VEHICLE MONITORING USING CONTROL AREA NETWORK PROTOCAL

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Abstract: Controller area network protocol is standard bus designed to interface between microcontroller and device to communicate with each other without a host computer. It is an attractive alternative in the automotive and automation industries due to its ease in use, low cost and provided reduction in wiring complexity. This project is aimed at the implementation of CAN protocol using PIC for vehicle monitoring system. The main feature of the system includes monitoring of various vehicle parameters such as Temperature, presence of CO level in the exhaust, Battery Voltage and Light due to spark or fire, motor speed Control, IR obstacle sensor, fuel level measurement, pressure monitor, gas sensor, voltage sensor, LDR sensor. Outputs of the monitoring results are displayed in the LCD and alarm blows out when sensor crosses its threshold values connected to the master node. The software part is done in MP Lab IDE using Embedded C. Schematic is prepared using OrCAD. Hardware is implemented and software porting is done.

Keywords: CAN protocol, MP Lab IDE, PIC 18F448.

1. Introduction

Controller area network (CAN) is a messaged based protocol used in automotive and automation industries due to its ease in use, low cost and provided reduction in wiring complexity. Each node is capable to transmit and receive messages, but not simultaneously. Only one device can send data at any time while all the others listen. If two or more devices attempt to send data at the same time, the one with the highest priority is allowed to send its data while the other nodes return to receive node. Error detection and error handling are important for the performance of CAN. Error detection is done in five different ways in

Vehicle Applications of Controller Area Network: bit monitoring and bit stuffing, as well as frame check, ACK check, and CRC.

This project target is to development of system where we can monitor various vehicle parameters such as as Temperature, presence of CO level in the exhaust, Battery Voltage and Light due to spark or fire, motor speed Control, IR obstacle sensor, fuel level measurement, pressure monitor, gas sensor, voltage sensor, LDR sensor. Each sensor will display their respective sensed values in the LCD that are connected to the master node ,whenever the sensor that crosses its threshold value then an alarm will blow and the desired sensor value will be displayed in the LCD.

II. BLOCKDIAGRAM

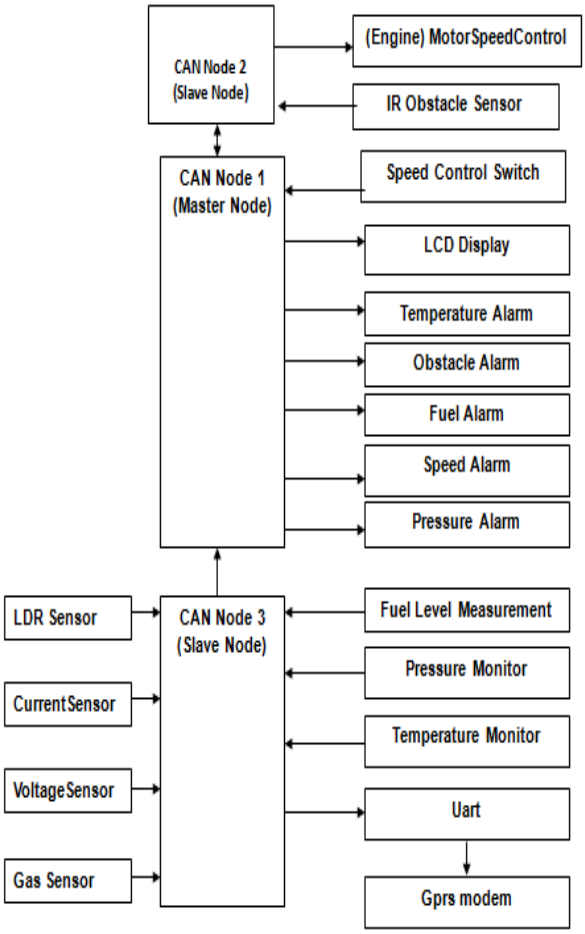


Fig 1: BLOCK DIAGRAM

III. DESCRIPTION AND WORKING

CAN node consists of a host microcontroller unit and CAN module (CAN controller and transceiver) unit, in this project we used PIC18F448 microcontroller, because of simple and easy programming and it has inbuilt CAN module, which will help in the reduction of hardware units.

