Artificial Intelligence (Ai) and Personal Assistance for Disabled People using Raspberry Pi

K. Sarat Kumar, P. Kanakaraja , K. Ch. Sri Kayva, NLSP Sairam , N.ch. Hemanth, E. Saichand , M. Tejaswi, L.Sri Naga Teja

Abstract: ***Now a days, Internet of things (IoT) becoming very essential in the society. IoT is a network in which all the physical objects (or) things that are connected to internet and exchange the data from one device to another and also benefit for humans. The main objective of this project is to control the home appliances by using speech. In this the speech recognition is done by Amazon Alexa which is interlinked with raspberry pi module. The electrical appliances like fan, lights, fridge etc. are integrated in a system which are connected to raspberry pi to control the home appliances that are to be performed by the user commands which are easy to interact with the humans and the devices. There are several technologies existing in the society to control home appliances but in our project, we are implementing raspberry pi and nodeMCU which were interconnected to If This Then That (IFTTT) and Adafruit to control the home appliances. We have achieved the control on home appliances.***

Key Words: Home automation, Voice Recognition, Raspberry Pi, Relays, Amazon Alexa, Adafruit, IFTTT,.

I. INTRODUCTION

Internet of things (IoT) is the network of physical objects which contains the electronic embedded gadgets in order to communicate with respect to external environment [1]. In a nutshell, IoT is a concept which connects all the devices to internet and communicates with each other. It is a huge network of connected devices – which can gather, share and analyze data about how they are used and how they are operated [2]. Home automation describes the integration of technology within the home environment to provide convenience, security to its occupants [3].

Revised Manuscript Received on May 07, 2019.

K. Sarat Kumar, Department of ECE, Koneru Lakshmaiah Education Foundation, Vaddeswaram

P. Kanakaraja, Department of ECE, Koneru Lakshmaiah Education Foundation, Vaddeswaram

K. Ch. Sri Kayva, Department of ECE, Koneru Lakshmaiah Education Foundation, Vaddeswaram

NLSP Sairam, Department of ECE, Koneru Lakshmaiah Education Foundation, Vaddeswaram

N.ch. Hemanth, Department of ECE, Koneru Lakshmaiah Education Foundation, Vaddeswaram

E. Saichand, Department of ECE, Koneru Lakshmaiah Education Foundation, Vaddeswaram

M. Tejaswi, Department of ECE, Koneru Lakshmaiah Education Foundation, Vaddeswaram

L.Sri Naga Teja , Department of ECE, Koneru Lakshmaiah Education Foundation, Vaddeswaram

With the integration of the Internet of Things (IoT), the implementation of home automation is getting more popular. A smart home ordinarily consists of electrical and electronic machines, for example, lights, fans, climate control systems, room-radiators, air-coolers, microwave, etc., Each device can be associated and controlled remotely, over a protected channel utilizing Wi-Fi or web through programming application, from inside or outside the house. Home Automation System (HAS) is to control the voice with understanding basics with a system that can respond to voice [4] signals and control the status of electrical appliances [5].To improve the life style for elderly and disabled people the current home automation is integrated with speech direction which will be feasible to operate in any condition[6].Voice recognition modules are utilized in IOT's for recognizing the voice commands by humans and responding to their needs.

II. METHODOLOGY

In this paper we have utilized different types of devices which are explained below.

A) Raspberry Pi

Raspberry Pi, a credit-card-sized single-board computer. Raspberry may be a low-cost laptop that exposes pins for physical computing. The Pi primarily runs a version of the Linux operating system called Raspbian to host software applications that you write. Without a question that the Pi is more than powerful enough for a wide variety of projects. The Raspberry Pi three is that the third era Raspberry Pi. The raspberry pi model B [9] is implemented in February 2016. It is utilized to get signals from either android tablet or PC and as indicated by the direction. It is associated with the smaller scale telephone and it can send the signs to the raspberry pi unit then it changes the communication into information by utilizing that signal we can get the output. It is additionally utilized as a web server to store the status of device in the database and offer it to the php web application to show on the site page.

