

raf

TJ223.P76 .A99 2008.



0000062761

Electronic combination lock using PIC / Azzad Firdaus
Zolkepli.

ELECTRONIC COMBINATION LOCK USING PIC

AZZAD FIRDAUS BIN ZOLKEPLI

This report is submitted in partial fulfillment of the requirements for the award of
Bachelor of Electronic Engineering (Industrial Electronics) With Honours.

Faculty of Electronic and Computer Engineering

Universiti Teknikal Malaysia Melaka

April 2008



UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER
BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Electronic Combination Lock Using
PIC

Sesi Pengajian : 2007/ 2008

Saya **AZZAD FIRDAUS BIN ZOLKEPLI**

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan 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)

(COP DAN TANDATANGAN PENYELIA)

FAUZYAH BT SALEHUDIN

Pensyarah

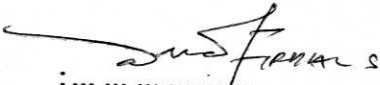
Fakulti Kej Elektronik dan Kej Komputer (FKEKK),
 Universiti Teknikal Malaysia Melaka (UTeM),
 Karung Berkunci 1200
 Ayer Keroh, 75450 Melaka

Alamat Tetap: 15 Lorong Seri Setali 24
 Taman Tunas Jaya,
 25300 Kuantan,
 Pahang Darul Makmur

Tarikh: 12/5/2008

Tarikh: 12/5/2008


“I hereby declare that this report is the result of my own work except for quotes as cited in the reference”

Signature : 

Author : Azzad Firdaus Bin Zolkepli

Date : 12/5/2008

“I hereby declare that I have read this report and in my opinion this report is sufficient in term of the scope and quality for the award of Bachelor of Electronic Engineering (Industrial Electronics) with Honours”

Signature : 

Supervisor's Name : Puan Fauziyah Binti Salehuddin

Date : 12 / 5 / 2008

This thesis is dedicated to my lovely family, my dearest mom, dad, brother, sister and my friends. Their love is the greatest support of this research journey far away from home.

ACKNOWLEDGEMENT

Praise be to Allah S.W.T, the Most Gracious, the Most Merciful for all the blessings and guidance upon me thoroughly my study.

While the motivation and hard work in pursuing a degree's must come from within, interactions with others have stimulated and sustained me personally during my studies. I want to acknowledge many people whose professional help and personal support has made it possible for me to complete this final project.

I am deeply indebted to my supervisor Puan Fauziyah Binti Salehuddin whose help, stimulating suggestions and encouragement helped me in all the time of research for and writing of this thesis.

I would like to express my gratefulness to my family for their continuous love and support throughout my life. Finally, I wish to thank my housemates and all my friends for their support through this final project.

ABSTRACT

The Electronic Combination Lock project is a basic access control system. The 'Code Lock' ability will allow the rightful user to deploy the platform to any property that requires simple password-protection. The PIC16F628A microcontroller used to ensure low costs. Possible applications may include such as vehicle protection, electronic safes and powered door locks. The following short thesis will explain how the early version was engineered and how to use the controller to accept valid passwords. With a little external hardware, the featured systems may easily be used to disengage an electric door strike or similar system.

ABSTRAK

Projek Kunci Kombinasi Elektronik adalah satu sistem kawalan akses yang asas. Keupayaan penggunaan kunci kod akan membenarkan pengguna untuk menggunakannya pada sebarang peralatan atau harta benda yang memerlukan perlindungan mudah menggunakan kata laluan. Mikropemproses PIC16F628A digunakan bagi memastikan projek ini berkos rendah. Aplikasi –aplikasi bagi projek ini adalah seperti perlindungan bagi kenderaan, peti besi elektronik dan pengunci pintu elektrik. Tesis projek ini akan menjelaskan bagaimana perancangan pembikinan projek ini diatur dan bagaimana menggunakan sistem untuk menerima kata laluan. Dengan komponen dan peralatan yang sedikit dalam pembikinan projek ini, sistem ini boleh digunakan untuk membuka pemukul pintu elektrik atau alatan yang sejenis dengannya

