

Personal Assistant Robot - PLUTO

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ABSTRACT

In a society where people's desires for comfort are growing, the human race is increasingly relying on technical breakthroughs to solve difficulties. In recent years, home automation systems have become a popular topic. There are numerous devices on the market that can accomplish this, but making our own is great. The project's major goal is to create a cost-effective and performance-oriented robot for home automation based on the Internet of Things, Speech Recognition, Natural Language Processing, and Artificial Intelligence ideas. People who use it can offer speech orders, and the device answers by itself using voice commands. It can get the date, time, and weather, as well as play music and search for information on the internet and control your household appliances. The appliances that receive commands from the Raspberry Pi are controlled by NodeMCU chips. The Raspberry Pi online processes the user's vocal inputs via the microphone, translates them to text, and then performs the command. The entire project is implemented using a Python script that includes both online Speech to Text and Text to Speech conversion codes. The NodeMCU is programmed separately in order for it to operate the appliances and be accessible via its IP address. It can assist the visually impaired and elderly to connect with the rest of the world by allowing them to use their voice to access Wikipedia, Calculator, Email, and Music. This model can also keep people safe because it can be used as a surveillance system that records and compares the voice of the person standing at the door. It can also provide fun and information to the blind and visually handicapped. This model will use IOT to communicate with other systems, resulting in a completely automated system. The device will respond to the user in such a way that the user feels as though he or she is conversing with a personal assistant. This technology makes day-to-day tasks less difficult.

Keywords: Artificial Intelligence, Home Automation System, Natural Language Processing, NodeMCU, Raspberry Pi, Speech Recognition, Speech to Text, Text to Speech

INTRODUCTION

This paintings is built primarily based totally at the primary standards on Internet of things (IoT) and Natural Language Processing (NLP). We have placed forth a technique to combine all the house home equipment thru a vital command center. This will in the end lessen the human interplay with the home equipment and make the paintings less difficult. This machine is designed to offer a person pleasant enjoy in addition to an less difficult interface in order that all and sundry can use this effortlessly. This undertaking has been applied with the assist of Raspberry Pi four and NodeMCU that's an open supply platform in Internet of Things that runs at the ESP8266Wi-Fi SoC and the ESP-12 module primarily based totally hardware. Raspberry Pi is called the credit-card sized laptop which turned into to start with designed for education, stimulated through the 1981 BBC Micro. It is a low-price tool thru which numerous packages of IoT may be developed. Knowledge of Linux Operating System may be required to paintings with a Raspberry Pi board. It runs on a 1.4GHz 64-bit quad-middle processor, dual-band wi-fi LAN, Bluetooth four.2/BLE, quicker Ethernet, and Power-over-Ethernet support (with separate PoE HAT). It has in-built Wi-Fi and Bluetooth connectivity.



Fig.1. Raspberry Pi 4



Fig. 2. NodeMCU

NodeMCU is an Arduino-like hardware IO which comes at the side of an in-built ESP8266Wi-Fi module. It is a improvement package which enables us to create prototypes of our IoT product the usage of Lua Script. We also can use the Arduino IDE to code the NodeMCU. NodeMCU needs to be covered withinside the IDE so that you can assist us use the package with it. The Internet of Things is a chief leap forward in technology. It is not anything however communique of things (devices) with every different the usage of the net as a medium. Natural Language Processing is in reality a bridge-manner that reduces the space among human communique and system communique. The principal goal of NLP is to make the machines recognize the herbal human language in order that the utilization will become very tons comfortable. In technical terms, NLP is the set of rules which analyzes and synthesizes human speech. This set of rules is primarily based totally on synthetic intelligence and linguistics.

