SMARTIFY- SMART ROOMS ON-THE-GO

Capstone Project Report

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1. INTRODUCTION

1.1 THE AIM OF THE PROJECT

Automation systems have gained popularity in recent years, paralleling the advances in the concept of the Internet of Things. Although automation for commercial buildings is a mature technology, automation applications for residences are a relatively new development, which is gradually being adopted by consumers. Moreover, nowadays people have smartphones with them all the time. So, it makes sense to use these to control the home appliances. Therefore, this project is an Arduino used based device, enabling home automation using a simple Android app, which you can use to control electrical appliances with just simple clicks. Also, sensor is there which further enhances the product efficiency. This is an on-the-go project i.e. user can easily carry it out anywhere and thus any device connecting to this becomes IOT based device. Further this project is cost-efficient which further can be easily used on daily basis by users.

1.2 THE INTENDED AUDIENCE

This project focuses mainly on areas, such as the following ones: Commercial, Educational, Government, Industrial, Institutional etc. However, the idea is to increase the use and consumption of technological devices and apparatus among the households.

1.3 PROBLEM DEFINITION

There are several devices, which enable users to enable home automation, but such systems are restricted to a single place. Portability of such setups is always a concern, in terms of connectivity and viability in a given space. In addition to the smart home concept features are some very expensive devices in the market. The other important consideration is the android application, that it has to be user friendly and simple to operate. To develop a user-friendly application and fulfill all the objectives of this project, the GUI of the application has to be the foremost priority. The interface of the

application will prove how easy the application is to use as well as give flexibility to the user.

1.4 PROJECT OBJECTIVES

The following list of objectives must be fulfilled:

1. Develop Bluetooth appliance controller: The Bluetooth will interface with the microcontroller to perform the desired automation. The microcontroller will get the signals from the Bluetooth enabled mobile phone and it will be processed.

2. Develop an application for a mobile phone: An application needs to be developed for the mobile phone, which needs to communicate with the Bluetooth receiver.

3. Integrate the device to the controller: The foremost priority that has to be kept in mind when developing a Smart Home is that it has to be cost-efficient. The appliance controller has to be inexpensively integrated with the appliances in the house with an easy installation.

4. Interface the sensor with controller: Temperature sensor is used which must operate accordingly i.e. estimate the surrounding temperature and give certain readings.

5. Test the set up and analyze the data: After the system is set-up, with the help of a mobile device and a controller, tests are conducted while data is recorded and analyzed. Moreover, portability is a concern, therefore it must be assured that device can be easily carried out and any appliance connected to this device could be controlled via android application.

1.5 THE APPROACH USED IN CARRYING OUT THE PROJECT OBJECTIVES

In the designing of the project, first all the requirements must be there and then the real hands-on control comes in when you start interacting with the home automation system from your remote app. The code for the controller is programmed and interfaced using Arduino IDE. Sensor is interfaced with the controller properly such

that it provides accurate readings. Next, a manageable Android application enabling user to manage smart features over a distance is further created using Android Studio.

1.6 PROJECT OUTCOMES

Inputs are sent via Android application by user where user controls the appliances as user wishes. For this, it must be sure that Bluetooth is turned on such that signals are sent via it and desired result is obtained.

Temperature and humidity sensor takes inputs of temperature as it examines it and give the readings accordingly. Further device must able to interface any appliance connected to it.

1.7 PROJECT SCHEDULE THROUGH GANTT CHART

		Name	Duration	Start	Finish	Predecessors	Resource Names
1		**Smartify**	**190 days?**	**3/1/17 8:00 AM**	**11/21/17 5:00 PM**		
2		**Communication**	**9 days**	**3/1/17 8:00 AM**	**3/13/17 5:00 PM**		
3		Project Initiation	2 days	3/1/17 8:00 AM	3/2/17 5:00 PM		Shivam;Shivangi;Shrey;Rohan
4		Requirement Gathering	2 days	3/3/17 8:00 AM	3/6/17 5:00 PM		Shivam;Shivangi;Rohan;Shrey
5		SRS	5 days	3/7/17 8:00 AM	3/13/17 5:00 PM		Shivam;Shivangi;Rohan;Shrey
6		**Planning**	**10 days**	**3/11/17 8:00 AM**	**3/24/17 5:00 PM**		
7		Estimation	0.5 days	3/11/17 8:00 AM	3/13/17 1:00 PM		Shivam
8		Scheduling	4 days	3/14/17 8:00 AM	3/17/17 5:00 PM		Shivangi
9		Project Plan	2 days	3/18/17 8:00 AM	3/21/17 5:00 PM		Rohan
10		Schedule Chart	3 days	3/22/17 8:00 AM	3/24/17 5:00 PM		Shrey
11		**Modelling**	**20 days?**	**3/27/17 8:00 AM**	**4/21/17 5:00 PM**		
12		**Analysis**	**5 days?**	**3/27/17 8:00 AM**	**3/31/17 5:00 PM**		
13		Use Case Diagram	2 days?	3/27/17 8:00 AM	3/28/17 5:00 PM		Shivangi
14		Activity Diagram	3 days?	3/29/17 8:00 AM	3/31/17 5:00 PM		Shrey
15		**Designing**	**15 days?**	**4/3/17 8:00 AM**	**4/21/17 5:00 PM**		
16		GUI	1.5 days?	4/3/17 8:00 AM	4/4/17 1:00 PM		Shivam;Shivangi;Rohan;Shrey
17		UML Diagrams	9 days?	4/11/17 8:00 AM	4/21/17 5:00 PM		Shivam;Shivangi;Shrey;Rohan
18		**Construction**	**130 days?**	**5/1/17 8:00 AM**	**10/27/17 5:00 PM**		
19		Arduino Setup	11 days?	5/1/17 8:00 AM	5/15/17 5:00 PM		Shivam;Rohan
20		Arduino Programming	18.5 days?	6/1/17 8:00 AM	6/27/17 1:00 PM		Shrey;Rohan
21		Working of Module	5 days?	6/27/17 8:00 AM	7/3/17 5:00 PM		Shivam;Shivangi;Rohan;Shrey
22		Android App	22 days?	7/12/17 8:00 AM	8/10/17 5:00 PM		Shivam;Shivangi
23		Linking	13 days?	8/15/17 8:00 AM	8/31/17 5:00 PM		Shivam;Shivangi;Rohan;Shrey
24		Sensor Controllation	14 days?	9/11/17 8:00 AM	9/28/17 5:00 PM		Shrey;Shivangi
25		Working of Sensors	13 days?	10/2/17 8:00 AM	10/18/17 5:00 PM		Rohan;Shivam;Shivangi;Shrey
26		Implementation	8 days?	10/18/17 8:00 AM	10/27/17 5:00 PM		Rohan;Shivam;Shivangi;Shrey
27		**Testing**	**24 days?**	**10/10/17 8:00 AM**	**11/10/17 5:00 PM**		
28		Design Test Plan	9 days?	10/10/17 8:00 AM	10/20/17 5:00 PM		
29		Test Suite Design	15 days?	10/21/17 8:00 AM	11/10/17 5:00 PM		
30		Test Report	6 days?	11/1/17 8:00 AM	11/8/17 5:00 PM		
31		**Deployment**	**9 days**	**11/9/17 8:00 AM**	**11/21/17 5:00 PM**		
32		Delivery	2 days	11/9/17 8:00 AM	11/10/17 5:00 PM		
33		Support	2 days	11/11/17 8:00 AM	11/14/17 5:00 PM		
34		Feedback	4 days	11/14/17 8:00 AM	11/17/17 5:00 PM		
35		Final Product	2 days	11/18/17 8:00 AM	11/21/17 5:00 PM		

