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An Implementation of Polyglot Voice Supervise Home Device Using Raspberry Pi

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Abstract

Most of us tend to enjoy the ease of living by doing the bare minimum. The same applies while operating the devices at home by just a few touches or by using our voice in the preferred language. A smart home is an Internet of Things (IoT) platform that uses the internet to control the devices at our home, and this technology has grown enormously over the past few years encouraging new ideas. And with that thought, this system will be implementing Home Automation with Raspberry Pi and Google Assistant by controlling the appliances like lights, fans, air conditioners, temperature sensors, and more, in any preferred language. Platforms like If This Then That (IFTTT), Adafruit, Message Queueing Telemetry Transport (MQTT), and Raspberry Pi IO are used to connect the hardware with the software that is a common path for devices that are connected to the Relay module and the Google Assistant. The IFTTT platforms are easily available on our smartphones or a website that makes it easy for us to access different devices at different parts of the house or anywhere. Home automation minimizes the manual switching ON/OFF of the appliances whilst being controlled by the commands that are given by the users. This project builds an automation system that uses the range of Wifi or Bluetooth, which is easily accessible by the users to connect their devices and control them by voice through Google Assistant. This makes it easy for the users to access their devices wherever they are. Home automation comes as an advantage for older people and especially the physically disabled. The main objective of this proposed project is to provide a comfortable and a digitalized environment to use the day-to-day appliances with added security.

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Keywords: *Google Assistant; Home Automation; Raspberry Pi; IoT; IFTTT.*

1. Introduction

Work these days are completely dependent on applications that are used at home, workplace, schools, industries, etc. It is easier when these appliances are automated and can be used in a user-friendly manner. Nowadays, there is a huge demand for these smart applications and appliances developed every day. These productions are unique and are manufactured in huge demand meeting the customer's needs. Every industry is trying to normalize the usage of smart appliances in creating a digital environment. But imagine when you have a smart application at home to operate your home appliances, everything at home works at your fingertips. Appliances like lights, fans, AC, refrigerator, sensors, etc can be operated. The google assistant understands the commands of the user and responds to the commands by responding with comments that we have implemented. Day-to-day life activities can be easily controlled. There are people in different regions who speak different languages. Controlling the appliances in their preferred language is a challenging task. Google Assistant recognizes the user's commands given in any language and responds to them in that language. We propose an IoT-based multilingual home automation system using Raspberry Pi and Google Assistant using other platform services that are easily accessible on our phones or website to monitor and control the devices whether you are at work or on vacation. Our proposal enables the user to use their voice to control home appliances which makes it easy and convenient to access appliances in a preferred language. The workplaces can be modernized using smart applications and our homes can

be easily converted into smart homes. This brings a major development in the lifestyle of people, trying to automate things in their environment and also saves a lot of time and effort.

Literature Survey

In paper [1], a simple prototype of a smart speaker is developed that has the functionalities of both Google Assistant and Amazon Alexa with a detailed description of their respective architecture. Users can invoke the given assistant by saying the hot words. This system can be used to control smart home IoT devices such as bulbs, Wifi-enabled connections, etc. This speaker can be used with any IoT appliance. Although it needs to be installed separately, it is also expensive and there is no application built based on this prototype [1]. In paper [2], the IFTTT application and the Blynk application are used to help with the commands. Once the commands are said they have to be decoded. And these commands help in the relay module for switching ON/OFF as per the user's needs which are present in the microcontroller. It is built for Google Assistant and the readings that are recorded during the usage are auto-deleted after certain readings. The technology that is being used is quite Complex. System compatibility may vary at times [2].

In paper [3], where a model is created with an algorithm to permit the observing of home circumstances and automate. The microcontroller used in the contemporary prototype is Arduino Nano ATmega328P and Node-MCU that updates their information to the Blynk application. The system is easy to use and control. The system compatibility depends upon the usage. There is no security backup in case the system fails [3]. Another research had a goal to process Human Natural Voice while giving back a meaningful response to the user in return. Here, when the user questions and the assistant cannot give an accurate response it is stored in the database for future enhancing. The technology can connect to many API connection software. It can operate on any electronic voice control. The validation of the inputs can throw issues occasionally. The system supports a single language and cannot be used by the uneducated [4]. In paper [5], the IoT agent receives the user data in the form of commands, which are sent to control the systems through Google commands. This command is received by Google assistant and then the devices will be controlled accordingly. The system is comparatively available at a lower cost. The technology being used is quite flexible for home automation and other smart appliances. It also aims at energy conservation. The system does not include home security. Only limited or fewer devices can be connected [5].

