VOICE BASED HOME AUTOMATION USING AMAZON DOT

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ABSTRACT

In recent years, the field of Internet of Things (IoT) has seen significant investments made by the research community and the industry. This project presents the design of the low cost voice recognition based home automation system for the physically challenged people suffering from quadriplegia or paraplegia (who cannot move their limbs but can speak and listen) to control the various home appliances and can actuate the bed elevation just by the voice commands according to their need and comfort. Specifically, the Smart Home space has been a prime focus with the introduction of devices such as Amazon Echo or Dot, Google Home, Samsung Smart Things among others. The growth of an industry results in innovative, economic, and advanced solutions. In this project, our focus is on making non-smart homes smart and how to build a robust, cost-effective system that can be widely used. To power our system using Amazon Dot for recognizing user request. The Raspberry Pi acts as the brain of this system, processing the requests, responding to the requests. A Raspberry Pi 3 is used as the hardware component for providing smart features for non-smart homes. Our main objective of developing this model is to create a home automation system which interacts with the user through various voice commands based on concerned parameters which is also eco-friendly.

Keywords: Home Automation, Internet of Things, Speech Recognition, Smart Homes, Raspberry pi 3

1. INTRODUCTION

In this modern era, automation of everything is the need of the home Automation is the use of control systems and information technology to regulate equipment, industrial machinery, and processes, minimizing the need for human involvement. Automation plays an increasingly important role in the global economy and in day by day encounter. Engineers work to associate automated devices with mathematical and organizational tools to create complex systems for rapidly expanding parameters of applications and human activities. For the development of smart cities, there is a need to automate everything, so the concept of smart home automation system is an idea which is used to make the city smart. A Smart Home is one that provides comfort, security and gives the feeling of home to house members. Smart homes also provide Energy efficiency (low operating cost) and convenience at all times, for every individual at home.

Home automation means the monitoring and control of household objects intelligently for effective usage. The household objects should be intelligently interconnected as well as provide information for better operations. Home automation augmented with the Internet of Things (IoT) provides better flexibility in managing and controlling household objects in a wider aspect. This will support the interconnectivity of a large number of smart homes for better resource utilization in wider area.

People who are working are so busy so that they often forget to turn off their electrical devices when they are leaving the house for work. Those devices consume the electricity whole day so it leads to huge amount of electricity to go waste. So to overcome this problem Smart Home Automation System concept has been introduced.

"Smart Home" is a term used to characterize a residence house that has appliances, lighting, heating, cooling, security and camera systems that are capable of communicating with each other and can be remotely accessed from any room as well as remotely from any area by phone or internet through speech.

Internet of Things (IoT) is a new revolution of the Internet and the expansion of internet services. IoT digitizes our world, providing us with prolific amounts of data & new delivery models that allow business to engage in new value creation special needs with a system that can respond to voice command and control all the appliances or devices in the home. The system should be cheap, easy to configure, easy to use and easy to run.

In this project, Raspberry Pi is used which is installed in the home and all the appliances are attached with it through the relay. The recent developments in computers and other devices making them relatively less expensive than some time recently. It also leads to the development of smaller devices. Computer gets cheaper and smaller in size. Single Board computer (SBC) is a single circuit complete computer with Memory, Input/output (I/O) and different components of computers. Raspberry pi is an example of SBC that is popular and easily available in the market. It is a low- cost and small size computer used in Smart Home Automation System. RPi is a credit-card sized single board computer developed in the United Kingdom by the Raspberry pi foundation. There are various generations of Raspberry pi.

It also provides platform for communication between objects where objects can organize and manage themselves. It allows everyone to be connected anytime and anywhere. There are various technologies that enable IoT:

- RFID and near-field communication
- Optical tags and quick response codes
- Bluetooth low energy
- ZigBee
- Wi-Fi-Direct, etc.

The aim of the Wireless Home Automation System through voice mainly targets elderly and disabled person.

2. LITERATURE REVIEW
In the existing system, the studies on Home Automation System focuses on addressing the problems or power consumption range of operation and cost of the whole system. To automate the appliances, various methods are used like SMS and Email. The work presented here is focused on fast and easily accessible of a wireless smart home automation system to reduce the manual work and everyone accesses this system. It is having low cost, secure, and access fast as compared to the previous systems.

Ana et al. [1] proposed the work on Home Automation System through Siri enabled mobile devices but the Siri application is installed on the iOS device then only it is accessible to users. They used Apple's Siri for the efficient speech recognition module which is used for translating voice commands and sending it to the actuator of the system through ZigBee networks. The limitation of the work is that there is no utilization of sensors which shows the current status of the appliances and for each appliance, it requires module so it makes the system uneconomical and limited.

Piyare&Tazil [2] et al. proposed the work on this by using the Bluetooth technology for Home Automation System using an Arduino board as well as the wireless system. Through a Bluetooth connection, a cell phone or mobile device is used to send commands to the Bluetooth antenna of the Arduino board but the disadvantage in this is that it is applicable only for the short distance.

S. Hidayat et al. [3] proposed a work on Home Automation system through Voice schedule. In this paper it proposed a system which is using the Raspberry Pi with the devices attached in a Relay and by using the voice command it will control the devices but the disadvantage of this work is that the wired medium is used so the cost of the system increases and the scheduling system is activated approximately 1 minute after the raspberry pi is activated.

