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A SYNOPSIS

ON

"Automation Using Alexa and Raspberry Pi"

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INTRODUCTION

Now a days virtual assistant is very useful to human. It makes human life easier like operate PC's or laptop on only voice command. Virtual assistant is a less time consuming. By using virtual assistant, we save our time and contribute in other works. Virtual assistants are typically cloud-based program that requires internet connected devices. Virtual assistant is the flexibility to contract for just the services they need. For creating virtual assistant for your raspberry pi go from basics python.

Virtual assistants are task-oriented. Virtual assistants' ability to understand and perform requests. Virtual assistants are a software that understands verbal and written commands and completes task assigned by clients. Virtual assistants are able to interpret human speech and respond via synthesized voices. There are several voice assistants in market like Siri for apple TV remote, Google Assistant for pixel XL smartphones, Alexa as a smart speaker which is developed by using Raspberry Pi, Microsoft Cortona for windows 10. As like this all-virtual assistant we also created a virtual assistant for Linux.

Our goal for this project is to develop a Voice enabled Smart Speaker Prototype with Raspberry Pi providing services offered by Google Assistant and Amazon Alexa in same piece of hardware. It will also work for Home Automation System for controlling Smart Devices with Assistants. User can use both services alternately by invoking them with hot words (i.e., Ok google, Alexa). This model works on primary input of user's voice. Any person ranging from child to old-age person can use this Smart Speaker using Raspberry Pi to get answers for usual queries, enjoy entertainment, schedule day, manage tasks, reminders, control smart home etc.

The voice sends user commands provided through raspberry-pi for home appliance control using GPIO pins to relay module. The circuit consists of relay-based circuit which acts as switches for individual ac loads. Based on commands received by the receiver, the raspberry processor processes the commands and then switches relays accordingly to switch on/off required loads on the circuit. We use a transformer to provide required supply to our board. Thus, we demonstrate a real time home automation system using raspberry pi.

We use Artificial Intelligence technology for this project. Also use python as a programming language, because python offers a good major library. For this software use microphone as input device to receive voice requests from user and speaker as output

device to give the output voice. This process is the combination of several different technologies like voice recognition, voice analysis and language processing. Virtual assistant uses Natural Processing language to match user text or voice input to executable commands. When a user gives a command to personal virtual assistant to perform a task, the natural language is converted the audio signals into digital signals Virtual assistants can provide several services which includes,

- Showing weather condition.
- Gives latest news.
- Turn on/off light.
- Telling jokes, etc.
- Showing datetime.
- Searching on Wikipedia

LITERATURE REVIEW

In the existing system of virtual assistant there are several virtual assistants in market by using Artificial Intelligence technology. Many companies have used the dialogue systems technology to establish various kinds of Virtual Personal Assistants (VPAs) based on their applications and areas, such as Microsoft's Cortona for Windows and Espeak for Linux, Siri for Apple, Google Assistants for Android.

The first digital virtual assistant installed on a smartphone of apple was Siri, it was introduced as a feature of the iPhone in 2011. Aim of that virtual assistant was to add in tasks such as sending a text message, making phone calls, checking the weather or setting up an alarm. Over time, it has developed to provide restaurant locations, search the internet, and provide driving directions. In 2014 Cortona virtual assistant was developed by Microsoft. Cortona uses Bing search engine for performing tasks like answering questions for the users, setting remainder, etc. In 2016 Google Assistant was developed by google. It is primarily available for mobiles and smart home devices. Google Assistants via chat on google messaging app and via voice on google smart home speaker.

The home automation using the raspberry pi is the most commonly used and most affordable method in efficiency and implementation of home automation systems than any other. The raspberry pi provides more powerful platform for the processing and actioning of commands as per the user needs and that is why raspberry pi is most commonly used in the field of home automation. It can act as a powerful processing unit. With the help of various sensors and other modules such as relay module, display module etc. a better home automation system can be used with more security options to home. As the raspberry pi is a faster and efficient computing machine, the number of devices that can be connected to the raspberry pi is also a large number. The devices connections in raspberry pi are also made using the relay module. All the inputs and outputs from the devices and from the controlling device are all processed through the raspberry pi. A single server can be used to do all the large data computing and when it comes online servers, it's so costly. It is better to have a free server for the cost-effective automation system building and also the security is to be concerned for the data that passes through the servers.

