Design of Vehicle Bus Data Acquisition and Fault Diagnosis System using CAN

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***Abstract*— The vehicle bus data acquisition and fault diagnosis system, focusing on its lower computer system and the upper computer system is designed. This system is based on the widely used CAN bus technology, to extract the vehicle's status or fault information. When the vehicle breaks down, the status of vehicle will be sent as SMS to the control system using GSM technology. In automotive electronics, engine fault detect units, engine temperature sensors, air bag release-systems and battery low level detect system etc. are connected using CAN with bit rates up to 1 M bit/s.**

***Keywords*— ARM7, CAN protocol, GSM technology, sensors.**

I. INTRODUCTION

With the continuous development of industrial, automotive technology and electronics technology has also made great progress. The structure of vehicles become more complex, increasing the degree of automation is increasing, and the network of the body are also increasing in the major car manufactures. This system is based on the widely used CAN bus technology, to extract the vehicle's status or fault information. The increasing complexity of automotive electronic control system makes automotive fault diagnosis and maintenance work more difficult. In the way, we need more skilled technicians and more advanced device to detect and maintain fault. We are also using GSM technology for sending information of BUS status when fault is detected.

II. RELATED WORK

A. *CAN*

The Controller Area Network (the CAN bus) is a serial communications bus for real-time control applications; operates at data rates of up to 1 Megabits per second, and has excellent error detection and confinement capabilities. CAN was originally developed by the German company, Robert Bosch, for use in cars, to provide a cost-effective communications bus for in-car electronics and as alternative to expensive, cumbersome and unreliable wiring looms and connectors[1]. The car industry continues to use CAN for an increasing number of applications, but because of its proven reliability and robustness, CAN is now also being used in many other control applications. CAN or Controller Area Network is a robust industrial strength hardware and software protocol used to communicate between microcontrollers. It is very popular in modern automotive applications and is gaining popularity in industrial and home automation applications.

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 (e.g. Revolution Per Minute, Hopper Full, X-ray Dosage, etc.) is labelled by an identifier that is unique throughout the network [2] [3]. 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 Non Return to Zero (NRZ) encoding (with bit-stuffing) for data communication on a differential 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 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.

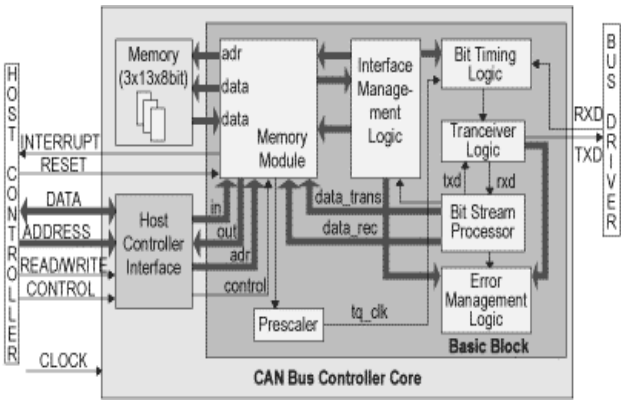

Figure1: Block diagram of CAN protocol

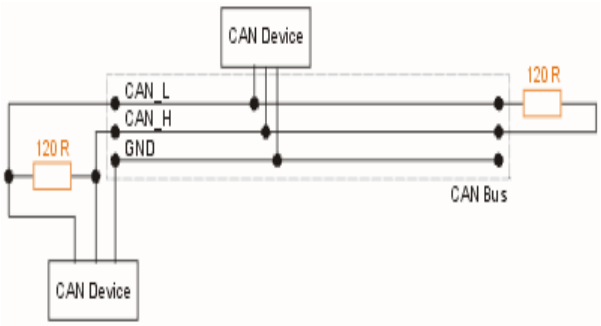

Figure2: Implementation of CAN protocol

B. *GSM MODEM*

GSM stands for Global System for Mobile Communication. It's a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz.

