

**8031 MICROCONTROLLER CARD
WITH LCD DOT MATRIX DISPLAY**

By :

Kyriakides Kyriakos

Project Report

Submitted to

the Department of Electrical Engineering

of the Higher Technical Institute

Nicosia - Cyprus

in partial fulfillment of the requirements

for the diploma of

TECHNICIAN ENGINEER

in

ELECTRICAL ENGINEERING

JUNE 1992

S U M M A R Y

Author :Kyriakides Kyriakos
Project Title :8031 Microcontroller with LCD interface

Microcontroller..., a by-product of microprocessor development! Same fabrication techniques and programming concepts are met in both devices.

Microcontrollers are not as well known to the general public or even the technical community as some microprocessors are. Their effect and existence though, is evident in our every day life. Take for example all those smart electronic appliances you can find in the commerce today; VCR's, clock radios, telephones, cars, fax machines or even toys!

This project work is dealing with one of the most popular microcontrollers, the Intel 8031. Its purpose the in-depth study of the 8031, its capabilities, potential and applications, as well as particularities. All of the aforementioned are demonstrated via the construction of an 8031 microcontroller card with an LCD module to control and display results.

CONTENTS

	<u>Pages</u>
ACKNOWLEDGEMENTS	I
SUMMARY	II
CONTENTS	III
INTRODUCTION	1
<u>CHAPTER 1 : THE 8031 MICROCONTROLLER</u>	
1.0 Introduction	4
1.1 Microprocessors & microcontrollers	4
1.2 The 8031 Architecture	6
I. Memory Organization	8
II. Stack area & Stack Pointer	11
III. Special Function Registers	11
IV. The Program Status Word	12
V. A & B registers	13
VI. Program Counter & Data Pointer	14
VII. I/O Ports	14
VII. The reset.	
<u>CHAPTER 2 : THE LIQUID CRYSTAL DISPLAY</u>	
2.0 Introduction	18
2.1 LCD Characteristics	20
2.2 Pin Connections & Functions	20
2.3 Instruction Description	22
2.3.1 Clear Display Instruction	23
2.3.2 Cursor Return Home	23
2.3.3 Entry mode set	23
2.3.4 Display ON/OFF control	23
2.3.5 Cursor or Shift Display	23
2.3.6 Function set	24
2.3.7 Set CE RAM Address	24
2.3.8 Set DD RAM Address	24
2.3.9 Read Busy Flag & Address	24
2.3.10 Read/ Write to DD/ CG RAM	25

2.4 Initialization 25

CHAPTER 3 : HARDWARE DESIGN & CONSTRUCTION

3.0 Introduction 27

3.1 The 8031 pinout 28

3.2 Microcontroller card design 29

 3.2.1 External memory 30

 3.2.2 Reset & Clock 32

 3.2.3 Address Recoding 34

 3.2.4 I/O ports 36

 3.2.5 Memory back up 36

3.3 LCD Interfacing cct 38

3.4 The Power supply 41

3.5 PCB layouts 42

 3.5.1 The microcontroller PCB 42

 3.5.2 The LCD module PCB 43

CHAPTER 4 : THE SOFTWARE

4.0 Introduction 45

4.1 The 8031 instruction set 45

4.2 Programming 46

 4.2.1 Main Program 46

 4.2.2 Programming the LCD 47

4.3 The Subroutines 47

CONCLUSIONS 51

REFERENCES 53

COMPONENTS LIST 54

APPENDICES

Appendix A Circuit Diagrams

Appendix B Data Sheets

Appendix C Printed circuit boards

Appendix D 8031 Instruction set

Appendix E Program listings