DTMF Based Security Robot-SECBOT

An ease for un-manned security

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***Abstract*— This Research involves the current technologies like DTMF (Dual Tone Multi-Frequency); GSM module; sound sensor; GPS locator which are present in a smart phone, which are combined together to retort out the issue of Security. DTMF is a methodology used by the help of phones for the communication signalling on telephone lines in the voice-frequency band between a user and the switching device. Whereas the sensors like sound sensors are used in a manner where the quantities like sound are converted into electronics understandable language .The operations which we have used here are for availing humans the facility of security purposes as well as for the defence system of a country; controlled by the help of a simple cell phone which they often use in their life. For having great versatility and various applications with key features such as GPS location, automatic obstacles avoidance, thief sensing, edge detection and hence giving an alert to the user in the form of text message or a call. This is how we can easily use this rover in different aspects for home security as well as in different other fields by the help of modification and advancing technology of programming and interfacing.**

***Keywords*— DTMF; GSM Unit; Microcontroller 8052; Sound Sensor; Thermal Sensor; Defence Security; smart phone.**

I. INTRODUCTION

The technical branch which we have used here is Robotics; a combination of various techniques i.e. controlling, intelligence, sensors feedback as well as processing information. Being feasible and easily adaptable this type of bots in the field of robotics can be easily acceptable in the society or in the defence because of their wide applications and acceptable modifications.

While for our concern here, the major discussion on this paper is on the security possibilities which can be easily availed by the humans through machines .In this context we have designed a bot for security easily activated by the user whenever he will feel its necessity by a simple phone call. However this bot can be easily used by the defence system of a country where infiltrations in borders are frequent and causes bloodshed.

The methodology used here is the application of here is the involvement of technology of DTMF combined with thermal sensors which will effectively produce a very efficient result. Earlier efforts include the work of [1] J. Hrabec and B Honzik which have designed a soccer playing remote through human intervention [2]. Tung Y. Lin, who worked on the development of The Development of Intelligent Home Security Robot by using GPS module as well as RF module. [3]Yun Chan Cho, who worked on developing a Remote Robot Control System based on DTMF of Mobile Phone using CDMA external module, for varying the speed of the robotic vehicle. [5] Yi Jincong developed the Intelligent Robot Obstacle Avoidance System Based on Fuzzy Control that utilizes signals of the ultrasonic sensors to avoid obstacle and fuzzy theory with sensor signals is used to control the speed of the wheeled mobile robot and make it move to target location. [7] Sng Hong Lian developed an obstacle avoidance mobile robot which is controlled by a Fuzzy logic controller which can also measure the distance and climb up the walls in which the Fuzzy logic concept was adopted. [8] Password protection. Karthi Balasubramanium worked on developing a robot for object recognition and obstacle avoidance using the concepts of image processing and SONAR technology. [9] Y. Shimosasa, J. Kanemoto,H. Horri results of the test operation of a security service system and autonomous guard system.[10] Guangming Song, Kaijian Yin, Yaoxin Zhou and Xiuzhen Cheng, TA Surveillance Robot with Hopping Capabilities for Home Security.

Our work provides a benefit here i.e. of wider coverage by the help of DTMF as well as robust control by cell phone This robot has occupied a maximum region of area for coverage, as a result it can also be used to reach the places where humans accessibility or reach is still a question such as small tunnels, no man's land which are near borders, and other weird places etc. In this manuscript, we are controlling this rover through a wireless communication system using DTMF technology, GSM technology [12] through a cell phone and thermal, sound sensors. As the system is supplied with 5V, the thermal sensors will be activated at the time of requirement and it will detect the presence of human or any other type of intruder in the case of home or either in the field areas like border. As the

call is made to the robot, the robot will get activated and start moving in the premises for where it has been designed by the developer. After being moving in the premises the bot will be ready to listen any type of sound in the premises by the help of sensor. Now when a sound will take place as a sign of intruder it will wait until that sound occurs for 5 to 6 times than it will start its motion towards that location. After getting to the location as mentioned it will scan and set the alarms and send the text message to the user. The similar case can be seen for the defence areas i.e. whenever there will be infiltration the bot will start moving to that location and thereafter it will scan for images and if the result will come positive than it will send the location through GPS [13] and text the prior saved message to the operating switching device.

