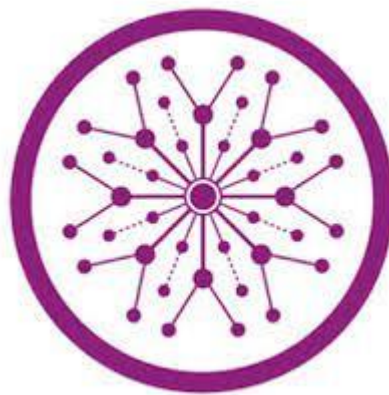


AI Based Smart Home Solution

Final Year Project

Session 2017-2021

A project submitted in partial fulfillment of the degree of BS
in Computer Science



Department of Computer Science
Faculty of Computer Science & Information Technology
The Superior University Lahore

fall 2021

| Type (Nature of project) | [<input type="checkbox"/>] Development [<input type="checkbox"/>] Research [<input type="checkbox"/>] R&D | | | |
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| Area of specialization | Mobile Application Development, Custom Analytics, Machine Learning, Ai | | | |
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*The candidates confirm that the work submitted is their own and appropriate credit has been given where reference has been made to work of others

Plagiarism Free Certificate

This is to certify that, I Muhammad Rabeel S/D of Muhammad Wakeel, group leader of FYP under registration no BCSM-F15-360 at Computer Science Department, The Superior University Lahore.

I declare that my FYP report is checked by my supervisor.

Date: **22/02/2022**

Name of Group Leader: Muhammad Rabeel Wakeel

Signature: _____

Name of Supervisor: Humaira Muqadas

Associate Professor

Signature: _____

HoD: Dr.Irfan-ud-din

Signature: _____

Project Report

AI Based Smart Home Solution

Change Record

| Author(s) | Version | Date | Notes | Supervisor's Signature |
|-----------|---------|------|---|------------------------|
| | 1.0 | | <Original Draft> | |
| | | | <Changes Based on Feedback from Supervisor> | |
| | | | <Changes Based on Feedback From Faculty> | |
| | | | <Added Project Plan> | |
| | | | <Changes Based on Feedback from Supervisor> | |

APPROVAL

Project Supervisor

Comments: _____

Name: _____ Date: _____
Signature: _____

Project Manager

Comments: _____

Date: _____ Signature: _____

Head of the Department

Comments: _____

Date: _____ Signature: _____

Dedication

*This work is dedicated to my team, supervisor and family who helped me in
Completion of this project.*

Acknowledgements

I am really thankful to my supervisor and the team of CAXTEK Trainings who helped me achieve competition for this project.

Executive Summary

The popularity of home automation has been increasing vastly in recent years due to much higher affordability and simplicity. Being able to control aspects of our houses, and for having the feature to respond automatically to events, it is becoming more and more popular and necessary due to security and cost purposes. We propose to implement an integrated home automation and security system. Our project proposes a low-cost AI Home Automation solution using off the shelf components to reduce cost and open-source software to get around licensing requirements of software. The Arduino can also send alerts if it detects an abnormality.

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Chapter 1

Introduction

Chapter 1: Introduction

This chapter includes all the basic information of project that we are going to develop.

This includes the complete information of project feasibility statement problem statement
Better enhancement comparative of this application in market new features to be included.
What the user got benefits from our plate form scope of this project.

Goals and objective Gantt chart analysis project plan work breakdown challenging faces

1.1. Background

The concept of "home automation" has existed for several years. "Smart home" are the following terms that have been used to introduce the concept of network device inside the home. Home Automation Systems include centralized control and remote monitoring of the status of lighting, the security system, and other devices and systems within a home. Home Automation Systems enables energy efficiency, improves safety systems and certainly comfort and ease of use.

1.2. Motivations and Challenges

Home Automation brings about a smarter home and is utilized to give a higher and more beneficial way of life. The magnificence of a home Automation framework is that it is very versatile, adaptable and its abilities are constrained just by our creative ability. With the AI practically around the bend, it's about time that we move towards boundless selection of such a prototype. At the same time when I wanted to implement something like an Android Application I didn't have the examples to follow. Same issue was faced by my fellows too. The only thing that helped me was my ability to search.

1.3. Goals and Objectives

Our major goal is to provide an android application where a user can get control on his home appliances. Main objective of our project is to provide friendly interface.

1.4. Literature Review/Existing Solutions

While the concept of smart homes has had several false dawns in recent decades, new technologies are starting to struggle for the attention of homeowners, with the potential to better control energy and water use. Smart speaker technologies such as Amazon's Echo, Google Home, and Apple's Siri have all made inroads through their voice interaction capabilities, with Google Nest providing a breakthrough with its smart thermostat. On the water side, a smart phone-enabled technology promises to "virtually" control the temperature in your hot water tank, with a clamp-on meter that can detect leaks and monitor peaks in water use. Still, these technologies fall short of tying together the plethora of systems that support a consumer's energy, water, security, and ambient needs. Eventually these technologies will become so interconnected and intelligent that human intervention is barely needed.

