TEMPERATURE SENSOR TERMINAL FOR CAN BUS DATA ACQUISITION SYSTEM

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Laporan ini dikemukakan untuk memenuhi sebahagian daripada syarat penganugerahan Ijazah Sarjana Muda Kejuruteraan Elektronik (Kejuruteraan Komputer) Dengan Kepujian

Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
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UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek	:	Temperature sensor terminal for CAN Bus data acquisition system
Sesi Pengajian	:	2/ 2007/2008

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I dedicate this to both of my lovely parents and family, a person that love and need most for giving me a support, all my lecturers, all my friends and last but not least the people that contribute directly and indirectly.

PENGHARGAAN

Dengan nama Allah yang maha pemurah lagi maha mengasihani. Segala puji-pujian bagi Allah S.W.T tuhan semesta alam. Selawat serta salam ke atas junjungan besar Nabi Muhammad S.A.W ahli keluarganya para sahabat dan orang-orang yang mengikuti mereka. Bersyukur saya kepada Allah S.W.T kerana kehendaknya dapat saya menyiapkan laporan Projek Sarjana Muda 2 ini dengan lancar. Ribuan terima kasih juga saya ucapkan kepada PSM saya iaitu En. Mazran Bin Esro yang banyak membantu dan memberi bimbingan kepada saya dalam menyiapkan laporan ini. Selain itu penghargaan juga diucapkan kepada para pensyarah yang memberi idea dan panduan kepada saya semasa menjalankan projek ini. Tidak lupa juga kepada ibu bapa saya yang senantiasa memberi galakan dan dorongan kepada saya untuk menyiapkan projek ini. Segala budi baik yang di berikan oleh semua pihak saya ucapkan jutaan terima kasih dan hanya Allah yang dapat membalas jasa mereka.

ABSTRACT

This project is mainly about Temperature Sensor Terminal for CAN Bus data acquisition system. The temperature sensor from the terminal, which is from Microcontroller(PIC16F876) will be able to detect the temperature from terminal and will be able to transmit the temperature data to PC or LCD display through CAN Bus system. In automotive industrial, signal are corrupted due to noise during transmission. So, it can even more robust against noise by using twisted pair of wires. In this project, the twisted pair (CAN Bus) wire is use. Furthermore, CAN controller and also CAN transceiver will be using for data transmitting to other terminal. The methodology is the references in order to ensure this project working properly which has literature review, hardware stage, software stage. Hopefully this project will be able to satisfied all people especially my supervisor and also industrial.

ABSTRAK

Projek ini adalah berteraskan (Controller Area Network Bus) dengan melibatkan pengesan suhu di litar kawalan nod B. Pengesan suhu pada litar kawalan iaitu daripada litar kawalan yang melibatkan (PIC16F876) akan mengesan suhu daripada system yang di buat dan seharusnya boleh menghantar dan menerima data iaitu nilai bacaan suhu seterusnya dipaparkan pada LCD atau juga paparan komputer melalui CAN Bus sistem. Dalam industri automasi, gangguan isyarat berlaku disebabkan hingar semasa isyarat dihantar. Jadi ia akan mengukuhkan atau menguatkan lagi terhadap hangar dengan menggunakan 2 wayar. Dalam projek ini, menggunakan 2 wayar dengan keseluruhan sistem. Selain itu juga, litar kawalan CAN, CAN Transceiver akan digunakan sebagai penghantaran dan penerimaan data kepada terminal yang lain. Metodologi kajian digunakan sebagai rujukan bagi mempastikan projek ini berjalan mengikut peringkat urutan yang telah ditetapkan pada jadual perancangan projek dimana meliputi kajian latarbelakang projek, perkakasan dan perisian. Diharapkan projek ini akan memberi kepuasan kepada semua khususnya penyelia saya dan juga industri.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This project is about designing the temperature Sensor terminal for CAN (Controller Area Network) Bus data acquisition system. The temperature sensor will be fed into signal conditioning circuit, then into Analog input of the microcontroller or CAN I/O (Input/output) expander (MCP 2515). The signal will be able to be seen from PC signal analysis. For testing purpose, another CAN terminal complete with PIC microcontroller, CAN transceiver and CAN module will receive the data from the bus and shall display the temperature reading on PC signal in HyperTerminal. This project is using C programming language of PIC and also using PIC 16F876.

