

Title: Home Equipment by using DTMF Signal

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1. INTRODUCTION

Abstract— The goal of this project is to control ON and OFF home equipment's using Dual Tone Multi Frequency (DTMF) signals. This device will enable the users to control appliances using the telephone. The user can switch ON any equipment or appliances in advance before coming home as a safety precaution. This equipment is capable of triggering an alarm and informs the owner via automatic phone ringing. In order to activate this device, all users need to do is to call home and input the password after twelve ringing tones. The user will be allowed to control home appliances upon entering the correct password key. This application also will be interfaced to the existing circuit that is connected to the appliances. The final outcome of this system which does not require any radiations, any laser beam which has no limitation of range, it can be used from any distance from meters to thousand kilometers using a simple telephone line or mobile phone.

Keywords: Dual Tone Multi Frequency (DTMF), PIC Microcontroller, Central Control Unit, DTMF Communication The Client Appliance Unit.

2. PROBLEM STATEMENTS

- i) If someone forgets or not sure whether the home appliances one turn ON or OFF, they can monitor the appliances using the phone.
- ii) This project is to design and develop a system which will help users to makes protective because this device can trigger the alarm and informs the owner via automatic phone ringing.
- iii) This system is suitable for all homes. It is because the system has a simple function and do not use a lot of circuits and less cost. It also saves electricity because this device will enable the users to control the appliances by using the telephone from anywhere.

Technologies like IR remote control are used for short distance applications. In such case if a system which does not require any radiations or which is not harmful, long remote control switch. The solution is such a system which does not require any radiations, any laser beam which has no limitation of range, mean it can be used from any distance from meters to thousand kilometers using a simple telephone line or mobile phone. Here, this project using a telephone as a media, which serves main part of this system, by using home phone as a local phone and another phone, either landline or mobile phone as a remote phone. The application will involve a mobile phone user who will be able to monitor and control his/her electronics appliances at home regardless they are in 'ON' state or 'OFF' state. This application will be interfaced to the existing circuit that is connected to the appliances. This project was aimed at controlling ON and OFF home equipment using Dual Tone Multi Frequency (DTMF) signal. This device will enable the users to control appliances by using the telephone. This project uses a home phone as a local phone and another phone, either landline or mobile phone, as a remote phone. Apart from that, the user can switch on any equipment or appliance in advance before coming home as a safety precaution. This equipment is capable of triggering an alarm and informs the owner via automatic phone ringing. In order to activate this device, all users need to do is to call home and insert the password after twelve ringing tones. The user will be allowed to control home appliances upon entering the correct password combination. This application will be used by a mobile phone user who will be able to monitor and control electronics appliances at home whether in an ON' state or 'OFF' state. This project combines two circuits with a main control system. They are DTMF circuit and controller circuit (central control unit). The DTMF can be configured to send or receive touch tones used in many phones as a communication system. While the controller reacts to control the system. The controller will be programmed to execute the function of this system

by using PIC microcontroller. The system collaboration diagram is shown in Figure 1.1(a).

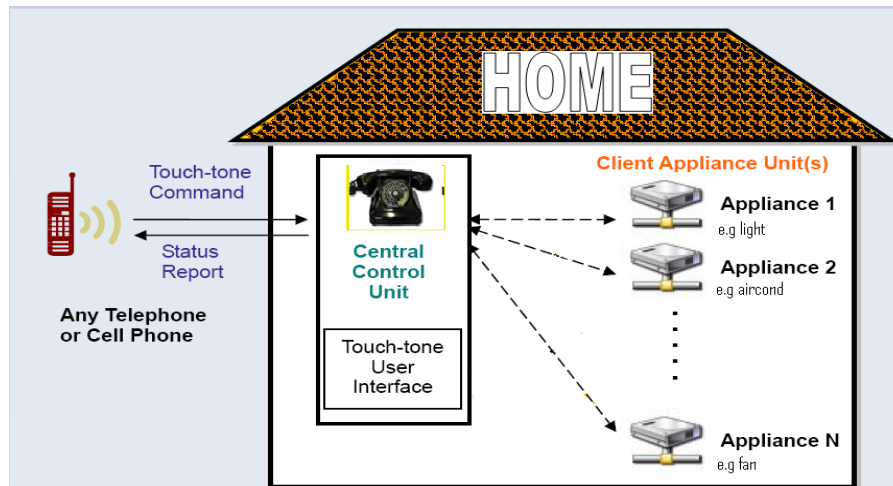


Figure 1.1(a): Collaboration Diagram of Home Phone Signal.

2. OBJECTIVE

The project is aimed at achieving these objectives

1. To build the main system to control switches from long distance.
2. To build the main hardware system that can convert the line phone from DTMF signal to binary signal.
3. To design Home Appliance Control System phone lines usable with any telephone device and also to understand the architecture and programming of PIC.

