PROTOTYPE OF POWER LINE INTERFACE SOCKET USING EMBEDDED
CONTROLLER FOR DATA ACQUISITION AND CONTROL.

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Dedicated to my beloved family especially my parent, lecturers and all of my friends

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ABSTRAK

Pada masa kini, pasaran kita telah dipenuhi dengan produk-produk yang serba guna dan innovatif dengan kemajuan penyelidikan teknologi. Kesemua ciptaan produk ini mempunyai satu matlamat iaitu membawa kehidupan yang lebih selesa dan menyenangkan kepada manusia. Tujuan projek ini adalah menreka cipta satu soket elektrik yang dapat beroperasi dengan bijaksana dengan bantuan teknologi komunikasi kuasa modem iaitu ia akan dapat mengawal pelbagai alat elektrik di rumah tanpa wayar. Selain itu, projek ini turut mempunyai satu sistem yang direka cipta untuk mendapatkan maklumat seperti masa dan tarikh socket dibuka, berapa lama socket dah dibuka dan lain-lain. Prototype ini dapat memberikan keselesaan kepada orang ramai dengan ciptaan sistem yang dapat mengawal alatan elektrik di rumah dari jauh dan juga menjimatkan kos pengguna dimana pendawaian adalah tidak diperlukan di sini. Prototaip ini menggunakan konsep "Senang dipakai" dimana pengguna hanya perlu memasukkan socket alat elektrik ke dalam socket yang direka cipta.

ABSTRAK

Nowadays, there are a lot of innovation products in the market through the development of the advance technology. Those products are all having the same goal which is bringing people to the better and comfortable life. The purpose of this project is to design a power socket which behave and operate smartly via the power line communication technology. The title of the project is "prototype of power line interface socket using embedded controller for data acquisition and control" where a power socket prototype is being developed. Besides that, control systems will also being develop in order to control and obtain the operation detail of the socket such as date and time. PIC 18F4550 microcontroller has playing the role as main source to control the power socket via the power line modem in the project. No more additional wire just plugs and use, easy to use and install, one power socket provide power and communication needed are all the purpose of the implementation of this project.

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LIST OF ABBREVIATION

PLC	Power Line Modem
MCB	Miniature Circuit Breaker
DB	Distribution Board
VB 2010	Microsoft Visual Basic 2010
PIC	Peripheral Interface Controller
COM PORT	Communication Port
IRR	Infrared Receiver
RF	Radio Frequency
MCU	Microcontroller Unit
UART	Universal Asynchronous Receiver/Transmitter
PCB	Printed circuit board
FSK	Frequency Shift Keying
TTL	Transistor-transistor Logic

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CHAPTER I

INTRODUCTION

1.1   Overview of the project

Nowadays, controlling remotely through home network is becoming important for electrical home appliances in order to provide a better and comfortable life. In this project, power line communication (PLC) technology has been used where power line is utilized as communication cable in order to form a home network that can be remotely controlled. Power Line Communication (PLC) carries out a high speed data transmission through power lines. A simple wireless network can be constructed with advantage of stable data transmission, and this type of network is gradually receiving growing attention. [1] Power line communication is suitable as the communication medium in the home network compared to other mediums because it can be easily installed in an existing residence and do not need new cabling.

In this project a no new wire embedded system have been develop to control and monitor the power socket. For the hardware part, power line modem and PIC microcontroller have been used to build a power line controller socket. Power line modem is used to form a network through the existing power line grid while PIC microcontroller is used as the controller to control any domestic product which is

plugged into the socket. For the software part, a control and monitor system using Microsoft Visual Studio 2010 will be developed in order to monitor and control this power line socket. Once the domestic product have been plugged into the power line socket, then user can be able to control and monitor the domestic product through the system, for example turning ON/OFF the appliances, setting timer for ON/OFF application. The system is also able to provide details on the duration where the socket has been in use. Those electrical appliances which functions with network monitoring and controlling capabilities do not require any network re-layout. [2]

1.2 Objective

The main objectives of this final year project are:

i. To establish a communication between power line modem, PIC, and domestic devices using existing AC power line.
ii. To control any domestic that plug into the PLC Power control outlet socket remotely.
iii. To design a Power control outlet socket.