1.5. Gap Analysis

Whenever a learner wants to learn something AI Automation. He or She gets confused about the level at which they are standing for their relative skill and sometimes they don't even know from where they can start. Traditional home Automation are only providing button based. Moreover, a Admin has to do proper AI Automation or Automation for reaching out to the target market which he or she can't do for free.

1.6. Proposed Solution

We've provided a platform where you can get learning resources including

1. Python
2. App Codes
3. schematic

For free that are rewarded All the Arduino library. Home Automation provides learning hardware and implementation material for user it also provides a platform. We are providing

1. Hardware Implementation
2. App making
3. Software

All these things will be totally protected with the latest App to maintain the user's confidentiality and safety. These provided solutions will be on the same platform the user doesn't have to Download multiple App for that.

1.7. Project Plan

The work breakdown structure (WBS) and Gantt Chart are listed below according to the activities we are going to perform with relevant dates and responsibilities assigned to the team members. All the activities are specifically assigned by the Team Leader with respect to their relative abilities.

1.7.1. Work Breakdown Structure

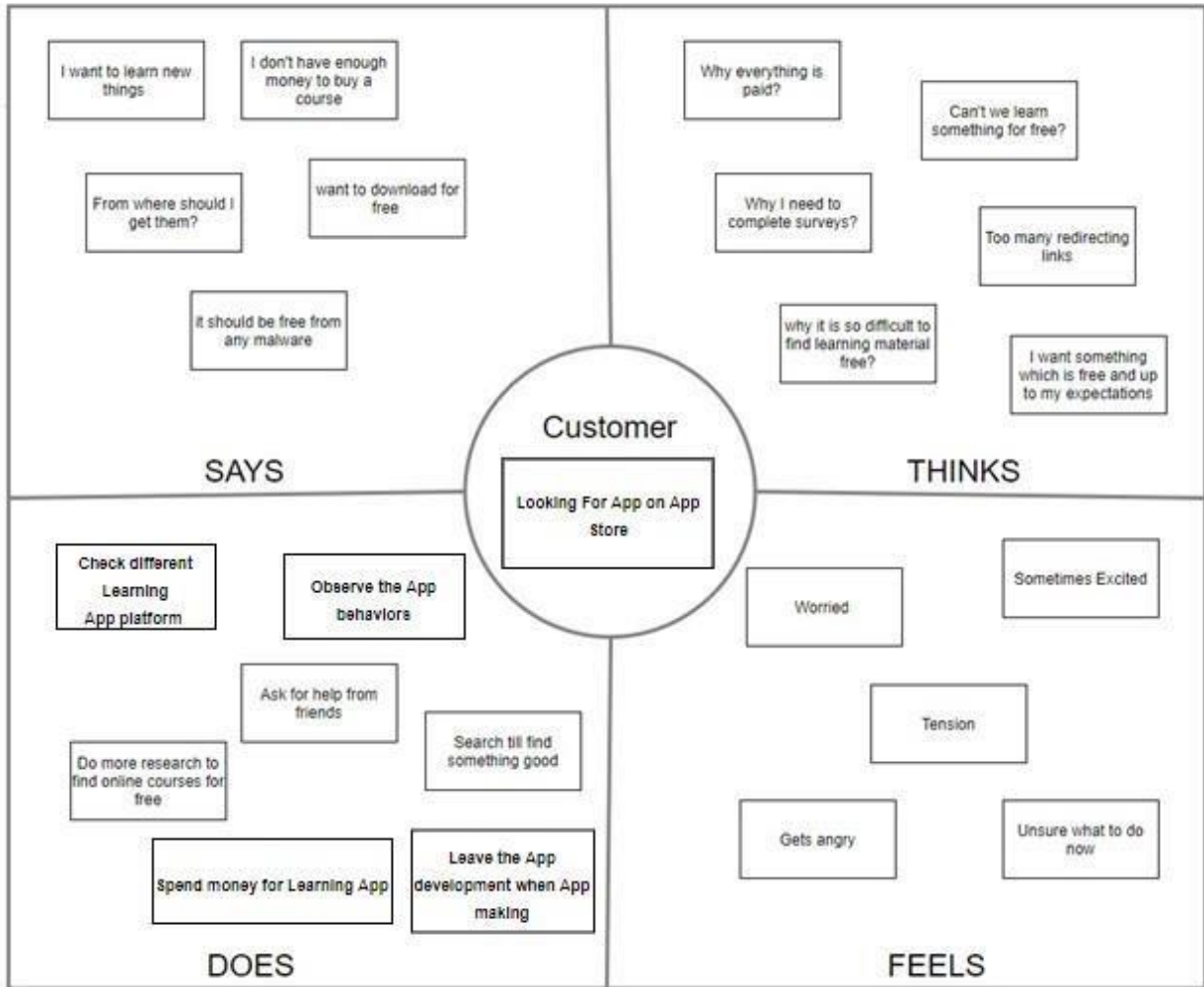
| Task | Start Date | Day's to Complete | Roles and Responsibilities |
|--|------------|-------------------|----------------------------|
| Start of the Project | 1-Oct | 5 | Muhammad Rabeel |
| Client meeting for asking requirements | 10-Oct | 10 | Muhammad Ghufuran |
| Meeting with team members to check the feasibility of the project | 21-Oct | 11 | Hamid Raiz khan |
| Client meeting for discussing risk and threats associated with the project | 27-Oct | 6 | Muhammad Rabeel |
| Planning | 02-Nov | 5 | Muhammad Ghufuran |
| Studying the project | 15-Nov | 17 | Hamid Raiz khan |
| Meeting with team members to understand implementations | 25-Nov | 10 | |
| Developing blueprints | 08-Dec | 13 | Muhammad Rabeel |
| Searching and locating vendors | 15-Dec | 7 | Muhammad Ghufuran |
| Developing | 20-Dec | 5 | Hamid Raiz khan |
| Buying compatible devices | 22-Dec | 2 | |
| Integrating them with each other | 30-Dec | 7 | Muhammad Rabeel |
| Developing a central control system | 10-Jan | 10 | Muhammad Ghufuran |
| Testing for any vulnerabilities | 17-Jan | 7 | Hamid Raiz khan |
| Implementation | 19-Jan | 2 | |
| Installation of devices | 26-Jan | 7 | Muhammad Rabeel |
| Adjusting the system to the real world | 05-Feb | 9 | Muhammad Ghufuran |
| Final testing | 13-Feb | 8 | Hamid Raiz khan |
| Training and Handling Over | 17-Feb | 4 | |
| Training client | 21-Feb | 3 | Muhammad Rabeel |
| Handling over of security information (keys/password) | 24-Feb | 3 | Muhammad Ghufuran |
| Describing polices | 26-Feb | 2 | Hamid Raiz khan |
| Finalizing Project | 27-Feb | 1 | Muhammad Rabeel |
| Final report | 15-Mar | 16 | Muhammad Ghufuran |
| Closing of project | 21-Mar | 7 | Hamid Raiz khan |