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Fig 1: Gantt Chart

2. LITERATURE REVIEW

Home automation was first introduced into the world market in the 1970s, but it failed to meet the expectations of people and was unsuccessful. There were various reasons associated with the failure of the home automation system. The system was neither user friendly nor cost efficient. Currently, the foremost point to be kept in mind when designing a home automation system is that it should be cost-efficient and easy to install.

K. Y. Lee and J. W. Choi, in their research on the Housing Learning and Improvement Network in 2003, defined a Smart Home as a "unit where all the appliances of the house are connected together and controlled and monitored remotely." The following paragraphs will give a summary of the previous research works in the field of Smart Homes. T. Tamura et. al., in their research, constructed the welfare techno houses in Japan in 2003. The motive behind the project was to monitor the health of the disabled and older people living in the home, thereby improving their quality of life. D. J. Cook et. al. successfully conducted the MavHome project at the University of Texas, Arlington. The project used sensors to detect the state of the environment, and with the help of controllers, took the necessary action to maintain equilibrium. These sensors form an ad-hoc network to make the decisions. H. Kanma et. al. conducted a medical research to monitor people who require medical help and present a wireless solution at the University of McGill in Canada. The project made use of cell phones and inexpensive sensors. It worked by making use of wireless protocols such as Bluetooth, ZIGBEE, as well as GSM and analyzing data through an adaptive architecture.

The research had an architecture that consisted of three main parts. First, sensors collected the medical data and transmitted it via sensors to mobile devices. Second, an application called J2ME on mobile devices processed the collected data. Finally, all the data that was collected was combined to address the needs of the elderly. The major benefit of this project is that it could be implemented at an inexpensive price in a short span of time.

In the past few years, significant research has been conducted in the field of Smart Homes to make the technology better for handicapped and elderly people. N. Liang et.

al. has described challenges related to Smart Homes and conducted research at the University of Erlangen, Germany, for the betterment of these populations and identified the benefits in-order to help them lead more independent lives. For the implementation of these projects, there are various sub-networks used such as the Bluetooth module, Wireless LAN, RFIDs, and TCP/IP. A Bluetooth network transports the sensor data and interconnects the network. As per the location of the occupancy recorded, the RFID system transmits data from the RFID tags. The messages are transmitted via Bluetooth using Bluetooth modules. This reduces the cost, as no further hardware is required for the implementation.

The idea presented in this project is the one similar to the project presented by the students at the University of Nigeria regarding the design of a home automation system using Arduino. The project focuses on the design of a home automation system using the Atmega 328 microcontroller. The project does, however, emphasize the advantages of using a wireless standard. To connect to a wide range of devices, Bluetooth is a global standard and is easily available in almost all devices, for it is easy to set up and use. It also encrypts data using a 128 bit long shared key, making it a secured connection as well.

With the advancements in RF Technology, such as Zigbee and Bluetooth, these systems have also become popular in the market. The previous infrared systems had numerous security issues and there were interferences between signals, making it unsecured and less popular in the market. Research is still occurring in this field; various systems have been proposed, but very few of them have been implemented in the market.

2.1 REASON FOR CHOOSING ARDUINO UNO

There are various successful microcontrollers including MIT‟s Handyboard, Phidgets, and Netmedia‟s BX-24 but the Arduino offers numerous advantages for individuals, including students and instructors, that give it an upper hand compared to the other microcontrollers. The advantages of the Arduino are listed as follows-

1. Less expensive: Arduino boards are inexpensive compared to other microcontrollers that are available in the market. A preassembled Arduino board is available for low prices.

2. Compatible: Arduino is compatible with all the operating systems including Linux, Macintosh, and Windows, whereas other microcontrollers are restricted to Windows.

3. Easy to program: The environment used to program Arduino and the ways to perform the coding are user friendly even for beginners.

4. Expandable programming and open source: The programming language of an Arduino is an open source and can incorporate the Arduino code into the AVR-C code if needed.

5. Allows easy and fast prototyping: There are a number of pre-wiring and free code libraries, which help to test an idea instead of spending time in building and creating an excessive amount of low level codes. [9]

Fig 2: Arduino Logo

2.2 IMPORTANCE OF BLUETOOTH IN HOME AUTOMATION

Home Automation, or Smart Home, has benefited from the critical innovations of Bluetooth technology can be used to connect devices such as mobile phones and laptops. Wired devices require a point to point connection but communication can be established between multiple devices with Bluetooth. A group of Bluetooth devices is called a piconet and this technology is apt for building a Smart Home. Figure 3 shows the different appliances of the house (light, fan, etc.) which are controlled via Bluetooth. Bluetooth provides a good platform as it is readily available in almost all the smart phones which are present in the market today and is easy to understand and

use. This provides the flexibility to people of all ages to use Bluetooth in a handy manner.

2.2 BLUETOOTH MODULE

The Arduino Uno board does not have any features that make it communicate with a Bluetooth on its own. The Arduino Uno cannot communicate with the Android device on its own. Hence, a Bluetooth module HC-06 is implemented in this project. AT commands are used to program a Bluetooth module HC-06 which is a user-friendly module. It only features one fixed module, either a master or a slave. In this project, the slave module is used. [1]

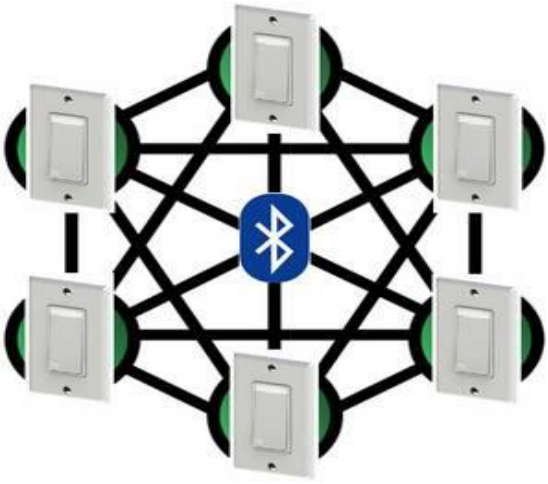


Fig 3: Bluetooth Connection

2.3 THE ANDROID OPERATING SYSTEM

The Android operating system uses Linux Kernel with the programming interface of Java and is an open source. The essential equipment platform for Android is the ARM architecture. Android applications are typically uploaded/purchased via the Google Play store.

