Long Range Spy Robot with Metal and Obstacle Detection

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***Abstract*—In present time almost everything used basically is operated by remotes. The biggest limitation of remote controlling is its limited frequency level. This paper suggests a method for robotic control using the DTMF tone generated when the user gives commands using mobile phone keypad buttons connected with a remote mobile robot. This spy robot holds four technologies together, they are- Ultrasonic Sensor, Metal Detection, Night Vision Wireless Camera and DTMF. Robot motion is done by DTMF Technology. The system uses two mobile phones, one to control the robot that sends DTMF commands via call to another mobile phone mounted on the robot vehicle.**

INTRODUCTION

Today military forces are looking for different types of robots for landmine, bomb detection, surveillance and rescue operation. Thus robots reduce the risk of their casualties and help to defeat the enemies. Our spy robot is based on DTMF technology to cover long range. The name spy robot defines the robot is used to spy the enemy terrain, as the size of robot is considerably small it is easy to spy. It can be guided by computer or mobile and can be enabled to do tasks on its own. Our idea is to control the robot by mobile, the major advantage is it covers long range and can be operated from remote areas. Nowadays wireless cameras play a very important role in security issues. Camera we used is a wireless night vision camera. It can capture picture and video information through the camera during both day and night and send it to the receiver unit. Our aim behind making this long range spy robot with Night vision camera is mainly to use it in war fields and areas of mining. This system Long Range Spy Robot with metal and obstacle detection controls the robot motion via call; after it detects metal, the buzzer starts and the motion of the robot is stopped immediately; and after encountering and detecting the obstacle also the robot motion stops immediately. It is a mobile operated robot so we don't have to worry about range. So our spy robot's aim is to spy enemy territories, to collect information from enemy terrain, and to save the lives of military people. Spying enemy territory also helps is planning attack against them from safe place, losing a robot to save our soldiers life is not a big issue.[1]

MOTIVATION AND OBJECTIVE

By using DTMF technology, operators can operate the robot via call irrespective of range and distance.

- The main aim of this robot is close observation of human activities on the war field. It also has night vision cameras to transmit the videos on field which can stop infiltration of enemies on field.

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- It will help military people to ensure safety and aim targets before entering unknown territory. Plus, metal detectors are used to detect underground metallic objects, which can protect them from unknown underground planted bombs..
- This system can be controlled irrespective of range and distance via call. This happens because of the DTMF we are using. By analysing all the situation., this system can be used for close observation technology, mining, and military application. All these applications can be accomplished by installing cameras.

2.0 LITERATURE SURVEY

This concept of long range spy robot with metal and obstacle detection is a very original system which operates irrespective of distance. This is because we are using DTMF technology which allows the user to operate the robot via call. Here we have used a microcontroller ATmega328 which is the brain of the whole system, all the sensors and other hardware is interfaced with this microcontroller (metal detector, obstacle detector, spy camera).

In order to operate the robot, we have to call on a mobile phone which is connected to the robot, therefore, we are using two mobile phones, but instead of a mobile phone that is connected to robots we can use GSM chips also. After the call is received (automatically), the operator has to send a command through the keypad of the mobile phone. This system also has a night vision camera, so users can view the captured area irrespective of day/night. Captured streaming can be viewed on a laptop. This whole system is operated via DTMF.

Priyanka Yadav1 et.al.[2] proposed an idea to design and develop a robotic vehicle using DTMF technology for remote operation attached with a wireless camera for monitoring purposes. while the receiver decodes before feeding it to a microcontroller to drive DC motors via motor driver IC for necessary work.

A metal detector is also mounted on the robot body to detect if any bomb is placed underground or nearby. If any metal is detected a buzzer will be activated in the control room to inform about it.

