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EFFICIENT DESIGN OF HUMANOID ROBOT FOR MILITARY AND INDUSTRIAL USES

Arjun V.A[1], Manoj Kumar T[2]

[1]UG Scholar, Electrical and Electronics Engineering Department, BC Caarmel Engineering College, Kerala, India
[2]Assistant Professor, Electrical and Electronics Engineering Department, BC Caarmel Engineering College, Kerala, India

Abstract

The purpose of this paper is to describe the design and implementation of advanced robotic technology at low cost which has huge application in military and industrial areas. The process of disposing explosives is highly risky job. So in order to reduce the risk, for detecting and disposing explosives we can use robots instead of humans. Also in industries undergoing high thermal process where a labor finds it difficult to manage the work due to uncomforted situation, in these areas implementation of a robot is lot more useful than the previous situation. So through this paper we introduce a new mode of industrial automation and robotics for military application.

Keywords: - *Internet of things, Robotic arm, voice recognition, gesture recognition, metal detector, App developing.*

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1. INTRODUCTION

In the modern era of science and technology it's all about automation and the applications of robots in industries, military, educational purpose are increasing day by day. The main focus of each and every company manufacturing robots is to design more accurate user friendly robots with large applications in domestic as well as industrial purpose.

Our intension is to create an efficient design of robot which has huge applications in military, space research and industrial applications at very low cost.

In this prototype, all movements are controlled wirelessly using Bluetooth/wifi and the response of the prototype is send to the user's device. And also all activities can be made to work on internet of things platform. We use Arduino Mega as Primary controller and ESP8266 &Arduino UNO as secondary controller for controlling the prototype and C language to program the controller. Arduino platform is very easy and user friendly for beginners. Instead of Arduino Mega we can use Raspberry pi, PIC, etc. we choose Arduino.

2. SYSTEM DESIGN

This prototype consist of robotic arm which can controlled wirelessly using Bluetooth, metal detector for detecting mine bombs and other explosives, GPS system that work on IOT platform, base consisting 4 wheels (were all other parts are placed) which is controlled using Bluetooth communication based on voice/gesture recognition, emergency flotation system which detect presence of water and activate an air pump, obstacle sensing using ultrasonic sound displaying readings on computer screen.

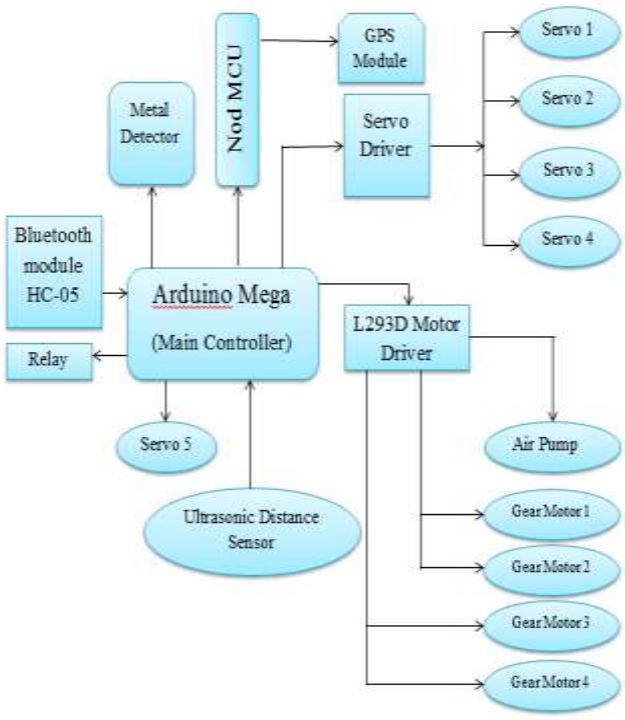

Fig -1: Block diagram of robot control

3. ROBOTIC ARM

This robotic arm consists of three servo motors each of different torque depending on the load it must carry. The control signals for the servo motors are initiated by the microcontroller when the Bluetooth module receive signal from user device(it can be smart phone, tablets or PC).[4][3][6].