3. REQUIREMENT ANALYSIS

3.1 REQUIREMENTS

3.1.1 Functional Requirements

System Activation-Upon receiving the signals from the android application, the system must activate itself.

Automation-Upon activation the automation system should power up the respective tasks like switching on the lights automatically via application. This task must able to operate anywhere without any need for installation of the product.

Temperature Change Detection-The temperature and humidity sensor must be able to detect significant change in temperature and give reading accordingly.

3.1.2 Non-Functional Requirements

Portable design-The design of the automation system needs to be light and portable so that it can be used at multiple places therefore it is on-the-go project.

Cost efficient-The system needs to be cost-efficient for it to be used by people in place of other costly home automation systems.

Quick and responsive-The software of the automation system needs to be quick enough for the sensors to work well in time.

Reliable-The system needs to be free of sensor errors, and other troubles which can occur from the device.

3.2 USE CASE DIAGRAM

A **use case diagram** is a graphic depiction of the interactions among the elements of a system. A **use case** is a methodology **used** in system analysis to identify, clarify, and organize system requirements.

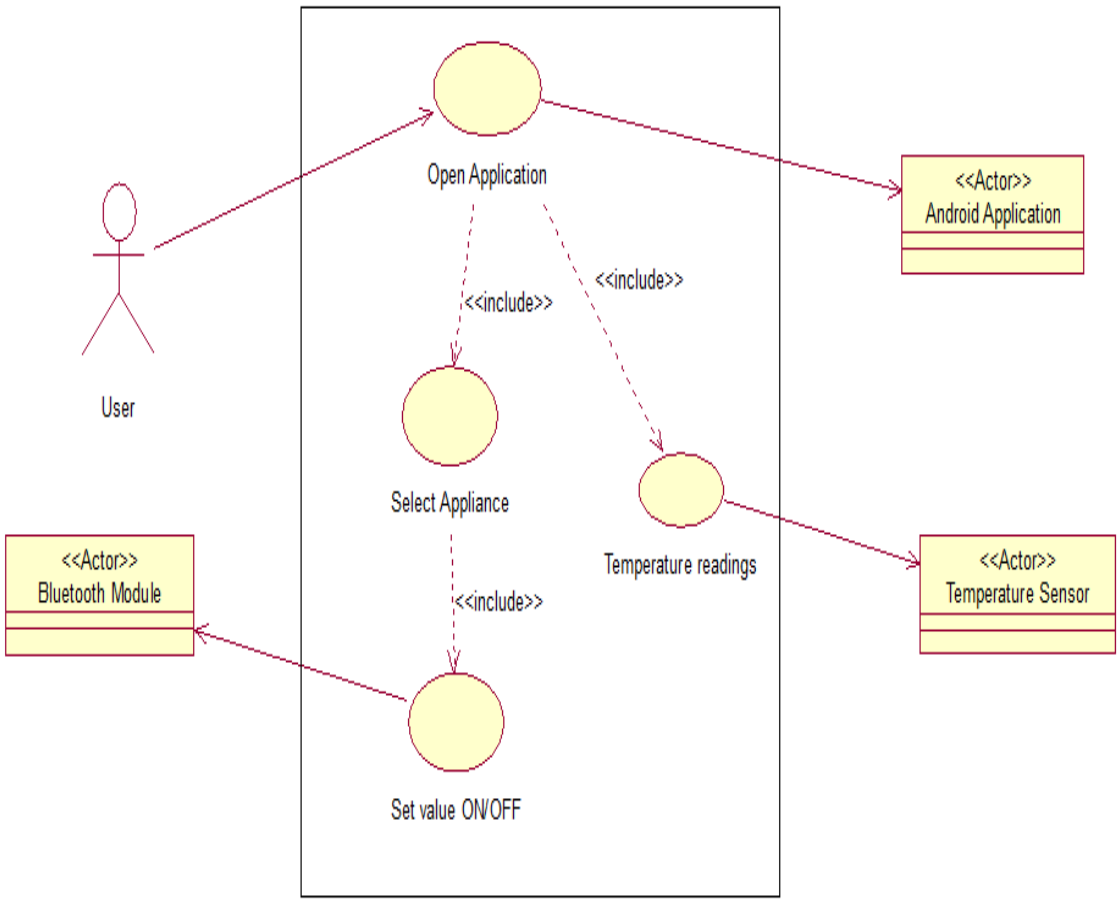


Fig 4: Use Case Diagram

3.2.1 USE CASE TEMPLATE

Use Case: Automation Control

Id: UC-001

Description:

User opens the android application and select the Home appliances he/she wants to on/off. This signal will be sent to the appliance via a Bluetooth module and makes the appliance to work as per user. This would act as a smart socket and the advantage is that it would not be restricted to a single place. User can use this device as per user requirement at any place he/she wants to use. Moreover Temperature sensor gives reading about the temperature of the surroundings.

Level: User Goal

Primary Actor: Person living in the house/Tenant

Supporting Actor: Owner of the house /Supervisor

Stakeholders and Interests:

With the use of this project, life would be an ease. It would be beneficial to both owner as well as tenant of the house. Owner would not have to worry anymore as appliances could turn off easily with the application. Moreover, tenant is also pleased with the idea that he/she has not to get up and switch off everything and thus it also saves electricity as well as it can be carried anywhere as user wishes.

Pre-Conditions:

For this use case to work properly, Smart phone supporting android application must be there. Bluetooth must be ON in the smartphone else project will not work as the signal transferring from application to appliance is via Bluetooth only. Appliance must be connected to the socket properly. Sensor must be interfaced properly.

Post-Conditions:

Success end condition:

When all the connections are proper and Bluetooth is on, user uses the application to control the appliance. User can turn on/off the appliance and know its status via application only, instead of manual switching. Moreover, temperature reading is also displayed.

Failure end condition:

User is unable to control the appliance through application. It could be because of connection not connected properly or may be Bluetooth connection is not answering properly.

Minimal Guarantee:

Appliances could be controlled manually if the project is not working as stated.

Trigger:

For this project to be initiated, Android phone with the application and Bluetooth on is must. After that signals are sent via phone to the appliances.

Main Success Scenario:

1. User Opens the android application as well as make Bluetooth on.
2. User go to home appliances and control the device he/she wants to.
3. This signal is sent via Bluetooth to the appliance where further Arduino Uno is connected to make this transfer possible.
4. Thus, User can control any appliance connected on its own.

Extensions:

1. Bluetooth is must for connection.

2. If user's Bluetooth is not on, then application will prompt user to on Bluetooth first and then let user continue with the process.