Paper [6] provides a user-friendly environment while operating the appliances through the internet by utilizing port forwarding technology. This technology is applied to smart home automation and controls the devices such as Fans, Lights, AC, and Doors from within the home using Bluetooth, Wifi, or from remote places by using Node MCU as the microcontroller. This project is specially designed for the physically challenged. It only controls the appliances within a short range cost-effectively using Bluetooth. The number of appliance connections is limited [6]. A referral project proposes a low-cost home automation system by using (IoT) and voice recognition which is a design implementation. Here, a Raspberry Pi 3 (RPi) Model B+ is used as the center for the controller. All the processing and transmitting of the input data happens here. The system is easier and convenient to monitor. All of the data is stored in Firebase and can easily be accessed anytime by the user. There are high chances of data leakage and also data damage. Due to this, the system is said to be less secure [7].

In paper [8], the home appliances are operated using a remote controller just as we control our TV. This universal controller can be used cost-effectively by just using a simple smartphone and an Arduino as a microcontroller. The transmission of data happens via Bluetooth transmission. All the appliances can be operated using one single smartphone. The only major flaw here is if there is any device connected to the same network it can be controlled easily by other devices or home appliances. This can be quite risky as the appliances can be accessible to anybody in the range. It can only be operated when the commands are given in a single language. Hence it does not support multiple languages [8].

Proposed System

A. System Design

As mentioned in our survey there are a few projects proposed towards home automation with different methodologies. But this project has a different approach as it will be improvising and enhancing the capabilities of a home automation system using an IoT platform. This project vividly uses both the sensors and the voice controlling methodology, thereby enhancing the current needs. This project will be mainly using Google Assistant, (IFTTT Applets). All the appliances will be controlled by the Raspberry Pi and the Relay module.

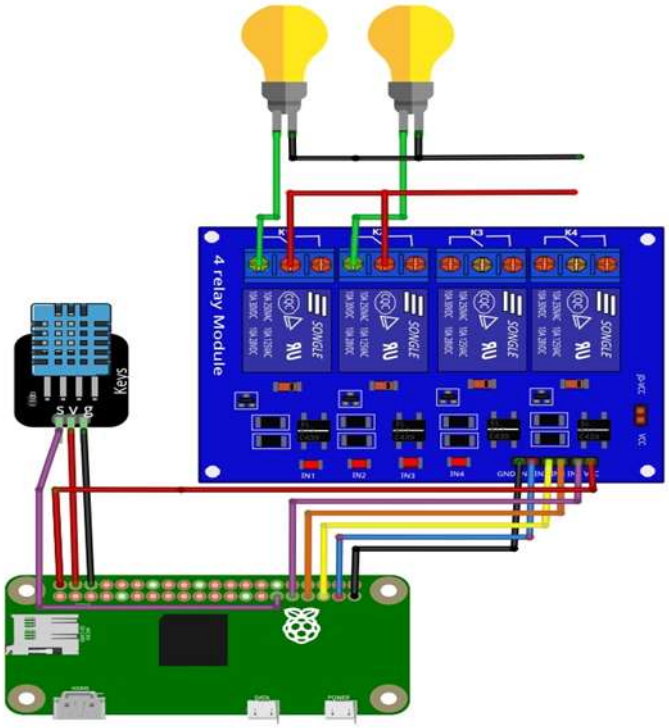

Fig 1: Proposed system design and its respective connections to be made

B. Hardware components

1)Raspberry Pi (zero - wireless): Raspberry Pi is a small type of computer, the OS booted on Raspberry Pi is Raspbian Lito OS. It has built-in wifi and Bluetooth, which includes a 1GHz processor, 500 MB RAM, 16GB SD card, and consumes low energy. The RPi power consists of 5V - 2Amp.

2)Relay: The Relay is known as an electromechanical switch. It runs at a very low power to control high-powered electronic devices such as motors, allowing computers and microcontrollers by switching it ON/OFF, which is created by magnetic induction. Also, the optocoupler (isolator) gets activated by the Light Emitting Diode (LED) rays falling on the Phototransistor connected to the base of the transistor. The coil inside a Relay generates the magnetic field that is created while the 230V alternating current is passed through it. It lets current flow to the other side of the circuit, allowing the bulb to glow.

3)DHT-11 Temperature sensors: DHT-11 works on one wire protocol, which gets updated every 15 secs. which has two parts that are temperature and humidity sensors, the data from the sensors is transmitted through a digital output pin, thus recording the surrounding temperature up to 4 -5 meters.

4)Bulb/ socket: A tool to convert electricity into light that has a closed vacuum fixed into the socket of the lamp. The control pin and normally open of the Relay get the phase (+)and neutral (-) of the main socket, by making the bulb glow in the socket.