Mr. Lokesh Mehta et.al.[3] proposed that a spy robot can also be controlled by a computer system using its keyboard..
Wai Mo MuKha ng et.al.[4] proposed that a spy robot is used to transmit video data to the intervention troop..
Dheeraj Singh Patel et.al. [5] , cell phone controlled robot using its buttons to see the live telecast of the target place by a camera attached on the robot.
Chiranjivi M. Deshpande et.al, [5] proposed that a phone can be used as a controlling device to operate external devices using DTMF technology. So using a DTMF technology robot operation can be controlled

BLOCK DIAGRAM AND FLOW CHART OF SPY METHOD

Block Diagram of proposed Spy Robot

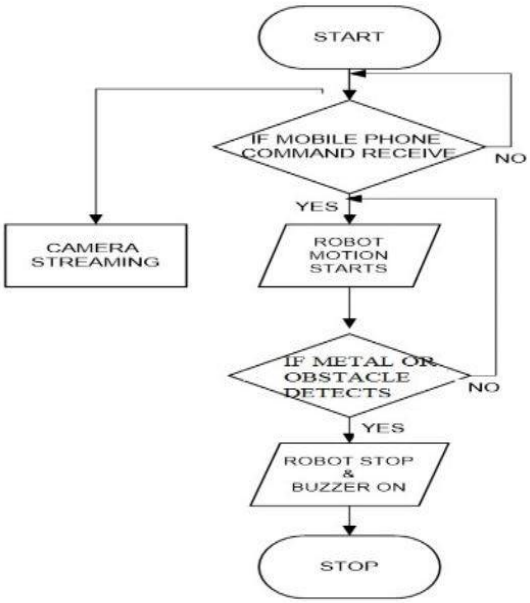


Figure 1 Block diagram of proposed method

MICROCONTROLLER: It belongs to the AVR family (ATMEGA328). All remaining hardware peripherals are connected to the microcontroller for receiving, processing and sending data.
MOBILE PHONE: Mobile is used to send commands to robots from anywhere in the world. This is done by connecting any GSM mobile phone to get a broad range to control the robot.
DTMF DECODER: Mobile phone will be connected to the DTMF decoder for accessing the commands sent by the remote mobile phone in audio format (DTMF) and decoder decodes the audio format to binary equivalent in 4 bit which is then send to the microcontroller for further process.
METAL DETECTOR: Metal detector is attached to the front bottom of the robot for detecting the landmines and the detected data is sent to the microcontroller for the process.
BUZZER: This is the metal detection alert in the form of sound, during the metal detected process the microcontroller stops the robot motion and sends a signal to the buzzer to start.
MOTOR DRIVER: Motor drivers are connected to drive robot motors having high power requirements. Based on the DTMF commands, the microcontroller sends a signal to the motor driver to drive the motors for the robot's movements.
MOTORS: DC geared motors of 12 volt attached to the robot for providing mobility to the robot. It gets a signal from the motor driver which is connected to the microcontroller.

CAMERA: Night vision wireless camera works on IP protocol which provides live streaming video data to the remote receiver. Receiver is Mobile phone or PC. If the camera gets internet access then live video can be seen from anywhere in the world.
OBSTACLE DETECTOR: The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object. So it can detect obstacles and avoid obstacles.

Flow Chart of proposed method

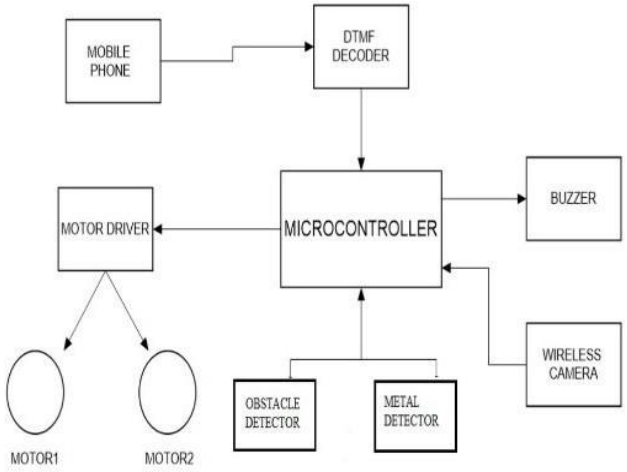


Figure 2 Flow Chart of proposed method

- 1st step: Start the system with switching on the power supply module.
- 2nd step: The continuous monitoring of command inputs from the mobile phone through DTMF decoder.
- 3rd step: If the command is received, the DTMF decoder then starts motion of the robot based on the command received.

