GSM Based Wireless Robot Vehicle with POF features using DTMF

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Abstract:- Today Robotics plays a fundamental role in fields of medicine, industries, home automated systems and many others. The methodology of DTMF (Dual Tone Multi-Frequency) with GSM module is used for designing our robot. Robot is controlled by a mobile, through this we can make our robot communicate on a large scale over a large distance even from different cities or place. This robot has a number of merits as well as important features such as password authentication, avoiding obstacles in its path with fire detection[POF] so that robot can protect itself from fire and hence immediately provide an alert through text messaging to the calling person with sensors being automatic in nature.

Keywords:- DTMF, GSM module, LCD display, POF, sensors

I. INTRODUCTION

"ROBOT" is an automatically operated machine that replaces manual work of humans, though it may not look much like a human being or function in a human like manner. Advanced, high-functioned robots are used today in automobile manufacturing, assembly of aircrafts, and electronic based devices use robotic devices together with other computerized instruments to sort or test finished products. Due to this demand of smart systems in every field of technology the automation is the preferred area for betterment of the society .Wireless Communication is the most evolving fields of application in current state, where different technologies can be used so as to have automated systems with easy to handle, durable and being highly accurate. Conventional, wireless-controlled robots used RF circuits, which have the demerits of limited working range, limited frequency range with limited access .Use of a mobile phone for robotic control can overcome these limitations. It provides working range as large as the coverage area of the providers of network, no interference with other controllers present in same place. So this system will be a powerful and reliable tool that will offer this service at any time, and from anywhere with the constraints of the technologies being applied.

II. METHODOLOGY

The technology used is Dual Tone Multi Frequency (DTMF). DTMF produces a audio signal of two tone from frequency of 697Hz to 1633Hz. The arrangement of keypad in DTMF is seen such that each row and column has its own corresponding frequency.

1	2	3	697 Hz
4	5	6	770 Hz
7	8	9	852 Hz
*	0	#	941 Hz
1209 Hz	1336 Hz	1447 Hz	

Figure 1 The combination of frequency for respected keys

Above seen figure 1 is a representation of the typical DTMF keypad and the associated row and column frequencies. When any of the key from 1 to 9 including special symbols is pressed (one at a time) present in keypad particular code is transmitted. This code with two frequencies among which one is higher frequency and second one is lower frequency

III.   RELATED WORKS

The early RF circuits based robots had controlled range of frequency and access to use the robot in which signals had early interference with noise and also there was a requirement of separate transmitters and receivers for transmission and reception of signals. The replaceable algorithm found was fuzzy logic based robots with ultrasonic sensors. This logic was based upon approximate data than exact data, the algorithms were knowing for few cases , values were not exact in nature, the level of difficulty in calculations was going on difficult for huge distances and Ultrasonic sensors were expensive too. The models built for calculation depended mostly on distance of travel which was also a constraint [1]. Though DTMF technology with sensors was used by early researchers to control the robot, GSM module being not interfaced with robot didn't provide text alert immediately to called person during the detection of obstacle and fire and was also not a protected type of usage where the users being unauthorized used the robots.[2]

IV. FRAMEWORK OF THE SYSTEM

A. BLOCK DIAGRAM

The heart of our -robot is a Microcontroller, programmed in Embedded C language for ATmega-32 Microcontroller with help of AVR studio. In our project POF features includes password protection by authentication, obstacle and fire detection.
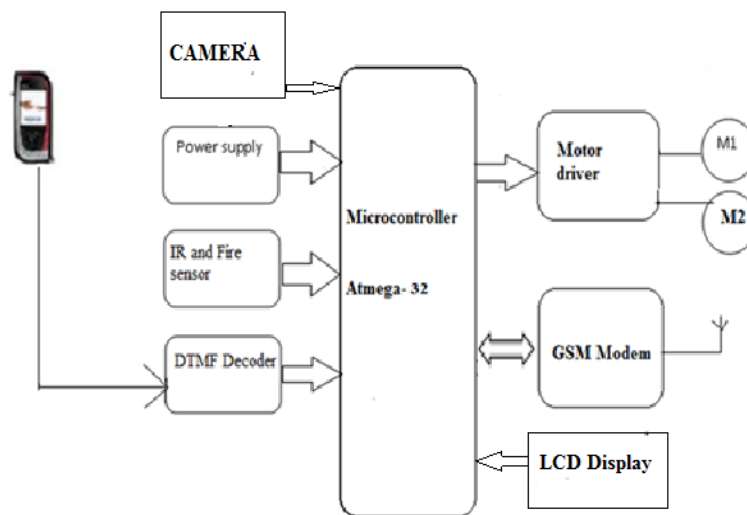

