

**UNIVERSITI MALAYSIA PAHANG**

**BORANG PENGESAHAN STATUS TESIS\***

JUDUL: **MC68000 MICROPROCESSOR STAND ALONE  
EDUCATIONAL BOARD**  
SESI PENGAJIAN: 2011/2012

Saya HENG POH XUAN ( 881004-26-5376 )  
(HURUF BESAR)

mengaku membenarkan tesis (Sarjana Muda/Sarjana /Doktor Falsafah)\* ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Universiti Malaysia Pahang (UMP).
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. \*\*Sila tandakan ( ✓ )

**SULIT**

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

**TERHAD**

(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

**TIDAK TERHAD**

Disahkan oleh:

\_\_\_\_\_  
(TANDATANGAN PENULIS)

\_\_\_\_\_  
(TANDATANGAN PENYELIA)

Alamat Tetap:

**70G-H TAMAN MAHAWANGSA  
JALAN PUTRA,  
05150 ALOR STAR  
KEDAH.**

**EN. NIK MOHD KAMIL BIN NIK YUSOFF**

(Nama Penyelia)

Tarikh: **19 JUNE 2012**

Tarikh: : **19 JUNE 2012**

- CATATAN:      \*      Potong yang tidak berkenaan.  
                      \*\*     Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali tempoh tesis ini perlu dikelaskan sebagai atau TERHAD.  
                      ♦      Tesis dimaksudkan sebagai tesis bagi Ijazah doktor Falsafah dan Sarjana secara Penyelidikan, atau disertasi bagi pengajian secara kerja kursus dan penyelidikan, atau Laporan Projek Sarjana Muda (PSM).

**MC68000 MICROPROCESSOR STAND ALONE EDUCATIONAL BOARD**

**HENG POH XUAN**

This thesis is submitted as partial fulfillment of the requirements for the award of the  
**Bachelor of Electrical Engineering (Electronics)**

Faculty of Electrical & Electronics Engineering  
Universiti Malaysia Pahang

**JUNE, 2012**

## TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	TITLE PAGE	i
	SUPERVISOR'S DECLARATION	ii
	STUDENT'S DECLARATION	iii
	DEDICATION	iv
	ACKNOWLEDGEMENT	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENTS	viii
	LIST OF FIGURES	xii
	LIST OF TABLES	xiv
	LIST OF ABBREVIATIONS	xv
	LIST OF APPENDIXES	xvii
 1	INTRODUCTION	 1
	1.1 Introduction	1
	1.2 Problem Statement	3
	1.3 Objectives	3
	1.4 Scope of Project	4
	1.5 Thesis Outline	5

2	LITERATURE REVIEW	6
	2.1 Introduction	6
	2.2 Literature Review on Educational Board	7
	2.2.1 MINI 11 – Microcontroller Development Board for SCL Approach	7
	2.2.2 A Multidisciplinary Educational Board System for Microcontrollers	8
	2.2.3 Universal Development Board for Education in Embedded Systems	9
	2.2.4 Designing a Multi-Processor Education Board for High-Performance Embedded Processing	10
	2.2.5 Learning Embedded Systems with Multi- Microcontroller Evaluation Tool	11
	2.2.6 A Microcontroller Laboratory Hardware Platform for the Academic Environment: The UDM-EVB	12
	2.2.7 Development of a Microcontroller Laboratory Facility for Directing Students towards Application Oriented Projects	13
	2.2.8 Design Based Tutorials for System-on-Chip Teachings	14
	2.3 Conclusion	14
3	HARDWARE DESIGN	15
	3.1 Introduction	15
	3.2 Hardware Development	17
	3.2.1 System Board of the MC68000 Educational Board	17
	3.2.2 Power Supply Module	18
	3.2.3 Clock Circuit Module	19
	3.2.4 Reset Circuit Module	20
	3.2.5 Memory Module	21

3.2.6	Read/Write Control Bus Module	22
3.3	Application board of MC68000 Educational Board	23
3.3.1	Address Allocation for Application Board	24
3.3.2	LED Module	26
3.3.3	7-Segment Display Module	27
3.3.4	Dot Matrix	28
3.3.5	Liquid Crystal Display (LCD)	29
3.3.6	Direct Current Motor	30
3.3.7	Bar Graph	31
3.3.8	Multi – Segment Display	32
3.3.9	8-ways DIP Switches	33
3.3.10	Keypad	34
4	SOFTWARE DESIGN	36
4.1	Introduction	36
4.2	Software Development Tools	37
4.3	Software Approach	39
4.4	Microprocessor Testing	40
4.5	LED Module Testing	41
4.6	7-Segment Testing	42
4.7	Bar Graph Display Testing	43
4.8	Keypad Module Testing	44
4.9	LCD Module Testing	45
4.10	Motor Module Testing	46
4.11	Multi-Segment Module Testing	48
4.12	DIP Switch Module Testing	49
4.13	Dot Matrix Module Testing	50
5	RESULT AND DISCUSSION	51
5.1	Introduction	51
5.2	System Board Testing	52
5.3	Application Testing	53
5.3.1	Testing for LED Module	55

