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Application of Embedded CAN Module

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ABSTRACT
An application of CAN-BUS communication module has been proposed in this paper together with its hardware and software design. The CAN module is responsible for coordination of microcontroller and subsystem. With the CAN module, the engineers do not have to understand all aspects of CAN protocol, CAN controllers and CAN transceivers therefore an industry automation can be build conveniently. The CAN module reads the real time sensor values from the control unit and sends it to central unit where the appropriate actions are taken in order to bring back compatible values. The main purpose of this project is to make this information freely available on the embedded system devices. With the help of this software packages, the CAN-BUS communication would be transparent to the microcontrollers of the nodes in the system.
Keywords - CAN field bus, Code vision AVR, Embedded system

I. INTRODUCTION

The Controller Area Network (CAN) module is a serial interface which is useful for communicating with other peripherals or microcontroller devices.CAN (Controller Area Network) was originally developed for automotive applications in the early 1980's. Development of the CAN-bus started in 1983 at Robert Bosch GmbH.

CAN-BUS can be used more and more widely in the areas of automotive machinery, CNC machinery tools, and medical devices, smart sensors for its high performance, high reliability and flexible design features. The hardware units such as CAN controller, CAN Transceiver make the application job easier and the integration of CAN controller and microcontroller also propels the usage of CAN technology in different area.

It is necessary that CAN-BUS as a kind of communication media should be modularised as an embedded CAN module, in order to lower the degree of difficulties in the embedded CAN application development. There are also some other benefits for embedded CAN module, such as providing common interface for distributed control system.

1.1 Advantage of ECM over other solution

The Controller Area Network (CAN) module is a serial interface which is useful for communicating with other peripherals or microcontroller devices. CAN bus have the following main features:

- Good real-time.
- Fault isolation is good.
- Long distance communication.
- Good anti-mistake transmission design.
- Theoretically CAN bus can connect 2000 nodes.
- Allow communications within noisy environments.

1.2 Concept of ECM

This paper is going to introduce the ECM (Embedded CAN Module), its working principles, hardware and software implementations and its performance. The ECM is a module which can be embedded into any embedded system, connecting the embedded host as a CAN node of the field BUS network.

II. HARDWARE INTERFACE AND ARCHITECTURE

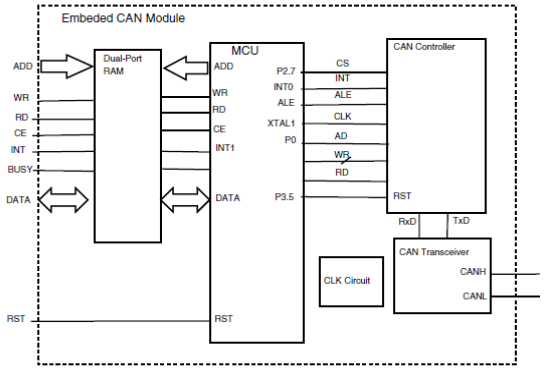

fig. 1.structure of ECM

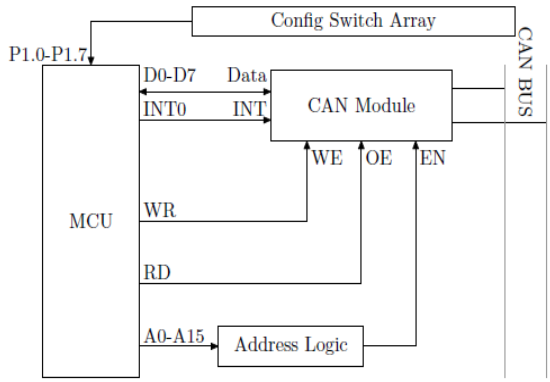

fig. 2.CAN Module in the embedded system

The Fig.2 defines the interface between ECM and host system for example microcontroller. The interface between embedded CAN module and the host MCU is the Dual-Port RAM unit, therefore the ECM communicates with the host by the ways of memory sharing. The shared memory has been divided into two parts as shown in Fig.3.The segment A stores data from the host, which represents some configuration instructions or data to be transferred through the pipes(buffer).Segment B stores the data from ECM, which is the data collected from the pipes(buffer).

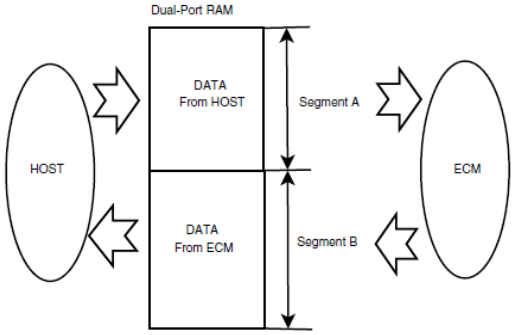

fig. 3.segmentation of dual-port RAM

2.1Block Diagram For Application Using ECM

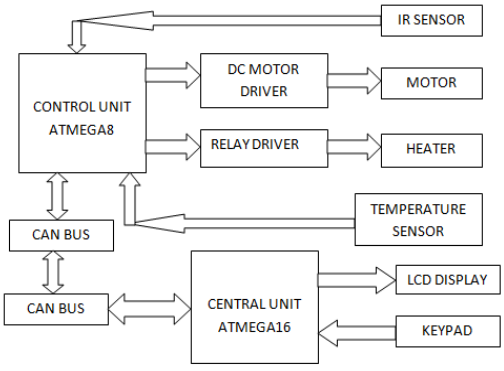

fig. 4.block diagram of the application

Fig.4 shows one of the simple applications using ECM. Here we are using two units named as control unit and central unit. The control unit has been designed, to sense the temperature from the temperature sensor and speed of motor through IR sensor. Central unit has been designed to display the speed and temperature sensed by sensor on LCD display. As ECM is the two way communication system we can also set parameter through keypad and accordingly the devices connected to the units are working.