1.8. Report Outline

Report Outline This report represents every aspect of the project with respect to its behavioral responses, design of its backend and frontend and usage management of every stake holder.

Testing of this project is done in iterations which are also mentioned in Chapter 7.

1.9. Empathy Map



Chapter 2

Software Requirement Specifications

Chapter 2: Software Requirement Specifications

2.1 Introduction

2.1.1. Purpose

The goal of home automation systems is to optimize the performance of your home. Consider some of the following benefits: Remote access: Control your home from your mobile device, including a laptop, tablet or smartphone. Comfort: Make your home more comfortable and livable with home automation.

2.1.2. Document Conventions

Standard rules of documentation have been followed in order to standardize the work. This software requirement document uses the following conventions.

| Description | Appearance |
|---------------------|-------------------------------------|
| Andriod Application | AI Based Home Automation |
| Server | Mobile App |
| Database | Python/C |
| SRS | Software Requirements Specification |

2.1.3. Intended Audience and Reading Suggestions

This document is intended for developers, project managers and users of this website who wish to read about what the website can do. Rest of SRS contains work flow of the system, how the system works, flow of data at the hosting and other technical functionalities of the software.

- For developers there is a need to start from introduction and understand workflow diagrams.
- The project manager sequence of reading is from introduction to class diagram and use cases.
- For users of application there is a need to read from introduction and read all descriptions including scope and functionalities.

2.1.4. Product Scope

- This application is used as a platform to control home appliances through AI.
- This project helps people with disabilities, seniors and anyone who wants to use technology to make life easier. applications are used by administrators and administrator-approved users.
- The module of this application contains all the navigation menus, a simple interface that includes the full user interface for the user.

For getting started, we need to get some resources to take our first step. Those resources are listed below

1. Hardware integration
2. Application development
3. Proper marketing Strategy (We've made our own)

There are steps which will ensure our success and proper structure that we work towards consists of some things that are important for us to move forward with respect to revenue and App development.

Step 1: We need to have a proper mobile app that meets all requirements of controlling the devices.

Step 2: We need to publish the App which we have backed up with our test running we did.

Step 3: We need to have proper App for the stuff/resources we upload at our server.

Step 4: We've to do proper hardware study with competitor breakdown for our categories and the content we want to rank at App store.

Step 5: We'll do complete optimization of our application and We'll develop an environment that makes our App

- Crawlable
- Indexable

Step 6: We will develop different pages with App for each category that'll convert our WIFI switching into hardware switching

Step7: We'll do algorithm marketing (developed by our team) to get User to our App and relevant people who want to get resources. This will help us with some points let me list them for you

- Ranking at App Store at relative keyword which will increase because high circulation sources
- People who wants to Learn, publish and advertise (our customers)
- Revenue

2.1.5. References

Article Title: Smart homes

Website Title: [Google Blog](#)

URL: <https://www.hiri.org/blog/5-smart-home-trends-moving-the-market-in-2021>

2.2 Overall Description

2.2.1. Product Perspective

This application is designed and developed to provide the best service to our users. Users can use the application menu to navigate to a specific category of their choice. User behavior, analytics, bounce rates, and all other factors are managed in the admin panel. A new user is added on the administrator side or the developer side. This project replaces the home automation project that provides automation. All of these services are offered on a single platform for ease of use.

