

Speech Driven Robot Based on Artificial Intelligence

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Abstract - Personal assistant is one of the best results of Artificial Intelligence. With the popularity of speech-driven Artificial Intelligent assistants like Google Home, Alexa, the not only listening the question but also replying in seconds brought the thought into reality. Here this paper gives brief on concepts used for making speech driven robot. It shows way to develop speech-driven robot based on Artificial Intelligence (AI). Voice Recognition System plays an important role in virtual assistants in for helping the user to have a communication with the system. Speech driven Robot is a robot whose movement can be controlled by the user by giving specific voice commands (with Hot word as a wakeup call). The speech is received by a microphone; it sends the input to microcontroller which is Raspberry Pi. The microcontroller analyzes the message and accordingly get the signal to Google, depending upon the input it answers to our questions correctly. In this project, we are trying to make a robot having the important functions for performing the task, which will help user along with assistance, for which input will be given to robot through Node MCU.

Key Words: Artificial Intelligence, Speech Recognition, Raspberry Pi, Node MCU.

1. INTRODUCTION

Speech is an important interface for most of the system due to development in communication technologies. Instead of using different difficult interfaces, speech is easy to communicate with computers. Speech driven robot can perform repeated task, so it frees up the time for user which can be further utilized. Our system can perform the tasks without any error and having more efficacy that tends to an improvement in fully user satisfaction.

As it gets activated depending on voice command only, this provides the Contact less access for user to most of the

functions. So, it makes our device easy to handle with fast response. Voice assistant can be used while doing other tasks such as cooking, watching TV, driving, etc. Our main objective is to develop a robot which can understand the asked questions and answer correctly with performing assigned task correctly.

By using a simple approach for implementing the system, where a robot is controlled by voice commands. Voice command is taken through a microphone, processed in microcontroller which is Raspberry pi and sent to the robot and then the robot performs assigned task accordingly. Humans are used to interact with Natural Language (NL) in the social context. This idea leads Robotic to make NL interface through Speech for the Human-Robot Interaction (HRI). It encourages Robotic to use Speech Recognition (SR) technology for the Human Robot Interface (HRI). Here Robot can easily interact with Human through Speech to gain the initial knowledge.

Creating machines that behaves like human, it has always been a dream of human being. Recognizing the speech and responding accordingly is a very important part. With the improvements of the technology and research on artificial intelligence, it came true. Speech is the most used way of communication for people. Mostly we use speech throughout our lives for communication with each other. In the developments of communication technologies, for interfacing many systems, speech is considered as important factor. Instead of using difficult interfaces, speech is simple interface for communicating with controllers. In this project, the main objective is to develop a robot which can answer the asked questions correctly & can perform the task given.

Now we know Artificial intelligence (AI) is used by robot which is controlled by a computer to perform the assigned

tasks that are mostly done by humans because human intelligence requirement. We are using Google assistant for the project because it is Artificial Intelligence dependent speech driven service. Using the voice as a input to system, we can communicate with the google assistant and it can search on the cloud, control appliances, etc. This service is also can made available on smartphones. We can control devices including lights, motors using our Speech driven robot.

2. LITERATURE SURVEY

Shubh Srivastava, Rajanish Singh proposed paper on “Voice controlled Robot car using Arduino” (2020). The project model consists of a microcontroller fitted with Bluetooth communication module. and then this is connected to the motors and other used components of the car. When the Bluetooth is made ON and it relates to available system through Bluetooth, from the function which has been already provided, the robot car will be operated through wireless commands from the application. Robot car will move in four directions i.e Forward, left, Backward and Right. Then motor will start rotating and after then stop the motors command will stop the robotic car. In this project, they have shown how to use Bluetooth application of an android mobile for controlling the robot car [1].