The System consists of three main components; web server, which presents system core that controls, and monitors users' home and hardware interface module (raspberry-pi, microphone, speaker, and relay module), which provides appropriate interface to raspberry-

pi and actuator of home automation system. The System is better from the scalability and flexibility point of view than the commercially available home automation systems. The User may use the same technology to login to the server web-based application. If server is connected to the internet, so users can access server web-based application through the internet using compatible web browser. The relays are directly interfaced to the main controller. Proposed design offers are the control of energy management systems such as lightings, heating, air conditioning. Embedded system Raspberry Pi to serve as a communication gateway between mobile devices and home automation systems. It has been designed Alexa with raspberry-pi board were developed for home automation. Python program is used on the laptop to provide the user interface. The raspberry board has I/O ports and relays are used for interfacing with the devices which are to be controlled and monitor

In this project we use Python as a programming language and Visual code studio as a platform on which we execute our code for virtual assistant. We create the personal virtual assistants web application in the form of .exe file which is easy to get in any laptop or PC's and use it, for showing datetimes, weather monitoring, Latest news, on/off light, etc. In our virtual assistant user can able to train or update it by their own needs to do some tasks.

PROPOSED WORK

In the proposed system, the input we give here is voice input from Alexa. Relay acts as interface between devices and Raspberry pi. The voice input is given to developer console. There is two-way communication between developer console and Alexa. The IoT configuration is done in the cloud itself. The devices that are being connected to the Relay should be given 5V power supply. For the interfacing Raspberry pi to the front end and back end, first the raspberry-pi connected to the internet.

Block Diagram:

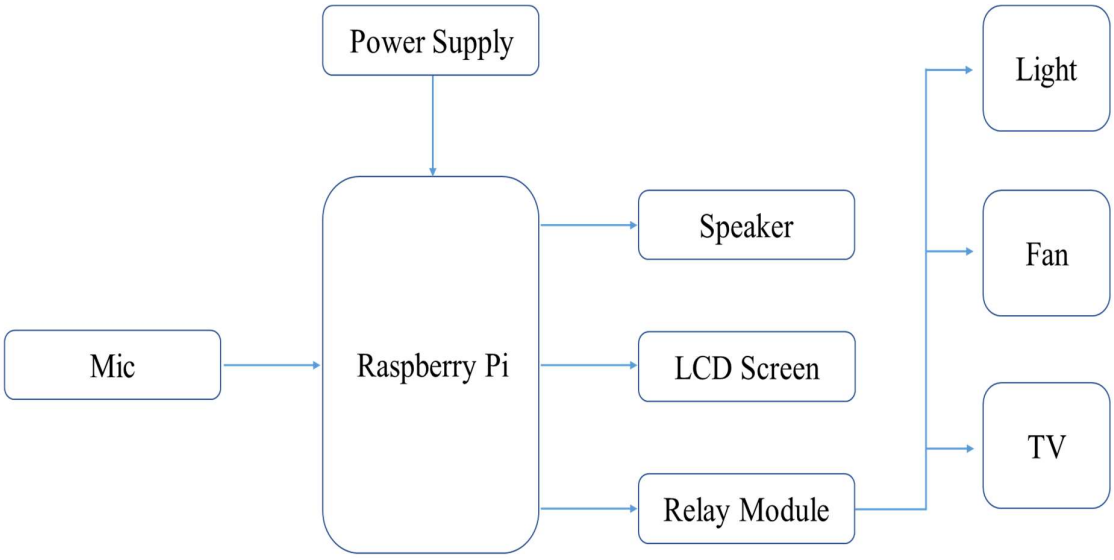
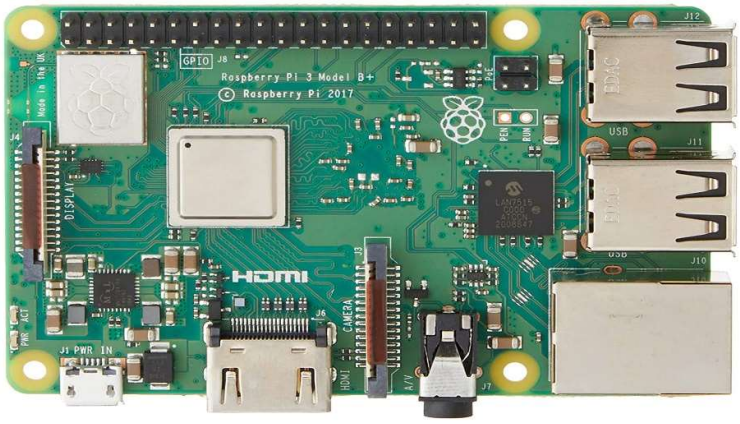


Fig1.Block Diagram of Automation Using Alexa and Raspberry Pi

The following is the set of equipment used for this project.