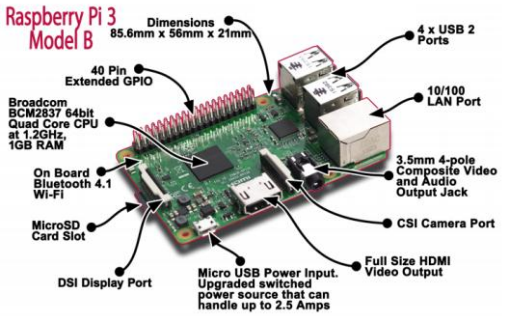

Figure: 1 Structure of RaspberryPi

Source:
https://www.google.com/search?q=raspberry+pi+structure&source=lnms&tbm=isch&sa=X&ved=0ahUKEwin6r_w4LHhAhXNbn0KHZFMAVYQ_AUIDigB&biw=1350&bih=648#imgrc=4uvb4TRL_Kzw7M:

B) Node MCU

The ESP8266 itself could be a self-contained Wi-Fi networking answer providing as a bridge from existing small controller to Wi-Fi and is additionally capable of running self contained applications [7]. Here in our project the signals are send to this nodeMCU from the cloud then the nodeMCU has a inbuilt software in that we are given some pins to particular appliances, for example if we give the signal as tin on light then the pin 1 in node MCU can send the power supply to the corresponding appliance. In this way the node MCU is used in our project.

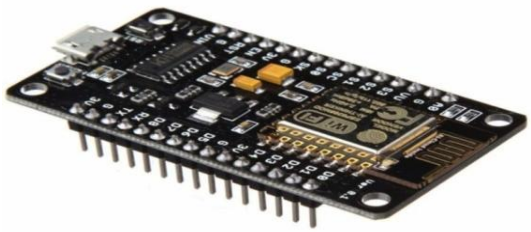

Figure: 2 Structure of NodeMCU

Source:
https://www.google.com/search?q=images+of+nodemcu&tbm=isch&source=lnms&sa=X&ved=0ahUKEwjuL_L4bHhAhWWe30KHVboAzMQ_AUICigB&biw=1350&bih=648&dpr=1#imgrc=i3K8D9w3olRIHM:

C) Relay Devices

Relays act as a mechanically switch by using different principles called solid-state relays. Mainly, relays are used to control the power given to circuit and sends the signal.

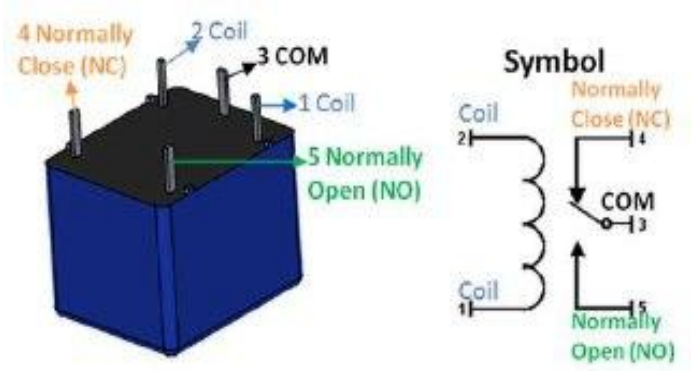

Figure: 3 Structure of Relay Devices

Source:
https://images.app.goo.gl/ccXoiKGGvaPDJtui8

In relays there are 5 pins one is common which is in the middle of the relay device. There are 2 pins which are normal close and normal open. The coil is in between the first two pins.

C) Amazon Alexa

Amazon Alexa simply known as Alexa, which is developed by Amazon, used as smart speakers. It has the capability of voice interaction, playing audio books, for example, news. Alexa enables users to perform the framework utilizing the gadgets (Android mobile app) require to activate the Alexa's listening mode . The communication with Alexa can also be available on different languages like English, German, French, Japanese, Italian etc. Amazon allows the devices to manufacture the Alexa voice capacities into their associated frameworks by utilizing the Alexa Voice Service (AVS), a cloud based framework which furnishes interface with Alexa. Alexa voice service is cloud based speech recognition.

