

HOME APPLIANCE CONTROL SYSTEM

TAN WEI SYE

**This report is submitted in partial fulfillment of the requirements for award of
Bachelor of Electronic Engineering (Computer Engineering) with honors**

**Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka**

JUNE 2012



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN

PROJEK SARJANA MUDA II

Tajuk Projek : HOME APPLIANCE CONTROL SYSTEM

Sesi Pengajian :

1	1	/	12	
---	---	---	----	--

SayaTAN WEI SYE

(HURUF BESAR)

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

(TANDATANGAN PENULIS)

Disahkan oleh:

(COP DAN TANDATANGAN PENYELIA)

“I hereby declare that this report is the result of my own expect for quotes as cited in the references.”

Signature: 

Author: TAN WEI SYE

Date: 18 JUNE 2012

“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 Electronic Engineering (Computer Engineering) with Honors.”

Signature : _____

Supervisor's Name : MDM. PN YUSMANITA BINTI YUSOP

Date : 18 JUNE 2012

Special Dedication to my family especially my father and my mother

ACKNOWLEDGEMENT

I wish to express sincere appreciation to Universiti Teknikal Malaysia Melaka (UTeM) for giving me a chance to further my study on Bachelor of Electronic Engineering in Faculty of Electronic and Computer Engineering (FKEKK).

I would like to take this opportunity to express my deepest gratitude and regards to all who gave me the possibility to completing this PSM. I wish to express my deepest thanks for my supervisor, Pn. Yusmarnita binti Yusop for her guidance and constant encouragement throughout the development of the project.

Besides that, I want to express my deepest thanks to my all friends that help me and giving opinion along the implementation of the project.

Finally, I would like to thanks my parent of their moral support when i having pressure. I will always remember their kindness and helping me so much in this project.

ABSTRACT

In this project, propose a home appliance control system using PLC which used to stores program of the control system. CX Programmer is the software that used to design Ladder Diagram which is the programming language that used for PLC. Communication between HMI and PLC is important in the home appliance control system. HMI is allows users to view and control the state of the lamps and fans at different location in home. CX Designer is the software that used to design the GUI that used for LCD touch screen panel of HMI. Users can touch button on the one LCD touch screen only without using much hardware of switches or buttons to control home appliances. The lamp can be controlled by using Timer which is designed in the ladder diagram without using hardware. These two technologies are less wiring, saving cost and energy.

ABSTRAK

Dalam projek ini, mencadangkan sistem kawalan peralatan rumah dengan menggunakan pengawal PLC yang digunakan untuk program simpanan sistem kawalan. CX Programmer yang digunakan untuk merekabentuk Ladder Diagram yang merupakan bahasa pengaturcaraan yang digunakan untuk PLC. Komunikasi antara HMI dan PLC adalah penting dalam sistem kawalan peralatan rumah. HMI membolehkan pengguna untuk memerhati dan mengawal keadaan lampu dan kipas di lokasi yang berbeza di rumah. CX Designer adalah perisian yang digunakan untuk merekabentuk GUI yang digunakan oleh LCD sentuh panel skrin pada HMI. Pengguna boleh menyentuh button pada satu LCD sentuh panel skrin sahaja tanpa menggunakan banyak suis atau butang sebagai perkakasan untuk mengawal peralatan rumah. Lampu boleh dikawal dengan menggunakan TIMER yang direkabentuk dalam Ladder Diagram tanpa menggunakan perkakasan. Kedua-dua teknologi ini adalah kurang pendawaian, menjimatkan kos dan tenaga.

TABLE OF CONTENT

CHAPTER	CONTENT	PAGE
	PROJECT TITLE	i
	DECLARATION	ii
	DEDICATION	v
	ACKNOWLEDGEMENT	vi
	ABSTRACT	vii
	ABSTRAK	viii
	TABLE OF CONTENT	ix
	LIST OF TABLES	xii
	LIST OF FIGURES	xiii
	LIST OF ABBREVIATIONS	xv
I	INTRODUCTION	
	1.1 Background	1
	1.2 Objectives	3
	1.3 Problem Statements	3
	1.4 Scopes of Work	3
	1.5 Importance of Project	4
	1.6 Project Methodology	4
	1.7 Report Structure	5
II	LITERATURE REVIEW	
	2.1 Introduction	6
	2.2 Comparison	7