- **Raspberry Pi**



- The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse.
- It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.
- It can be considered as a single board computer that works on LINUX operating system.
- The board not only has tons of features it also has terrific processing speed making it suitable for advanced applications.
- PI board is specifically designed for hobbyist and engineers who are interested in LINUX systems and IoT (Internet of Things)

- **Microphone**

- A microphone converts sound into a small electrical current. Sound waves hit a diaphragm that vibrates, moving a magnet near a coil.

- The dynamic microphone (also known as the moving-coil microphone) works via electromagnetic induction.
- They are robust, relatively inexpensive and resistant to moisture. This, coupled with their potentially high gain before feedback, makes them ideal for on-stage use.
- Dynamic microphones use the same dynamic principle as in a loudspeaker, only reversed.

- **Relay Module**

- The relay is the device that open or closes the contacts to cause the operation of the other electric control.
- It detects the intolerable or undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area.
- Thus protects the system from damage. It works on the principle of an electromagnetic attraction.

CIRCUIT DIAGRAM

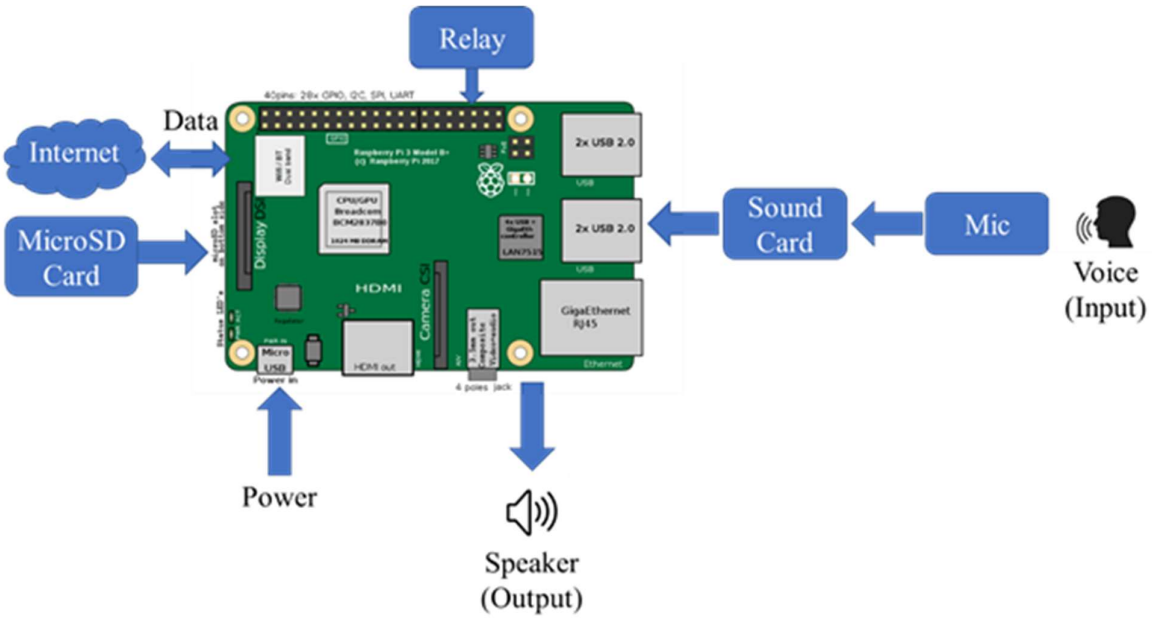


Fig2: Circuit Diagram of Automation Using Alexa & Raspberry Pi

It works in a way that the microphone listens to all the necessary keywords that are stored in the raspberry device. Once the voice instruction passes through the microphone, the raspberry device does the processing and shows the status on the LCD screen. And according to the instruction, the raspberry device forwards the commands to the relay to close or open the circuit. The flow of current is then stopped or provided to the devices.