D) If this then that (IFTTT)

"***If this then that"***, additionally called IFTTT could be a free based service to form chains of simple conditional statements, called applets. These applets can perform a configured action in response to a trigger. Triggers and actions are web services provide by platforms such as Facebook, pinterest, YouTube, spotify and now plane sites.

E) Adafruit

It is Message Queuing Telemetry Transport (MQTT) application program interface (API) which allows connecting things over internet. Adafruit's circuit playground is filled with LED's, sensors, buttons, and clip pads and so on. Circuit playground categorical is the newest which provides support for making code, circuit python, and arduino [8]. It has a strong processor, ten neo pixels, mini speaker, infra red receive and transmit, 2 buttons, a switch, fourteen clip pads, and a plenty of sensors, electrical phenomenon bit, IR proximity, temperature, light, motion and sound.

III. Block Diagram

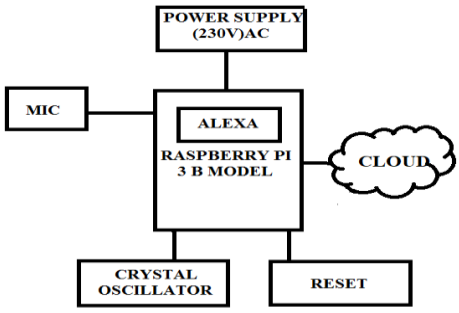

Figure: 4 Block Diagram of the Circuit where the signal is send to cloud

To connect the Alexa voice service an Amazon developer account has to be created. The speech signal, which given as input is translated into digital form by using an Microphone which is connected to Raspberry Pi. The Microphone identifies the speech, which we had given is send to the Pi board; from this the given data is send to the cloud (Alexa voice services) through Wi-Fi module.

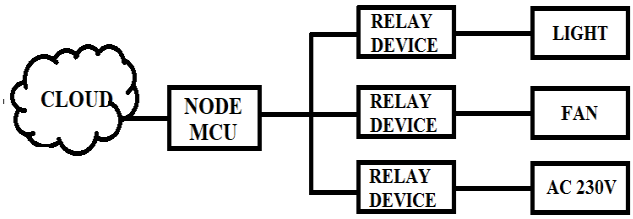

Figure: 5 Block diagram of the circuit the signal from cloud send to node MCU

From cloud the signal which we had given is sent to the NodeMCU via Adafruit. By using a web based service IFTTT, Adafruit is connected to Alexa voice service. As we know the abbreviation of IFTTT, THIS indicates Alexa voice THAT indicates the resultant output. Both IFTTT and Adafruit accounts are to be created . The IFTTT account is to be linked with the Adafruit. The NodeMCU was linked to Adafruit using the key Adafruit IO which was generated in the Adafruit account. The output is generated at the NodeMCU. The NodeMCU is linked with the relay board and the relay board switches.

IV. CIRCUIT DIAGRAM

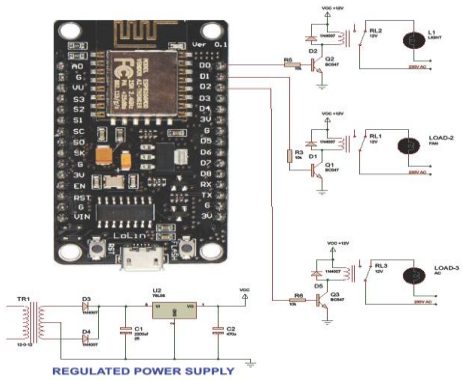

Figure: 6 Circuit Diagram of NodeMCU

Here this circuit (Figure 6) is built under using the Amazon Alexa. By alexa we can control the home appliances by connecting this node mcu with Alexa and in Alexa it was already connected to IFTTT and Adafruit.

