

“Home on Phone: Adding Value to your Home”

A PROJECT REPORT

Submitted by

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In fulfillment for the award of the degree

Of

BACHELOR OF ENGINEERING

In

COMPUTER ENGINEERING



Sarvajanik College of Engineering and Technology,

Surat.

Gujarat Technological University, Ahmedabad.

April-May, 2017

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CERTIFICATE

This is to certify that the project entitled *Home on Phone: Adding Value to your Home* has been carried out by Darshil P. Kapadia (130420107526), Krish J. Mehta (130420107529), Parth P. Sarvan (130420107547), Ruchir C. Shah (130420107551), students of B.E.IV (CO), Semester-VIII, under my guidance in fulfillment of the degree of Bachelor of Engineering in Computer Engineering of Gujarat Technological University, Ahmedabad for the academic year Apr – May, 2017.

**Signature of
Guide**

Prof. Bintu Kadhiwala

**Signature of
Head of the Department**

Dr. Keyur Rana

Signature of Jury Members

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Acknowledgements

It gives us the great pleasure in submitting this project report in title “Home On Phone: Adding Value to Your Home” carried out to study in Computer Engineering at **Sarvajanik College of Engineering and Technology, Surat.**

We must express our thanks to **Prof. Bintu Kadhiwala** who has endeared us from the learning and processing the knowledge during the project work and his positive attitude has encouraged us to look forward well in all spheres and add.

We avail this Opportunity to express our gratitude to number of the people without whom this project would not have been possible. We heartily express our gratitude to **Mr. Dhaval Modi** who has been helping us in carving out great ideas and making this whole topic even more useful.

We also thank our Head Of Department of Computer Engineering Department, **Dr. Keyur Rana** for his co-operation and assistance at every stage of our project and our curriculum activities.

Submitted by

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Abstract

We have decided to make our houses smarter. This project will help the user to know what is happening in the house at each and every point using a Web Application. Hence, we are motivated to develop a project on ‘SMART HOME’. The Project includes the following modules:

Module – I: Security through Geo-Fencing

In this module, we'll alert the user as soon as someone enters the room (which should not be compromised) along with the photo of the person entering and without making the person entering know about it. In this module, we will try to data fence a certain area using OpenCV.

Module – II: Light Watch

In this module, we are going to adjust the intensity of the bulb/tube light/LEDs in a room according to the amount of sunlight entering that room and we are also going to have a manual mode in which the user can manually change the intensity of bulb/light.

Module – III: Ambience Assistant

In this module, whenever a person enters his home and is connected by the HOME WIFI the desired home appliances will turn on according to the settings done by the user in his android application.

Module – IV: Mail Notifier

In this module, the user will be notified as soon as any person posts the mail in the mail box.

Module-V: Android Application

In this module, we are going to make an android application which will be integration of all the modules and through this application all the home appliances can be controlled by the user.

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INTRODUCTION

CHAPTER 1: INTRODUCTION

1.1 Aim and Objective to Project

The aim of this project is to design and construct a Smart home system that will remotely switch on or off any household appliance connected to it, using raspberry pi, Android app and web services.

The objective of this project is to

- Implement a low cost, reliable and scalable smart home system
- Remotely switch on or off any household appliance
- Using a raspberry pi to achieve hardware simplicity
- App notifications for spontaneous feedback.

Other Objectives of our project is to conserve energy and provide security using OpenCV.

1.2 Materials/Tools Required

1.2.1 Software Required

MQTT

MQTT stands for MQ Telemetry Transport. It is a publish / subscribe, extremely simple and lightweight messaging protocol, designed for constrained devices and low-bandwidth, high-latency or unreliable networks. The design principles are to minimize network bandwidth and device resource requirements whilst also attempting to ensure reliability and some degree of assurance of delivery. These principles also turn out to make the protocol ideal of the emerging “machine-to-machine” (M2M) or “Internet of Things” world of connected devices, and for mobile applications where bandwidth and battery power are at a premium.

Mosquitto

Mosquitto is an open source (EPL/EDL licensed) message broker that implements the MQTT protocol versions 3.1 and 3.1.1. MQTT provides a lightweight method of carrying out messaging using a publish/subscribe model. This makes it suitable for "Internet of Things" messaging such as with low power sensors or mobile devices such as phones, embedded computers or microcontrollers like the Arduino.

Android Studio

Android Studio is the official integrated development environment (IDE) for Android platform development.

ESPlorer

The ESPlorer is an IDE (Integrated Development Environment) for ESP developers. It coded in JAVA a multi-platform IDE that runs on Windows, Mac OS X or Linux. This IDE allows you to establish a serial communication with your ESP8266, send commands, upload code directly to the ESP8266 Chip and much more

Nodemcu Flasher

Nodemcu flasher is a firmware programmer for Nodemcu DEVKIT V0.9. You can use it to program Nodemcu DEVKIT or your own ESP8266 board.

1.2.2 Hardware Used

Raspberry Pi

The Raspberry Pi is a credit card-sized computer that plugs into your TV and a keyboard. It is a capable little computer which can be used in electronics projects, and for many of the things that your desktop PC does, like spreadsheets, word processing, browsing the internet, and playing games. It also plays high-definition video. We want to see it being used by kids all over the world to learn programming.

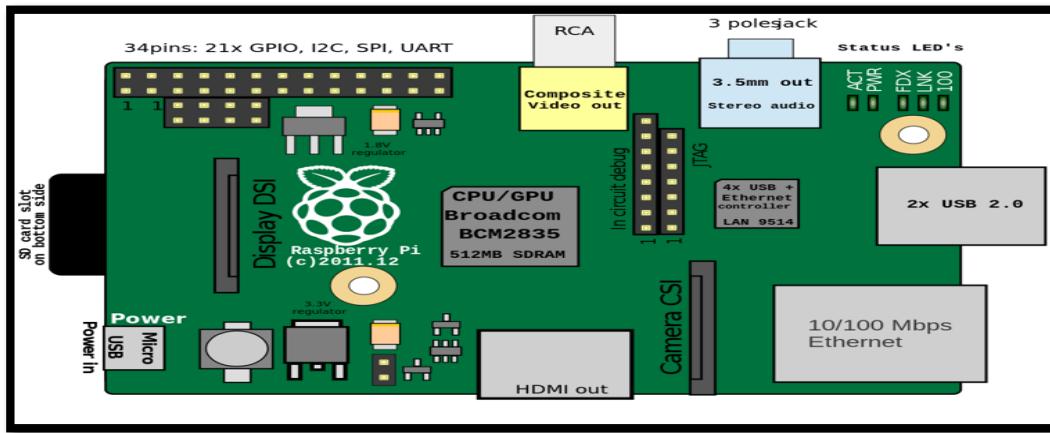


Fig. 1.1 Raspberry Pi

NodeMCU (ESP8266)

NodeMCU is an eLua based firmware for the ESP8266 WiFi SOC from Espressif. The NodeMCU firmware is a companion project to the popular NodeMCU dev kits, ready-made open source development boards with ESP8266-12E chips.

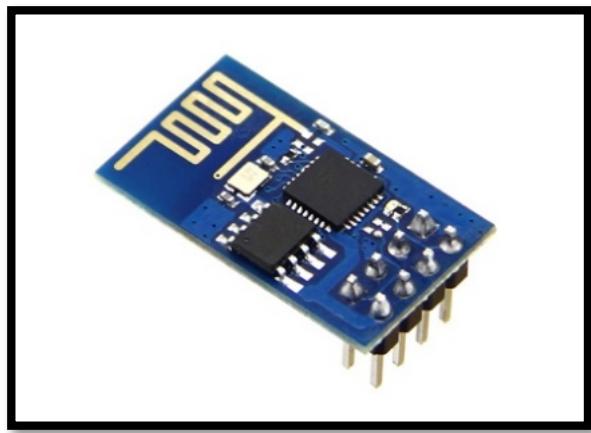


Fig. 1.2 Nodemcu

Relay Switch

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.



Fig. 1.3 Relay Switch

Raspberry Pi Camera

The **Raspberry Pi camera** module can be used to take high-**definition** video, as well as still photographs. Supports 1080p30, 720p60 and VGA90 video modes.

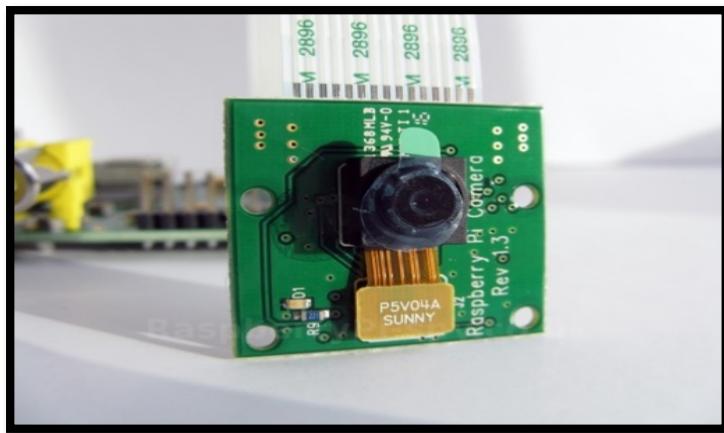


Fig. 1.4 PI Camera

Dimmer Circuit

Dimmer circuits are useful for adjusting the intensity of the light. By changing the voltage waveform applied to the lamp, it is possible to lower/higher the intensity of the light output.

