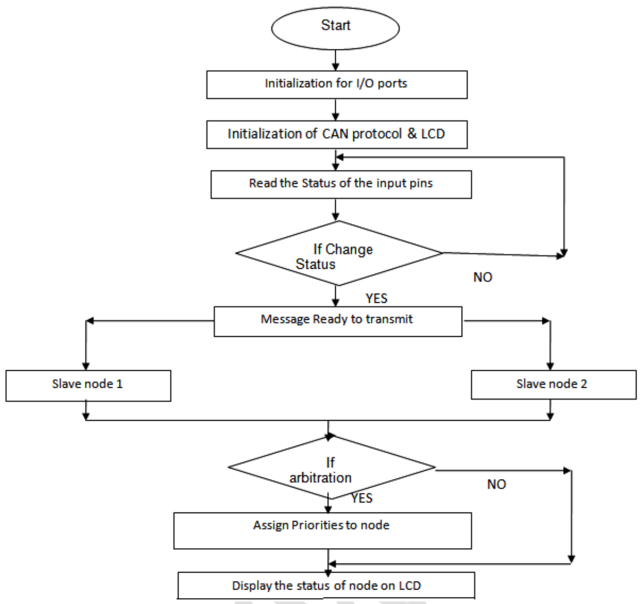

Fig 1.Flowchart of System

IV. RESULT AND ANALYSIS

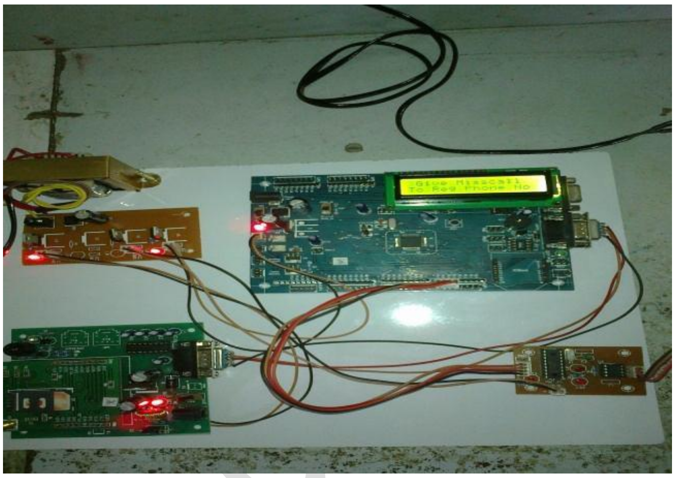

Fig 1.Hardware system

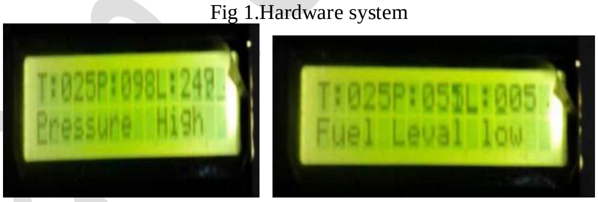

Fig 1.Pressure and Fuel level status

V. CONCLUSION

This project introduces an embedded system with a combination of CAN bus systems. Digital control of the vehicle is an important criterion of modern technology. With the rapid development of embedded technology, high performance embedded processor is penetrated into the auto industry, which is low cost, high reliability and other features to meet the needs of the modern automobile industry. The proposed high-speed CAN bus system solves the problem of automotive system applications, also has a certain practical value and significance. With ARM as the main controller and it makes full use of the high-performance of ARM, high-speed reduction of CAN bus communication control networks and instrument control so as to achieve full sharing of data between nodes and enhance their collaborative work. This system features efficient data transfer among different nodes in the practical applications.

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