2.2.2. Product Functions

The project function depended on three types of users that impacted on the website depending on their skills and needs. All the users are listed below.

General User.

Easy to use.

User friendly Interface.

Provides limited access.

Contact at WhatsApp for consultation and updates.

Administrator.

Admin can Allow new user.

Setting changes **Developer.**

Android Structure Setup.

Optimization of App

Technical Support

Linkage (Internal/External).

2.2.3. User Classes and Characteristics

| Classes | Characteristics |
|-----------|--|
| Admin | Administrators have full access to the system. He will train the in almost every detail of the system. |
| User | Users are defined by the administrator. Administrators define user access to control |
| Developer | Developers can edit any recommended changes. By admin |

Classes are made for describing the relation between user characteristics and others with operation functions. User classes help in this project to relate or use the parent functionality and perform more operations. There are following types of users on the Application.

2.2.4. Operating Environment

- The App can be accessed by using any type of device.
- Its design is responsive with every touch screen. It's dimensions and its content are responsive along every device.
- In addition, for the user who visits the Google App store search will get an App (Smart Homes).

Software's:

Python language/ Android studio **Hardware:**

- Wemos
- Dht11
- Esp 32 cam
- Relays module
- Fan
- light

2.2.5. Design and Implementation Constraints

A.I. Home Based Automation is a platform dependent. Embedded application working on Arduino board or another linked device.

Work products such as documents will be in compliance with IEEE standards. Language requirements: English

Communications protocols: It should be voice alert and message alert inside. Plus, the Proposed A.I. Home Based home automation is implemented using ASP, HTML and CSS and Python. The application is implemented in Android studio and the embedded hardware interface application shall be implemented using C Language.

2.2.6. User Documentation

A complete user manual guide will be present in the Application as “Smart Homes”. Moreover, if a user wants to learn about App. There'll be a manual attached in the navigation menu which is a perfect navigation practice recommended by Android Studio. These are user documentation lists. As follow:

- Download Android Studio.
- How to get to a specific App page?
- How to use different features of the application.
- Example inputs and outputs.

Explanations of error messages and troubleshooting guides.

The quality of user documentation can affect the rate of implementation of updated applications. Examples should include methods such as: help files, online support and printed manual.

2.2.7. Assumptions and Dependencies

All the dependencies and assumptions that this project will have been listed below.

1. Users have basic knowledge of the system environment.
2. User has sufficient security knowledge.
3. The home security system requires the product to be installed correctly.
4. Persons who can interact with home security systems such as lighting systems, telephone systems, alarm systems, etc. in power-on mode. system components are always connected. Each user must have a user ID and password.
5. There is only one administrator.
6. The App must always be running mobile/tablet.
7. Internet connection is required.

2.3. External Interface Requirements

2.3.1. User Interfaces

The first interface is the App Smart homes screen. Here, the user has a specific username and password to access the database. The user module can be a smartphone, tablet or the user's laptop. We present the application with a simple user interface. On the user side, you have four options. When the AI-powered home automation page opens, the user is presented with a main screen. When a user clicks on one of the bottoms under the icon,



2.3.2. Hardware Interfaces

A user can access this website by using the following devices.

- Mobile Phone
- Tablet

Any other device which supports App installation. Users must be connected to the internet for using the real time enrollment and downloading of courses.

2.3.3. Software Interfaces

App is an easy-to-use platform designed and developed for native usage. It is developed in Android for designing interfaces. App running scripts are coded with C and design is managed by Android Studio.

1. Real time database
2. Data storage
3. Push Messaging
4. App management.
5. Analytics.

2.3.4. Communications Interfaces

The system uses Wi-Fi connections to connect to the database. Although the code itself. It doesn't tell the network controller to do anything. An internet connection is required to use the app. Otherwise, the cached version will appear and the proper use promised by the Smart home automation team will not be available.

2.4. System Features

AI Based Home Automation is a user-friendly website that provides all the features to its users at a single place with. The App features are as follow:

- An App Alert when a Security is break.
- Contact law enforcement.
- Home appliance management Maintain and prepare an active security system. Monitor and control all sensors.
- Control of additional electrical devices (lights, etc.). remote access.

2.4.1. System Feature 1

The system feature is named as the Top most important feature of our application. I.e., “**Smart Homes Panel**”.

2.4.1.1. Description and Priority

The major stakeholder of our project is the user with a high-level priority rated as 10/10. We’ve the website provides learning resources in PDF and video format zipped in a RAR file. So, we’ve to maintain security and make sure it doesn’t get affected with any type of viruses.

2.4.1.2. Stimulus/Response Sequences

- At first, when the user will come to our App. The App will load the fonts, images with Lazy Load and already store cache files for faster loading. After that the user will go to a specific button using the navigation menu.
- When a user clicks the download button a App file will be accessed and comes for downloading from the server whose link will be pointed to that certain button.