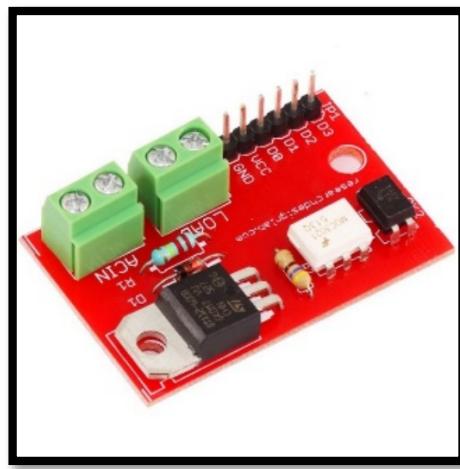


Fig. 1.5 Dimmer Circuit

Light Dependent Resistor

A photoresistor (or Light-Dependent Resistor, LDR, or photocell) is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity.

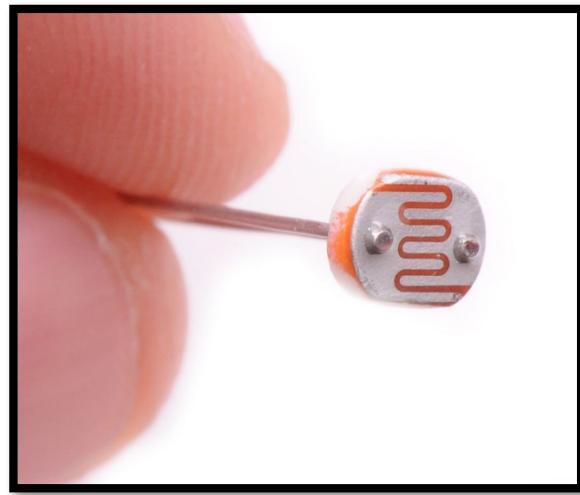


Fig. 1.6 Light Dependent Resistor

Push Button

A push-button (also spelled pushbutton) or simply button is a simple switch mechanism for controlling some aspect of a machine or a process.

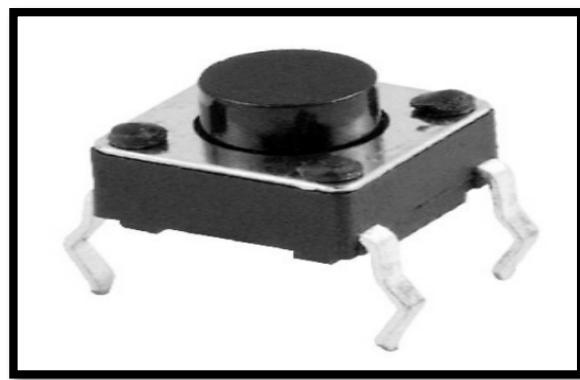


Fig. 1.7 Push Button

PCB

A PCB is a thin board made of fiberglass, composite epoxy, or other laminate material. Conductive pathways are etched or "printed" onto board, connecting different components on the PCB, such as transistors, resistors, and integrated circuits.

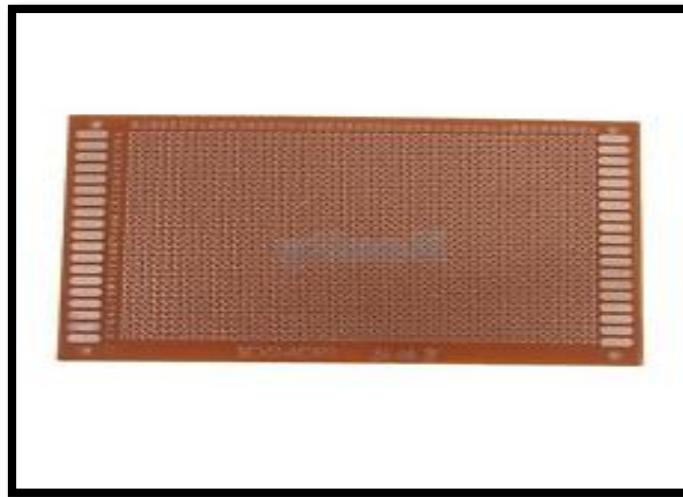


Fig. 1.8 PCB

LITERATURE REVIEW

CHAPTER 2: LITERATURE REVIEW

Home without IoT

Today, homes are places of relaxation and assures safety that allow people to relax after a long day of work and get a good tight sleep. Although homes today are well-organized and do their job well, they could become more methodical, coherent and do their jobs better. The homes of today has a huge risk of getting breached by any third person, doesn't conserve the energy at the fullest, doesn't notify about happenings of each area at each time and much more. The homes of tomorrow will optimize home security and comfort. These homes will be better, smarter, and more connected. These homes will add value to the homes.

The power of IoT (Internet of Things)

The term, Internet of Things (IoT) refers to a wide vision in which “things” such as the everyday places, objects, networks and environments which can be interconnected with each other via the Internet. A simple example of an IoT object which is now available in some of the homes is a thermostat which can be used to determine as to when an individual occupy certain rooms and alter the levels of heating, lighting and maintaining a perfect ambience in the house accordingly. The Internet of Things (IoT) will include a diverse and vast network of interconnected devices. These devices will include various sensors to measure the surrounding environment around them and actuators which can physically act back into their environment such as opening a door, switching of devices and storing of the vast data generated, nodes to relay the information and also coordinators to help manage sets of these components. Through this, it can possibly altogether broaden, improve and even move the relationship in the middle of individuals and their general surroundings.

Making a Smarter Home (IoT Home)

Smart homes are houses that can be controlled by the touch of a button. All of the appliances in these homes are connected through one broker, and the system can be controlled with our app. These systems have many capabilities involving home automation and controlling things from outside of the house. These homes use a host of technologies to connect the

devices from electrical wires to wireless networking. The appliances that can be connected to the system are countless because almost every device is connected to the home's electrical grid or wireless network. With the advancement of time, rapid development in technology and processing power which leads to a considerable reduction in device cost and size. All these factors have contributed to the popularity of electronic devices today, so people are much enthused about making their respective homes smarter. So, we are going to propose a home model which will make the user aware of the happenings of the house, will conserve the energy and will provide a more reliable security.

PLAN OF WORK

CHAPTER 3: PLAN OF WORK

3.1 Gantt Chart

A Gantt chart is a type of bar chart, devised by Henry Gantt in the 1910s, that illustrates a project schedule. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. Terminal elements and summary elements comprise the work breakdown structure of the project. Modern Gantt charts also show the dependency (i.e., precedence network) relationships between activities

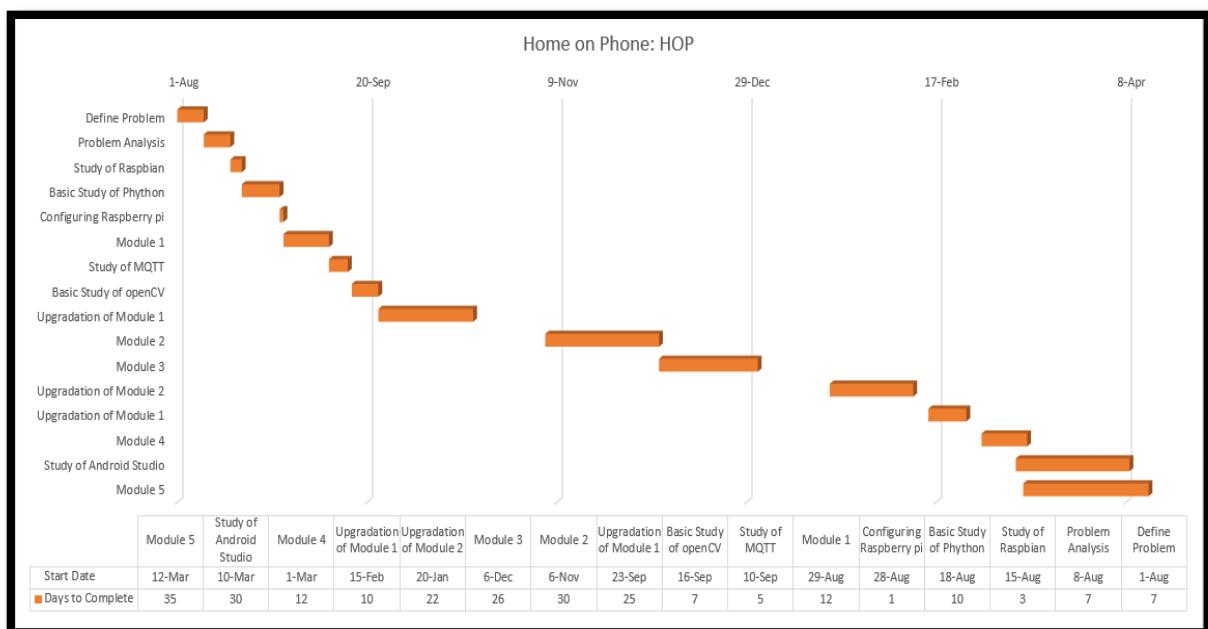


Fig. 3.1 Gantt Chart

DESIGN

CHAPTER 4: DESIGN

4.1 AEIOU Canvas

Description:

AEIOU means Activity, Environment, Interaction, Object, and User.

- **Activities** are sets of actions towards things people want to accomplish using our product.
- **Environments** include the entire area where activities take place.
- **Interactions** are between a person and someone who will use our product. Product can be used by many different type of people according to their needs.
- **Objects** are things which are related to our product. For example, in our product printer, fan etc. are objects related to our product.
- **Users** are the people who will be using our product.

HOME ON PHONE: ADDING VALUE TO YOUR HOME

Fig. 4.1 AEIOU Canvas

4.2 Empathy Mapping Canvas

Description:

In empathy mapping canvas, there are users and stakeholders with whom the user is directly or indirectly interacting. Fig 2.2 shows that the user can be an owner of the house, a shopkeeper and stakeholders are Businessmen, Technician, Security guard etc.