The GSM modem basically consists:

- SIM card holder to hold the activated SIM card for sending and receiving SMS.
- 5V AC power supply header to which the 5v ac adapter is connected.
- Power led which gives the indication of modem status that is on or off.
- 9 pin female to which the GSM antenna is connected.

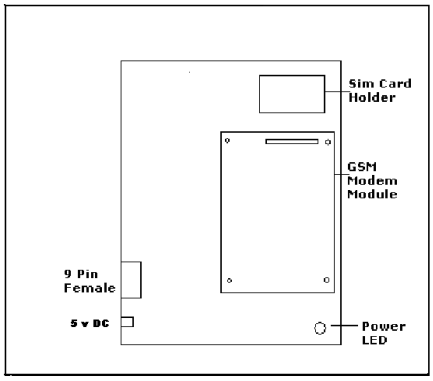

Figure3: GSM Modem Block Diagram.

Through the mobile equipment the network messages are sent and received. These messages are sent to the terminal adapter which is nothing but a GSM data card. Now if there is some data to be sent to the mobile equipment then the terminal equipment that is basically a computer or processor sends out AT commands to the terminal adapter which in turn sends the mobile equipment the required data. The GSM modem being a serial communication device is connected to the serial port or a serial device through a serial connector. The power input to the modem is given through a 9v ac adapter. The LED will indicate different status of the modem are OFF (Modem is Switched off), ON (Modem is connecting to the network), Flashing Slowly (Modem is in idle mode), Flashing rapidly (Modem is in communication mode).