S L S Sri Harsha, SChakrapani Reddy [4] International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) "Enhanced Home Automation System using Internet of Things" Naveen Kumar M R, Assistant Professor, Information Science and Engineering, VVCE, Mysuru International Research Journal of Engineering and Technology (IRJET) .

S. Jain et al. [5] proposed a work on Raspberry Pi based Interactive Home Automation System through E-mail in which it design a basic home automation application on Raspberry Pi through reading the subject on Email and it used Python programming language which is a default programming environment provided by the Raspberry Pi. It used LED's to indicate the switching actions. The limitation of this work is called tariff in home automation through DTMF (Dual Tone Multi Frequency) and it doesn't provide any security for the system in case of Email is hacked then any unauthorized person can access.

M. Narendar et al. [6] proposed a work on Raspberry Pi based Advanced Scheduled Home Automation System through Email but the automation process that is employed in this work in scheduled automation. The limitation of this work is it used the Raspberry Pi 2 model B so that less no. of devices are connected with it and more that one instruction was given by the E-mail than one instruction interrupts the other instructions.

D. Pavithra et al. [7] proposed a work on IoT based Monitoring and Control System for Home Automation and it used the portable devices for the user interface. They can communicate with Internet gateway, by using low power communication protocols like ZigBee, WI-Fi, etc. It makes web portal to interact with the devices at home and web portal is accessed via Smartphone. It doesn't provide security to their system and limited no. of devices are used in their work.

To resolve this problem, Wi-Fi technology can be used for a wider range of applications. So in this project, Raspberry Pi 3 is used to resolve the problem and the number of Input/output ports in the Raspberry Pi also increases so we can attach more than 5 appliances to it.

3. TECHNOLOGY STACK

In this project, we have integrated many technical components and established a seamless functionality among them. Our technological stack is delineated as follows:

• Physical Layer: This layer comprises of the devices with which the user interaction takes place:

1) Raspberry Pi 3 Model B - enabled with Wi-Fi

2) Amazon Dot - Smart Personal Assistant device that is present in the user's home. It is triggered using voice commands. Based on the request made, a response will be returned to the user.

• Programming Layer: The source codes of all our programs are written in Python 2.7 and Node.js 4.3. The technological stack is elaborated in the following sections.

A. Devices

The input is given through Amazon's Echo. Echo's natural lifelike voices result from speech-unit selection technology. It is able to perceive what the users are saying using NLP algorithms built into the Echo's text-to-speech (TTS) engine. The Echo hardware complement includes a Texas Instruments DM3725 ARM Cortex-A8 processor, 256MB of LPDDR1 RAM and 4GB of storage space. It connects to the internet through Wi-Fi 802.11a/b/g/n. The Raspberry Pi serves as another I/O device. For this project, we have used a Raspberry Pi 3 Model B, which uses a Broadcom BCM2837 SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache.

B. Infrastructure

Alexa voice services powers Amazon Echo by converting speech into text and giving intelligent replies to user requests. Alexa is capable of voice interaction, music playback, making to-do lists, setting alarms, streaming podcasts, playing audiobooks, and providing weather, traffic and other real time information. Alexa can also control several smart devices using itself as a home automation hub.

4. SYSTEM DESIGN
A. System overview
Our system as shown in Figure 2- User, Raspberry Pi and Alexa Voice Service. In this section, we will explain briefly about each component's role to make the system function.
B. Amazon Dot
Alexa Voice Service is the intelligent voice control service that powers the device, Amazon Echo. Alexa uses natural language processing techniques trained by the developers and the user

community of Amazon to process user requests and cater to their individual needs. The voice service can be triggered using the keyword "Alexa". As mentioned earlier, the skill/application that we have developed can be triggered using the voice command, "Alexa, Turn the lights on". Once Alexa is triggered, it runs a script on the cloud, which in-turn runs a subroutine on the Raspberry Pi to Switch on the light. Once computation is done in the Raspberry Pi, it sends the confirmation back to Alexa. Only the essential information is sent to Alexa which passes it on back to the user.

C. Raspberry Pi

Our application relies on Raspberry Pi as it satisfies the hardware requirements and also does all the computation. The Raspberry Pi has a Wi-Fi and it will use the relay to switch on and switch off the appliances.

3. CONCLUSIONS

The smart home space has a lot of interesting challenges to be solved. One very important problem that we tried to address in this paper is that of non-smart. We made use of one of the hottest smart devices available today in the market, Amazon Echo and coupled it with the Raspberry Pi. The module we used for performing home automation tasks worked well. Further, on testing the application on Amazon Echo in real-time, we obtained promising results. We believe that this a step towards a cost-effective smart homes. We aim to build similar applications in the future for Google Home and other personal assistants that can revolve around using simple voice commands to provide a cost effective solution for non-smart homes.

4. REFERENCES

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Fig 1: Smart Home using IoT [17]
"http://smarthomeenergy.co.uk/sites/smarthomeenergy.co.uk/files/images/smart-home_0.jpg"

Fig 2: Raspberry Pi 3