Smart Home (Home Automation)

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Abstract-   The wide availability of sophisticated devices in markets today had laid paths for developing consumer base models at lesser cost of resources. The result has been incorporated of wide variety of techniques and technologies in development of every application. Home automation is one such area that has been incorporated different technologies like IoT,DTMF,wireless etc and further evolved into what we know as Smart home. Home automation is using technology to control and perform daily chores, saving time and energy. We purpose a cell-phone and Arduino based home automation system that works through DTMF decoder, Arduino Uno and Relay connected to different appliances. With the increase in the availability of smart devices there is an increased threat of security, We have thus introduced a smart door locking systems that triggers the alarm during an intrusion.

Keywords: Automation, Arduino Uno, DTMF, Smart home, Appliances.

I.   INTRODUCTION

The aim of the proposed system is to develop a cost effective solution that will provide controlling of home appliances remotely and also enable home security against intrusion. The thought is to introduce a low cost, low maintenance control system that works on minimal power input. Though devices connected as appliances consume electrical power, these devices should be controlled i.e. turned on/off as and when required. In this system, we are going to develop a DTMF based home/office appliance control-system along with the door-lock security system As a result, much importance has been given to this aspect and a range of remote controls are prevalent today. One of the most common form are the systems prevalent on DTMF based automation system. Our product is an adaptation of the same principal of DTMF based automation system, we are going to control our appliances wirelessly. The first part of the circuit is connected to few of the home appliances (lamp, fan, TV, etc) to turn on/off the connected appliance from Smart Phone. The second part of circuit is connected to the sensor placed in front of the door, further connected through the Arduino UNO board to the buzzer.

The circuit can be activated up to 5-7 meters. It is very easy to build and can be assembled on a general-purpose PCB. For this purpose we made a circuit that consist of a DTMF Decoder, Arduino UNO, Relay, Led's, connecting wires, Aux Wires, Breadboard, Mobile phone.

II.   OBJECTIVE OF THE STUDY

To implement prototype of home automation system controlled by a Smartphone. To design a user friendly, safe system to control home appliances along with door safety system to be useful to the elders and handicapped.

III.   MATERIALS REQUIRED

DTMF 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 the 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. In DTMF there are 16 distinct tones. Each tone is the sum of two frequencies: one from a low and one from a high frequency group. There are four different frequencies in each group.
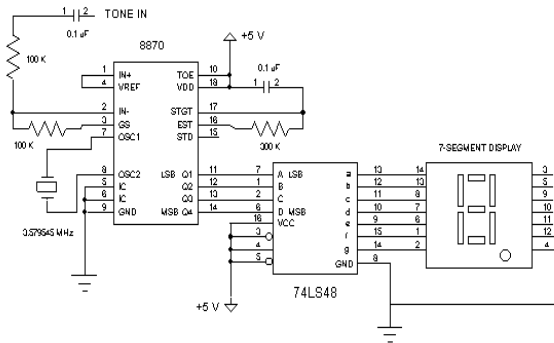
Figure 1. Circuit for DTMF Decoder

Arduino UNO: In our project Pin 4, Pin 5, Pin 6, Pin 7 is the input pins. These pins are connected to Pin D0, Pin D1, Pin D2, and Pin D3 of the DTMF controller. Pins on Arduino UNO are connected to Vcc and Ground. Pin 8 is connected to LED1, Pin9 to LED2, pin 10 to LED3.On pressing different numbers on mobile keypad various ON/OFF functions are controlled. Codes for performing different operations on selection of various buttons are uploaded here. Also, Code for Buzzer is run on the Arduino UNO.
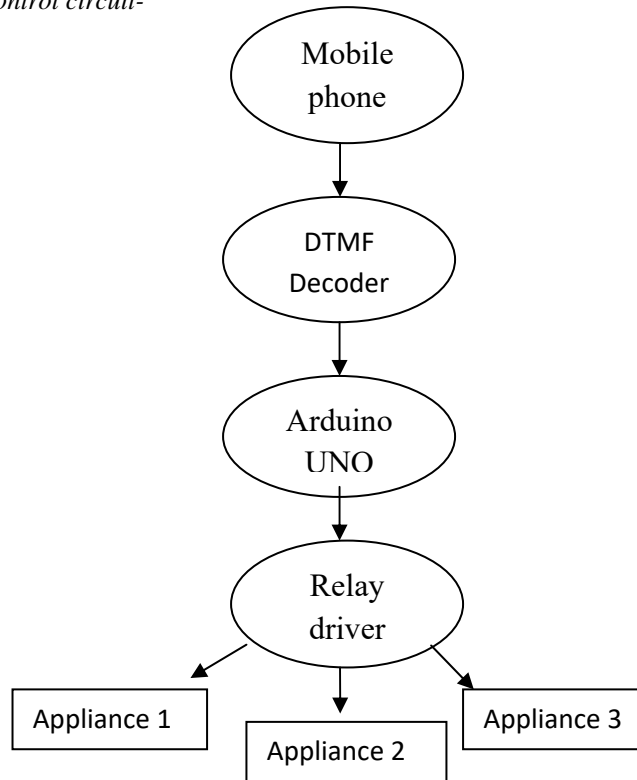

