DTMF BASED HOME AUTOMATION

Course name : Microprocessor interfacing & Assembly Language
Section: 01

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Introduction

The goal of this project is to allow users to use a cell phone-based interface to control their home appliances and systems remotely.

Conventionally, electrical appliances in a home were controlled via switches that regulate the electricity to these devices. Today, we have entered the era of technology. Gone are the days were manual operation were performed. Home automation is becoming increasingly popular and commonplace around the world. Because it offers the user with comfort and simple access to the house equipment, smart home automation becomes vital.

Home automation works by automating everything in the house and using technology to regulate and perform tasks that we would typically perform manually. Home automation takes care of a lot of different activities in the house.

Project Description

The objective of this project is to develop a device that allows for a user to remotely control and monitor multiple home appliances using a cellular phone. 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. The main aim of this project is to implement a low cost, reliable and scalable home automation system that can be used to remotely switch on or off any household appliance, using a microcontroller to achieve hardware simplicity, low cost short message service (SMS) for feedback and voice dial from any phone to toggle the switch state.

Requirements:

Fig.1 Power Supply

i) **Regulated Power Supply -** A source of electrical power is referred to as a power supply. A power supply unit, often known as a PSU, is a device that supplies electrical or other types of energy to a load or group of loads connected to it. A 5v DC power supply is required in our system for all electronic components involved in the project. This requires step down transformer, rectifier, voltage regulator, and filter circuit for generation of 5v DC power.

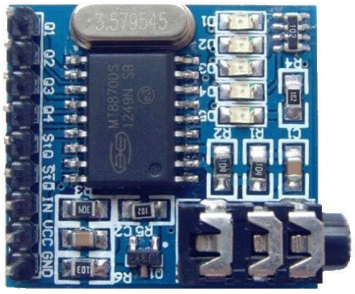


Fig.2 DTMF decoder IC

ii) **DTMF decoder IC (M-8870) -** The DTMF Decoder (MT8870) is a device which is used to decode the DTMF tones generated by the dialler keys of a cell-phone. It integrates both the band split filter and digital decoder functions. The decoder utilizes the digital counting techniques to detect and decode all 16 DTMF tone-pairs into a 4-bit binary code. For e.g. - if a user dials '1' in his key- pad the output generated by the decoder is 0001 and so on. The output of the DTMF decoder can be used to drive home appliances.

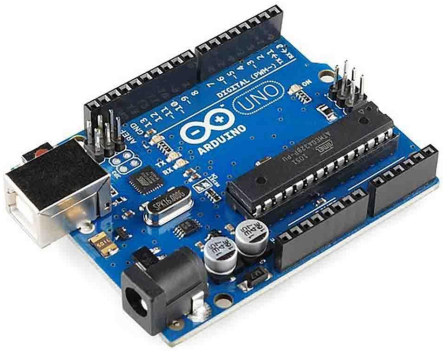


Fig.3 Arduino UNO

iii) **Arduino UNO -** Arduino is a versatile, easy-to-use open source electronics prototyping platform with adaptable hardware and software. It's for artists, designers, amateurs, and anyone else who wants to make interactive things or environment. Arduino Uno is basically based on ATmega328 microcontroller (MCU). It consists of 14 digital input/output pins, six analogue inputs, a USB connection used for programming the onboard MCU, a power jack, an ICSP header and a reset button. It is operated with the help of a 16MHz crystal oscillator and contains everything needed to support the MCU. It is very easy to use as we simply need to connect it to a computer using a USB cable, or power it with an AC-to-DC adaptor or battery to get started. The MCU onboard is programmed in Arduino programming language using Arduino IDE.

