DTMF BASED HOMESECURITY AND AUTOMATION

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ABSTRACT

Ease to mortality is the prime concern these days. Remote access to appliances of utility counts as pioneering engineering works.For a Better home security there is an incredible need for home automation. Home not only needs to be secure but also the home appliances need a more efficient and automatic control system. Moreover, wastage of a huge amount of electricity due to negligence or forgetfulness is one of the main problems which needs to be addressed. This project was started with a simple aim of making the lighting and cooling in a room power efficient and automatic. This project controls the lighting, cooling, lock, curtains and buzzer of a room on the basis of cell phone input, temperature sensor, light sensor and the infrared sensors. It also has the mode of home locking and intruder alarm. This project works on 9 different modes. It is based on the 8051 microcontroller platform and works on 220 volt AC. By adding DTMF to this system, it allows a person to have complete control of his appliances from anywhere in the world by just dialling to the number and pressing a key in the keypad.

Keywords: *DTMF, Home-Automation, infrared sensor, temperature sensor*

I.   INTRODUCTION

Artificial intelligence (AI) is the intelligence of machines and the branch of computer science that aims to create it.AI textbooks define the field as "the study and design of intelligent agents where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success" [1]. AI is that aspect of computer science that focusses on creating machines, capable of engaging on behaviours considered as intelligent by humans. System are being created by researchers , which can understand speech, mimic human thought, beat the best human chess player and innumerable other feats which were never possible before.

DTMF Based Home Automation System is an artificial intelligence system that incorporates the control of lights, air conditioner, curtains, lock and alarm in a room. The control is based on the condition of light outside the room, the temperature of room, number of persons in the room and the DTMF input to the system.

II.   WORKING

The system works on nine modes:

▪   **MODE 1**

Automatic double light, curtain and air conditioner control:

This mode is selected by pressing key "1" of the keypad of the mobile phone when it is connected to the system via a head phone or by pressing the key "1" of the phone from which a person is calling to the phone connected to the system. In this mode the system checks the counter which is incremented and decremented by the two infrared sensors to see whether there is any person in the room or not. If there isn't any person in the room, the lights are shutoff. The air conditioner is also shut off and the curtain remains in the same position as it was before. If the value of counter is greater than zero which means that the room isn't empty, the lightning, curtains and air conditioner are set/reset according to the condition of light sensors and temperature sensors. If the light outside is good enough, the lights in the room are shut and the curtains are closed so that the outside light illuminates the room and power is saved. If light outside the room isn't enough, the lights are set on and curtains are opened. The air conditioner is set on and off depending on the temperature of the room. If the room temperature is less than 24 degrees Celsius, the Air Conditioner is shut down and if the temperature is more than 24 degrees Celsius, then air conditioner is set on.

▪   **MODE 2**

Automatic single light, curtain and air conditioner control:

This mode is selected by pressing key "2" of the keypad of the mobile phone when it's connected to the system via a head phone or by pressing the key "2" of the phone from which a person is calling to the phone connected to the system. In this mode, the system checks the counter which is incremented and decremented by the two infrared sensors to see whether there is any person in the room or not. If there isn't any person in the room, the lights and the air conditioner are shutoff and the curtain remains in the same position as it was before. If the value of counter is greater than zero, which means the room isn't empty: the lighting, curtains and air conditioner are set/reset according to the condition of light sensors and temperature sensors. This mode is the same as mode 1, only difference is that in MODE 1, two lights were set on and off, but in MODE 2, only one light is set on and off depending on the conditions. Also here, the second light is always set off.

