

**DEVELOPMENT OF THE HOME APPLIANCES
CONTROLLER BASED ON DTMF SIGNAL**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF THE HOME APPLIANCES CONTROLLER
BASED ON DTMF SIGNAL**

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

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Tajuk Projek : DEVELOPMENT OF THE HOME APPLIANCES CONTROLLER BASED
ON DTMF SIGNAL

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DEDICATION

To my beloved
parents
siblings
and bestfriends.

ABSTRACT

Home automation has been around from many decades in terms of lighting and simple appliances control, and only recently has technology caught up for the idea of the interconnected world, allowing full control of home from anywhere becomes reality. There are certain people that sometimes forget to turn off their home appliances before leaving the house and this can lead to wastage of energy and money. Therefore, in this project a microcontroller-based application is proposed to help the users monitor and control their house appliances from afar without physically at home just by using telephone communication line. This project is built by using the Dual-Tone Multi Frequency (DTMF) signal from telephone line produce when pressing the keypad of the telephone. This signal is then decoded into binary numbers and will be processed by the processor. It will produces output to the interfaced home appliances and switch on or off the device. This can be realized just by making a simple phone call to the landlines telephone connected to the system. This project had been verified to control the home appliances that had been limited to 4 output relays.

ABSTRAK

Penerapan teknologi automasi rumah telah wujud dari beberapa dekad dalam segi pencahayaan dan peralatan kawalan yang ringkas, dan hanya baru-baru ini teknologi ingin merealisasikan idea untuk menghubungkan dunia, yang membolehkan kawalan sepenuhnya di atas perkakas rumah dari setiap tempat. Terdapat beberapa orang tertentu yang kadang-kadang terlupa untuk mematikan peralatan rumah mereka sebelum meninggalkan rumah dan ini boleh membawa kepada pembaziran tenaga dan wang. Oleh itu, dalam projek ini sebuah aplikasi berasaskan mikropengawal dikemukakan untuk membantu pengguna memantau dan mengawal peralatan rumah mereka dari jauh tanpa berada di rumah secara fizikal dengan hanya menggunakan talian komunikasi telefon. Projek ini dibina dengan menggunakan isyarat nada frekuensi berganda hasil dari talian telefon apabila pad kekunci ditekan. Isyarat ini kemudiannya dinyahkan kepada nombor binari dan akan diproses oleh pemproses. Ia akan menghasilkan keluaran ke peralatan rumah yang disambung yang akan mematikan atau menghidupkan peranti. Ini boleh di menjadi kenyataan dengan hanya membuat panggilan telefon kepada talian tetap yang disambung dengan sistem. Projek ini telah berjaya untuk mengawal peralatan rumah yang terdiri daripada 4 keluaran geganti.

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"In the name of Allah, Most Gracious, Most Merciful"

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CHAPTER 1

INTRODUCTION

1.1 Project Overview

Home automation is a modern technology that gives the home owner the ability to take action and control of the device, placing security system and provide convenient in their home even when they are not physically at home. Home automation is becoming more and more popular around the world and is becoming a common practice. Controlling devices by using switches are common already. Most of the times it was done manually. But from a few decades ago, controlling device by using remote control switches are becoming popular.

The examples of the remote control switches are as listed below with their application:-

1. Infrared remote control switch as can be seen from the Astro decoder remote control.
2. Light activated switch as applied to the road lamp that will be turn on whenever the light intensity become low or dark.
3. Wireless remote control switch as applied to the automated sliding gate.

However, these technologies have their own limitations where the laser beam are harmful to mankind and the infrared remote control switch are only for the short distance application. Thus, to overcome this, the need to design and construct a project circuit that does not provide any radiations and also have no limitation of range so that it can be used from any distance ranging from meters to thousand kilometers. The technology that fulfill all the criteria mentioned before is a Dual-Tone Multi Frequency (DTMF) signal from a simple telephone line or mobile phone. Thus, the home appliances now are going to be control more efficiently and effectively at anytime and anywhere.

