IOT System for Controlling a Remote Located Robot using Speech Recognition (Dialog Flow and Google Actions)

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***Abstract*- Nowadays, Robotics plays a major role in a lot of Automation Fields. Robotic Actions become more efficient in the upcoming years.. It is not convenient to use a custom controller for operating a robot car and the easiest way to control a robot is definitely with voice. In this paper, we have propounded a voice recognition-based system where controlling processes will be very much expedient to use.. It is very helpful for differently-abled people to control the car. In this time of connected world, this IOT based project focuses on connecting to your favorite robots/machines without caring of where the robot is located in the world**

***Index terms*- IoT, Android, Robot, Speech Recognition, Ultrasonic, Voice Control, Web App, Node.js, Python**

I.INTRODUCTION

Robots are a package of systems that include mechanical, electrical, computing and automation fields of technology which can be used to perform various tasks in industrial and domestic use. And with increasing developments in this field robots can now be controlled with lesser direct human intervention to achieve a more natural interaction with machines. This allows the user to free up their hands and work on other tasks. Some basic applications of robots utilizing voice recognition are to support people with disabilities, executing preset commands, etc. To process the voice commands a simple and efficient method is to use a smartphone. With their own independent operating system and internet connectivity they are increasingly being utilized in many applications.

One of the major features that we shall make use of is Web Socket to enable one-on-one communication in real-time and Node js for sign-up and login. This will allow the phone to communicate with the robot. Several Operating Systems are used for smartphones but the most common one is the Android OS developed by Google Inc. Its flexibility and ease of use make it an ideal interface for robotic applications. These android related systems are very efficient for developing applications throughout the world. The robot car will be automatically stopped by sensing obstacles if anything on its way and this obstacle detection process is handled by the ultrasonic sensor. Ultrasonic sensors use sound wave transmitters and receivers to record the echo time and use that to calculate the distance. All the system is controlled from a single board computer named Raspberry Pi 3B+ and voice speech is recognized using Google speech recognition engine.

A web socket is a connection between a client and server. It provides a bidirectional, full-duplex communications channel that operates over HTTP through a single TCP/IP socket connection. At its core, the web sockets protocol facilitates message passing between a client and server

This can find large scale applications where direct human presence is a risk such as working in a radioactive environment or during bomb disposal. Five basic commands are used to steer the robot that is forward, right, left, reverse and stop to guide the robot.

With the help of the two basic functions which are voice recognition and Socket communication the robot can be used for variable purposes and application commercially and domestically as mentioned above.

II. LITERATURE SURVEY

Robot Controlled Car Using Wi-Fi Module Authors: S R Madkar, Vipul Mehta, Nitin Bhuwania, Maitri Parida. This paper shows how to control robot car using Wi-Fi module through an android application. It is also shown that the appliances can be controlled even in the absence of an android phone by sending a normal SMS. This project can be modified quite easily by including a spy camera as well that can stream the videos to the user, and our bot will be connected to a webapp, which is hosted on a server. So, basically we can control our robot using the internet and we can use speech recognition for controlling the robot.

III. IMPLEMENTATION

Commands to robot are sent via the internet using the peagle control page. Users can directly give the command from the control page by using buttons and other HTML inputs given on the control page or Google assistant can receive the input. That input is processed and directed to Raspberrypi through the internet. Once the command has been received the Raspberry pi then compares the text to the preprogrammed instruction set as follows:

1 Forward: Activates all motors and Moves Robot forward.
2 Backward: Activate all motors and Moves Robot backward.
3 Right: Activates all motors and makes a 90-degree point turn.
4 Left: Activates all motors and makes a 90-degree point turn.
5 Stop: Deactivates all motors.
6 And many more…

This is a brief explanation of instruction receiving of raspberry pi and is more complicated in code. Users can also change the speed of movement and speed of turning.

3.1. HARDWARE

3.1.1. Raspberry pi

The Raspberry Pi is a series of small single-board computers. The Raspberry pi 3 Model is the latest product in the Raspberry pi 3 range, boasting an updated 64-bit quad core processor running at 1.5GHz with built-in metal heat sink, dual-band 2.4GHz and 5GHz wireless LAN, faster (300 mbps)

Fig 1: Raspberry pi 3B+

3.1.2. Raspberry Pi Camera Module

The Raspberry Pi camera module is capable of taking full HD photo and video. In terms of still images, the camera is capable of 3283 x 2450 pixel static images, and also supports 1080p30, 720p60 and 640x480p90 video.

Fig 4: RPi Camera Module

3.1.3. Ultrasonic Distance sensor

Ultrasonic distance sensors determine the distance to an object by measuring the time taken by the sound to reflect back from that object. The frequency of the sound is somewhere in the range of ultrasound, this ensures the more concentrated direction of the sound waves because sound at higher frequency dissipates less in the environment.

Fig 5: Ultrasonic Distance Sensor

3.1.4. SIM800L GSM / GPRS module

SIM800L is a miniature cellular module that allows for GPRS transmission, sending and receiving SMS and making and receiving voice calls. Low cost and quad-band frequency support make this module a perfect solution for any project that requires long-range connectivity.