C. Software components

1)Google Assistant: Assistant that can be interacted with android and ios phones, performs various tasks setting up schedules, reminders and can also handle automation devices Routines in google assistant helps in completing multiple tasks with a single command.

2)IFTTT: If This Then That is a service-based platform launched in the year 2010. This platform provides its users to connect to different applications or devices. All we have to do is sign up for free and enable the apps to be used and devices to work altogether. Then we browse the IFTTT app or browser and then connect services and search for more services.

3)Adafruit: Adafruit is an IOT platform used to present, and communicate with the project data . Along with that, it secures the data. This acts as a third-party app. It is cheap, flexible, and simple to use and understand. This is where our comments are inserted concerning the project.

4)MQTT (broker): MQTT is open-source, is used for data exchange between constrained devices and server applications. Further, it is a messaging protocol that acts as a subscriber and publisher that is designed for a few devices and networks which act as a cellular network and follow TCP/IP protocol.

2. Materials And Methods

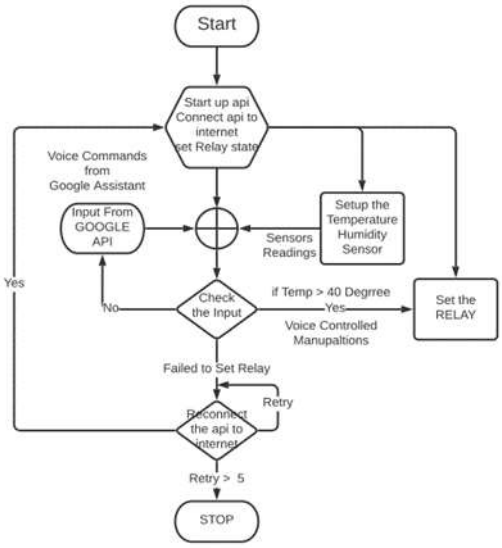

Fig 2: Methodology Flowchart

The main component used here is the Raspberry Pi 0 W to which the temperature sensor is connected. One of the operating wires TX will be transmitting digital output to the GPIO pins of the receiver RX of the Raspberry Pi, and the other two pins are connected to the VCC and the ground. The sensor can record the temperature of the room up to 4-5 meters and water vapor percentage inside the room. This data will be updated every 15 seconds of the previous record, hence being a compatible system to cope up with the changing of temperatures and humidity. Also, the duration of the temperature updates can be changed according to our needs. The Raspberry Pi 0 W is connected to Wifi or Bluetooth to control the devices. This project also uses a 16 GB SD card to record and store the data that will be read by the sensors then boots the OS, which is the Raspberry Lito OS.

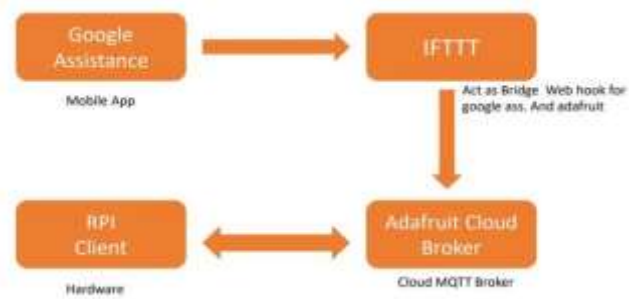

Fig 3: Implementation of the software.

The Google assistant is the mediator of the project that sends the voice commands that are given by the user to the IFTTT application, to know the current status. Then this message is sent to the Adafruit software, the third-party platform that makes connections to the MQTT broker. Adafruit will publish the commands that are being received from the IFTTT to the server, where the Raspberry Pi subscribes the packet from the MQTT broker. Later this data is transmitted to a Relay that is being connected to the smart appliances.

Fig 4: Dashboard of Adafruit

The Opto-coupler which acts as an isolator is used in back EMF which is found on the Relay module. This separates the current flow that is flowing into the Relay board and prevents it from flowing towards the Raspberry Pi. The LED present inside of the coupler lights up when the current flows and reflects on to the phototransistor that is present, due to which it gets activated and connects the base of the transistor of the Relay. The Relay is used as an electromechanical switch that receives the data from the Raspberry Pi. After the Relay gets activated, the transistor of the Relay board connects to the common of the Relay board and the induction coil inside the Relay acquires a magnetic field due to the current flow. Due to this magnetic field being created, the normally opened pin and common pin of the circuit get attracted due to the metal shield, and hence pass the current flow. When there is no current flow, the common and normally closed pins get closer and stop the flow of the circuit.The socket gets connected from the Relay of the common phase of the socket and to the neutral of the socket using an Alternate Current(AC) of 230 V -50 Hz.