II. OVERVIEW OF THE TECHNOLOGY USED

A. DTMF Description

DTMF stands for dual tone multiple frequencies. DTMF generation is a composite audio signal of two tones between the frequency of 697Hz and 1633Hz [6]. Its coding definition can be expressed as:

$$f(t)=A\_\{a\}\sin(2C\{a\}t)+A\_\{b\}\sin(2C\{b\}t) \quad (1)$$

In the formula (1), the two terms separately express the Values of low and high voice frequency. Aa and Ab respectively indicate the sample quantization baseline of tone cluster of low voice frequency and high voice frequency, and the ratio of their amplitude is:

$$K=Ab/Aa \ (0.7<K<0.9) \quad (2)$$

The DTMF keypad is arranged such that each row will have its own unique tone frequency and also each column will have its own unique tone. Below is a representation of the typical DTMF keypad and the associated row/column frequencies. When any of the key like "1", "2", "*", "#" etc is pressed particular code is transmitted. This code is consist of two frequency among which one is higher frequency and second one is lower frequency(see Fig 1).columns.

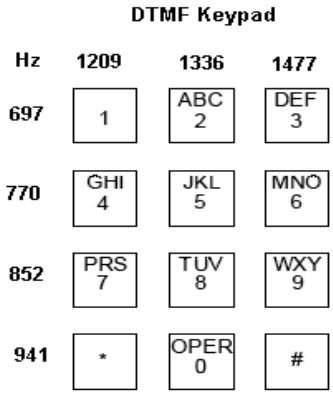

Fig. 1 Visual of DTMF Numberpad

When any DTMF code has been received at mobile phone it can be audible through speaker. So to decode this DTMF code speaker output itself can be used. Output of speaker is connected to IC MT8870 which is DTMF decoder IC. It used widely to decode DTMF code. It gives 4-bit digital output Q1; Q2, Q3, and Q4 according to the received key (see Fig. 2).

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

Fig. 2 The equivalent digital output for each key.

An MT8870 series DTMF decoder is used here. All types of the MT8870 series use digital counting techniques to detect and decode all the 16 DTMF tone pairs into a 4-bit code output. The built-in dial tone rejection circuit eliminates the need for pre-filtering. When the input signal given at pin 2 (IN) in single-ended input configuration is recognized to be effective (see Fig. 3), the correct 4-bit decode signal of the DTMF tone is transferred to D1 (pin 11) through D4 (pin 14). Outputs D0 through D3 outputs of the DTMF decoder are connected to port pins of Microcontroller.

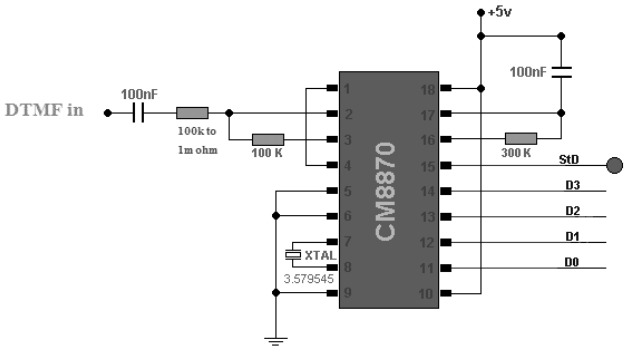

Fig. 3 Connection Diagram for MT8870

B. Infrared Sensor

Infrared sensors are used here for the purpose of edge avoidance so that the bot will not fall out of his track. As it is well known that everybody above 0K emits infrared radiations and so we are using here i.e. the bot will emit have infrared sensor which will emit infrared wave through it; and as soon as the receiver stops absorbing the waves the output will become zero and thus the bot will be programmed in a way to turn from his path. The circuit of infrared is shown in is (see Fig.5).