Transducers:

A transducer is a device which measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. This part of the system consists of various sensors. These sensors sense and send the desired values sent to the Microcontroller Unit . Sensor devices used in this system are

1) TEMPERATURE SENSOR

National Semiconductor's LM35 IC has been used for sensing the temperature. It is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature. The temperature can be measured more accurately with it than using a thermistor. The sensor circuitry is sealed and not subject to oxidation, etc. The LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4°C at room temperature and +/- 0.8°C over a range of 0°C to +100°C. Another important characteristic of the LM35 is that it draws only 60 micro amps from its supply and possesses a low self- heating capability. The sensor self-heating causes less than 0.1 °C temperature rise in still air. The sensor has a sensitivity of 10mV / °C.

2) LIGHT SENSOR

Light Dependent Resistor (LDR) also known as photoconductor or photocell, is a device which has a resistance which varies according to the amount of light falling on its surface. Since LDR is extremely sensitive in visible light range, it is well suited for the proposed application. LDR sensor is connected to LM358, it consisting of two independent high gain internal frequency compensated operational amplifier which are designed to operate from a single power supply.. One input of LM358 is LDR and the other input is a reference voltage. When light falls, LDR resistance decreases and the negative terminal voltage is less compared to reference voltage and at that time LED turns ON. This concept can be used to detect if there occurs fire in the engine.

3) GAS SENSOR

MQ-6 Gas sensor used here. it is highly sensitive to butane, propane and LPG and also responsible to natural gas. the sensor used here is used to detect different combustible gas ,mainly methane. Gas sensor output voltage is connected to LM358. If V+ >V- , then the output voltage is high and the LED connected to the output is ON. If V+ < V- , then the output voltage is low and LED is OFF.

4) BATTERY VOLTAGE

The operating voltage range of PIC18F458 is 2.0V to 5.5V. So a 5.1V Zener diode is connected to get a regulated output voltage.

5) CURRENT SENSOR

A **current sensor** is a device that detects electrical current (AC or DC) in a wire, and generates a signal proportional to it. The generated signal could be analog voltage or current or even digital output. It can be then utilized to display the measured current in an ammeter or can be stored for further analysis in a data acquisition system or can be utilized for control purpose.

6) *OBSTACLE IR SENSOR*

This sensor can be used for most indoor applications where no important ambient light is present. This sensor can be used to measure the speed of object moving at a very high speed, like in industry or in tachometers. The basic idea is to send infrared light through IR-LEDs, which is then reflected by any object in front of the sensor. Then pick-up the reflected IR light. For detecting the reflected IR light, we are using another IR-LED**,** to detect the IR light that was emitted from another led off the exact same type. It has High sensitivity (110 V/W).,Low resistance (50 K ohm),Very good signal to noise ratio, Good response time (40 ms),Low cost thin film technology,Easy and accurate measuring of the sensor temperature by means of a built-in temperature sensor.

7) *PRESSURE SENSOR*

A pressure sensor measures pressure, typically of gases or liquids. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer; it generates a signal as a function of

the pressure imposed. For the purposes of this article, such a signal is electrical. Pressure sensors can alternatively be called pressure transducers, pressure transmitters, pressure senders, pressure indicators and piezometers, manometers, among other names.

8) FUEL LEVEL SENSORS: This sensor detect the level of substances that flow, including liquids, slurries, granular materials, and powders. Fluids and fluidized solids flow to become essentially level in their containers because of gravity whereas most bulk solids pile at an angle of repose to a peak. The substance to be measured can be inside a container or can be in its natural form. The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place, while point-level sensors only indicate whether the substance is above or below the sensing point. Generally the latter detect levels that are excessively high or low.