Dr. Jaydeep Patil, Atharva Shewale, Ekta Bhushan, Alister Fernandes, Rucha Khartadkar proposed paper on “A Voice Based Assistant Using Google Dialog flow and Machine Learning” (2021). There is a survey for comparing the various voice based personal assistants available for use in the market namely, Siri, Cortana, Google Assistant and Alexa. From which they got the conclusion as, Google assistant has better results in virtual reality by having 60% of correctness. Siri resulted in 44% of accuracy in virtual reality. Cortana had less accuracy as compared to other two which is nearer to 30%. Whereas it is observed that Alexa is not suitable with simple questions and Cortana is having poor response due insufficient voice recognition. In this project, they have made a Virtual Personal Assistant which is having the main features that helping in assisting requirement of people. They have studied IBM Watson and Google Dialog flow platforms for

understanding different Natural Language. For the implementation of software application, in this project, they used Google Dialog flow as the NLU Platform [2].

Abhinav Salim, Ananthraj. C R, Prajin Salprakash, Babu Thomas proposed paper on, “Voice Controlled Robotic Arm” (2017). As human voice gives continuous control signals to operate a real 3D robotic arm. Their goal behind the preparation of this model is to create robotic arm which will help the disabled people by assisting them in their daily activities. They used speech recognition technology where the controller understands the input given through speech. And this recognition of speech allows user to perform other task parallelly while continuing the work with computer. The robotic arm which they used for this project was a lightweight model which is controlled by four motors. Four DC motors are used by which directional motion was achieved required for the rotation of Arm. This system of recognizing the voice automatically by recognizing the voice input given through mic. The speech recognizer system was dependent on HM2007 processor which was the heart for this. As given voice input is an analog signal which converted to digital signal and then provided to microcontroller. According to the input received controller process for the action and we get the correct result [3].

K. Kannan & Dr. J. Selva kumar published paper on “Arduino Based Voice Controlled Robot” (2015).

The objective behind designing a walking robot is to provide ease to the user for supporting in various ways as it is controlled by servo motors. By providing the input to transmitter, the virtual reality module start taking the voice commands and convert the voice commands into digital signals. Transducer converts the voice into electric signal. Then these digital signals are transmitted through ZIGBEE module to the robot. Command given from transmitter side receives at receiver side of the other ZIGBEE module. Accordingly, ATmega 2560 performs the action to provide required output [4].

K. Hema Shankari¹, Dr. R. Thirumalai selvi, proposed paper on, “A Survey on Using Artificial Intelligence Techniques in

the Software Development Process” (2014). This study gives the detailed of the techniques developed in artificial intelligence from the software engineering application. The aim of this research paper was to provide guidelines to user for various techniques of the artificial intelligence which can be applied for solving the problems that may come in software engineering processes. It is also focusing on finding the exact techniques of artificial intelligence which can be used in software development process [5].

3. SYSTEM DEVELOPMENT

From the survey of artificial intelligence, voice robots studied as above, now we are proposed a project on speech driven robot based on Artificial intelligence. The module is prepared in two parts, refer the following block diagram i.e fig. 3.1 & Fig. 3.2

Fig. 3.1 shows interface between Raspberry Pi & Google console. As RPI board is got registered on google console.

Firstly, provide power supply & internet connection (through LAN or WiFi) to the Raspberry pi. When voice command given to controller through microphone it converts the voice signal to electrical signal & provides to the microcontroller, then it analyses the input and provides the output to the speaker which converts the electrical signal into voice.

