Android Controlled Home Automation

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*Abstract— **This paper is based on the concept of smart home automation. This paper aims to fulfil the needs of every person, especially the elderly or disabled ones, and it saves electricity at the same time. This system follows the home automation system concept and comes with a low cost and wireless network-based system. Features included in this system will change the standard of living at home.***
***This entire system will have remote access by a smartphone. At the same time, the system is made a safety control with a low voltage activation method. This system comes with a voice mode and real-time video streaming through an "Android application." It also helps the user to control the switches manually. This system is entirely user friendly, cost-efficient, and easy to install.** The proposed system's prototype implementation is evaluated based on the criteria considered after the requirement analysis for an adequate home automation system.*

Keywords: Arduino, IoT, Android, Wi-Fi, Home Automation

I. INTRODUCTION

The idea of "Home Automation" is not a new idea, rather it has existed from many years. The popular idioms like "Smart Home", "Intelligent Home" are introducing the concepts of networking appliances and devices in the house. A research area in engineering, and Computing opens by the designing of Home Automation Systems (HASs). HASs incorporate in different ways like, it is facilitating to lighting features, centralize control of appliances, security locks of gates and doors and lots of other additional systems, to provide advanced support to security systems and energy efficiency. HASs becoming well liked these days and join quickly in this emerging market. Moreover, end users, mainly the disabled and elderly attributable to their complexity and cost, don't always welcome these systems. For the improvement of wireless connectivity, there are a number of dissimilar of connections are launch such as GSM, WIFI, and

Bluetooth. Out of the four well liked wireless connections that provide implemented in HAS project, Wi-Fi is being opt with its satisfactory capability. The capabilities of Wi-Fi are more than sufficient to be put into practice in the design.

Nowadays, most of the laptop/notebook or smartphone has built-in WIFI adapter. It will indirectly lower the cost of this system. In this paper authors have proposed the complete design of home automation and security system using Raspberry pi, a credit sized computer. Raspberry pi provides the same characteristics of a mini computer, and it's had the GPIO pins where other part and devices can be attaching. GPIO registers of Raspberry pi are used for the output grounds. Authors have designed a power strip that could be effortlessly connected to GPIO Pins of the Raspberry pi. The home appliances are connected to the input/output ports of Raspberry pi down with the power strip and their activity is observed to the raspberry pi. The android running Operating System in any phone connected to the network can enter the status of the home appliances via an application. It introduces the design and application of automation system that can monitor and command home appliances via android phone or tablet.

So, in this paper authors have tried to make the prototype of home automation system for controlling all the home appliances wirelessly with all the features including voice mode, video streaming and so on. An android device is made to to control the system with the help of an android device. The system can be used in wide range of areas.

II. EXPERIMENTAL STEPS

A. Experimentation

The first step for the development is the collection of necessary equipment and materials. Authors have first developed simple algorithms and flowcharts to complete the procedure.

B. Design

In this phase, authors have designed the layout of the application. The necessary features to be included. They

were designing the power strip to connect the home appliances that can be controlled via GPIO pins.

C. Developing and Testing

In this phase, the development of application was performed. The bugs were identified and removed. We consulted many software experts for the evaluation of our application. Hardware design includes the design of power strip.

D. Real World Testing

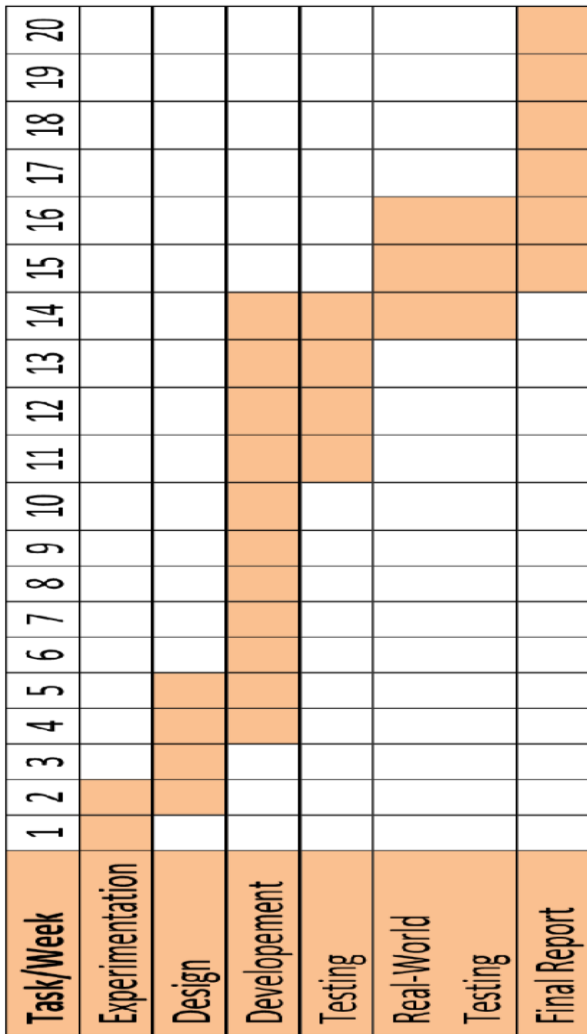Finally, our system was to be tested in the real electrical appliances.