▪   **MODE 3**

Automatic double light and curtain control, air conditioner always ON:

This mode is selected by pressing key "3" of the keypad of the mobile phone when it is connected to the system via a head phone or by pressing the key "3" of the phone from which a person is calling to the phone connected to the system. **In this mode, the air conditioner is always set on, irrespective of the counter value and the temperature conditions**. In this mode, the system checks the counter which is incremented and decremented by

the two infrared sensors to see whether there is any person in the room or not. If there isn't any person in the room, the lights and the air conditioner are shutoff and the curtain remains in the same position as it was before. If the value of counter is greater than zero, which means the room isn't empty; the lighting, curtains and air conditioner are set/reset according to the condition of light sensors and temperature sensors. . If the light outside is good enough, the lights in the room are shut and the curtains are closed so that the outside light illuminates the room and power is saved. If light outside the room isn't enough, the lights are set on and curtains are opened. **This mode can be used for cooling of the room before entering into the room so that temperature of room is in comfortable range.**

- ▪ **MODE 4**

Automatic air conditioner control and double lights ON and curtain open:

This mode is selected by pressing key "4" of the keypad of the mobile phone when it is connected to the system via a head phone or by pressing the key "4" of the phone from which a person is calling to the phone connected to the system. **In this mode, both the lights are on and curtains are open irrespective of counter value and light conditions outside the room. This mode can be used at the places where the outside light intensity remains low or for the places where the lights shouldn't be shut at any time of the day like control rooms, hospitals etc.**

- ▪ **MODE 5**

All OFF mode:

This mode is selected by pressing key "5" of the keypad of the mobile phone when it is connected to the system via a head phone or by pressing the key "5" of the phone from which a person is calling to the phone connected to the system. **In this mode, the lights, air conditioner, all are turned off. The curtains remain in their previous state. The counter remains counting the number of people inside the room irrespective of OFF state. So after moving from MODE 5 to other mode, the counter doesn't provide wrong data.**

- ▪ **MODE 6**

All OFF with lock on and intruder Alarm activated:

This mode is selected by pressing key "6" of the keypad of the mobile phone when it is connected to the system via a head phone or by pressing the key "6" of the phone from which a person is calling to the phone connected to the system. **In this mode the lighting and air conditioner, all are turned off.** The electromagnetic lock of the door is turned ON (i.e. room is locked) and also the infrared sensors are activated. If there is an obstruction in between any of the infra-red sensors (meaning there is any intruder inside the room), the buzzer is set ON. We can use siren instead of buzzer too as it is switched on and off through a relay which has the capacity of conducting large currents both AC and DC. The buzzer acts as an indication that there is some intruder in the room and can also serve as an alarm call to police in case it is used in banks or other offices. The buzzer can't

set off manually. The buzzer is set off by changing the mode of the system. Thus it provides acknowledgement to the owner of the room, who can change the mode of system.

- **MODE 7**

Manual mode: Lights On, Curtain On, Air Conditioner On:

This mode is selected by pressing key "7" of the keypad of the mobile phone when it is connected to the system via a head phone or by pressing the key "7" of the phone from which a person is calling to the phone connected to the system. In this mode the lights, air conditioner, and curtains remain on, irrespective of the counter value and the conditions of temperature sensor and light sensor. Electromagnetic lock as well as Curtains are also open in this mode.

- **MODE 8**

(Manual mode)

Lights OFF, Air Conditioner ON, Curtains ON:

This mode is selected by pressing key "8" of the keypad of the mobile phone when it is connected to the system via a head phone or by pressing the key "8" of the phone from which a person is calling to the phone connected to the system. This mode can also be called as sleep mode in which lights remain off, curtain remains open and air conditioner remains always on irrespective of the conditions of counter, temperature sensor and light sensor. **This mode can also be used in cinemas or while using a projector in the room.**

- **MODE 9**

Automatic mode with curtain closed:

This mode is selected by pressing key "9" of the keypad of the mobile phone when it is connected to the system via a head phone or by pressing the key "9" of the phone from which a person is calling to the phone connected to the system. **In this mode, the curtains are closed all the time irrespective of the light sensors.** In this mode, the system checks the counter which is incremented and decremented by the two infrared sensors to see whether there is any person in the room or not. If there isn't any person in the room, the lights and the air conditioner are shutoff and the curtain remains in the same position as it was before. If the value of counter is greater than zero, which means the room isn't empty; the lighting, curtains and air conditioner are set/reset according to the condition of light sensors and temperature sensors. . If the light outside is good enough, the lights in the room are shut and the curtains are closed so that the outside light illuminates the room and power is saved. If light outside the room isn't enough, the lights are set on and curtains are opened. . The air conditioner is set on and off depending on the temperature of the room. If the room temperature is less than 24 degrees Celsius, the Air Conditioner is shut down and if the temperature is more than 24 degrees Celsius, then air conditioner is set on.

