

Raspberry Pi Project – Voice Controlled Robotic Assistant for Senior Citizens

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Abstract – Whether it is a nursing home, or senior citizens at home, they need help. But help can't be available every time. At night, for example. Many people get up to drink water. But for our seniors, they need someone else to come help. With a robotic assistant, all this will be accomplished easily. It can get them food, water, and many more things. Due to COVID-19, there aren't many people at nursing homes. But a robotic assistant won't have such barriers.

Key Words: COVID-19, Robotics, Raspberry PI, Bluetooth, PPE, medical robots, Personal Assistant, LeenaBOT.

1. INTRODUCTION

Senior citizens and physically challenged people will need assistants most of the time, even for a small task like getting water, food, and clothes. To assist senior citizens and the physically challenged we are proposing a personal assistant robot car that can be controlled with voice command. In this article we will cover how to design voice controlled robot car using raspberry pi. Making voice controlled assistants will be easy to operate than a device controlled assistant.

Table -1: Bill of Materials

Components Name	Quantity	Description
Raspberry Pi 4 with 32GB micro SD card	1	1GB or 2GB RAM
DC-130 Motor	4	DC Gear Motor
5V out Power bank	1	Two USB Out: 5V, 2.1Amp 1Amp
Breadboard	1	Small size
Breadboard power supply board	1	5V out
Microphone	1	
Speaker	1	
Plastic car tire Wheel	4	
Universal Wheel	2	
6DOF robot arm with Servo Motor	1	Pre assembled 6DOF robot arm considered for this project
Android Smart phone	1	

Scope of this article is limited to voice controlled robot car design and robot arm control. For robot arm assembly please refer [2]

2. SYSTEM INTERFACE

In our proposed setup, Robot car with robot arm is connected to Raspberry Pi 4. The Raspberry pi has inbuilt Bluetooth, by writing Bluetooth server program at raspberry pi we will be able to make it always in listening mode for incoming connections. From android smart phone using a car controlling app we will be able to send our voice command. [3]

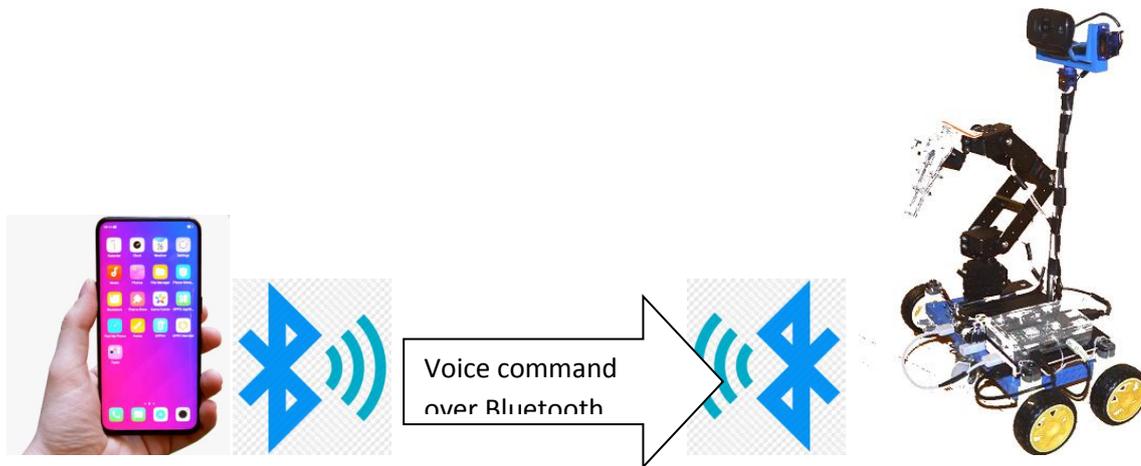


Fig -1: System Interface diagram

3. HARDWARE ASSEMBLY

L283D is used as motor driver for the car. Each motor driver can control two DC motors. So we will need two motor driver to control four motor and wheel.

