SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y.B.Sc. Electronic Science
Revised Syllabus

To be implemented from June 2015

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1) Title of the course: Third Year B.Sc. Electronic Science

2) Introduction:

      Semester Pattern is followed at S.Y.B.Sc. Electronic Science. Third year B.Sc. syllabus is designed to provide an insight into applications of various circuit blocks , design analog and digital systems, methods to analyze working of systems and some of consumer products. Training on system design and simulations, learning programming languages like "C" and tools like "MATLAB" is included. A course in Project work is maintained in new syllabus and a guideline for it is framed.

      In the theory courses adequate knowledge of Analog systems design, digital system design, communication systems, basics of nanotechnology, nanoelectronics will be acquired by the students.

      Student taking admission at T.Y.B.Sc. Electronic Science have to complete 12 theory courses six each semester, two practical courses (Annual) and one project course (Practical III, Annual). In the practical course of 100 marks there are compulsory experiments along with the one activity to be done for practical course I and II. The details are mentioned in the syllabus.

3) Aim and Objectives:

      The aim of the course is to generate trained manpower with adequate theoretical and practical knowledge of the various facets of electronic circuits and systems. Due care is taken to inculcate conceptual understanding in basic phenomena, materials, devices, circuits and products and development of appropriate practical skills suitable for industrial needs. Following are the
objectives -

    i. To design the syllabus with specific focus on key Learning Areas.
    ii. To equip student with necessary fundamental concepts and knowledge base.
    iii. To develop specific practical skills.
    iv. To impart training on circuit design, analysis , building and testing.
    v. To prepare students for demonstrating the acquired knowledge.
    vi. To encourage student to develop skills for accepting challenges of upcoming technological advancements.

4) Eligibility: Second Year B.Sc. Pass / ATKT , with all subjects cleared at F.Y.B.Sc.

5) Examination -
    A) Pattern of Examination :
    i) Semester III
    Theory Papers - Six Theory papers of 50 marks per semester
               (Internal examination 10 + Semester Examination 40, Total 50)
    ii) Semester IV
    Theory Papers - Six Theory papers of 50 marks per semester
               (Internal examination 10 + Semester Examination 40, Total 50)
    Practical - Three Practical courses, out of which Course III is Project work.

iii) Pattern of the question Paper:

The pattern adopted for theory and practical examination is as below.

Theory:

The topic wise weightage is decided as per lecture allotted to cover the syllabus for the topics. The Internal option is also taken into consideration in the process. Equal weightage is given for each topic. No topic can be given as optional.

Internal Examination 10 Marks

It is a continuous evaluation process and is executed by the teacher conducting the course.

Four types of questions -

Objective, Fill in the blanks, True or False and One Sentence Answer.

There are two or three different sets of the question papers used for internal examination in the same class for same paper.

External Examination 40 Marks

Pattern is as follows-

Q.1 Answer all of the following : 12 marks

Compulsory no internal option, contains one mark , two mark objective and numerical questions.

Q.2 Answer any TWO. : 08 marks

Three questions are given, each having 4 marks, any two are to be solved.

Q.3 Answer any TWO. : 08 marks

Three questions are given, each having 4 marks, any two are to be solved.

Q.4 Answer any TWO. : 12 marks

Three questions are given, each having 6 marks, any two are to be solved. There is complete option question for Q.4 having three compulsory numerical Problems having weightage of 4 marks each.

Practical :

Internal Marks 20 :

Continuous assessment

External Examination 80 Marks.

Have to perform 2 experiments of 40 marks of the duration 3 hours each. (Practical Examination is scheduled in two sessions.)

B) Standard of passing:

Candidate must score 40% marks at the semester examination in each course. **i.e. 16 marks at semester theory paper and 32 marks at the practical course.** There is no separate passing for internal course, however the total marks of internal and external should be 40% of the total marks to be awarded.

C) ATKT Rules: As per University rules.

D) Award of Class:

Overall class at Third Year B.Sc. Electronic Science will as per University rules as follows -

- Above 70% First class with distinction
- Between 60% to 70% First Class
- Between 50% to 60% Second Class
- From 40% to 50 % Pass class.