NOTE:

The 0, #, * in the keypad of mobile phone are not used in this system. So clicking on them will yield no change in the mode of the system.

III.   OVERVIEW OF BLOCK DIAGRAM

The block diagram depicts the eight main blocks that form the A.W.R., the brief functions of which are as follows:

1.   Power distribution Module:

Its function is to supply power to each and every part of the system and uses 7805 and 7812 voltage regulator.

2.   Microcontroller Module:

It consists of 40 pin, 8051 microcontroller which has processing functions.

3.   I.R. Sensing Module:

It consists of two IR transmitters and two (TSOP-1738) I.R. receivers.

4.   Temperature Sensing Module:

Its function is to sense temperature (by LM35) and it gives out digital output by using LM3914 and 7432.

5.   Light Sensing Module:

It has a function of sensing light (by LDR) and giving digital output by using 74LS15.

6.   Output Module:

It consists of two lights, an air conditioner and a buzzer controlled by ULN2803 and 12 volt relays.

7.   DTMF Module:

This module makes use of MT-8870 DTMF decoder for mode selection by means of a cell phone calling.

8.   Curtain Control Module:

It consists of DC geared motors controlled by L293D.

9.   Lock Module:

It consists of an electromagnetic lock controlled by ULN2803.

IV.   DESIGN:

A.   DTMF:

Dual-tone multi-frequency (DTMF) signalling is used for telephone signalling over the line in the voice frequency band to the call switching centre[2]. It is used for telephone tone dialling which is known as TOUCH-TONE. DTMF assigns a particular frequency (consisting of two separate tones) to each key so that it can easily be recognised by a microprocessor. The signal generated by the DTMF encoder is a direct algebraic summation, in real time, of the amplitudes of two sine(cosine) waves of different frequencies, i.e., pressing '5' will send a tone made by adding 1336 Hz and 770 Hz to the other end of the line [3].

The DTMF module comprises of a DTMF decoder chip which changes tones into digital outputs. It is an 18 pin chip with the following circuit design:
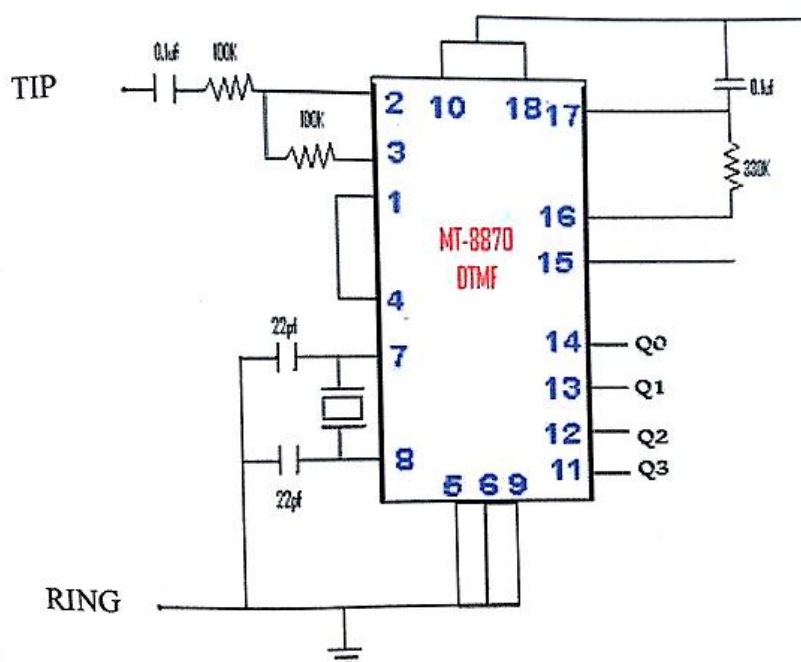
Fig 1: Circuit Diagram of DTMF Decoder Chip

