

MULTIPLEX SWITCHING SYSTEM FOR SINGLE PHASE ELECTRICAL
APPLIANCES

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Tajuk Projek : Multiplex Switching System for Single Phase Electrical Appliances

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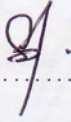
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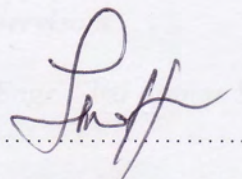
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Specially dedicated to

My beloved parents

Arshad bin Rabani & Nor Rizan binti Abdul Ghani

My supervisors

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*and those people who have guided and inspired me throughout my journey of
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ABSTRACT

Electrical wiring is one of the most important things that need to be considered in housing or any construction. There are few problems occurred for current technology of electrical wiring which are switch has lower safety level, life span of wires, exposing of external wiring and highly cost for adding load. Therefore, this project is to design multiplex switching system for alternating current (AC) single phase combination with electrical switches or appliances, to design and develop PIC control unit to accommodate 10 I/O systems for AC systems and to design and develop multiplex control unit or system from input to output board with two wires communication. At the end of this project, there will be a controller switch board that located behind the switch and receiver board on the ceiling which connected with distribution box (DB). Both boards will connect by using two communication wires that act as a shared medium in this multiplexing switching system for single phase electrical appliances.

ABSTRAK

Pendawaian elektrik adalah salah satu perkara yang paling penting yang perlu dipertimbangkan dalam perumahan atau apa-apa pembinaan. Terdapat beberapa masalah yang berlaku bagi teknologi semasa pendawaian elektrik di mana di antaranya adalah suis mempunyai tahap keselamatan yang lebih rendah, jangka hayat dawai, mendedahkan pendawaian di permukaan dinding rumah dan kos yang tinggi untuk pendawaian tambahan. Oleh itu, projek ini adalah untuk merekabentuk sistem sistem pensuisan yang menggunakan konsep ‘multiplexer’ untuk penggunaan perkakas elektrik fasa tunggal, untuk merekabentuk dan membangunkan PIC unit sebagai kawalan untuk menampung sepuluh masukan dan keluaran sistem untuk arus ulang-alik dan untuk merekabentuk dan membangunkan unit kawalan multipleks atau sistem dari masukan ke keluaran litar dengan komunikasi dua wayar. Pada akhir projek ini, akan ada suatu litar untuk mengawal suis yang terletak di belakang suis dan litar untuk menerima pada siling yang akan diletakkan berdekatan dengan kotak agihan (Distribution Board). Kedua-dua litar akan disambungkan dengan menggunakan dua wayar komunikasi yang bertindak sebagai medium yang dikongsi dalam sistem pensuisan ini.

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CHAPTER I

INTRODUCTION

1.1 Overview

This project will introduces new technology in wiring system that applies in electrical appliances. Electrical wiring is one of the most important things that need to be considered in housing or any construction.

For this project, Programmable Interface Controller (PIC) microcontroller is used to control this new system which is multiplex switching system for single phase electrical appliances. This PIC is program to control ten input output (I/O) system that connected from controller section to receiver section.

The controller section is function as a multiplexer and located behind the wall switch. Meanwhile, the receiver section will be act as a demultiplexer that located on the ceiling.

1.2 Project Objectives

There are three objectives involved in this project which are:

- a) To design multiplex switching system for alternating current (AC) single phase combination with electrical switches or appliances.
- b) To design and develop PIC control unit to accommodate ten I/O system for AC system.
- c) To design and develop multiplex control unit or system from input to output board with two wires communication.

1.3 Problem Statement

There are few problems appeared in electrical wiring that leads to this project.

- a) Low safety

Safety always comes first in handling any electrical appliances. 'Please do not touch using wet hand' is always a signage for precautions. Human will be easily getting electric shock if violate the signs. This happens because of the connection live that flow in the switch. Figure 1.0 below shows the effect when switch on the electrical appliances' switch with wet hand.



Figure 1.0: Effect when switch on with wet hand

b) Life span of the wires

In standard of electrical wiring, each wiring need to be replaced after 15 to 20 years after the usage. Electric wiring has to be replaced once it completed its lifespan as the condition of cables deteriorates due to aging or oxidation. The oxidation will caused the resistance of the wire increase and then would cause increasing of current and power consumption. The side effect of this problem is it will be more costly to change the old wires.