2.3	Programmable Logic Controller (PLC)	8
2.3.1	Definition	8
2.3.2	Basic Operation	9
2.3.3	Input and Output Devices	10
2.3.4	Advantages of PLC	11
2.3.5	Ladder Diagram	12
2.4	RS232	14
2.5	Graphical User Interface (GUI)	15
2.6	Photocell Sensor	16
2.7	SPDT Relay	17

III PROJECT METHODOLOGY

3.1	Introduction	19
3.2	Flow Chart Diagram	19
3.3	System Block Diagram	22
3.3.1	Hardware Part Development	23
3.3.2	Software Part development	23

IV RESULTS AND DISCUSSIONS

4.1	Ladder Diagram	27
4.2	Graphical User Interface	38
4.3	Hardware Connection and Wiring	48

V CONCLUSION AND RECOMMENDATION

5.1	Conclusion	52
5.2	Recommendation	53

REFERENCES

54

LIST OF TABLES

NO	TITLE	PAGE
2.1	Comparison concept of ideas applied in home appliance control System	7
2.2	Comparison between the PLC and PIC	7
2.3	Feature and Benefit of Programming Logic Controller (PLC)	11
4.1	Addresses Value of Inputs and Outputs in Symbol Table	30

LIST OF FIGURES

NO	TITLE	PAGE
1.0	Block Diagram of Home Appliance Control System	2
2.1	Architecture of PLC system	9
2.2	Simple Ladder Diagram	13
2.3	RS 232	14
2.4	Omron ns5-sq005-v2	16
2.5	Photocell sensor	16
2.6	SPDT relay	18
3.1	Flow chart of project methodology	21
3.2	Block diagram of home appliance control system	23
3.3	Prototype of graphical user interface	24
3.4	Flow chart of controlling lamp using timer	25
3.5	Flow chart of controlling lamp using switch	25
3.6	Flow chart of controlling speed of fan	26
4.1	Create new file	27
4.2	Menu Change PLC	28
4.3	Menu Device Type Settings [CJ1G-H]	28
4.4	'Symbols' icon	29
4.5	Toolbars icons	31
4.6	Ladder diagram of controlling Lamp4 using timer	31
4.7	TIM001 is switched off	32
4.8	TIM001 is switched on	32
4.9	Lamp4 is switched on after 10 seconds	33
4.10	Lamp4 is switched off	34
4.11	Ladder diagram of controlling the lamps	34

4.12	Lamp1 is switched on	35
4.13	Lamp2 is switched on	35
4.14	Lamp2 is switched off	35
4.15	Ladder diagram of controlling speed of fan	36
4.16	Fan of Speed1 is switched on	36
4.17	Transfer program to PLC	37
4.18	Create new project	37
4.19	Menu New Project	38
4.20	Menu New Screen	38
4.21	Edit Screen/Sheet Property	39
4.22	Menu Title of Screen/Sheet Properties	39
4.23	Menu Size/Pop-up of Screen/Sheet Properties	40
4.24	Menu Background/Others of Screen/Sheet Properties	40
4.25	Icons of toolbar	41
4.26	Interface of User Account	41
4.27	Menu General of Command Button	42
4.28	Menu Password of Command Button	42
4.29	Keyboard used for enter password	43
4.30	Interface of Home Area	43
4.31	Menu Property of 'Front Door' command button	44
4.32	Menu Address Setting	45
4.33	Interface of Front Door	45
4.34	Interface of Living Room	46
4.35	Interface of Bedroom	46
4.36	Interface of Staircase	46
4.37	Menu Communication Method	47
4.38	Wiring of 230AC lamps with output of PLC	49
4.39	Wiring of 230AC fan with output of PLC	50
4.40	Dark ON Relay Circuit	51

LIST OF ABBREVIATION

AC	–	Alternating Current
C	–	Capacitor
CPU	–	Central Processing Unit
DC	–	Direct Current
DCE	–	Data Circuit terminating Equipment
DTE	–	Data Terminal Equipment
GSM	–	Global System for Mobile Communication
GUI	–	Graphical User Interface
HMI	–	Human Machine Interface
I/O	–	Input/output
IC	–	Integrated Circuit
LCD	–	Liquid Crystal Display
LDR	–	Light Dependent Resistor
LED	–	Light Emitter Diode
NC	–	Normally Close
NO	–	Normally Open
PIC	–	Peripheral Interface Communication
PC	–	Personal Computer
PLC	–	Programming Logic Controller
PT	–	Programmable Terminal
R	–	Resistor
SMS	–	Short Message Service
SPDT	–	Single Port Double Throw
USB	–	Universal Serial Bus
V	–	Voltage

CHAPTER I

INTRODUCTION

This chapter will give reader a basic introduction of how the idea of the project generated. In this chapter will show the introduction, objectives, problems statements, scopes of work, methodology and simple brief for the report structure.