However the marks in the Electronic Science papers at Second Year B.Sc. course will be taken into account, for awarding the ultimate class of the course at T.Y.B.Sc.
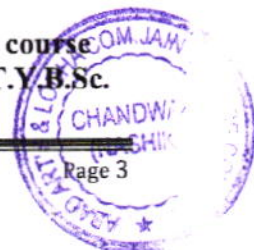
E) External Students:
Not applicable for this course. External Students are not allowed.

F) Setting of Questions paper/ Pattern of Question paper:
Setting of the question paper is as per University Schedule and it is centralized system adopted by University of Pune. Pattern of question paper will be as per decided by Board of Electronic Science, University of Pune.

G) Verification of Revaluation: As per University Statutes and rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

6) Structure of the course : **Total six Theory in each semester and Three Practical courses.**
    i) a) Compulsory Paper : Five theory papers in Semester III and Semester IV
        b) Optional Paper : One (Paper VI)

Course Structure

Paper	Semester-III		Semester-IV	
Paper I	EL-331	Advanced Digital System Design	EL-341	Advanced Communication Systems
Paper-II	EL-332	Microcontrollers	EL-342	Microcontroller and its Applications
Paper III	EL-333	Analog Circuit Design and Applications of Linear IC's	EL-343	Power Electronics
Paper IV	EL-334	Principles of Semiconductors Devices	EL-344	Foundations of Nanoelectronics
Paper V	EL-335	'C' Programming	EL-345	Mathematical Methods and Circuit Analysis using MATLAB
Paper VI	EL-336 A)	Optional Course Fiber Optic Communication	EL-346 A)	Optional Course Industrial Automation
	B)	Electronic Product Design and Entrepreneurship	B)	Consumer Electronics
Paper –VII	EL-347	Practical Course I		
Paper –VIII	EL-348	Practical Course II		
Paper –IX	EL-349	Practical Course (Project)		

Note : Vocational courses will be substituted in place of PAPER V AND VI
    c) Question paper : <u>Theory</u> -
                  • **For Internal Examination 10 Marks**
                  • **For Semester Examination 40 Marks**
        Practical-
                  • **For Internal Examination 20 Marks**
                  • **For Semester Examination 80 Marks**

ii) **Medium of instructions:** ENGLISH

7) **Equivalence subject/Paper and Transitory Provision:**

T.Y.B.Sc. Electronic Science Semester III

		Old Syllabus		New Syllabus
Paper I	EL331	Advanced Digital System Design	EL331	Advanced Digital System Design
Paper II	EL332	Microcontroller	EL332	Microcontrollers
Paper III	EL333	Analog Circuit Design and Application of Linear IC's	EL333	Analog Circuit Design and Applications of Linear IC's
Paper IV	EL334	Foundation of Nanoelectronics	EL344	Foundation of Nanoelectronics
Paper V	EL335	'C' Programming	EL335	'C' Programming
Paper VI	EL336	Optional Courses	EL336	Optional Courses
	A)	Fiber Optic and Fiber Optic communication	A)	Fiber Optic Communication
	B)	Sensor & Actuators	B)	Industrial Automation
Paper VII	EL-347	Practical Course- I	EL-347	Practical Course- I
Paper VIII	EL-348	Practical Course- II	EL-348	Practical Course- II
Paper IX	EL-349	Practical Course- III (Project Course)	EL-349	Practical Course- III (Project Course)

T.Y. B.Sc. (Electronic Science)

Paper IX: EL-349 Practical Course- III

Project Work

Guideline to conduct Practical Course III

Practical Course III is a project work of 100 Marks.

- Internal project Examination (Out of 20)
- University Annual project Examination (Out of 80)

The project work should be followed with following guidelines.

a) The name and subject of the project type must be well defined.

b) Planning of the work must be specified.

c) Theoretical, reference work must be provided.

d) Pilot experimentations / Preparations must be specified.

e) Typical design aspects, theoretical aspects, aim and objectives of the work must be specified in detail.

f) The actual work done must be reported along with experimentation procedures.

g) There must be observations, interpretations, conclusions, results of the project work.

h) Algorithm, program strategy, module wise description of parts etc be provided in case of projects related with development of computer software.

i) Applications, usefulness, student's contribution in it must be clearly specified.

j) Further extension work may be suggested for better outcome of the project.

k) It is recommended to present the projects in competitions / project exhibitions organized by various authorities.
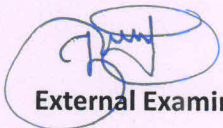
Shri. Neminath Jain Brahmacharyashram
College,Chanwad.

