EMBEDDED TCP/IP-BASED DC MOTOR CONTROLLED VIA LOCAL AREA NETWORK

NGO CHEE GUAN

MAY 2008

“I hereby declared that I have read through this report and found that it has comply the partial fulfilment for awarding the degree of Bachelor of Electrical Engineering (Power Electronic and Drive)”

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Supervisor’s Name : ………………………………………………………
Date : ………………………………………………………

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This Report Is Submitted In Partial Fulfilment of Requirement for the Degree of Bachelor in Electrical Engineering (Power Electronic and Drive)

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Universiti Teknikal Malaysia Melaka

May 2008

"I hereby declared that this report is a result of my own work except for the excerpts that have been cited clearly in the references."

Signature : ....

Name : ....

Date : ....

To beloved father and mother

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ABSTRACT

The project title is embedded TCP/IP-based DC motor controlled via local area network. The objective is to design and develops a proportional integral (PI) speed controlled DC motor via TCP/IP network by using rabbit microprocessor and its core module model RCM 3200 and RCM 2100. User Datagram Protocol (UDP) is implemented in this project to link between master controller and slave controller through network. User stay in a location will control the direction and speed of the DC motor at remote site by adjusting the user control system. The user control system is attach to the master controller which PI algorithm is apply to provide a feedback control through networking. The PI algorithm will compare the reference speed from user control system and feedback speed from slave controller and calculate the require duty cycle of PWM signal needed to supply to DC motor driver. The calculated value will be sent to slave controller as datagram by using UDP. After the slave controller gets the value, it will generate appropriate PWM signal for DC motor driver to drive the DC motor at desired speed. Beside that, the slave controller will read the feedback speed from speed sensor and pass the feedback speed to master controller for further processing. The aim of this project is to design a working laboratory scale prototype that can remotely control a DC motor via local area network by using embedded TCP/IP controller.

To implement this project, rabbit core module 3200 and its prototype board, rabbit core module 2100 and its prototype board, Ethernet switches, L298 dual full bridge driver, DC motor, speed sensor, rectifier and analogue to digital converter is implemented. For software development, Dynamic C is implemented to writing, compiling, debugging, linking and loading the programme to rabbit core module. Finally, hardware and software is integrated for functional test to ensure that the prototype is work as expected.

ABSTRAK

Tajuk projek ini adalah kawalan motor arus terus melalui rangkaian kawasan setempat (LAN) berasaskan sistem TCP/IP terbenam. Objektif projek ini adalah mereka dan membangunkan pengawal proportional integral (PI) kelajuan motor arus terus dengan menggunakan mikropemproses rabbit dan model modul terasnya RCM 3200 dan RCM 2100. Protokol Pengguna Datagram (UDP) digunakan dalam projek ini untuk menghubungkan antara pengawal tuan dan pengawal hamba melalui jaringan. Pengguna yang berada pada lokasi tertentu boleh mengawal arah putaran dan kelajuan motor arus terus di tempat lain dengan mengawal system pengawal pengguna. System pengawal pengguna adalah disambung kepada pengawal tuan dimana algoritma PI diaplikasikan untuk memberi kawalan suap negative melalui jaringan. Algoritma PI akan membandingkan kelajuan rujukan dari system kawalan pengguna and kelajuan suap balik dari pengawal hamba dan mengira putaran duti pengubahsuaian lebar denyut (PWM) yang diperlu untuk dibekal kepada pemandu motor arus terus. Nilai yang dikira akan dihantar ke pengawal hamba dengan menggunakan UDP. Selepas pengawal hamba mendapat nilai tersebut, ia akan menjanakan signal PWM yang sesuai kepada pemandu motor arus terus untuk memandu motor arus terus pada kelajuan ditetapkan. Selain itu, pengawal hamba akan membaca kelajuan suap balik dari sensor kelajuan dan menghantar bacaan tersebut kepada pengawal tuan untuk pemprosesan selanjutnya. Matlamat projek ini adalah mereka cipta sebuah prototaip berskala makmal bekerja yang boleh mengawal motor arus terus secara jarak jauh melalui rangkaian kawasan tempatan dengan menggunakan pengawal TCP/IP terbenam.

Untuk melaksanakan projek ini, modul teras rabbit 3200 dan papan prototaipnya, modul teras rabbit 2100 dan papan prototaipnya, suis Ethernet, L298, motor arus terus, sensor kelajuan, rectifier and ADC akan digunakan. Untuk pembangunan perisian, Dynamic C akan digunakan untuk menulis, mengkompil, menghubung dan memasukkan program pada modul teras rabbit. Akhirnya,

perkakasan dan perisian akan diintegrasikan untuk ujian kefungsian untuk memastikan prototaip yang dihasilkan bekerja seperti yang diharapkan.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

DC	- Direct Current
DSP	- Digital Signal Processor
LAN	- Local Area Network
PI	- Proportional Integral
PLC	- Programmable Logic Controller
PWM	- Pulse Width Modulated
RAM	- Random Access Memory
RCM	- Rabbit Core Module
TCP/IP	- Transmission Control Protocol / Internet Protocol
UDP	- User Datagram Protocol

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Objectives

- To develop an embedded TCP/IP-based DC motor controlled via local area network by using rabbit microprocessor.
- To develop a Proportional-Integral (PI) controller that can remotely controls a DC motor through local area network.

1.2 Scope

- Develop algorithms that enable communication between Master Controller (RCM 3200) and Slave Controller (RCM 2100) by using User Datagram Protocol (UDP).
- Develop a software function to enable Slave Controller (RCM 2100) to produce PWM signal.
- Build an H-bridge driver for DC motor.
- Design and constructs a feedback circuit from motor speed sensor to Slave Controller (RCM 2100).