Press key 2 for Forward motion Press key 4 for Leftward motion Press key 6 for Rightward motion Press key 8 for Backward motion Press key * for stopping

- 4th step: During the robot motion if metal or obstacle gets detected then the robot will be stopped immediately and the buzzer starts giving the alert.

- Camera does continuous streaming irrespective of the commands received or the motion of the robot.

4.0 DESIGN METHODOLOGY

Stages

In order to make it happen our idea, we have use this four steps during Process

Which are:

- Planning
- Analyzing
- Designing
- Final implementation

At the initial stage we came up with the idea 'long range spy robot with Metal and Obstacle detection'. After we studied the background work of this field. While studying in this field we found that there were limitations so we decided to overcome those limitations as much as we could. This kind of technology is useful in the war field and mining industry in order to replace humans where life is endangered. After thinking about our idea, we did research about new technology in this domain in our previous work in university in order to analyze the problem. Plus, this helps us to find more applications using this technology. then we started to build the proposed system and the way to integrate these provided systems to provide useful information.

After this theoretically working of this concept started which included studying what sensors are required? how to reduce the cost, block diagram and flow chart.

Actual implementation started in the last stage. After designing and measurements per our theoretical discussion. First, wheels are attached, in order to hold the entire robot. Then DC motors are connected to wheels and the Motor Driver is connected to the Arduino, so that it will have high power, this setup is made to give our robot mobility. After this DTMF Decoder is connected to the Microcontroller, here we have used Atmega 328 Microcontroller so that all hardware connected to enable communication between all hardware it will process data sent from both sides. A Metal Detector is attached in front of the robot if it detects metal it sends a signal to the Microcontroller and Microcontroller stops motion and sends signal to Buzzer. The Buzzer is also connected to a Microcontroller. The same with an Ultrasonic Detector is connected to Atmega328 Microcontroller so whenever any obstacle comes in it will stop the motion. all this action taken by and from Microcontroller are implemented in code through Arduino Uno. after all this setup we have use Mobile Phone that will connect to DTMF Decoder for accessing command send by remote mobile phone(or GSM model) through keypad and DTMF decoder will decode format to binary 4 bit number which is then send to Microcontroller for robot movement.

At the end after interfacing and connection is done, finally testing is performed and results are noted. [4].

WORKING

DTMF controlled robots run via call where the command is sent through the keypad of a remote mobile phone. Here we are using two mobile phones. One is with the user and another is connected to the robot. The phone with the user is the command transmitter unit and the second phone on the robot is the receiver unit.

First, we have to initiate a call from the user mobile phone to the receiver phone, and the call is received automatically via automatic answer mode function in mobile phone. Then, the user can control the motion of the robot by using different keys on the keypad of the mobile phone.

When any of the keys is pressed, a particular sound is produced from each key, this sound is captured and decoded by the DTMF decoder. This decoded information is then sent to the microcontroller, the microcontroller processes the information and sends this processed information to motor driver IC, and then the motor driver IC starts the motion of the robot accordingly.

Now, here are keys to control robot motion:

- When we press 6 from the user phone, the robot will turn right.
- When we press 4 from the user phone, the robot will turn left.
- And when we press *, the robot will stop robot motion.

The sensors used in this system are Metal detector and obstacle detector respectively.