2.4.1.3 Functional Requirements

REQ-SF1-1: Add Menu

REQ-SF1-2: remove Menu

REQ-SF1-3: Change App color

REQ-SF1-4: Add New Bottom

2.5. Other Nonfunctional Requirements

2.5.1. Performance Requirements

Performance of this App is very efficient and responsive immediately.

The speed of the mobile Internet connection and the speed of the connection to the server will affect performance.

The effectiveness of the code affects how quickly the 's instructions are given to the system.

Hardware attached to the system may suffer from a latency factor between the time it takes to execute an instruction and the time it takes to execute the instruction.

2.5.2. Safety Requirements

- Don't leave notes on the door for people or family members.
- Keep garage doors shut.
- Keep your alarms and notification working properly.
- Practice for controlling the whole system.
- Not App use Another network.

2.5.3. Security Requirements

- Security is another design limitation.
- The system must encrypt/decrypt data transmitted between Ip Cam protocol.
- You don't need a Face recognition on the front door.
- Infrared motion sensor. CCTV camera.

2.5.4. Software Quality Attributes

- The App application will be available at both App store.

- The Application will be available using any type of internet connection ● The user interface will be responsive to enhance user experience.
- Stress testing of App is done and it can manage up to 10000+ users at a time.
- The application will run at any device supporting IOS.
- The indexing and crawling of App are managed in robots.txt file to insure auditing of App's performance.

2.5.5. Business Rules

- At the admin side, each user has their level for verification, level will define what kind of stakeholder he is and what kind of functionalities he will perform.
- At the admin side, managing the App roles will be assigned to each stakeholder. For example, if he's a developer he'll have access to the Button and customization menu.
- No stake holder can access the user data or activities except the admin.

2.6. Other Requirements

The requirements that are must to fulfill Appstore approval factors are most important for us and I've listed them as follows:

1. Proper Navigation to the pages.
2. Button should be in the menu.
3. Proper indexing should be done.

Chapter 3

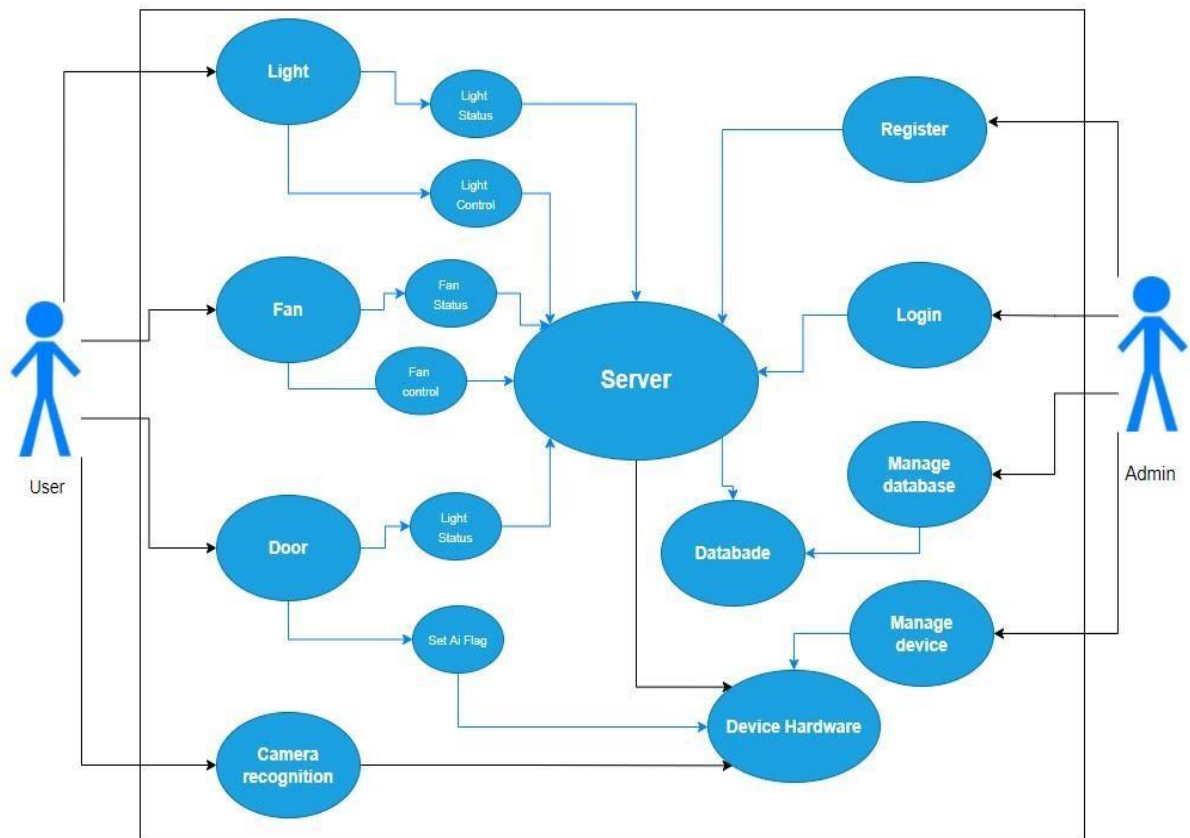
Use Case Analysis

Chapter 3:

System Analysis

This chapter is all about the roles and functionalities of the system and its actors in the use case form. All the primary and secondary actors with respect to their responsibilities. We have made a use case diagram in which we've properly defined each and every functional and nonfunctional requirement according to the respected id or levels. In the use case given below explains the relation between actors and their functionalities.