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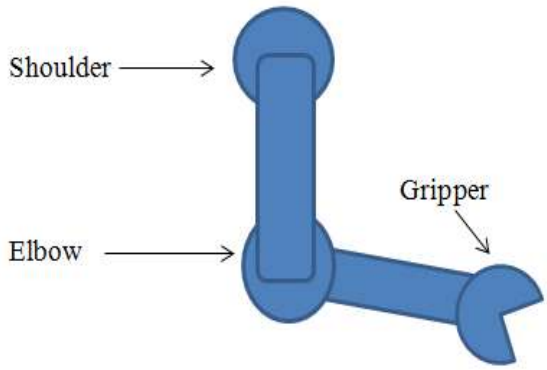

Fig -2: Structure of a robotic arm

3.1 Servo Motor

Servomotors are motors that are used in automatic control systems and they are closed loop devices. The servomotor convert an electrical signal applied to them into an angular displacement of the shaft. Servomotors are simple DC motors that have gearing and adjusting the gear ratio we can adjust the torque. For the shoulder we need servomotor with large torque. So we use S8218 servomotor which has a torque of 40kg.cm. For elbow we use MG995 which has a torque of 10kg.cm. For gripper we use a mini-servomotor which has a torque of 0.5kg.cm. [4]

Fig -3: Servo motor

3.2 Servo Motor Driver

A servo motor controller is a circuit that is used to control the position of a servo motor. It is also called as a servo motor driver. A servo motor controller consists of a controller, the servo motor and the power supply unit. Servo motor driver may be used to control a single servo or even a group of servo motors. Here we need to control three servo motors. So we must use a servo motor driver.

3.3 Control

We use android application for sending control signals to the robot. The application consists of several slide bar. Individual slid bar for each servo motor. First of all the android phone is connected with robot using Bluetooth. By sliding the bar we can adjust the angle of rotation of servo motor.

4. VOICE & GESTURE RECOGNITION VIA BLUETOOTH

In order to control the robot with voice or gesture we need to develop a receiver and a transmitter. We can use an android phone with voice/gesture recognition application as transmitter. We can easily develop an android application that link with Google Assistant to recognize voice. The receiver which is placed inside the robot consist of a controller and a Bluetooth module. HC-05 is the commonly used Bluetooth module for several projects. The Bluetooth module receive the transmitter signal and depending on the signal the execution of motor commands are done by arduino.[3]

4.1 Connection

As we know that $V_{cc}$and Gnd of the module goes to V_{cc} and Gnd of Arduino. The TXD pin goes to RXD pin of Arduino and RXD pin goes to TXD pin of Arduinoi.e(digital pin 0 and 1).

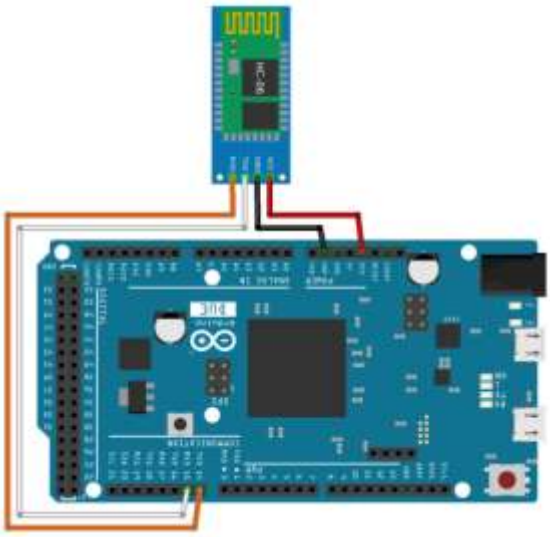

Fig -4: connection of Bluetooth module with Arduino

4.2 Android Mobile App

There are many online website for developing android application in simpler ways or we use Android Studio for developing Android application. There are many voice/gesture recognition android application available in playstore, so we can even use one of them. so the instruction for using this mobile application are[3] :

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- First, Turn ON the smartphone's Bluetooth and pair the smartphone with receiver's Bluetooth module placed in the robot.
- Then, click the 'Connect Robot' button for connecting the robot with phone.
- After connecting, click on the microphone icon on the screen. At that time Google assistant will appear on the screen and listen to our voice. We should provide the voice command at that time. Or instead of microphone icon we can choose gesture option. And a window will appear where we can draw the gesture.