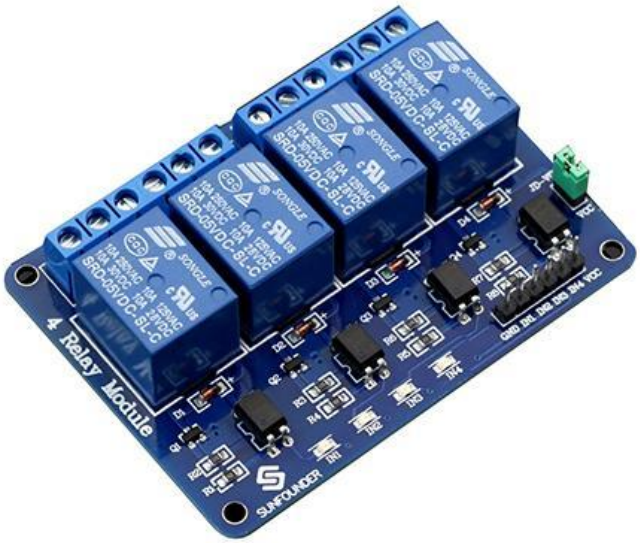


Fig.4 D-Four Channel Relay Module

iv) **D-Four Channel Relay Module -** A relay is a device that allows us to turn on or off a circuit with considerably more voltage and/or current than Arduino can handle. The low-voltage circuit on the Arduino side is completely isolated from the high-voltage side, which is connected to the load, thanks to the relay. We use a 4 channel, 5V relay for this project. This 5V 4-channel relay interface board and each channel needs a 15-20mA driver current. It can be used to control various home appliances and equipment with large current. It has a standard interface that can be controlled directly by microcontroller.

Fig.5 Crystal Oscillator

v) Crystal Oscillator - A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a constant frequency.