1.3 Problem Statement

Current home appliances do not have the capabilities where they can be remotely controlled, thus, it needs the users to manually activate the appliances before they can be used. This conventional method may not be convenient for the disabled/handicapped as they are not capable of moving around in a normal manner where the power socket placed at certain heights can be real troublesome. Apart from that, existing power lines are not fully utilized if it just functions as power supply. In current technology, existing power line grids are able to form communication network. This communication can then be fully utilized for various

purposes, for example monitoring and controlling electrical appliances in our house. Nowadays, new installation of wireless technology involves complicated procedures and expensive cost, which makes the idea of smart house unpopular in the society. But now, with the existence of power line communication, everyone is able to enjoy the benefits of wireless technology with a lower cost. The limitation posed by power socket such as cost and space can be eliminated too.

1.4   Scope of Work

1. Familiar with the operation of power line modem and establish the communication
2. Establish the communication between power line modem and PIC 16F877A.
3. PIC 16F877A is use as controller to switch on the devices.
4. Design control interface by using Microsoft Visual Basic 2010.
5. Design and built an AC power socket prototype.

1.5   Methodology

This project contains two components which are the hardware and software components. On the hardware part, the power line transmission function needed to be developed with the pic microcontroller in order to control appliances through power line. Interfacing of power line modem with pic microcontroller is the main part of the hardware while the software part requires designing a control system panel that is able to interact with the hardware. Microsoft Visual basic 2010 software has been chosen in this project to design the control interface and serial communication is used to connect the prototype with the control interface. All the operation of the prototype with control interface is using the serial port communication.

1.6   **Project Expected Outcome**

The basic communication through power line will be established and the PIC controller will be able to control any electric appliances that plug in to the power line interface socket. Besides that, one control and monitor system is being develop and able to control and monitor the power line interface socket by the help of RS-232. The system is able to control ON/OFF of the domestic product, provide the detail data like date and time of the socket being ON/OFF to user.

1.7   **Thesis Structure**

Chapter 1: This chapter will introduce the brief idea of the project where it will cover the objectives, problem statement, scope and the project outcome.

Chapter 2: This chapter will be discussing the project background. The method, theory and concept are briefly explained in this chapter.

Chapter 3: This chapter will discuss on the methodology of the project. It will discuss on the method that will be carried out in order to complete this project like research, reading and other.

Chapter 4: All the simulation, result and collection of the data and analysis will be presented in this chapter.

Chapter 5: This chapter will discuss the details about the discussion and summarize the project achievement. It also includes the conclusion and recommendation that can be taken for the future improvement of this project.

CHAPTER II

LITERATURE REVIEW

2.1   Introduction

This chapter will discuss on other remote control project method such as infrared, radio frequency and Bluetooth. Those projects will be reviewed and comparison with this power line communication project will be made. Besides that, the comparison of different power line modem and PIC will also be included in this chapter.

2.2   Lightning Management System (Infrared)

From the reviewed paper, the author wrote that infrared technology is being used as switch in the home to switch on light. Through this, user need to point on the infrared receiver (IRR1) to the wall that is mounted with timer, from there IRR1 then only will transfer the logic _1'to another module IRR 2 that connects with the load. The figure below is showing the overall concept of the project. [3]
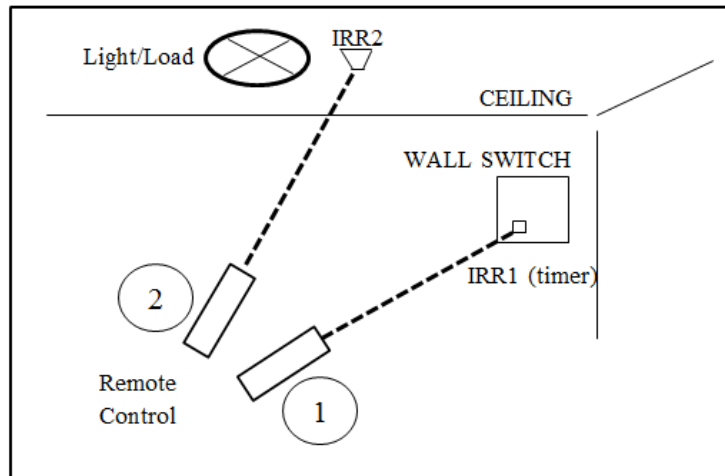
Figure 2.0: IIR 1 and IIR 2 connection circuit

From the above project, a comparison has been made with the power line communication in order to see which technology is suitable as remote control medium inside the project[3]. Table 2.1 is showing the characteristic of two project.