CONTENTS

CHAPTER	TITLE	PAGE
	PROJECT TITLE	i
	REPORT STATUS VALIDATION FORM	ii
	DECLARATION	iii
	ACKNOWLEDGEMENTS	vi
	ABSTRACT	vii
	ABSTRAK	viii
	CONTENTS	ix
	LIST OF TABLES	xii
	LIST OF FIGURE	xiii
	LIST OF ABBREVIATIONS	xvi
	APPENDIX	xvii
I	INTRODUCTION	
	1.1 Project Introduction	1
	1.2 Project Objectives	2
	1.3 Problem Statements	2
	1.4 Project Scope	2
	1.5 Report Structure	3

II BACKGROUND OF THE STUDY

2.1 Introduction	4
2.2 Keypad	5
2.3 Microcontroller	7
2.3.1 PIC16F628A	8
2.4 Relay	10
2.5 Electromagnetic Lock	12
2.6 Electric Strike	14
2.7 Light Emitting Diode (LED)	15
2.8 Transistor	16
2.9 Power Supply	17
2.9.1 Transformer	17
2.9.2 Rectifier	18
2.9.3 Voltage Regulator	19
2.9.4 Watchdog Timer	20

III METHODOLOGY

3.1 Introduction	22
3.2 Hardware Development	23
3.2.1 Power Supply	23
3.2.2 Inputs	24
3.2.3 Outputs	27
3.3 Software Development	31
3.3.1 Keypad Scanning	32
3.3.2 Code Validation	37
3.3.3 Code Changing	39
3.3.4 Lock Timing	39

	3.2.5 Alarm Timing	40
IV	RESULT	
	4.1 Functionality	41
	4.2 Analysis	42
	4.3 Complete Project	42
V	DISCUSSION AND CONCLUSION	
	5.1 Discussion	50
	5.2 Suggestion	51
	5.3 Conclusion	51
	REFERENCE	52

LIST OF TABLES

NO	TITLE	PAGE
2.1	Keypad Layout	5
2.2	Output Arrangement	6
2.3	Pins Output	9
2.4	Pre-scaling rate	21
3.1	Output Arrangement	26
3.2	Ports for the Outputs	27
4.1	Component List	49

LIST OF FIGURE

FIGURE	TITLE	PAGE
2.1	Schematic of a 4x4 keypad	5
2.2	Actual Keypad	6
2.3	PIC16F628A	8
2.4	PIC16F628A Pin Diagram	9
2.5	Serial port ICSP programmers	10
2.6	Normally Open relay	11
2.7	Normally Closed relay	11
2.8	12 V Relay	12
2.9	Electromagnetic Lock	12
2.10	Basic concept of Electromagnetism	13
2.11	Electric Strike	14
2.12	Electric Strike Connections	15
2.13	Light Emitting Diodes	16
2.14	NPN transistor	16
2.15	Transformer	18
2.16	A Full bridge rectifier	18
2.17	Voltage regulator	19

2.18	Typical connection	20
3.1	Block diagram of the project	22
3.2	Electronic Combination Lock Circuit	23
3.3	Steps down Transformer	23
3.4	AC Adapters	24
3.5	Keypad diagram	25
3.6	4x4 Keypad	25
3.7	Manual Switch	26
3.8	5V Relay Circuit	28
3.9	12V Relay Circuit	28
3.10	Electric Strike Circuit	29
3.11	Buzzer Circuit	29
3.12	Green LED connections	30
3.13	Red LED connections	30
3.14	Flow chart of main process	31
3.15	Keypad Scanning Flow Chart	33
3.16	Column Scan Flowchart	34
3.17	Keypad Scanning	36
3.18	Keypad Scanning 2	37
3.20	Code Validation Flowcharts	38
3.5	Code Changing Flowcharts	39
4.1	Completed Circuits	43
4.2	Keypad	43
4.3	Door Model	44
4.4	Electronic Combination Lock Controller	44
4.5	GREEN LED	45
4.6	RED LED	45

4.7	Before (left) and After Unlocked	46
4.8	Electric Strike Lips	46
4.9	Opened Door	47
4.10	PCB Design	48
4.11	Top View of the Circuit	48