HOME AUTOMATION
USING ANDROID

PROJECT REPORT SUBMITTED TO

THE DEPARTMENT OF ELECTRONICS AND COMMUNICATION

PROJECT DONE BY
DIPALI JADHAV

WITH THE GUIDANCE OF

MR.O.M.PARDESHI SIR.

External Examiner

Internal Examiner

Head
Department of Electronics
Department of Electronic Science
College, CHANDWAD, Dist. Nashik.

Table of Contents

List of Figures

List of Table

Acknowledgement

Abstract

This project presents the overall design of Home Automation System (HAS) with low cost and wireless system. This system is designed to assist and provide support in order to fulfill the needs of elderly and disabled in home. Also, the smart home concept in the system improves the standard living at home. . The switch mode and voice mode are used to control the home appliances. The video feedback is received in the android application which streams the video of IP-Camera. The main control system implements wireless technology to provide remote access from smart phone. The design remains the existing electrical switches and provides more safety control on the switches with low voltage activating method. The switches status is synchronized in all the control system whereby every user interface indicates the real time existing switches status. The system intended to control electrical appliances and devices in house with relatively low cost design, user-friendly interface and ease of installation.

1. Introduction

1.1. Background

The "Home Automation" concept has existed for many years. The terms "Smart Home", "Intelligent Home" followed and has been used to introduce the concept of networking appliances and devices in the house. Home automation Systems (HASs) represents a great research opportunity in creating new fields in engineering, and Computing. HASs includes centralized control of lighting, appliances, security locks of gates and doors and other systems, to provide improved comfort, energy efficiency and security system. HASs becoming popular nowadays and enter quickly in this emerging market. However, end users, especially the disabled and elderly due to their complexity and cost, do not always accept these systems.

Due to the advancement of wireless technology, there are several different of connections are introduced such as GSM, WIFI, and Bluetooth. Each of the connection has their own unique specifications and applications. Among the four popular wireless connections that often implemented in HAS project, WIFI is being chosen with its suitable capability. The capabilities of WIFI are more than enough to be implemented in the design. Also, most of the current laptop/notebook or Smartphone come with built-in WIFI adapter. It will indirectly reduce the cost of this system.

This project forwards the design of home automation and security system using Raspberry pi, a credit sized computer. Raspberry pi provides the features of a mini computer, additional with its GPIO pins where other components and devices can be connected. GPIO registers of raspberry pi are used for the output purposes. We have design a power strip that can be easily connected to GPIO Pins of the Raspberry pi. The home appliances are connected to the input/output ports of Raspberry pi along with the power strip and their status is passed to the raspberry pi. The android running OS in any phone connected to a network can access the status of the home appliances via an application. It presents the design and implementation of automation system that can monitor and control home appliances via android phone or tablet.

1.2. Project Objectives

Android controlled Smart Home Automation should be able to control the home appliances wirelessly with effectively and efficiently.

Controlling Home Appliances via Application (Switch and Voice Mode)

To develop an application that includes the features of switches and voice mode application. Switch Mode or Voice Mode can be used to control the switches of home appliances.

Real Time Video Streaming from IP camera

To receive the quality video from the camera to the android application.

Secure Connection Channels between Application and Raspberry pi

Use of secure protocols over Wi-Fi so that other devices cannot control the appliances. Options for secure connection is SSL over TCP, SSH

Controlled by any device capable of Wi-Fi (Android, iOS, PC)

To make the home appliances flexible in control, any device capable of Wi-Fi connectivity will able to control the home appliances from remote location.

Extensible platform for future enhancement

The application is to be highly extensible, with possibility of adding features in the future as needed.

1.3. Scopes

The project aims at designing a prototype for controlling the home appliances that can be controlled wirelessly via an application that provides the features ofspeech recognition, video streaming, and switch mode. An application is run on android device. The system can be used in wide range of areas.

The system integrated with different features can be applied in the following fields.

- **The system can be used in home, small offices to the big malls**
  The system can be used from home to offices to control the electrical appliances.

- **For remote access of appliances in internet or intranet.**

  The home/office appliances can be controlled in intra-network or can be accessed via internet.

- **For the development of technology friendly environment**

  The system incorporates the use of technology and making smart home automation. By the use of day to day gadgets we can utilize them for different prospective.