EXISTING SYSTEM

There are Home Automation Systems which can be voice managed. The number one goal of those structures is switching i.e., Switching ON and OFF the home equipment and not anything greater than that. The Existing device restricts the opportunity of technological improvements which may be placed forth as outdated. There are a few structures which use cell telephones to method the Natural Languages and placed them into work. But that stays a void of a devoted tool which may be relied upon. So the present device isn't very lots reliable. There are sure digital assistants to be had as devoted gadgets which can be very lots more expensive to afford. So it will become economically ineffective. Though gadgets like Amazon Echo, Google Home are to be had, extra configurations and setup perhaps required to make it possible for automation of the home equipment which calls for technical assistance. Moreover, there needs to be a few bodily interplay with the gadgets to wake it up which will carry out the obligations within side the current device. The Open Source systems like Jasper which may be used to increase voice managed packages may be used. But it calls for a whole lot of sensible expertise in Raspberry Pi and Linux Operating Systems. It takes an excessive amount of time in installation because it works default within side the CMUSphinx Speech engines which can be essentially offline. As to triumph over all of the troubles of the present device, our challenge works on a devoted unmarried python script which calls for the maximum minimal configuration and setup and makes it clean for the installation.

PROPOSED SYSTEM

This paintings specializes in supplying with the perfect and the only approach to speak with the device with the aid of using giving voice instructions thru herbal languages. This venture gets rid of the anxious technique of tiring configurations and setups and overheating of the device which in the long run influences the performance. The communication with the aid of using herbal languages to the device and its reaction makes the person sense like he's speaking to some other human and makes him forget about the reality that a device is appearing all of the tasks.

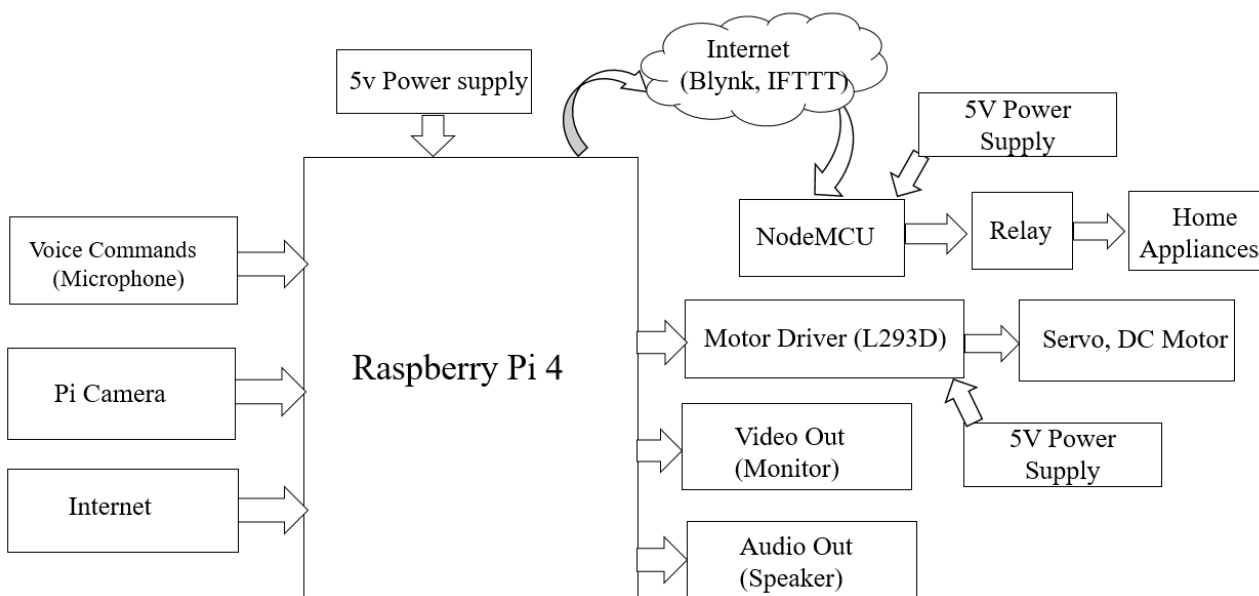


Fig. 3. Proposed System Model

Fig.3 shows the architecture of the proposed system. The work initially seemed difficult as a whole. So to make it simpler it was divided into modules to make the work easier and also for debugging.