Moreover, there are activities done by users. In our case, various activities are energy conservation, maintaining ambiance etc.

In the end, there is story boarding which contain two happy stories and two sad stories describing the need to develop this project and the situation where it can be helpful.

Design for HOME ON PHONE [HOP]		Design By: 14_E		
Date 24TH SEPTEMBER 2016		Version 10.1		
USER SECURITY-GUARD  PARENTS 	POSTMAN  ENTREPRENEUR  SHOP-KEEPER 	STAKEHOLDERS BUSINESSMEN  TECHNICIAN 	MAID's  HOME-OWNER  SECURITY-GUARD 	
ACTIVITIES MONITORING   MAINTAINING-AMBIANCE				
REAL TIME NOTIFICATION   REMOTE-ACCESS  ENERGY-CONSERVATION 				
STORY BOARDING HAPPY  <p>MR. GOPAL FORGOT TO CLOSE THE WATER NOB, BUT AS HE HAD THE MOBILE APPLICATION HE GOT NOTIFICATION ABOUT THE SAME SO HE IMMEDIATELY WENT AND CLOSED THE WATER THIS IS HOW HE WAS ABLE TO PREVENT THE WASTAGE OF WATER.</p>				
HAPPY  <p>ONE DAY MR. ROY HAD A ROBBERY IN HIS HOUSE, HE WENT FOR A POLICE COMPLAINT. THERE THE POLICE ASKED FOR SOME MORE INFORMATION ABOUT THE ROBBERY. SO HE WAS ABLE TO SHOW THE PHOTOGRAPH OF THE ROBBER AS HE WAS USING OUR SECURITY SYSTEM AND AT THE END POLICE WAS ABLE TO CATCH THE ROBBER.</p>				
SAD  <p>MR. ROY WAS VISITING THE OFFICE AT NIGHT. HE WAS LOOKING FOR THE SWITCHES TO TURN ON THE LIGHTS. DUE TO THE DARKNESS, HE STUMBLED OVER THE CHAIR AND HURT HIMSELF. IF THE LIGHT HAD SWITCHED ON THROUGH PHONE THEN THIS ACCIDENT COULD HAVE BEEN AVOIDED.</p>				
SAD  <p>BHARTI OFTEN USED TO FORGET TO CHECK THE POST BOX AND ONE DAY SHE HAD AN IMPORTANT POST IN THE POST BOX BUT AS SHE WASN'T AWARE, SHE MISSED THE DUE DATE OF THE POST AND SO HAD TO PAY A HEAVY LATE PENALTY.</p>				

Fig. 4.2 Empathy Mapping Canvas

4.3 Ideation Canvas

Description:

Ideation canvas consists of many sections like people, activities, situation/context/location and props.

People section includes the people who will use our product. People can be parents, home owner etc.

Next is Activities section which contains all activities which can be performed using our product like maintaining ambiance, conserving water etc.

Next is situation/context/location which describes the situation or context or location where our product will be useful like libraries, industries etc.

Finally, props include all the hardware components that will be used in our product like Raspberry pi, Nodemcu etc.

HOME ON PHONE: ADDING VALUE TO YOUR HOME

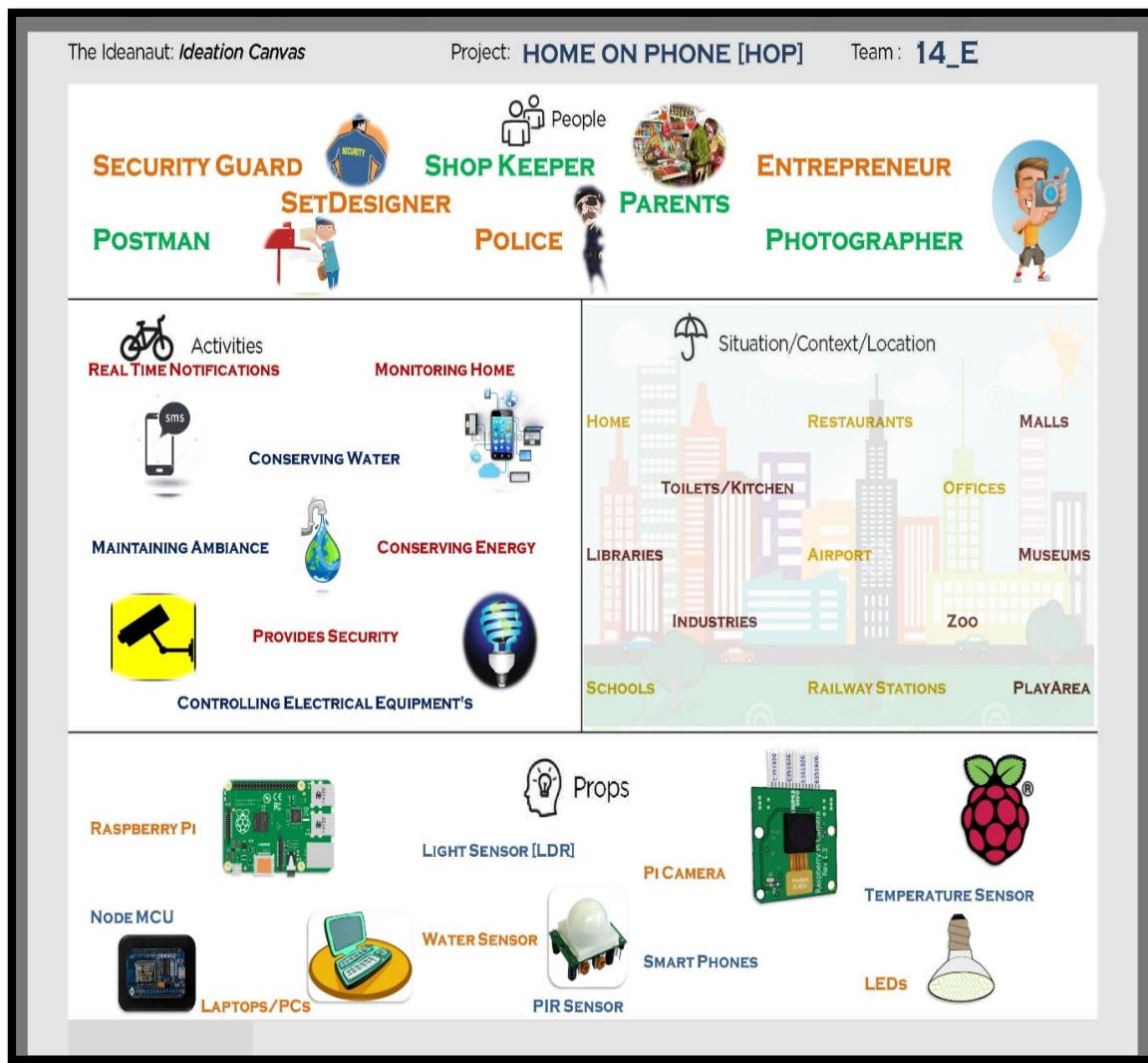


Fig. 4.3 Ideation Canvas

4.4 Product Development Canvas

Description:

Product development canvas describes the purpose of product, people involved, feature of the product, functions of product and components involved.

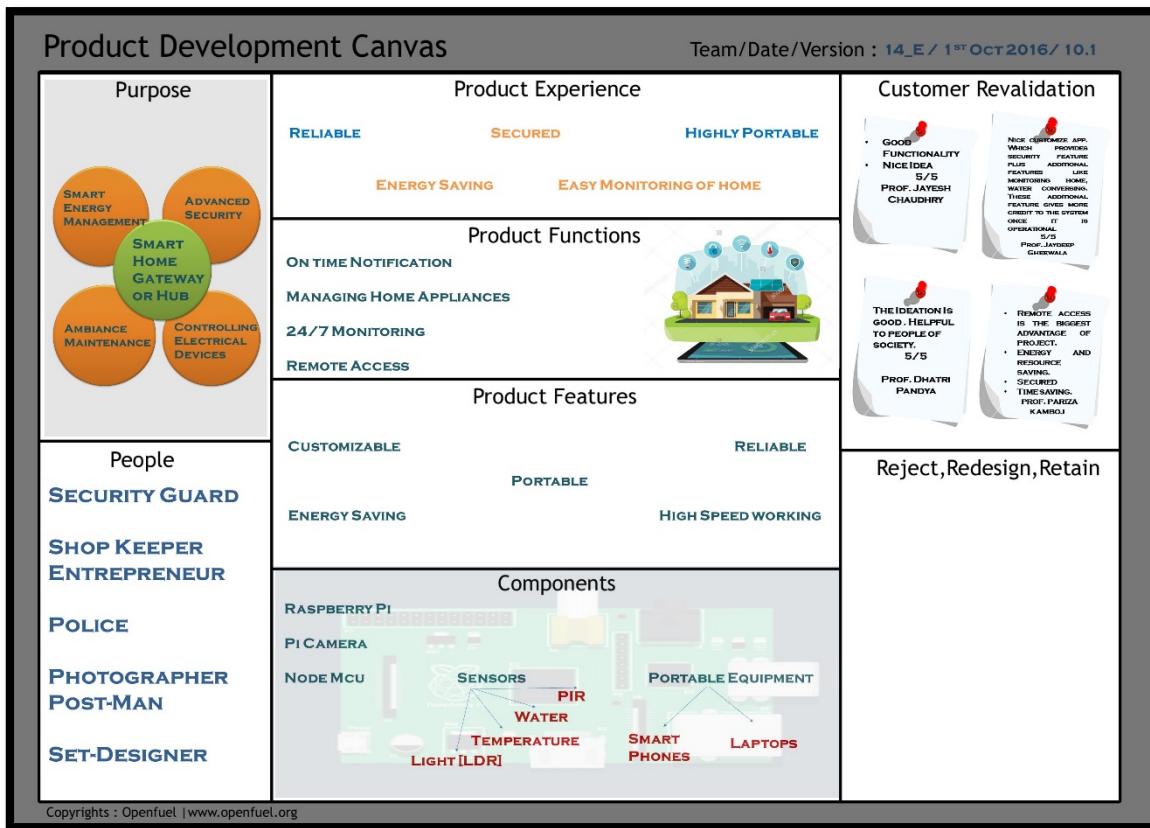


Fig. 4.4 Product Development Canvas

4.5 Business Model Canvas

Description:

The Business Model Canvas is a strategic management and lean startup template for developing new or documenting existing business models. It is a visual chart with elements describing a firm's or product's value proposition, infrastructure, customers, and finances. It assists firms in aligning their activities by illustrating potential trade-offs.