1. PIN 16 is 5V VCC connected to +ve of power supply board
2. PIN 2,7,15,10 are input control pin and are connected to Raspberry pi GPIO pins
3. PIN 4,5,13,12 are the Ground pin connected to -ve of power supply board

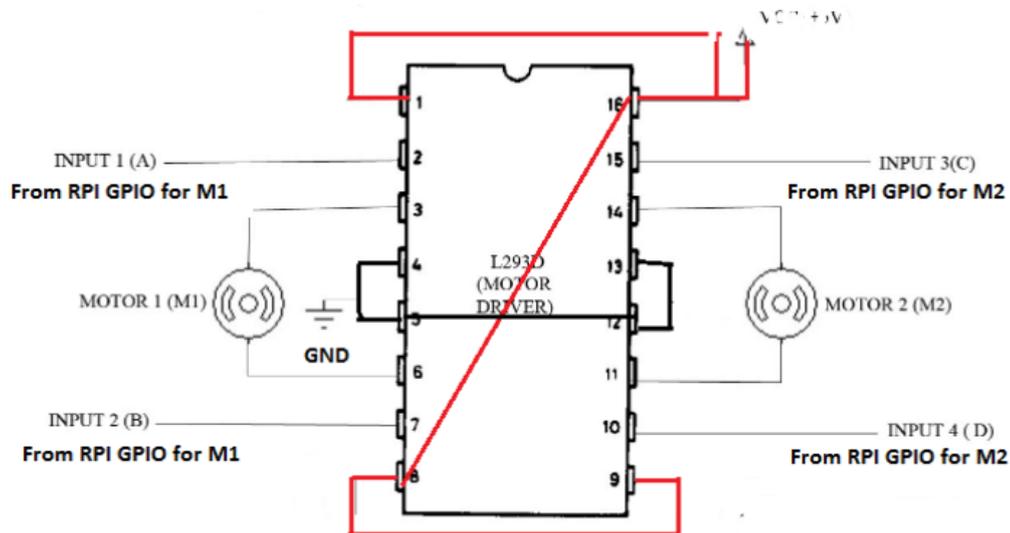


Fig -2: Motor driver connection for L293D[1]

3.1 DC-130 Motor connections

As per the diagram Fig-3 four DC-130 motors are connected, Each L293D can drive two servo motor. In order car to make right turn and left turn car is designed such a way that length is greater than width. Making circle of rotation for each wheel within body of the car and thus avoid friction while making right turn and left turn.[5]