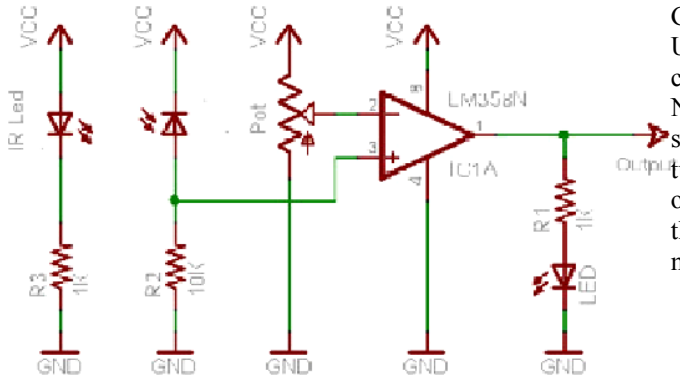

Fig.4 Infrared Sensor.

C. Sound Sensor

The purpose of attaching sound sensor here is to confirm the arrival of unwanted person in the premise of user. The IC used here is a 555 timer i.e. here a voltage is generated by our sensor as it receives any sound for 5 times in our premise. This voltage is thereafter used for further action. The diagram shows us the circuitry used for our sound sensor in a NE555N IC. . The circuit of infrared is shown in is (see Fig.6).

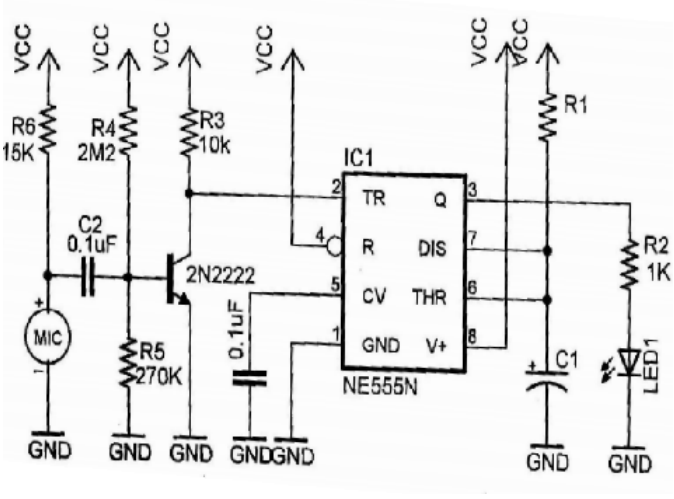

Fig.5 Sound Sensor Design.

III. PROPOSED DESIGN

A. Block Diagram and Description

The Microcontroller 89S52 [11] is the heart of this vehicular system which is interfaced with various sensor units as well as GSM module, DTMF Decoder and a motor drive to drive the motors of the robot. When the power supply of 5V is supplied to the system and as soon as the user will call on the cell phone attached with the vehicle through an earphone, the caller will receive a text message about the intruders work in his premises. Sound Sensor is connected to the "INT1" pin, GPS locator is connected to "INT0" pin, Obstacle Detection Unit is connected to "TIMER1" pin and Thermal Sensors is connected to the"TIMER1" pin of 89S52 Microcontroller. Now $_{\text{suppose}}$ for an instance, The robot is moving forward and it senses an obstacle in front of it, it will immediately stop there, turn right and move or suppose it senses any noise in the room or place for 5 to 6 times than a Interrupt is generated and as the interrupt is generated the microcontroller will send a text message to the user that "intruder is sensed".

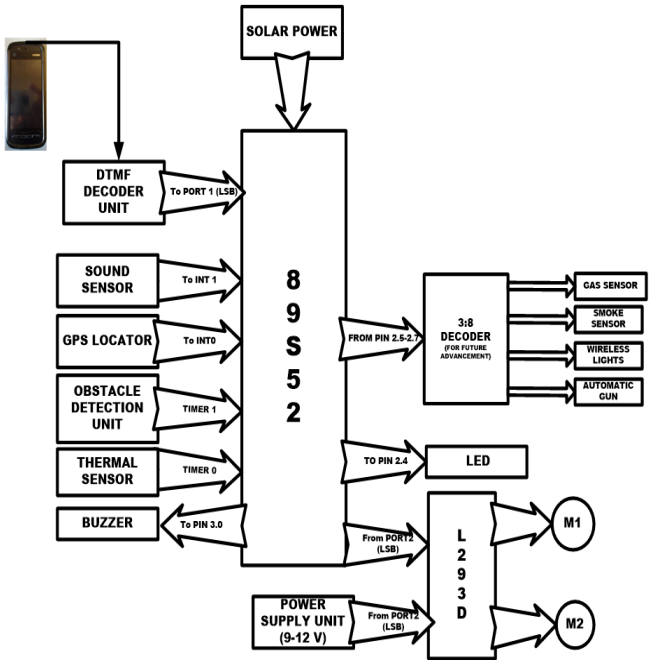

Fig. 6 Block Diagram

This is how this robot works. We have drawn this Block Diagram (Fig. 7) and this process Flowchart using Microsoft Visio software. Also the flow chart of our device is shown below in (Fig. 8)