3. METHODOLOGY

First, this project started by searching for literature reviews from books and journals as a readability sources. Then the suitable circuits were identified. The circuits are The Central Control Unit (CCU), DTMF communication (DC) and Owner Appliance Unit (OAU). The CCU is connected to the household phone line and receives and processes a touch-tone command sent by an owner's phone home, while the DC circuit converts the line telephone to the binary data using IC CM8880.

The next circuit is OAU, which controls home devices with phone key presses.

The next activities are circuit design and programming. The tool to design this circuit was used PROTEL, PROTEUS and MULTISIM software. This system uses Dual Tone Multi Frequency (DTMF) technology of our telephone set. Every telephone set will have this facility. Have two type of dialing facilities in our telephone system (i) Pulse dialing mode (ii) Tone dialing mode. Here this system works on tone dialing mode. The DTMF mode is shortly called as tone dialing mode. To achieve these objectives, the following steps should be determined by Research and Development Work , Engineering Design , Literature Survey Experimental or Theoretical, Computational Studies and Simulation and Implementation.

To ensure that this project achieve the objective all the following steps should be done. At the beginning, the knowledge of the programming must be powerful. To achieve that particular part, literature study and in a meanwhile mastering in simulation tools need to be done. A programming language is an artificial language that can be used to control the behavior of a machine, particularly a computer.

Programming languages are defined by syntactic and semantic rules which describe their structure and meaning respectively. Many programming languages have some form of written specification of their syntax and semantics; some are defined by an official implementation, while others have a dominant implementation. Then, Research on Signal indicator for home appliances control will helps to generate this project.

The application will involve a mobile phone user who will be able to monitor and control his/her electronics appliances at home regardless they are in 'ON' state or 'OFF' state. The big part of the project will be the programming and the circuit design itself. Before the software/circuits are constructed, the various parameters of control should be identified. In the same time, the suitable types of controlled strategy need to study and choose the programming what want to use. After establish the method, circuit/software was design.

The next step is hardware construction. Phones are required to control the system. When the system is established, the next step is to combine the DTMF circuit and the phone for the complete system.

The next stage will be simulation for the circuit. Lab experiments are a way to verify the overall designed operation. Besides, MPLAB software will be used as compilers in programming. MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchip's PIC® and dsPIC® microcontrollers. MPLAB IDE runs as a 32-bit application on MS Windows, is easy to use and includes a host of free software components for fast application development and super-charged debugging. MPLAB IDE also serves as a single, unified graphical user interface for additional Microchip and third party software and hardware development tools. Moving between tools is a snap, and upgrading from the free software simulator to hardware debug and programming tools can be done in a flash because MPLAB IDE has the same user interface for all tools.¹

Then hardware circuit will be transferred to a PCB board and the etching process will be completed. The combination of Central Control Unit (CCU) circuit, DTMF communication (DC) circuit and Owner Appliance Unit (OAU) circuit is important to make a complete system. Troubleshooting will be needed if circuit getting problem to ensure the project function successfully.

In the end, a model will be built to place the project. This device will allow individuals to remotely control and monitor the current operating status of home appliances or facilities via a phone call.

4. RESULT

To perform any operation, the user needs to dial a local telephone and enter the right combination password after twelve rings. This device can turn ON or OFF the application and also can check the

¹http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en019469&part=S W007002

status at the same time. The different tones represent ON and OFF status states. Each device is represented by a unique code and can control four appliances at homes. This system uses accurate switching, and any false code entered will not be activated. Below are the steps on how the HomePs operated:

- 1) After twelve ringing, entered password. Tone signal can be heard and it means that password was entered is true. DTMF circuit will read the tone signal and directly connect to telephone line. A fixed line is needed to connect from telephone line.
- 2) Pressing number ‘*1’ on keypad of a home phone, we set the password. If the password is accepted in this system, we can hear a ‘beep’ sound generated from DTMF IC.
- 3) Pressing number ‘#5’ to set the telephone number to trigger the alarm system and also call the owner via telephone ringing when somebody enters the house without permission.
- 4) When the user check the status, they can hear a ‘beep’ when appliances in condition ON, otherwise they will hear a twice ‘beep’ when appliances in condition OFF.
- 5) The table below is a combination of pressing buttons on the keypad of a mobile phone and home devices. When a key number is pressed according to the commands, the appliances will be ‘ON’.

Table 1.1 result

Telephone keypad pressed	Device switch ON
#1	Side lamp
#3	Back lamp
#5	Alarm siren

4.1 HARDWARE RESULTS



Figure 2: The complete connection of the Home Phone Signal

a) Password Setting

The password was successfully entered in this device. It is proof that the signal produced a 'beep' sound after setting the password. This signal comes from the DTMF circuit.

b) Telephone Interface

After connecting the circuit to a telephone line and also inputting the password after twelve rings, the circuit is automatically activated and can control all devices.

c) Device Status Checking

A 'beep' sound is received when appliances are in ON status, and a double 'beep' is produced when appliances are in OFF status.

d) Device Switching Unit (Relay Output)

All appliances can be controlled using ON/OFF or checked status. This circuit can also make a call to the user when this sensor is activated.