3.1 Use Case Model



3.2 Fully Dressed Use Cases

| | |
|--------------------|---|
| USE CASE NAME | AI Based Smart Home Solution |
| MADE/CREATED BY | Muhammad Rabeel Hamid Ghufran |
| MADE/CREATION DATE | 4-12-2021 |
| ACTORS | Admin, Users |
| DESCRIPTION | <p>This application is designed and developed to provide users with the best services in controlling home appliances. Users can use the app to access specific categories of their choice. User behavior, analytics, bounce rates, and all other elements are managed in the admin panel.</p> <p>New users download from page of the administrator or developer. This app replaces all other apps that offer home automation services. All of these services are offered to users on a single platform. We have developed a app using an automatic chatbot and the latest UI- standard.</p> |
| DATA | Data is gathered according to the marketing strategy like information of Facebook groups which are related to learning and tech based. User data at the website is also gathered for analytics purposes. |
| PRE-CONDITION | Users should have to visit the App no login no sign-up just a connection to the internet. |

| | |
|-----------------------|--|
| POST-CONDITION | Viewing, controlling. |
| PRIMARY ACTOR | User |
| SECONDARY ACTOR | Admin |
| Use Case Name | Download/Install |
| Priority level | 2 |
| Primary actor | Users |
| Pre-Condition | User just needs to visit the App |
| Post-Condition | He can then download and install the App |
| Main success Scenario | The User just needs to visit our App and can download the App and install the App. |
| Extensions | If he cannot find the App-on-App Store, he/she can contact our customer support and can get help or he/she can use the Chat Bot for his queries. |

