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DTMF Based Robot for Security Applications

N. Mohan Raju¹, M. Naga Praveen², A. Mansoor Vali³, M. Amrutha⁴, K. Jaya Theertha⁵
^{1,2,3,4,5}Department of ECE, JNTUA

Abstract: The main idea is to implement microcontroller based application which can provide security like video monitoring, fire safety, bomb detection using metal detector and identifying nearby obstacles using ultrasonic sensor. For this we are using DTMF [Dual Tone Multi Frequency] technique which is as in build feature in some mobiles and GSM technology.

The sensors used for indicating the variations in the surroundings and are interfaced to the micro controller along with a mobile which supports DTMF by using DTMF decoder on the receiver side. GSM modem is also interfaced to the controller through a driver IC max232 for serial communication. The controller will monitor the present state of these sensors and if there is any change in the state of the sensors, it will send the message to the predefined mobile number. Then we will establish a call between the controlling mobile and the remote mobile. Now any key pressed on the mobile will generate a frequency, which can be heard on the mobile placed on robot. That frequency can be detected by controller by means of DTMF decoder. Keys assigned for control can be User Defined for controlling like robot movements. Here we are using a mobile phone in which the Android app is installed in it through which the camera is linked to the Android web camera via Wi-Fi in laptop and video is monitored in laptop and we are controlling the rotation of the phone to see all sides.

Keywords: ARM processor, DTMF decoder, GSM, fire sensor, ultrasonic sensor, metal detector.

I. INTRODUCTION

The main objective is to design a system which provides a solution to make known of the surroundings, robot are used instead of human beings to make aware of new places. So, we have proposed a DTMF based robot for security applications which can be controlled remotely by a mobile phone so the mobile which is mounted on robot and it will be monitored via internet from pc. Camera in the mobile can be used to visually control the robot directions within a range so this can be used to make aware of new places by collecting information.

Thermister is used to detect the fire, controller will alerts the system and sprinkler will be on to control the fire. By using sound waves we will identify obstacles in ultrasonic sensor. Using electro magnetism principle we will detect metals. In this project we use regulated 5V, 500mA power supply. 7805 is a three terminal voltage regulator which is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

II. PROPOSED METHOD

The main application of the project is video monitoring and controlling using mobile phone.

In this project we are using ARM7 processor which is interfaced with a DTMF decoder and GSM modem. The technology is DTMF (dual tone multi frequency) in this we require a mobile phone that is mounted on a robot. Android app is installed in the phone that is placed on the robot. After installation that is linked with the camera on the android web in pc via wifi. Video is monitored in pc. Using mobile phone we are going to call the mobile no. placed on the robot. After lifting the call we need to give commands opening dial pad in the phone that is present in our hand. For every key in the dial pad there is a specific tone of two different frequencies i.e lower frequency and higher frequency.

A. The Different Frequencies of Each Key in Dial Pad are as Follows

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

DTMF digits

Figure1: DTMF keys with frequencies.

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When we press a specific key in phone that is in our hand a tone is generated and it is received at the phone on robot. At the DTMF decoder we obtain the tone which consists of both higher and lower frequencies. that will be decoded by the decoder and the obtained output will be in the form of 4-bit binary data and it will be sent to the arm processor and identifies the command given at transmitter side by the processor and makes the movement of the robot.

B. The Following are the Binary Codes that are used here

Command	Address	DTMF module output
Forward	04	0010
Backward	05	1000
Left	07	0100
Right	06	0110
Stop	00	0101

Here the key '4' indicates the front move
 '5' indicates the back move
 '6' indicates the right move
 '7' indicates the left move
 '0' indicates stop

These four bit data is given as input to the motor driver circuit based upon the input provided the motor circuit enables the motors. Each motor circuit is capable to drive two motors. So there are two enable pins present on circuit when the four bit data is 0010 – forward the two motors gets enabled and robot moves in forward direction. When the motor gets enabled the indication is '10' i.e. one terminal is given with supply Vcc and another with ground. So when the two motors is on the output is '1010'.