The three modules are as follows:

- Speech to Text Module
- Command Module
- Text to Speech Module

Speech to Text Module

The first module is the Speech to Text Module whose most important feature is to transform the speech alerts into textual content in order that it could be less difficult to position it within side the shape of a program. Initially the Raspberry Pi is installation to acquire the audio via a USB microphone within side the default mode. Also ALSA configuration is executed for higher audio experience. After the simple setup is executed, an STT engine need to be mounted within side the Raspberry Pi. There are diverse STT engines specifically Pocket sphinx, Wit.ai STT, Google STT, Julius, AT&T STT. Pocket sphinx engine is thought for its offline talents and works nicely without net. It is mainly designed to paintings nicely with structures like Raspberry Pi. The hazards are that it takes a lot time to configure it. It additionally calls for plenty of dependencies. In that case, Wit.ai or Google STT will be a higher choice. Wit.ai is designed to paintings primarily based totally at the wit.ai cloud services. It makes use of an particular approach known as the crowdsourcing to teach the voice reputation algorithms. A speedy dependable net connection is needed to apply this engine. Google STT is immediately from the Google. It calls for an lively net connection to paintings. It is the only this is utilized in android telephones for speech inputs. So it's miles dependable as in reputation. In this project, We have used Google STT that is open supply and effortlessly handy and known to offer promising results. A speech reputation library is mounted that allows you to be imported into the python script. The complete script might be written primarily based totally at the library. Initially, the microphone is assigned as supply after which the voice is received from the user. Before that, it's far made to regulate itself consistent with the ambient noise otherwise the microphone might mistake noise as inputs. Usually the device takes approximately a 2nd to conform itself to the encircling noise and get used to it. Once it receives adapted, the device will clear out the noise and take within side the speech audio one after the other and sends it to the Google cloud. The Google cloud converts the speech into textual content and we will fetch the facts and keep it in a string. This string will encompass useless terms which won't be required within side the programming. So the string is damaged into phrases and simplest the desired phrases are searched for and corresponding moves are assigned to them below separate functions.

Command Module

This is the module which is composed maximum of the programming together with the code of NodeMCU. First we can study the part of NodeMCU setup. The IO of NodeMCU is just like that of Arduino. So human beings with earlier understanding to Arduino will locate it less difficult to code. Initially the NodeMCU is taken into consideration the server wherein the SSID and the password of the router can be furnished before-exceeded withinside the code. The hardware connections are very minimal. The board is hooked up to a 5V relay circuit and the home equipment are

related thru the relay. The relay acts because the switching. The strength deliver to the relay can be given from the NodeMCU. Motor drivers have to be used for interfacing High Voltage vehicles and additionally different appropriate drivers have to be used for Air Conditioners (HVAC) and water warmers which makes use of up excessive voltage for his or her functioning. The software program component consists of task of a static IP to the NodeMCU. Once the IP is assigned to the board, a code is written to create a website which includes ON and OFF buttons respective to the variety of gadgets to be controlled. The buttons may be accessed thru the IP which may be covered withinside the python script of the Raspberry Pi. Separate capabilities are created to fetch the date, time, climate (the use of any climate API), Google Search and to get entry to the NodeMCU thru the browser or via way of means of blynk. These capabilities are programmed to be accomplished primarily based totally at the key phrases observed via way of means of the use of 'if' statements. It ought to be referred to that everyone the specified libraries ought to be well set up within side the corresponding directories to keep away from pointless insects within side the program. This assignment changed into to begin with began out with the goal of connecting it to pytsx3. The configuration of pytsx3 took a number of time and additionally the setup did now no longer entire correctly which brought about many mistakes which sooner or later crashed the machine repeatedly. So we determined to create a devoted python script with the intention to include best the specified capabilities and rule off all of the pointless capabilities and modules which makes it lighter and lesser complicated whilst as compared to pytsx3. Thus this command module serves because the mind to our machine. Most of the strategies takes location here. This script is made executable and additionally made to run default on startup the use of Linux commands.