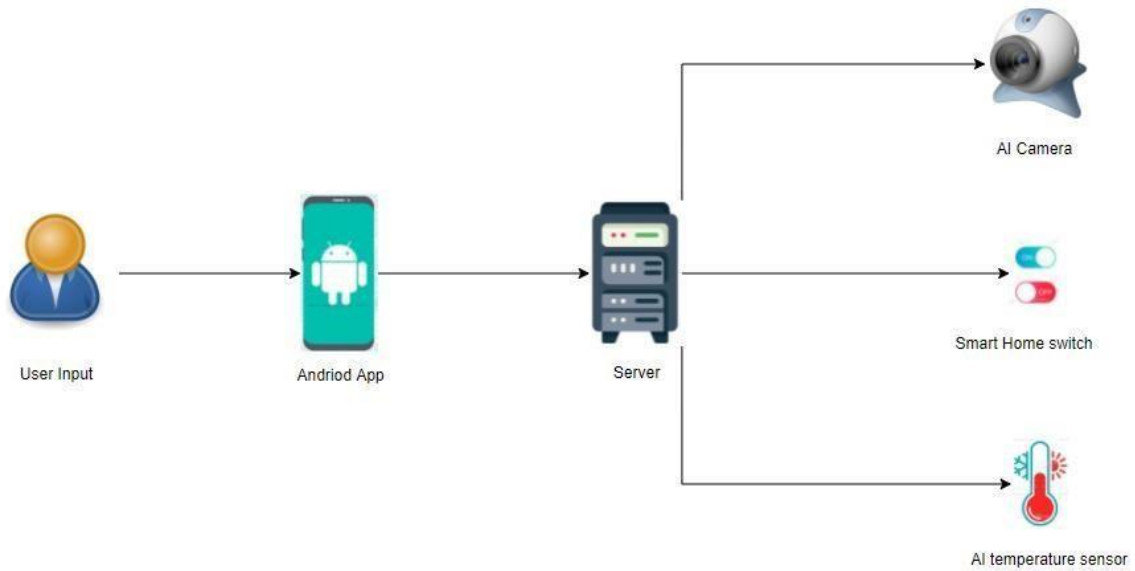
Chapter 4

System Design

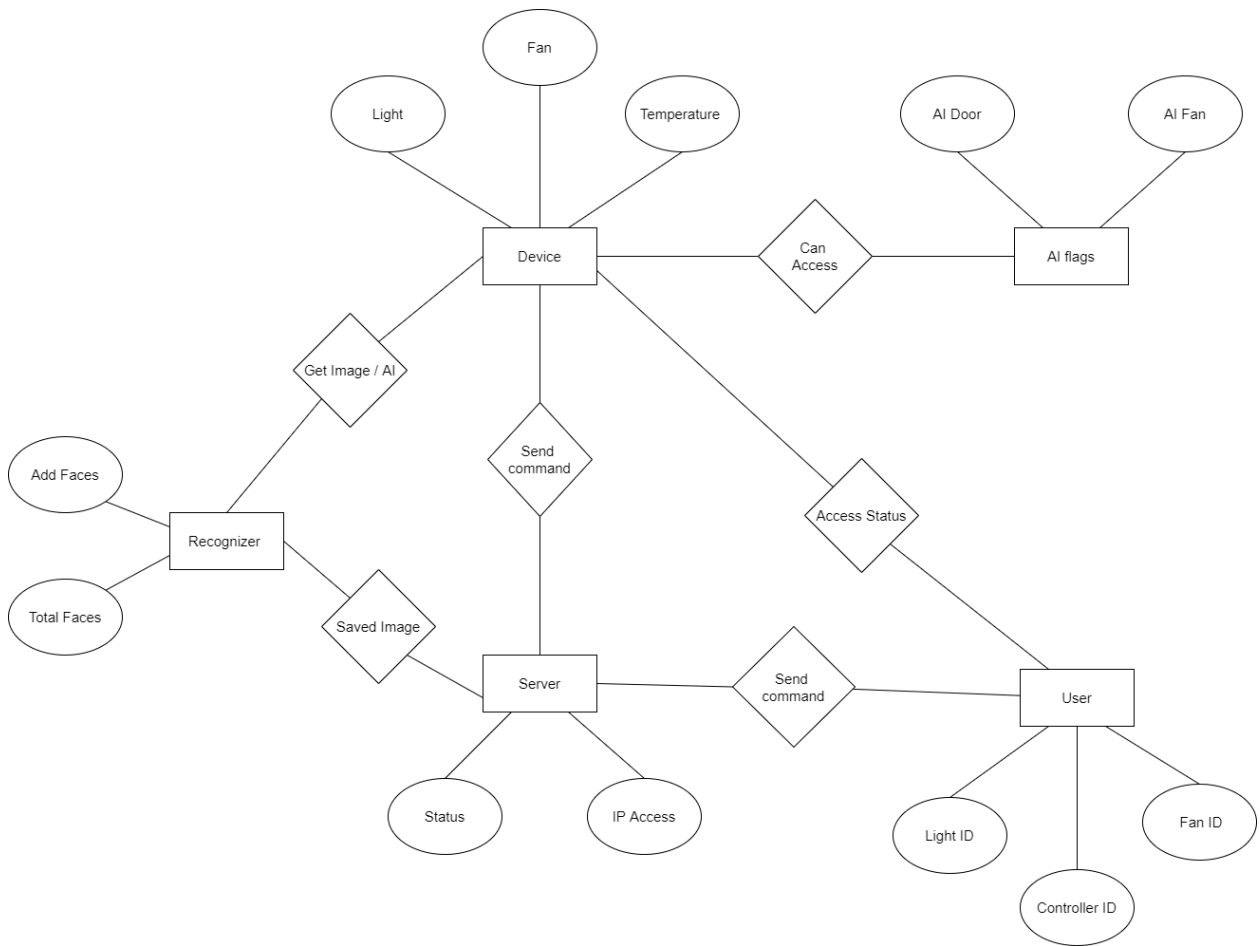
Chapter 4: System Design

In this chapter all the diagrams are given so you can clearly check out the overall working graphically.