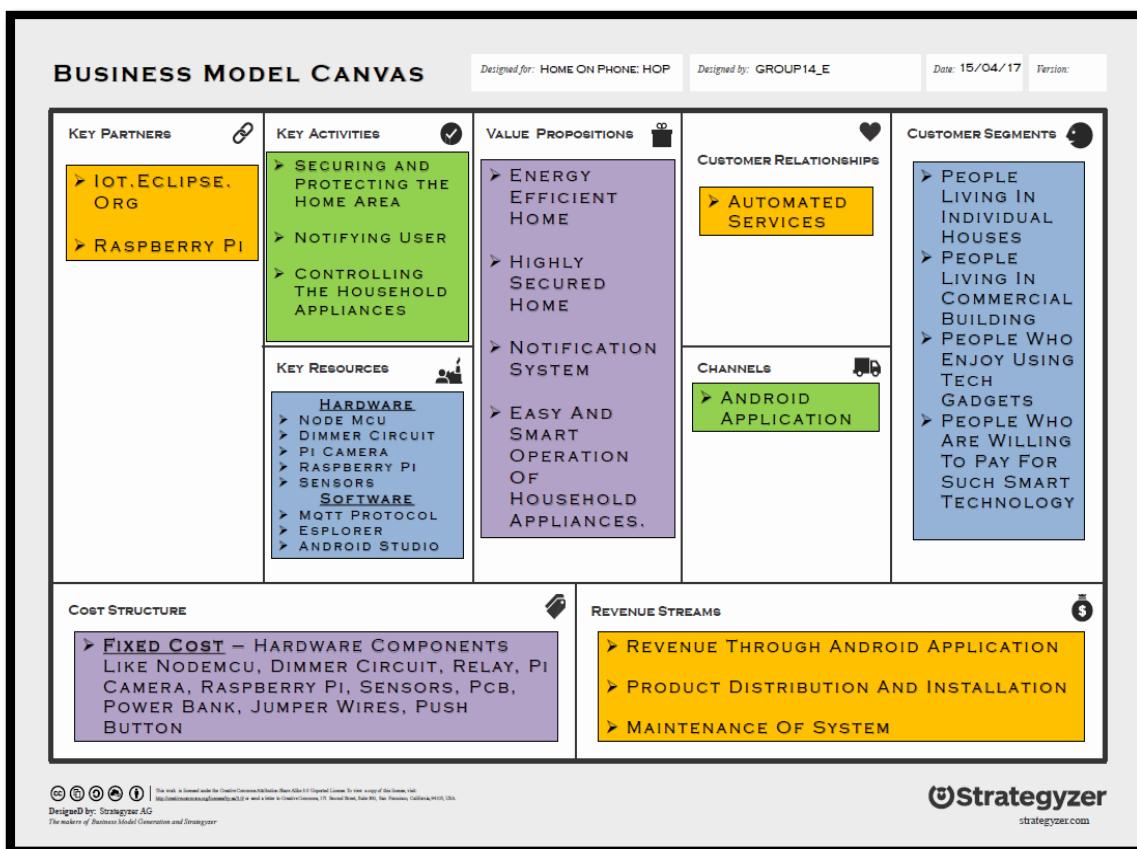


Fig. 4.5 Business Model Canvas

IMPLEMENTATION

CHAPTER 5: IMPLEMENTATION

5.1 Diagrammatic Representation of Flow of Implementation

1) Module 1 – Security through Geo-Fencing

Description

In this module, we'll alert the user as soon as someone enters the room (which should not be compromised) along with the photo of the person entering and without making the person entering know about it. In this module, we will try to data fence a certain area using OpenCV.

The other thing which we have added in the application is that the user can switch on/off the notification.

Sequence Diagram

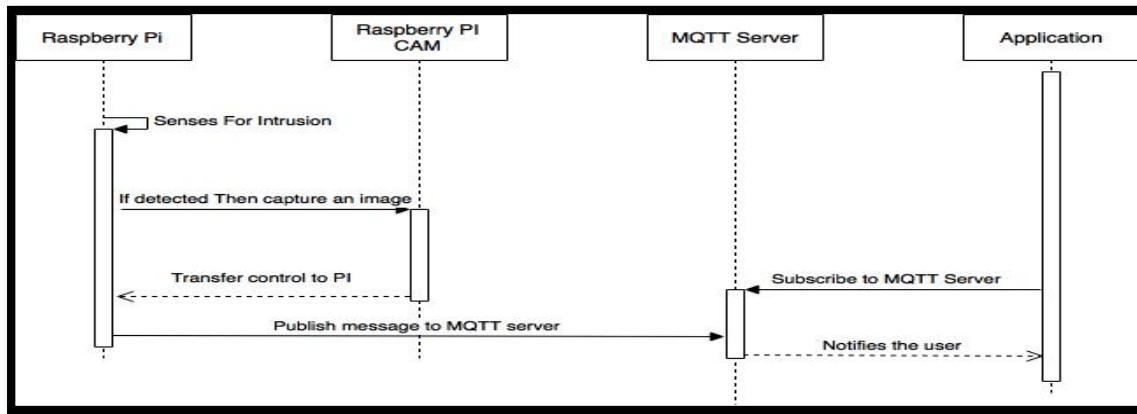


Fig. 5.1 Module 1 – Sequence Diagram

Activity Diagram

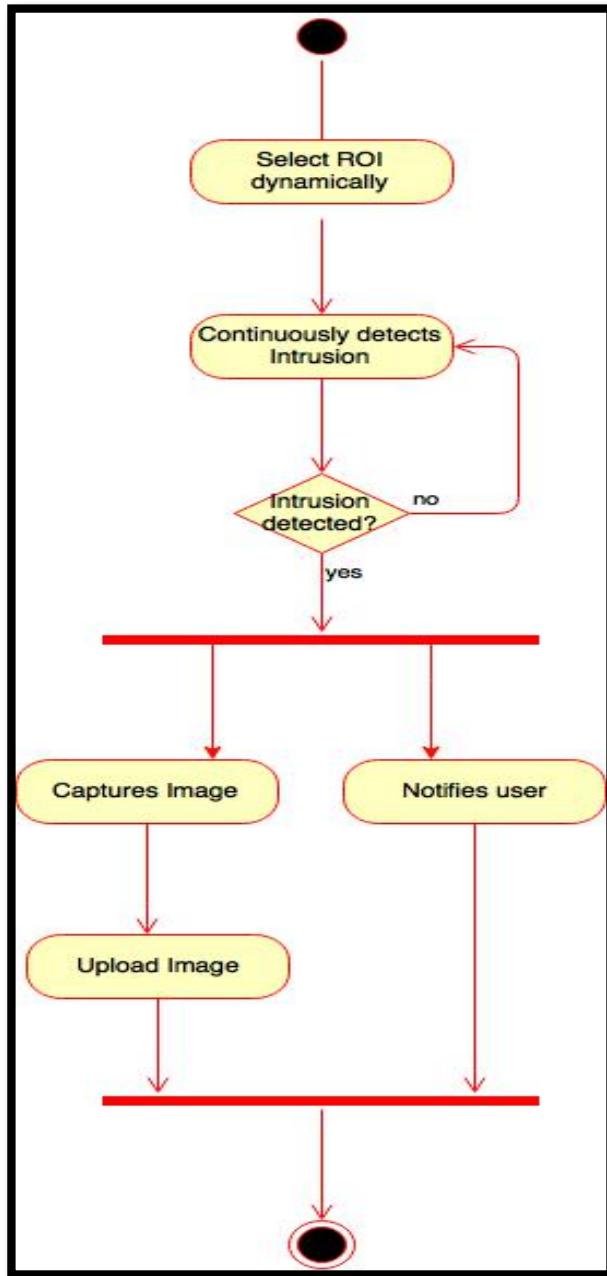


Fig. 5.2 Module 1 – Activity Diagram

2) Module 2 – Light Watch

Description

In this module, we are going to adjust the intensity of the bulb/tube light/LEDs in a room according to the amount of sunlight entering that room and we are also going to have a manual mode in which the user can manually change the intensity of bulb/light.

In the automatic mode, we are going to keep an intensity bar in the Android application through which we will be able to adjust the intensity of the bulb with respect to the value of the LDR.