CONNECTIONS

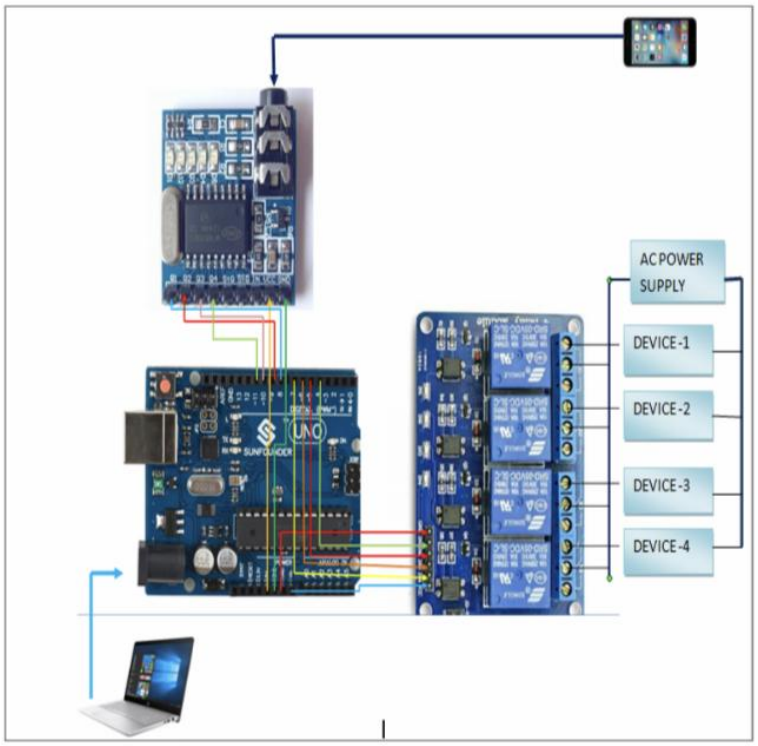


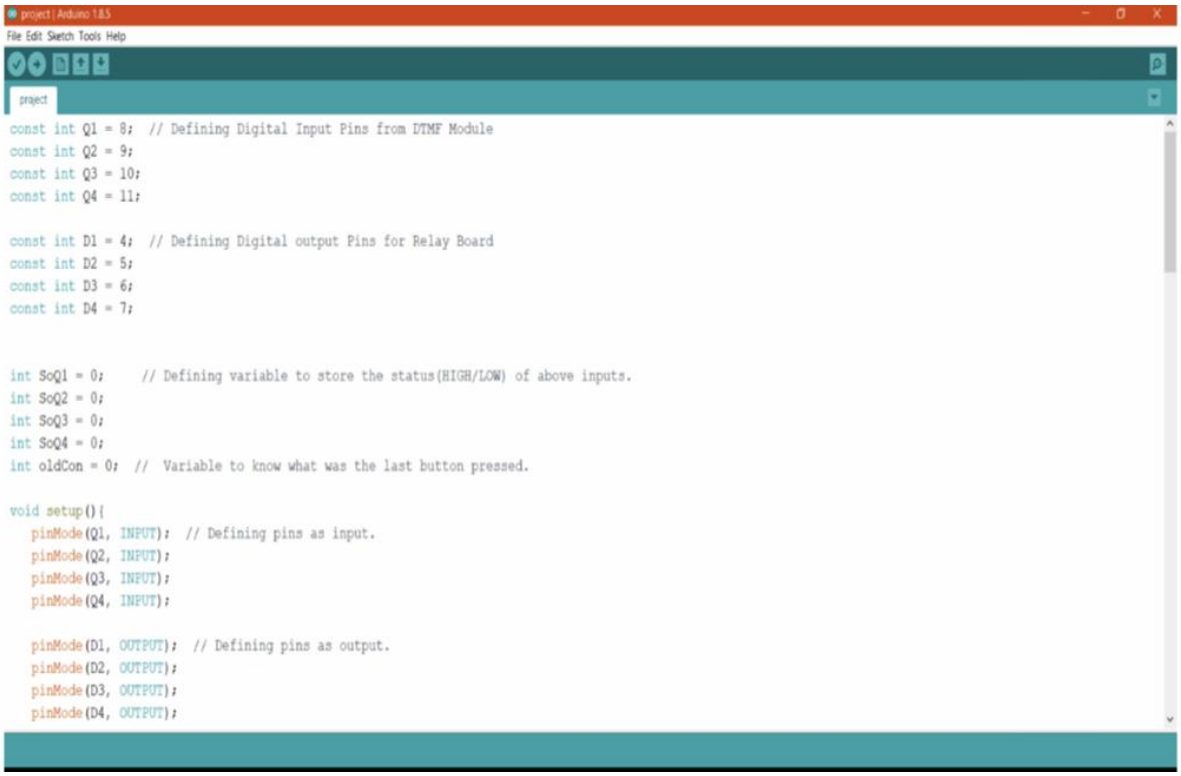
Fig.12: Connection Layout of the Hardware

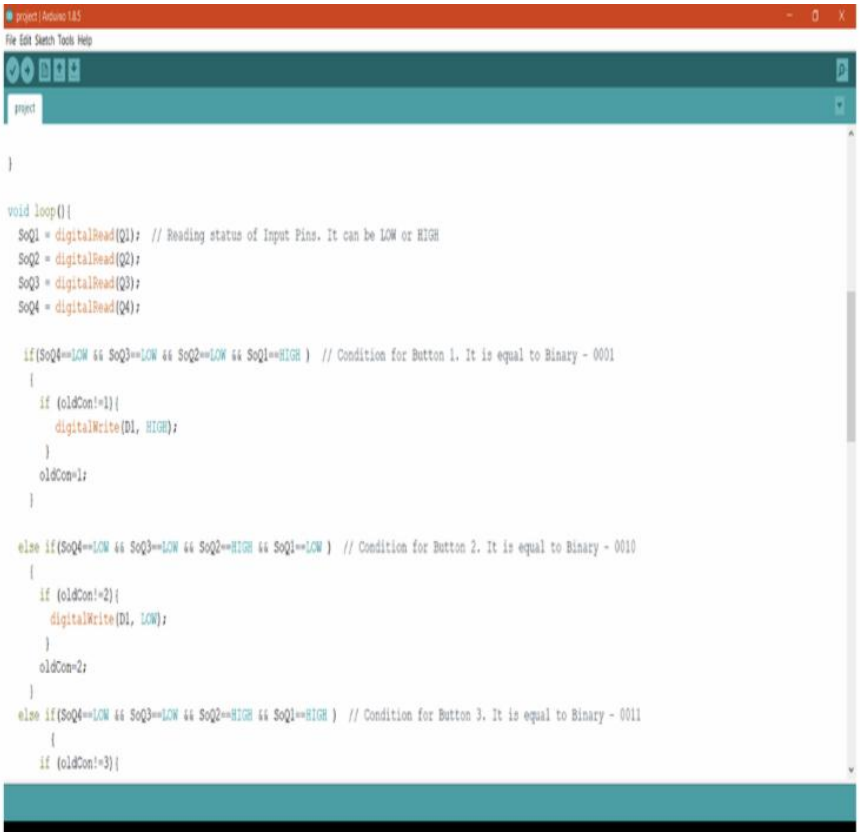
The above figure (5) depicts the connection of the entire system. When the user dials the home mobile number the phone at home rings and if nobody picks the call, then the system picks up the call automatically. When we press any number on the phone keypad it generates a particular frequency, which is received by the other phone and then the code/number is decoded by the DTMF decoder /receiver. Here the decoder decodes the frequency of the tone generated by the particular code/number. The DTMF decoder generates a binary output which is given to the microcontroller. Here a program code is fed to the microcontroller which activates the relay module according to the key pressed by the user. At the output of the microcontroller the

devices are connected to a 4-channel relay module. It is a driver which drives the appliances based on the microcontroller output. Thus, when the relay drive is activated by the microcontroller, the device either gets ON or is switched OFF as per the requirement

