

# Efficient Automation using DTMF



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**Abstract:** We have seen the implementation of Home Automation using bluetooth and WIFI technologies, but the drawbacks of those technologies are range issues. The range upto where the devices can be connected is limited. In order to overcome that we propose a unique System for automation using Dual Tone Multi Frequency (DTMF). This paper suggests an idea for controlling the devices using DTMF tone generated when the user presses the keypad buttons. The advantage of this system is that it can be operated from any distant or remote area.

**Keywords:** Load control, DTMF, relays.

## I. INTRODUCTION

Security and automation is a prime concern in our day to day life[2]. Earlier electronic devices were controlled using switches which are used to regulate the electric power to the devices. Today, we have entered the era of technology. Now with this increase in technology, no more manual work is done or encouraged. Home automation is becoming more famous around everywhere and people are more interested and attracted to it. In this Home automation the most important is Smart Home Automation which really eases our work totally and provides comfort to the users. The process of implementing Home Automation is by using technologies like Bluetooth or WIFI so that the work which previously we used to do manually is no more required. Home automation can handle a lot of different activities in the house, agriculture, industries etc. The principle used for this mobile phone controlled automation is by decoding of DTMF tone generated by keypad numbers. DTMF is known as Dual Tone Multi Frequency. The main components used in this model are the DTMF Decoder, Arduino UNO, relay module and few devices. For the working of this system we have used lamps to demonstrate AC loads. The advantages of using this technology are many and can be used in various fields. One can control home appliances from anywhere in the world and can save power. It helps in reducing the wastage of electricity. Compared to other systems the cost involved for making this model is less.

## II. PROBLEMS IDENTIFIED

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Automation has been in existence from long time using different methods and technologies. The main technologies involved are using either bluetooth or WIFI. Both are used according to the range upto where you want to control the devices. The problems faced are that the range is limited, in order to overcome this we are using the DTMF model. With this we can operate the device from anywhere just by making a call and can control the loads i.e., devices.

## III. SYSTEM STRUCTURE

The system components are structured in two ways for maintaining the external connections of the system and for internal working i.e., to receive the input, process it and to control the devices. They are

- Hardware
- Software

The hardware of the system maintains the performance mechanism of the entire setup. Taking the input signals, giving it to arduino, decoding DTMF tones.

The software involved in this is programming the Arduino Uno with Arduino software. For this we require Arduino software, Keil compiler, Embedded C language or Assembly.

## IV. HARDWARE

### 1. MICRO CONTROLLER

A Microcontroller is a small micro computer which monitors and governs the internal processes of an embedded system in many machines, vehicles, circuits, in medical devices. It mainly consists of processor, memory and



Figure 1 Microcontroller

### 2. POWER

The Arduino can be powered by using USB connection or with an external power supply. The external power supply can either be from AC-to-DC adapter or a battery can be used.

### 3. RELAY

Earlier relays were seen in transmitting and receiving the information known as Morse code, which has the input signals as 1 or 0. The change in these 1s and 0s is now mechanically called as ON or OFF which is done by electromagnets.

Later these were used in various applications and developed. Relay is generally known to ‘pass something from one to another’. This is the reason why this electromagnet is named as Relay because it transmits the signal from one side of the device to other side.



Figure 2 Relays

4. DTMF Decoder Module

The DTMF decoder module is used to decode the tones received from the mobile. The received tone is shown to us in the binary form, there are lights on it when received a tone it gives its respective binary code as output. It has digital counting techniques to detect and decode all the 16 tone-pairs generated and represent them in 4 bit code.

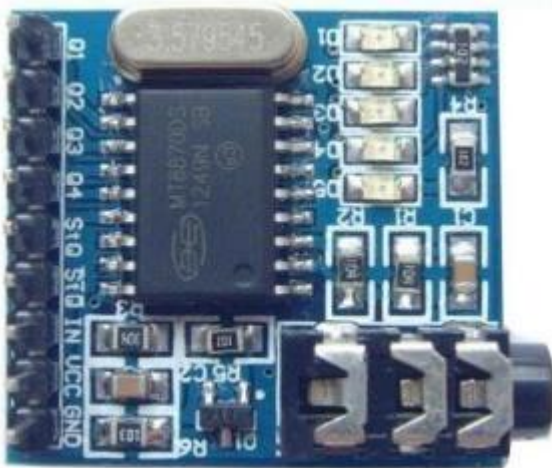


Figure 3 DTMF module

V. CIRCUIT SETUP

In circuit setup firstly, power supply should be given to all the relays and DTMF module in order to connect to devices and receive input and give output. The 5v and ground pins of arduino are connected to bread board. Now in the same line of that series put the pins and give it to each relay and DTMF at their 5v. In the similar way connect the ground pins also. With this the power connect has done, next the output of DTMF module is to be given to arduino. For this connect the 4-bit binary code pins to arduino so that according to the code the signal will be sent to the respective relay. In order to give power supply to all these the power for Arduino is given through an USB cable which is connected either to a laptop or powerbank. For receiving the input from the mobile to DTMF module, the phone is connecte with an AUX wire to the module. This is the total circuit setup.