Sequence Diagram

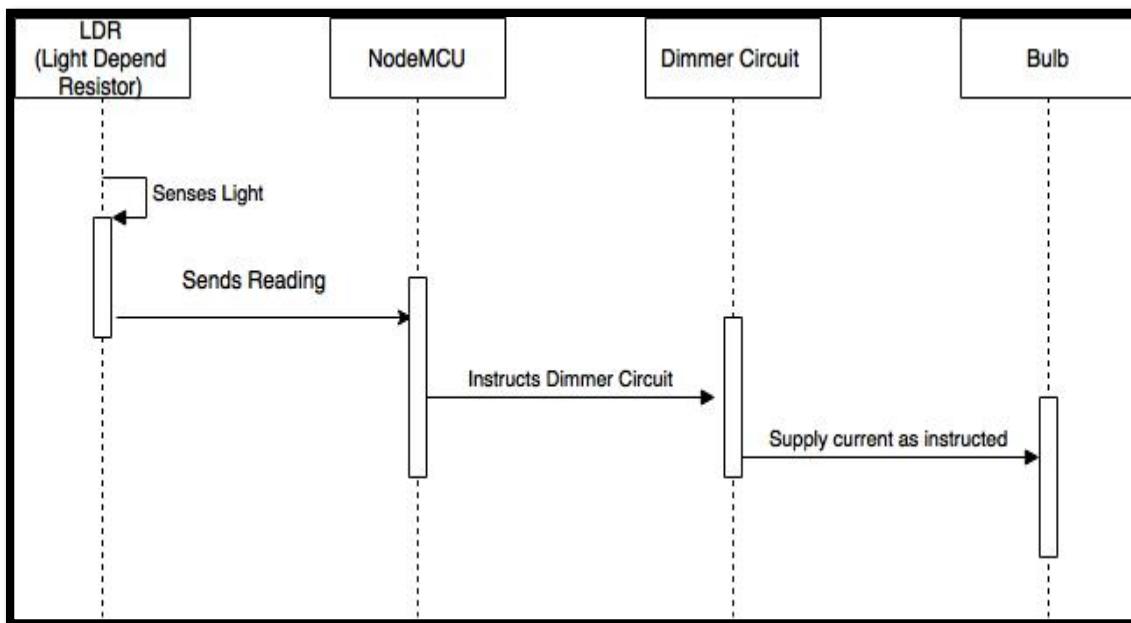


Fig. 5.3 Module 2 – Sequence Diagram

Activity Diagram

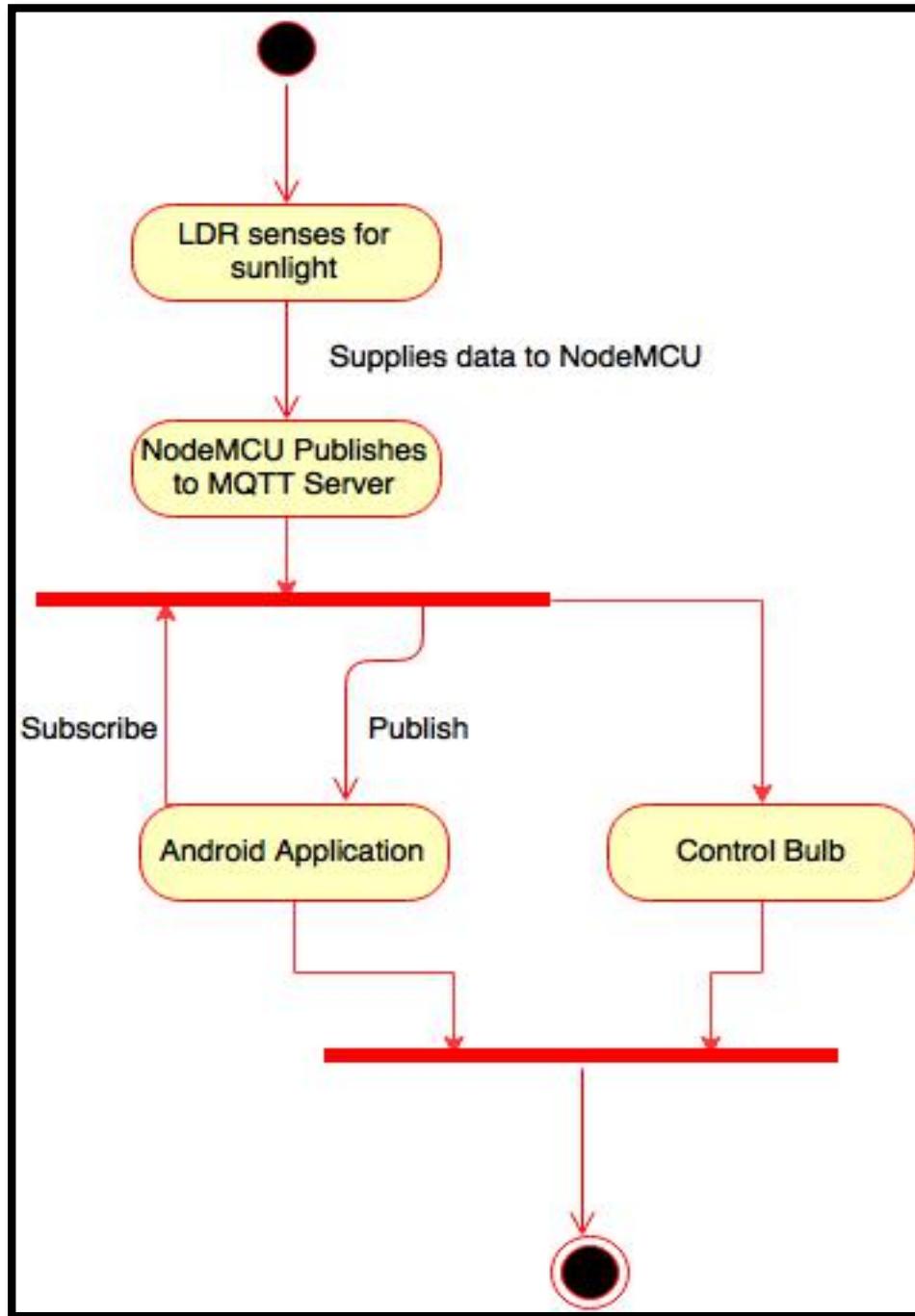


Fig. 5.4 Module 2 – Activity Diagram

3) Module 3 – Ambience Assistant

Description

In this module, whenever a person enters his home and is connected by the HOME WIFI the desired home appliances will turn on according to the settings done by the user in his android application.

The extra feature which we are going to provide, is that in the Android application the user can turn off/on the ambience assistance.

Sequence Diagram

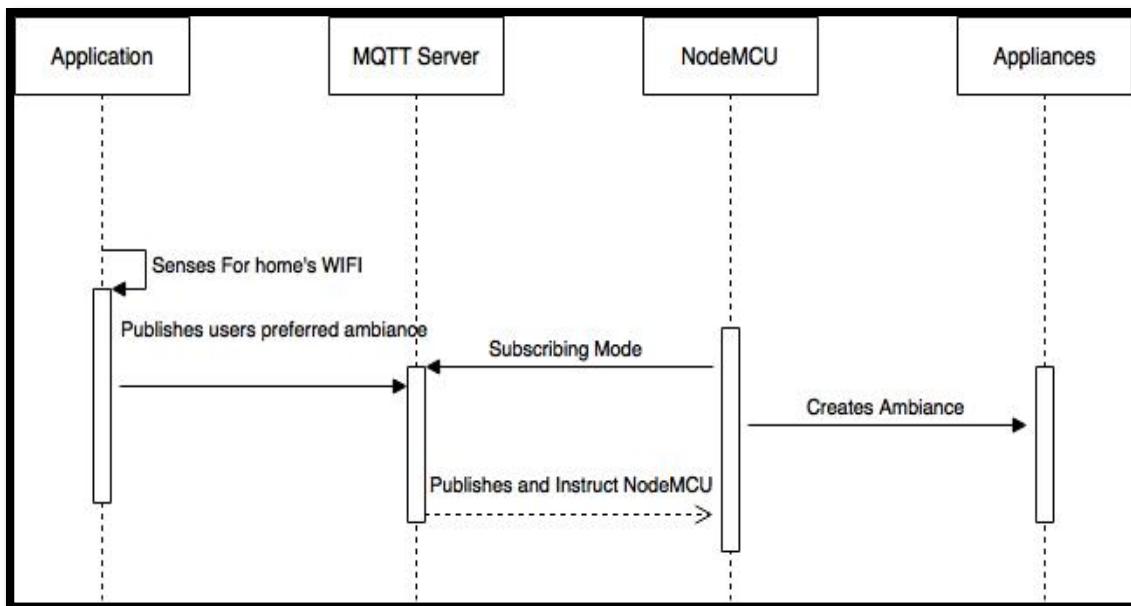


Fig. 5.5 Module 3 – Sequence Diagram

Activity Diagram

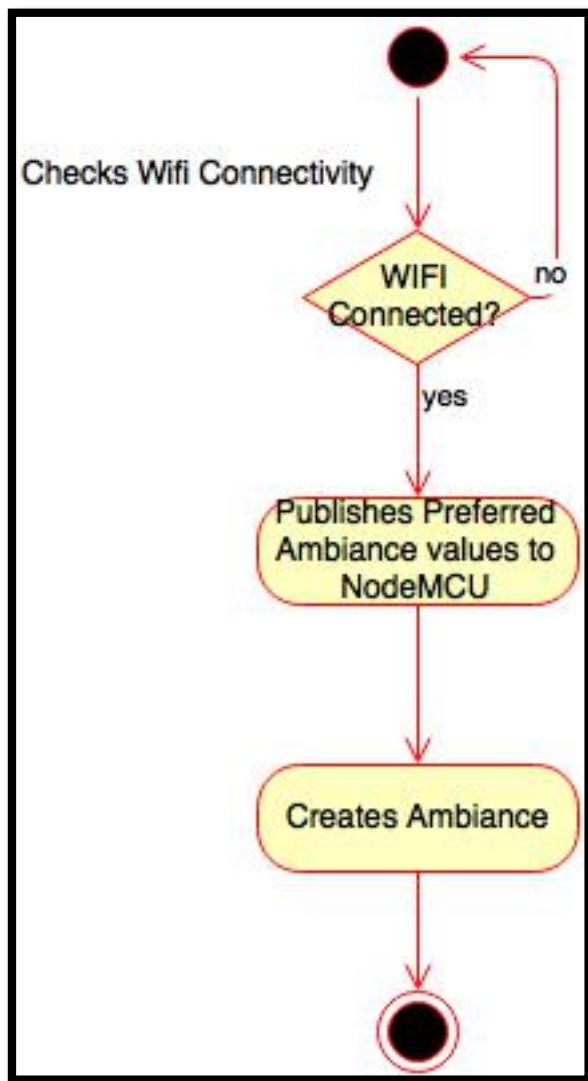


Fig. 5.6 Module 3 – Activity Diagram

4) Module 4 – Mail Notifier

Description

In this module, the user will be notified as soon as any person posts the mail in the mail box.