Button	Low DTMF Freque- ncy (Hz)	High DTMF Frequ- ncy (Hz)	Binary Coded Outpput			
			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

Fig 2: DTMF Frequencies Tone

KEYPAD NO.	BINARY OUPUT	FUNCTION
0	1010	NOT DEFINED
1	0001	Mode 1
2	0010	Mode 2
3	0011	Mode 3
4	0100	Mode 4
5	0101	Mode 5
6	0110	Mode 6
7	0111	Mode 7
8	1000	Mode 8
9	1001	Mode 9
*	1011	NOT DEFINED
#	1100	NOT DEFINED

Fig 3: Output Function of Numbers

B.   LIGHT SENSING:

This module enables the detection of light by using light detecting resistor with the 74LS15 chip which is able to produce digital output. Due to the light falling on the LDR, its resistance drops which is directly proportional to the intensity of light.

C.   ELECTROMAGNETIC LOCK:

An electromagnetic lock is a locking device that entails an electromagnet and armature plate. The electromagnet is fastened to the door structure and the armature plate to the door. Moreover, a current passes through the electromagnet and attracts the armature plate holding the door closed. The basic principle of an electromagnetic lock is electromagnetism. It is used to lock the door when energized considering that the holding force is linear to the load.The lock and armature plate should be face-to-face to attain optimum operation.
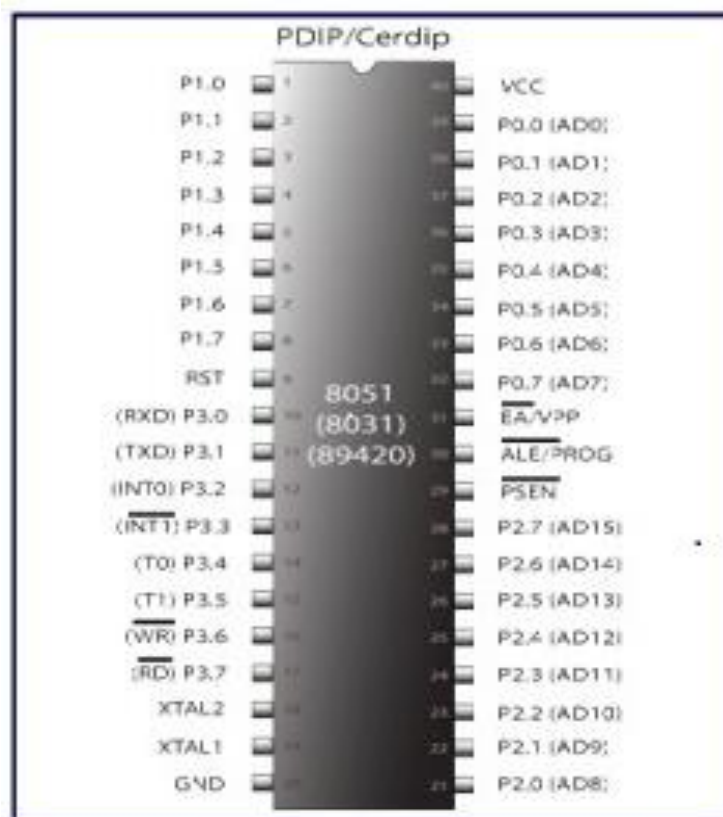
D.   MICROCONTROLLER:
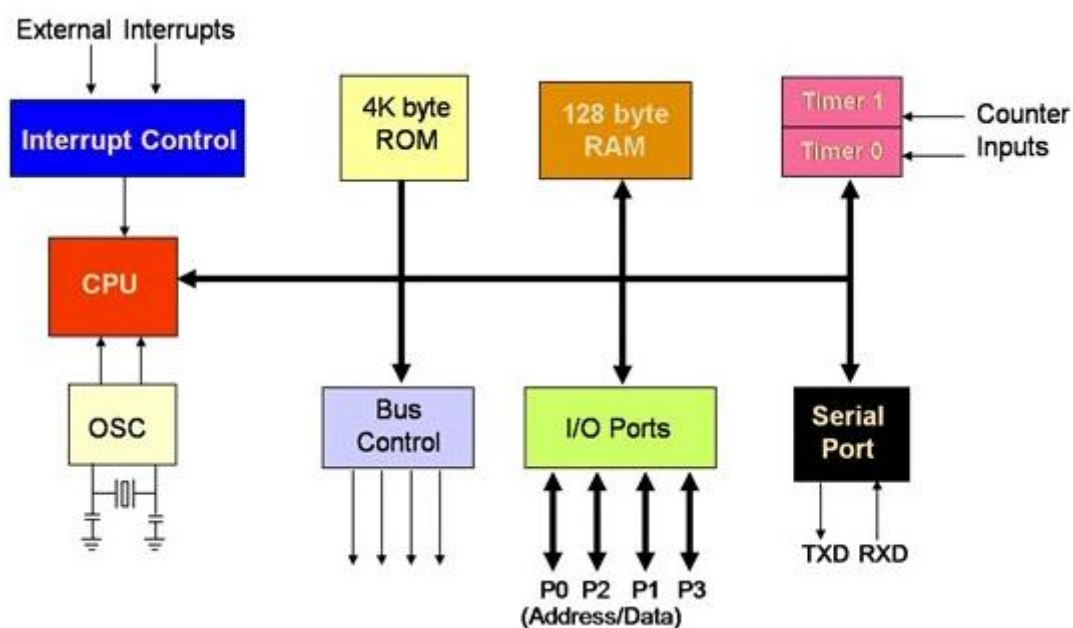
Fig 4: Pin Diagram of 8051