5. METAL DETECTOR

For this prototype we use a simple metal detector. i.e. using 555 timer. For domestic purpose we can use metal detector to find buries metal which can be harmful to the civilians. For military application metal detection take a major role in finding mine bombs and other explosives. In this prototype we use NE555 Timer.[2]

At normal state the NE555 timer vibrate at a particular frequency. This drives the buzzer. The buzzer is used for indication. The inductor produce magnetic field when supply is given. So when this inductor is places closer to a metal or magnet the inductance of coil decreases. This decrease in inductance led to variation in frequency at which 555 IC works. So the frequency difference of 555 Timer led to change in the sound of buzzer.[2]

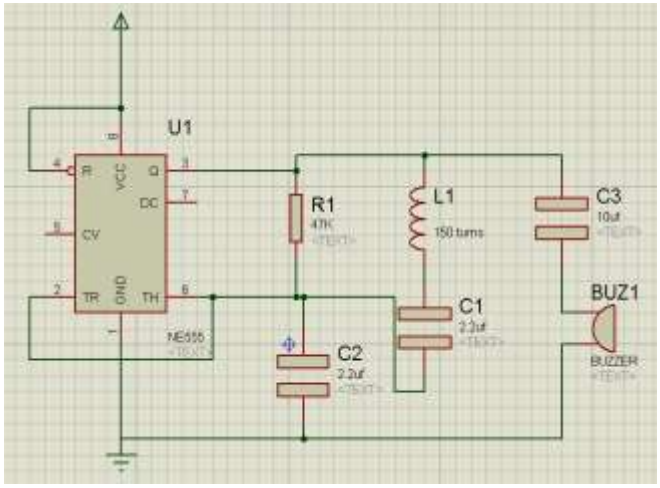

Fig -5: Circuit diagram of Metal Detector using 555 Timer

6. IOT BASED GPS SYSTEM

For an IOT based GPS system we need a Microcontroller, Wi-fi module and a GPS module. In this prototype we are using NodeMCU which include firmware which runs on the ESP8266 Wi-fiSoC, so no need of external Wi-fimodule.or else we can use arduino board with separate wifi module. If we are using NodeMCU the Rx pin of GPS module is connected to the Tx pin of NodeMCU and Tx pin of GPS Module is connected to Rx pin of NodeMCU. As we know that $V_{cc}$and Gnd of the module goes to V_{cc} and Gnd of NodeMCU.[1]

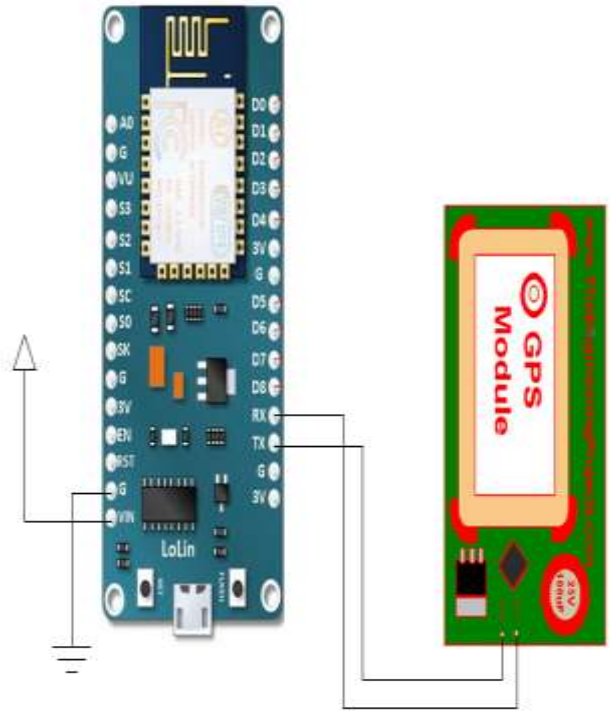

Fig -6: Circuit Diagram for IOT based GPS system

We use a mobile application to get the readings from GPS module via internet. We should have to log in to the app. Each account has an id. The id must be provided while programming. This id represent the account to which the collected data must be send. When the NodeMCU is connected to any hotspot device it sends the collected data from GPS Module to the server. So the received data will be send to the corresponding account whose id is given in the program of NodeMCU.[1]