This system is designed for controlling arbitrary devices which connects to the system through the central control unit. To activate the Central Control Unit of the system, a call need to be made as the call is answered automatically, the caller has to enter a number of digit password to access the system to control the devices. As the caller press the specific password as the programmed instructions, it will result in turning ON or OFF the specific devices on the user appliances unit. The device switching is achieved by using relays. The purpose of the security system is preserved here is so that the dedicated password owned and known by certain people only.

1.2 Project Objectives

The objective of this project is to develop a device that allows user to remotely control and monitor multiple home appliances using landlines telephone. This system will be a powerful and flexible tool that will offer this service at any time and from anywhere with the constraints of the technologies being applied. Possible target appliances include security system, lights and fan but it is not just limited to that. It can be anything with an electrical interface.

The proposed approach for designing this system is to implement a microcontroller based control module that receives its instructions and commands from a telephone over the DTMF signal. The microcontroller then will carry out the issued commands and then flows to the user appliances unit to turn them ON or OFF. For security purposes, a means of user identification will be implemented and will combine caller identification with an authorized password.

1.3 Problem Statement

Generally, before leaving the house, all of the appliances that had been switched on before need to be turned off to avoid massive accident such as that can cause firing such as short circuit, overload and etc. However, there is sometimes when the appliances are left switched on without turning it off. Imagine that when the person had already 15km away from the house but suddenly started to realize that we forget to turn them off. It is very hectic to go back and forth another 15km just to do so. This is wastage of time and can create a lot of chaos and tension and lead to the wastage of power energy and can caused global warming in the longer period of time.

Recent technologies make it possible to solve this problem. DTMF control system had been chosen where it can be used as a switch to control the appliances remotely by just pick and dial up the phone. This technology can work in a large area as long as there is coverage from the network provider. This system also does not causing harm to human as the radiation is very minimal and save to use.

1.4 Scope of Project

This project work focuses on the ability to switch on and off any electrical appliance remotely and automatically. For this project, the electrical appliances are limited to the household appliances; 3 bulbs and 1 alternate current fan. It has the ability to be controlled from anywhere as long as the user has working telephone network. The scopes of this project are concentrating to this following diagram as shown in Figure 1.1 below.