Variations: N.A.

Frequency: This Use case will be executed everyday as user uses the appliances every day.

Assumptions: Android supporting phone as well as Bluetooth must work properly.

Issues: The main issue would be Bluetooth Range. May be user wants to control device from outside area, this would create difficulty as interruption would be there in the signal. The other would be of sensor capability.

To Do: N.A.

3.3 ACTIVITY DIAGRAM

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams are intended to model both computational and organizational processes (i.e. workflows). Thus, the following Activity diagram show the overall flow of control.

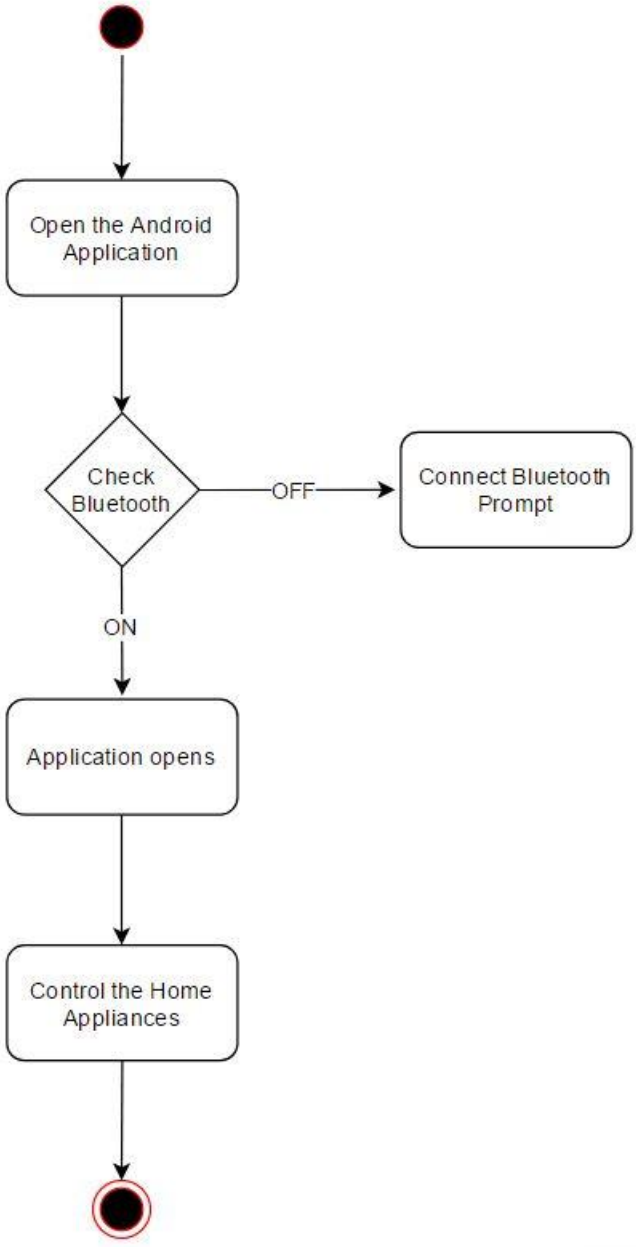


Fig 5: Activity Diagram

3.4 CLASS DIAGRAM

A class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.

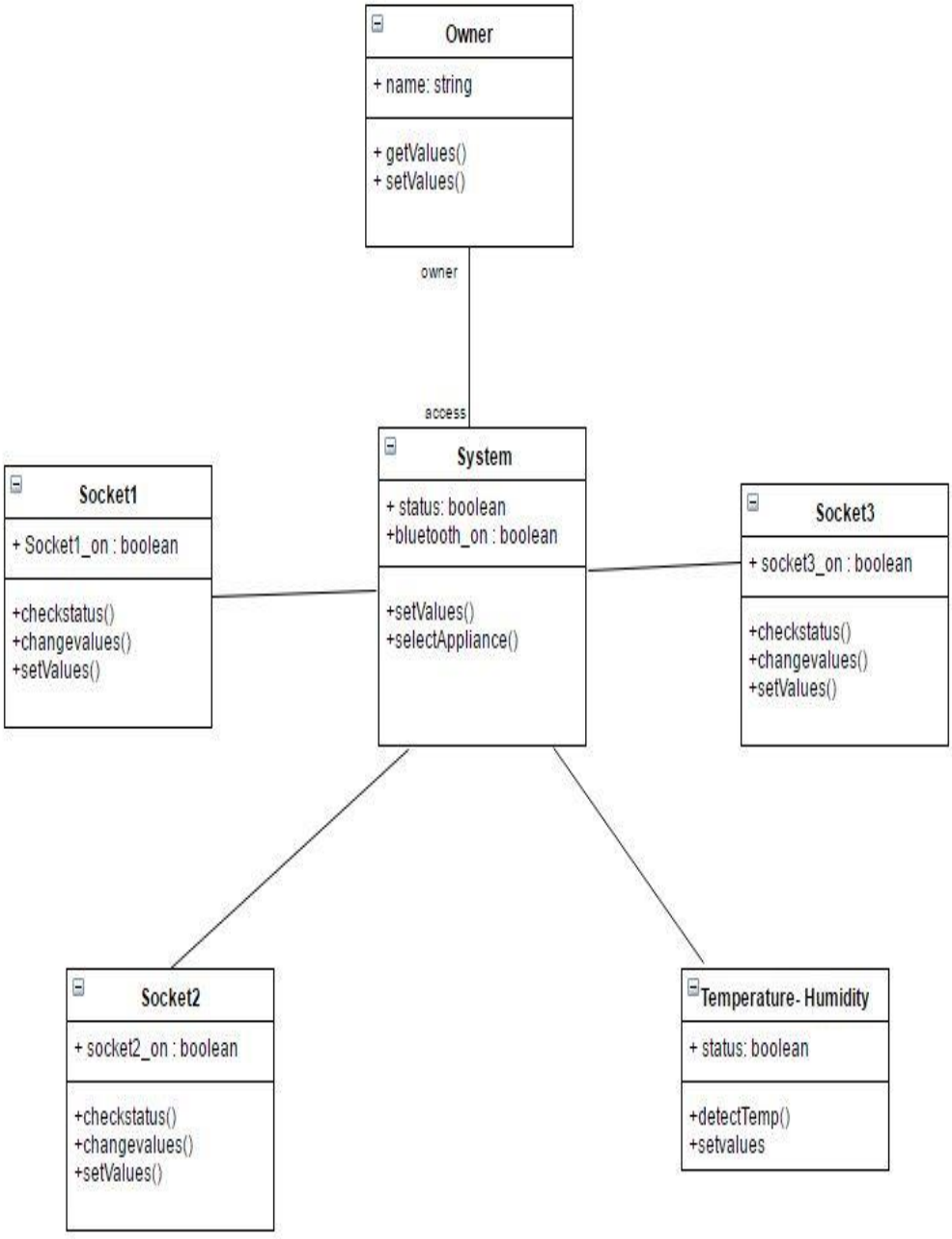


Fig 6: Class diagram

3.5 SOFTWARE REQUIREMENTS SPECIFICATION

Version 1.0

3.5.1 INTRODUCTION

Purpose

The purpose of this Software Requirements Specification (SRS) document is to provide a detailed description of the functionalities of the Smartify project, its parameters and goals. This document will cover each of the system's intended features and will also cover hardware, software, and various other technical dependencies.