Text to Speech Module

This Text to Speech Module is used specifically as a remarks reaction that's achieved on the a hit or unsuccessful finishing touch of any assignment. It makes use of the Text to Speech Engine whose number one feature is to transform the textual content inputs into Voice outputs. There are numerous Text to Speech Engines to be had each on line and offline like eSpeak, Festival, Flite, SVOX Pico TTS, Ivona TTS, Google TTS, Mary TTS, Mac OS X TTS. eSpeak is an offline Speech synthesizer. It could be very available and mild weighted and it's far well matched with many platforms. It is open supply and has simpler configuration process. There are picks of voice from five male voices and four woman voices and additionally the velocity at which the phrases are uttered may be managed primarily based totally at the requirement. Google TTS makes use of API a good way to require an energetic and rapid net connection to synthesize the textual content to speech. It sounds proper but the requirement of connectivity doubts the private ness of the customers. Mary TTS is an offline speech synthesizer written primarily based totally on Java. To use Mary TTS, a server should be installation and it may additionally be hosted at the identical machine. As it takes in plenty of steps, it's far pretty a busy process. We have used the google TTS to get the output voice remarks from the machine. Initially the google assistant engine is hooked up within side the Raspberry . The engine may be known as without problems thru a python script. The speed, voice modulation may be adjusted as consistent with the need and comfort. The TTS is known as for interacting with the consumer to acquire the voice instructions to carry out responsibilities in addition to to renowned the assignment if finished or now no longer. The eSpeak is an offline synthesizer so it does now no longer require an energetic net connection. The Voice outputs from the machine are pre-programmed which can be installed random orders. The instructions are achieved primarily based totally at the customers enter in a random manner. The script is coded in this type of manner that it offers customized replies primarily based totally at the consumer queries. It is also linked to Google and Wikipedia to discover the overall questions that the consumer asks and translates the desired statistics and reads it out to the consumer. The machine is designed to provide a customized sense at home.

EXPERIMENTATION & IMPLIMENTATION

FEASIBILITY STUDY

The cause of this mission is to demonstrate the implementation of a Voice Command System as an Intelligent Personal Assistant (IPA) which could carry out severa obligations or offerings for an individual. These obligations or offerings are primarily based totally on consumer input, place awareness, and the cappotential to get admission to records from a number of on line sources (which include climate or visitors conditions, consumer schedules, retail prices, telling time, nearby visitors, tour assistant, events, notification from social applications, invoke its system getting to know in any other case get it from Wikipedia... etc.....). There are Home Automation Systems that are voice controlled. The number one goal of those structures is switching i.e., Switching ON and OFF the home equipment and not anything greater than that. As to triumph over all of the problems of the prevailing machine, our mission works on a committed unmarried python script which calls for the maximum minimal configuration and setup and makes it smooth for the set up The Existing machine restricts the opportunity of technological improvements which may be placed forth as outdated. It can assist the visually impaired to connect to the arena by means of giving them get admission to to Wikipedia, Calculator, Email and Music during their voice. This version also can hold humans stable as it may be used as a surveillance machine which captures the voice of the individual status on the door and similarity checking. Also it may be a supply of amusement and records for blind/visually impaired. This version will engage with different structures via IOT, hence presents a completely computerized machine. Many experiments and outcomes had been performed and documented.

IMPLIMENTATION

As for Main, We evolved a Personal assistant (Named “Pluto”) the usage of Python in PyCharm IDE. First, while the person begins off evolved the machine, he makes use of a microphone to ship within side the enter. Basically, what it does is that it takes sound enter from the person and it's far fed to the pc to procedure it further. Then, that sound enter if fed to the speech to textual content converter, which converts audio enter to textual content output that is recognizable with the aid of using the pc and also can be processed with the aid of using it. Then that textual content is parsed and looked for key phrases. Our voice command machine is constructed across the machine of key phrases in which it searches the textual content for key phrases to suit. And as soon as key phrases are matched then it offers the applicable output. This output is within side the shape of textual content. This is then transformed to speech output the usage of a textual content to speech converter which entails the usage of an optical individual popularity machine. OCR categorizes and identifies the textual content after which the textual content to speech engine converts it to the audio output. This output is transmitted through the audio system which might be related to the audio jack of the Raspberry Pi. Each of the instructions given to it's far matched with the names of the modules written within side the application code. If the call of the command fits with any set of key phrases, then the ones set of moves are executed with the aid of using the Voice Command. If the machine is not able to suit any of the stated instructions with the furnished key phrases for every command, then the machine apologizes for now no longer capable of carry out the stated task. All in all, the machine works at the predicted traces with all of the functions that had been to begin with proposed. Additionally, the machine additionally affords sufficient promise for the destiny as it's far fantastically customizable and new modules may be delivered any time without worrying the operating of modern-day modules.