1.1 Background

A home appliances control system can be developed efficiently to achieve more comfortable and easier daily life environment. The communication between a human and a programming logic controller (PLC) at the Human Machine Interface (HMI) is important in the control system. The user can views, changes and saves the states of home appliances at different locations of home.

In computing, a graphical user interface (GUI) is a type of user interface that allow user to interact with home appliances with image rather than switches. GUI can be used in Human Machine Interface. A GUI represents the information and action available to a user through graphical icons and visual indicators such as command, label, on-off button and lamp button. Its goal is to enhance efficiency and ease of user for controlling the home appliances and making operational decisions feedback from the states of home appliances.

In this project, the user can easily touching the button on the screen of Human Machine Interface (HMI) to switch on or switch off the lights and fans at front door, living room, bedroom and staircase of home.

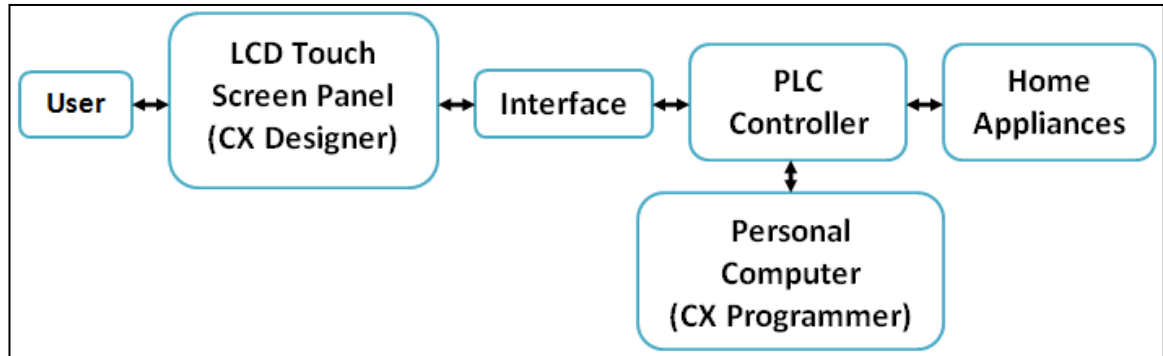


Figure 1.0: Block Diagram of Home Appliance Control System

From the Figure 1.0, the communication is established between the LCD touch screen panel as Human Machine Interface (HMI) and programmable logic controller (PLC) by using interface card. The software CX designer is used to design user interface on LCD touch screen panel. Users can send message to PLC to controls the lights and fans through the LCD touch screen panel. It is more saving time and energy to control the home appliances.

CX-One software allows user to build, configure and program the host devices which are programming logic controller (PLC) and human machine interface (HMI) in this control system. This greatly reduces the complexity of the configuration and allows control system to be programmed. CX-Programmer is the software that installed in personal computer that used for create the ladder diagram which is the programming language that used in PLC. CX-Simulator is a debugging environment equivalent to the actual PLC. The system environment can be achieved by simulating the operation of a CJ Series PLC with virtual PLC. in personal computer. CX-Simulator makes it possible to evaluate program operation, check cycle time and reduce debugging time before the actual equipment is assembled. CX-Designer is used to create screen data for NS-series Programmable Terminals. It can also check the operation of created screen data on the computer. It enables efficient development process for screen creation, simulation and project deployment.

1.2 Objectives

The main objectives of this project:

- i. To design a home appliance control system by using programming logic controller (PLC).
- ii. To provide a system to enable advanced home control capabilities such as view and change states of the lamps and fans at home.
- iii. To saving time and effort by having home automatically do routine functions.
- iv. To simplify human life because can control all home appliances by one device only.

1.3 Problem Statements

. There are many home appliances in our living space, need to make them intelligent so as to make living life more safety, convenient and comfortable for users especially for older and disabled people who more reliance on home care. If the area of home is bigger, is not easily to control home appliances at different location in the home. It will be wasting time and energy to controls all home appliances. Many electrical switches and devices need to control all the home appliances causes higher cost in hardware wiring. Sometimes, many home appliances also cause waste electricity if users forget to switch off the electrical devices.