Figure 2 Block diagram

Sensor inputs as well as DTMF inputs are given to the microcontroller and hence microcontroller is programmed in such a way so that it will drive the motors according to the input as well as will send a SMS to the pre-defined cell phone number immediately after applying the power supply. In this project we use MT-8870 DTMF decoder IC which decodes tone generated by the keypad of cell phone.

The first process is to check password authentication. In this method when a user makes a call to the predefined number placed in the robot, it sends an OTP code to the authorized user. The user has to enter this code to complete the authentication procedure. Only if this process is done correctly the robot can be moved.

Then the user has to press any button either 2,4,6,8 to move in required direction. This is then sent to a DTMF decoder where the number is converted to corresponding binary digits and sent to motor driver through microcontroller. The robot will then move in the required direction.

If any obstacle is present in its way,that will be detected by the proximity sensors and the same will be acknowledged to the user through GSM module. The robot will stop immediately and waits for any command by the user. The same procedure takes place even when fire is detected.

An LCD display is used   for the display of operations being performed by the robot which indicates whether the robot is moving or any obstacle or fire is detected or not.

a.. Microcontroller

The microcontroller heart of our project used here is At mega 32 which is a modified architecture 8-bit RISC single(Harvard) chip microcontroller, which was developed by Atmel in 1996 which helps in controlling actions of motor, GSM modem,DTMF decoder and sensors.

b. A GSM modem (SIM 900)

This is a modem that works with a GSM wireless network being a phone is specialized and wireless act as interface between microcontroller (Atmega 32) and GSM network helps in auto call receive by providing a authenticating user to access the robot sending a message alert during obstacle and fire is being detected to the authenticated user with help of its AT commands.

c. DTMF Decoder (MT8870)

This helps in providing a decoded value (dual tone) for particular key pressed, using which particular motor is drive on or off respectively which in turn help in movement of robot.

e. A Motor driver

This has L293D with DC motors works in H-Bridge principle which receive the commands from microcontroller and helps in driving the motors for required directions.

f. IR and Fire sensors

These help in detection of obstacle and fire respectively and is indicated through message alert to the user by commands given from microcontroller. LED being absent in fire sensor cause the main difference between two sensors

g. A LCD Display

A LCD display of (16*2) is being used which helps in display of internal working taking place during the call process.

i**.** Power supply

A power supply of +12V is used for power up of the robot devices used.

V.   SOFTWARE USED

In this project, to design the Block diagram Microsoft Vision software is used. For of the Microcontroller, we have used AVR STUDIO in Embedded C language ie, for code generation and creating a hex-file of generated code and program IFP software for microcontroller program burning.
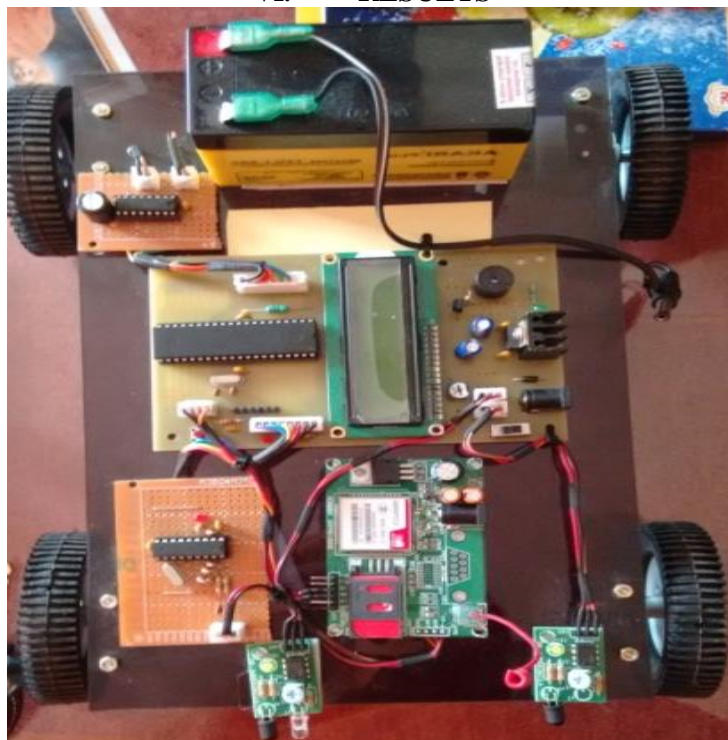
VI.   RESULTS

Figure 3 Final robot views

Implementation results:

1. The robot is initialized and the robot modules such as motor driver, DTMF decoder etc is powered up for the access and microcontroller waits for the initialization of GSM command.