The four bit data input to the processor is '1000' then the processor understand the code i.e. backward direction and moves the robot in backward movement by giving the supply '0101' to the motor enable pins.

If the data is '0110' then the movement of the robot is towards right side and the motor output is '0110'. Similarly if the data is '0100' then the movement of the robot is towards left side and the motor output is '1001'. Finally if the data bits are '0101' the robot is going to stop and all the enable pins are grounded i.e. no power supply is given to pins and the motor output is '0000'.

C. The Detailed Information is Tabulated as Follows

DTMF module inputs	Motor Outputs
Forward - 04- 0010	1010
Backward -05- 1000	0101
Left -07- 0100	1001
Right -06- 0110	0110
Stop -00- 0101	0000

D. GSM: Global System For Mobile Communications

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GSM is a digital technology used for transmitting of mobile voice and data services. Here in the place of GSM previously used technologies are zigbee etc. A sim is inserted in the GSM modem and is used for transmission of messages between GSM and phone. We need to send an SMS to the sim inserted in modem with *any mobile no. that we need to receive messages.

Example: *9618009000

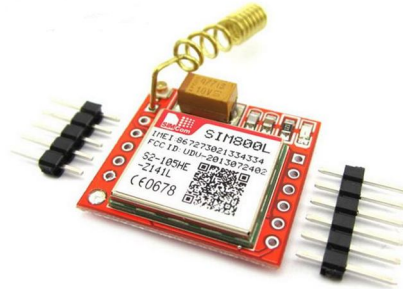


Fig: GSM MODEM

E. We are using an LCD on Which the Sensor Information is Displayed and we are using 16*2 LCD and is as Follows

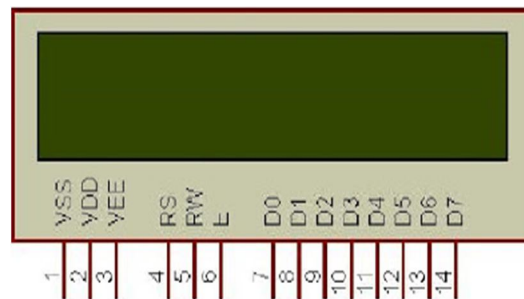


Fig: LCD display

The main intension of using GSM is for receiving messages when the variations in the surroundings are detected using sensors. We are using fire sensor used for detection of fire and automatically it turns on the water sprinkler towards the fire. Immediately a message indicating 'FIRE ON' is sent to our mobile .so that we can easily identify the fire accidents in our surrounding areas.

We have one more sensor placed on robot is ultrasonic sensor which is used for the detection of obstacles in the surrounding areas. The ultrasonic sensor consists of two sections transmitter and receiver parts. The transmitter transmits the sound waves from the echo pin of sensor and calculates the distance of the obstacle present from its position when the sound waves are reflected back to the trigger (receiver) pin of the sensor after they hit an obstacle. Whenever an obstacle is found the message 'OBSTACLE ON' is sent to us via GSM.