1.4 Scopes of Work

The project is covered few parts, which are:

- i. Programming Logic Controller (PLC) used for control the light and fan.
- ii. Connect the PLC with Personal Computer by using RS232 serial port.
- iii. Study on Ladder Diagram which is the programming language of PLC.
- iv. Design the ladder diagram in CX Programmer for specific instruction or function for controlling system.

- v. CX Designer from CX-One Software is used to create the Human Machine Interface (HMI).
- vi. Design the user interface which can view, change, reset and save states of lamp and fan.
- vii. Build the communication between LCD Touch Screen with PLC by using Interface Card.

1.5 Importance of the Project

In this project, the home appliances control system is designed to allow users to view and control home appliances of varying kinds by using one device only. It is more saving cost because can reduce the cost of hardware wiring. Memory of programming logic controller (PLC) can be getting bigger and used to store the program of control system. It is more efficiency to control many kinds of home appliances especially in the bigger area of home. Users can controls the home appliances by touching the buttons on the LCD panel of human machine interface (HMI). User interface of LCD panel display the states of home appliances at different location of home. It is more saving time and energy to view and change the state of home appliances.

1.6 Project Methodology

The objectives must be achieved to obtain a successful outcome in this project. From the beginning of this project is having discussion with supervisor, need to study the project have been designed by other company or person. For the following stage, all the information related to hardware and software components information is seeking and the most suitable would be selected for used in the project. If the outputs of this system did not fulfill the desired output, so the troubleshooting would be carry out until it reaches the project requirements. Further details explanation of the project methodology will be explained in Chapter III.

1.7 Report Structure

This report is documentary delivering the ideas generated, concepts applied, activities done and the outcome of the project. It consists of five chapters. The description of this report as following:

Chapter I: Introduction

The first chapter is introduces the general overview of the project. In this chapter, it states the background, objectives, scope of work, importance, problem statement and methodology of this project.

Chapter II: Literature Review

This chapter discusses the research of study related to the project. The information of research is obtained from journal, book reference, lecturer notes and etc. This chapter is performed and document about the theoretical concept applied in completing this project.

Chapter III: Project Methodology

This chapter is identifies the materials, equipments or apparatus are used in this project. It also determines the method or procedures are implemented in this project. Flow chart and Gantt chart are used to design the flow of completing the project.

Chapter IV: Results and Discussions

It shows the current results or progress of the project. The results are explained with the aid of figures and tables.

Chapter V: Conclusion and Recommendation

It is the final part of the thesis which concludes the Final Year Project. It is includes the application of the project and the recommendation that can be implemented for future references.

References

The list of references is determined.

CHAPTER II

LITEATURE REVIEW

This chapter will discuss about literature discourse and the review of smart home appliances control system. This chapter is regarding the background study of the project to perform and documented about the theoretical concept applied in completing the project. The reason of choosing the specific software and hardware also included in this chapter.

2.1 Introduction

Literature review are based in information obtained from valid sources such as books, articles of relevance, publisher paper or any other source deemed appropriate.

2.2 Comparison

The Table 2.1 shows the comparison of different project with the concept of ideas that applied in home appliances control system. The information is obtained from the IEEE journals.

Table 2.1: Comparison concept of ideas applied in home appliance control system

	A	B	C	My Project
Controller	Adapter	8-bit Microcontroller	Microcontroller	Programming Logic Controller (PLC)
Controller Terminal	Cellular Phone	Cellular Phone	Personal Computer	Personal Computer
Communication Medium	Bluetooth	GSM Modem	Microphone	HMI
Monitoring System	Interface	Interface	Interface	LCD touch screen
Software Application	Java	C Programming	Dialogue System	CX- Programmer CX-Designer

Table 2.2 shows the comparison of two different types of controller which are programmable logic controller (PLC) and peripheral interface controller (PIC).

Table 2.2: Comparison between the PLC and PIC

Programming Logic Controller (PLC)	Peripheral Interface Controller (PIC)
The range of current output: AC = 240V DC = 24V, 2.1 A	The range of current output: DC = 5V, 24mA
Input and output slot can be inserted according to the system requirement.	Limited input and output pin
Operates at high voltages at 120V or 240V	Operated at low voltage is 5V
Simple programming techniques required	Complicated programming techniques required

Less wiring	More wiring
High cost	Low cost

2.3 Programming Logic Controller (PLC)

A programmable logic controller (PLC) is a solid state user programmable control system with function to control logic, sequencing, timing, arithmetic data manipulation and counting capabilities.