Fig 5: Microcontroller 8051 Block Diagram

FEATURES OF MICROCONTROLLER DESIGN:

- **CPU (Central Processor Unit):**

A CPU examines and accomplishes all processes that are carried out in the Microcontroller. User has no power over the functioning of CPU. It construes program printed in storage and carries out all of them. CPU handles different types of registers in 8051 microcontroller.

- **Interrupts:**

Interrupt is a sub-routine call that reads out the Microcontroller's key function or job and helps it to takes on some other program which is more significant at that point of time. The characteristic of 8051 Interrupt is extremely beneficial as it benefits in emergency cases. Interrupts provides us a method to postpone or delay the current process, carry out a sub-routine task and then all over again restart standard program implementation. Interrupt is an extremely important and constructive characteristic of 8051 which is basically a sub-routine call that reads the microcontroller's key function and helps by providing a method to postpone the current process, carries out a sub-routine task and then restarts the standard program implementation all over again.There are 5 interrupt supplies in 8051 Microcontroller, two out of which are timer interrupts, two are peripheral interrupts and one is serial port interrupt[4].

- **Memory:**

Microcontroller needs a program i.e. a set of commands which enlighten the microcontroller to perform specific tasks. A storage space is required by these programs so that they can be gathered and interpreted by microcontroller. This memory is renowned as program memory or code memory, commonly known as READ ONLY MEMORY OR ROM.

- **Bus**

Buses are group of wires which role as communication channels or mean for transfer of data. A bus comprises of 8, 16 or more cables and can bear 8 bits, 16 bits all together. The two types of buses are address bus and data bus.