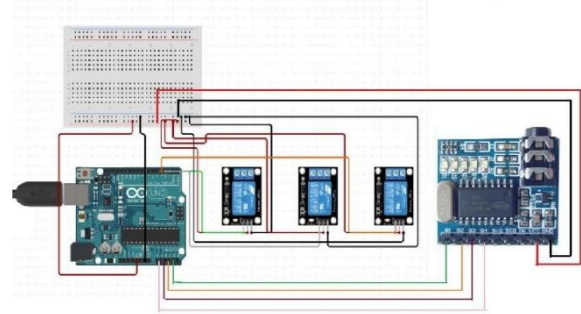


Figure 4 Circuit diagram

VI. DTMF MECHANISM

The dial pad of every phone has two frequencies i.e., row and column frequencies. Row frequencies are low DTMF frequencies and the column frequencies are high DTMF frequencies. When a button is pressed both the frequencies combine together and give the output as the binary code which will be decoded by the DTMF module. As we know that a 4-bit code can represent 16 numbers they are from 0-15. In the similar way we can connect 16 devices to this circuit at a time.

Table 1 Frequencies in a dial pad and their binary output

Button	Low DTMF frequency (Hz)	High DTMF frequency (Hz)	Binary coded output			
			Q1	Q2	Q3	Q4
1	697	1209	0	0	0	1
2	697	1336	0	0	1	0
3	697	1477	0	0	1	1
4	770	1209	0	1	0	0
5	770	1336	0	1	0	1
6	770	1477	0	1	1	0
7	852	1209	0	1	1	1
8	852	1336	1	0	0	0
9	852	1477	1	0	0	1
0	941	1336	1	0	1	0
*	941	1209	1	0	1	1
#	941	1477	1	1	0	0

VII. WORKING PROCESS

The flow chart represents the working mechanism of the project clearly.

1. Firstly, connect the mobile phone to the DTMF module through an AUX.
2. Power On the circuit and by default all the devices are OFF.
3. Now set the auto call lift option enable in the phone connected to the module.
4. Call to the mobile and when it is lifted up open the keypad in your phone and press 1, this is received by the Module and it decodes and gives to microcontroller.



5. According to the program device 1 turns ON. For 2 device 2 turns ON and for 4 and 5 the devices 1 and 2 are turned OFF respectively. We can change this to our requirement.

6. The algorithm can be explained as when any number is pressed, first it checks with 1 if it is true the respective function is carried or else it checks with 2 and so on. Once it matches with any number it performs its function stops and again go back to its original state.

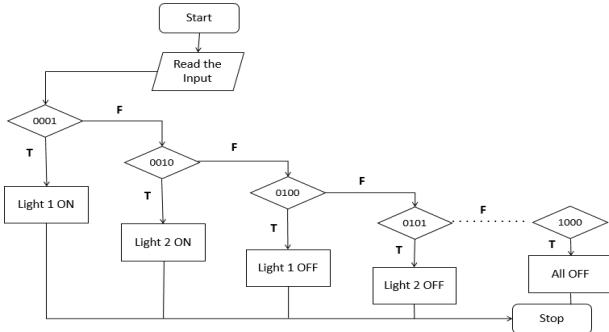


Figure 5 Flow chart

VIII. RESULTS



Figure 6 Key 1 is pressed and device 1 is ON



Figure 7 Key 2 is pressed and device 2 is ON



Figure 8 Key 4 is pressed and device 1 is OFF

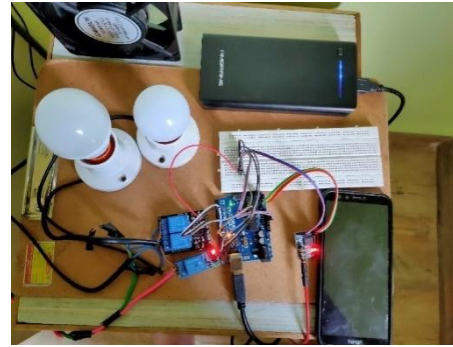


Figure 9 Key 5 is pressed and device 2 is OFF

IX. CONCLUSION

In this paper we have proposed the idea of implementing home automation using DTMF module because previously we have observed the issues faced with bluetooth and WIFI i.e., the range is limited to some extent by them. By this model we can control the devices anywhere by just making a phone call. All we need is to maintain a phone with all the devices connected. This overcomes the drawback of range limitation and is more effective implementation when compared with others.

X. FUTURE SCOPE

As of now we are using the calls to do this process but, sometimes it becomes difficult if anyone knows the number can misuse it. In future using GSM module the devices can be controlled by sending an SMS. This will reduce the problem of answering the calls and makes the process more easily.

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