Figure 2. Arduino UNO

*Relay driver:*The IC used is UL2003.The relay is usually provided with 4 terminals, two of which are connected to relay winding and other two are connected to the circuit to be controlled. The Red light on the Relay board turns on when power is applied (via the VCC pin). When power is applied to one of the Channel pins, the respective green light goes on, plus the relevant relay will switch from NC to NO. When power is removed from the channel pin, the relay will switch back to NC from NO.
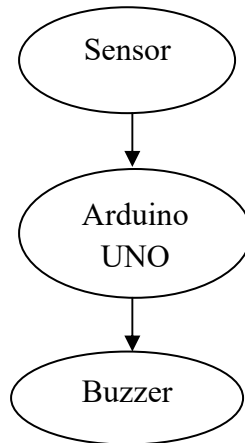

Fig 3: Relay driver

Sensor: Sensor is composed of photodiode which are light sensitive. When sensor senses a white radiation then 0 is send to arduino and then buzzer alarm is activated. This indicates that the door is open. When sensor senses a dark radiation then 1 is send to arduino and no buzzer alarm is activated. This indicates that the door is close.

IV.   DESIGN OVERVIEW

A.   Appliances control circuit-

```
        ┌──────────────┐
        │    Mobile    │
        │    phone     │
        └──────────────┘
               │
               ▼
        ┌──────────────┐
        │     DTMF     │
        │   Decoder    │
        └──────────────┘
               │
               ▼
        ┌──────────────┐
        │   Arduino    │
        │     UNO      │
        └──────────────┘
               │
               ▼
        ┌──────────────┐
        │    Relay     │
        │    driver    │
        └──────────────┘
        ╱      │      ╲
       ▼       ▼       ▼
┌───────────┐ ┌───────────┐ ┌───────────┐
│Appliance 1│ │Appliance 2│ │Appliance 3│
└───────────┘ └───────────┘ └───────────┘
```

Flowchart 1: Appliances control

B.   Door locking system-

```
        ┌──────────────┐
        │    Sensor    │
        └──────────────┘
               │
               ▼
        ┌──────────────┐
        │   Arduino    │
        │     UNO      │
        └──────────────┘
               │
               ▼
        ┌──────────────┐
        │    Buzzer    │
        └──────────────┘
```

Flowchart 2: Door locking control

V.   CONSTRUCTION

In the process of realizing this project, the construction was initially carried out on a breadboard to allow for checking and to ascertain that it is functioning effectively. All irregularities were checked then tested and found to have a

satisfactory output. The component were then removed and transferred to a board strip and soldered into place and all discontinuous points were cut out to avoid short-circuiting.

VI. WORKING

Here, We have included some pictures from our hardware model of the appliance as shown by the following
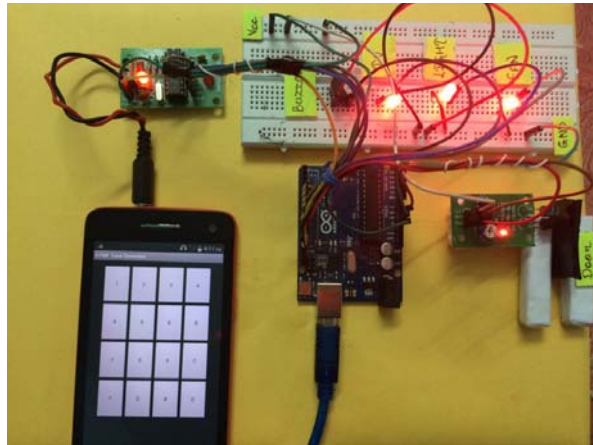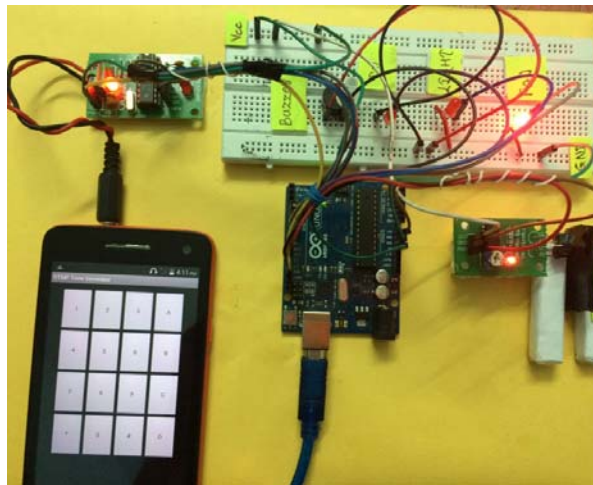