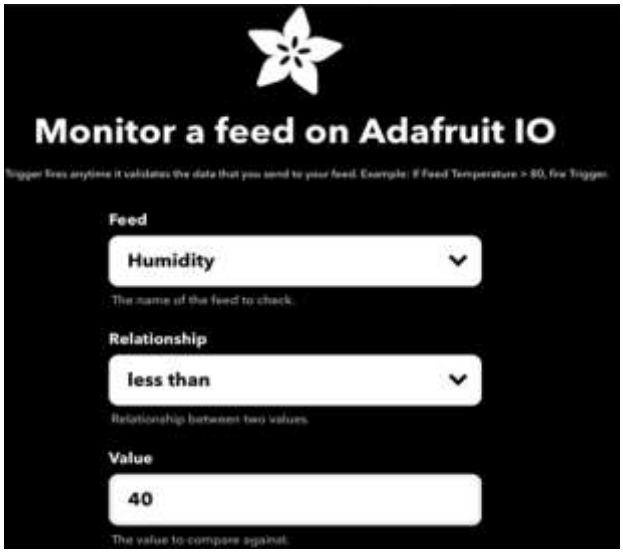

Fig 5: IFTTT Applet

3. Results and Discussion

After connecting the components, the system gets activated and the voice command that is given by the user which gets processed and will be sent to the IFTTT which acts as a bridge that will be sent to the Adafruit cloud broker (MQTT broker) connecting to the RPi client by subscribing. Later, this activates the Relay board that has all the components connected to it. According to the commands, the appliances that are connected play a role. If the user asks for the lights to be turned on, the Relay board activates the lights that are connected as shown in Fig. 6. Fig. 4, shows the dashboard of the ongoing process.

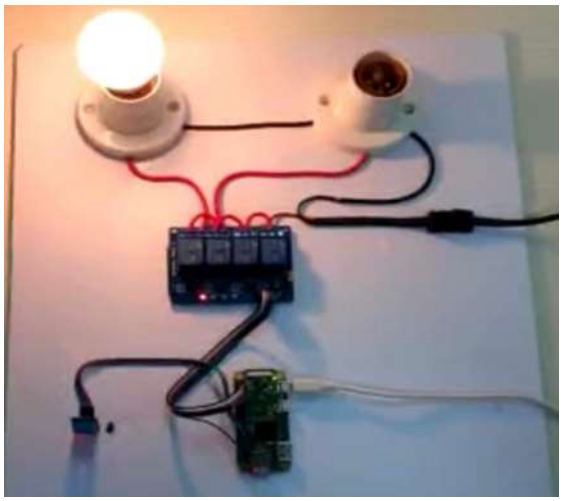

Fig 6: Experimental result on giving the voice command- "Lights ON kardo" (in Hindi)

Various appliances like lights, fans, ACs can be connected to the Relay board, based on its capacity. As per the above-proposed methodologies and techniques, the system tends to respond to the voice commands as well as live recordings of the naturally available data. When this smart project is installed in a residential or commercial place, it takes commands or readings within 5 meters of its surroundings and operates the smart appliances that are connected to it, based on the user requirements as mentioned in the above Fig. 4.

Applications

The sensors present in the system help in reacting to the temperature automatically. The loss of power is drastically reduced, and since most of it is automated the manpower required for automation is easily reduced in private commercial spaces. It is of multiple usages as it would help control more appliances such as fans, lights, air conditioners, temperature sensors and so on. Burglary and fire can be quickly detected, and the controls for the lights, locks, fans, and more can be operated from Laptops, Tablets, or Smartphones, which are easily usable by an adult or a physically challenged person. The proposed system provides the use of natural language for turning on or turning off the appliances. People can use multiple languages to control connected appliances. The user need not have to worry about energy conservation as the appliances can be automated, using the sensors. The system provides home security by being completely digitalized and allowing only the authenticated users to connect to its environment.

4. Conclusion

Finally, the system eases the operations on the appliances that are used regularly. It digitalizes the way of living and is a very efficient way to be using household appliances. It makes it easier for the elderly as well as physically challenged people. It cuts down on the number of damages that could be caused by manually switching ON/OFF of the switches. The technology is however being used immensely, but this project adds to the current technique being unique, by being able to take commands in various languages. It is also a combination of both sensors as well as voice processors, making it more convenient to be used. However, it can be enhanced by building up an application based on this idea. It would also be more reliable if it could include a security system and also be able to respond on its own in case of any emergencies. Further, a customized web server can be set up according to our needs. More regional languages can be added too for better usage [17-22].

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