LIST OF ABBREVIATIONS

AC	-	Alternate Current
DC	-	Direct Current
EEPROM	-	Electrically erasable, programmable, read-only memory
ICSP	-	In-Circuit Serial Programming
IO	-	Input Output
LED	-	Light Emitting Diode
PIC	-	Programmable Integrated Controller
RAM	-	Random Access Memory
RISC	-	Reduced Instruction Set Computer

CHAPTER 1

LIST OF APPENDICES

NO	TITLE	PAGE
A	Program Coding	53
B	PIC16F628A Datasheet	57

CHAPTER 1

INTRODUCTION

1.1 Project Introduction

Electronic combination lock using PIC is a basic access control system with an ability that allows the rightful user to deploy platform to any property that requires simple password protection. Electronic combination lock is a type of lock in which a sequence of numbers is used to open the lock. This type of lock uses a numerical code for authentication where the correct code must be entered in order for the lock to deactivate. The lock can be use with an outdoor gate or a normal door. The functionality of this lock is implemented in software. When the correct code is entered it will turns on a relay to open the door. This relay can operate a power to open magnetic lock .

The significant of this project is first eliminating the need for a key. When there is no key, it will allow each person who lives at a residence to enter home without a key. The lost and forgotten keys are problems of the past. Hence using the electronic combination lock, it will reduce the risk and liability of keys falling into wrong hands as a result being stolen or duplicated. The electronic combination lock, changing access code is more cost effective than the process of changing all keyed locks .

1.2 Project Objectives

The objectives of this project can be divided into three:

- i) To design a keyless door entry by using electronic combination lock.
- ii) To write a program to ensure the lock is functioning and the code is reprogrammable.
- iii) To construct an electronic combination lock circuit using PIC microcontroller.

1.3 Problem Statement

The problem statement of this project is when locking a door using a traditional key, the common problem is losing the key and lock can be tampered or picked. Another problem using a key to lock a door is, if the key is missing or stolen it can be duplicated, and to solve this we have to change the whole set of locking mechanism for security reason. By using electronic combination lock, this problem may not occur and can be solve. The personal identification number that is used to lock the door is reprogrammable.

1.4 Project Scope

The scope of this project is mainly about electronic access control using code identification system. The circuit is designed to be low-end and low-cost that will focus mainly on affordability and simplicity. The circuit will be controlled by one microcontroller that is PIC microcontroller. By using PIC microcontroller, it can be program using C language or assembly language. The keypad will act as input and send the signal to the microprocessor for processing. The signal that has been processed then will be send to the relay for locking or other function.

1.5 Report Structure

This thesis is a documentary delivering the idea generated concepts applied, activities done, and the preliminary final project product itself. It consists of five chapters. Following is a chapter by chapter description of the information in this thesis.

Chapter 1 will includes the background, objective, problem statement, all the necessary scope of work regarding the project and briefly describe about the project methodology.

Chapter 2 is a literature review on theoretical concepts applied in this project. This chapter will explain and discuss about the project and the component that use in this project.

Chapter 3 will discuss about the project methodology and introduces the construction of the project, which involves hardware development and software development. This chapter will explain about the approach taken in order to achieve the objectives of the project and a closer look on how the project is implemented.

Chapter 4 will be described the final outcome of this project and analysis that have been done to justify its function and to make sure it meets the objectives of project.

Chapter 5 will conclude the project and how it can be improved for further development.

CHAPTER 2

BACKGROUND OF THE STUDY

2.1 Introduction

Access control has existed as concepts for as long as human have had assets worth protecting. Guard, gates and lock have been used since ancient times to limit individual access to valuables. Access control can take many forms. In addition to determining whether a user has rights to use a resource, the access control system may constrain when and how the resource may be used. Combination lock is one of mechanism that used to implement the concept of access control [3]. Combination lock can be divided into two groups that are mechanical and electrical. Mechanical combination locks exist since 11th century. The first known combination lock was invented in 1206 by the Arab scholar, inventor and mechanical engineer al-Jazari[8]. Gerolamo Cardano later described a combination lock in the 16th century. An electronic lock is a locking device which operates by means of electric current. Electric locks are sometimes stand-alone with an electronic control assembly mounted directly to the lock. More often electric locks are connected to an access control system. Electronic locks offer a variety of means of authentication such as biometrics, key token, numerical codes, passwords and passphrases. Electronic combination lock using PIC consist of three essential elements that are keypad, microcontroller and relays. The relay will be use as a switch to trigger the electromagnetic lock and the illumination .