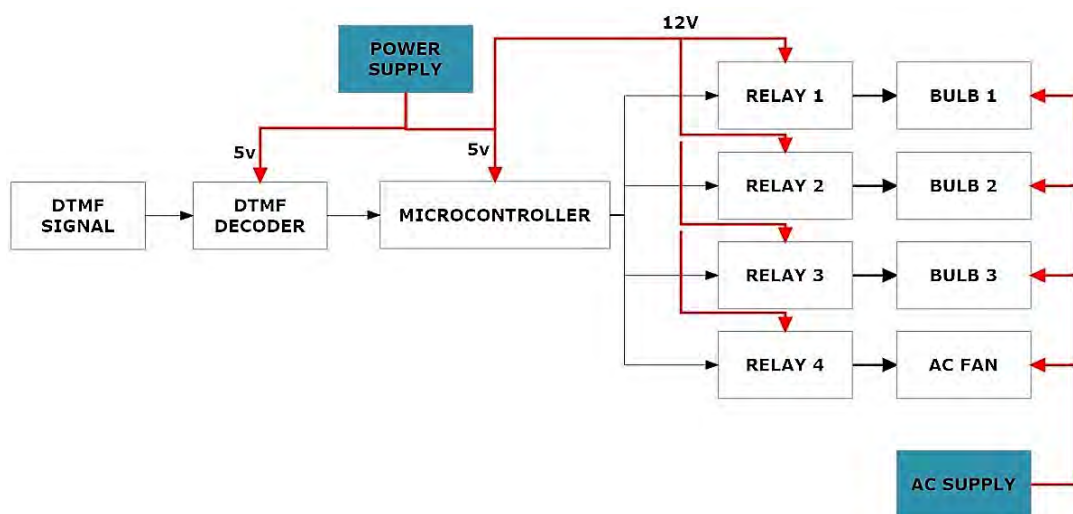


Figure 1.1: Scope of Work Diagram

As can be seen from the block diagram above, power supply are producing two main output voltage which 12V for relays and 5V for DTMF decoder IC8880 and microcontroller PIC16F873. The DTMF transceiver, IC8880 are used as the decoder to translate the DTMF signal that send by the user to the binary number as the input to the microcontroller PIC16F873. Telephone will be automatically answered on the twelve rings and the ONLINE LED will be turned on to indicate that the Home Control System is on active state. The user need to enter 4 digits password in order to activate the Home Control System and only then sending the command through the keypad number to be executed by the microcontroller as the following table.

Table 1.1: User's Home Control System Number Code

Code	Description	Operation
xxxx#	Enter default password. (2345#)	Home Control System become active
11#	LED 1 or Bulb 1	Status ON
21#	LED 2 or Bulb 2	Status ON
31#	LED 3 or Bulb 3	Status ON
41#	LED 4 or AC Fan	Status ON
10#	LED 1 or Bulb 1	Status OFF
20#	LED 2 or Bulb 2	Status OFF
30#	LED 3 or Bulb 3	Status OFF
40#	LED 4 or AC Fan	Status OFF

For safety purpose, this system comes with a default password which is 2345. After receiving the correct combination number only then the Home Control System will become active. However, if the user want to change the combination number to their preference, they can change it to other combination number which activate the PROGRAM mode of the system.

The IC8880 also can transmit a signal to be used as an alarm system as it is a transceiver. The limit switch will activate the alarm system and the microprocessor will send the order to call the user phone. For doing so, user need to set the phone number that the Home Control System will be alert to.

At the other end of the Home Control System is the Client Appliances Unit which consists of four relays that each are connected together with the AC power supply. It act as the switching device that are connected to normally open contact. When the microcontroller giving the high input to the relays, the relays will be active and turn on the home appliances until the relay receive input low.

1.5 Report Structure

The structure of this report is divided into five main chapters excluding their subs. There are Chapter I Introduction, Chapter II Literature Review, Chapter III Project Methodology, Chapter IV Results and Discussion and Chapter V Conclusion and Future Work.

Chapter I is as an Introduction of this report. This chapter acts as the first acquaintance of this project that touch on the project overview, the objective of this project, problem statement, and scope of work.

Chapter II is about the Literature Review which is an important part of this project and the most crucial section of this report. It discuss on the previous work that had been done in the same field. Literature review will covers on the reviewed journals and also the components used in this project and some theory that required in supporting the research of this project.

Chapter III is discuss on the Project Methodology. This chapter explain the procedures that have been conducted in order to complete this project. It divided into 2 main subsection which is for the circuit design and program design. The process of designing, fabrication, assembly, troubleshooting and making the final product is discuss here. In order to make the user understand more about the process, a flowchart are used to illustrate the process.

Chapter IV, Result and Discussion is about the analysis and the finding of this project. The results from the project, is illustrated by using tables and pictures. This chapter discuss and explain the design process and the finding between the expected and actual result.

Chapter V is about the Conclusion and Future Work. Conclusion of this project has been made due to overall project. This chapter also contain a recommendation for future work that can be made to this project to make it more reliable.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will explain and discuss about the source and reference that related and relevant to the project. Some research to gather on the basic working principle and information from the previous related work had been done and been reviewed again in this chapter. This is important chapter in order to make the project function as desired at the end of the time.

2.2 History of Home Automation

Home automation has been around since the World War 1 (1914), in fact, the wireless remote control was first patent and unveiled by Nikola Tesla in 1898 when he controlled a miniature boat by sending it radio waves [1]. Since then, after the second World War, numerous type of home automation systems have been evolved rapidly and