1.4. Technology Exposures That Project Provides:

1. Google's Android open source technology.

2. Wi-Fi technology.

3. Interfacing Wireless Adapter to Raspberry pi.

4. Interfacing relays with ac and dc power sources.

5. Using Transistor as a Switch.

6. Embedded programming.

1.5. Project Management

This project constituted development of application as its major part as well as the hardware to control home appliances. Management of any project has several steps or processes in it. So, our projects can be described under the following steps-:
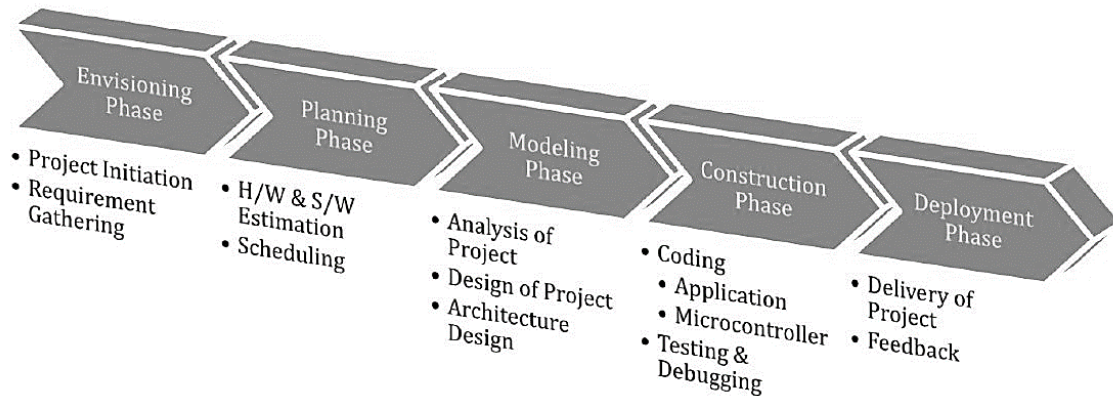
Figure 1: Waterfall Model

1.5.1. Experimentation

In this step, we were discussing about the necessary equipments and materials. We were studying about the similar projects, gathering the information of programming language to be used. We were developing simple algorithms and flowcharts.

1.5.2. Design

In this phase, we were designing the layout of the application. The necessary features to be included. We were designing the power strip to connect the home appliances that can be controlled via GPIO pins.

1.5.3. Development 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.

1.5.4. Real-World Testing

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

Figure 2: Gantt chart

Task/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Experimentation	▓	▓																		
Design		▓	▓	▓	▓															
Development					▓	▓	▓	▓	▓	▓	▓	▓	▓	▓						
Testing											▓	▓	▓	▓						
Real-World Testing															▓	▓				
Final Report																	▓	▓	▓	▓

2. Literature Review:

As per our survey, there exist many systems that can control home appliances using android based phones/tablets. Each system has its unique features. Currently certain companies are officially registered and are working to provide better home automation system features. Following models describes the work being performed by others.

N. Sriskanthan [7] explained the model for home automation using bluetooth via PC. But unfortunately the system lacks to support mobile technology.

Muhammad Izhar Ramli [8] designed a prototype electrical device control system using Web. They also set the server with auto restart if the server condition is currently down.

Hasan [9] has developed a telephone and PIC remote controlled device for controlling the devices pin check algorithm has been introduced where it was with cable network but not wireless communication.

Amul Jadhav [10] developed an application in a universal XML format which can be easily ported to any other mobile devices rather than targeting a single platform.

Each of these system has their own unique features and on comparison to one another lacks some advancement.

Our designed system has application layer prototype. The application is able to synthesize the speech data with the help of Google Voice Reorganization. The synthesized data are analyzed and further processing is carried out. In layman words, our design system provides features of controlling the home appliances using voice commands.

The use of socket programming is performed to connect the android application with the raspberry pi. This further adds security to our system. The data are received only by the server at the specified port and data are further analyzed. Our project is different in a sense it has its own software level application to control the home appliances.

