Google Assistant Using Raspberry Pi

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ABSTRACT: The idea of a computer or a machine developing it's intelligence by interacting with learning from human beings seemed like a farfetched theory when Stanley Kubrick made his sci-fi epic '2001 A Space Odyssey' back in 1968, an adaption of the novel of the same name written by Sir Arthur C. Clarke. Now, some fifty plus years down the line, artificial intelligence has almost become reality. Google Assistant is an artificial intelligence powered virtual assistant developed by Google [5]. This is primarily available on mobiles and smart phone devices. Google Assistant can interact with Android phones or mobiles to do a variety of tasks such as setting alarms, playing music, making calls, playing videos, getting information from the internet etc. To keep things simple, Google Assistant is a voice controlled smart assistant. But, Google Assistant in smart phones or mobiles cannot drive the hardware devices. So, the main aim of this project is to use Google Assistant to run the hardware devices. This can be achieved by using various devices like Zigbee. Majority of the present devices use either Arduino or Raspberry Pi. Using Google Assistant for any type of automation is very much cost efficient and even occupies less space. Implementing Google Assistant using Arduino requires a Google Assistant source. But using Raspberry Pi, a standalone device can be designed. Moreover, the difficulty of creating applications or simply apps for Automation can be avoided. This device, apart from controlling the hardware devices, can be used for interaction. It is completely 'Handsfree' and this is the main advantage. Even a Google Assistant application in a smart phone can be used for driving hardware devices which was not possible earlier. The implementation of Google Assistant using Raspberry Pi requires multiple steps from installation of operating system to customization of commands. Customization of commands is the new feature which will be added to the Google Assistant in this project. In simple words, a very own personal assistant can be created

KEYWORDS: Raspberry Pi, personal assistant, handsfree, voice commands, artificial intelligence, automation.

I. INTRODUCTION

This project uses Google Assistant SDK provided by Google to interact with the Raspberry Pi. The user can command the Raspberry Pi to control various devices [1]. The main aim of this device is to decrease the power consumed by the device and man power put in by the user to control various devices. The effort of making a personal app for Internet of Things or IoT will be removed. Google Assistant app can also be used to control various appliances. Other virtual assistants like Cortana and Siri cannot be implemented as standalone devices. This is because of the non existence of the SDK for them. Other virtual assistants like Alexa can also be used for automation purpose. But the quality and accuracy of taking audio as input in Alexa after implementing on Raspberry Pi or Arduino is quite poor and unreliable. This project focuses mainly on using normal devices, which are not smart, that are used in day to day life. In other words, this project does not require any smart devices or smart appliances, it will make things smarter. The cost of making such a device will also be reduced.

II. LITERATURE SURVEY

Mummaka Sai Srinath, Manepalli Nanda Kishore, MD. Anto Preaveena in [1] used Raspberry Pi to run small LEDs. Manish Prakash Gupta in [2] explained the use of Google Assistant for Home Automation using Blynk App and a smart phone. Emad S. Othman in [3] used Raspberry Pi to implement a voice controlled Personal Assistant. Vamsi

Krishna Patchava, Hari Babu Kandala, P. Ravi Babu in [4] used Raspberry pi and designed a home surveillance and automation system.

III. PROPOSED METHODOLOGY AND DISCUSSION

The previous methods to implement Google Assistant for Automation used smart phone and Arduino. Some of the methods used NodeMCU. A standalone device cannot be prepared if a smart phone is involved in it. So, instead of using a smart phone or any Apps to control appliances, this project uses Raspberry Pi, NodeMCU and relays. This avoids the use of mobile phones and IoT apps.

The various devices required to implement this project are:
1. Raspberry Pi
2. Sound card
3. SD card
4. Some home appliances that need to be controlled

Raspberry Pi [6]: The Raspberry Pi is a device which acts like a mini computer. Raspberry Pi board contains various parts like RAM, display port, USB ports, Ethernet/LAN port, audio jack, a processor to process, camera port [7]. There are various model of Raspberry Pi. The latest model can be used for the implementation of Google Assistant. The various features of Raspberry Pi are micro USB interface, very convenient power management, USB ports, Linux OS (Raspbian), Bluetooth, GPIO header. The speed of the Raspberry Pi depends on the various models. The main advantage of Raspberry Pi which attracts users to it is the use of external memory. Whenever there is a problem with the memory, the chip will not be affected. Using another SD card is enough to rectify this problem.

