

DISTRIBUTED 68HC11 MICROCONTROLLER USING SJA 1000 AS
CONTROLLER AREA NETWORK

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ABSTRACT

Distributed embedded system can be used for wider area application with many joint-functionalities among multiple controllers compared to using a single controller system. Originally developed for automotive purpose, Controller Area Network (CAN) protocol promises advantages in sending small data bytes over the network for distributed embedded system applications. Hence, this project revolves around the development of a dependable distributed embedded system, which suggest the usage of CAN protocol as a dependable networking solution. Researches had been made to find out the suitable CAN chip to build up the CAN bus system. As a result an SJA 1000 Stand Alone Can Controller was used to make three chip of microcontrollers to communicate with each other without using a personal computer as the host computer in the serial interface mode. The type of the microcontroller chosen was MC68HC11A8 as one of the M68HC11E Family by Motorola. The scope of work for this project was to find out the suitable instructions for MC68HC11A8 microcontroller especially the I/O configuration to conduct the communication process through the CAN controller between the three MC68HC11A8 chips . The Micro C - IDE was used to write down the program while the 68HC11 simulator was also used to simulate and translate the program. The simulated program was then downloaded into the Proteus Program (schematic circuit layout program). Research for the suitable protocol of the CAN bus which is BasicCAN protocol as the interface to MC68HC11A8 chip was also being done. For this project, it involved three MC68HC11A8 chips, three SJA1000/n Stand Alone Can Controller as their interface, three 82C520 chips as a driver for SJA 1000/n and also 68HC11 simulator. At the end of this project, demonstrator had been successfully developed, performing simple application that imitates communication over the network. As such, the CAN protocol can be fully utilized in the development of an application specific dependable networking system by using PeliCAN protocol; for future work.

Keywords: distributed, controller area network, microcontroller, networking, simulator, protocol

ABSTRAK

Sistem pengagihan terbenam mempunyai kelebihan yang tersendiri terutamanya untuk aplikasi yang meliputi kawasan yang luas dan melibatkan pelbagai fungsi gabungan antara pengawal berbilang jika dibandingkan dengan sistem satu pengawal. Protokol *Controller Area Network (CAN)* pada awalnya dicipta untuk kegunaan automatik. Ianya menjanjikan kelebihan di dalam penghantaran bait data bersaiz kecil melalui rangkaian untuk aplikasi sistem pengagihan terbenam. Hasil daripada kajian yang telah dijalankan didapati bahawa SJA 1000 *Stand Alone CAN Controller* adalah merupakan cip CAN yang bersesuaian untuk membina Sisem Bas CAN. Ianya digunakan sebagai perantaramuka untuk membolehkan tiga mikropengawal berkomunikasi satu sama lain di dalam mod komunikasi secara sesiri tanpa memerlukan sistem komputer sebagai hos. Jenis mikropengawal yang digunakan untuk projek ini ialah MC68HC11A8 yang merupakan salah satu dari keluarga cip Motorola M68HC11E. Skop kajian projek ini ialah untuk mencari suruhan yang bersesuaian untuk mikropengawal MC68HC11A8 terutama sekali konfigurasi masukan dan keluaran untuk membolehkan kawalan komunikasi pengawal CAN di antara tiga MC68HC11A8 cip mikropengawal dilakukan. Perisian Micro C-IDE digunakan untuk menulis aturcara manakala simulasi 68HC11 pula digunakan untuk mensimulasi dan menterjemahkan aturcara berkenaan ke dalam bentuk Kod Hex. Aturcara yang telah disimulasi *download*kan ke dalam Perisian Proteus iaitu merupakan Program Lakaran Litar Skematik. *Basic CAN* adalah merupakan protokol CAN yang digunakan untuk projek ini. Projek ini melibatkan tiga cip MC68HC11A8, tiga SJA 1000 *Stand Alone Can Controller* sebagai perantamuka, tiga cip 82C520 sebagai pemancu kepada SJA 1000 dan juga simulator 68HC11. Di akhor projek ini, sistem ini telah berjaya dibina dengan melaksanakan aplikasi mudah dalam mensimulasikan komunikasi di dalam rangkaian. Untuk tujuan pelaksanaan aplikasi yang lebih canggih, kajian mengenai protokol PeliCAN boleh dilaksanakan pada masa hadapan.

Kata kunci: pengagihan, *controller area network*, mikropengawal, rangkaian, *simulator*, protokol

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LIST OF SYMBOLS

Ω - Ohm

LIST OF ABBREVIATIONS

MCU	-	Microcontroller
SJA	-	Stand Alone CAN Controller
CAN	-	Controller Area Network

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CHAPTER 1

INTRODUCTION

1.1 Background Of Research

The Controller Area Network (CANbus) was originally developed for instrumentations in cars. Due to its ruggedness and proven reliability, it has been adapted in other applications such as robotics, medical equipments, photocopy machines, etc. In this project, a prototype of CANbus system was developed using 68HC11 microcontrollers and SJA1000 as the off-the-shelf CAN controller.

1.2 Problem Statement

The recent researches have shown that the Controller Area Network (CANbus) that was originally developed for cars' instrumentations are proven for its ruggedness and reliability. The concept has been adapted in many applications such as robotics, medical equipment, photocopy machines, etc. In this project, the capability and reliability of CANbus will be applied to three 68HC11 microcontroller and SJA 1000 in order to investigate and to analyse its capability to communicate with each other by

using CAN as the bus. Therefore, the project's main objective is to investigate the effectiveness of the CANbus application to three 68HC11 microcontroller.

1.3 Research Objectives

- a) To determine the capability and reliability of the CANbus to distribute 68HC11 microcontroller.
- b) To understand how to configure the 68HC11 microcontroller to handle CAN signal.
- c) To demonstrate the product effectiveness application in any types of microprocessor or microcontroller without a CAN capability.
- d) To develop prototype of CAN Bus system by using at least three 68HC11 microcontroller and SJA 1000 as the off-the-shelf CAN controller.

1.4 Research Scope

- a) Development of the prototype of CAN bus system using 68HC11 microcontroller and SJA 1000 as off-the-shelf CAN controller.
- b) The Micro C Compiler are used to write the source code.
- c) The MC68HC11A8 microcontroller was chosen as the prototype chips and the SJA 1000/n as the stand-alone CAN controller with 82C520 CAN Transceiver.

1.5 Implementation Plan

The project was implemented in two semesters. Project 1 (Research Project Proposal) was done in semester 1 while Project 2 (Final Project) was done in

semester 2. In Project 1, the whole semester was dedicated for literature review concerning microcontroller MC68HC11 and stand alone can controller (SJA1000) that was used for designing the demonstrator. The development of the hardware and its associated application program was carried on in Project 2. Details on the Implementation Plan for this project are as attached in Appendix B of this report.

1.6 Report Outline

This report is organized in such a way that the next chapter (Chapter 2) will elaborate on the MC68HC11 as microcontroller and SJA 1000 as Stand Alone Controller Area Network protocol. Explanation on the hardware development for the CAN implementation in the demonstrator was described in Chapter 3. Meanwhile, the the design of the network programming and steps in preparing the model for the SJA 1000 used in Schematic Circuit Layout Program (Proteus 7.4) are described in Chapter 4. Chapter 5 shows the results of the developed demonstrator by comparing output from Proteus 7.4. Future works for the demonstrator developed is as summarized in Chapter 6.

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