3. Block Diagram

3.1. Block diagram of proposed system

```
┌─────────────────────┐              ┌──────────────┐        ┌──────────┐
│ Android device      │  ⟷           │   Network    │  ←     │   IP     │
│ (mobile/ tablet)    │              │  (Router)    │        │  camera  │
└─────────────────────┘              └──────────────┘        └──────────┘
                                           │  │
                                           ↓  ↓
                                     ┌──────────────┐
                                     │ Wi-Fi Adapter│
                                     └──────────────┘
                                           │
                                           ↓
                                     ┌──────────────┐
                                     │ Raspberry Pi │
                                     └──────────────┘
        │            │            │           │
        ↓            ↓            ↓           ↓
   ┌────────┐   ┌────────┐   ┌────────┐  ┌────────┐
   │ Relay  │   │ Relay  │   │ Relay  │  │ Relay  │
   └────────┘   └────────┘   └────────┘  └────────┘
        │            │            │           │
        ↓            ↓            ↓           ↓
 ┌───────────┐ ┌───────────┐ ┌───────────┐ ┌───────────┐
 │Appliance 1│ │Appliance 2│ │Appliance 3│ │Appliance 4│
 └───────────┘ └───────────┘ └───────────┘ └───────────┘
```
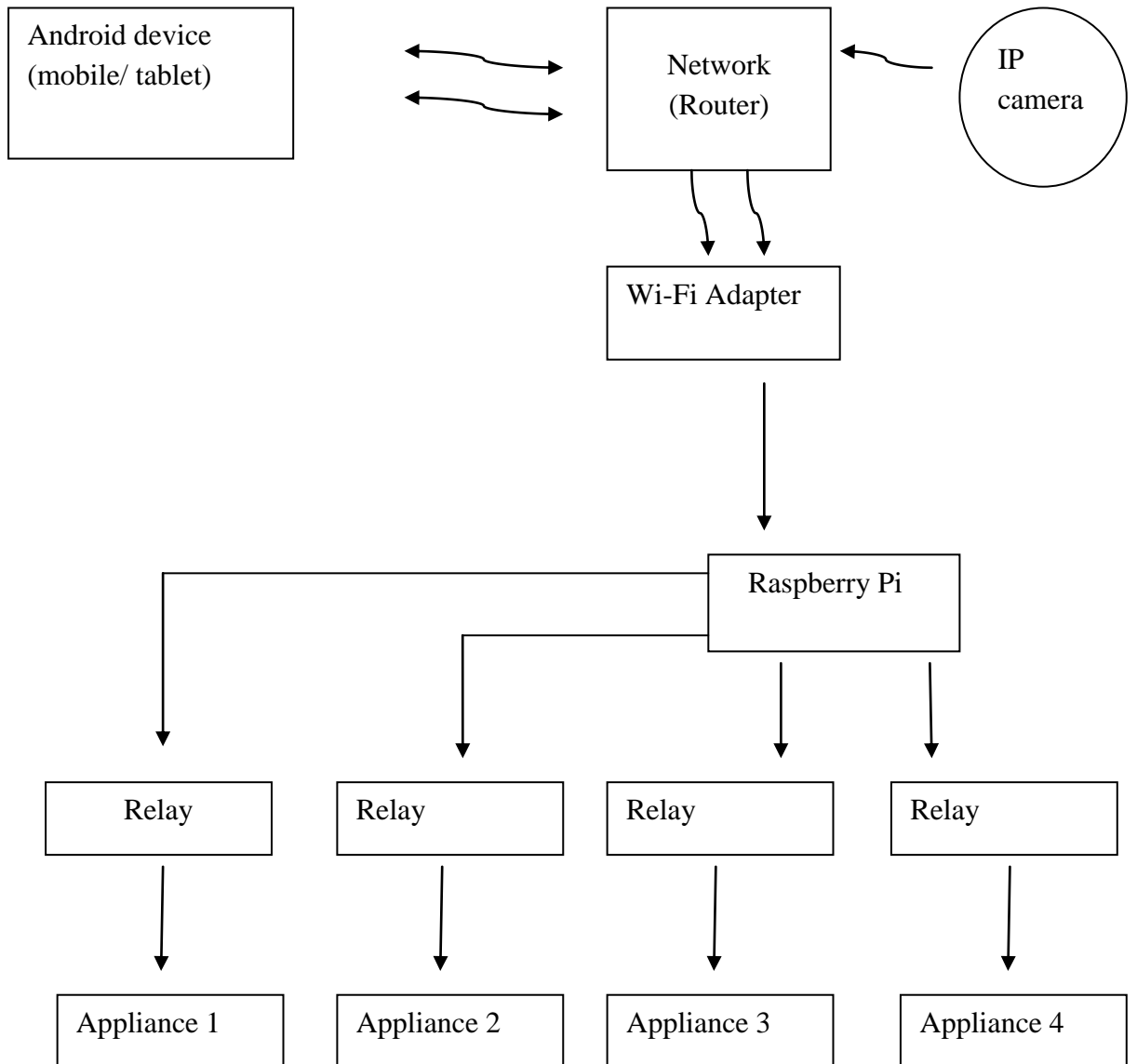
Figure 3: Block Diagram of Proposed System