It defines how our end users, developing team and audience see the product and its functionality.

The purpose is to collect and analyze all assorted ideas that have come up to define the system, its requirements with respect to end users.

Document Conventions

Whole text document is written in Times New Roman in size 12.

Chapter Headings are written in size 16 bold. Sub-headings are written in size 14 bold.

Bold-faced text has been used to emphasize section and sub-section headings. Underlined text has been used on general topics and or specific points of interest.

Intended Audience and Reading Suggestions

This document is intended for all individuals participating in and/or supervising the Smartify project. It details the overall description of the project as well as the functional and non-functional requirements of the project.

This document is to be read by the development team, the project mentor Mr. Rajkumar Tekchandani, our project in-charge Dr. Inderveer Chana, our panel and any other individual or group interested in our project. Also end users of our project who wish to read about what this project can do. Our faculty who provide us with the resources required for the development of the project may review the document to learn about the project and to understand the requirements. The SRS has been organized approximately in order of increasing specificity. The developers, project mentor and project in-charge need to become intimately familiar with the SRS.

Others involved need to review the document as such

• **Overall Description:** The project mentor and the project in-charge have to become accustomed to various project features.

• **System features:** Testers need an understanding of the system features to develop meaningful test cases and give useful feedback to the developers.

• **External Interface Requirements**: The hardware developers need to know the requirements of the device they need to build.

• **Nonfunctional and Functional Requirements:** The hardware developers.

Project Scope

The main objective of this project is to design and implement a smart home automation system meant to be used anywhere-enabling portability.

The real hands-on control comes in when you start interacting with the home automation system from your remote app.

Using Bluetooth module as a connectivity medium between the sensors and the automation device, while a Bluetooth network is used for connectivity between the phone and the device.

Sending data over wireless network allows flexibility in signals and is also quick.

Creating a manageable Android application enabling user to manage smart features over a distance.

3.5.2 OVERALL DESCRIPTION

Product Perspective

There are several devices, which enable users to enable home automation, but such systems are restricted to a single place. Moreover, portability of such setups is always a concern, in terms of connectivity and viability in a given space.

Therefore, our perspective is to build an Arduino used based device enabling home automation using a simple Android app, which you can use to control electrical appliances with simple clicks. Commands are sent via Bluetooth to Arduino Uno. So, you need not get up to switch on or switch off the device while watching a movie or doing some work.

Moreover, with this home automation there are some features which enhance the use of this project. Sensor like temperature and humidity sensor which estimate the surrounding temperature and gives the reading accordingly.

Product Features

The following list offers a brief outline and description of the main features and functionalities of the project:

Temperature Change Detection-The temperature sensor must be able to detect significant change in temperature for the system to work.

System Activation-Upon receiving the signals from the android application, the system must activate itself.

Automation-Upon activation the automation system should power up the respective tasks like switching on the lights automatically. Thus it must be ensured that is system is portable.

User Classes and Characteristics

With the use of this project, life would be an ease. It would be beneficial to both owner as well as tenant of the house. Owner would not have to worry anymore as appliances could turn off easily with the application. Moreover, tenant is also pleased with the idea that he/she has not to get up and switch off everything and thus it also saves electricity.
Moreover, project would be also beneficial to the users as it could be taken anywhere without any worry of installation and thus it could automatically control appliances as per user wish and thus helps in saving electricity.

Operating Environment

The product works with the help of Arduino software(IDE) in a monitor based environment. Developer will have to check the result for during the execution of the project at every stage which may be with the help of LED or the Serial Monitor in the Arduino software. Moreover, Android Studio or Eclipse (IDE) is required to build android application which controls the appliances.

For this project to work properly, user just need a working android based smartphone with our application installed in it. With this the device must be setup into the place where user wants it to work. Then user must make sure that Bluetooth must be on as it acts as a connectivity medium and signal are sent via this which further controls the appliances.

Design and Implementation Constraints

The primary constraints in the development of this project are as follows:

- The external devices connected to Arduino is limited by the pins of Arduino.
- Reaction time while signal is sent via android application must be less.
- Sensor must respond in a perfect manner with accurate results.

User Documentation

The primary goal of project is to ease our daily life. Therefore, the project will be designed to be as simple and convenient for everyone to use as possible. But still, installers may still require some supplementary information about each component of the project and how it works as well as how one can install an application. An additional user manual will be provided which will play the following roles:

- Tell the installer how the project works.
- Give details about the Arduino and its pins.
- The process of each components will be explained along with the pin details, so that is easy to set up.
- Give information how sensors work.

Assumptions and Dependencies

The assumptions made for the project is to run without any faults are as follows:

- Application should work properly as per requirement and must not forcibly shut itself down.
- Application must be made such that it supports mostly android version.
- Device must properly respond to the commands given by application with proper signal strength.
- Sensor must properly work as per requirements.

3.5.3 SYSTEM FEATURES

The organized functional requirements for the product by system features, describing the major services provided by the product are:

3.5.3.1 AUTOMATION CONTROL

Description and Priority

When signals are sent via application, devices must respond on/off automatically. There must be good signal strength for this. User must be able to control the appliances accordingly.

Stimulus/Response Sequences

When signal is sent, appliances must on/off without any delay i.e. with a good signal strength. The system should be portable.

Functional Requirements

The detailed functional requirements associated with this feature are:

- Arduino must work properly.
- All the appliances must be connected properly.

3.5.3.2 TEMPERATURE CHANGE DETECTION

Description and Priority

The temperature sensor must be able to detect significant change in temperature and must provide readings for the same.

Stimulus/Response Sequences

Temperature and humidity sensor takes inputs of temperature as it examines it and estimates the surrounding temperature.

Functional Requirements

The detailed functional requirements associated with this feature are:

- Temperature sensor must predict accurate readings.

3.5.4 EXTERNAL INTERFACE REQUIREMENTS

User Interfaces

For this device, the user interface is the Android app through which the user can set or switch on the gadgets in case the device fails. The user can interact with this application directly using a smart phone with Bluetooth enabled on it, which connects to the Bluetooth module present on the device.

Hardware Interfaces

There is only one connection between the software and the hardware and that connection is made through the Arduino. The whole source code has to be made in the

Arduino software which will be further transferred to the Arduino board via a USB cable. The code will include all the libraries required to run the various hardware components.