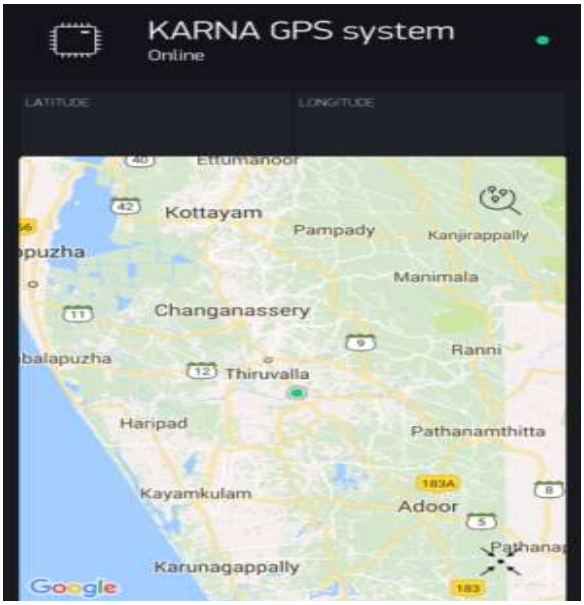

Fig -7: Screenshot of mobile application used

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7. OBSTACLE SENSING USING ULTRASONIC SENSOR

In order to detect the object we use ultrasonic distance sensors. This sensor measure the distance of target objects or materials through air using "non-contact" technology. The detected objects were displayed on PC screen. The sensor is rotated 180 degree in clockwise and anti-clockwise direction using a servo motor, the direction towards which the sensor is facing is denoted by a green line, when an obstacle is detected by the sensor the colour of the line will change to red. We use processing software to display the output.

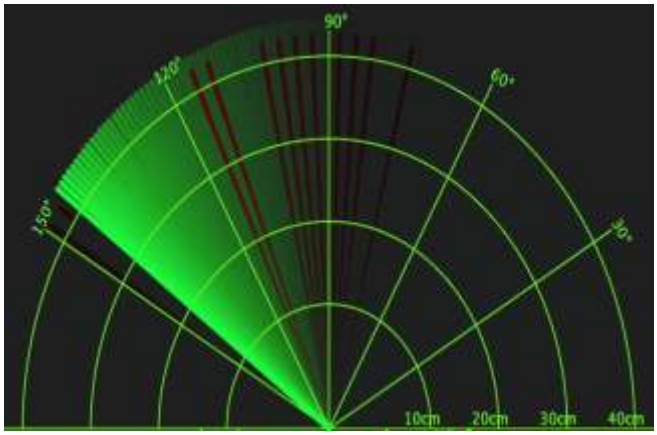

Fig -8: Obstacle sensing using Ultrasonic sensor

8. RESULTS

The prototype was successful, by using voice/gesture recognition using android app, the robot was very user friendly and was eye catching. By placing the metal detector on robotic arm it became easier to detect explosives. IOT based GPS system gives the accurate position of prototype by using android app we are able to display more data.

Fig -9: Prototype

Fig -10: Prototype

9. CONCLUSION

By designing the robotic arm we learn more about servo motor controls and to develop android application. And this helped us to design a robot that is more user friendly. The exact position of the robot is send from the GPS module in robot to our mobile via internet. With the help of the application that we developed we can see the location of robot on Google Map. So by using this we can give voice command to the robot via internet or Bluetooth. Throughthishardwareprojectwehavelearntabout voice & gesture recognition, GPS, basics of AI & Internet of Things, etc.andwehavealsodevelopedourskillinelectronicsandprogramming.Itwasgreatscopeforustotakethetechnologyalittlebitfar.

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