3.2. Proposed System:

The android OS provides the flexibility of using the open source. The inbuilt sensors can be accessed easily. We have built an application with following features. Android Phone acts as a client and data are sent via sockets programming.

1. Switch Mode

2. Voice Mode

3. Video Mode

Switch mode uses the radio buttons that are used to control the home appliances. The radio button sends the status of the switch.

Voice Mode is used to control the home appliances using voice command. Using the inbuilt microphone of Smartphone, the application creates an intent that fetches the speech data to the Google server which responds with a string data. The string data are further analyzed and then processed.

Video Mode shows the video stream of the room. The captured video is streamed at the android application.

All the devices are connected to a common network. Smartphone, raspberry pi and IP camera are connected to the common network Router is used to create a common network.

Wi-Fi Adapter is used to connect raspberry pi to the network. Raspberry pi is used to maintain the server. The pi collects the data analyses it and further activates GPIO pins as necessary. The GPIO pins of raspberry pi are connected to the relay. Relay switch are used to connect the home appliances.

IP Camera

This security camera can offer you the freedom to get your home or business surveillance via network anytime and anywhere. It comes with alarm function, when somebody appears on the camera under alarm function, it will take a picture or sound the alarm and email the pictures to you immediately. IP camera can be used in various places, such as warehouse, office, supermarket, and doorkeeper and so on.

IP camera is incorporated with following features.

1. Inbuilt Microphone and Mic. These provide two way communications between remote user and the person standing in front of camera.

2. Alarm Service Setting provides the features of alarm while detecting unauthorized movement of user.

3. File Transfer Protocol Setting and Email Setting Provides the features of emailing the video stream or images at the regular interval of time.

Advantages of Wi-Fi over other wireless technologies like Bluetooth and ZigBee:

Bluetooth is generally used for point to point networks and Bluetooth operates at a much slower rate of around 720 Kbps which is very small for video transfer or moving large amount of data like the image captured from a camera, whereas the bandwidth of Wi-Fi can be up to 150Mbps and very ideal for video transmission.

Wi-Fi is very much secure means of communication than Bluetooth.

Wi-Fi connection to send video, audio, and telemetry operation, while accepting remote control commands from an operator who can be located virtually anywhere in the world.

Robots are already being eyed for obvious tasks like conducting search-and rescue missions during emergencies or hauling gear for soldiers in the jungle or woods. The mechanics of the robot uses the concept that has been developed to ensure robust navigation, search and transportation in rough terrain.

3.3. Solution Details

3.3.1 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.

3.3.2. Software Environment

1. **Android Developer Tools (ADT)**

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

2. **RPI-GPIO library**

   - GPIO interface library for the Raspberry Pi.

4. Application Description:

Application Consists of Graphical User Interfaces. It consists of following different activities.

1. Start Mode Activity

2. Option Mode Activity

3. Voice Mode Activity

4. Switch Mode Activity

5. Video Mode Activity

Figure 4.1: Start Mode Activity   Figure 4.2: Option Mode Activity

4.1 Start Mode Activity:

In this mode, all the rooms of the home are displayed. The user can select the necessary room from the option to control the appliances connected to specified room.

4.2. Option Mode Activity:

This mode provides the user for the option to control. The user can select either switch mode or voice mode to control the appliances.