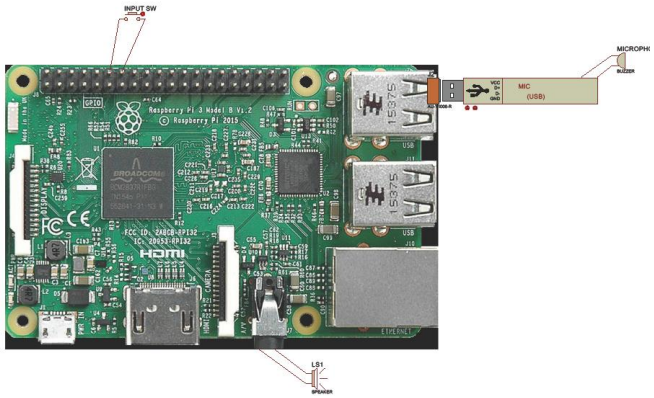

Figure: 7 Circuit Diagram of Raspberry Pi which is sending signals to Cloud

Instead of using Amazon Alexa app we can use the raspberry pi board and this raspberry[10] is treated as Amazon Alexa as shown in Figure 7.

V.RESULTS AND DISCUSSION

In this paper we have analyzed the speech from a person by Alexa which converts the speech signal and gives the necessary signals to the nodeMCU, which control all the home appliances. Alexa is interacted with home automation by giving the voice signal as “Alexa Trigger Turn on the device (Fan, Light, Fridge etc…)” to raspberry pi through mic the data signal is sent to the IFTTT and Adafruit the signal was received by the node mcu and from node mcu the home appliances operated. The relays are used as switches the nodemcu is connected to the relays and the relays are connected to the lights, fans etc as shown in Figure 6. The speech conversion is happened in Amazon Alexa and it can send the signals to nodeMCU.

By this way we operated the home appliances by using the voice signal[11]. The Amazon Alexa is readily available in market. But the cost is very high, so if we use raspberry pi as Alexa the cost is very less. And also if we buy Amazon Alexa then we had to buy the corresponding appliances but while using this raspberry pi as Amazon Alexa then our normal appliances are used for controlling.

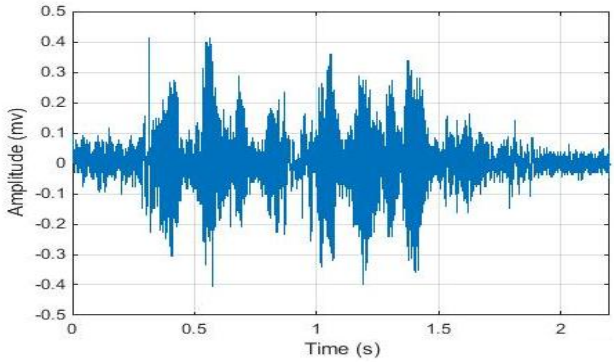

Figure: 8 Waveform for the speech signal "Alexa trigger turn on the light"

In this, we plot a graph between speech signal and time for recognizing the speech signal. we have taken pin1 which are related to home appliances (Light).

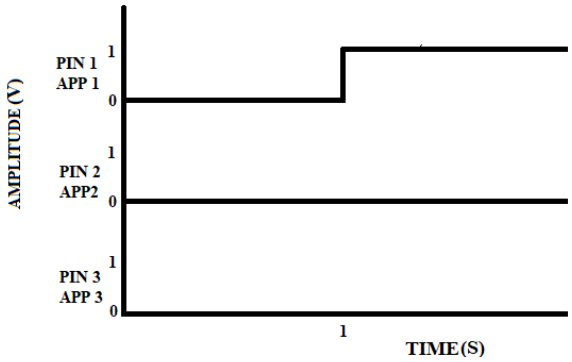

Figure: 9 Pin-1 output (APP- Appliance)

In this waveform, when the cloud is given signal to nodeMCU "Turn on the Light", it gives the output as square form, it shows in ON condition(pin-1) remaining two pins undergoes a straight line(OFF) condition.