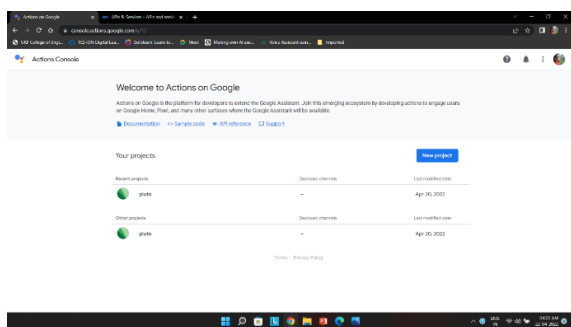


Fig. 4. Google cloud platform and API service

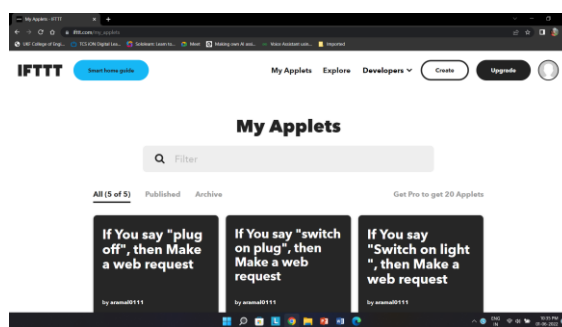


Fig. 5. IFTTT Applets

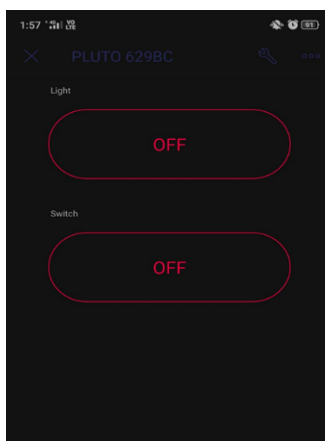


Fig. 6. Blynk App

RESULT AND DISCUSSION

Personal Assistant Robot (PLUTO), on this paper, it's miles mentioned approximately design & improvement of an IOT machine that consists of Person Assistance, Smart domestic machine and 24/7 Surveillance. It is primarily based totally on use of Python code for the automation machine. The Voice managed non-public assistant is done via way of means of the usage of the Raspberry Pi board and takes a shot on the idea and motive it become deliberate with. As the assistant makes use of Google Assistant API so it offers replied appropriately with the precision of 85.5%. For the motion order, the assistant has an exactness of approximately 95% this is following 1-2 2nd the motion path is trailed via way of means of the assistant and the Start Input textual picture from Pi digital cam Pre-processing (noise elimination etc.) Segmentation Feature Extraction Classification Post processing Text to Speech Stop Proceedings of the assistant actions in RIGHT, LEFT, FORWARD, BACK headings as indicated via way of means of the order and STOP. All matters considered, the assistant works on the anticipated traces with all capabilities that had been before

everything proposed. Furthermore, the voice-managed non-public assistant likewise offers sufficient ensures to the destiny as it's miles tremendously adaptable and may be added new modules without demanding the operating of present day modules. The designed hardware prototype version is as regarded in fig 7.