DC MOTOR: A DC motor is an electric motor that runs on direct current (DC) electricity. The brushed DC motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary permanent magnets, and rotating electrical magnets.It works on the principle of Lorentz force , which states that any current carrying conductor placed within an external magnetic field experiences a torque or force known as Lorentz force. Advantages of a brushed DC motor include low initial cost, high reliability, and simple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses. Maintenance involves regularly replacing the brushes and springs which carry the electric current, as well as cleaning or replacing the commutator. These components are necessary for transferring electrical power from outside the motor to the spinning wire windings of the rotor inside the motor

LCD:Liquid Crystal Display (LCD) consists of rod-shaped tiny molecules sandwiched between a flat piece of glass and an opaque substrate. These rod-shaped molecules in between the plates align into two different physical positions based on the electric charge applied to them. When electric charge is applied they align to block the light entering through them, where as when no-charge is applied they become transparent. Light passing through makes the desired images appear. This is the basic concept behind LCD displays. LCDs are most commonly used because of their advantages over other display technologies. They are thin and flat and consume very small amount of power compared to LED displays and

Cathode Ray Tubes. LCD is used to interface with PIC 18F448. This means there are 16 characters per line by 2 lines. There are three control signals Register select, Enable and Read/Write. There are two important registers in LCD. Command Code register and Data register.

- If Command RS=0, R\W=0, E=1\0
- Data RS=1, R\W=0, E=1\0

CAN based communication

The CAN bus was originally designed to be used within road vehicles to solve cabling problems arising from the growing use of microprocessor-based components in vehicles. Owing to the low price of CAN bus and its ability to support real- time communication, CAN is nowadays widely used as an embedded control network to connect several control units, sensors, and actuators in a dispersed manipulate system. CAN is used as a low speed determination for the addition of all the information present in the system. One of the reasons which justify the success of the CAN lies in the helpful precedence based bus negotiation mechanism it implements. Any letter contention on a CAN bus is deterministically determined on the basis of the precedence of the objects exchanged, which is fixed in the identifier field of the frame. Thus, the priority of a message is the priority of the object it contains, spoken by the identifier, which represents the significant part of the CAN frame.

The arbitration mechanism present in CAN requires a short length of the bus in order to allow all nodes to sense the same bit. This way, the system can behave as a form of large AND gate, with each point able to check the output of the gate. The identifier with the lowests stastical value has the highest precedence, and a nondestructive bitwise arbitration mechanism provides the collision resolution.

The priority of a CAN message is static and system wide common, and it is linked to a variable. This means that each edge can carry only a variable each time, so that different variables need different frames. For this cause, each frame has a small dimension, contains only a few data bytes, and is very handle for applications at the field level.

Universal Synchronous Asynchronous Receiver Transmitter

A **universal asynchronous receiver/transmitter** is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. It is the key component of the serial communications subsystem of a computer. The UART takes bytes of data and transmits the individual bits in a sequential fashion. At the destination, a second UART re-assembles the bits into complete bytes. Serial transmission of digital information (bits) through a single wire or other medium is much more cost effective than parallel transmission through multiple wires. A UART is used to convert the transmitted information between its sequential and parallel form at each end of the link. Each UART contains a shift register which is the fundamental method of conversion between serial and parallel forms.

GPRS:

GPRS stands for general packet radio service in this project GPRS is used to update the date in the web. The sensor values are updated in the web by using this technology.

The Flowchart representation of the proposed model is shown below.

