

## Home Automation with Personal Assistant

**Mr. Upendra Kumar, Mr. Neeraj Gupta, P. Dinesh Reddy, Pawan Kumar Ojha , Munuana Arnold, Apoorva**

Asst. Professor, Department of Electronics and Communication Engineering  
Amity University, Gurgaon, Haryana

Student, B. Tech, Department of Electronics and Communication Engineering  
Amity University, Gurgaon, Haryana

**Abstract :-** The Internet of Things (IoT) paradigm has been achieved in complex contexts, such as in the home automation market. Due to complexity in its working as well as huge internet traffic, the whole process is not long lasting and it becomes cumbersome to maintain the proper functioning of devices. Now-a-days, giant Techno-institutes are massively dependent on IoT based applications to provide better commercial as well as domestic e-products in terms of simplicity and feasibility. In the following project we have discussed a new methodology of Home Automation in which the electronic gadgets used in home environment as well as workplace can be controlled by the device itself. “With a unique internet access point in the particular environment, the device is connected to the IP gateway so that it can be controlled from anywhere and any place with the help of proper internet connection. The IP address provided will not function for an individual device, but for the entire network to which all the devices are being accessed.”[1] The interconnection of all the devices can be enabled with the help of an open source software. Initially the device will act and remember the commands as given and will act accordingly. After some duration of time, it will automatically start the actions as previously in-scripted in its memory.

Home automation not only helps to reduce human efforts but is also energy efficient and time saving. The main objective of home automation is to help handicapped and old aged people that will enable them to control home appliances and alert them in some immediate situations.

**Keywords:-** Home automation, personal assistance, Raspberry-pi, remote-access.

\*\*\*\*\*

### I. Introduction

Ever since the invention of “Echo IV” IN 1966 by Jim Sutherland, the advancement in home automation technology is increasing at a tremendously fast pace. It was only during this advancement that the term- “Microprocessor” was introduced in 1971.

Past some years, there have been many new inventions in the field of home automation with the feature of personal assistance. Amazon echo has popularized an intelligent personal assistant called “ALEXA” which is capable of voice interaction, music playback, making to-do lists, setting reminders and alarms, playing the media files, providing the flash briefings of news and forecasts. This device can also control smart devices linked with it, which itself acts as a home automation hub. The device is usually activated with a wake-up word .

With the recent study on the user statistics of Android and home-automated devices, Consumers investing on virtual personal assistant-enabled wireless speakers will hike up to \$2.1 billion worldwide in 2020, up from \$360 million in 2015 which shows a gigantic hike in the numerals.

However in our project we are modifying the working of personal assistance with its adaption of auto-detecting the commands as asked before and repeating it with the same accuracy and precision with right pace and right format under the given time constraints or as the user specifies.

### II. Related works on Adaptive Home Automation

“Currently available home automation systems use different wireless communication standard to exchange data and signaling between their components, like Bluetooth, Zigbee, Wi-Fi, and finally the Global System for Mobile Communication (GSM). Wireless based home automation systems decrease installation cost and effort, and enhance system flexibility and scalability.”[4]. The large amount of hardware leads to difficulties in installation as well a maintenance of the complete system. Current home automation systems are inefficient in security. They are also very poor in bandwidth utilization. They may either leave a large amount of bandwidth or it will be very less. In case of Zigbee the bandwidth is too low and in case of GSM it is too high. SMS based and GSM based home automation is costly for the consumer as it becomes expensive to communicate via SMS. The varieties of home automation system improves the quality of the resident’s life by facilitating a flexible, comfortable, healthy safe environment.” [5]

### III. Proposed system:-

The proposed system is designed in order to minimize the limitations of previous works and gives better flexibility in terms of its working, more secured and more comfortable. “The desideratum is to control home appliances via an OS(phone/tablet/laptop) device with the use of Wi-Fi as a communication provider and RPi as a server system. The server is integrated with a relay circuit which controls the

particular appliance”.[2]. “This communication between the server and the relay circuit is different for different home appliances. The feature of remote controlling and monitoring is executed with the help of Internet connection.”[7]

This Project involves in making Home Automation “smart” with the help of Personal Assistant (build-own Alexa) interacting with “dummy” home appliances. In this context, dummy means the conventional electrical appliances which are not smart on their own. This processing is done in Raspberry Pi (RPi) via Arduino, and the coding is based on Python. Raspberry Pi is a system-on-chip microprocessor with specifications of 1GB RAM,40-pin header general purpose input-output pin. It supports HDMI, 3.5mm analogue audio-video jack, 4× USB 2.0, Ethernet, Camera Serial Interface (CSI), Display Serial Interface (DSI) ports while Python is a programming language. Raspberry Pi acts as a central hub to the other devices connected to it. It is also connected to the internet (IoT) so, that user can control it remotely. Further in order to make it adaptive, the concepts of machine learning is used. This implies that the system will be taking decisions on its own by conceptualizing the previously accomplished tasks of the user.

