

# HOUSE CONTROLLER

SAW CHIA FUNG

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

Faculty of Electronic and Computer Engineering  
Universiti Teknikal Malaysia Melaka

April 2010



UNIVERSITI TEKNIKAL MALAYSIA MELAKA  
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN  
PROJEK SARJANA MUDA II

Tajuk Projek : House Controller  
Sesi Pengajian : 2009/2010

Saya SAW CHIA FUNG 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)

Alamat Tetap: P.O.Box 14139,  
88847 Kota Kinabalu,  
Sabah, Malaysia

  
(COP DAN TANDATANGAN PENYELIA)

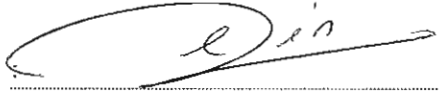
**KHAI RUDDIN BIN OSMAN**  
Pensyarah  
Fakulti Kejuruteraan Elektronik Dan Kejuruteraan Komputer  
Universiti Teknikal Malaysia Melaka (UTeM)  
Karung Berkunci No 1752  
Pejabat Pos Dunan Tunggal  
76109 Dunan Tunggal, Melaka

Tarikh: 30 April 2010

Tarikh: 30 April 2010



“I hereby declare that I have read this report and in my opinion this report is sufficient in terms of the scope and quality for the award of bachelor of Electronic Engineering (Computer Engineering) With Honours.”

Signature   
Supervisor's Name : ENGR. KHAIRUDDIN BIN OSMAN  
Date : 25/4/2010

## ACKNOWLEDGEMENT

First and foremost, I would like to praise God for His blessing. He gave me physical and mental strength to carry on my final year project up to completion.

I would like to express gratitude and thanks to my supervisor, Mr Khairuddin Bin Osman for his support and unfailing patience throughout the duration of the project. His encouragement and guidance are truly appreciated. Otherwise, this project has not been possible. I have learnt a lot under his guidance, be it practically or theoretically.

In addition to that, I also would like to thanks my lecturers: Mr. Tan Kim See and Prof. hamid Bin Hamidon. They are the people who give me a hand during facing the problem.

Other than that, I am also grateful to my all friends who help me and giving me opinion along implementation of this project.

I would like to thanks my parent on their moral support as I can count on them whenever I am upset or down.

Finally, I would like to offer thanks and deepest gratitude from the bottom of my heart for all the support, encouragement and inspirations I obtained throughout the duration of this project. The help rendered to me priceless, be it from the smallest of its kind to the largest.

## ABSTRACT

Overall, the purpose of this project is to build a system that can control electronic and electrical appliances by using Personal Computer (PC). This technology is allowing user to activate their house electric element by using a PC. Basically, this project development consists of three parts. The first part is software development. Graphical Interface User (GUI) is used as interface from user to the system. Program code and GUI was designed by using Visual Basic 6. The user can active their house electrical element through the software. The second part is a circuit. This circuit was created to convert from low voltage to high voltage. For acknowledge, the voltage of a parallel port is around 1.9Vdc to 2.5Vdc. Hence, the voltage of the parallel port is unable to activate a programmable logic controller (PLC). Thus, this converter circuit is to enable an output parallel port (1.9Vdc to 2.5Vdc) to active a PLC (24Vdc). A transistor was applied into the converter circuit (C9013). The function of the transistor is to be a switching. The third part is the relay. The relay is applied to the output PLC. The function of the relay is to convert from Vdc to Vac. Lastly, from the normally open (NO) of the relay is applied to electric element.

## ABSTRAK

Tujuan utama projek ini adalah untuk membina satu sistem kawalan yang menggunakan komputer untuk mengawal peralatan-peralatan elektrik and elektronik. Teknologi ini membolehkan pengguna boleh mengaktifkan peralatan-peralatan elektrik di rumah sendiri dengan menggunakan komputer peribadi. Justeru, projek ini mengandungi tiga bahagian utama. Pada bahagian pertama adalah bahagian perisian. Perantaraan gambar and pengguna (GUI) adalah digunakan untuk berkomunikasi antara pengguna dengan sistem. Program code dan perantaraan gambar and pengguna (GUI) adalah direka dengan menggunakan Visual Basic 6.0. Pengguna boleh mengaktifkan peralatan-peralatan elektrik rumah atau bangunan melalui perisian. Bahagian kedua adalah merekabentuk satu litar pembolehubah yang di mana litar pembolehubah ini boleh meningkatkan voltan rendah kepada voltan yang lebih tinggi . pada pengetahuan am, voltan yang dikeluarkan daripada parallel port adalah antara 1.9 vat hingga 2.5 vat. Voltan yang diberikan oleh kabel selari adalah tidak mencukupi untuk mengaktifkan perisian kawalan logik (PLC). Oleh demikian, Litar pembolehubah ini adalah perantaraan antara kabel selari dengan PLC. Dengan ada litar pembolehubah, maka voltan parallel port dapat mengaktifkan PLC. Satu komponen elektronik iaitu C 9013 (Transistor) akan digunakan pada litar pembolehubah tersebut. Tujuan transistor di dalam litar pembolehubah adalah sebagai switching. Pada bahagian terakhir untuk sistem ini adalah geganti di bahagian keluaran PLC akan mengaplikasikan geganti. Tujuan geganti pada bahagian tersebut adalah untuk menukarkan voltan arus terus kepada voltan arus ulang-alik.

## TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	i
	ACKNOWLEDGEMENT	iii
	ABSTRACT	ix
	ABSTRAK	v
	TABLE OF CONTENTS	vi
	LIST OF TABLES	x
	LIST OF FIGURES	xi
	LIST OF ABBREVIATIONS	xiii
	LIST OF APPENDIX	xiv
<b>I</b>	<b>1.0 INTRODUCTION</b>	<b>1</b>
	1.1 Project Overview	1-2
	1.2 Problem Statement	2
	1.3 Objective	3
	1.4 Scope of Project	3
<b>II</b>	<b>2.0 LITERATURE REVIEW</b>	<b>4</b>
	2.1 Visual Basic 6.0	4-5
	2.2 Hardware	5
	2.3 Simple LED driving circuits	5-6
	2.4 Parallel port	6
	2.4.1 Background of parallel port	6-7
	2.4.2 Hardware of parallel port	7-8



	2.4.3	Parallel port registers	8-9
	2.5	Winsock	9-10
	2.6	Converter circuit	10-11
	2.7	Programmable Logic Controller	11-12
	2.8	Electrical Wiring	12-13
<b>III</b>	<b>3.0</b>	<b>RESEARCH METHODOLOGY</b>	
	3.1	General Diagram of the Project	14
	3.2	Project Sequence Overview	15
	3.3	Introduction to Programmable Logic Control	16
	3.3.1	Flow from Introduction to Operation	16-17
	3.3.2	Scan Time	17-18
	3.3.3	User Memory	19-20
	3.3.4	Device Configuration	20-23
	3.3.5	Relay no	24-25
	3.3.6	Assigning Relay Nos	25-26
	3.4	Software Development	26
	3.4.1	Multisim 7	27
	3.4.2	Proteus VSM Source Code Editor	27-28
	3.5	Programming language	28
	3.5.1.	Assembly language	28-29
	3.6	Component Selection	29
	3.6.1.	Resistor	29-30
	3.6.2.	Diode	30-31
	3.6.3.	Relay	31-33
	3.6.4.	Transistor	33-34
	3.6.5.	Earth leakage circuit breaker	34-35
	3.6.6.	Miniature circuit breaker	35-36
	3.7	Parallel Port vs. Serial Port	37-38

	3.8	PCB Fabrication	38
	3.8.1.	PCB layout	38-39
	3.8.2.	PCB preparation	39
	3.8.3.	PCB UV Exposure	40
	3.8.4.	PCB Development	40-41
	3.8.5.	PCB Etching	41-42
	3.8.6.	PCB Troubleshooting	43
<b>IV</b>	<b>4.0</b>	<b>RESULT AND ANALYSIS</b>	
	4.1	Expected Result	44
	4.2	Software Result	45
	4.3	Software Testing	45
	4.4	Graphical User Interface	45-46
	4.5	Analysis of Appliances System Activation	46
	4.6	Circuit	47-48
	4.7	Software Testing	48
	4.8	Software Implementation	48
	4.9	Proteus Analysis	48-50
	4.10	Electrical Controller Circuit Analysis	50-52
	4.11	Ladder diagram	52-53
	4.12	Software result	54
	4.13	Graphical User Interface	54-56
	4.14	Output analysis	56-58
<b>V</b>	<b>5.0</b>	<b>CONCLUSION AND DISCUSSION AND RECOMMANDATION</b>	
	5.1	Discussion	59-61

5.2	Commercialization	61
5.3	Conclusion	61-62
5.2	Recommendations	62
	<b>REFERENCE</b>	<b>63</b>
	<b>APPENDIX A</b>	<b>64</b>
	<b>APPENDIX B</b>	<b>67</b>

