

# DTMF based home automation for geriatric people

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**Abstract-** Today's the demand for better home security systems has drifted over to a need for home automation. Not only does a home need to be secure but home appliances need a more refined control system. Home appliances should not be limited to only local control. There needs to be a simple and elegant way to avoid this type of situation and allow people the freedom of having complete control of their house from anywhere. According to recent statistics, there is an increasing growth in the percentage of older people in almost every part of the world. In recent years, the number of older people (people that are above 60 years) has increased significantly in every country and region. Now a day's mobile phones have become a part of our daily life. Due to low cost of mobile phones they are widely used in home automation. With the help of a mobile and a microcontroller, home appliances will be controlled.

**Keywords:** Mobile phone, DTMF decoder, microcontroller, appliances.

## INTRODUCTION

Modern homes are getting smarter with the advancements in engineering and technology. Physical operation of wall switches placed in different corners of the house is not convenient especially for the elderly and physically disabled members present in the home. World's population is ageing, considering the increasing percentage of older persons almost in every nation of the world as a result of advanced health care technologies. A Home Automation System (HAS) uses various sensors and components for controlling and monitoring the home environment. Several papers on Home Automation System have used Speech recognition, Bluetooth, GSM and a number of other ways of operation of the system. In this paper we present a Home Automation and System (HAS) where controlling can be done by using the concept of Dual Tone Multi Frequency Decoding to drive a number of Electrical Appliances (EAs) by means of interfacing with a relay driver capable to do so.

## LITERATURE REVIEW

The objective of our project is to make the lives of aged people easy by making the homes automated so that it makes them as independent as possible. Hence, we need a smart device or system to achieve this goal. It is based on Dual-Tone Multi Frequency (DTMF) and how to employ it to automate the home or office.

Dual-tone multiple-frequency signaling (DTMF) is an in-band telecommunication signaling system using the voice frequency band over telephone lines between telephone equipment and other communications devices and switching centers. DTMF system also known as touch-tone system. The touch-tone system using a telephone keypad gradually replaced the use of rotary dial and has become the industry standard for landline and mobile service. Other multi-frequency systems are used for internal signaling within the telephone network. As register signaling is used in DTMF phones here tones rather than make/break pulse are used for dialing and each dialed digit is uniquely represented by a pair of sine waves tones. These tones (one from low group and another from high group) are sent to the exchange when a digit is dialed by pushing the key, these tone lies within the speech band of 300 to 3400 Hz and are chosen so as to minimize the possibility of any valid frequency pair existing in normal speech simultaneously. Actually this minimum stator is made possible by forming pairs with one tone from the higher group and the other from the lower group frequencies. A valid DTMF signal is the sum of two tones, one from a lower group (697-940 Hz) and the other from a higher group (1209-1663 Hz). Each group contains four individual tones. This scheme allows 10 unique combinations. Ten of the codes represents digits 1 through 9 and 0. Tones in DTMF dialing are so close that none of the tones is harmonic of the other tone. Therefore, there is no change of distortion caused by harmonics. Each tone is sent as long as the key is remained pressed. The DTMF signal contains only one component from each of the high and low group. This significantly simplifies decoding because the composite DTMF signal may be separated

with band pass filters into single frequency component each of which may be handled individually.

The underlying principle mainly relies upon the ability of DTMF ICs to generate DTMF corresponding to a number or code in the number pad and to detect the same number or code from its corresponding DTMF decoder. A DTMF generator generates two frequencies corresponding to a number or code in the number pad which will be transmitted through the communication networks constituting the transmitter section which is simply equivalent to mobile set. [i]. The application of this project is to switch on and off home appliances by a cell phone. When we are not at home it may happen that we do not remember whether the appliance is switched on or off. So, we can develop this project such that we get the status of the appliances as a message on our cell phone and hence take the required action. This can be done using GSM module. It helps in effective control of home appliances and increases power efficiency. It increases appliances lifetime and also power efficiency. DTMF tones are mainly use in terrestrial stations for turning on and shutting off remote transmitter. It is mainly use in telephone stations for detection of called and dialed numbers. It also helps us to reduce electrical power wastage.