Block Diagram:

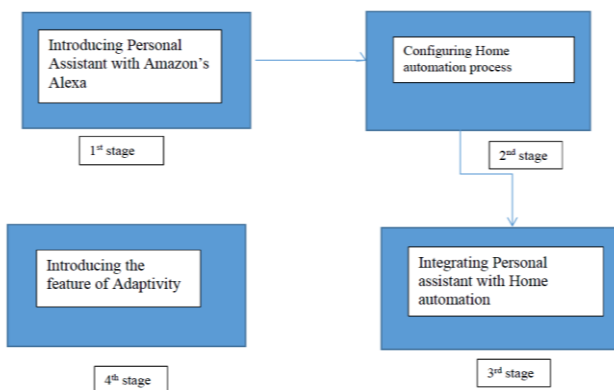


Fig. 1:- Working block diagram of Adaptive Home Automation with personal assistant

“Home appliance network (home automation) is required to be without new wiring and to be very easy installation”.[6] This new kind of system brings OS and Raspberry-pi into home automation implementation. The proposed system architectures generally incorporate a raspberry-pi computer for the purposes of network management and provision of remote access. Raspberry-pi can be configured according to our home system. The user will communicate to raspberry-pi through Wi-Fi network using VNC viewer. The devices connected to the Raspberry pi can be controlled through remot3it server. The system is flexible and scalable, allowing additional home appliances designed by multiple vendors, to be securely and safely added to the home network with the minimum amount of effort. The wifi network should be having adequate strength also. The serial data coming from wifi unit is connected to raspberry-pi circuit. The core of the home automation system consists of raspberry-pi board. it can be viewed as a mini computer capable of doing many functions

like controlling tube-lights,fans curtains gates etc. It can also be used for setting reminders, to-do lists, getting news and notifications from the smart turned dummy devices. The raspberry-pi board is configured for each home appliances .so according to user intervention thematched out will make high and the corresponding relay will switch on and device start function. The system is scalable and allows multi-vendor appliances to be added with no major changes to its core.

The raspberry pi board is configured according to the home system and it will enable the relay circuit as per user request. The relay circuit can control the home appliances also. We can add appliances to the system also and also combine some additional security features.

### Advantages of proposed System

The new system must provide the following features:-

- It allows more flexibility through android device.
- It is accessible for the user throughout the world from any place.
- The electronic devices can be made smart using this technology.
- It allows a good range of scalability.
- It provides security and authentication.
- Additional vendors can be easily added

### Working of peripherals

Alexais a virtual personal assistant designed to compete with the likes of Apple's Siri, Google Now, and others. “It was designed by Amazon's secretive Lab126, capable of listening to our voice commands and responds with contextual responses to get the activities done.” It help us listening tracks on Spotify, reating to-do lists, shopping, and even controlling our smart home products.”[10]

“Alexa has been popularized by the Amazon Echo, a device which is both a speaker and a

smart-home hub, but capable to work on many other devices”[9].“Similar to other virtual assistant, it faces troubles in understanding user commands but its errors can removed due to frequent updation of its intelligence as it is a cloud-based service[6]”.

The System Design has been divided into four modules namely Voice Recognition Module, Power Control Module, Remote Control Module and Core Control Module.

In the voice recognition module, human voice is sampled at the rate of 16,000 per second. the operator gives voice as input and microphone converts the speech signal to the electric signal and the signal is given to the speech recognition module. The speech recognition module converts the analog signal into digital signal and the signal is transferred

to the system. The system will take the decision to to turn on/off any devices with the help of relay based power control module.

**Power Control Module** is a relay based switching system which is responsible for switching any home appliance device. The main requirements of power control module is to take input from the GPIO pin of the Raspberry pi and based on the input switch on/off any device.

**Relay circuit** opens and closes electrical contacts, or activates and deactivates operation of other devices in the same or another electrical circuit. Mechanical and Solid state are the two types of relays found. A mechanical relays is a combination of an inductor and a switch, and the electromagnetic force of the inductor causes a switch to change position. A solid state relay accomplishes the same function with semiconductor devices changing impedance to effectively activate or deactivate a circuit open or closed.

The Remote Control Module has a raspberry based system which stores the current status of all the devices into a file and also store them into cloud server. Web application and Android application fetch all the device status

from the cloud server and display for the user. When a user change the status of any device

from web application or android application, it updates the status of specific device on the

cloud server. A job is always running on the system to get status from remote cloud server in every second.

