IoT Based Artificial Intelligence Robot System using Voice Recognition

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Abstract

The Artificial Intelligence and Robotics are inscribed of identical problems. These two fields cooperate productively in the area of building intelligence agent. The collaboration results are developed with the IoT produced the Magnificent results in the surveillance systems. We put forward a surveillance robot which can be integrated into any kind of Critical place. The controller of the robot will be the powerful Raspberry Pi 3 Model B. User will send the command through the android voice application (APP) or Web page to control the Robot. Wi-Fi connectivity (Internet) is used to communication medium between robot and smart phone. If Hollow pit or obstacle is detected the robot send an alert message using GSM module to user to ask whether I should move left or right and wait until user reply. The distance between Hollow pit or Obstacle will be measured and displayed to the local web page.

Keywords - *Raspberry Pi Model B, Android Application, Robotics, Hollow pit, Obstacle, Web page.*

I. INTRODUCTION

Traditionally, surveillance systems of voice control say that, the first term to be considered is Voice Identification i.e. prepare the system to accept human voice. Voice Identification is a technology where the system accepts the words (not its Content) given through Voice. Voice is a Perfect approach for robotic control. The robot operation is controlled by human voice-commands, can provide a potential solution to their problems.

The purpose of this project is to make a mobile robot which will be able to receive the voice commands. The Voice command can be performed at real time. Moreover, the robot has Motion detection where it does not crash against object or Hollow pit.

The Intelligent robot is controlled anywhere by using Android application or web page through Wi-Fi. Raspberry Pi 3 model-B is the major part of the proposed system. It consists of inbuilt Wi-Fi and Bluetooth in the same processor. The RPI 3 model-B is high speed achievement processor compared to the other controller. Android application is easy to handle and established by MIT App inventor.

II. RELATED WORK

Many project and system have been proposed in developing a critical area and home security system. With a common Motto, they have established a system by using various Processors and features.

In [1], the authors Discusses a system developed for remote surveillance of house using a raspberry pi 3. It is monitored to the entire system. The Result of the introduced concept successfully bypass an obstacle and also measure the distance from the obstacle to the robot. And webcam interfaced with RPI 3 robot will captured the images, Also the robot has been successfully controlled from remote place using Putty software.

In [2], the authors describe a system an Object Tracking algorithm and how to evolve a set of voice commands for moving the differential drive-based wheels of the robot. Voice-commands are given as an input side of the Android OS based platform which are handled and transmitted to cloud server in real-time. The voice-commands change to text form are then communicated to an onboard Bluetooth module of the robot, using the Blue-tooth module of the smart-phone. The Bluetooth module of the robot receives the commands in the form of text and then sends the command to the controller for future Operation. The speed control mechanism controlled through a software ensures stopping the robot before a pre-set differential delay-time. In order to make the 'Object Tracking' more robust and ensure its range of applications more dynamic, better algorithms are being developed.

In [3], The author says that the robotic arm can be controlled using Raspberry pi, android application and WIFI. Raspberry pi is used for controlling of overall system. Smart phone with Android application is used as input for the system. Using this application user can give input to the system through commands. By taking input from smart phone raspberry pi controls the robotic arm according to

given input. Android application and WIFI is used for remote control.

In [4], the author says that a robot to understand voice commands, the robot has to have speech recognition capability. A short review of speech recognition methods and available speech recognition software is discussed here. In addition, aspects of voice recognition connected with natural language interfaces for robot control are analyzed. As an example, a real movable robot system is presented. In this system voice communication is realized using a computer, with a mobile phone attached via modem and sound cards. Because the process of voice recognition depends on received sound quality, a comparison of voice commands transmitted via different mobile phones was performed.

In [5]. The author presents a robot assistant that will help the needful in hospitals, care facilities and homes. The main objective is to develop a voice-controlled machine to overcome the disability or immobility. HuBot is a wireless robot that helps a patient by performing the tasks by taking user's voice as input. HuBot is designed as a wireless voice-controlled robot using, RF module. HuBot can be used effectively with voice commands and is designed and developed with a vision to help and support the people and is developed with low cost so that it can be accessible to the people very easily.