The difference between new wire and old wire can be seen in Figure 1.1. The new wire will look more shiny compared to the old wire due to the oxidation occurred.

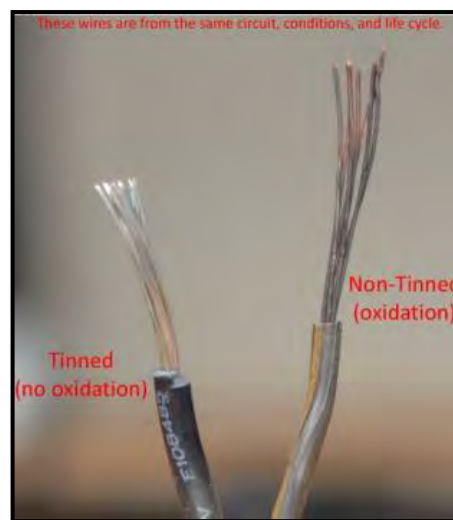


Figure 1.1: Difference between new wire and old wire

c) External wiring

Each wiring that connected to load need to be looped if there are need to add point. Therefore, the new wiring needs to be created because each load will use different switches. Hence, the new wiring need to be added to the

exist switch. The wiring will look stringy and the wires will expose to the surface.

Figure 1.2 shows the external wiring for electrical appliances. In Figure 1.2 (a), it shows the structure of the wires in the PVC conduit. Therefore, the wires have high risk for easily damaged due to the environmental such as fire. By referring to Figure 1.2 (b), the diagram show the connection for current technology when need to add more electrical appliances. The yellow and blue lines show the new wires that added to the existing wiring.

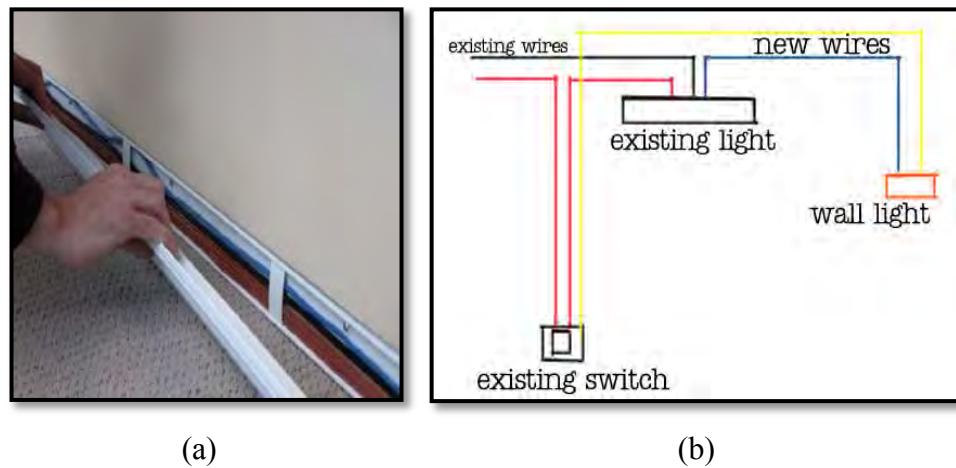


Figure 1.2: External wiring

d) Cost

The added wiring will be more costly. The rating price in Malaysia to add one point or one load is usually from RM70 till RM100. The cost only for wiring and not include load installation. The price also vary depends on the distance. It also depends on the type of electrical appliances that need to be installed.

Table 1.0 below shows the example of quotation pricing for electrical wiring that need to be done for kitchen and living room.

Table 1.0: Example pricing for electrical wiring

Items	Price (RM)
6 point lamp for new kitchen	240.00
1 point lamp for outside kitchen	60.00
2 point extension plug at kitchen	140.00
1 point exhaust fan	70.00
1 point extension for refrigerator	140.00
9 point at living room	540.00
Total	1190.00

1.4 Scope Of Projects

There are two categories for work scope that already outlined which are software that will be embedded with hardware.

a) Hardware

In this hardware part, the electronic circuit will be designed to develop multiplexing switching system. There will be two circuits which is control section and receiver section. Transformer and relays will be added to the receiver section.

i. Transformer:

- Will be used to step down the AC current that flow into the circuit

ii. Relays

- To control interface between AC load
- Can be used for RF receiver that will be used to design the remote control

- Can be replaced at any time when the relay fault (no need to disturb other part)

b) Software

Creating the programming will be applied in this part. The PIC that involved in this project is PIC16C54. The programming will be focused on develop a system that control the multiplexing and demultiplexing switching. The software that will be used to run the programming smoothly is PIC C Compiler.