In the Android application, we have added a feature in which whenever the PUSH button through the flap of the mail box the user will be notified with a notification on his phone.

The other thing which we have added in the application is that the user can switch on/off the notification.

Sequence Diagram

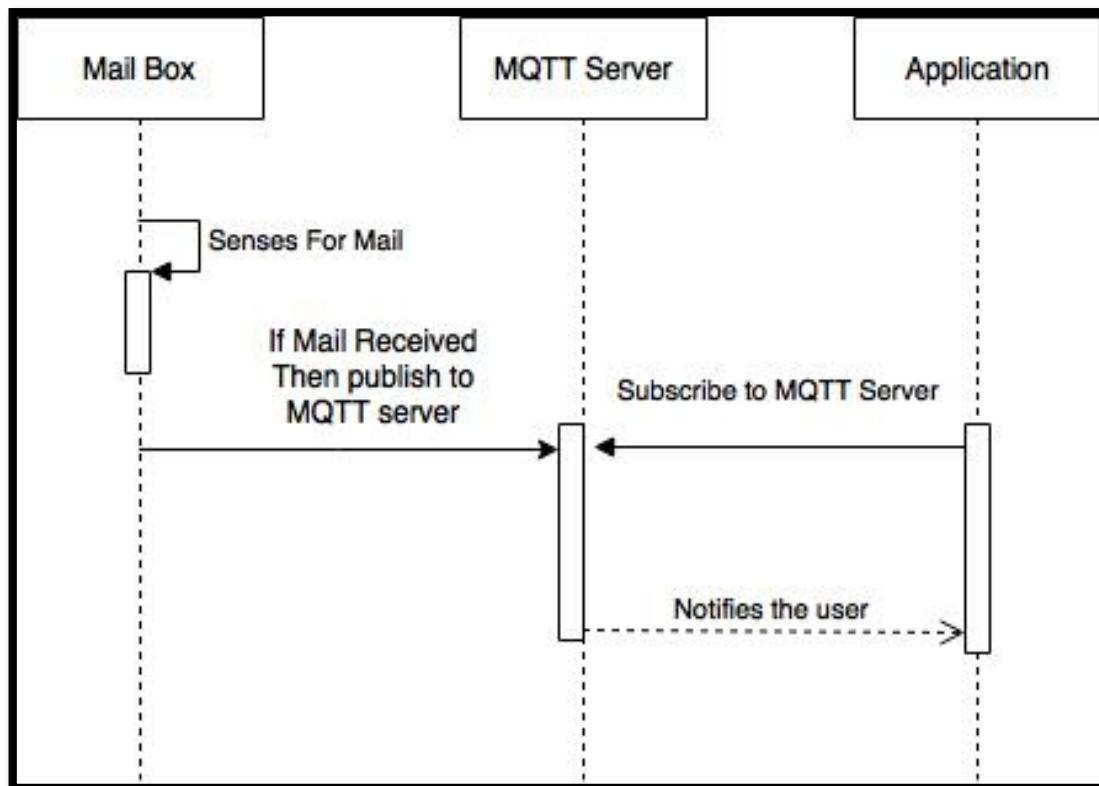


Fig. 5.7 Module 4 – Sequence Diagram

Activity Diagram

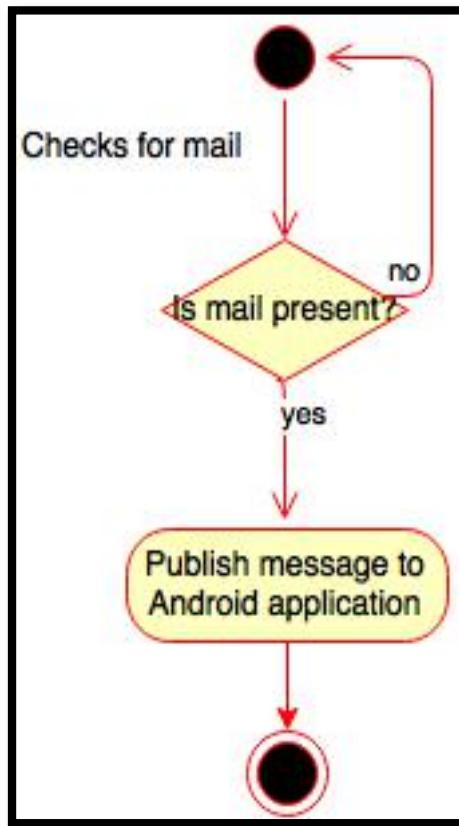


Fig. 5.8 Module 4 – Activity Diagram

5) Class Diagram

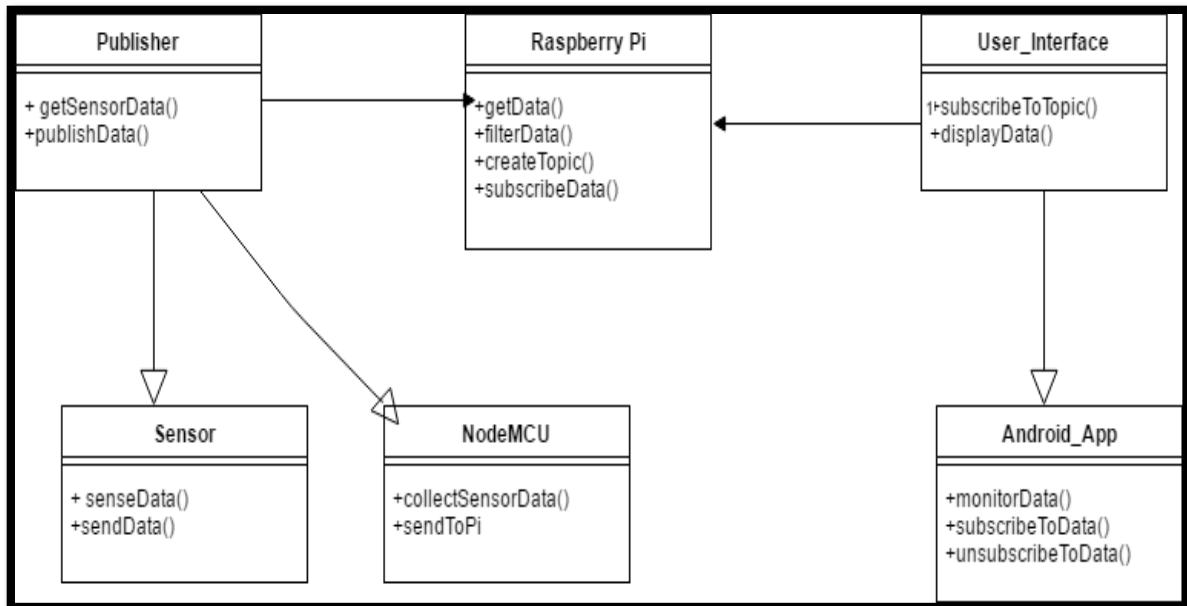


Fig. 5.9 Class Diagram

6) Use Case Diagram

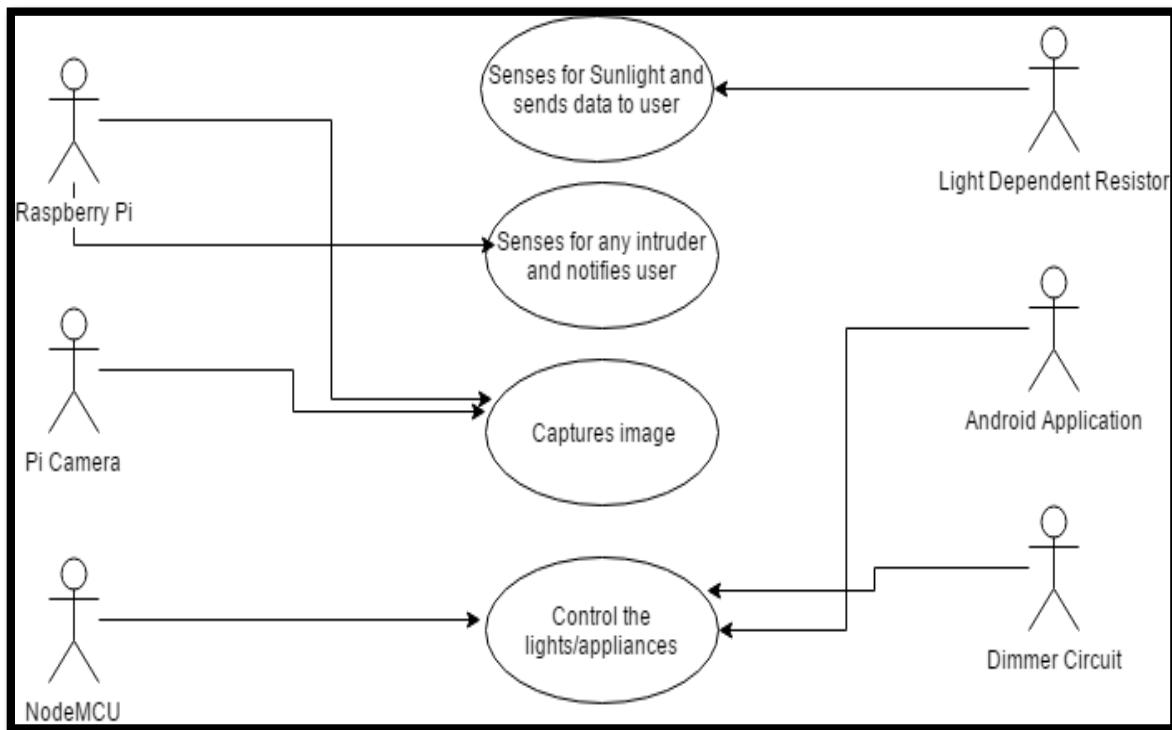


Fig. 5.10 Use Case Diagram

5.2 Implementation Steps

1) Module 1 – Security Through Geo-Fencing

In this, we have used OpenCV which helps in detecting the motion. We also made use of PI Camera which will help us in capturing a photo of the invader.

Step-1:

Firstly, we configured our Raspberry PI by installing a Raspbian OS using NOOBS which was installed on our SD Card.

Step-2:

After configuring the Raspberry PI, we connected our PI Camera to the Camera Port

Step-3:

Writing a python program to create a REGION OF INTEREST using opencv library and once any suspicious activity is observed in ROI then image is captured using pi camera.

Step-4:

After detecting the unwanted intrusion and capturing a photo, the main thing was to notify the user that their house has been invaded and also showing them the photo of the invader.

We have decided to give this notification to the user through android application. Notification will be in form of drobox link. User need to click on link and will be redirected to drobox and can view photo of intruder.

2) Module 2 – Light Watch

We have divided this module in two parts i.e. Auto Brightness and Manual Brightness.

- **Auto Brightness** – In this part we are using LDR (Light Detecting Resistor) to detect amount of sunlight entering in room and then to adjust intensity of light accordingly.
- **Manual Brightness** – In this part user can adjust intensity of light as per his/her wish. In this part, there is no use of LDR.