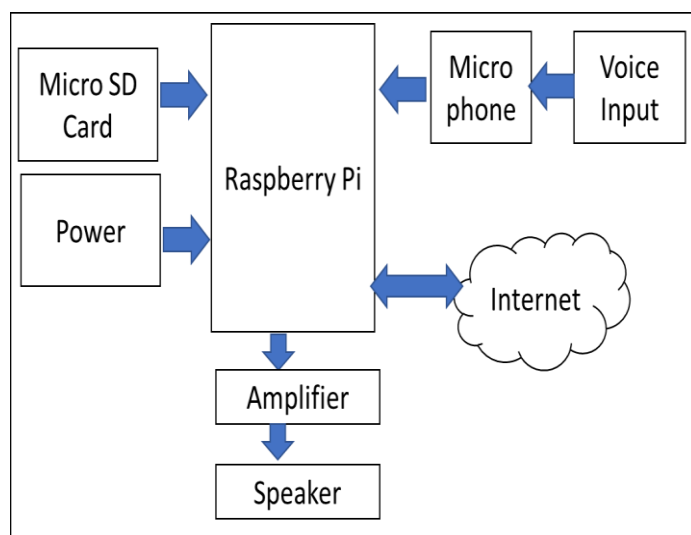


Fig. 3.1: Raspberry Pi Interface for Google

Fig. 3.2 shows the block diagram for robot connection on wifi module. As shown Node Microcontroller unit (MCU) is connected to the two-motor driver L293D which are then connected to two-wheel motors for motion and one for

cleaning brush motor and fourth for LED light. Whose connection are again given to the raspberry Pi.

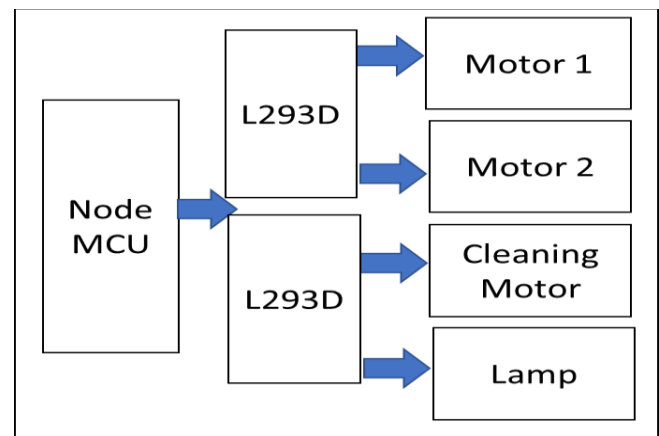


Fig. 3.2: Robotic Module

After the user interface implementation, it is important to develop a dialog manager which will handle all the commands given by user in the form of voice to perform assigned task. Google dialog flow platform is used for the same, Figure 3.3 Shows the window of google console.

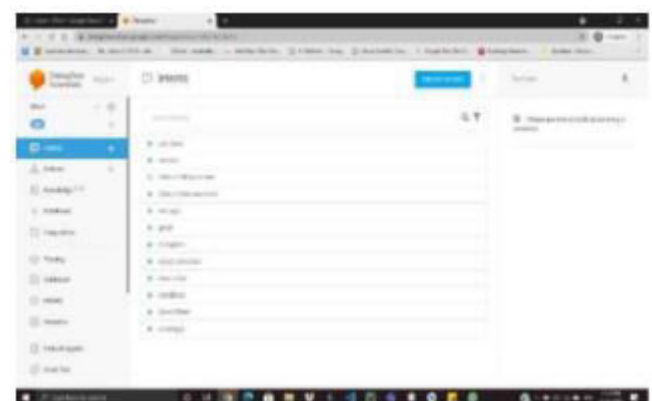


Fig. 3.3: Google Console

Input from Google is fetched to IFTTT which perform the communication between two. For this from already created Gmail account we have perform few steps to create the commands as shown in Fig. 3.4

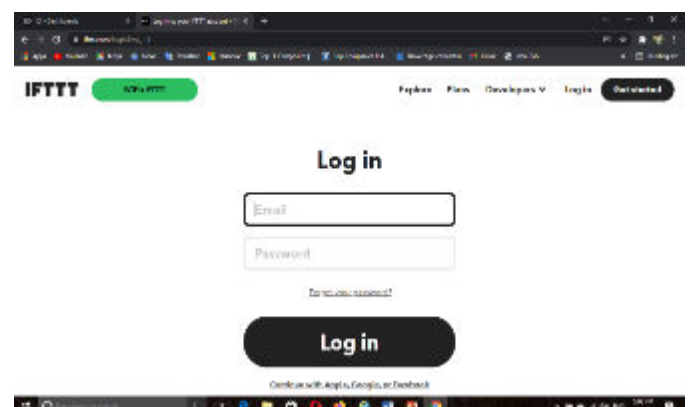


Fig. 3.4: IFTTT Signed in Window

To create our commands, we will get window for creation as shown in Fig. 3.5. Here we have to generate the command as per our requirement. In “If this” we have to write what will be our input to system and in “Then That” we have to write what task to be performed by system i.e output.