Software Interfaces

The Android application acts as the software interface, where the signals sent by various sensors are processed by the Arduino, and the relative state is displayed by the app. Also, in the event of controlling the device by the smart phone, the software application acts as the interface between the user and the device, where the user can manually switch on/off the apparatus by controls on the app.

Communications Interfaces

The communication interface for this device is the Bluetooth module, which does-

1. Connecting the main device to the smart phone on the network.

The Bluetooth module works in both scenarios, and passes on the signals received to the Arduino, where the relevant code line is processed to generate output signals.

3.5.5 OTHER NON-FUNCTIONAL REQUIREMENTS

Performance Requirements

Performance should not be an issue in this project as this project is based on automation of room when a sense of motion or change in temperature is detected. If this doesn't work, that will be a failure of this project. The project depends upon the following things to enhance its performance:

1. The Bluetooth module should have sufficient signal strength to detect the smart phone connected to the device.

2. The temperature sensor needs to be in working condition, be able to detect surrounding temperature properly.

Safety Requirements

The device should be connected to the mains supply carefully, as there is a potential risk of an electric shock in the event of mishandling. The device itself should be durable enough to prohibit current leakage, and prevent short circuit, which can be taken care of by making sure that the connections are proper and tight, as well as no overlapping wires are present. Also, the whole apparatus should be strongly covered so as to make it as water resistant as it can possibly be.

Security Requirements

The system does not have any security or privacy issues. Some of the issues are fully taken care of and listed below-

- The appliances will be controlled via android application only.
- There is particular range to control the appliance. No on outside that range could control it.

Software Quality Attributes

-Correctness: The app should be able to pass the right command to the right device, as well as display correct data.

-Reliability: The app should produce a minimal error rate, making it more reliable.

-Readability: The app must be easy to understand and structured well

-Adequacy: The app must provide information about what is necessary and asked for.

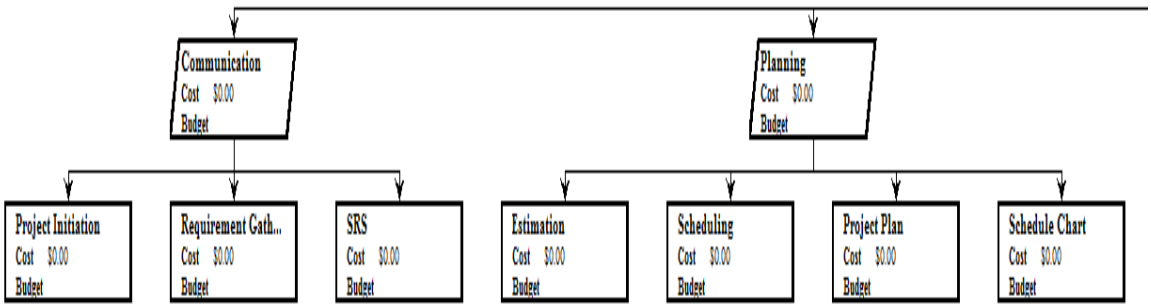
3.5.6 OTHER REQUIREMENTS

The additional requirement that are required for this project are:

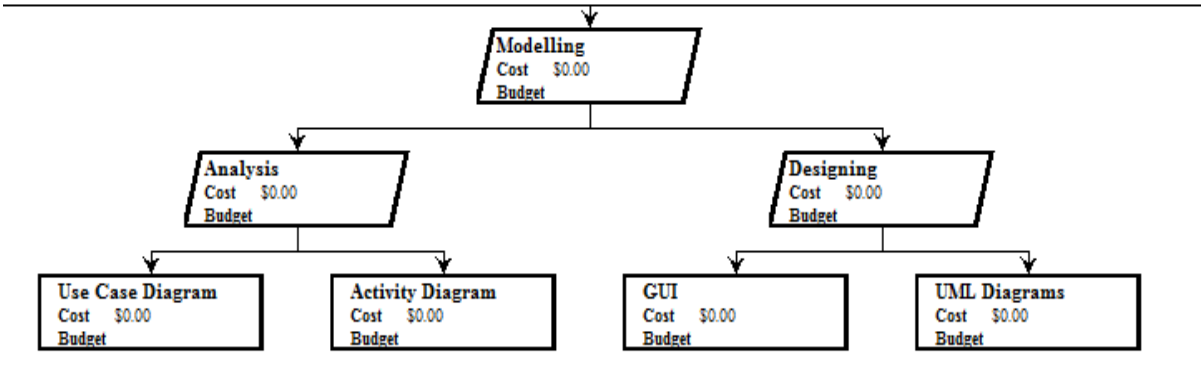
1. The device needs to be portable, for it to be carried everywhere which is the real purpose of this project.

2. The device needs to be economical, and relatively cheaper than other type of home automation devices available in the market.