- **Oscillator:**

A microcontroller 8051 consists of an on-chip oscillator which works as a time source for CPU[5]. It essentially facilitates harmonized employment of all pieces of 8051 micro controller.
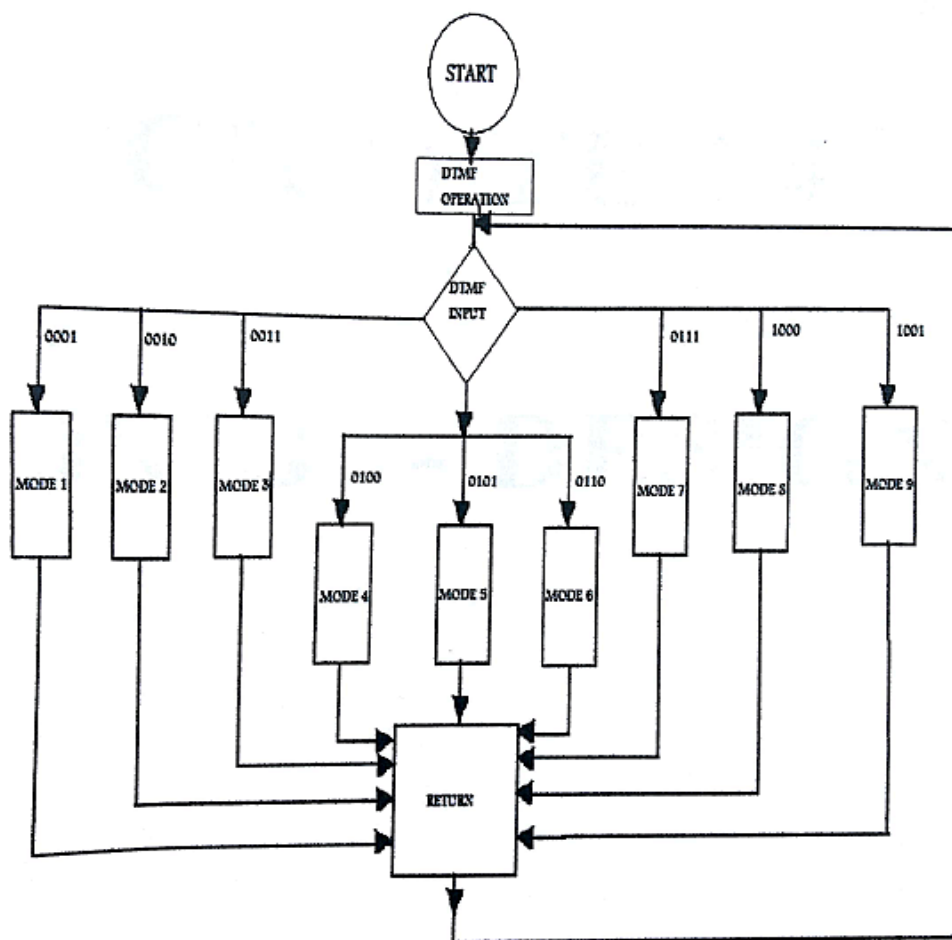
V.   SOFTWARE DESCRIPTION:

Fig 6: Flowchart

VI.   CONCLUSION:

This paper presents an efficient method to control household system bringing home automation into our lives. The DTMF based microcontroller is made into a programmable access system that allows telephony as the medium to switch "ON" and "OFF" an appliance. The system makes use of cell phone to grant access to the appliance distinctly. The cell phone dialler has numbers which have their individual dial frequencies which are pre-requisitely set up for "ON" "OFF" and error signal using DTMF. This system requires to be set up in the domains of mobile network .It has the capability to detect unauthorized entry other than "ON" "OFF" and informing it via error signals and hence the buzzer alarm .Thus a person can operate the appliance from any place using his cell phone. . This project helps to lessen human efforts and preserve resources. It is more reliable and can be used for security purpose. Moreover, the system is intelligent enough to take decisions on its own and is cost-effective as the components used are inexpensive and readily available.

VII.   ACKNOWLEDGEMENT

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