III. SYSTEM OVERVIEW

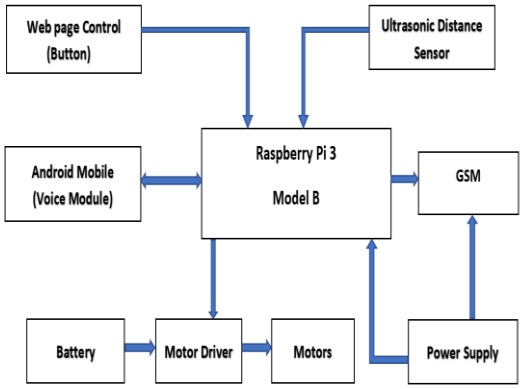

Fig .1. Proposed Block diagram

Fig. 1 Shows Block diagram for Proposed System. Raspberry Pi 3 Model-B is heart of the system. It is Interfaced with Ultrasonic Distance Sensor. Android mobile APP or Web page (Button) is placed at input for giving commands to work robot at remote side. The commands given through android application or web page is received by Raspberry pi 3. According to given commands RPI 3 forces robot to do required operation. The presence of the object and Hollow pit is sensed by using an Ultrasonic sensor. Ultrasonic sensor is which helps to distance measurement from the robot to Obstacle or hollow pit.

The Signal Access from the sensor is given to Raspberry pi-3 Model B. DC Motor which helps to the movement of the robot to the particular Direction. In User can view the robot from the Remote place and sending the Command (Voice or Button) through the Android application or web page. If the robot detects the hallo pit or Obstacle from its path, suddenly stopped to the same place. And sending the Alert Message to the User. The Power supply is the input side of the RPI system and the GSM module for the purpose of the endless process.

IV. HARDWARE REQUIREMENT

A. Raspberry Pi 3 Model-B

Raspberry Pi 3 controller is the Most popular and latest controller. The Maximum Size of the RPI is credit – card. Providing less speed of computing and process. It uses Only python programming language. Fig .2 Shows Raspberry pi 3 Model-B Module and Pin-Out Diagram.

As shown in fig.2, 40 General Purpose Input/ Output pins can be used for interfacing RPI 3 with Ultrasonic sensor, dc motors, GSM etc.

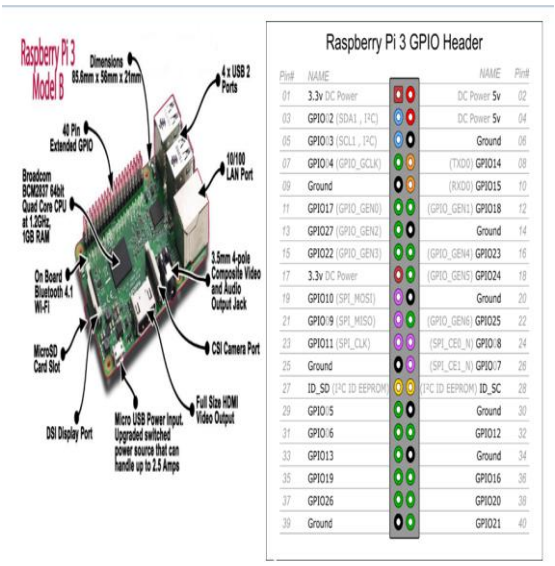

Fig .2. RPI 3 Model - B with Pin-out diagram

Aspect of RPI 3 Model-B:

- 40 GPIO Pins
- SD card extended up to 32 GB
- BCM2837 Broadcom Processor
- 1.2GHz Quad-Core ARM Cortex-A53
- Inbuilt WIFI and Bluetooth connectivity
- 1GB-RAM
- 4-USB ports
- Full size HDMI
- Camera segment V2 can be directly connected using CSI port.

- Touch screen can be directly connected to DSI port.

B. Android Mobile

Android is an open source and Linux-based operating system for mobile phones such as smartphones and tablet computers. Android was established by the Open Handset Alliance, led by Google, and other companies.

Android offers a unified method to application development for mobile phones which means developers need only develop for Android, and their applications should be able to run on different devices powered by Android.

Android applications are usually developed in the Java language using the Android Software Development Tool.

Once developed, Android applications can be packaged simply and sold out either through a store such as **Google Play**, **Slide ME**, **Opera Mobile Store**, **Mobango**, **F-droid** and the **Amazon Appstore**.

Android powers hundreds of millions of mobile phones in more than 190 countries around the world. It is the biggest installed base of any mobile platform and growing fast. Every day above 1 million new Android devices are activated worldwide.

C. Ultrasonic Sensor

Ultrasonic sensors emit short, high-frequency sound pulses at regular time intervals. It propagates in the air at the velocity of sound. If they collide an object, then they are repeated back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo.

As the distance to an object is determined by measuring the time of flight and not by the intensity of the sound, ultrasonic sensors are excellent at suppressing background interference.

D. Motor Driver IC

To drive the robot, motors are required and to drive the motors, motor driver IC's are required. As the current delivered by the microcontroller is too low and the motors require high current, motor driver IC's are used as they act as current amplifiers which take in low current input and provide high current output which is sufficient enough to drive the motors. The motor driver IC used in this project is the L293D which is a dual H-bridge motor driver IC. And also, Automatic Thermal shutdown is available.