**LIST OF TABLES**

<b>NO</b>	<b>TITLE</b>	<b>PAGE</b>
2.3	Parallel port signal lines	8
2.6	Output signal and ladder diagram	12
3.16	Standard EIA color code table	30

## LIST OF FIGURES

NO	TITLE	PAGE
1.0	House Controller System block diagram	2
2.1	Simple LED circuit	6
2.2	DB25 Connector	7
2.3	Winsock	9
2.4	winsock	10
2.5	Converter circuit	11
2.7	Electrical schematic diagram	13
3.1	General diagram of the “Smart House Controller”	13
3.2	Implementation for PSM 1 and 2	15
3.3	Configuration step of PLC	17
3.4	The time cycle to scan time	17
3.5	Response time delay	18
3.6	Byte counting	20
3.7	Number code of the relay in Keyence	21
3.8	Range of relay in expansion units	22
3.9	Relay in expansion unit	23
3.10	Relay address number	24
3.11	The number of address Nos.	25
3.12	Programmable Logic Controller frame and connection	26
3.14	Multisim 7 Software	27
3.15	Proteus VSM Source Code Editor	28

3.17	Pole and throw relay	32
3.18	Transistor symbol	33
3.19	Transistor C9013	34
3.20	Earth leakage circuit breaker	35
3.21	Miniature circuit breaker	36
3.22	PCB layout	39
3.23	PCB preparation	39
3.24	PCB UV Exposure	40
3.25	PCB development	41
3.26	PCB etching	42
4.1	House Controller block diagram	44
4.2	Visual Basic form 1	46
4.3	Initial LED Condition	47
4.4	LED light is turn on	48
4.5	Converter schematic diagram	49
4.6	Converter layout	50
4.7	Electrical controller	51
4.8	Fius, MCB, relay in the electrical controller	52
4.9	MCB and Contactor in the electrical controller	52
4.10	Ladder diagram of House Controller	53
4.11	Main menu	54
4.12	Checked Item Menu for server	55
4.13	Checked Item Menu for user	56
4.14	parallel port, base voltage and collector voltage in de-active	57
4.15	collector voltage in active	57
4.16	base voltage in active	58
4.17	parallel port in active	58
5.1	Prototype of house controller	60
5.2	House Controller software for server and user	61

## LIST OF ABBREVIATIONS

A	Ampere
Bit	Binary digit
DB	District board
ELCB	Earth leakage circuit breaker
GUI	Graphical User Interface
IDE	Integrated development environment
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input/Output
k	Kilo
LED	Light Emitting Diode
M	Mega
m	mili
NC	Normally close
NO	Normally open
o	Degree
PC	Personal Computer
PCB	Printed Circuit Board
PIC	Peripheral interface controller
PLC	Programmable Logic Controller
TCP	Transfer Control Protocol
UDP	User Datagram Protocol
Vac	Voltage alternates current
Vdc	Voltage direct current

**LIST OF APPENDIX**

<b>NO</b>	<b>TITLE</b>	<b>PAGE</b>
A	C9013 DATA SHEET	64
B	KEYENCE PLC DATA SHEET	67



## CHAPTER 1

### INTRODUCTION

#### 1.1 Project Overview

House controller is a system where to control a house electrical element by using PC (Personal Computer). In this house controller, we can switching the lighting 'on' and 'off'. Besides that switching electrical element, in this system have an additional function which was the electrical element can be set in time. The objective to create this system is to convenience an owner to control their house lighting point and also socket point in their room. First of all, A software must installed into a PC. Thus, user can use the Personal Computer to control this House Controller system. The software is create by using Visual Basic. After installed the software to a PC, there must have a parallel port as an interface between PC to the out-going. A PLC (Programable Logic Controller) was attached to the parallel port before the PLC attach to a electric element. The purpose of the PLC is to receive data from PC and transmit or operate the electric element. Before the electric element receive signal from the out-going of the PLC, there must have a relay between out-going of the PLC to an electric element. The purpose of a relay in this system is to contact from 24V to 240V for our

switches in this system. Then, the out-going of the relay will connect to the DB (District Board). Besides that, an additional MCCB have to install in the DB. This is because when we want to do maintenances or troubleshoot in this system, we can turn 'on' the MCB to bypass the power supply to the district board. For the additional, in the Smart House Controller software have a timer button. The Purpose of the timer is for user to set the duration of time for turn 'on' and turn 'off' their electric element. Figure 1.0 shown the House Controller block diagram