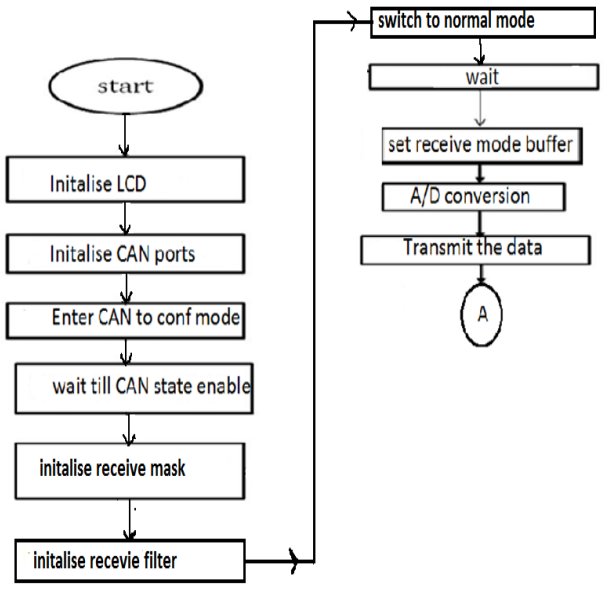


Fig 3: flow chart for can based monitoring system

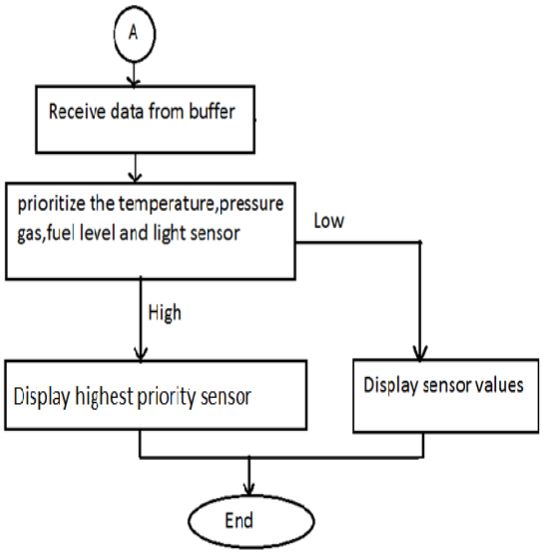
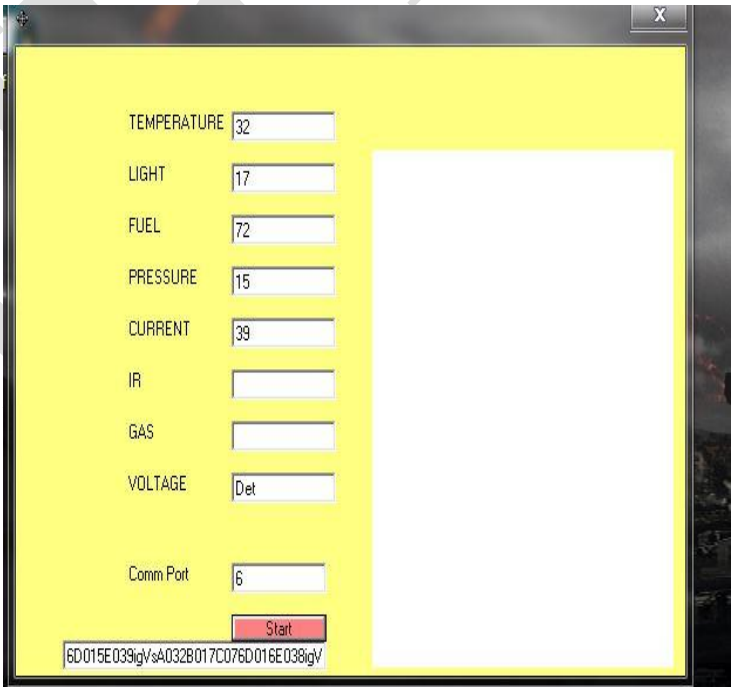


Fig4 : Flow chart for can based monitoring system

IV. RESULT

Hence by using CAN protocol in the vehicles it is ease in use, low cost and provided reduction in wiring complexity. All the sensor values are displayed in the LCD that is connected to the master node and an alarm blows out whenever the sensor crosses its threshold frequency.



V. CONCLUSION AND FUTURE WORK

This thesis is concerned about implementation of CAN nodes for monitoring parameters For monitoring the above parameters, LM35 sensor, 9V battery, LDR and MQ6 sensors are used. For implementing this, the programming of LED, ADC and LCD interfacing with microcontroller is done using MP LAB IDE.

This thesis is limited to a two node network. This can be extended to four nodes, eight nodes, 16 nodes etc. for vehicle monitoring applications.

Response time analysis can be done. Response time analysis for CAN aims to provide a method of calculating the worst-case response time of each message. These values can then be compared to the message deadlines to determine if the system is schedulable. Initially we provide analysis assuming no errors on the CAN bus. This analysis is then extended, to account for errors on the bus.

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