III. SOFTWARE DESIGN

CAN is based on the "broadcast communication mechanism". All the nodes in the network are able to pick-up or receive all transmissions. The 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, an identifier that is unique throughout the network is used to label the content of the message, which controls its priority of the bus. Each of the receiving nodes performs an acceptance test or provides local filtering on the identifier. If the message is relevant, it will be processed, otherwise it is ignored.

Communication is the transmission of data. In the measurement and control system, the nodes are categorized into different classes such as sensor, controller etc. The data is transferred from one node to another sequentially; therefore it can be considered that the data is transferred through the pipe. It is the software of the ECM that makes the pipe communication possible. The software can be divided into three parts:

- The host pipe communication driver (sensors).
- The software running on the ECM(code vision AVR)
- The communication protocols between host system and the ECM (CAN bus protocol).

The software under use is *CodeVisionAVR* which is a C cross-compiler, Integrated Development Environment and Automatic Program Generator designed for the Atmel AVR family of microcontrollers. The program is designed to run under the Windows 98, Me, NT 4, 2000, XP and Vista 32bit operating systems.

The C cross-compiler implements nearly all the elements of the ANSI C language, as allowed by the AVR architecture, with some features added to take advantage of specificity of the AVR architecture and the embedded system needs. The compiled COFF object files can be C source level debugged, with variable watching, using the Atmel AVR Studio debugger.

The Integrated Development (IDE) has build-in AVR Chip, In-System Programmer software that enables the automatic transfer of the program to the microcontroller chip after successful compilation/assembly.

3.1Control Unit

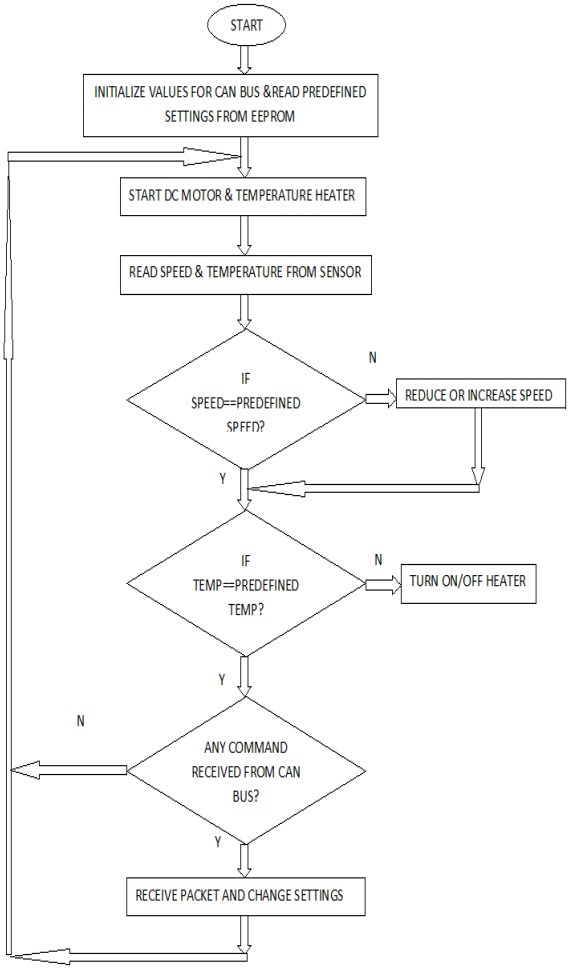

fig. 5.flowchart of control unit

As shown in Fig.5 first we read the predefined settings from EEPROM & initialize the values of temperature and speed (in rpm) for CAN Bus. We start the DC Motor & Temperature Heater and read the real time values from the sensors. Checking algorithm is implemented to verify whether the observed values and predefined values match or not and accordingly the values are increased or decreased by sending the data in packets.

3.2 Central Unit

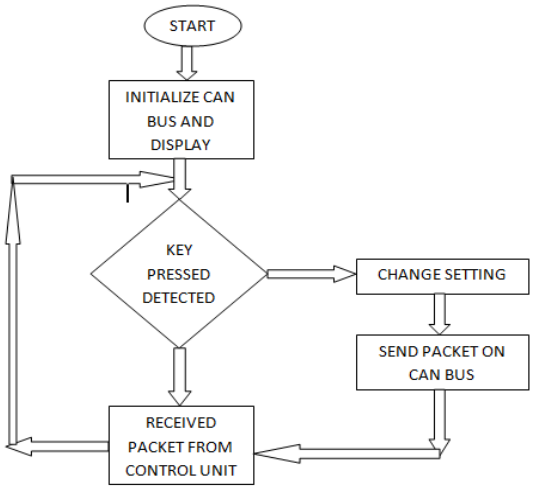

fig. 6.flowchart of central unit

In this unit after initializing the CAN Bus and LCD Screen, we check if any key is pressed or not .If key is pressed then the settings are changed and packet is sent to the CAN Bus, if not then received packet from control unit is displayed on the LCD Screen and the process goes on.

IV. CONCLUSION

This paper has designed an embedded CAN module, which can be used as an interface by embedded system, simplifying the communication in CAN networks as reading and dropping data through pipes. It makes the CAN communication easier and, importantly, more efficient. The experiment demonstrates the effectiveness but a lot of work has to be done to prove the efficiency, with more sophisticated field-bus network and more nodes in it. With careful design of the software, and comprehension in CAN protocols, it is worth the confidence, and that's what would be done in the coming research activities.

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