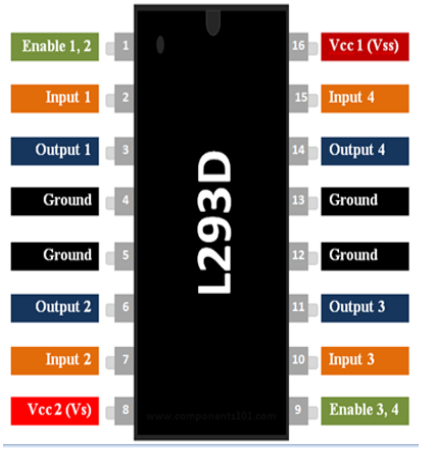

Fig .4. Motor driver IC

E. GSM: -

Global system for mobile communication is a wide area of wireless communications system that uses digital radio transmission to add voice, data, and multimedia services. It was Initially concentrated on **circuit switched** voice service. The **GSM system** leading to offers expanded some types of data, messaging, multicast, and multimedia services. It having the following features,

- Dual-Band GSM/GPRS 900/ 1800 MHz
- RS232 interface for straight communication between GSM module to Computer.
- Conquerable baud rate
- SMA Connector and Stub Antenna
- SIM holder.
- Built in Network condition LED
- Inbuilt strong TCP/IP protocol stack for internet data transfer over GPRS.
- Input Voltage: 12V DC.

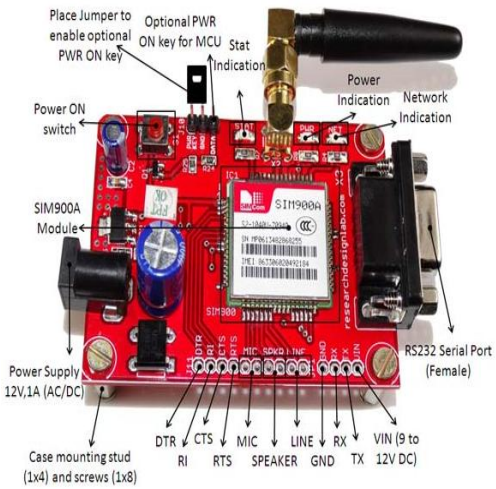

Fig .5. Schematic of GSM SIM-900A

V. FLOW CHART

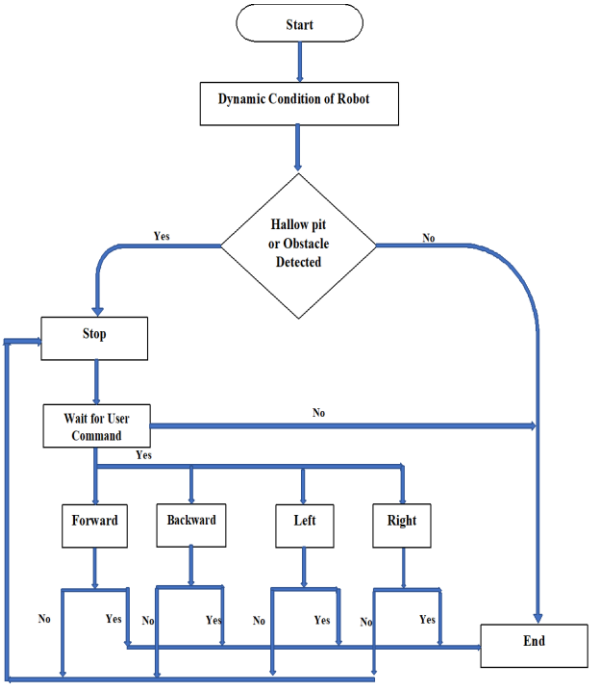

Fig .6. Flow chart for Robot Movement

VI. IMPLEMENTATION AND RESULT

Prototype consists of a voltage regulator circuitry with L293D motor driver and raspberry pi. The real time voice will be based on the mobile Application. And Button control are displayed in the webpage which can be viewed from anywhere in the world using internet or within the Wi-Fi range and one can control it using those control provided.

Step 1: Build the Robotic unit, we can use DC Motor based simple robot. To control your motors, we need L293D IC. Here we used L293D ICs for controlling two motors. And using the GSM module for sending the alert Message.

Step 2: Connection of power Supply. Here we used 9v rechargeable battery for driving the motors. But as per specifications Pi will work on 5 V, So we use IC 7805 for this and also an external portable battery bank can be used directly. We connect battery terminals directly to motor driver IC.

Step 3: Now design the control page that provides a way to control our robot this page is designed with PHP and write the controlling of the robot code based on the L293D IC logic used. At the same time, also design the voice-based command Android application by using the MIT APP Inventor.

