A NOVEL VOICE CONTROLLED ROBOTIC VEHICLE FOR SMART CITY APPLICATIONS

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Abstract: There are a lot of researchers working towards enhancing the connection between humans and robot. In this article, we have developed a robotic vehicle which can be controlled by voice commands. The control system of the robot movement will respond to the voice of the commanding person. A Texas board, MSP432P401R is connected to TI-RSL (Texas Instruments-Robotic System Learning) kit and used together with Wi-Fi module, CC3100 booster pack interfaced to an android application IFTTT (If This Then That) and Blynk to transmit the voice commands. The proposed system is designed based on microcontroller (MSP432P401R) which is connected to smart android phone through Wi-Fi module for receiving voice commands. The voice commands are converted to text by an android app and sends necessary data to the controller for robot movement. The voice commands are processed in real-time, using an online cloud server called Blynk. After receiving each command from the controller, the TI-RSL kit responds and moves in the desired direction. Moreover, we have also used camera module to watch the live streaming and direct the robotic vehicle without facing any obstacle. The camera is interfaced with Raspberry Pi for live streaming. The purpose of our article is to use this robotic vehicle in high toxic areas, where human cannot reach but human voice can.

Keywords: Internet of Things, Wi-Fi Booster Pack, TI-RSL kit, Smart City.

1. Introduction

The objective of the article is to control the robotic vehicle in a desired direction. It can also be controlled by using voice or push buttons. Two goals are set for this article; one is to control the robot using voice commands and act accordingly. Second is to live stream the place so that users can command the vehicle accordingly to move in particular direction without facing obstacle. This system contains of two parts, robotic vehicle part and camera which is interfaced with Raspberry Pi and battery for the power source. We can control this robotic vehicle using the modern methods i.e., using Google assistance to move in desired direction. This article is designed to control a robotic vehicle through voice commands by live streaming the location. Thus, human and robotic interaction is achieved.
2. Technologies used

The designing of the robotic vehicle includes both hardware and software components. For hardware, the following components are used:

- MSP432P401R.
- CC3100 Wi-Fi Booster Pack.
- Raspberry Pi.
- Robotic System Learning (RSL) kit.
- Pololu Motor Driver Board.
- Camera.

For software, the following technologies are used:

- Energia.
- Raspbian OS.
- Blynk.
- IFTTT.
- Google Assistant.

3. Block diagram

This article is divided into two parts.

1. Robotic vehicle.
2. Raspberry Pi.

Here, Raspberry Pi is used only for live streaming and therefore there are no connections made between Robotic vehicle and Raspberry Pi. Raspberry Pi and Camera are placed above the Vehicle. Hence, there are two block diagrams separately for each.
4. Methodology

The purpose of using MSP432P401R is, low power consumption and also powerful microcontroller, which is a Texas Instruments product. Likewise, CC3100 is also one of their products and it is also an ultra-low power consumption and it reduces the work from the microcontroller which makes the controller work smoothly [1]. Pololu motor is a driver board which gives constant and sufficient power to the motor to run the wheels. Raspberry Pi is used for the purpose of live stream where the USB camera is connected to the Raspberry Pi so that one can monitor the area and guide the robot [2-3].

4.1. Blynk

Blynk is a cloud server which is virtually connected to Wi-Fi Booster Pack. Program consists of four commands:

1. Moving forward.
2. Moving backward.
3. Turn left.
4. Turn right.

Four buttons are to be created in Blynk app for respective four commands. In order to create buttons, the following steps are to be followed:
Step 1: Open Blynk app and select new article device

Step 2: Give the article name and select device

Step 3: An Authentication token will be sent to registered email and that token is used to link Blynk app with program

Step 4: A digital dashboard is displayed and then click on add button
Step 5: Select four Buttons from Widget Box

Step 6: Four buttons will be displayed on dashboard

Step 7: Select button and pin mode as virtual pin and mode as switch mode

Step 8: Click on play in order to make Robotic vehicle respond to Blynk app

4.2. IFTTT

IFTTT is a service offered by an electronic device to another electronic device, communicating with each other. Applets need to be created in order to connect Google Assistant with IFTTT. The procedure of creating applets is shown below:
Step 1: Open IFTTT app and click on get more

Step 2: Click on create; “Make your own Applets from scratch”

Step 3: The page shown above will be displayed and click on ‘This’

Step 4: Select trigger service as “Google Assistant” because commands are passed through it
Step 5: Select on “Say a simple phrase” as commands are passed in the form of phrases.

Step 6: The page above will be displayed. Fill the details regarding what to say and in return how it must respond.

Step 7: Click on ‘That’ to select action service.

Step 8: Select “Webhooks” as it makes a web request.
Step 9: Type the specific URL
http://188.166.206.43/authtoken/update/V0 so that IFTTT gets connected with Blynk and “PUT” method and “application/json” as content type. Here, as first command is linked with V0 button of blynk app, it is mentioned in URL.

Step 10: Click “Finish” and turn on notifications

Step 11: An applet is created so that when user says, “move forward”, then Google Assistant responds with “moving forward”. In the same way, create three more applets for three more commands.
5. Working Model

MSP432P401R micro controller is interfaced with CC3100 Wi-Fi Booster Pack which has Wi-Fi on-chip. Connections are made between Pololu driver board and MSP432P401R as shown below.

![Connections between Pololu motor driver board and MSP432P401R](image)

There are total of six connections, two connections for each motor and one for power supply and the other for ground. Two connections for each motor is, one for direction (digital pin) and the other for speed (analog pin). Pololu motor board is interfaced with RSL kit. Blynk is virtually connected to Wi-Fi Booster Pack. Blynk is connected with program with the help of authentication token provided. IFTTT is virtually connected to blynk app with the help of specific URL. When the user gives commands through Google assistant, the voice signals will be converted to text with the help of IFTTT. As IFTTT and Blynk is connected, blynk transfers the signals to the MSP432P401R via Wi-Fi Booster Pack [4]. Thus, signals are transmitted to robotic vehicle as connections are made between Pololu board and MSP432P401R. Therefore, when the program is dumped into the micro controller (MSP432P401R) and commands are given by the user, the vehicle responds and moves in the desired direction. Camera is interfaced with Raspberry Pi and during software installation process; an IP address will be obtained which can be used further for live streaming [5].
6. Conclusion

Voice controlled robotic vehicle remotely operated by Google assistant which was designed and implemented to be used in high toxic areas. According to this system, a smart voice controlled robotic vehicle is deployed with the help of MSP432P401R which is connected with Wi-Fi booster pack using the Blynk App account with the IFTTT and Google assistance within it through which a user can control robot just by giving the voice controls input.

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