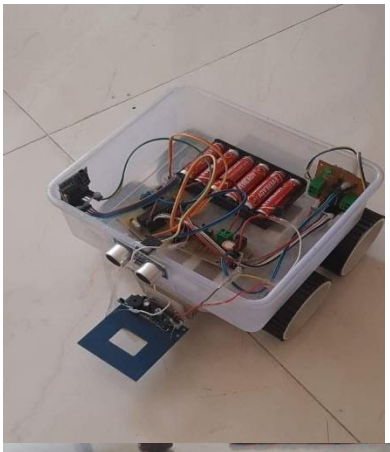
When the metal detector detects the presence of metal, it sends the generated information to the microcontroller and the microcontroller sends a high signal over the port connected to the buzzer and the motor driver, as a result the buzzer gets on and the motion of the robot stops immediately. The ultrasonic sensor which is used as an obstacle detector continuously transmits ultrasonic waves, in the presence of obstacles the ultrasonic waves reflect back and are detected by the receiver of the ultrasonic sensor. The time taken by the waves to reflect back after getting transmitted determines the distance of obstacles from the robot. As soon as the presence of an obstacle is detected near the robot, the information is sent to the microcontroller and it will stop the robot's motion.

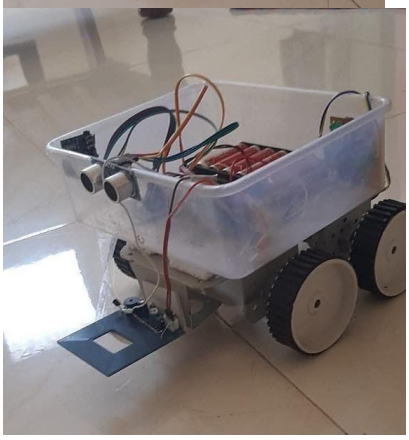
6.0 RESULT

During tests our proposed model worked as expected. This spy robot is tested to the best of our ability. We could observe accurately what is happening, our system does not cause any harm. The major advantage is DTMF technology which supports long range compared to any other technology. There is no need for any extra circuitry for night vision, which helps us to collect information and survey even during dark environments. We are able to collect the information in both pictures and video. This paper presents a new method of vision-based surveillance robot with metal detection and obstacles avoidance capabilities for general purpose robots in indoor environments.As this model is just a prototype the

range of modules is quite less.Experimental results with various positions of obstacles and metals to check the ability of robot to detect and notify have shown good precision, and time delay is very less. For future work, we will improve this system for swarm robotics.

Figure 3 Top view of the robot
Figure 4 Side view of the robot





CONCLUSION AND FUTURE SCOPE

Conclusion

The main motive of this kind of concept is surveillance of war fields or mining fields where in most of the areas human intervention is not allowed or dangerous. Spy robots are basically used for spying on the enemies and with the help of these we can prepare for counterattack to save military people's lives. This spy robot is also used to observe the mining areas. As this robot is user friendly, it can easily move, capture images and wirelessly transmit them as well as it can avoid obstacles, which alerts people about dangerous situations. This helps organizations to view things at a remote location. With available facilities and infrastructure we can be successful in designing cost effective systems to meet required applications. Wireless technology that we have used helps to handle robots efficiently without manual operation. As we are using DTMF technology, this robot can cover long range.

Another advantage of this concept is night vision camera that helps to monitor areas at night also. While developing this robotic vehicle with its multi-tasking feature, many drawbacks have been overcome, one of those is RF communication and Bluetooth based communication which has limited range,where in this system can be controlled irrespective of range and distance via call due DTMF technology.

FUTURE SCOPE

- The robot may also include a bomb disposal kit in order to diffuse the bomb in a war fileld .
- By including a PIR sensor , it can also detect human motion near a robot or area under consideration.
- We can also include voice recognition technology in future which can be used for giving commands to the robot.
- Also this concept can be further enhanced by incorporating various types of sensors like pressure , □re, temperature, etc.
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