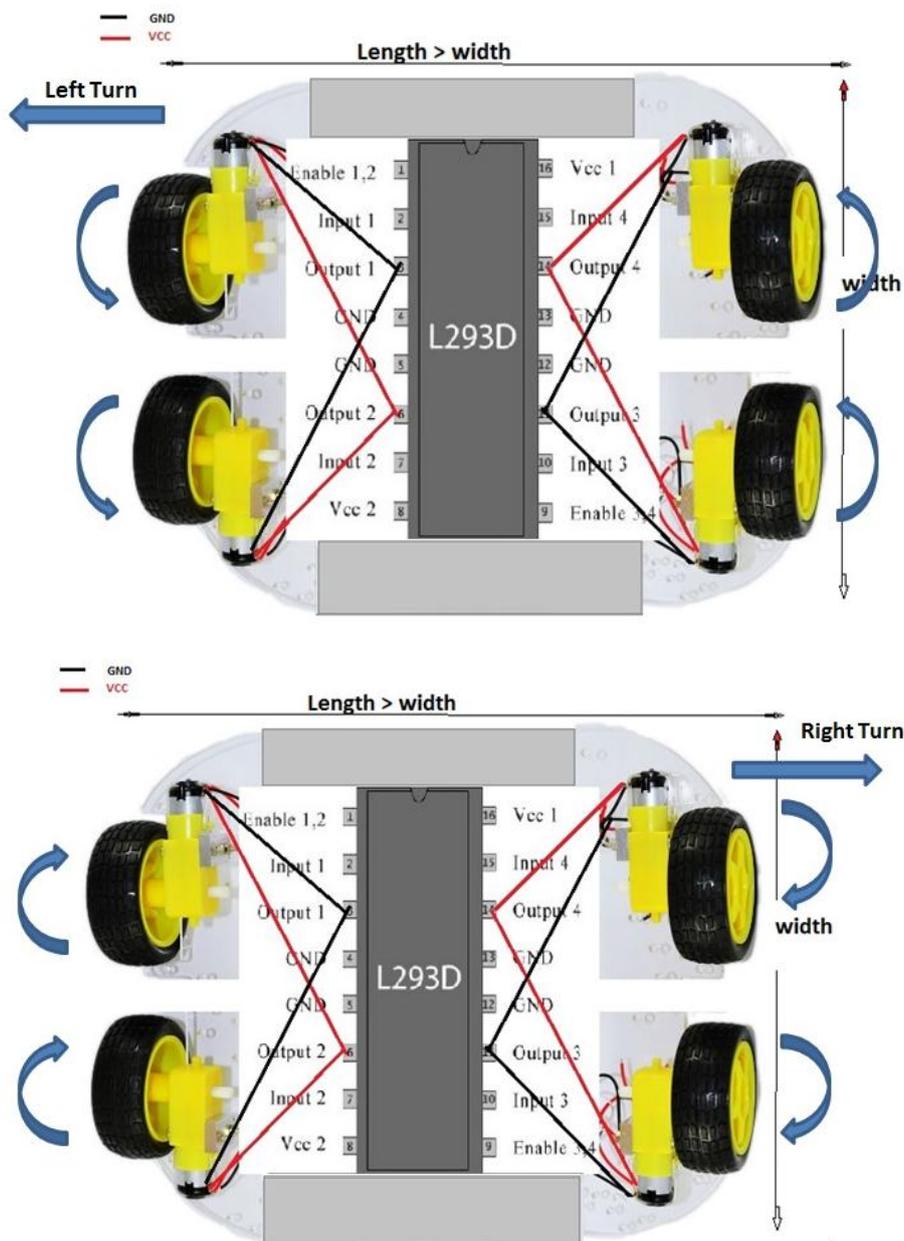


Fig -3:

4. SOFTWARE

In this project we have two software modules

- Server side python code to receive data from phone
- Client side app in android phone to send voice commands

4.1 Server side python Program

Server side python code is a combination of Bluetooth socket program and driver code to drive servo motor and DC-130 motors. As given in flow chart diagram server code waits for incoming connections. Once connected receives control voice commands and sends signals to each motors.

Depending on input value, we have used if else condition to switch to each movement of DC motor or servo motor connected on robot hand. Robot hand control is already covered in this article. [1][2]

4.2 App on Android Phone

In Google store multiple Bluetooth app available. You can use any of these apps to send voice data. For our testing we used MeArm Bluetooth App [4] and using this app we can send voice commands to server side program.

Now run server side program in raspberry pi and it will be in "Listening.." mode.

Once you select raspberry pi in mobile app and click connect. Connection will get established and then you will be send voice commands like "go front" "move right" "move left" etc. Voice command is converted to text in program using voice to text conversion open source library. Each voice command is assigned to a number and the assigned number is sent to server side program on Bluetooth connection.[6]