The device is turned on or off according to the given instruction. The raspberry device processes all the information before proceeding it further to the device. There is also a buzzer that is attached to it. You can turn it on or off just by giving the instruction to the Raspberry Pi home automation device through the microphone. The raspberry pi shows the initial status on the LCD screen and the completed status as the instruction is processed and completed.

METHODOLOGY

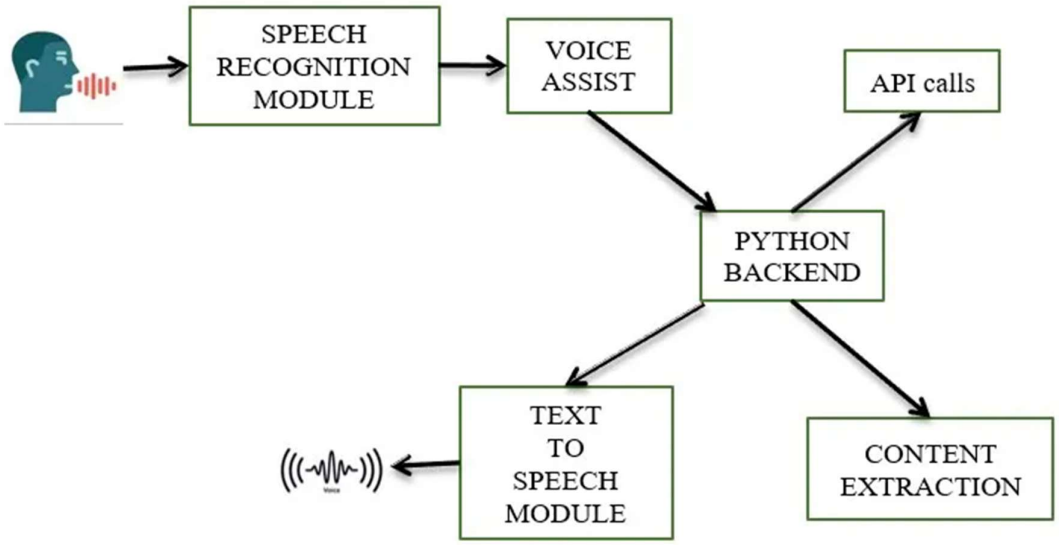


Fig: Detailed Workflow

Virtual assistants use natural language processing (NLP) to match user text or voice input to executable commands. When a user asks a question to personal assistant to perform a task, then natural language audio signal is converted into executable command or digital data that can be analyzed by the software. Then this data is compared with a data of the software to find a suitable answer. Virtual Assistant is used to run machines on your own commands. For making virtual assistant we use some python installer packages like Speech recognition, pyaudio, requests, pyttsx3, etc. Speech recognition is the process of converting audio into text. This is commonly used in voice assistants like Alexa, Siri, etc. Python provides an API called Speech Recognition to allow us to convert voice or audio command into text for further processing. By above diagram, firstly users give the command to the interaction entities like raspberry pi, PC's this interaction entities listen the command and recognize it. For further analyzing process compare this command with cloud in which we already store data. After matching request, the output is generated in the text as well as voice form if the request is match with cloud data. Look up for the function or a logic to be executed based on request and send output of the backend process as a response.

Scope of Application:

The project we are discussing has a wide range of practical scopes:

1. Future scope for the home automation systems involves making homes even smarter. Homes can be interfaced with sensors including motion sensors, light sensors and temperature sensors and provide automated toggling of devices based on conditions.
2. A Wi-Fi enabled Relay coupled with Raspberry Pi enables to operate Lights/any other appliances using mobile phone from anywhere any-time. Home automation is the trending technology, it is the first step towards buzzing word IoT.
3. The main objective of home automation and security is to help handicapped and aged people that will enable them to control home appliances and alert them in critical situations.
4. Smart homes allow you to have greater control of your energy use, all while automating things like adjusting temperature, turning on and off lights, opening and closing window treatments, and adjusting irrigation based on the weather.

Facilities Required for Proposed Work (H/W, S/W)

Hardware Requirement: -

- Microphone
- Speaker
- Raspberry-Pi 3
- Relay Module
- LCD Display
- Bulb, Fan

Software Requirement: -

- Visual Code Studio
- PuTTY
- VNC Viewer

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