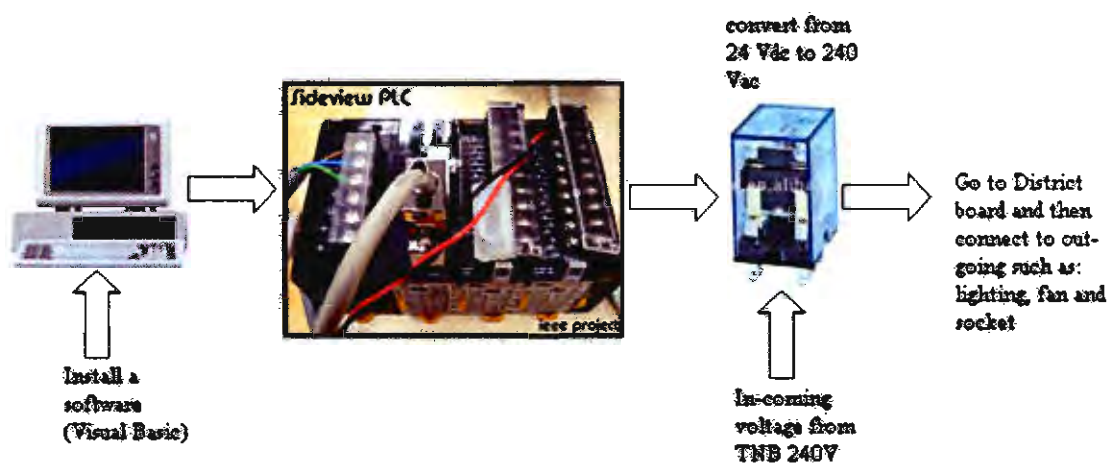


Figure 1.0: House Controller block diagram

## 1.2 Problem Statement

This project is proposed to solve problem that occur mostly towards those traveler and those people have a lot of work. By developing this project, it will give them benefit and convenience by lighten their burden and make their life comfortable and also feel secure when travel.

### 1.3 Objective

The main goal of this project is to allow us to implementation and design a smart house controller. Besides that, there are some objectives to be achieved in this project which are:

- a. Learning the system of the Programme Logic Computer (PLC).
- b. Operate the visual basic system.
- c. Know how to construct an electrical wiring.
- d. Installation of lighting fitting, fan and socket outlet.
- e. Learning the relay component.

### 1.4 Scope Of Project

The scopes of project are including:

1. This project involve hardware and software design.
2. This project consists of three main circuits. There are 'software of this system', 'PLC schematic diagram' and 'electrical element wiring'.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1. Visual Basic 6.0

Microsoft Visual Basic 6.0 is a programming environment used to create graphical applications for the Microsoft windows family of operating systems. Visual Basic is the most productive tool for rapidly creating a wide range of windows, web, mobile, and office applications built on the .NET framework. A simple utilities or sophisticated applications can be developing using Visual Basic 6.0. The Visual Basic language is designed to be human readable and accessible to everyone from novice programmers to advanced system architects. All of this is built on top of the .NET framework, which guarantees that programs written in Visual Basic run with unsurpassed scalability and reliability. Programs written in Visual Basic will interoperate seamlessly with programs written in any other .NET languages such as Visual C#, Visual J#, or Visual C++. ActiveX technologies allow us to use the functionality provided by other applications, and even automate applications and objects created using professional or enterprise edition of Visual Basic. Internet capabilities make it easy to provide access to documents and application across the

internet or intranet from within your application, or to create internet server applications [4]. Generally speaking there are required two things:

- The Visual Basic compiler to turn program into running application
- Some form IDE (integrated development environment) in which to write code.

## 2.2. Hardware

For the hardware part, there have florescent, socket output to trigger the output. Hence, the florescent and socket element will install on a demo board. Besides that, ELCB (earth leakage circuit breaker) also will install on the demo board. The main purpose to install ELCB is to prove that this smart house controller system is safety to use in any place [5].

## 2.3. Simple LED driving circuits

A simple circuit can construct to drive a small LED through PC parallel port. The only component needed is one LED and one 470 ohm resistors. It simply connects to the diode and resistor in series. The resistor is needed to limit the current taken from parallel port to a value which light up acceptably normal LEDs and is still safe value (not overloading the parallel port chip). In practical case the output current will be few mA for the LED, which will cause a typical LED to somewhat light up visibly, but not get the full brightness.

Then the circuit is connected to the parallel port so that one end of the circuit goes to one data pin and another one goes to any of the ground pins. Be sure to fit the circuit so that the LED positive lead (the longer one) goes to the data pin. If the LED is connected in the wrong way, it will not light up in any condition [6].