1.5 Project Workflow

The project workflow is shown in Figure 1.3

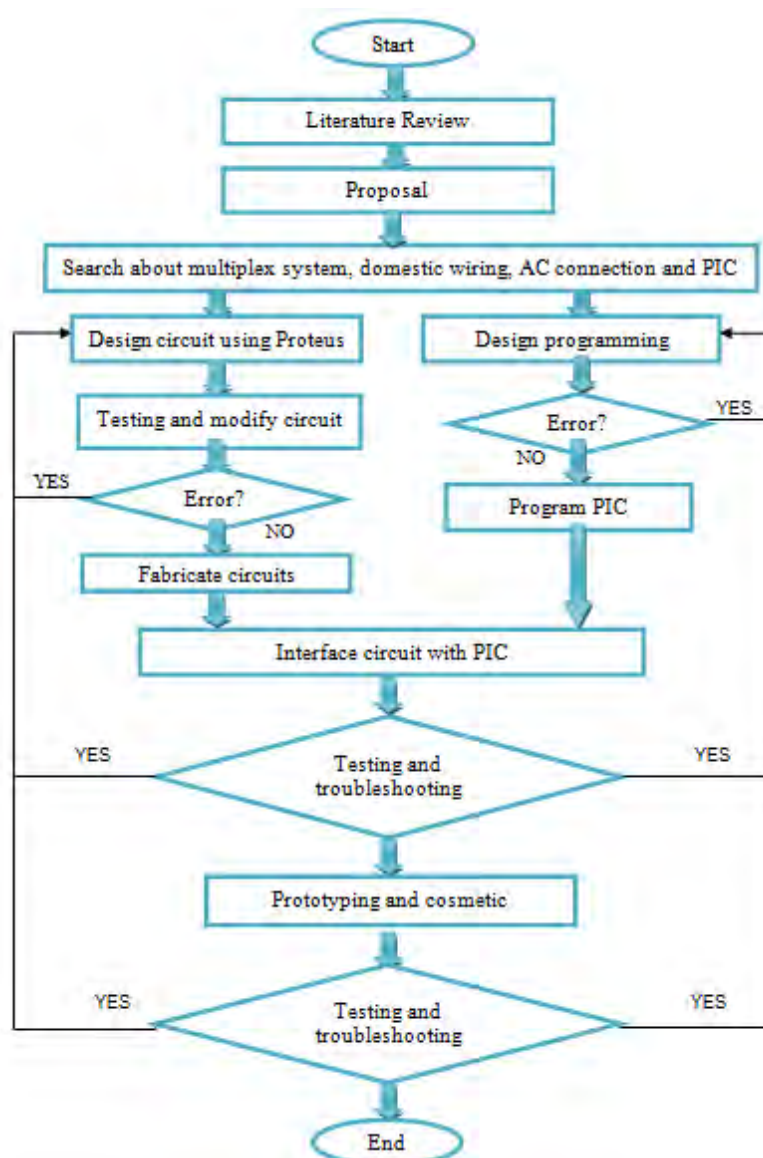


Figure 1.3: Project workflow

a) Literature review

Before start this project, full information need to be collected to complete the project. Information about multiplexing system, domestic wiring, AC connection and PIC will be collected by referring to journals and reference books. Sources from internet will be used as small side to add more knowledge. The comparison between current technologies of electrical wiring will be done.

b) Designing

There are two circuits that will be involved in this project which are receiver and control circuit. These circuits will be designed by using Proteus ISIS 7 Professional software. The same circuit will be used to design printed circuit board (PCB) by using Proteus ARES 7 Professional.

c) Programming

Programming technique will be used to program PIC (PIC16C54). The selected programmer tool is PIC C Compiler to program the PIC. Programming need to be always changed till no error occurs in the program.

d) Testing and troubleshooting

The hardware and software part will be tested first by using the designed circuit. Troubleshoot step will take over if there are errors occurs. Keep troubleshoot till get the desired results. Then, construction of PCB circuit can be continued and tested. After both hardware and software done and stable, it needs to be test on electrical appliances.

e) Prototyping

After all steps have been successfully done, it continues with prototyping. A basic electrical wiring will be done to act as a model to realization this project.

1.6 Thesis Outline

This thesis basically divided into five main chapters. This first chapter contains introduction for the whole project. It gives brief overview about this