Sound card [8]: A sound card is a device which is used to provide audio input and output. A Raspberry Pi board will have a 3.5mm audio jack which is used for the purpose of output. So, the board doesn't have any facility to take audio input. To provide this facility to Raspberry Pi board a sound card is used. The input, in the form of audio, can be given to the board using a mic attached to the sound card. The output can be obtained by using speakers attached to the sound card. The implementation of sound card as input and output device is a bit complex. Proper interfacing will be required between Raspberry Pi and sound card.

SD card [9]: The SD card plays a key role in Raspberry Pi. It acts like a ROM. RAM is provided on the board itself. All the data that should be required to perform a task will be stored in the SD card. Generally, the Linux OS Raspbian will be installed in the memory card or SD card. This OS is very much required for the working of Raspberry Pi. Infact, the Google Assistant SDK is provided for Raspbian OS only.

Some home appliances: Generally, this project or product or simply a device can control up to 10 hardware devices or 10 home appliances. Basing on the need and purpose the home appliances are used. Basing on the types of home appliances and their characteristics the programming of the device will be changed. The program can be a simple instruction or a series of complex instructions which may require additional controlling devices.

The project is first registered using Google Cloud Console. The registration process requires a Gmail account. This registered project will be connected to the user's Gmail account. The user can use the Google Assistant app in the mobile. The required Google Assistant SDK files will be downloaded on to the Raspbian OS. Before downloading and installing the SDK files, the Raspberry Pi should be updated and upgraded. A USB type sound card will be used in this project. The output of the Raspberry Pi should be detached before configuring the sound card. A microphone and speaker are attached to the sound card. Testing of the sound card can also be performed to check whether the sound card is working or not. A virtual Python environment will be created to run the Google Assistant in Raspberry Pi. The use of hotword can be enabled in the Raspbian OS. The hotword used to trigger the Google Assistant is "Ok Google" or "Hey Google". This project can also provide the "push to talk" service. In this service, the sentence said by the user will be detected only when the "enter" key is pressed. This was the service provided earlier. If this facility is needed to the user, then the project does not become handsfree. It will be a standalone device but not a handsfree device. So, this project deals with this issue. The command to enable the hotword service can be seen from the below figure. So,

whenever the user enters into the created environment and enables the hotword service, a message about the conversation mode will be displayed. The user can now use the hotword to trigger the Google Assistant. A time gap of 1 second should be given so that the Google Assistant can prepare to listen to the user's request.

Figure 1: Hotword Enabling

To control the hardware devices or appliances, NodeMCU along with relays are used. NodeMCU is used to control various hardware devices. It is an open source IoT platform [10]. The GPIO pins of Raspberry Pi can produce a voltage of only 3.3V. This voltage is not at all sufficient to run the appliances. So, instead of using the GPIO pins to run the appliances, a NodeMCU, along with relay, will be used. The NodeMCU can be programmed using Arduino IDE. A transistor can be used between the relays and the GPIO pins of Raspberry Pi. But the life of the transistor will be reduced because of the voltages required to run the appliances. The NodeMCU will have an inbuilt Wi-fi facility. Apps like blynk can be used to control the appliances manually. The app and the NodeMCU will be connected together through Wi-fi. The presence of NodeMCU will reduce the probability of damage to the relay board and the Raspberry Pi board. The NodeMCU and relays will be connected as shown in the below figure.
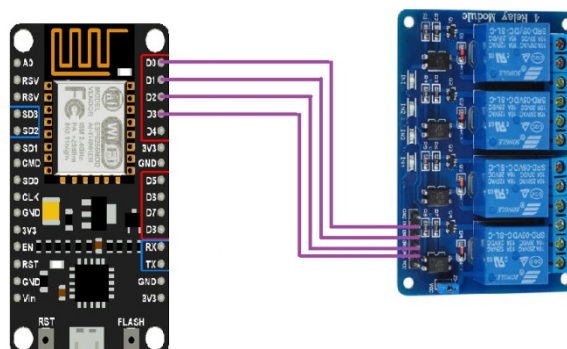

Figure 2: NodeMCU and Relays

Arduino IDE thinks NodeMCU as an Arduino while programming. So, the pin names of Arduino should be used while programming the NodeMCU.