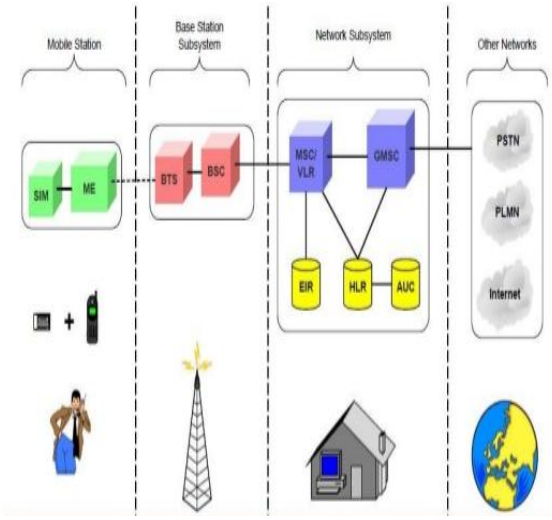

Figure4: Architecture of GSM network

III. SYSTEM IMPLIMENTATION

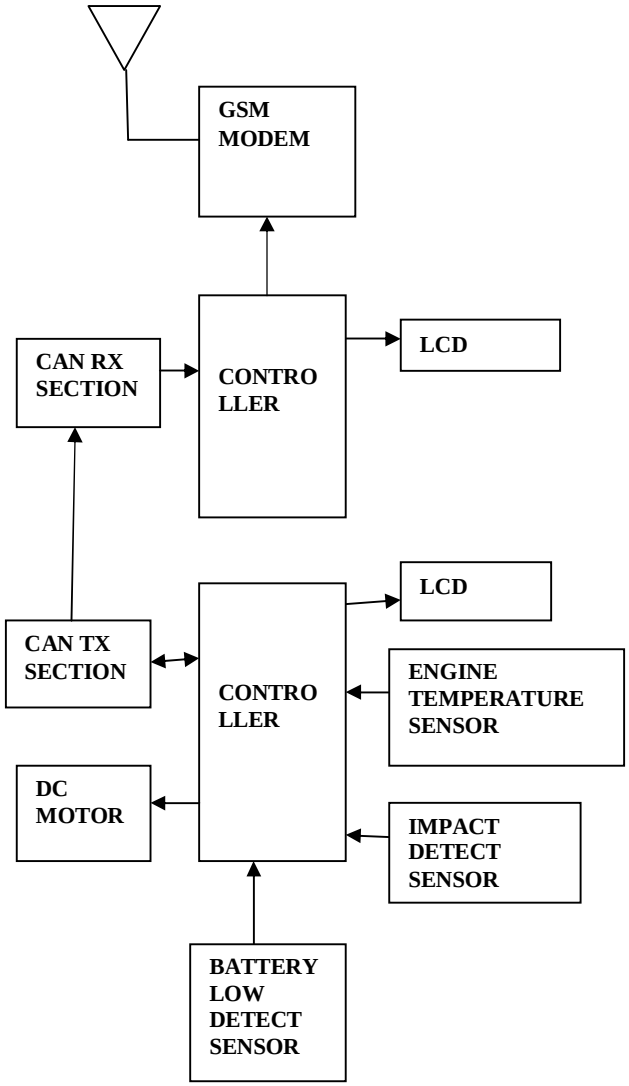

Figure5:: Block diagram of the system

In the implementation of our prototype system, vehicle interior network structure can use topology bus network, all the electrical systems nodes inside the bus vehicle are attached to the CAN bus through their own respective CAN communication module. Here we are using one slave and one master. CAN/SMS Wireless Gateway not only be used to organize and coordinate all the interior electrical systems nodes, but also can be used as internal and external communications data interface. It gathered up the information from all the interior electrical systems nodes sent to the remote monitoring service center computer via SMS wireless module. This paper focuses on bus data acquisition and remote monitoring system based on CAN bus and SMS, which can be used to improve the efficiency of monitoring, to maintain the system security, to lower the maintenance costs as well as the operating expensed. With the development of the mobile technology, the design will be made better; the data transmission based on wireless communication will be used more widely. The communication network designed is able to stay stable in a long run in the experiment and meets the expected target. Here, Keil cross compiler will be used for building the applications. LPC2148 development board will be used to test the built application. Flash magic software is used to dump the .Hex file in to the Microcontroller.

IV.RESULTANALYSIS

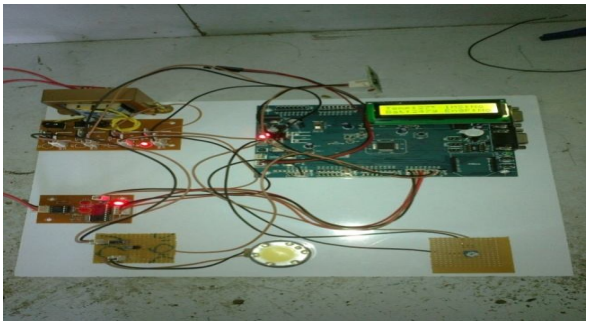

Figure6: Transmitter section f the Hardware design

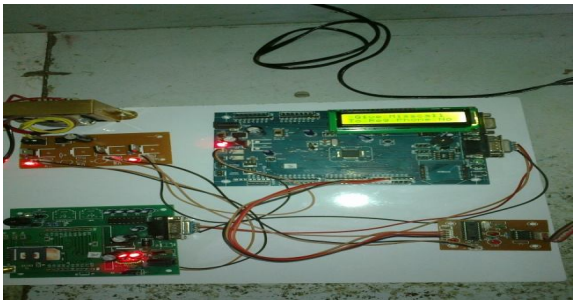

Figure7: Receiver section of the Hardware design

Fig6 shows the transmitter section of the hardware design. It includes dc motor, temperature sensor, battery low level detect sensor and impact detect sensor. When dc motor off it will shows the status as fault is occurred in lcd.

When the temperature of engine is high it will show the status as temperature is high in lcd. When the battery of engine is low it will show the status as battery is low in lcd. When the impact of engine is detected it will show the status as impact is detected in lcd. All the process will be done with the help of CAN protocol. After getting this type of results we will controls the engine of the vehicle.

V. CONCLUSION

This paper is implemented successfully for a vehicle data Acquisition and Fault Diagnosis System using CAN protocol and GSM technology, where we can also access accurate data in heavy network load. This project can be extended further by using GPS technology, to know the location of the vehicle where it's breakdown.

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