Fig. 1:   Gantt Chart

III.   PROPOSED MODEL
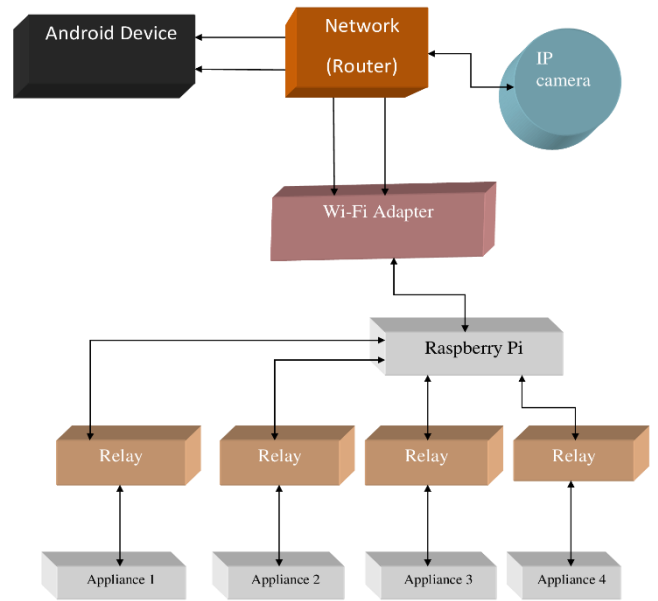
A. Block Diagram

Fig. 2: Block diagram of Proposed system

B. Proposed System

The android operating system is an open source and provides a good platform to perform all the actions. The inbuilt sensors are easily accessible. The android device send all the data via programming and hence acts as a client.Our system is enriched with following features.

1) *Switch Mode Activity.*
2) *Voice Mode Activity.*
3) *Video Mode Activity.*

Switch mode will use the radio buttons that are used to control the home appliances wirelessly. The radio button also sends the status of the switch and we can switch the appliance on/off anytime. Moreover, manual control of all the switches will be present so as to make the entire process user friendly.

Voice Mode is used to control all the home appliances using voice command instructions. With the help of the inbuilt microphone of Smartphone or any other device, the application fetches the speech data to the Google server which responds with a string data. The string data are further analyzed and then processed accordingly.

Video Mode shows the live or recorded video stream of the room. The captured video will be streamed by the help of the android application. All the devices will be connected to a common network, through a common system. Smartphone, Raspberry pi and the IP camera are connected to the common network system. Router is used to create a common network and Wi-Fi Adapter is used to connect Raspberry pi to the network. Raspberry pi is used to maintain the server and the programming codes are uploaded to it in order to run the system. The Raspberry pi collects the data and further activates GPIO pins as necessary. The GPIO pins of raspberry pi are connected to the relays. Relay switches are used to

connect the home appliances and it further takes actions according to the user's choice.

C. IP Camera

A security camera will give the freedom to have a home or business 24/7 surveillance via network anytime and anywhere. It also comes with alarm function, when somebody appears on the camera under alarm mode or alarm function, it will take a picture or activate the alarm and will give you an alert by emailing the pictures to you immediately.

IV.   SOLUTION DETAILS

1)   Hardware Environment

Control Electronics

- Raspberry Pi as the controller for its processing power and large developer community.
- 4 Relays are connected to power strips.
- GPIO pins are connected to transistor. Transistors are used as switch.

2)   Sofware Environment

Android Developer Tools(ADT)

-To build the android application to receive the live video feed from the camera and to send the signals to control the robot.

RPI-GPIO library

-GPIO interface library for the Raspberry Pi.

V.   APPLICATION DESCRIPTION

The Android application consists of GUI which helps the user to control the appliances with an ease. The android application consists of various different activities as follows:.

1)   Start Mode
2)   Option Mode
3)   Voice Mode
4)   Switch Mode
5)   Video Mode

Fig. 3.1: Start Mode   Fig. 3.2: Option Mode

A.   Start Mode :

In this mode, all the rooms of the home will be displayed. The user can select the required room from the given options to control the appliances connected to specified room.

B.   Option Mode :

The option mode provides the user with different types of usage options. The user can select either switch mode or voice mode to control all the appliances and can enjoy a real time surveillance through video mode.