Fig. 7. Robot Prototype Model



Fig. 8. Complete Hardware Setup

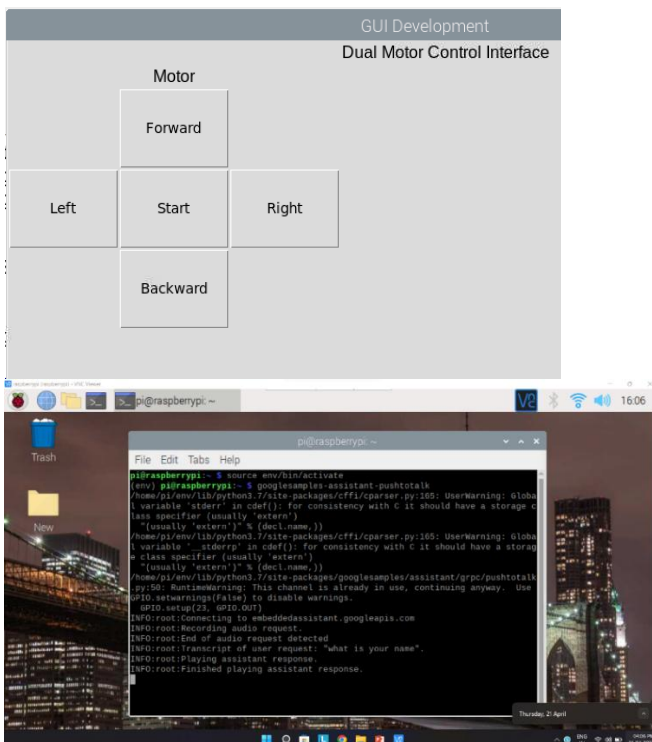


Fig. 9. Output Interface for Movement Control

Fig. 10. Output for Assistant in Terminal

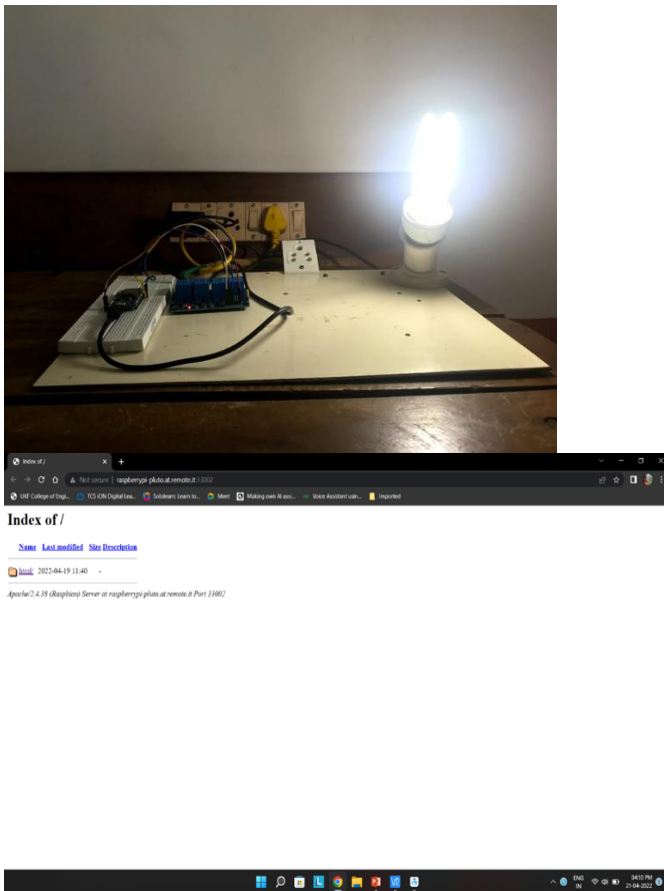


Fig. 11. Output for Light On Command

Fig. 12. Output HTML Page for Surveillance System

CONCLUSION

The current voice popularity primarily based totally Home Automation structures essentially run through most effective a set of instructions which makes it a stereotypic functioning. The person loses hobby as time actions on. To spoil the stereotype and to triumph over all of the troubles and troubles with inside the current machine, this proposed machine takes in a committed python script which absolutely is interactive now no longer with a set of instructions however with dynamically converting responses. This type of method makes the person sense non-public at the same time as the use of the machine. The software program and hardware applied on this machine are primarily open supply and less expensive when produced in large portions will lessen the fee of manufacturing very a lot which in the long run becomes low cost to nearly everyone

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