2.2 Keypad

Keypad according to American Heritage Dictionary is an input device, sometimes part of a standard computer keyboard, consisting of a separate grid of numerical and function keys arranged for efficient data entry [1]. Keypads are often used as a primary input device for embedded microcontrollers. The keypads actually consist of a number of switches, connected in a row/column arrangement as shown in Table 2.1. In this project, the keypad used is a 4x4 keypad that is keypad that has 4 column and 4 rows creating 16 buttons. Table 2.1 below is a layout for 4x4 keypad.

Table 2.1: Keypad Layout[2] .

1	2	3	A	Row 0
4	5	6	B	Row 1
7	8	9	C	Row 2
*	0	#	D	Row 3
Column 0	Column 1	Column 2	Column 3	

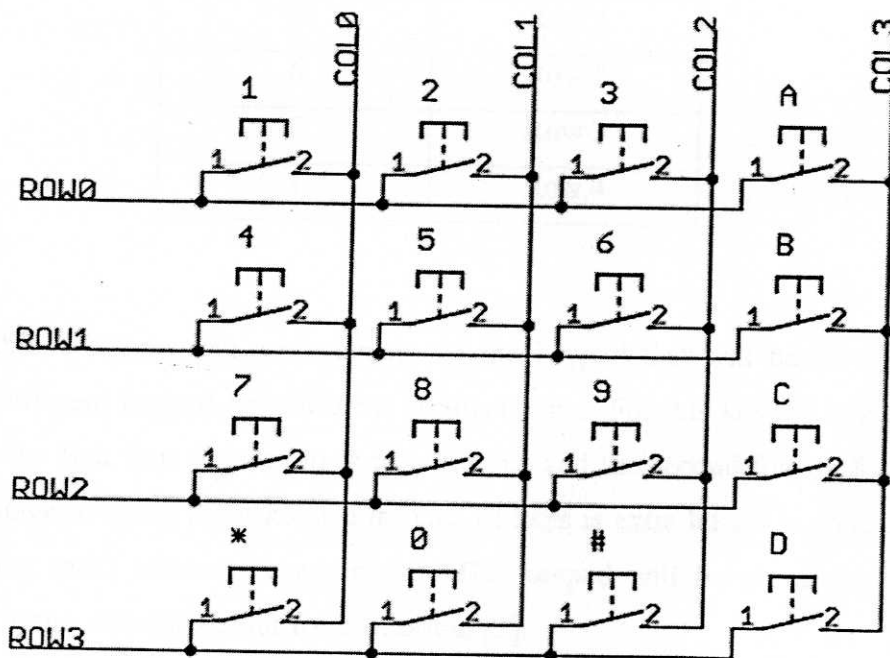


Figure 2.1: Schematic of a 4x4 keypad.

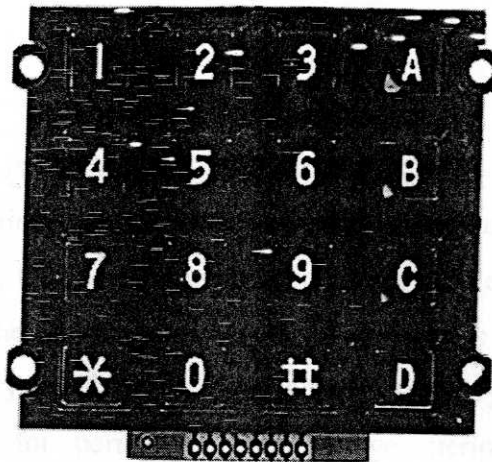


Figure 2.2: Actual Keypad [2].

Table 2.2: Output Arrangement [2].

Output Pin Number	Symbol
1	Column 1
2	Column 2
3	Column 3
4	Column 4
5	Row 1
6	Row 2
7	Row 3
8	Row 4

Table 2.2 shows an arrangement for the keypad that will be used in this project. Different keypad has different arrangements. For this keypad that has 16 key (4x4) the first four output pin is for columns and the second four is for rows. The advantage of using these keypad instead 12 keys is extra letters in code can be use enabling more secured access code. The keypad will be act as input and connected to the microprocessor for processing [2].