For adjusting intensity of light, we have used Dimmer Circuit.

Step-1:

We created circuit using LDR to detect amount of sunlight entering in room. Output is numerical i.e. in number format.

Step-2:

We connected this circuit with dimmer circuit which will reduce the voltage to change intensity of light.

Step-3:

We connected this connection to nodemcu. In nodemcu we have written program using ESPlorer in which reading of LDR is checked and intensity of light is changed accordingly.

Step-4:

For Manual mode, we have provided an intensity bar in android application, so that user can set intensity of light according to his/her wish. Communication between android application and nodemcu is done via MQTT protocol.

3) Module 3 – Ambience Assistant

In this module, we give user an option to set his/her ambience and save it in android app. Now whenever user's device gets connected to Wi-Fi his/her following setting will be activated. Communication between android application and nodemcu is done via MQTT protocol.

Step-1:

We created program in nodemcu using ESPlorer.

Step-2:

Data from android application will be fetched by nodemcu when the phone is connected to the HOME Wi-Fi using MQTT protocol and then according to data nodemcu will activate following setting.

4) Module 4 – Mail Notification

In this module, we have used push button behind the flap of mail box so as soon as flap opens push button gets pressed and notification to user is sent via android application.

Step-1:

We created circuit using push button and nodemcu.

Step-2:

Whenever flap gets opened push button gets pressed due to which circuit gets complete and notification is sent to user in android app through MQTT protocol.

5.3 Snapshots

1) Module 1 – Security Through Geo – Fencing



Fig. 5.11 User Interface for Module – 1

2) Module 2 – Light Watch

- Manual Brightness

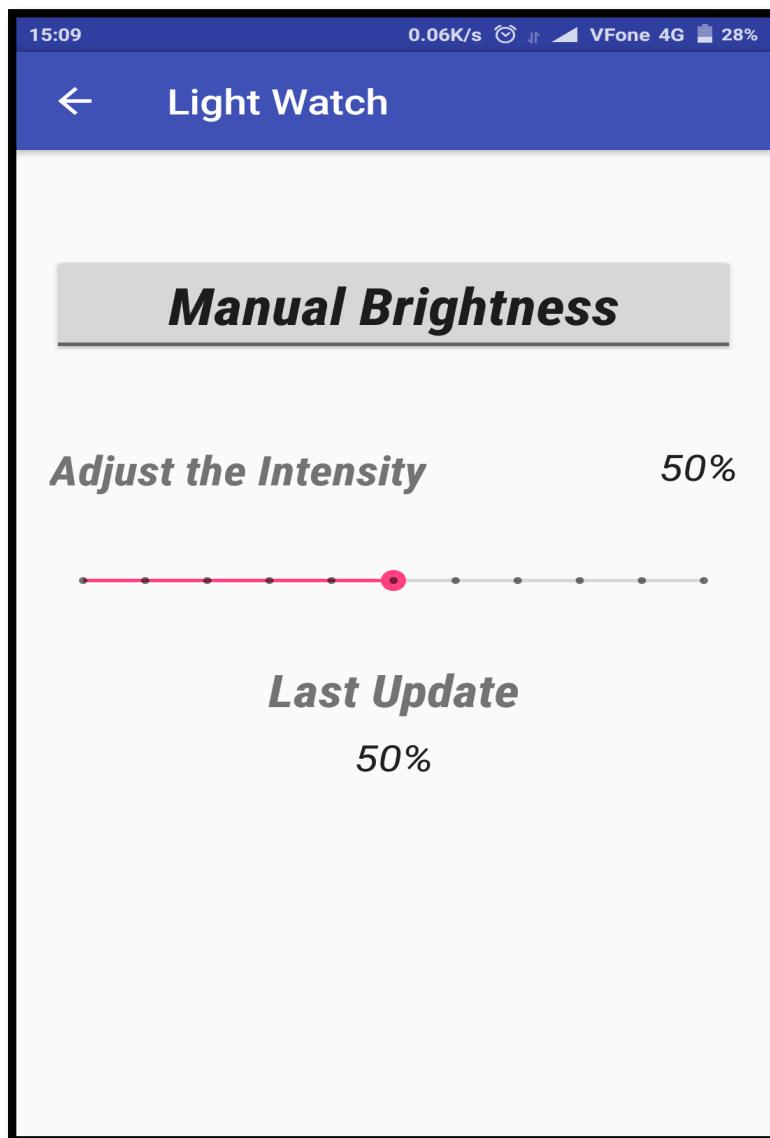


Fig. 5.12 User Interface for Module – 2 (Manual Brightness)

- Auto Brightness

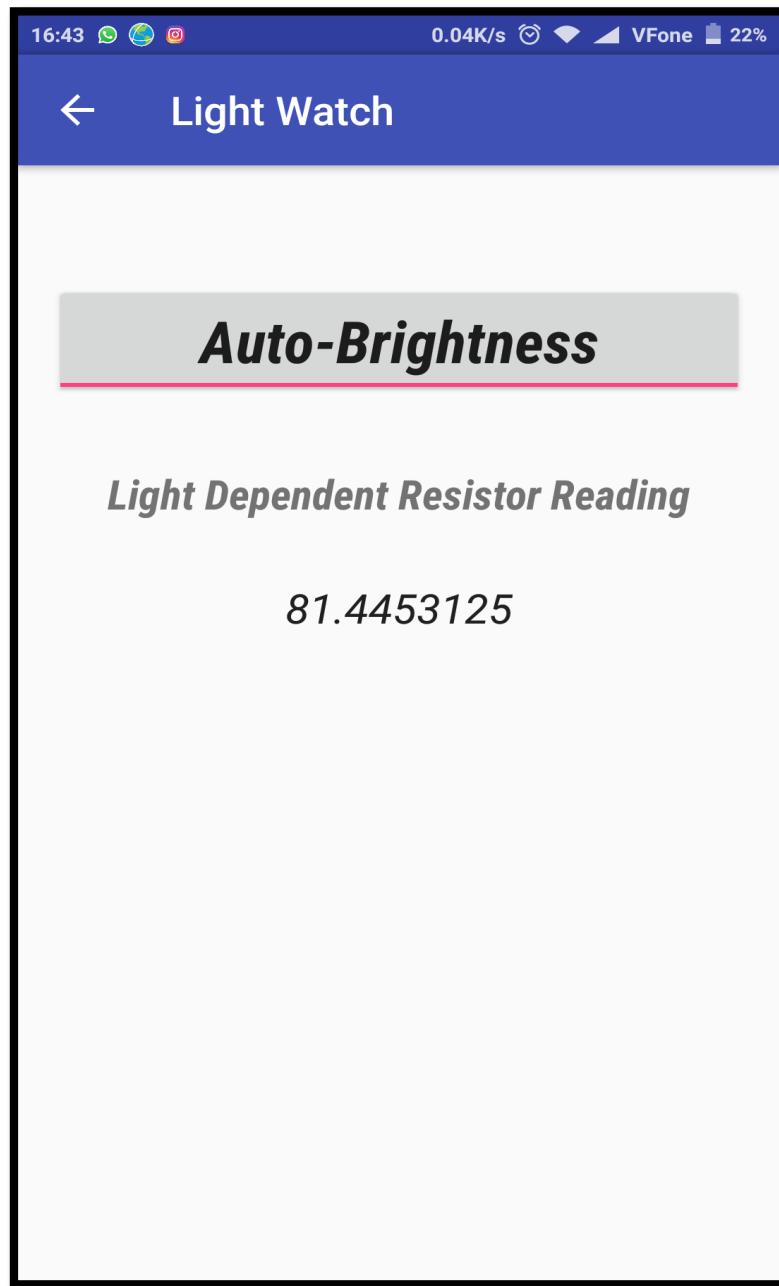


Fig. 5.13 User Interface for Module – 2 (Auto-Brightness)