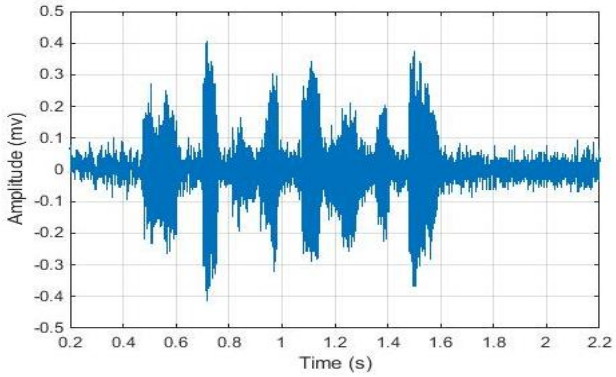

Figure: 10 Waveform for the speech signal "Alexa trigger turn on the fan"

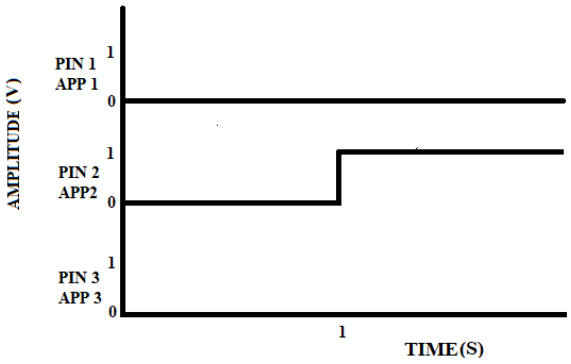

Figure: 11 Pin-2 output (APP-Appliance)

In this waveform, when the cloud is given signal to nodeMCU "Turn on the fan", it gives the output as a square form, it shows in ON condition (pin-2) remaining two pins undergoes a straight line(OFF) condition.

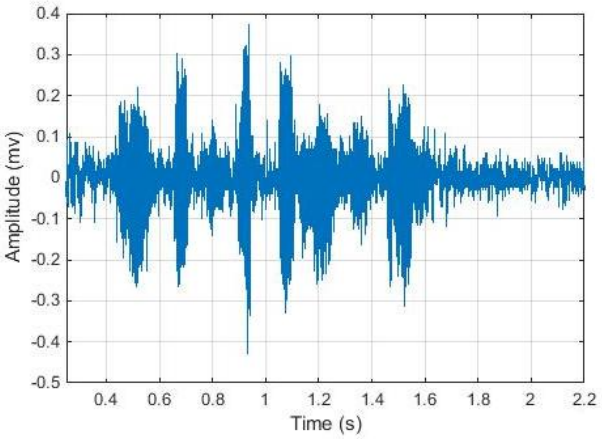

Figure: 12 Waveform for the speech signal "Alexa trigger turn on the fridge"

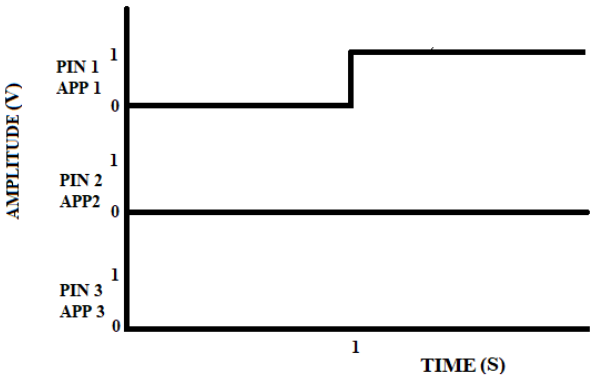

Figure: 13 Pin-3 output (APP-Appliance)

In this waveform, when the cloud is given signal to nodeMCU "Turn on the fridge", it gives a output as a square form, it shows in ON condition (pin-3) remaining two pins undergoes a straight line (OFF) condition.

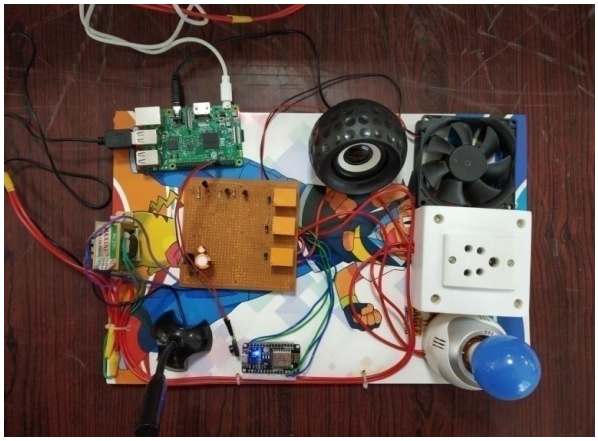

Figure: 14 Output if it is in OFF Condition

Here we had given the voice signal as "Alexa Trigger turn on the light" then the light is in ON condition as shown in the Figure 12 as once and again we had given "Alexa Trigger turn on the fan" then the fan is in ON condition as shown in the Figure 13.