**The Core Control Module** is the combination of all modules, also referred to as overall system. “The system itself include all the core modules, which are program based applications of the system such as schedule based switch on/off the water motor.”[8]

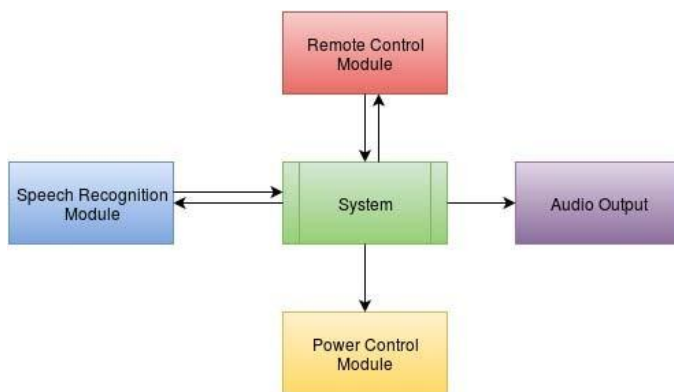


Fig.2 Design module of the project

After setting the modules, Setting up Raspberyp i required installing raspberry pi image into a micro SD card. For this project we used raspberry pi 2 model B. As this project required Internet, we plugged an Ethernet connection into the raspberry pi. To install require software packages, we used a Linux based laptop to remotely login into the raspberry pi system using SSH. “After logged in into the raspberry pi system we update software packages and installed Speech To Text (STT) engine and Text To Speech (TTS) engine. Configuring Alexa with Raspberri-pi needs a developer account to be made on Amazon”[11]. A web page

opens which directs the programmer to the setting database of Alexa in relation with the raspberri-pi.

Raspberri-pi has one of the most important I/O subsystems which connects R-pi with the external world. “When the row of GPIO (General Purpose I/o) pins along the edge of board is connected as an output, the Raspberry Pi replaces the purpose of both the switch and the battery.”[12]

AWS-Lambda lets you run code without provisioning or managing servers. You pay only for the compute time you consume - there is no charge when your code is not running. With Lambda, you can run code for virtually any type of application or backend service - all with zero administration. Just upload your code and Lambda takes care of everything required to run and scale your code with high availability. You can set up your code to automatically trigger from other AWS services or call it directly from any web or mobile app.

#### IV. Conclusion

The combination of the abovesaid peripherals help in the establishing of overall settings, implementation and execution of the distinctive feature of this project. With an attempt to modeize the project in the form of pure IoT, it is expected to optimise the day-to day activities of both domestic, professional and re-recreational environments. With the advent of comfortness, here are some more benefits as a resultant of this project :-

1. It helps the old and handicapped people to enjoy the electronic gadgets without any stress.
2. In industrial processes, automation leads to flexibility in the working pattern.
3. Greater flexibility, in turn provides less use of labour cost and improves efficiency.
4. The final reduction in operating cost increases the profitability of the organisation.
5. It broadens the study of Medical Science which needs a continuous efforts in new discoveries.

**Future Scope** The future is totally going to be smart and more advanced according to Moore’s law. Avid the same concept is being applied in this project too. Till now, in this project, the devices are being controlled by the user. But with further advancements, it can be made adaptive which is going to watch user’s usage pattern. After that, it is able to take its own decision according to the previous pattern of the user. The adaptive feature can be established by using the concepts of machine learning which is a part of neural networks. So with these concepts, this automation is going to hit down all the existing automations such as Voice controlled automation, mobile automation and many more.

#### References:-

- [1] N. Sriskanthan and Tan Karande, “Bluetooth Based Home Automation Systems,” Journal of

- 
- Microprocessors and Microsystems, 2002, Vol. 26, pp. 281-289
- [2] Shaiju Paul, 2 Ashlin Antony, 3 Aswathy B Android Based Home Automation Using Raspberry Pi IJCAT - International Journal of Computing and Technology-Volume 1, Issue 1, February 2014 www.IJCAT.org
- [3] B.MURALI KRISHNA, V. NARASIMAHA NAYAK, K. RAVI KISHORE REDDY, B. RAKESH,P. MANOJKUMAR,N.SANDHYABLUETOOTH BASED WIRELESS HOME AUTOMATIONS SYSTEM USING FPGA-Journal of Theoretical and Applied Information Technology-31st July 2015. Vol.77. No.3
- [4] Abhay Kumar<sup>1</sup>, Neha Tiwari<sup>2</sup> Energy Efficient Smart Home Automation System-International Journal of Scientific Engineering and Research (IJSER) www.ijser.in ISSN (Online): 2347-3878 Volume 3 Issue 1, January 2015
- [5] Chetana Sarode, Prof.Mr.H.S.Thakar ,” Intelligent Home Monitoring System”, International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 1, January -February 2013
- [6] <https://www.safewise.com/home-security-faq/how-does-home-automation-work>
- [7] [https://en.wikipedia.org/wiki/Home\\_automation](https://en.wikipedia.org/wiki/Home_automation)
- [8] [https://en.wikipedia.org/wiki/Index\\_of\\_home\\_automation\\_articles](https://en.wikipedia.org/wiki/Index_of_home_automation_articles)
- [9] [https://en.wikipedia.org/wiki/Amazon\\_Alexa](https://en.wikipedia.org/wiki/Amazon_Alexa)
- [10] <https://developer.amazon.com/alexa-skills-kit>
- [11] [https://en.wikipedia.org/wiki/Raspberry\\_Pi](https://en.wikipedia.org/wiki/Raspberry_Pi)
- [12] <https://www.raspberrypi.org/documentation/usage/gpio>