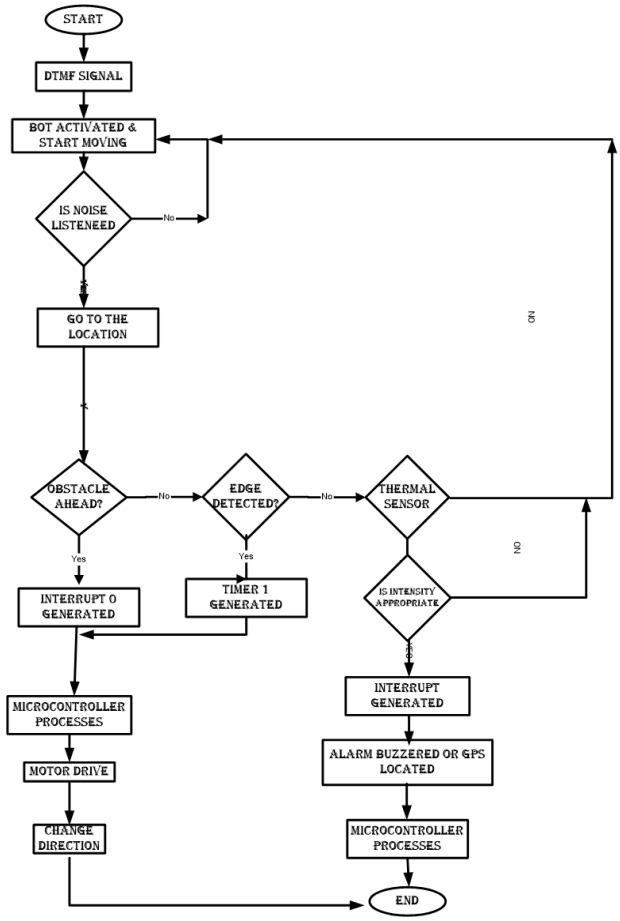

Fig. 7 Process Flow

B. *Software Simulation*

The simulation of the code written below is also shown in (fig.8*)*

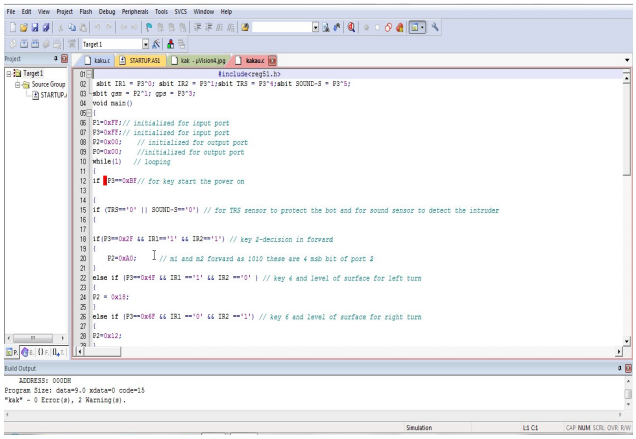

Fig.8 Simulation of Code in µVision4 software

The simulation result shown above was done on Micro vision 4 and the coding used for it is

```
#include<reg51.h>
 sbit IR1 = P3^0; sbit IR2 = P3^1;sbit TRS = P3^4;sbit SOUND-S = P3^5;
sbit gsm = P2^1; gps = P3^3;
void main()
{
P1=0xFF;// initialized for input port
P3=0xFF;// initialized for input port
P2=0x00;    // initialized for output port
P0=0x00;    //initialized for output port
while(1)   // looping
{
if (P3==0xBF// for key start the power on

{
if (TRS=='0' || SOUND-S=='0') // for TRS sensor to protect the bot and for sound sensor to detect the intruder
{

if(P3==0x2F && IR1=='1' && IR2=='1') // key 2-decision in forward
{
            P2=0xA0;      // m1 and m2 forward as 1010 these are 4 msb bit of port 2
}
else if (P3==0x4F && IR1 =='1' && IR2 =='0' ) // key 4 and level of surface for left turn
{
P2 = 0x18;
}
else if (P3==0x6F && IR1 =='0' && IR2 =='1') // key 6 and level of surface for right turn
{
P2=0x12;
}
else if(P3==0x8F && IR1 =='1' && IR2 =='1')     // key  8 for back ward
{
P2=0x15;
}
else if(P3==0x5F)// key 5 to stop
{
P2=0x10;
}
else if (P3==0xCF)    //   # key to stop the whole circuit
{
            P2 == 0x00;   // red led is on

}

else
{
P2=0x00;        // stop if any other condition red led is on
}
}


else
{
P2=0x00;        //for buzzer on
```

```
void gsm();   gsm on,send the meSOUND-Sage at mobile
}}}
}
void obs-avoid()interrupt 2
{
IE = 0;
P2 = 0x18;  // move left
}
void gsm()
{
        int gps=0;
        int gsm =0;
        EA = 1;
        TMOD = 0x30;
        TH1=TH2=0xE8;
        SCON = 0x40;
        TR1 = 1;
        SBUF = gps;
        gsm = SBUF;
}
```

The Debugging of the code is shown in Fig.9 with Microcontroller simulation at the frequency of 11.0592 MHz

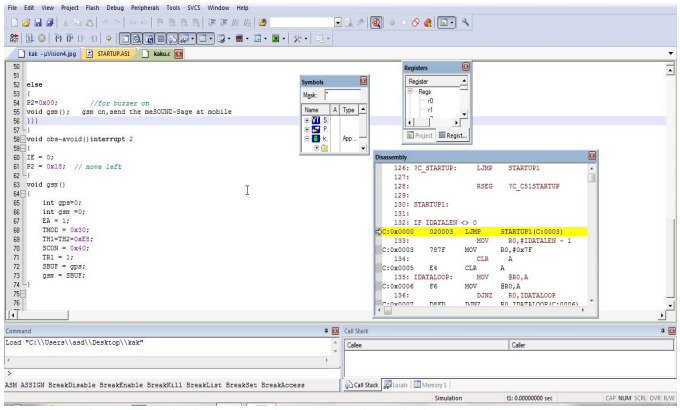

Fig.9 Simulation of Debugging of Code in µVision4 software