1.2 Objectives

The main objective of this project is to design temperature sensor terminal for the CAN Bus data acquisition system. The temperature from the input signal then shall be displayed by LCD display or PC signal using HyperTerminal. LM35 and Thermistor sensor will be used as temperature sensor. Other objective is to build a CAN bus terminal to indicate that CAN bus will be able to control and monitor any devices connected to the network. In this objective, a hardware that consist of CAN controller and CAN transceiver will be build as a CAN prototype that can monitor and control any other terminal in its network

This project also consists of PIC Controller which is PIC16F876, CAN Controller (MCP 2515), and CAN tranceiver (MCP 2551). The main target of this final solution of this project is integration of the CAN bus between two terminals which are consists terminal 1 and terminal 2. For the programming part, C programming languages are required for this CAN bus integration project.

1.3 Problem statements

This CAN Bus project is designed to solve the problem such as signal transmitted from one terminal to another are corrupted due to noise during transmission. The goal of a CAN in automobiles is to make automobiles more reliable, safe and fuel-efficient while decreasing wiring harness weight and complexity. There are so many electronic devices provide unreliable data and being interrupted by surrounding noise. In order to overcome that, CAN bus has been developed. CAN bus has robust error detection and fault confinement mechanisms, its digital data Input Output signal is harmless to any kind of interruption such as current surge or magnetic fields.

.4 Scope of work

The scope of this project is about to establish CAN Bus communication protocol between at least two terminals. For the both terminals are consists PIC16F876, CAN Controller (MCP 2515), CAN Tranceiver (MCP2551). Then, all this designed circuit will be constructed in PCB layout design for each of terminals. Speed of transmission between this two terminals through CAN bus is 1Mbps. Standard identifier for CAN Bus protocol will be used.

The CAN Bus permits an alternate format messages with 11 bit identifier. All the examples will be used then are 11 bit identifier. Furthermore, this project will be designed especially in temperature part at range between 0°-100°celcius. The temperature data will be taken for the next analysis which is for the linearization mode. This part will be discussed in chapter 4 which consists of result for this project. Lastly, for sending and also retrieving data through CAN Bus system, C programming languages will be used and also PICC Compiler is needed for compiling all of the CAN Bus programming.

CHAPTER 2

LITERATURE REVIEW

2.1 CAN Bus overview

CONTROLLER AREA NETWORK (CAN) originally developed in 1980 by Robert Bosch GmbH for connecting electronic control units (ECUs). A controller area network (CAN) is ideally suited to the many high-level industrial protocols embracing CAN and ISO 11898 as their physical layer. Its cost, performance, and upgradeability provide for tremendous flexibility in system design. The CAN bus was developed as a multi-master, message broadcast system that specifies a maximum signaling rate of 1M bit per second (bps).CAN does not send large blocks of data point-to-point from node A to node B under the supervision of a central bus master. In a CAN network many short messages like temperature or RPM are broadcasted to the entire network, which allows for data consistency in every node of the system.[11]

2.2 CAN standard

According to Abu Bakar Sayuti Hj Mohd Saman (2002), "Reconfigurable: Controller Area Network", MSc. Dessertation, CAN is an International Standardization Organization (ISO) defined serial communications bus originally developed for the automotive industry to replace the complex wiring harness with a two-wire bus. The specification calls for signaling rates up to 1 Mbps, high immunity to electrical interference, and an ability to self-diagnose and repair data errors. These features have led to CAN's popularity in a variety of industries including automotive, marine, medical, manufacturing, and aerospace. The CAN communications protocol, ISO 11898, describes how information is passed between devices on a network, and conforms to the Open Systems Interconnection (OSI) model that is defined in terms of layers. Actual communication between devices connected by the physical medium is defined by the physical layer of the model. The ISO 11898 architecture defines the lowest two layers of the seven layer OSI/ISO model as the data-link layer and physical layer in Figure below.[16]