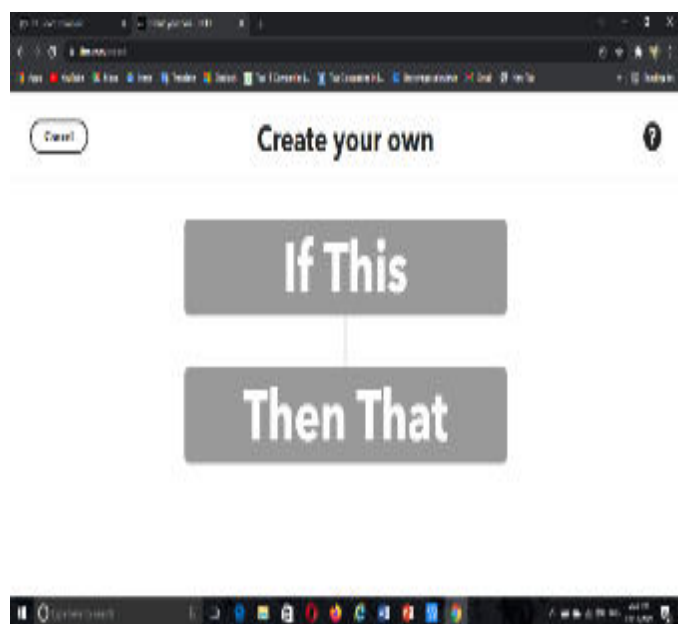


Fig. 3.5: IFTTT command creation Window

As per above description we have created 5 commands as shown in Fig. 3.6. For example, if we say Switch lamp star then robot will glow the LED lamp.

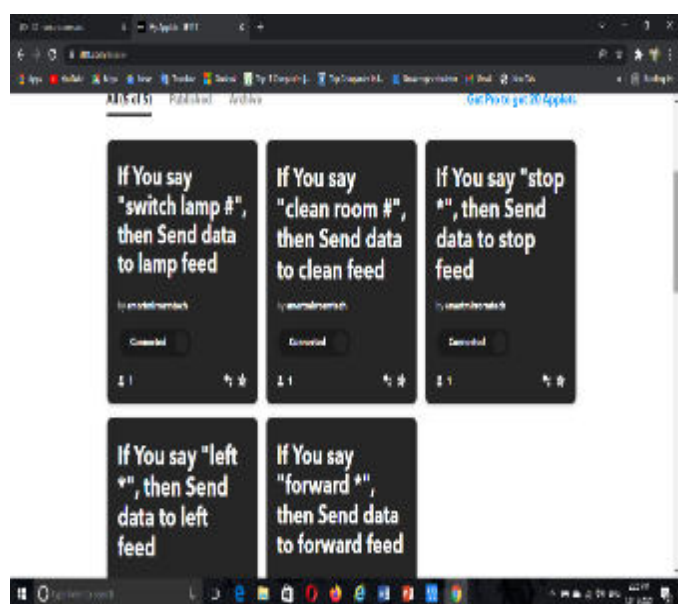


Fig. 3.6: Existing commands created on IFTTT for voice input.

For performing the actions by robot, we have used voice commands as shown in Table 3.1, and accordingly the robot will perform the actions by fetching data from system.

Table 3.1: Voice Input & then Output

IFTT command creation		
Sr No.	If voice Input is:	Then Output action is:
1	Switch Lamp Star	Lamp On
2	Clean Room Star	Start Cleaning
3	Forward Star	Goes Forward
4	Left Star	Turns Left
5	Stop Star	Stops all Action

4. RESULT AND ANALYSIS

In this part of the project, we will see the result of the system during implementation. VNC viewer application to see the communication between system & user. At start enter the IP address & search. Next step after opening the window of VNC we have to use Terminal button as shown in figure 4.1.