2.3.1 Definition

From the Figure 2.1, PLC can be viewed as industrial computer that has a central processing unit (CPU), memory, input output interface and a programming device. The CPU provides the intelligence of the controller. It accepts data, status information from various sensing devices, executes the user control program stored in the memory and gives appropriate output commands to devices.

Input/output interface is the communication link between field devices and the controllers. The processor can sense and measure the physical quantities regarding a machine or process through these interface. The CPU issues command to output devices. The programmer unit used to enter the application program which often uses simple user friendly logic.

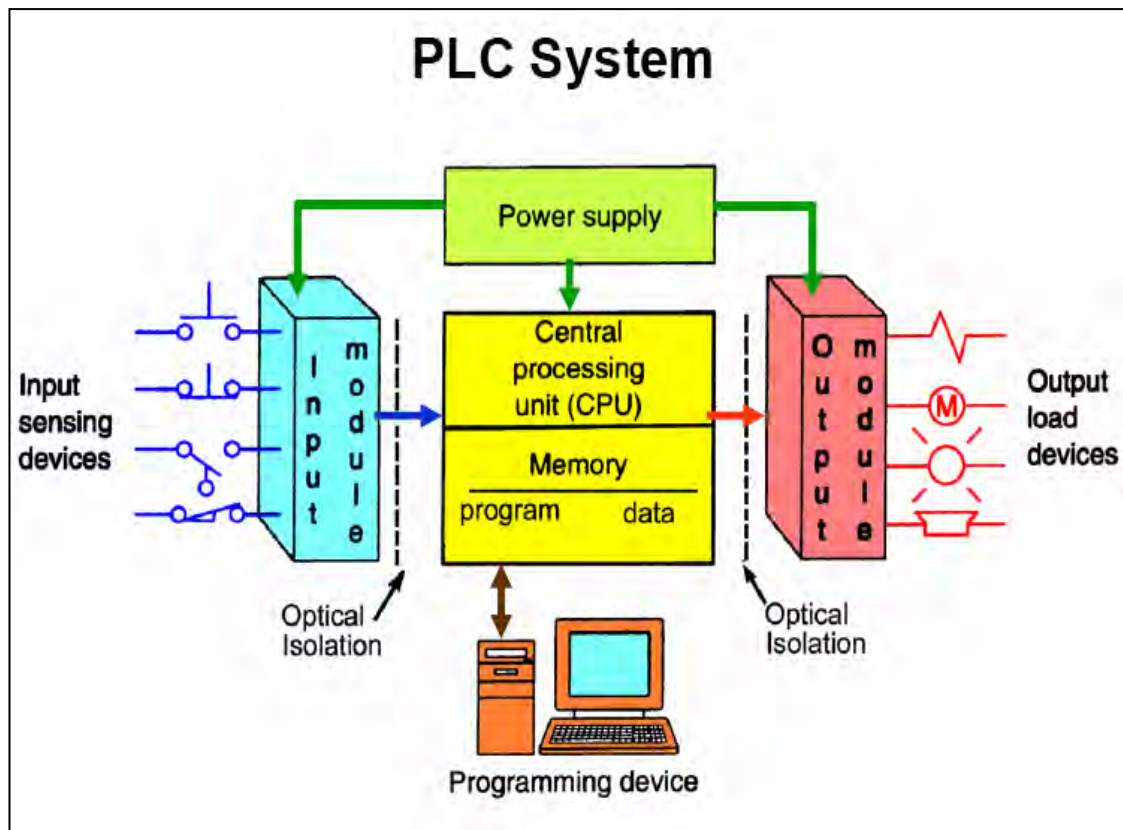


Figure 2.1: Architecture of PLC system

2.3.2 Basic Operation

The operation of the PLC system is simple and straightforward. The CPU completes three processes which are scans or reads from input devices, executes or solves the program logic and updates or writes to the output devices. For the PLC to be useful, it must require a program or logic for the CPU to execute. A PLC programmer can create the program logic by running software on a personal computer (PC). This logic can be written in ladder diagram. The programmer can transfer the program to the PLC. This is usually done by temporarily connecting the programmer to the PLC. Once the program is installed or transferred to the CPU, it is usually not necessary for the PC to remain connected.

Once the program is stored in the CPU, the program of PLC is then set to run and the PLC executes the application program repeatedly. The CPU regularly reads