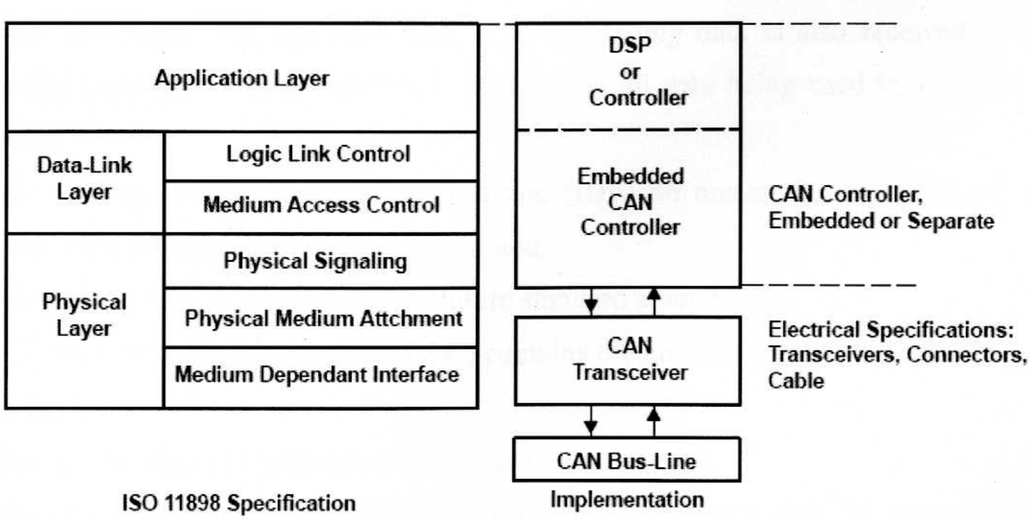

Figure 2.2 The layer ISO 11898 Standard architecture

2.3 The Bit Fields of Standard CAN

2.3.1 Standard CAN

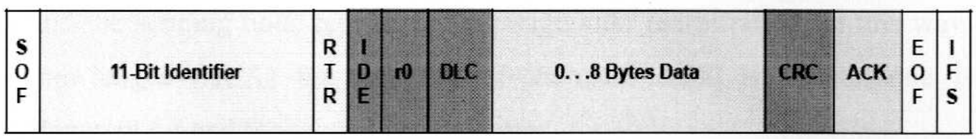

Figure 2.3.1 Standard CAN: 11-Bit Identifier

The meaning of the bit fields of Figure 2.3.1 are:

• **SOF**—The single dominant start of frame (SOF) bit marks the start of a message, and is used to synchronize the nodes on a bus after being idle.

• **Identifier**—The Standard CAN 11-bit identifier establishes the priority of the message. The lower the binary value, the higher its priority.

• **RTR**—The single remote transmission request (RTR) bit is dominant when information is required from another node. All nodes receive the request, but the identifier determines the specified node. The responding data is also received by all nodes and used by any node interested. In this way all data being used in a system is uniform.

• **IDE**—A dominant single identifier extension (IDE) bit means that a standard CAN identifier with no extension is being transmitted.

• **r0**—Reserved bit (for possible use by future standard amendment).

• **DLC**—The 4-bit data length code (DLC) contains the number of bytes of data being transmitted.

• **Data**—Up to 64 bits of application data may be transmitted.

• **CRC**—The 16-bit (15 bits plus delimiter) cyclic redundancy check (CRC) contains the

the different oscillators in a system also need to be accounted for with adjustments in signaling rate and bus length. [14]

Maximum signaling rates achieved with the SN65HVD230 in high-speed mode with several bus lengths are listed in below [14]

BUS LENGTH (m)	SIGNALING RATE (kbps)
30	1000
100	500
250	250
500	125
1000	62.5

Figure 2.4 Maximum signaling rates for Various cable lengths