The controlling process by the software is simple. When you send out high bit '1' to the data pin where the LED is connected, that LED will light up. The operation is depending on the coding set at interface (Visual Basic 6.0). Figure 2.1 shows the simple LED circuit which was applied to the House Controller.

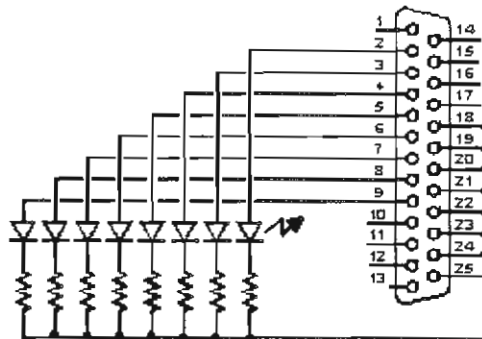


Figure 2.1: Simple LED circuit

## 2.4. Parallel port

A parallel port is a type of interface found on computers (personal and otherwise) for connecting various peripherals. It is also known as a printer port or Centronics port. The IEEE 1284 standard defines the bi-directional version of the port [6].

### 2.4.1. Background of parallel port

Parallel port is a simple and inexpensive tool for building computer controlled devices and projects. The simplicity and ease of programming makes parallel port popular in electronics hobbyist world. The primary use of parallel port is to connect printers to the computer and specifically designed for this purpose. Thus, it is often called as printer port or Centronics port (this name came from a popular printer manufacturing company 'Centronics' which devised some standards for parallel port).

The parallel connector can be found in the rear panel of your PC. It is a 25 pin female (DB25) connector (to which printer is connected). On almost all the PCs only one parallel port is present, but it can add more by buying and inserting ISA/PCI parallel port cards. The IEEE 1284 standard which has been published in 1994 defines five modes of data transfer for parallel port [6]. They are:

- a. Compatibility mode
- b. Nibble mode
- c. Byte mode
- d. EPP
- e. ECP

#### 2.4.2. Hardware of parallel port

As the name refers, data is transferred over data lines. Control lines are used to control the peripheral, and of course, the peripheral returns status signal back to the computer through status lines. These lines are connected to Data, Control and status registers internally [7]. Figure 2.2 shown the pin outs of DB25 connector and the details of parallel port signal lines are given in table 2.3.

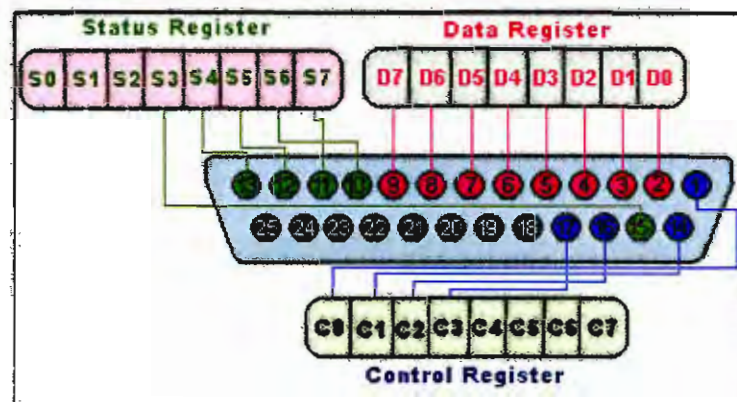


Figure 2.2: DB25 Connector

Table 2.3: Parallel port signal lines

Pin No (DB25)	Pin No (36 pin)	Signal name	Direction	Register - bit	Inverted
1	1	nStrobe	In/Out	Control-0	Yes
2	2	Data0	Out	Data-0	No
3	3	Data1	Out	Data-1	No
4	4	Data2	Out	Data-2	No
5	5	Data3	Out	Data-3	No
6	6	Data4	Out	Data-4	No
7	7	Data5	Out	Data-5	No
8	8	Data6	Out	Data-6	No
9	9	Data7	Out	Data-7	No
10	10	nAck	In	Status-6	No
11	11	Busy	In	Status-7	Yes
12	12	Paper-Out	In	Status-5	No
13	13	Select	In	Status-4	No
14	14	Linefeed	In/Out	Control-1	Yes
15	32	nError	In	Status-3	No
16	31	nInitialize	In/Out	Control-2	No
17	36	nSelect-Printer	In/Out	Control-3	Yes
18-25	19-30,33,17,16	Ground	-	-	-

### 2.4.3. Parallel port registers

Data, Control and status lines are connected to the corresponding registers inside the computer. So, by manipulating these registers in program, one can easily read or write to parallel port with programming languages like Visual Basic and C language. The register found in a standard parallel port is:

- a. Data register
- b. Status register
- c. Control register