4.2 Software Result

This program needs run on a PC to develop applications for HomePhone(PS) signal. The system uses an Integrated Development Environment, or IDE, because this provides a single integrated “environment” to develop code for embedded microcontrollers. An embedded system is typically a design making use of the power of a small microcontroller, like the Microchip PIC 168F73. This single device can be embedded into IC 168F73 devices and also gives low-cost digital control.

When the code builds with no errors, it needs to be tested. MPLAB IDE has components called “debuggers” and used a simulator as devices to help test the code. Even if the hardware is not yet finished, I can begin testing the code with the simulator, a software program that simulates the execution of the microcontroller.

The simulator can accept simulated input (stimulus) in order to model how the firmware responds to external signals. The simulator can measure code execution time, single-step through code to watch variables and peripherals, and trace the code to generate a detailed record of the program run.

5. DISCUSSION

This project is aimed at creating an ON/OFF home equipment controller using Dual Tone Multi Frequency (DTMF) signal. This device will enable the users to control the appliances by using the telephone from anywhere. This project is one of technology where people do not just use the telephone to make and receive calls but also can turn devices and appliances on and off.

For this project, the user needs to dial local telephone and after twelve rings input a password. We can determine the ON/OFF status of the device by the beep sound. This is because the DTMF signal will be converted to an electrical signal and the microcontroller acts to control the home devices when this circuit takes the data from the IC CM 8880. Then, interfaces with the relay circuit will be either ON/OFF or present a status check.

But, without a telephone line, the system cannot operate because the DTMF needs the signal to convert electrical signal to operate the system. Device status can be checked with the 'beep' sound. If device is in 'OFF' state, two 'beep' sounds will be heard.

This system can turn the application on and off and also can check the status at the same time. Different tones can be represented to show ON/OFF status state. Each device is represented by a unique code. This device can control four appliances in the home.

This project does not disturb telephone lines; the owner can use the telephone as usual. It is also can save time to turn home appliance 'ON' and 'OFF.' It is very suitable for use at every home. This system can be upgraded and used in commercial and public application because it is very easy to use.

Formerly, this project also had a problem for this circuit to work. When troubleshooting, capacitors were opened. Then, author removed other capacitor, after which the circuit could function and interface with software.

When assembled the code, the coding failed and had some errors in linking coding. The author had to check the spelling and format of the code entered in the editor window and make sure the new variables and special function registers, TRISC and PORTC, were in upper case. If the assembler reports errors in the Output window, author needs to double click on the error and the MPLAB IDE will open the corresponding line in the source code with a green arrow in the left margin of the source code window.

After that, the author also checked that the correct assembler and linker for PIC micro devices are being used. Upon a successful build, the output file generated by the language tool will be loaded. This file contains the object code that can be programmed into a PIC 168F73 and debugging information so that source code can be debugged and source variables can be viewed symbolically in windows.

On receiving a ringing signal, this circuit connects the master unit to the telephone line. The circuit is useful to accept the telephone call in the absence of the person. This circuit identifies the ringing signal sent by the other telephone.

6. CONCLUSION

The main hardware systems that can convert the line phone to current using DTMF circuit and have been done. The system for controlling the “Home Equipment Control Using Home Phone Signal” has been created. The important skill and knowledge on troubleshooting, analyzing and simulation are improved. So all objectives below have been achieved.

References

- [1]http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en019469&part=SW007002
- [2]<http://www.scienceprog.com/design-and-implementation-of-dtmf-detector/>
- [3] <http://projectdatas2006.blogspot.com/>
- [4]<http://www.datasheetcatalog.org/datasheet/calmicro/CM8880-1.pdf>
- [5]<http://www.datasheetcatalog.org/datasheet/calmicro/CM8880-1.pdf>
- [6]<http://www.digchip.com/datasheets/parts/datasheet/311/H11AA4-pdf.php>
- [7] George W. Struble (1975). *Assembler Language Programming* (2nd edition). University of Oregon: Addison-Wesley Publishing Company.
- [8] Stephen J. Bigelow, Joseph J. Carr, Steve Winder (2001). *Understanding Telephone Electronics*. USA: Newnes.
- [9] Hwang, Enoch (2006). *Digital Logic and Microprocessor Design with VHDL*. 2nd edition. USA: Thomson.
- [10] Tamara Dean (2003). *Guide to Telecommunications Technology*. (2nd edition). Canada: Thomson Course Technology.
- [11] William Schweber (1999). *Electronic Communication System*, (3rd edition). USA: Prentice Hall.
- [12] Mohd Nor Bin Hj Apin (2004/2005). *Development of Interactive Telephone Based Remote Control Using 68HL11E1*. Degree Thesis. Universiti Teknologi Malaysia.