Dual tone multiple frequency keypad:

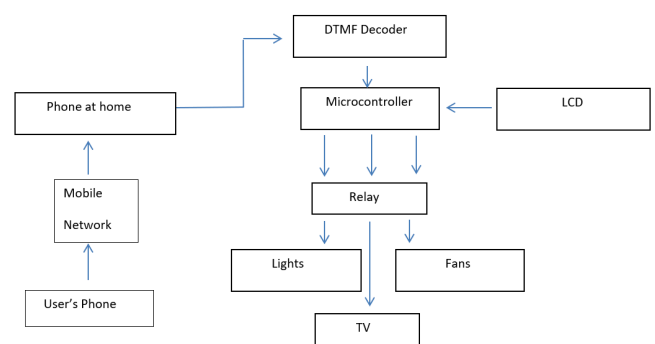
The DTMF keypad is laid out in a 4×4 matrix, with each row representing a low frequency, and each column representing a high frequency. Pressing a single key (such as '1') will send a sinusoidal tone of superimposition of two frequencies (697 and 1209 hertz (Hz)). The original keypads had levers inside, so each button activated two contacts. The multiple tones are the reason for calling the system multi frequency. These tones are then decoded by the switching center to determine which key was pressed. Present-day uses of the A, B, C and D signals on telephone networks are few, and are exclusive to network control. For example, the A key is used on some networks to cycle through different carriers at will. The A, B, C and D tones are used in radio phone patch and repeater operations to allow, among other uses, control of the repeater while connected to an active phone line. The \*, #, A, B, C and D keys are still widely used worldwide by amateur radio operators and commercial two-way radio systems for equipment control, repeater control, remote-base operations and some telephone communications systems. But nowadays in mobile handsets the A, B, C, D keys are not used usually [ii]. The DTMF tone frequencies are shown in Fig. 1.

|       | 1209Hz | 1336Hz | 1477Hz | 1633Hz |
|-------|--------|--------|--------|--------|
| 697Hz | 1      | 2      | 3      | A      |
| 770Hz | 4      | 5      | 6      | B      |
| 852Hz | 7      | 8      | 9      | C      |
| 941Hz | *      | 0      | #      | D      |

**Fig.1. DTMF Tone frequencies**

## HARDWARE IMPEMNTATION

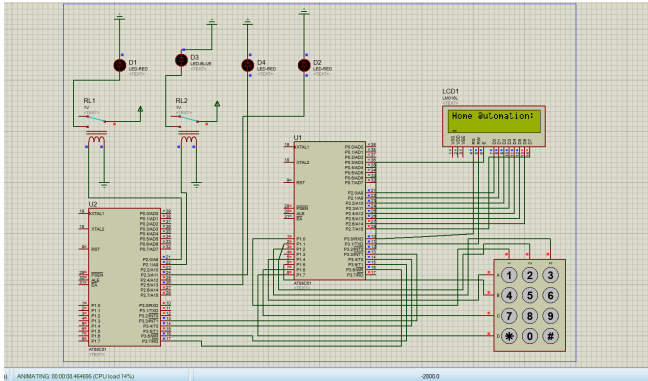
The system, through telephone network connects the user home appliances at home and gives him/her the ability to switch them ON or OFF. The schematic diagram of the project is shown in Fig. 2.