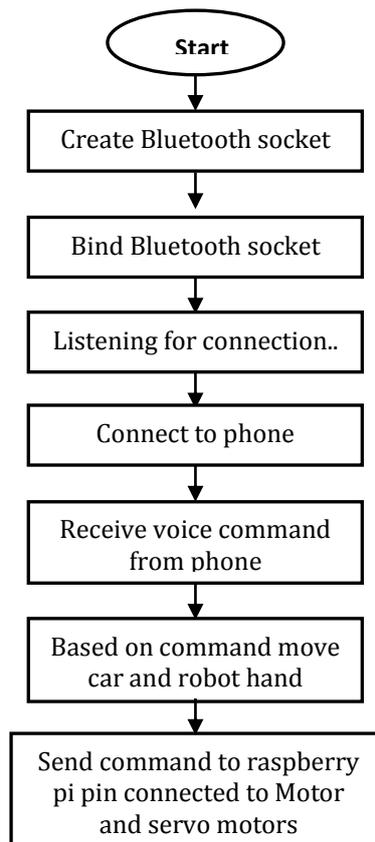


Fig -4: Program Flow diagram

5. Testing and Result

Bluetooth enabled Smartphone with MeArm app installed establishes connection with server side program running on raspberry pi. Once the connection is established you can send voice command from phone to raspberry pi.

Each command is assigned with numbers and these numbers are sent to raspberry pi. Based on number the code will switch to different section of code and will do particular operations. These commands are used to move car and robot hand.

In our testing we observed the robot car can bring a flower or stick or cloth with robot arm when voice command is sent from Bluetooth enabled phone.

```
pi@handi: ~/...$ python Blue1.py
listening
Accepted connection from ('18:83:31:2D:5C:0A', 1)
received 3,4,0

received 1st 3
received 2nd 4
received 3rd 0
received 8,4,0
```

Fig -6: Test results

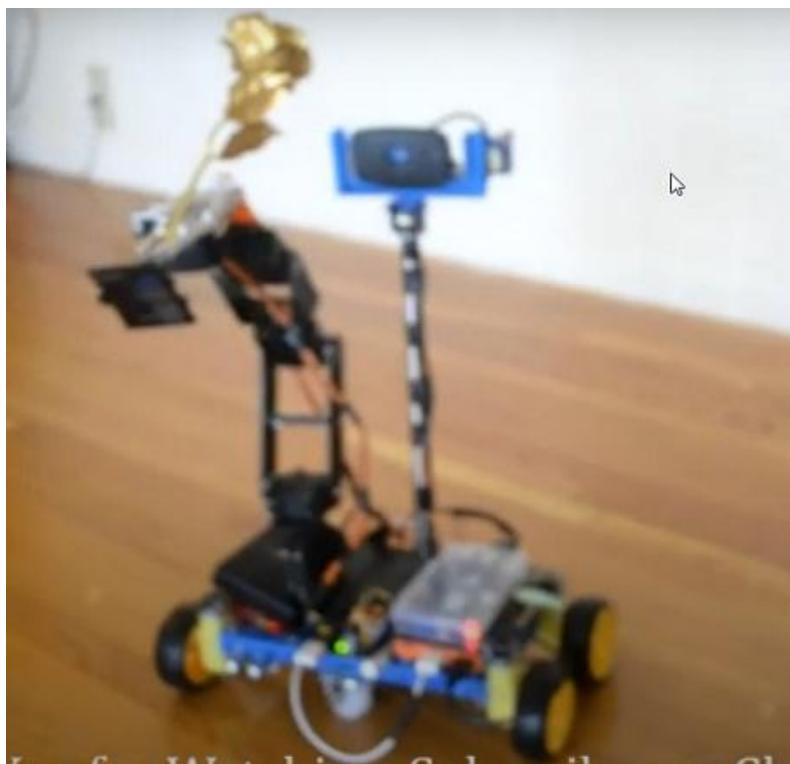


Fig -6: Robot assistant car getting golden flower on voice command

6. Conclusion

In this paper, we are proposing a smart phone controlled robot car assistant for senior citizens and physically challenged. Senior citizens and physically challenged will be in need of assistance most of the time, assistance for one or the other and help won't be available all the time. A voice controlled robot with a robot arm will be great assistant for these people when they are in need. Even some of the basic need like getting water or cloths. In our test we were able to test the assistant robot car by sending voice command from phone. Robot car was able to bring flower, cloths with voice command. We believe this prototype will be a great personal assistant for whoever in need for help.

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