4.3. Voice Mode Activity:

This mode provides the user to give the speech feedback to the application. The speech data are processed and required appliances are controlled.
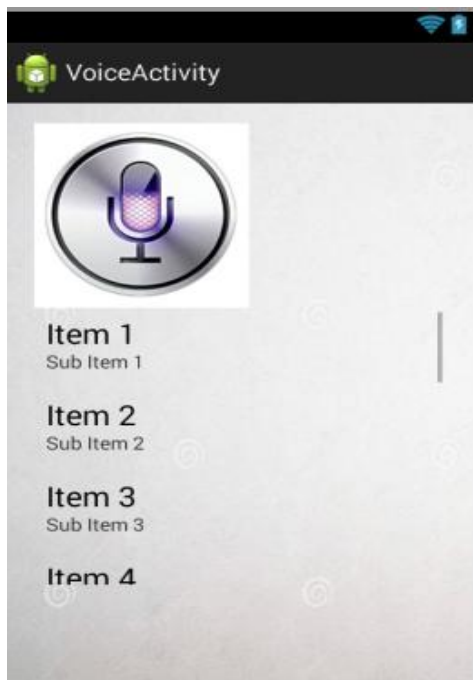

Figure 4.3: Voice Mode Activity   Figure 4.4: Switch Mode Activity

4.4. Switch Mode Activity:

This mode provides the user with on/off buttons to control the required home appliances.

4.5. Video Mode Activity:

This mode displays the video of the IP cameras connected at the rooms of the home.

5. Hardware and Programming Language Description

5.1. Hardware Description:

The power strip is designed and relays are connected to power strip. The home appliances are connected to the power strip. The Relays are connected to the GPIO pins of the raspberry pi.
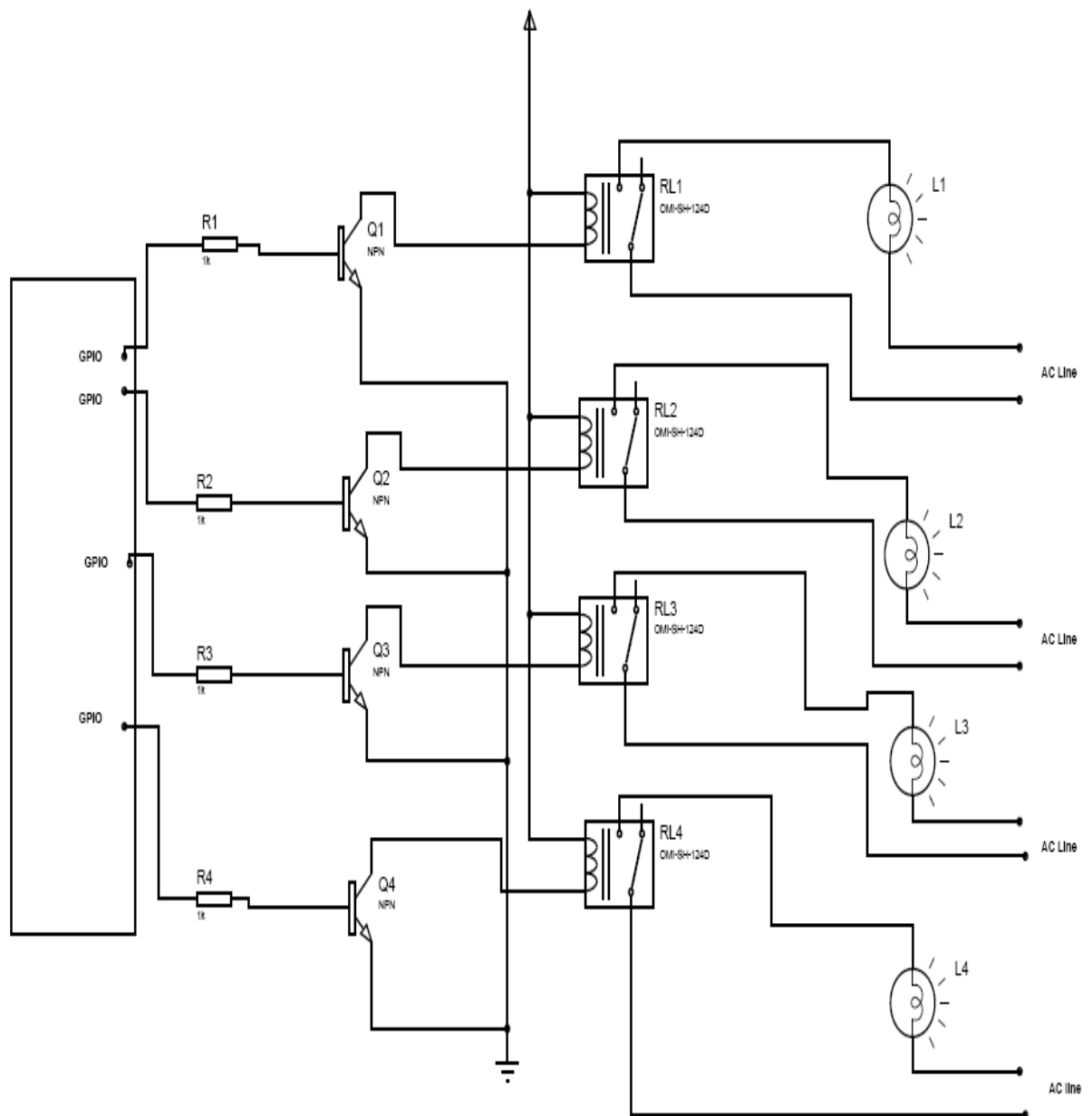