Step 4: Setting up the raspberry pi and installation of operating system from raspberrypi.org. Here we used Raspbian OS.

Step 5: Install the required packages in the pi using suitable commands.

Step 6: Connect a Wi-Fi dongle to connect raspberry Pi with Wi-Fi router. After connecting Wi-Fi dongle to PI, open WiConfig application this application is pre-installed in Raspbian OS & connect your PI with your Wi-Fi router. When it is connected with Wi-Fi router, IP Address can be found using config command.

Step 7: Once we got the IP address we can use it for controlling purpose.

Step 8: Pi gets turn on as soon as you connect 5V supply; you can see green LED blinking while startup process. After some time, open browser in your Laptop or mobile and write down following link: IP address /filename.

Now sitting in any place, you can control the robot either voice or web page through android mobile, anywhere in the world.

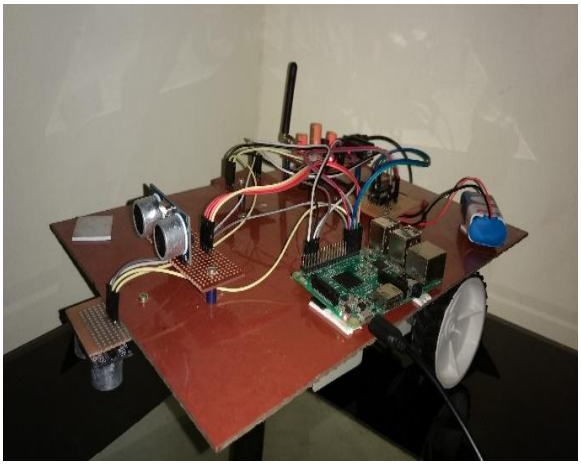

Fig .7. Experimental setup

Fig (7) shows the experimental setup of proposed system. Fig. (7) shows interfacing of DC motors, stepper motors and ultrasonic sensor with Raspberry Pi 3. L293D driver is used for interfacing RPI with DC motors. The robot has 2 motors, which require 1 motor driver IC for controlling the robot. Using L293D two motors can run independently at different speeds. With these two motors 2-wheeler robot can move forward, reverse and turn left or right. For H-bridge circuit input pins are connected to RPI GPIO pins and output of H-bridge is connected to motors. Python program for motors can be run using Terminal in RPI. Ultrasonic sensor has 4 pins which are interfaced with RPI using RPI GPIO pins. Similarly, stepper motor is interfaced using RPI GPIO pins. According to python program, robot can move forward or reverse or left or right i.e. to desired direction according to distance sensed by ultrasonic sensor.

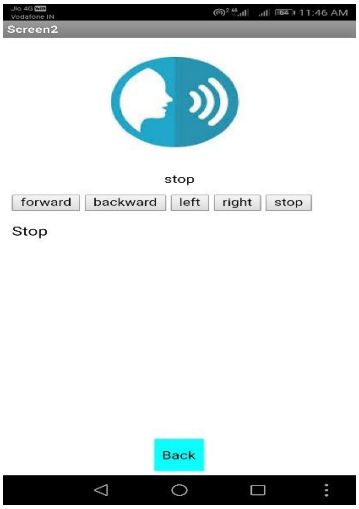

Fig .8. Voice Application

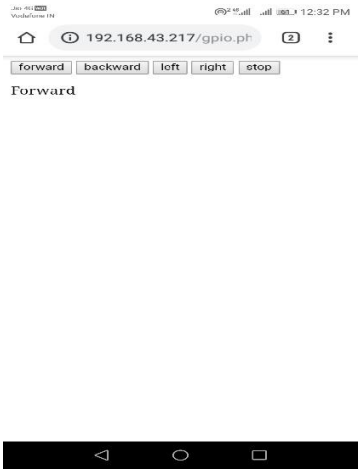

Fig .9. Web page control

Fig (8) shows the Mobile screen for controlling the robot based on the voice command with the button command android app. And then fig (9) shows the controlling of the robot through web page (Button) by using the IP Address.

VII. CONCLUSION

The Raspberry Pi 3 model-B is successfully used for controlling of robot. The result shows that robot can successfully detect and avoid the hollow pit & obstacles using the distance measured by itself from the obstacle. By analyzing the distance, the robot will send a message to the user. If the user gives the voice command from the input side, the robot take the action based on the user command until it does not move. IoT is the main concept between the robot and the Android mobile. Also, the robot has been successfully controlled from remote place using Android application or webpage control.

VIII. FUTURE SCOPE

We can use this system for military applications installing suitable sensors. By adding the robotic unit using camera which will show live streaming for its dynamic path. In Future we can able to assign IP address for this system. By using this IP address more than one device (IoT) are connected to it then we able to see the live streaming.

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