DEVELOPMENT OF GRAPHICAL USER INTERFACE (GUI) OF CAN BUS DASHBOARD

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" I hereby declare that I have read through this report entitle "Development Of A Graphical User Interface (GUI) Of Controller Area Network (CAN) Bus Dashboard" and found that it has comply the partial fulfilment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation and Automation)"

Signature : .....

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Due : .....

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DEVELOPMENT OF A GRAPHICAL USER INTERFACE (GUI) OF CAR DASHBOARD FROM CONTROLLER AREA NETWORK (CAN) BUS

NUR SAKINAH BINTI MOHD ISMAIL

A Report submitted in partial fulfilment of the requirements for the degree of Electrical Engineering (Control, Instrumentation and Automation)

Faculty of Electrical Engineering

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2014

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I declare that this report entitle "Development Of A Graphical User Interface (GUI) Of Controller Area Network (CAN) Bus Dashboard" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : Nur Sakinah Binti Mohd Ismail

Date : .....

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To My beloved Mother, Mrs. Salha Binti Sabar and My beloved father, Mr. Mohd Ismail Bin Roslan

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ABSTRACT

Nowadays, most of display system had been using digital and even Graphical User Interface (GUI) to provide the best application system. Purpose of this project is to develop a GUI display for Controller Area Network (CAN) dashboard. In this project, Controller Area Network (CAN) dashboard is chosen to improve their display system application. The CAN was used to control the performance of dashboard. Meanwhile, GUI was designed to display the performance of parameter. Therefore, CAN Bus is specialized to connect interaction between the dashboard and the input of circuit.

CAN is a serial network that was originally designed for the automotive industry. It was primarily used in embedded system and consists of two wires, half duplex, high speed network system. The CAN systems are well suited for high speed application using short wire. GUI is type of user interface allow interaction with electronic devices through graphical icons and visual indicator. This application is designed to make the program interactive and user friendly. By using GUI, user can be free from learning complex command languages.

Therefore, in this project required coding to display GUI Car Dashboard and CAN Bus network to connect GUI with micro board. In Chapter 1 explains on the introduction, objectives, and scope regarding this project. Then Chapter 2 is literature review to explain some theory involved and previous papers according to these theories. There are more than 10 previous research paper had been referred to complete this project. In Chapter 3 will explain about methodology of this project divide into 2 parts which is software part and hardware parts. Chapter 4 shows the results and analysis based on the results. Lastly, Chapter 5 explains about conclusion and recommendation in future towards this project.

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ABSTRAK

Pada masa kini, kebanyakan system paparan telahmenggunakansistem digital dan juga grafik (GUI) untuk menyediakan system aplikasi yang terbaik. Tujuan projek ini adalah untuk membangunkan satupaparan GUI bagi Kawasan Pengawal Rangkaian (CAN) papanpemuka . Dalamprojekini , Kawasan Pengawal Rangkaian (CAN) papan pemuka makhluk memilih untuk memperbaiki aplikasi system paparanmereka. CAN ini digunakan untuk mengawal prestasi papan pemuka . Sementara itu, GUI telah direka untuk memaparkan prestasi parameter. Oleh itu, CAN Bus adalah khusus untuk menyambung interaksi antara papan pemuka dan input litar.

CAN adalah rangkaian siri yang pada asalnya direka untuk industriautomotif. Iadi gunakan terutamanya dalam system terbenam dan terdiri daripada dua wayar , separuh dupleks , system rangkaian kelajuan tinggi. Sistem CAN baik sesuai untuk aplikasi berkelajuan tinggi menggunakan wayar pendek. GUI adalah jenis antara muka pengguna membolehkan interaksi dengan peranti elektronik melalui ikon grafik dan penunjuk visual . Permohonan ini direka untuk membuat program interaktif dan mesra pengguna. Dengan menggunakan GUI, pengguna boleh bebas daripada mempelajari bahasa arahan kompleks.

Oleh itu, dalam projek ini diperlukan pengekodan untuk memaparkan GUI Dashboard Kereta dan CAN rangkaian Bas menyambung GUI dengan papan mikro. Dalam bab 1 akan menerangkan tentang pengenalan , objektif, dan skop mengenai projekini. Kemudian bab 2 adalah kajian Sastera untuk menjelaskan beberapa teori yang terlibat dan kertas sebelumnya mengikut teori-teori ini . Terdapat lebih daripada 10 kertas penyelidikan sebelumnya telah pun dirujuk kepada menyiapkanprojekini. Dalam bab 3 akan menerangkan mengenai metodologi jurang projek ini kepada 2 bahagian yang merupakan sebahagian perisian dan bahagian-bahagian perkakasan. Bab 4 akan menunjukkan hasil dan beberapa analisis mengenai keputusan. Akhir sekali , bab 5 menjelaskan tentang kesimpulan dan cadangan pada masa akan dating kearah projek ini.

