DEVELOPMENT OF AN MCS51 MULTIPUPROSE BOARD AND ITS PROGRAMMING ROUTINES

By: LEFKOS DEMOSTHENOUS

Project Report Sumbmitted to the Department of Electrical Engineering of the Higher Technical Institute

In partial fulfiment of the requirements for the diploma of

TECHNICIAN ENGINEER in ELECTRICAL ENGINEERING

JUNE 1993

2152

ACKNOWLEDGMENTS

First, I would like to express my thanks to the Cyprus Telecommunications Authority who have sponsored my project.

I especially thank my project supervisor Mr. Ch. Theopemptou for his valuable support and guidance.

My thanks and appreciation are extended to the personnel of the Electronic Laboratory of CYTA for their support throughout the project period.

ABSTRACT

Author : Lefkos Demosthenous.

Project Title: Development of an MCS-51 multi purpose board and

its programming routines.

This project work deals with one of the most popular microcontrollers: 8051. Its main purpose is the construction of a multipurpose board with its programming routines.

The design of the board was such so as to give sufficient features for a lot of applications. For this reason the board offers the maximum memory that the CPU can handle but it can be also used with only minimum (on Chip) memory for small applications.

Basic software is provided for serial communication and for testing purposes. Furthermore, the small manual of the board will help its users to work with it quite easily. CONTENTS

¢

			Page	
Ack	Acknowledgments			
Abs	tract	II		
Int	roduction	III		
<u>CHA</u>	<u>PTER 1:</u>	1		
1.0	1.0 Microcontrollers and Microprocessors			
1.1 The MCS - 51 family			2	
1.2	1.2 Technical Features of MCS-51 family			
1.3	Archite	cture of 8051 Microcontroller	5	
	1.3.1	Introduction	5	
	1.3.2	Pin configuration	6	
	1.3.3	Memory organization	7	
	1.3.4	Special function registers	11	
	1.3.5	Ports	15	
	1.3.6	Timers/Counters	17	
CHAI	PTER 2:	Hardware of the board	19	
2.1 Introduc		ction	19	
2.2	Connect	ing External Memory	19	

			2.2.1	Introduction	19
			2.2.2	External Access Pin and External ROM	20
			2.2.3	Options for connecting external memory	20
	2.3	2.3	Memory Mapping		
		2.4	Jumpers		22
			2.4.1	Introduction	22
			2.4.2	Circuit diagram of the jumpers	24
			2.4.3	Jumper for Internal/External ROM	25
			2.4.4	Schematic Positions of Jumpers	25
	2.5	2.5	Expanding I/O Ports using 8255		
		2.6	Serial In	nterface using MAX 232	29
		2.7	Power Sup	Supply	
		2.8	Clock and	l Reset circuits	30
			2.8.1	Clock Circuit	30
			2.8.2	Reset Circuit	31
2.9 PCB Design			PCB Des:	ign	31
	2.10 Which microcontroller to use		crocontroller to use	32	
	2.11 The second board using 8051			nd board using 8051	33
		2.12 Component list		t list	34

e

<u>CHAP</u>	TER 3: Testing the design	36
3.1	Inspection and Simple Testing	36
3.2	Self test Programs	36
3.3	Other methods of testing	41
<u>CHAP1</u>	<u>TER 4:</u> Serial Communication	42
4.1	Introduction	42
4.2	Serial data Input/Output	42
4.3	Modes of operation	43
4.4	How to communicate with an IBM PC	45
4.5	Software	52
<u>CHAPT</u>	<u>ER 5:</u> 80C51 - Based 8-bit Microcontrollers by Philips	55
5.1	Introduction	55
5.2	Family Overview	58
5.3	More about some derivative features	60
CHAPT	<u>ER 6:</u> Software	63
6.1	Introduction	63

6.2 The 8051 Instruction Set

6.3 Program for loading a program through a PC 67 Conclusions 71 APPENDICES APPENDIX 1 Circuit diagrams

		5
APPENDIX	2	Printed Circuit Boards
APPENDIX	3	Instruction Set of 8051
APPENDIX	4	Data Sheets