CAN BUS APPLICATION IN SMART BUILDING

KHIRUDDIN BIN ZAKARIA

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To my beloved family and friends

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ABSTRACT

Controller Area Network (CAN) bus is one of serial communication bus which support distributed control and real time control effectively. Originating from automobile industries, CAN bus slowly gain appreciation in various industries automation due to its high immunity against electrical interference and the ability to self-diagnose and repair data error. CAN bus is suitable in application requiring a large number of short messages with high reliability in rugged environment. Its application has emerges in other areas i.e security, military, aviation and electronics. This paper intends to apply CAN bus as the network to support smart building requirements. A brief introduction on CAN principles is presented. Its various applications of CAN are introduced in different researches areas. A hardware prototype for a CAN bus application is developed based on Microchip's dsPIC30F4014 digital signal processor. The designs and implementation of the prototype system are described in details.

ABSTRAK

Rangkaian Kawasan Pengawal (CAN) bas adalah salah satu bas komunikasi bersiri yang menyokong kawalan dan kawalan masa nyata diagihkan dengan berkesan. Berasal daripada industri automobil, CAN bas semakin mendapat penghargaan dalam pelbagai industri automasi kerana imuniti yang tinggi terhadap gangguan elektrik dan keupayaan untuk mendiagnosis diri dan pembaikan ralat data. CAN bas sesuai dalam aplikasi yang memerlukan sejumlah besar mesej ringkas dengan kebolehpercayaan yang tinggi dalam environment yang lasak. Penggunaannya semakin banyak dalam industri lain seperti keselamatan, tentera, penerbangan, elektronik dan lain-lain. Laporan projek ini bertujuan untuk mengkaji penggunaan rangkaian CAN bas yang mampu menyokong keperluan bangunan pintar. Satu pengenalan ringkas mengenai prinsip CAN bas dibentangkan. Pelbagai aplikasi iaitu CAN bas diperkenalkan dan dikaji dalam bidang berkaitan. Satu prototaip perkakasan untuk aplikasi CAN bas akan dibangunkan berdasarkan mikro pemproses dsPIC30F4014 pemproses isyarat digital daripada Microchip. Reka bentuk struktur dan perlaksanaannya akan diterangkan secara terperinci.

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INTRODUCTION

1.1 Overview

A Smart Building integrates major building systems on a common network and shares information between systems to improve energy efficiency, operational effectiveness, and occupant satisfaction. The Smart Building is also referred to as Intelligent Building.

The Smart Building is an important outcome of computer technology in information age. Combination of the computer and building technology, Smart Building able to create a comfortable building that not only save energy, water and operational cost, but also benefit to the environment performance through decrease of greenhouse gas emission in the air.

CAN bus is initially designed for automotive industries. It allows microcontrollers and devices to communicate with each other without the presence of a host computer. It is a high performance and high reliable advanced serial communication protocol which effectively supports distributed real-time control. CAN

bus is suitable in application requiring a large number of short messages with high reliability in rugged environment.

CAN bus is considered as a de facto standard for data transmission in automotive applications and now is gaining wide appreciation in various industrial automation, military, medical and building automation system due to its high immunity towards electrical interference and the ability to self-diagnose and repair data errors.

1.2 Problem Statement

Smart Building relies on information gathers from sensors installed inside the building. The information on movement, heat, light and use of space allows the building management system to make real time alteration to a building environment to suits its occupants through a communication network.

In the past, devices and sensors in automotive industries are connected in a point to point wiring system which in turn causes the overall network system to be complicated. In a larger building, more electronic sensors, actuators, meters and control units need to be installed that make the building's wiring system becomes more complex, bulky, heavy and expensive. Additional cost has to be allocated for material and labor to install, alter the wiring. A solution for distributed bus system is required to solve this problem.

CAN bus is a high reliable communication network, high resistance against electromagnetic interference with transfer rate of up to 1 Mbps for real time distributed network. CAN bus is able to handle message of variable data length. CAN bus is a

two-wired serial communication system thus very economical especially for implementation in large building with more rooms to be monitored.

This paper proposed new implementation of CAN bus application in Smart Building. The system will be developed based on PIC microcontroller. A prototype model will be developed and CAN bus will be implemented as the network communication system. The proposed system will handle information from various sensors and variable message length through a two-wire distributed network of CAN bus.

1.3 Objectives

The objective of this project is to implement the CAN bus application in Smart Building. This objective is achieved by design and develop a hardware prototype model of the Smart Building automation system and writing software for implementation of CAN bus application in the system.

1.4 Scope of Work

Scope of work for this project will cover the following areas;

i. Design and develop hardware and software prototype for CAN nodes that performs as the lighting node, temperature sensor node and fire alarm node.

ii. Develop the Control Unit based on PIC microcontroller from Microchip and MPLAB IDE as the CAN software development tool and C++ as the GUI software development tool.

iii. Hardware and software integration and testing of the prototype system for correct operation by simulation of inputs and check for correct outputs.

1.5 Report Outline

This report has been divided into five chapters and one appendix. Chapter 1 introduces project background in general, explanation of the project objective and scope of work.

Chapter 2 describes several literature reviews that related to this project. This includes a research in the area of building technology evolution, several examples of existing network for building automation, an introduction to CAN bus protocol and previous research papers.

Chapter 3 explains the proposed methodology used during system development. This includes System Requirement Analysis, System Design, Hardware and Software Integration and Testing.

Chapter 4 presents the output of the hardware and software testing. This includes verification of the correct implementation of the CAN bus and the fulfillment of the system requirements.

Chapter 5 presents conclusion derived from this project and recommendations for future works.

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