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TABLE OF CONTENTS

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LIST OF TABLES

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LIST OF FIGURES

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LIST OF ABBREVIATIONS

GUI	-	Graphical User Interface
CAN	-	Controller Area Network
VB	-	Microsoft Visual Basic 2010 Express
ECU	-	Electronics Control Units
RPM	-	Revolutions per Minute
PC	-	Personal Computer
Mbps	-	Megabits per Second
CCS	-	Centrally Controlled System
FFT	-	Fast Fourier Transform
LCD	-	Liquid Crystal Display
UPS	-	Uninterrupted Power Supply
API	-	Microsoft Windows Application
LAN	-	Local Area Network
PIC	-	Pharmaceutical Inspection Convention
Arb.ID	-	Arbitration ID
SMS	-	Short Message Service
GPS	-	Global Positioning System

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LIST OF APPENDICS

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CHAPTER 1

INTRODUCTION

1.0 Overview

CAN was developed by Robert Bosch GmbH, Germany in 1986 for in vehicle network. In the past, automotive industry connected electronic control unit (ECU) by using wiring system. Then, bulky wire harnesses that were heavy and expensive are used in vehicles. Therefore, they are requested to develop a communication system between three electronic control units (ECU) in vehicle by Mercedes.

In 1987, first CAN silicon was developed. It is a high integrity- serial bus system for networking of intelligent devices as the standard vehicle in the network. In 1993, CAN become the international standard known as ISO 11898. Next, in 1994 higher level protocols have been standardized on CAN such as CAN open and Device net [28].

GUI was designed by Xerox Corporation's Palo Alto Research Centre in 1970. But due to CPU power and good quality monitor, GUI became expensive product. It makes GUI had slow acceptance from user. Therefore, Steve Jobs, co-founder of Apple decide to incorporate GUI system in his company computer.

Every year, GUI applications has increased and required a high demand from the market because of its criteria which is make the system easy to learn. Besides that, it had more convenient communication in human computer interaction and allows the developer to create graphics and audible display method. Moreover, it allows user take full

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advantages of the powerful multitasking capabilities of modern operating system. In this project, GUI is used to display the monitoring system in dashboard such as speedometer, temperature, RPM and engine oil which capture the data from CAN Bus. For this project, PC was used to display dashboard by using programming language in Visual Basic 2010.

1.1 Research motivation

Nowadays, cars had been developed in variety size, colour, and function from Variety Company. It shows world automotive industry was evolving from time to time. Malaysia does not miss the trend of automotive industry development. All cars competing companies market products that can fulfil the needs of the world community.

Furthermore, due to competition in automotive marketing over the globe, many automotive companies are vying to get the best marketability products. Moreover, by using GUI dashboard it can create more modern dashboard with a variety of themes can be displayed. So, the convenient vehicle with less oil usage can be produced to meet the modern lifestyle nowadays.

1.2 Problem Statement

Nowadays many automotive industries have been using analogue dashboard in vehicles. This analogue dashboard had been chosen because it easier to develop. Even though it had been widely used, but it has limitations during its operation. For example, fixed pattern and costly to replace when the dashboard damage.

Besides that, the analogue dashboard required wiring system with the bulk of heavy and expensive wires. Consequently, the GUI vehicle dashboards are introduced to overcome this problem by reducing wires and capture the data from CAN Bus network system.

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1.3 Objectives

- To analyze CAN Bus data by using (National Instrument) NI-CAN USB 8473s
- To design a GUI dashboard

1.4 Scope

- To study about the capability of GUI in capturing real data.
- To develop the GUI dashboard by using Visual Basic 2010

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CHAPTER 2

LITERATURE REVIEW

The objective of this chapter is to explain overall subjects related to this project. Several references had been used such as academic book and technical journals. This chapter cover types of topology used, controlled area network (CAN), dashboard and graphical user interface (GUI) in this project.

2.1 Type Of Bus

In every network, had two types of typology which is physical topology and logical topology. In logical topology describes more to communication of component across physical topology. However, there are various types of physical topology network such as star topology, mesh topology, ring topology and bus topology. In this project bus topology are used for networking system .Bus topology is a single cable network or “trunk” or “backbone” and linked to all computers. The illustration of this topology was shown in Figure 2.1.