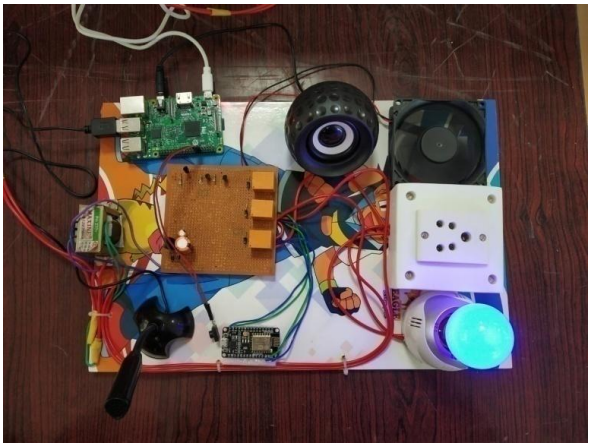

Figure: 15 Output if the light and fan are in ON condition

VI. CONCLUSION

IoT is playing a major role in our lives, which interconnects physical objects to perform tasks smartly. In this paper we have developed a module based on IoT and home automation, which serving the purpose of efficient human devices interaction. By analyzing these results, it states that the pin-1 is ON corresponding to the home appliances by our own speech. We developed the interaction between the humans and machines. Further it can be extended for the people who are visually disabled .

Acknowledgement

The authors would like to thank DST-SERB for providing support under the Project File No: SB/FTP/ETA-0175/2014 and management of KLEF for providing the facilities.

REFERENCES

1. P. Gupta, "Human Voice Controlled Home Appliances", International Journal of Advanced Research ,Vol. 4, Issue 5, pp. 142-143 2015.
2. P BHASKAR RAO, S.K. UMA, P.E.S. College of Engineering, Mandya , "Raspberry pi home automation with wireless sensors using smart phone", IEEE 7th International Conference on Consumer Electronics , 2017.
3. Yash Mittal, Paridhi Toshniwal, Sonal Sharma, Deepika Singhal, Ruchi Gupta and V. K. Mittal Jaypee , "A Voice-Controlled Multi-Functional Smart Home Automation System" , IEEE INDICON 1570186585, 2015.
4. Humaid AlShu'eili, Gourab Sen Gupta, Subhas Mukhopadhyay "Voice Recognition Based Wireless Home Automation System", International Conference on Mechatronics, 2011.
5. Prasanmit Nath, Umesh Chandra Pati, "Low-Cost Android App Based Voice Operated Room Automation System",3rd International Conference for Convergence, 2018.
6. S. Aravind, A. Mathew, S. Sugathan, R. Rajasre and S. Priyalakshmi, "Voice Controlled Smart Home", IEEE Transactions on Education vol. 5, Issue 1,pp 272-276, January 2015.
7. K. Tan, T. Lee and C. Y. Soh, "Internet-Based Monitoring of Distributed Control Systems-An Undergraduate Experiment," IEEE Transactions on Education, vol. 45, No. 2, May 2002.
8. M. Chan, D. Esteve, C. Escriba, and E. Campo, "A Review of Smart homes-Present State and Future Challenges,", IEEE International, Conference on Robotics and Automation , vol. 91, no. 1, pp. 55–81, Jul 2008.
9. N. Swamy, O. Kuljaca and F. Lewis, "Internet-Based Educational Control Systems Lab Using Net-meeting," IEEE Transaction on Education, vol. 45, No. 2, pp. 145-151, May 2002.
10. B. Petelj, M. Pandurov, D. Stefanovic, I. Papp, "Web based solution for smart home functionality extension and control", IEEE ICCE, 2015.
11. "Ubiquitous Home Control and Monitoring System using Android based Smart Phone", International Journal of Internet of Things, 2013.
12. https://github.com/Alexa/Alexa-avs-sample-app