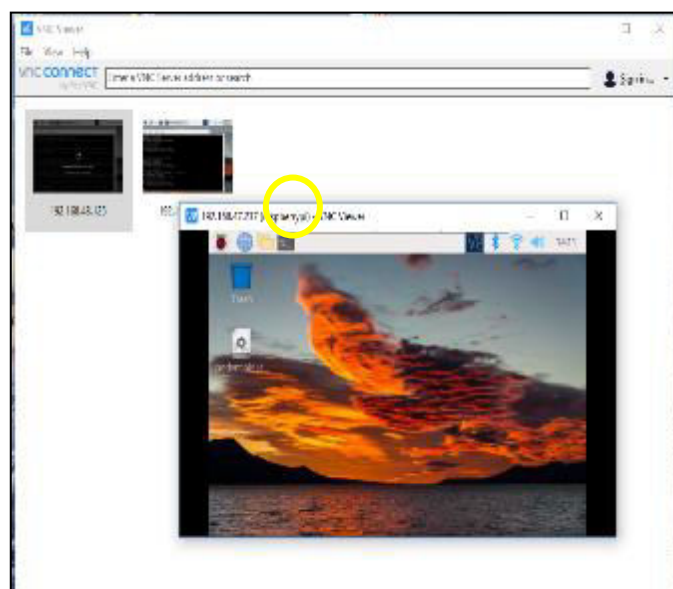


Fig. 4.1: VNC viewer window

After that communication window will be open in which we can see the results if all the 3 modules i.e Raspberry Pi, Node MCU & user are connected to wifi connection as shown in Figure 4.2.

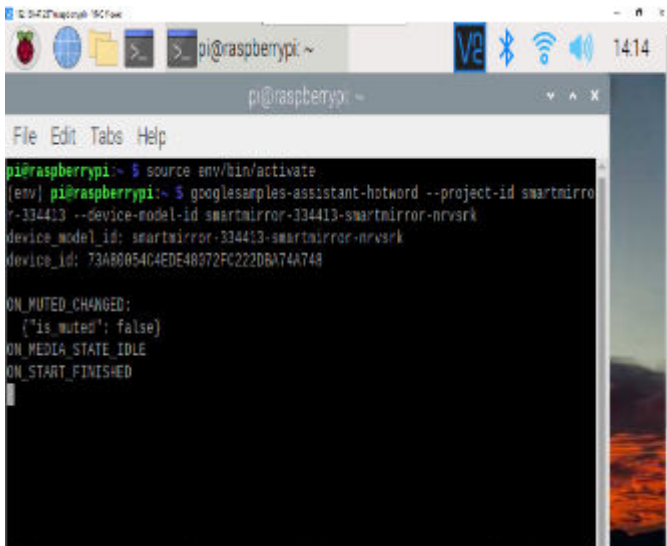


Fig. 4.2: Communication window for system & user.

Now we can start the communication with our robot as it shows “Conversation Turn Started” after giving the wakeup call. When we asked, “what is the Time?” on screen we can see “Recognizing speech finished” after which we can see responding started and robot answered the time as “2:14 Pm”. Now conversation turn finishes after finishing the response, as shown in Figure 4.3.

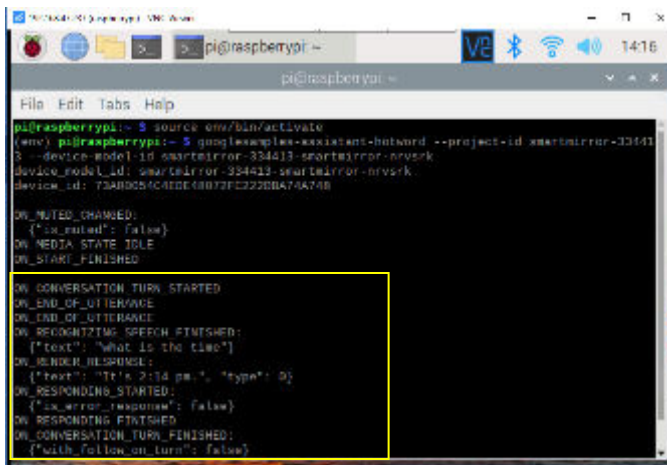


Fig. 4.3: Output communication on screen

When we provide voice command for “Switch Lamp Star” can see the output on screen while robot performing the action as shown in Fig.4.4. Also, the Fig.4.5 shows the output of robot by glowing the lamp at actual.

