"DISTRIBUTED CONTROLLERS SYSTEM"

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE

OF

MASTER OF ENGINEERING
(CONTROL & INSTRUMENTATION)

SUBMITTED BY

Kumari Shipra
(University Roll No. 13961)
(Class Roll No. 04/C&I/09)

UNDER SUPERVISION

PROF. PRAMOD KUMAR
DEPARTMENT OF ELECTRICAL ENGINEERING

DELHI COLLEGE OF ENGINEERING

(UNIVERSITY OF DELHI)
DELHI-110042
2009 – 2012

CERTIFICATE

This is to certify that the work presented in this project entitled “Distributed Controllers system”, is partial fulfilment of the requirements for the award of Degree of Master of Engineering in Electrical Engineering (Control & Instrumentation) submitted by Kumari Shipra (University roll no. 13961) to the Department of Electrical Engineering, is a record of the student's work carried out under my supervision and guidance.

(Dr. Pramod Kumar)
Professor
Electrical Engineering Department
Faculty of Technology, University of Delhi
Delhi-110042

ACKNOWLEDGEMENT

I would like to thank all the people involved in the preparation of this thesis. Especially, I wish to thank the supervisor of the thesis, Professor Pramod Kumar (Department of Electrical Engineering, Faculty of Technology, University Of Delhi) for his valuable guidance, encouragement and patient review. I would also like to thank Mr. Karan Singh (Sr. Lab Technician, DTU) and colleagues at IPEC college, Ms. Amita Agnihotri , Ms. Shilpa Gupta, Ms. Bindoo Mishra for their fruitful and constructive ideas. Finally, a special thank you to my Spouse Deepak Kumar and my family for his endless support and encouragement.

Kumari Shipra

University Roll No: 13961

Class Roll No: 04/C&I/09

CONTENTS

CERTIFICATE…….. ii

ACKNOWLEDGEMENT…… iii

CONTENTS…….. iv

LIST OF FIGURES…….. vi-vii

LIST OF ABBREVIATIONS…… viii

Chapter 1 : INTRODUCTION

1.1 Background..... 1

1.2 Objective of Project……..……..…….8

1.3 Scope of Project……..……..…….8

1.4 Outline of Thesis……...8

1.5 Conclusion…….....…….. 9

Chapter 2 : Literature Review

2.1 Introduction……10

2.2 Control System……..10

2.3 Distributed Controllers System……11

2.4 Programmable Logic Controllers……..12

2.5 Micro-controllers……14

2.6 8051 Micro-controller……16

2.6.1 Features……..16

2.7 AVR Micro-controller……17

2.7.1 Features ……18

2.8 Conclusion……19

Chapter 3 : Communication Protocol & Field Bus

3.1 Introduction……..20

3.2 Communication Protocol…….20

3.3 Network Topology……22

3.4 Field Buses…….23
3.4.1 Profi Bus…….24
3.4.2 World FIP……26
3.4.3 CAN……28
3.5 Ethernet Bus……..29
3.6 Mod bus…….30
3.7 MACRO……30
3.8 Communication protocol functional description…31
3.9 Conclusion……33

Chapter 4 : Methodology

4.1 Introduction…….34
4.2 DC Drives……35
4.2.1 Algorithm for DC Drive control……35
4.3 Algorithm for AC Drive ……....37
4.3.1 Direct & quadrature-Axis transformation……....38
4.3.2 Direct torque control……..45
4.4 Conclusion……..49

Chapter 5 : Implementation and testing of Distributed controller system

5.1 Introduction……..50
5.2 8051 Microcontroller……51
5.2.1 Pin configuration &description……51
5.2.2 Internal architecture…….54
5.3 AVR Microcontroller……56
5.3.1 Internal architecture……57
5.3.2 Pin configuration & description…….58
5.4 AVR studio4 integrated development environment…59

5.5 Distributed micro-controller system application……..61

5.6 Conclusion…….61

Chapter 6 : Conclusion and Further Scope of Work……62

References……63

LIST OF FIGURES

Figure No.	Figure Description	Page No.
1.1	Delta V Structure	4
1.2	Smart DCS	6
1.3	System Architecture	7
3.1	Industrial Communications for the example of PROFIBUS	21
3.2	PROFIBUS medium access control	26
3.3	Block diagram of world FIP medium access mechanism	27
3.4	MACRO ring network consists of group of a master and slave stations	31
4.1	Equivalent circuit of a separately excited DC motor	35
4.2	Block dia. Of DC drive	37
4.3	Clark transform vector diagram	41
4.4	Park transform vector diagram	42

4.5	Position of the rotor flux vector	42
4.6	Block dia. Indirect vector control method	43
4.7	Block dia.Direct vector control method	43
4.8	Basic structure of direct torque and stator flux vector	46
4.9	Axis of rotation for various quantities	48
5.1	Block diagram of DCS	50
5.2	Pin configuration of 8051 Microcontroller	51
5.3	Block dia. of 8051 Microcontroller	54
5.4	Block dia. of AVR Microcontroller	57
5.5	Pin configuration of AVR Microcontroller	58

LIST OF ABBREVIATIONS