Table 2.0 Comparison between Infrared and power line communcation

Infrared	Power line communication
Use infrared as remote control technology	Use power line communication modem as remote control
Involve with complicated of setup procedure.	Involve with easy setup procedure because there is no more new wire installing.
Need point on to the receiver at the nearest disctance in order to turn ON the light.	Just a simple touch button in the computer in order to turn ON the equipment. Able to control in the distance of 300m
Use LED light as indicator	Having one control system interface to indicate the status.
Not having controller inside the project	Having PIC 16F4550 controller in the project

2.3 A Passive RF Receiving and Power Switch ASIC for Remote Power Control with Zero Stand-by Power. (RF)
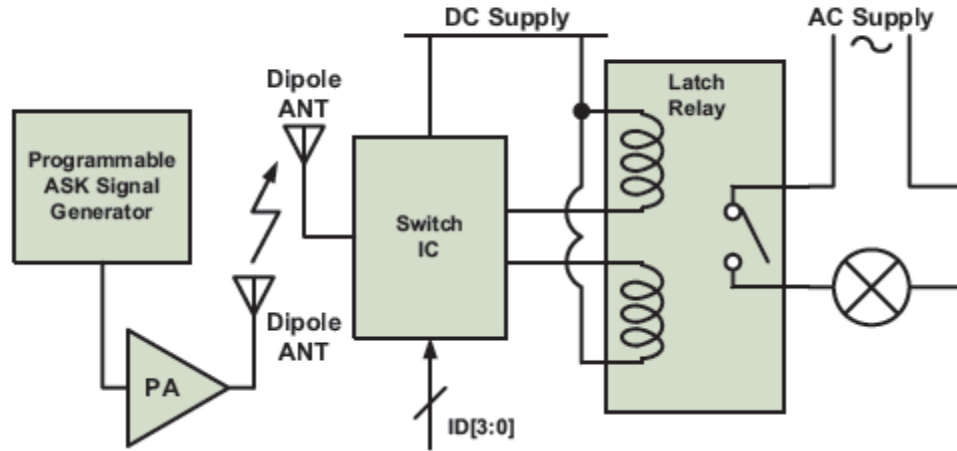

Figure 2.1: RF Power switch ASIC remote control circuit

The literature paper state that the project is using wireless radio frequency (RF) and power switch ASIC to switch on the load. This project is having one main attractive function which is having zero standby power. [4]

Table 2.1 Comparison between radio frequency and power line communication

Radio Frequency (RF)	Power line communication
Use radio frequency as remote control technology	Use power line communication modem as remote control
Involve with complicated of setup procedure.	Involve with easy setup procedure because there is no more new wire installing.
Need point on to the receiver at the nearest disctance in order to on the light.	Just a simple touch button in the computer in order to on the equipment. Able to control in the distance of 300m
Use ASIC to control on/off	Use PIC18F4550 to control on/off
Less of monitoring and control system	Having one systematic monitoring and control system

2.4   Project 3: The Information Home Appliances Control System – A Bluetooth Universal Type Remote Control (Bluetooth)

This project is work on the bluetooth remote control that able to control any household appliances. The bluetooth range here can be reach till 100m with the addition of antena. There will be two module developed in this project which is transmitter and receiver. In the transmitter module is included keyboard, MCU and bluetooth module while the receiver module comprise bluetooth module, MCU and load. The overall concept can be shown at figure below. [5]
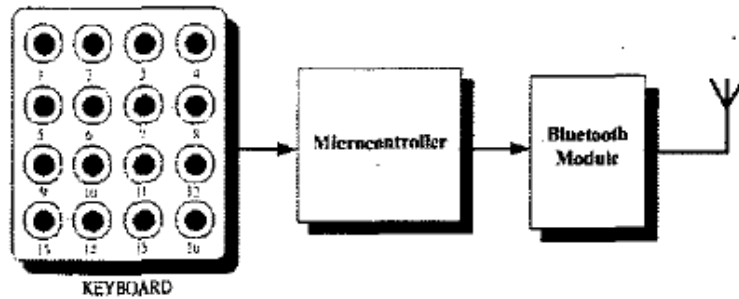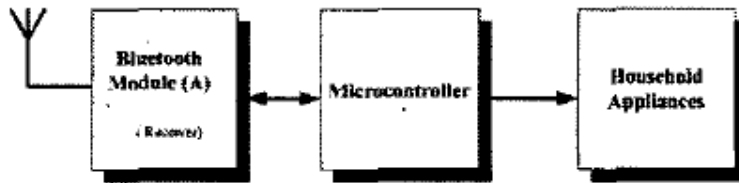
Figure 2.2: transmitter module

Figure 2.3: Receiver module

Table 2.2 Comparison between bluetooth and power line communication

Bluetooth	Power line communication
Use bluetooth as remote control technology	Use power line communication modem as remote control
Involve with complicated of setup procedure.	Involve with easy setup procedure because there is no more new wire