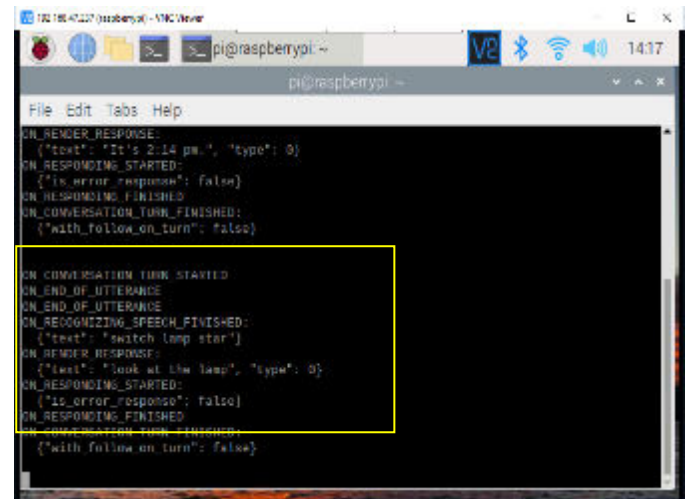


Fig. 4.4: Output communication on screen for Lamp ON



Fig. 4.5: Actual output of robot for Lamp ON

Figure 4.6 shows the actual working model of speech driven robot based on Artificial Intelligence.



Fig. 4.6: Model of Speech driven Robot based on AI.

Advantage of this project is, as data is captured from cloud network, it can be accessed from any location.

Also, in noisy area if there is any constraint to reach voice to robot, we can provide voice command through mobile.

And on Adafruit IO we have buttons for voice command from which we can operate manually too. Shown in Figure 4.7.

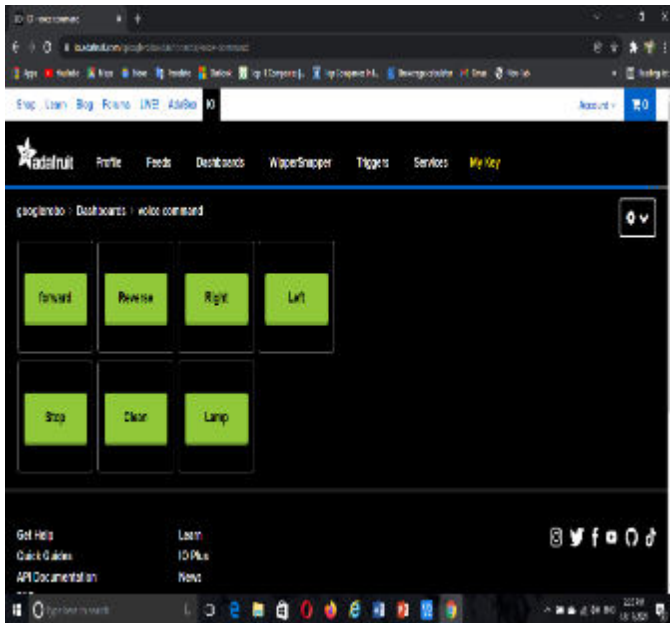


Fig. 4.7: Buttons created on Adafruit IO

5. CONCLUSION AND FUTURE SCOPE

Hence, we made a system which is simple to use & artificial intelligence makes it available for 24*7.

The system is robust and practical communication system, which activates human interaction and communication based on speech input. Provides answers to all questions which we ask & will do assigned work repetitively without getting tired. As we are using Raspberry Pi it is cost efficient & having huge processing power in compact board. A highly reliable and versatile system to answer the asked question in right manner by giving a wakeup call.

Future Scope:

- Image processing can be performed in the speech driven robot to detect the colour and the objects.
- For tracking the target, Automatic Targeting System can be implemented in the system.

6. REFERENCES

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