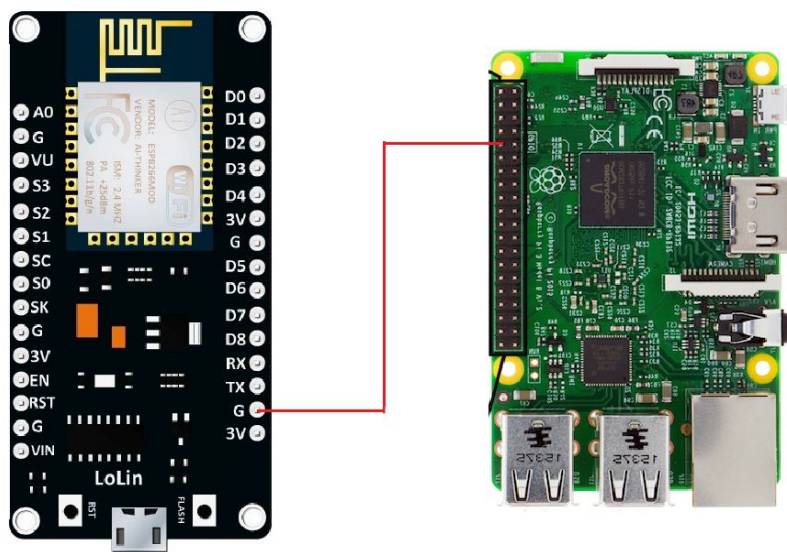The NodeMCU and the Raspberry Pi will be connected as shown in the below figure.

Figure 3: NodeMCU and Raspberry Pi

The power to NodeMCU can be applied using a micro USB cable. The overall arrangement of all the devices can be seen from the below figure.
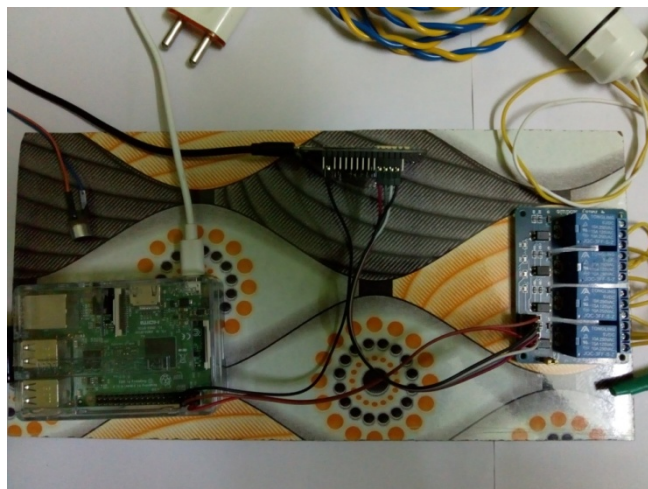

Figure 4: Whole Project

To control the NodeMCU, a tool called IFTTT will be used. The full form of IFTTT is If This Then That [11]. "This" is the phrase or a sentence given by the user like turn on LED. "That" is the response that will be produced for the

matched phrase or the sentence. "This" uses Google Assistant and "That" uses webhooks [12] to control the appliances.The whole mechanism of the project can be seen from the below figure.
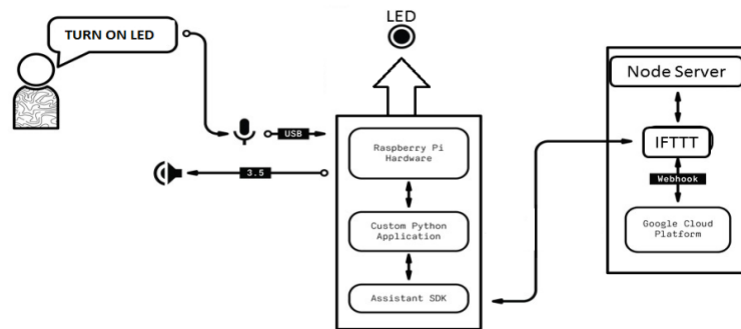