**Fig. 2. Block diagram of the proposed setup**

DTMF which is generated in cellular phones. Here, by using a cell phone we can control the home appliances from anywhere in the world (In Network Area). When we press any key then it generates a frequency after mixing two frequencies. And then send it to the receiver end over communication channel. User can activate their devices using this DTMF keypad as he/she want to activate. The encoder encodes the user input and sends via a communication channel. The receiver receives the modulated signal and demodulates it and the user input. This system is designed for controlling the devices, it includes a cell phone which is connect to the system via head set. To active the cellular phone part of the system a call is to be made and as the call is answered, in response the user would enter a three/four (as he/she want) digit password to access the system to control devices. As the caller press the specific password, it results in turning ON or OFF specific device. The device switching is achieved by relays.

## CIRCUIT DESIGN



In this system, the circuit mainly consists of three parts. First is the DTMF decoder, second is the transmitter which accepts the output of the decoder and the third is the receiver which accepts the input of the transmitter. Hence, devices like TV, Fan, AC, Mixer, Bulb, etc can be controlled as one wishes to. A serial communication between 8951 microcontrollers is used for transmitting the encoded data from the transmitter to the receiver. This means that the second part of the circuit is made a serial transmitter which sends the encoded data serially and the third part of the circuit is made a serial receiver which receives the serially transmitted data, serially. A password is already defined in the third part of the circuit. When the receiver receives an input from the transmitter, it compares the input data with the stored or defined data. If the data matches, then that particular device gets activated. One can also see the particular operation on the 16x2 LCD Display.

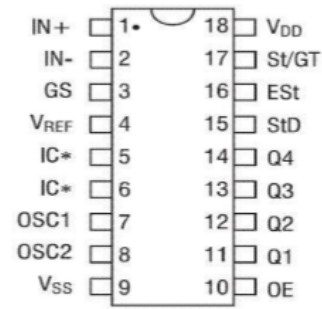
## SOME IMPORTANT COMPONENTS USED

## 1. DTMF DECODER IC (MT8870)

The MT8870 is a completed DTMF receiver integrating both the band split filter and digital decoder filter. The filter section uses switched capacitor techniques to high and low group filters. The decoder uses digital counting techniques to detect and decode all 16 DTMF tone pairs into a 4-bit code.

## Features-

1. Low power consumption
2. Internal gain setting amplifier
3. Power down mode
4. Telephone answering machine



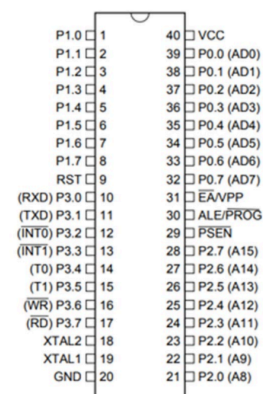
**Fig. 4. DTMF Decoder**

## 2. AT89C51

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pinout.

## Features-

1. Fully Static Operation: 0 Hz to 24 MHz
2. Three-level Program Memory Lock
3. 128 x 8-bit Internal RAM
4. 32 Programmable I/O Lines
5. Two 16-bit Timer/Counters
6. Six Interrupt Sources
7. Programmable Serial Channel
8. Low-power Idle and Power-down Modes



**Fig.5. AT89C51**

### 3. RELAY

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any

number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.



**Fig.6. Relay**

## RESULT

When the call is initiated and the keys are pressed the DTMF decoder decodes the signal into such form so that it can be further processed by the microcontroller to generate the specific signal to drive the driver for driving the output devices.

## CONCLUSION

One can easily achieve home security by automatically controlling the home appliances (especially for the elderly people). If someone forgets to put off any devices and if they have reached far off places from their home, then they can control the appliances with their phones. Thus, in this way one can keep track on both the things that is home and when one is busy in some workplace.

## FUTURE SCOPE

In every system there is always some extent of improvement. In our proposed system there can also be some future improvements, some of which are listed below:

1. Firstly, we can improve the stability of our system by using a feedback (SMS).
2. A GSM module can be used which acts as a wireless modem, sending and receiving data signals via radio waves.
3. The number of devices that can be controlled by the system can be increased in future.
4. The project can be made more user-friendly by employing advanced and different ways of providing inputs.

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