Fig 6: SIM800L GSM/GPRS module

3.2. SOFTWARE

3.2.1. Peagle Web App

Users can login to the webapp and can control the robot after connecting to it. Given below is the screenshot of the control page of the webapp. User interface consists of several webpages:-

1. Welcome page
2. Login page
3. Control page

Fig 7: Control Page of webapp

Fig 8: Live Location visualization

Webapp is created using basic web tools and languages like HTML, CSS, PHP, JS and advanced concepts like node JS. All the webpages are designed using simple HTML and CSS. JS is used to make the website dynamic and interactive. After clicking on the user button, the user is navigated to the user login page. PHP handles the login form. Creditinals are matched with those stored in the SQL database.

SQL is used to store admin and bot details.

Database structure

Database : peagle

Table - bot_table

Attributes - id (primary_key attribute)

- Name
- Bot_key

If the credentials match, the user is directed to the control page and a session is created for the same. After clicking on the connect button, the user is connected to HTTP server running at port 8080. Now the web app is running at port 8080 and listening to any incoming connection request of Web Sockets. The navigation is done through simple js event listeners and functions. Web Socket is the core technology used in the project. Here, web sockets are implemented using node js. Packages installed and used on our app are:-

1. Express
2. Socket.io
3. http
4. Path
5. Body-parser
6. Nodemon

Users can control the robot in different methods. Users can hold the buttons and control it as it moves. In the second method, users can set the time for which the instruction should be executed and give the instruction using the appropriate button. Sliders are used to set the speed of movement and rotation of robots. JavaScript listens to any event on these input elements and executes the required functions. Certain objects have been predefined whose property value changes in changing input element values. These objects are then forwarded to the server and ultimately to raspberry pi (robot) which then reads object values and executes required functions.

IV. SYSTEM DESIGN

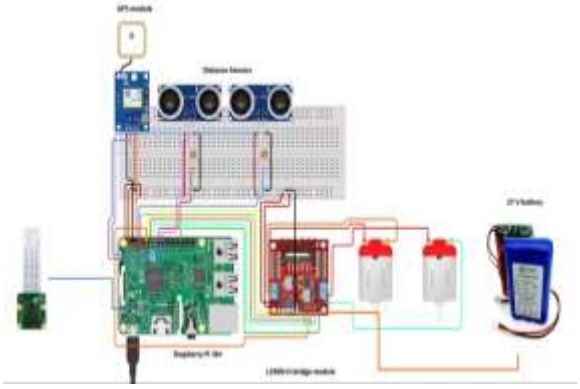

Fig 9: Hardware Design

The robot is controlled using a controlling webpage, which can be accessed on any web browser. But the similar kind of interface could also be provided by an Android/ios mobile app. The webapp could eventually be connected to Google assistant using Google action.

Fig 10: System Implementation

V. BLOCK DIAGRAM

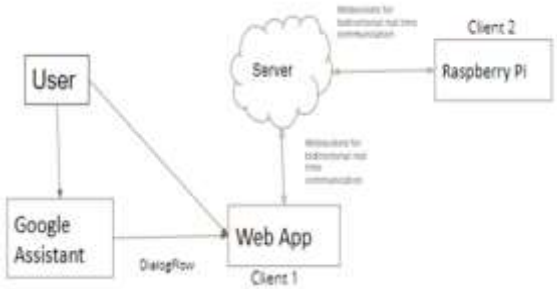

Fig 11: Block Diagram

In this system Consists of Raspberry pi – 3 Voice input through Google Assistant and Robot is connected to the Raspberry pi via motor driver. To enable Google Assistant we will use Dialog Flow. Actions happen via Web Socket Protocol because it is a lightweight Protocol, it consumes less Internet.

VI. RESULT

The car is controlled through the internet by accessing the web page controller. The user can also use their Google assistant to control the same. The user needs to know the credditionals to login the app. Users can control the robot in different methods. Users can hold the buttons and control it as it moves. In the second method, the user sets the time for which the instruction would be executed and will give the instructions using the appropriate button. Certain objects have been predefined whose property value changes in changing input element values. These objects are then forwarded to the server and ultimately to raspberry pi (robot) which then reads object values and executes required functions.

VII. APPLICATIONS

This system can be implemented in various applications such as:

1. Indoor spying of house, campus surveillance to check the improper activities.
2. Surveillance applications to send a live feed from the camera and track down objects.
3. Industrial Robots for surveillance.
4. Onboard digital assistants for automobiles.
5. Making video surveillance of any disaster affected area where human beings can't go.
6. Tracking locations of terrorist organizations.

VIII. FUTURE SCOPE

Further enhancement in this proposed model can make this much better and advanced. In the future, the plan is to install a PIR sensor, which can help in detection of humans. Image processing can also be implemented in the robot to get an enhanced image or to extract useful information from it. We can also add an Automatic Targeting System that can be implemented in the robot for tracking the target.

IX. CONCLUSION

The paper presents a robotic car that is controlled by voice. The robotic car was made of low-cost materials that were readily available. The robotic car can be controlled from a more distant location. The model of the robotic car was constructed and the

functionality was tested. Thus, Google assistance provides a wide variety of applications that are used for Disabled People. In a nutshell we can conclude that human detection robots can certainly be a future market for many industrial and domestic purposes related to automating daily tasks.

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