Figure 5: Whole Mechanism

IV.   RESULTS

The final results of the project can be seen from the below figure. In this project, a total of 4 appliances will be controlled. The 4 appliances are a light, an LED, a night bulb and a fan.
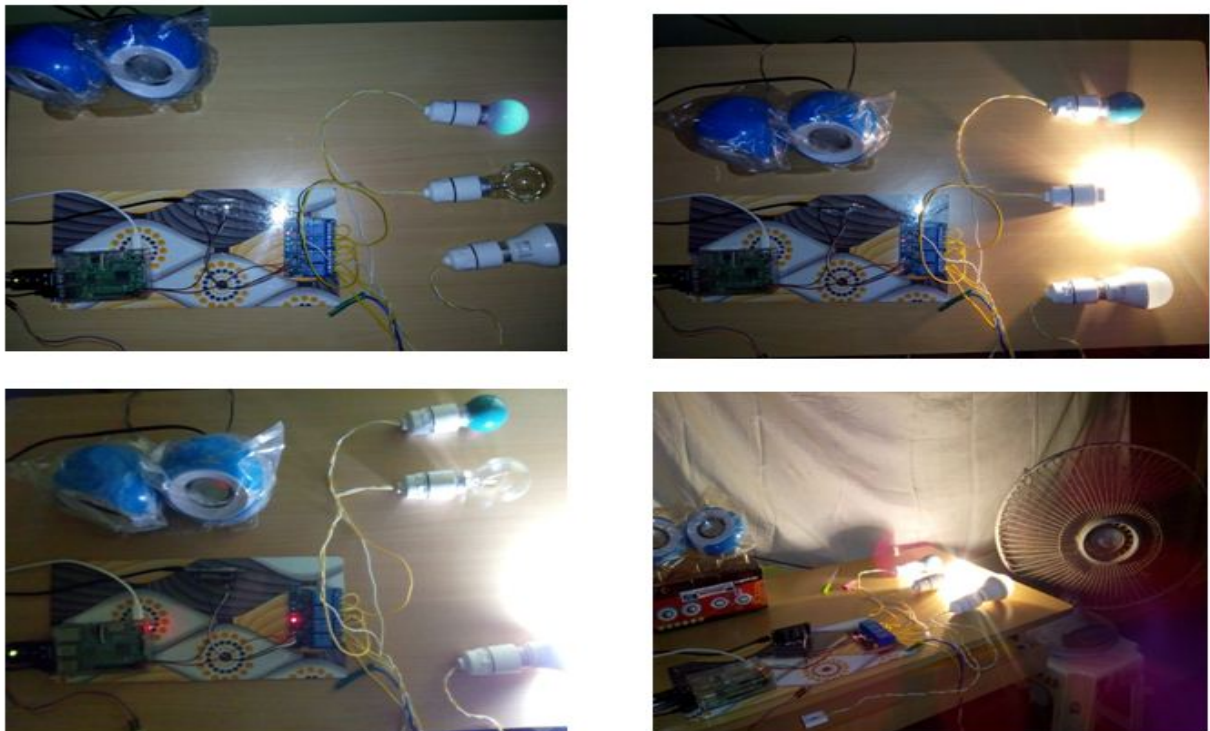

Figure 6: Device Controlling a Night Bulb, a Light, an LED and a Fan

V. CONCLUSION

Google Assistant will simply make the people's lives easy. Because of it's enormous usage in the present society implementing this device is dirt cheap. Even though it is a bit complex to implement, the device can be easily made with some time and ability to sort out things that are required. This device is very much useful for people who are physically challenged and visually impaired. It also makes the life of a busy individual easy. This project will reduce the cost and man power required to design an app to control appliances or devices. This project will remove the need of using a smart mobile to control devices. The Raspberry Pi board will also be protected from damages.

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