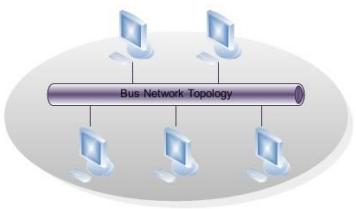

Figure 2.1: Bus network topology [21].

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All the computer will connected to one single cable and affected the performance each computer. In this network, every computer cannot send data simultaneously. Only one computer can transmit data at a time. Others computers will be waiting to transport data. In addition, the data can't send in computer-computer interaction. Data will only commit to trunk cable not other computers in this network.

This network had been chosen because of it is easy to install, inexpensive, flexible and it's required less wires used. However, bus topology has their disadvantages such as it had a limitation of cable length and number of stations, when one node fails, the entire network will shut down and the executions of the network will fall due to increasing of node or computer.

2.2 Controlled Area Network (CAN)

Controlled Area Network (CAN) is a serial bus communication protocol that provides reliable, economic, and efficient link between devices to provide the distributed real time applications by using bit-wise deterministic collision- resolution mechanism [1]. Besides that, it also had high integrity serial bus system for networking intelligent devices as in standard vehicle in the network.

CAN Bus can be classed as a broadcast communication mechanism because of it node operating system. This is because all the nodes can 'hear' the transmission, without exception. Furthermore, CAN is message oriented transmission protocol. It means, every message has its own message identifier and the whole network will define the priority of the message. [4]. Therefore, if two nodes send messages at a time, the one who higher priority will transmitted first followed by lower priority's message.

This transmission protocol will cause collision among the messages, and it'll be resolved by using bit-wise arbitration then allow the message to remain inviolate. In past, CAN Bus system are aim for automotive network system but nowadays, the CAN Bus is widely used in other sector such as automation.

European countries such as Swiss, German and Czech CAN Bus network had been enforced in public transport to control and monitoring door, light and others automation system. Thus, CAN Bus network system have a high demand in the world market place. In

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addition, there are several reasons why CAN Bus system had been chosen to replace the old wiring system.

In the past, most industries used point to point wiring system to connect electronic devices in vehicles. Due to improve on technology times by times, wiring system became more complicated, bulky, heavy and expensive. Then vehicle's weight will increase due to improved of the wiring system. By using CAN Bus, the wiring system can be scaled down.It can be represented as shown in Figure 2.2..

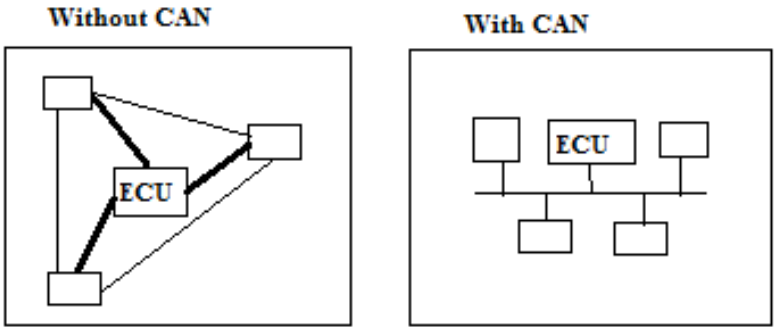

Figure 2.2: Network with CAN and without CAN

From Figure 1.1, it's shown that CAN Bus system only utilize a twisted cable to communicate with each other. Besides that, CAN Bus is contain several characters of large amounts of information, intuitive, high speed of responding, more accuracy and more stable display will had high demand in market [7]. Moreover, CAN Bus also had low cost due to lightweight network, wide broadcast communication, and priority system and had error checking capabilities.

Other features of CAN Bus had serial asynchronous Multi Master bus, transfer rate up to 1 Mbps, maximum bus length up to 40 m, unlimited number of nodes, 2032 different types of messages, 0 to 8 bytes information per data frame and have high safety level due to presence of mechanism for detection, notification and recovery faults.

Due to CAN Bus protocol, when the collision occurs, the arbitration will solved and allow message remain intact. Then, to main the arbitration process, the logic bit needs to define as either dominant or recessive [1]. For example in Figure 2.3, there will be 3 nodes in transmitting process. When all nodes start sending bit frames at the same time, node 1 and 2 will stop at identifier 6. This is because, at identifier 6, node 1 and 2 had

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