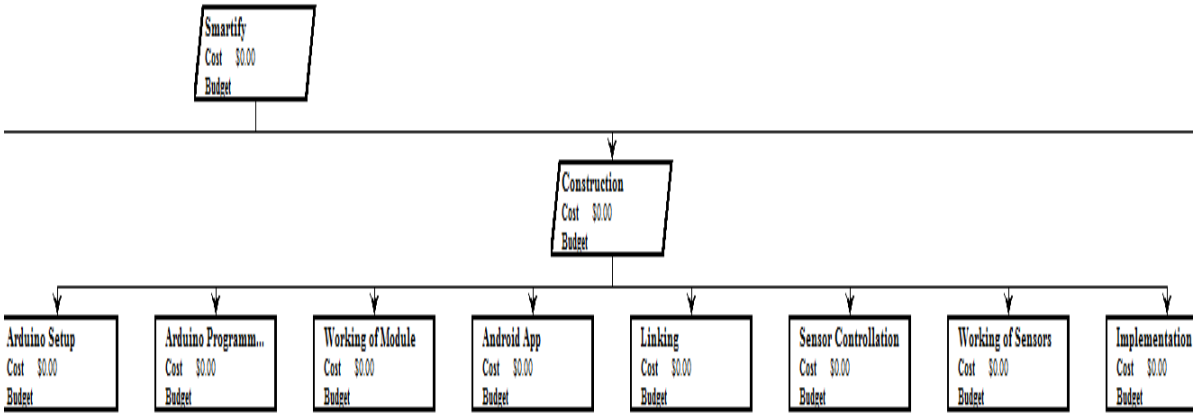
3.6 WORK BREAKDOWN STRUCTURE



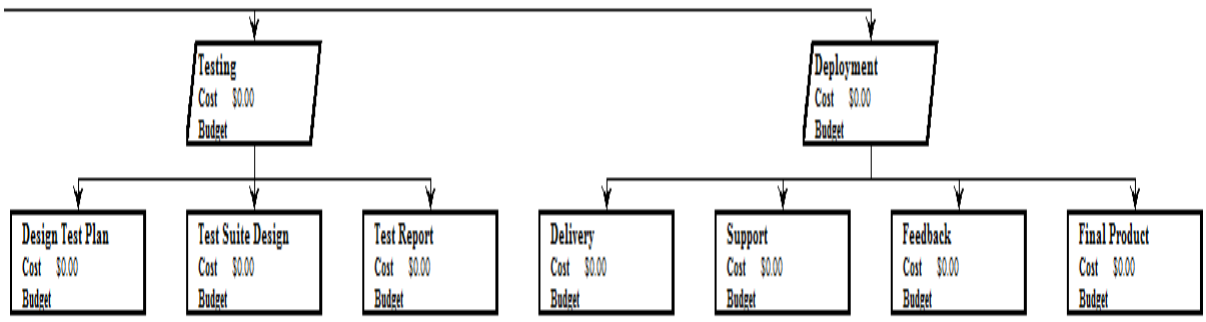
WBS-1



WBS-2



WBS-3



WBS-4

Fig 7 :WBS Hierarchy

4 DESIGN SPECIFICATION DIAGRAMS

4.1 FLOW CHART OF THE PROPOSED SYSTEM

This shows the steps needed to accomplish the goals of this project in a sequential manner. First, all the parts needed to design the project are collected and a primary concept is designed based on it. Connection between the Arduino Uno and the Bluetooth via the Bluetooth module which is the most important part of the project. After all the connection is being done, the Arduino board needs to be programmed and the Arduino software has to be installed. At the end, the Android based mobile phone is used to control the Arduino Uno via Bluetooth. Further sensors are interfaced with Arduino and should work accordingly.

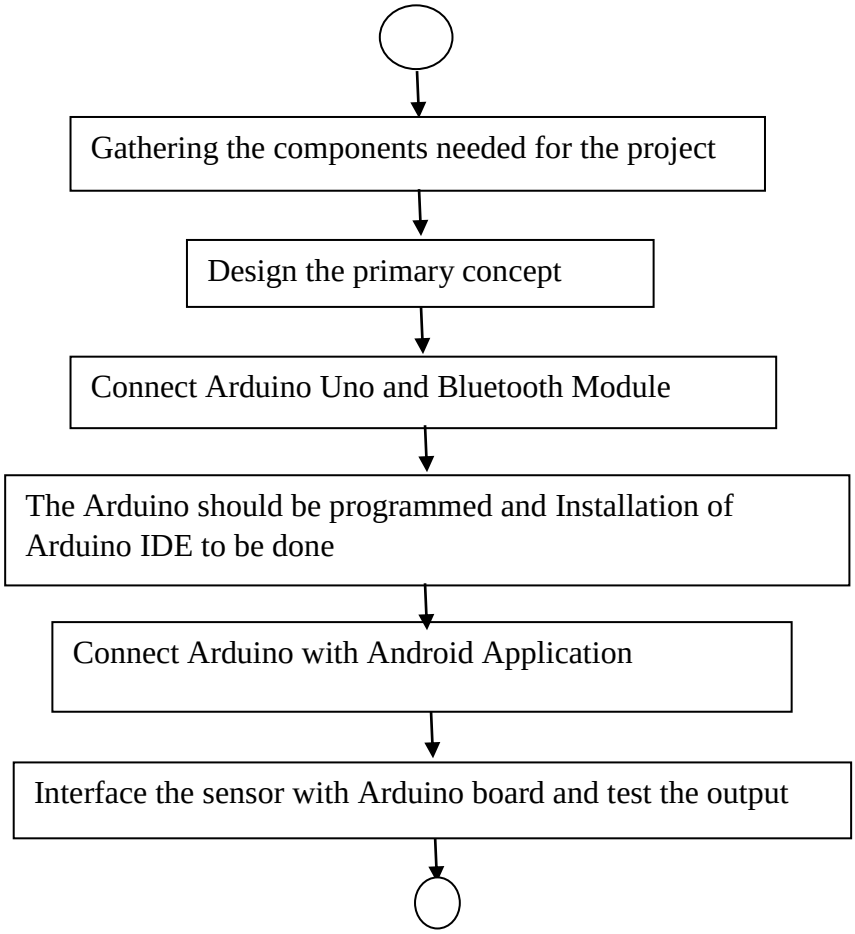


Fig 8: Flow of Proposed system

4.2 MODEL-VIEW-CONTROLLER ARCHITECTURE

Model–view–controller (**MVC**) is a software **architectural** pattern for implementing user interfaces on computers. It divides a given application into three interconnected parts in order to separate internal representations of information from the ways that information is presented to and accepted from the user.