C.   Voice Mode :

The voice mode allows the user to give the speech instruction to the android application in order to control the appliance status. The speech data will be processed and required appliances are controlled accordingly.
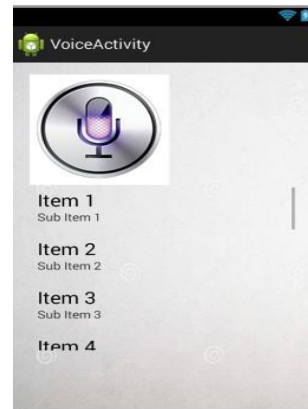

Fig. 3.3: Voice Mode   Fig. 3.4: Switch Mode

D.   Switch Mode :

The switch mode helps the user to simply switch on/off the required home appliances with the help of buttons available in the android application.

E.   Video Mode :

This mode displays the video of the IP cameras connected at the rooms of the home and user can enjoy a real time surveillance as well as the user can record video clips and can watch them later on.

VI.   HARDWARE & PROGRAMMING LANGUAGE

A.   Hardware Details

A power line will be designed and all relays will be connected to power line as well as all the home appliances will be connected to the power line. The Relays will be connected to the General Purpose input/output pins of the Raspberry pi.

VII. PART LIST AND COST ESTIMATION

TABLE 1. COST ESTIMATION

Name	Number	Price	Availability
Raspberry Pi 4 Model B 2GB RAM	1	3950	Available
Wi-Fi Adapter	1	1500	Available
SD card 32 GB	1	500	Available
Router	1	2000	Available
Relays(6V, 3A, PCB Mount)	8	35 per piece	Available
Jumper Wires	1pkt	Varies with Quantity	Available
Resistors	1pkt	Varies with Quantity	Available
Capacitors	1pkt	Varties with quantity	Available

VIII. CONCLUSION

The main aim of this paper is to develop smartphone/tablet-based control system for all the home appliances effectively. The switch mode activity and voice mode activity are used to control the home appliances alternatively. The video feedback will be received in the android application which will stream the real time or recorded video of IP Camera.

The complete system is based on Raspberry pi, an Android platform supported by languages like Java and Python. The main advantage of this system is it is easy to develop and implementation cost of this system is also very low and can be easily configured according to user's choice.

Authors have developed a simple prototype and using this as a reference, the authors will further expand this work many other programs.
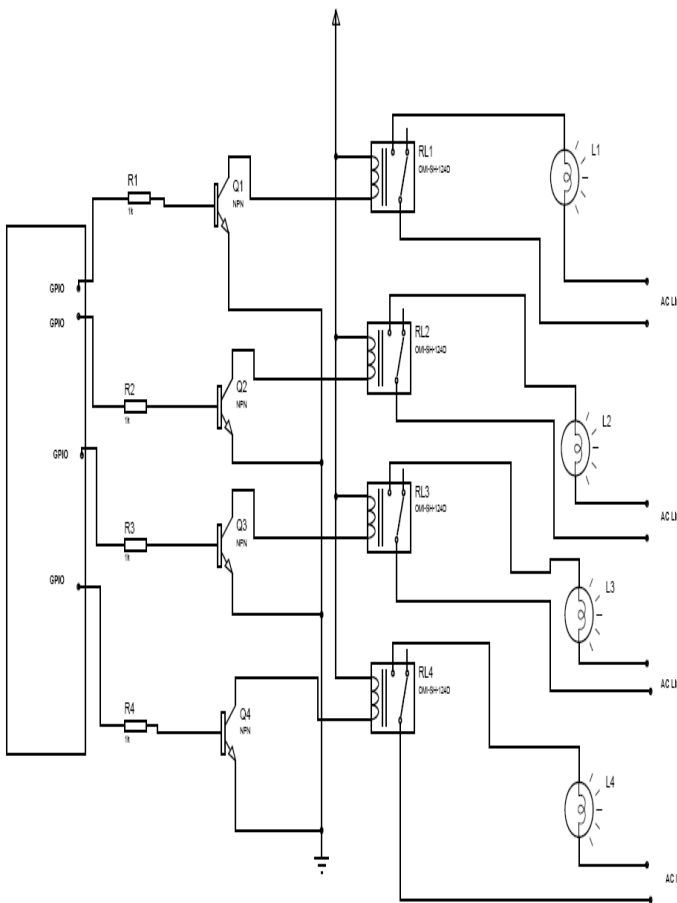

Fig. 4:Block Diagram of the Hardware Description

B. Software Details

Here we have used two different two different types programming languages for this project. For developing the app, we have taken taken the help of Android Studio. We have further used Java programming language for running the Android app. Eclipse software have been used to write codes under java environment. Raspbian operating system have been used for programming in Raspberry pi. The server had been setup at Raspberry pi. Python Langauage have been used to write the codes of the server and to take control of the Genereral purpose Input/Output pins of the operating system in Raspberry pi.

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