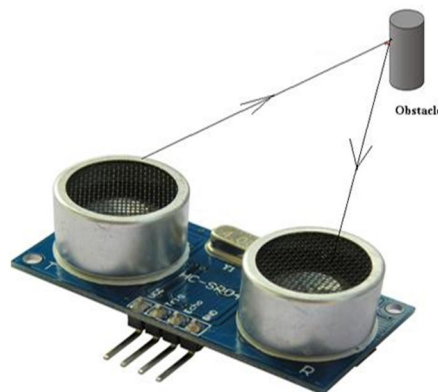


Fig: ultrasonic sensor with transmitter and receiver parts

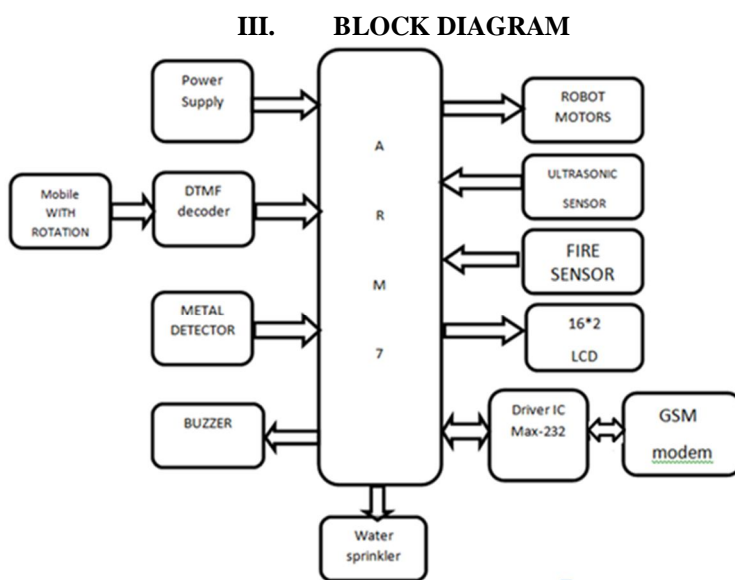
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Figure: ultrasonic sensor

Metal detector is used for the detection of the metals when the robot is moving. it is used for bomb detection. When the robot detects metals the message 'METAL ON' is received.

A buzzer is used here all the time when there is a change in the input to the sensors the buzzer beeps a sound indicating that sensors are in active (on).



IV. RESULTS



Fig: video monitoring on pc

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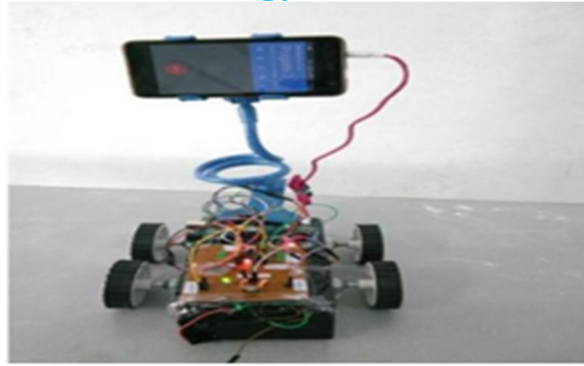


Fig: robot controlling using mobile phone



Fig: LCD

V. CONCLUSION

This project is designed and tested successfully. This project is mainly for the purpose of security applications like video monitoring and controlling using mobile phone. We can monitor the surrounding areas using the mobile phone placed on robot. This can be implemented in military applications for security applications for identifying the persons when they are approaching near to us. Human life can be saved here when we send a robot instead of a human.

We also have the ultrasonic sensors used for the detection of persons. Fire detection sensor detects the fire and immediately turns on the water sprinkler. Obstacle sensor is used for detection of obstacles

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N. Mohan Raju has done his B.Tech from St.Johns College of Engg. & Tech, Kurnool and M.Tech from Bharath Institute Of Engineering And Technology, JNTUH. He is presently working as a Assistant professor in department of ECE, BITS-kurnool. He has published 6 International Journals .His research areas of interest are Embedded Systems & Image processing.

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M. Naga Praveen is pursuing B. Tech. final year in Electronics and Communication Engineering branch at Brindavan institute of technology and Science, Kurnool



A. Mansoor Vali is pursuing B. Tech. final year in Electronics and Communication Engineering branch at Brindavan institute of technology and Science, Kurnool



M. Amrutha is pursuing B. Tech. final year in Electronics and Communication Engineering branch at Brindavan institute of technology and Science, Kurnool



K. Jaya Theertha is pursuing B. Tech. final year in Electronics and Communication Engineering branch at Brindavan institute of technology and Science, Kurnool



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