5.3.2	Testing for 7-Segment Module	56
5.3.3	Testing for DIP Switch Module	57
5.3.4	Testing for Bar Graph Module	58
5.3.5	Testing for Keypad Module	59
5.3.6	Testing for LCD	61
5.3.7	Testing for DC Motor Module	62
5.3.8	Testing for Multi-Segment Display Module	63
5.3.9	Testing for Dot Matrix Module	65
6	CONCLUSION	68
	6.1 Conclusion	68
	6.2 Recommendation	69
	6.3 Costing and Commercialization	70
	REFERENCES	71
	APPENDIX A	73
	APPENDIX B	79
	APPENDIX C	87

## LIST OF FIGURE

FIGURE NO.	TITLE	PAGE
2.1	System Block Diagram	7
2.2	Educational Board System block diagram	8
2.3	Architecture of an universal development board for different microcontroller families.	9
2.4	The System level view of the board	10
2.5	System Block diagram	11
2.6	Completed Training Project	13
3.1	System Block Diagram	16
3.2	Block Diagram of System Board	17
3.3	Power Supply Module	18
3.4	Clock Circuit Module	19
3.5	Reset Circuit Module	20
3.6	Memory Module	21
3.7	R/W Control Bus Module	22
3.8	Address Decoder of Application Board	24
3.9	LED Circuit Connections	26
3.10	7-Segment Display Module	27
3.11	Dot Matrix Module	28
3.12	Liquid Crystal Display Module	29
3.13	Direct Current Motor Circuit Diagram	30
3.14	Bar Graph Circuit Diagram	31
3.15	Multi-Segment Circuit Diagram	32
3.16	8-ways DIP Switches circuit connection	33
3.17	Keypad Schematic Diagram	34
4.1	Notepad	37
4.2	ASM68K Assembler	38
4.3	Universal IC Writer Software	38
4.4	Flow of the operating system	39

4.5	Free LED Running Connection Circuit	41
4.6	Flow Chart of LED Testing	42
4.7	Flow Chart of 7-Segment Testing	43
4.8	Flow Chart of Bar Graph Testing	44
4.9	Flow Chart of Keypad module Testing	45
4.10	Flow chart of LCD Module Testing	46
4.11	Flow Chart of DC motor Testing	47
4.12	Flow Chart of Multi-Segment Testing	48
4.13	Flow Chart of DIP Switch Testing	49
4.14	Flow chart of Dot Matrix Module Testing	50
5.1	Flow Chart of Testing Modules	54
5.2	Testing Program of LED module	55
5.3	Testing Program of 7-segment module	56
5.4	Testing Program of DIP switch module	57
5.5	Testing Program of Bar Graph Module	58
5.6	Truth Table	59
5.7	Button A is pressed	60
5.8	Button A is released	60
5.9	Button 5 is pressed	60
5.10	Testing program of LCD	62
5.11	Testing Program of DC motor module	63
5.12	Testing Program of Multi-Segment Module	64
5.13	Testing Program of Dot Matrix Module	65
5.14	Plan View of the MC68000 Educational Board	67

**LIST OF TABLES**

<b>TABLE NO.</b>	<b>TITLE</b>	<b>PAGE</b>
3.1	Address Allocation	25
3.2	Description of Data Bits for Keypad	35

## LIST OF ABBREVIATIONS

CSIC	Complex Instruction Set Computers
LED	Light Emitted Diode
LCD	Liquid Crystal Display
DIP	Dual-In-Line Package
I/O	Input and Output
MACSS	Motorola Advanced Computer System on Silicon
CPU	Central Processing Unit
RAM	Random Access Memory
ROM	Read Only Memory
DC	Direct Current
UMP	University Malaysia Pahang
SCL	Student Central Learning
EBS	Educational Board System
PC	Personal Computer
ARM	Advanced RISC Machine
FPGA	Field Programmable Gate Array
JTAG	Joint Test Action Group
IDE	Integrated Development Environment
UDM	University Detroit Mercy
EVB	Evaluation Board
SoC	System on Chip
SRAM	Static Random Access Memory
SDRAM	Synchronous Dynamic Random Access Memory
VHDL	VHSIC Hardware Description Language

A/D	Analog to Digital
D/A	Digital to Analog
CLK	Clock
TTL	Transistor-Transistor Logic
AS*	Address Strobe
R/W*	Read/Write
UDS*	Upper Data Strobe
LDS*	Lower Data Strobe
SPST	Single-Pole Single-Throw
EEPROM	Electrical Erasable Programmable Read Only Memory
PCB	Printed Circuit Board
SCL	Student Centre Learning
PWM	Pulse Width Modulation

## **LIST OF APPENDIXES**

<b>APPENDIX NO.</b>	<b>TITLE</b>	<b>PAGE</b>
A	Program	73
B	Schematic Circuit Diagram	79
C	Output Result of Application Board	87