IV. APPLICATIONS AND FUTURE SCOPE

A. *Military use*

This can be a great asset to save lives of both people along with soldiers in case of terrorist attacks like the one happened in 26 Nov, 2008 in Mumbai, India. Unmanned Aerial Vehicles (UAVs) will likely play an increased role in search and rescue in the United States. Slowly other European countries are thinking about making use of these vehicles in case of natural calamities & emergencies.

B. *Alarm Phone Dialler*

By replacing DTMF Decoder IC CM8870 by a 'DTMF Transceiver IC CM8880, DTMF tones can be generated from the robot. So, a project called 'Alarm Phone Dialler can be built which will generate necessary alarms for something that is desired to be monitored (usually by triggering a relay). For example, a high water alarm, low temperature alarm, opening of back window, garage door, etc.

C. *Pick and Place Arm*

This robot can be modified by attaching a robotic arm which will pick and place the robot in the back carrier box [5]. In process of picking an object, one arm will be constant and other arm will move. This other arm grasps the object and picks it up. For this purpose motor of 100r.p.m, 30r.p.m will be used to control and move arm and it will work according to instruction it got from microcontroller through GSM (by operator). If yes then the arm will move 180 degree upwards and keep the object in carrier box. And this takes place with help of motor will move the robotic arm through a rod this all control and instruction are all under Microcontroller.

V. CONCLUSIONS

The main conclusion derived by doing this project is that the future of human world will be more secure if the modifications are achieved in the Robotic World. The main advantage of this bot is that the user will be able to get notified prior about the intruder in his premises .Considering all the situations, the robot integrated with different sub modules can be used for redemption and security purpose.

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