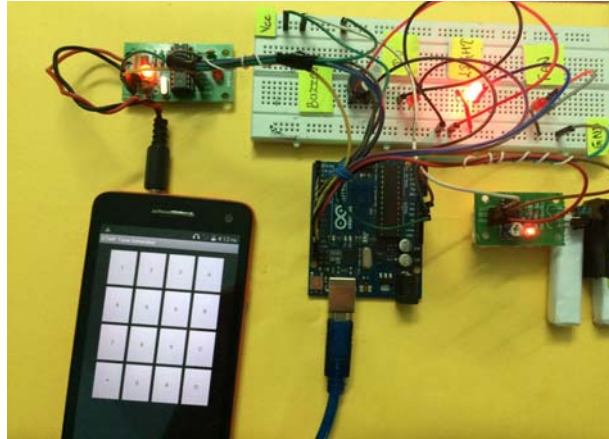
Fig 4: All appliances ON
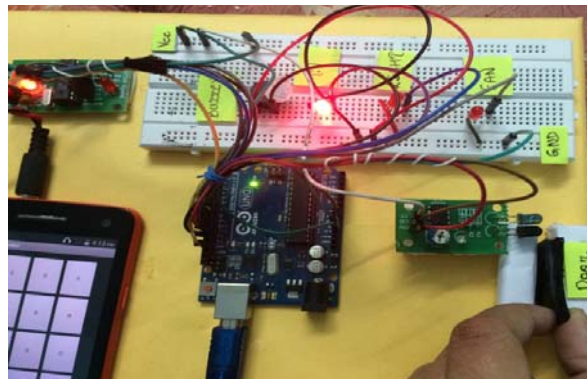

Fig 5: Appliance 1 ON

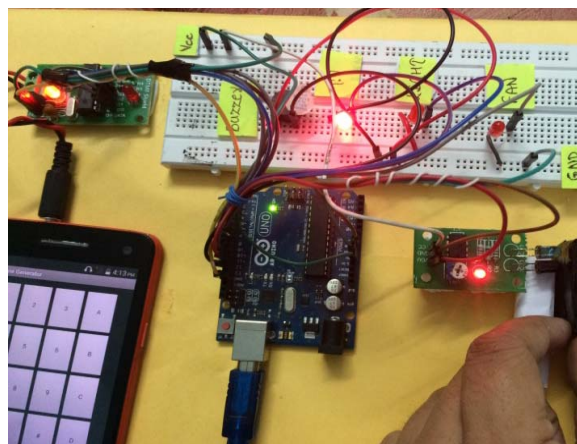Fig 6: Appliance 2 ON

Fig 7: Appliance 3 ON, Door open
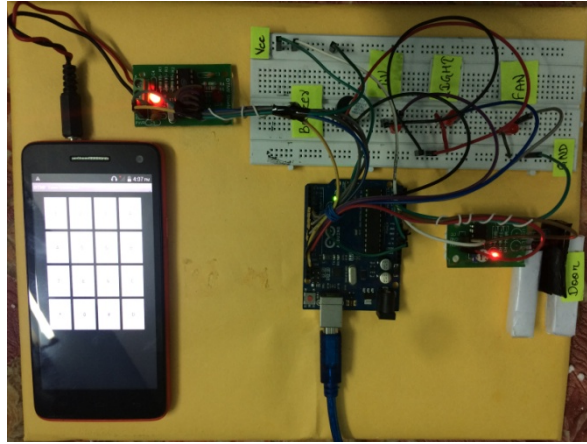

Fig 8: Appliance 3 ON, Door closed

Fig 9: All appliances OFF

VII.   RESULT AND DISCUSSION

In this project, pin 4,5,6 and 7 are the input pins of the arduino UNO. Pin 8,9,10,11 are the output of arduino connected to different appliances (shown by led here).On basis of program coded into arduino the led glows and goes off depending on the pressing of button on keypad. Assume appliance 1 be fan,applicance 2 be light, appliance 3 be TV. All appliances off from button 1. All appliances on from button 2. fan off from button 3. fan on from button 4. light off from button 5. light on from button 6. The sensor deactivates itself when the door is open and raises an alarm through the buzzer.

VIII.   CONCLUSION

In this paper we present a prototype of home automation using DTMF and Arduino along with a door-lock system. This proposed system has a vast scope and limitless applications. When implemented its full potential, it can help minimize energy consumption. This system can be modularized which will help us achieve complex functionalities..It can extend a security feature which can use Computer Vision to detect hand motions, which in emergency may be used to turn on an alarm. Also the system can be made to take necessary decisions based on the conditions. Also, with the use of artificial intelligence we can make the system learn the changes that needs to be adapted in a particular situation. Thus, making the system completely reliable by using a hi-tech technology to make our home safe with least efforts.

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