Figure 4 Initializing robot

2. The Initialized robot is seen in this step where the GSM initialization is seen and ready to send OTP password to the calling user when an attempt is made to access the robot.

Figure 5 Initialized robot

3. For authentication purpose the 4 digit OTP (one time password) being generate is sent by GSM module to pre- stored number entered in the program when this password has to be entered by user as seen in next step

Figure 6 Sending otp

4. The received Password is being entered by calling person through the keypad of cell phone which is verified by robot for futher access in turn enabling DTMF option in a basic cell phones but smart phones doesn't require this enabling process of DTMF key.

Figure 7 Enter the received password

5. The password being received is entered by user,if any other numbers pressed during this process the call is disconnected and user must make a new call for access. This allows only authenticated users**.**

Figure 8 Otp being entered

6. Once the Robot is verified it is ready to be accessed works upon user commands.

Figure 9 Robot after verification

7. This shows the directions given by the user for the robot to move in which forward direction is given as the command by user in following step.

Figure 10 Directions given for front movement

8. The text alert is through GSM module sent once an obstacle or fire is detected in the path travelling.

Figure 11 Alert sent when fire and obstacle is being detected

9.This shows the directions given by the user for the robot to move in which backward direction is given as the command by user in following step.

Figure 12 Directions given for backward movement

10. This shows the directions given by the user for the robot to move in which left direction is given as the command by user in following step.

Figure 13 Directions given for left turn

11. This shows the directions given by the user for the robot to move in which right direction is given as the command by user in following step.

Figure 14 Directions given for right turn

12. This depicts the vehicle when stopped.

Figure 15 Vehicle stopped once

13. The snap shot of messages received upon fire and obstacle detection with one time password (OTP) to predefined user.
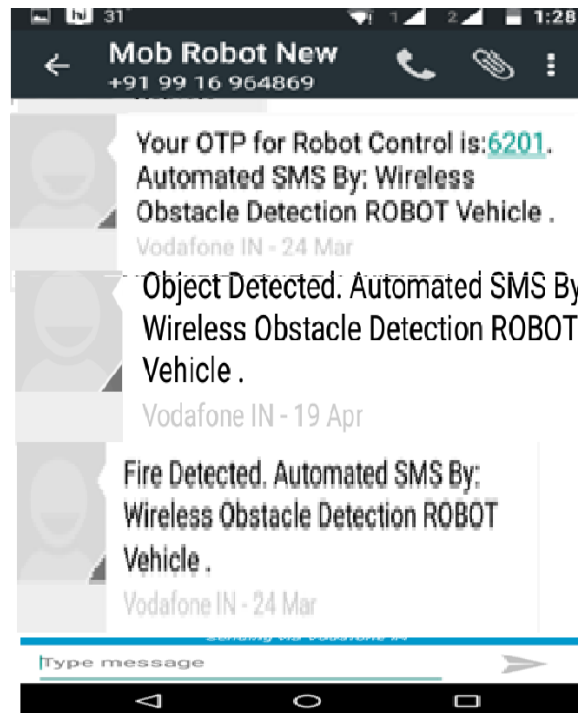

**Figure 16 The snap shot of messages received upon fire and obstacle detection with
one time password (OTP).**

VII.   CONCLUSION

a.   By developing this robotic vehicle with its multi-tasking feature, the drawbacks have been overcome of that seen in RF communication based robots which had a limited range where in this vehicle can be controlled from anywhere by usage of DTMF technology with GSM module by providing immediate text alert to the user. The main feature of this robot is that it is password protected and authenticated so that unauthorized person cannot communicate with the robot at any cost. It has various sensors and a LCD screen provided. Considering all the situations this can be used for surveillance and military applications with the help of installing the camera.

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