Figure 5: Block Diagram of the Hardware Description

5.2. Software Description

We have used two different programming languages for our project. For the development of the application on android, we have used Java Platform. Android Software Development kit incorporates Eclipse software where Java programming is performed.

Eclipse software is used to write the codes for the application under Java Platform. Raspbian OS is used at the raspberry pi. Server is established at raspberry pi. Python Language is used to write the codes of server, and to control the GPIO Pins of OS.

5.2.1. Java:

Java is a set of several computer software products and specifications from Oracle Corporation that provides a system for developing application software and deploying it in a cross-platform computing environment. Java is used in a wide variety of computing platforms from embedded devices and mobile phones on the low end, to enterprise servers and supercomputers on the high end.

5.2.2. Python:

Python is an interpreter, interactive, object-oriented programming language. It incorporates modules, exceptions, dynamic typing, very high level dynamic data types, and classes. Python combines remarkable power with very clear syntax. It has interfaces too many system calls and libraries, as well as to various window systems, and is extensible in C or C++. It is also usable as an extension language for applications that need a programmable interface.Python is a high-level general-purpose programming language that can be applied to many different classes of problems.

5.2.3. Raspbian:

Raspbian is a free Operating System based on Debian optimized for the raspberry pi hardware. Raspbian comes with more than 35000 packages; pre-combined software bundled in a nice format for easy installation on Raspberry pi.

6. Part List with Cost Estimation

Name	Number	Price	Availability
Raspberry Pi Model B 512MB RAM	1	6000	Available
WiFi Adapter	1	1500	Available
SD card 8GB(bigger size)	1	1000	Available
Router	1	2000	Available
Relays(6V,3A,PCB Mount)	8	30 per piece	Available
Jumper Wires	1 pkt.	20	Available
Resistors	1 pkt.	30	Available
Capacitors	1pkt.	30	Available

Table 1: Cost Estimation

7. Scope and Application

This system is designed to assist and provide support in order to fulfill the needs of elderly and disabled in home. Household appliances can be easily controlled via a Mobile/Tablet. Status of light, fan and other electrical appliances can be known. With the help of IP camera, video of rooms or certain area of a house can be recorded. This helps to provide security.

8. Limitations

Android devices having lower API version than 16 requires internet access to convert the speech data to string data. Currently, the application is made for Android Smart Phones; other OS platform doesn't support our application.

During voice mode, external noises (voice) may affect our result. The speech instruction that we command in our voice mode may not give exact result as expected.

9. Further Enhancements:

Looking at the current situation we can build cross platform system that can be deployed on various platforms like iOS, Windows. Limitation to control only several devices can be removed by extending automation of all other home appliances. Network can be connected to internet and Security cameras can be controlled from other places, allowing the user to observe activity around a house or business. Security systems can include motion sensors that will detect any kind of unauthorized movement and notify the user. Scope of this project can be expanded to many areas by not restricting to only home.

10. Conclusion:

The prime objective of our project is to use the Smartphone to control the home appliances effectively. The switch mode and voice mode are used to control the home appliances. The video feedback is received in the android app which streams the video of IP- Camera.

This project is based on the Raspberry pi, Android platform Java and Python. These platforms are Free Open Source Software. So the overall implementation cost is low and can be easily configured.

User can easily interact with the android phone/tablet. The user can send commands via the switch mode or speech mode. The data are being analyzed by the application and are sent over a network. The Raspberry pi acts as a server, analyses the data and activates the GPIO (General Purpose Input Output) Pins. The GPIO Pins are connected to the relays switch which activated the required home appliances.

In this way, automation process is carried out. This is a simple prototype. Using this as a reference further it can be expanded to many other programs.

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