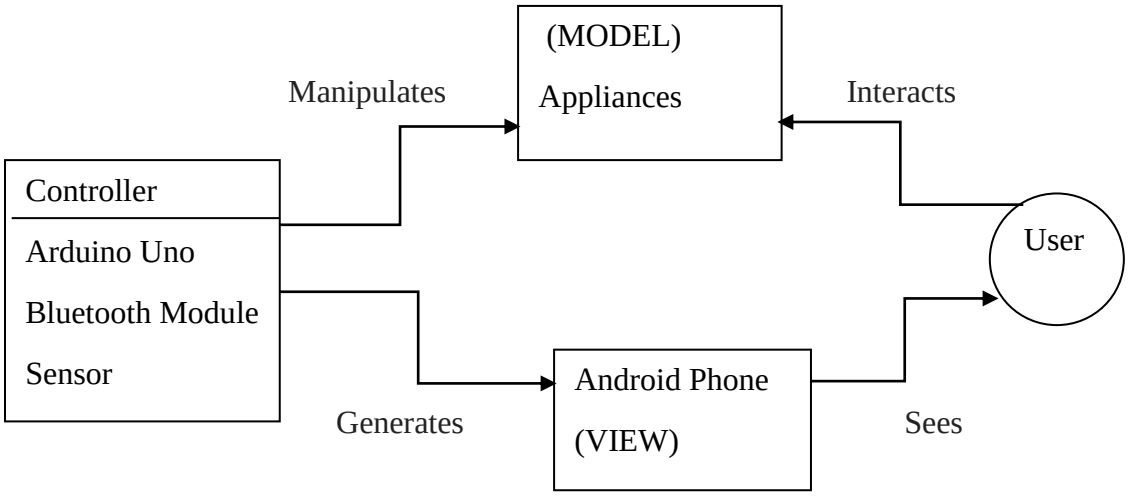


Fig 9: MVC architecture

4.3 COMPONENT DIAGRAM

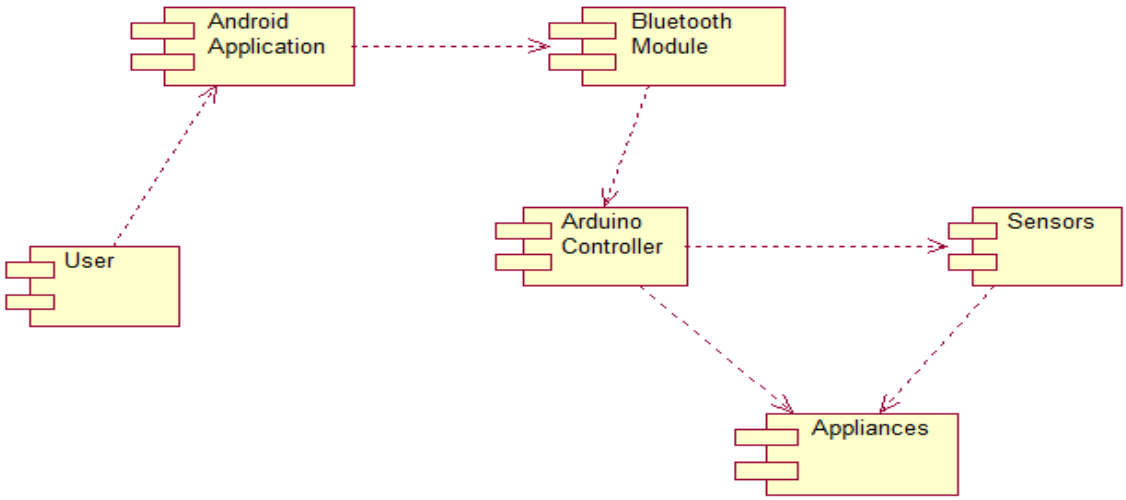


Fig 10: Component Diagram

4.4 BLOCK DIAGRAM

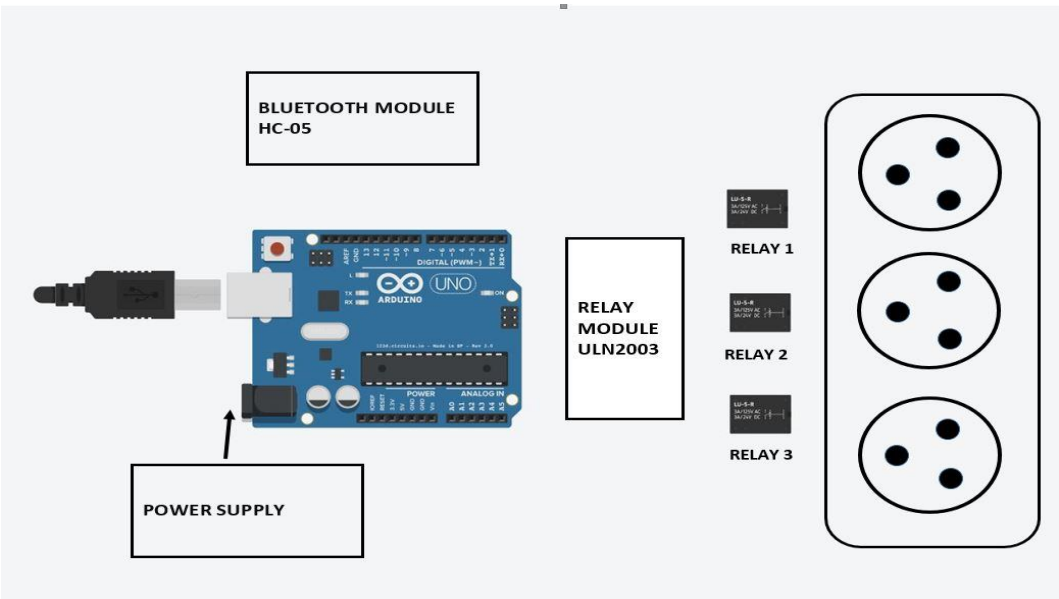


Fig 11: Block Diagram of project

4.5 USER INTERFACE DESIGN

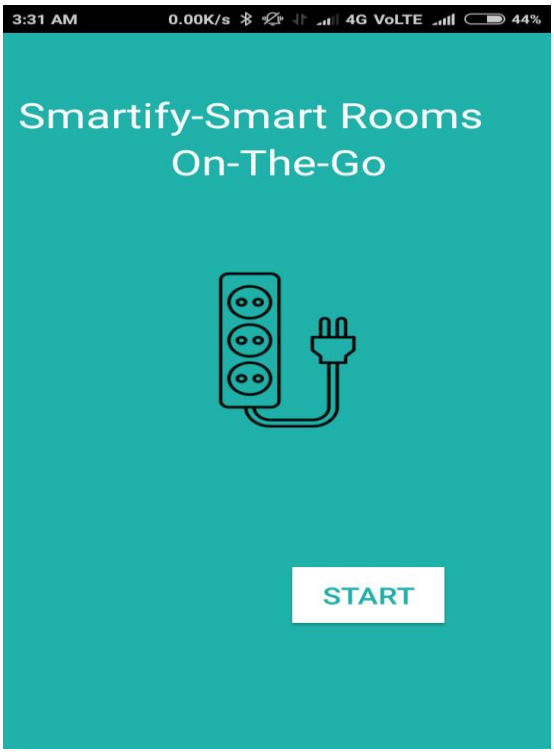


Fig 12: GUI of First module

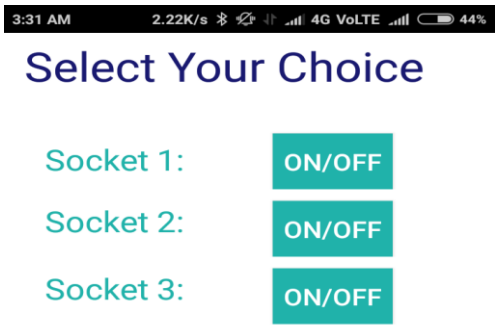


Fig 13: GUI of Second Module

5. CONCLUSION

The current project presented the implementation of an inexpensive home automation system, within the framework of assistive technology. The system implementation is based on the Arduino microcontroller, which has been programmed to control a range of home automation devices based on sensor signals and on direct commands by the user. The system has been programmed to have Bluetooth communication capability. Demonstrations of the system show that it facilitates the control of home-based devices such as electrical appliances, temperature sensing by the users.

The implementation of this project overall is successful. The motive of making the project cost efficient and user friendly is taken into account and achieved. The project is comprised of components such as a Bluetooth module, an Arduino board, an Android mobile device, temperature sensor, and an Android application (LMBT). Furthermore, with the discussions and objectives presented, it can be concluded that the objectives of the project have been achieved. Taking into consideration the target audience, the project developed is user friendly. Using an Android mobile phone, a smart switch is created and controlled with a smart phone.

FUTURE WORKS

Though overall the project is completed successfully, further study could be conducted to consider increasing the range of the signal to discover a method to amplify its range from the Bluetooth module. Also, in the future, the team intends to work upon full room automation which can be achieved using a single device, to be plugged in anywhere.

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