3) Module 3 – Ambience Assistant

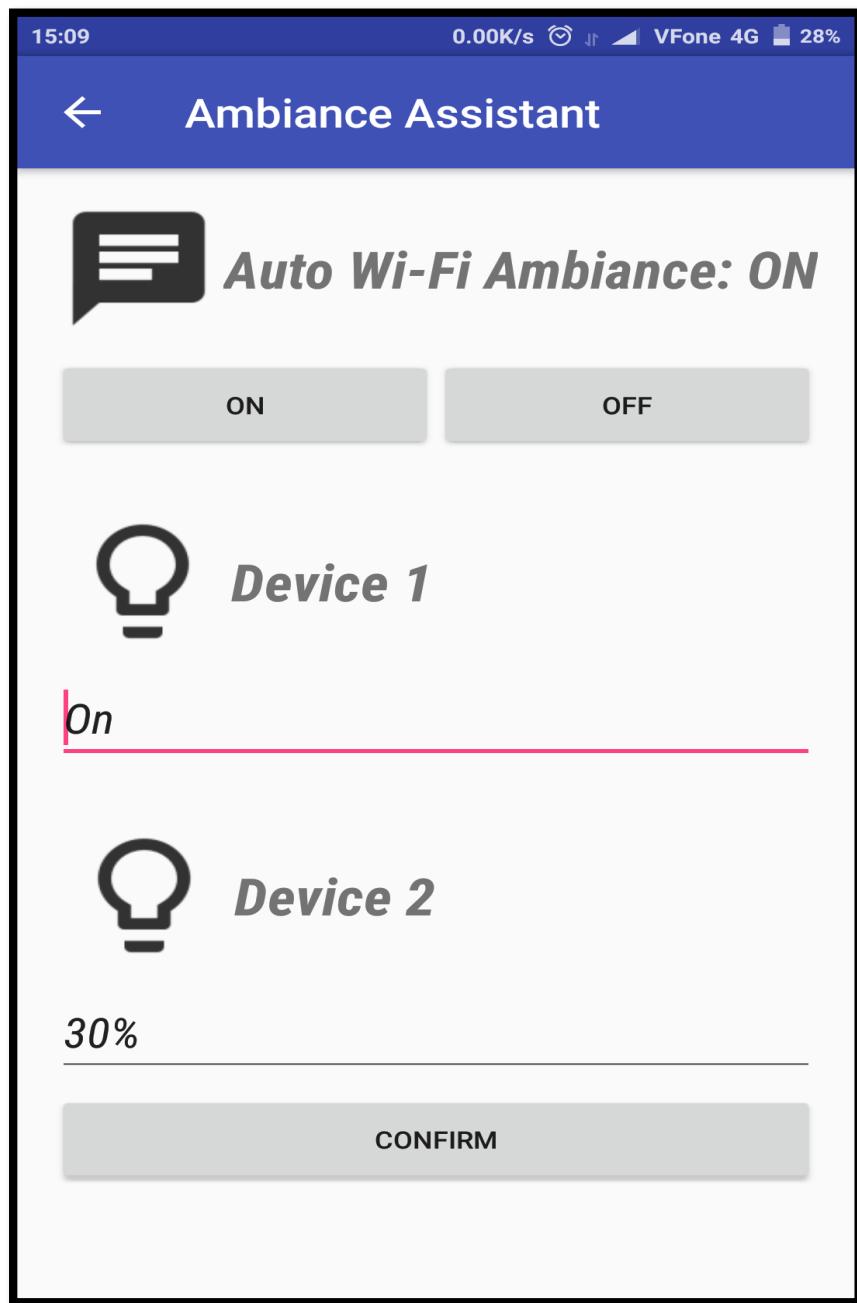


Fig. 5.14 User Interface for Module – 3

4) Module 4 – Mailbox Notification

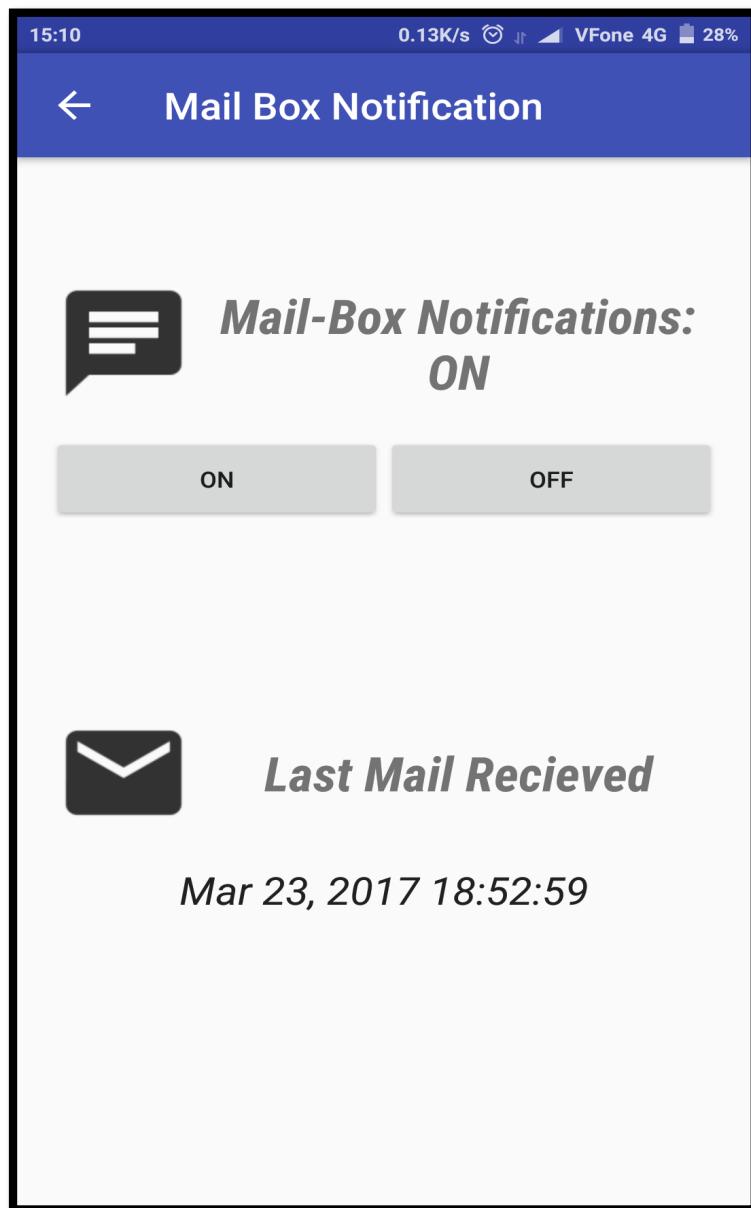


Fig. 5.15 User Interface for Module – 4

5) Module 5 – Android Application



Fig. 5.16 Android Application Icon

SUMMARY

CHAPTER 6: SUMMARY

Advantages of our work/results/methodologies

Existing Product	Advantages of our product
CCTV Camera:	<ul style="list-style-type: none"> • Existing CCTV Camera does not notify the user of anything. • Does the surveillance of the whole area and not a particular region
Mail-Box:	<ul style="list-style-type: none"> • Existing mail box does not notify the user about the mail. • Notifies user about suspicious activity along with a captured photo of that activity. • Does the surveillance of any one area which user is interested in.
Electric Socket:	<ul style="list-style-type: none"> • Existing sockets cannot be controlled wirelessly over an app. • Cost: INR 8000 • Our product will include sockets which can be controlled through an app which can help in many ways. For Ex: The charging will stop as soon as our phone gets charged up to some level. • Cost: INR 1500
Lights:	<ul style="list-style-type: none"> • Existing Lights does not work according to the sunlight. • Will adjust its intensity according to the sunlight entering in a room.
Overall cost(Approx.):	<ul style="list-style-type: none"> • INR 50,000 • INR 10,000

CONCLUSION AND FUTURE SCOPE

CHAPTER 7: CONCLUSION AND FUTURE SCOPE

Conclusion

In Module 1, we have implemented a very smart and cheaper security system which allows user to focus on only one area and notifying about any suspicious activities.

In Module 2, we gave access to user to control the home lights' intensity according to their preference and provided an option which helps them to control the intensity according to the sunlight.

In Module 3, we allowed user to register their preferred ambiance and then creating that environment as soon as the user gets connected to his/her home Wi-Fi.

In Module 4, we reduced the burden of user to check their mail box each time. The user gets notified as soon as the mail is dropped in the box along with timing of the last mail being dropped.

Hence, **Home on Phone** is the extraordinary home system for ordinary people.

Future Scope

There are still many ways by which the homes can get even smarter.

- Using the technologies of Artificial Intelligence and Data Mining we can detect the mood of user and can adjust the home environment accordingly
- We can also monitor a behaviour of user for controlling lights by using the technologies of Data Mining.

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CHAPTER 7: REFERENCES

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APPENDIX

HOME ON PHONE: ADDING VALUE TO YOUR HOME