The DTMF Decoder, Arduino UNO and the relay module gets the DC supply from the power supply unit. The DTMF decoder (MT8870) is connected to the Arduino UNO which in turn is connected to the relay module. The output of the relay module is connected to various loads. In our project we have used four loads (bulbs) for demonstration. The entire connection is made through jumper wires.

PROJECT CODE:

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}
void loop(){
SoQ1 = digitalRead(Q1); // Reading status of Input Pins. It can be LOW or HIGH
SoQ2 = digitalRead(Q2);
SoQ3 = digitalRead(Q3);
SoQ4 = digitalRead(Q4);
if(SoQ4==LOW && SoQ3==LOW && SoQ2==LOW && SoQ1==HIGH) // Condition for Button 1. It is equal to Binary - 0001
{
if (oldCon!=1){
digitalWrite(D1, HIGH);
}
oldCon=1;
}
else if(SoQ4==LOW && SoQ3==LOW && SoQ2==HIGH && SoQ1==LOW) // Condition for Button 2. It is equal to Binary - 0010
{
if (oldCon!=2){
digitalWrite(D1, LOW);
}
oldCon=2;
}
else if(SoQ4==LOW && SoQ3==LOW && SoQ2==HIGH && SoQ1==HIGH) // Condition for Button 3. It is equal to Binary - 0011
{
if (oldCon!=3){


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digitalWrite(D2, HIGH);
}
oldCon=3;
}
else if(SoQ4==LOW && SoQ3==HIGH && SoQ2==LOW && SoQ1==LOW) // Condition for Button 4. It is equal to Binary - 0100
{
if (oldCon!=4){
digitalWrite(D2, LOW);
}
oldCon=4;
}
else if(SoQ4==LOW && SoQ3==HIGH && SoQ2==LOW && SoQ1==HIGH) // Condition for Button 5. It is equal to Binary - 0101
{
if (oldCon!=5){
digitalWrite(D3, HIGH);
}
oldCon=5;
}
else if(SoQ4==LOW && SoQ3==HIGH && SoQ2==HIGH && SoQ1==LOW) // Condition for Button 6. It is equal to Binary - 0110
{
if (oldCon!=6){
digitalWrite(D3, LOW);
}
oldCon=6;
}

Features

- Complete DTMF Receiver
- Low power consumption
- Internal gain setting amplifier
- Adjustable guard time
- Central office quality
- Power-down mode

• Inhibit mode

Applications

• Receiver system for British Telecom (BT) or CEPT Spec (MT8870D-1)

• Paging systems

• Repeater systems/mobile radio

• Credit card systems

• Remote control

• Personal computers

• Telephone answering machine

Advantages

•It is a robust and easy to use system.

•There is no need for extra training of that person who is using it.

•All the control would be in your hands by using this home automation system.

•One can control home appliances from anywhere.

•It reduces wastage of electricity if someone forgets to switch off any appliance connected to the system if we were away.

•It is very low cost compared to other technologies like GSM.

Disadvantages

•Lack of security- Anyone can control the appliances by connecting to the mobile connected to DTMF module.

•Number of appliances is limited as the mobile can generate a limited number of phones.

•One cell phone should always be connected to the system.

Conclusion

This system employs DTMF technology to control home appliances without the necessity of a microcontroller, allowing it to be operated from anywhere in the world. It's a fantastic device for controlling electronic equipment from afar. When the user at the transmitter dials the number on the receiver's mobile phone and pushes the key on the keypad, he is able to manage the device from any location using low-cost technology. This system may be very useful in rural regions, and the device control can be used in a variety of fields such as agriculture, homes, factories, and so on. The use of mobile communication in device control has been adequately justified, and the previously mentioned limitations and issues have been addressed.