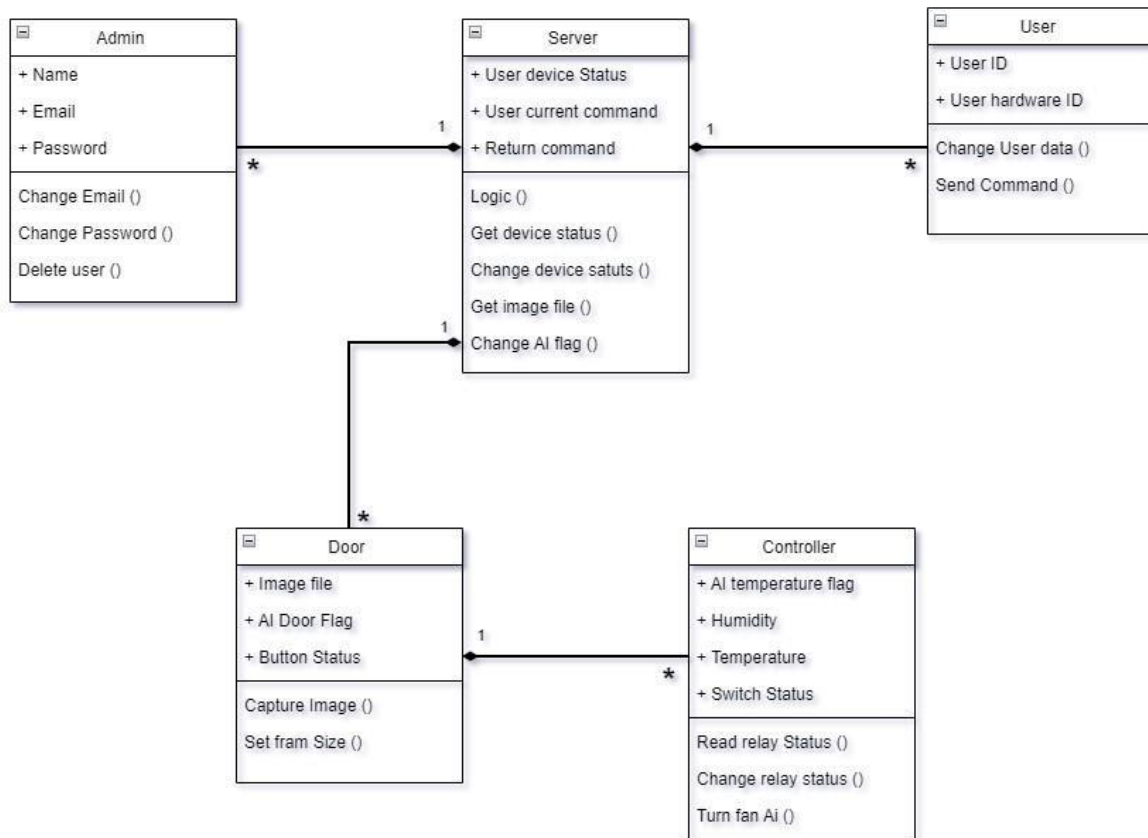
4.1. Architecture Diagram



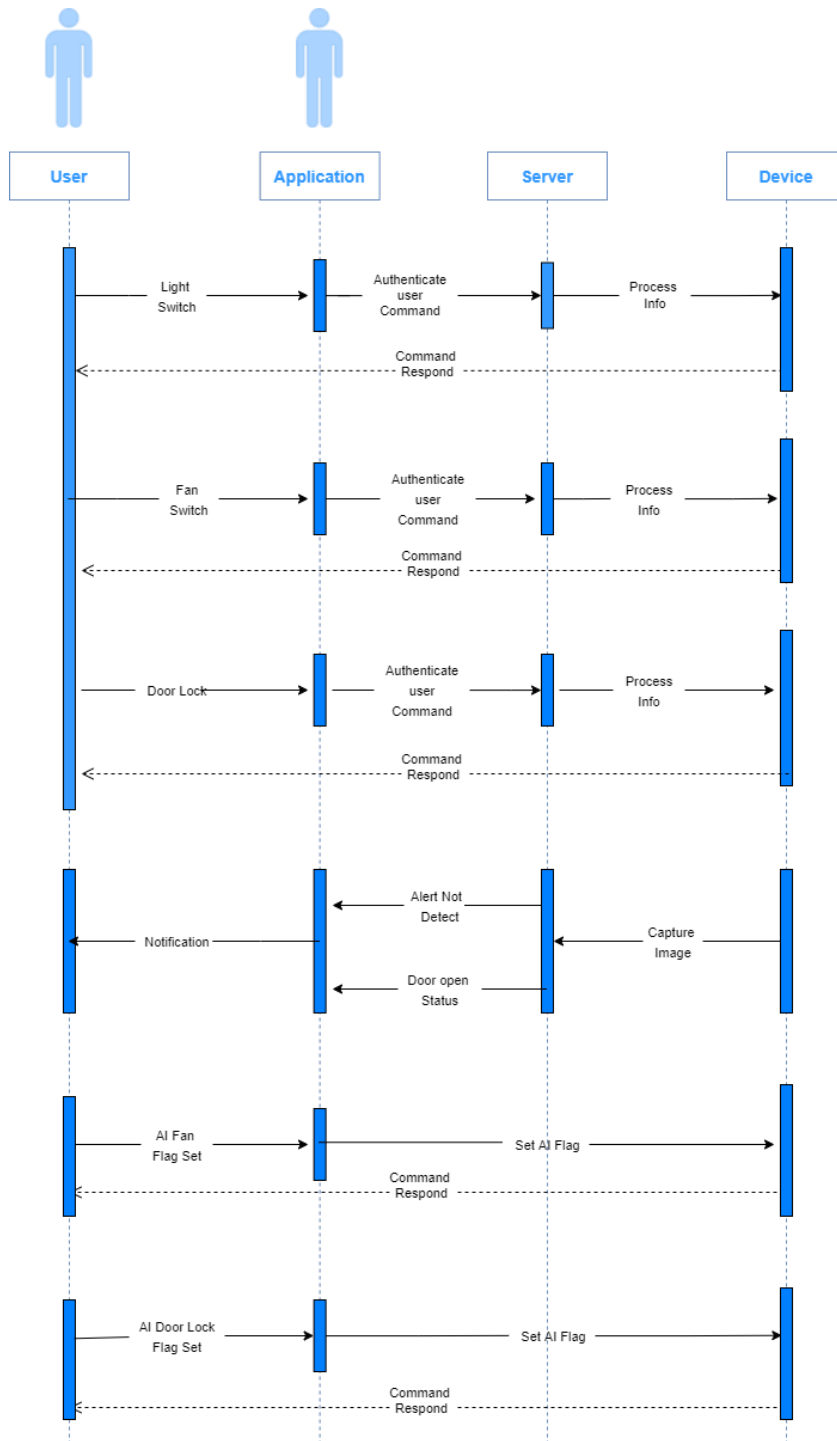
4.2. Entity Relationship Diagram with Data Dictionary



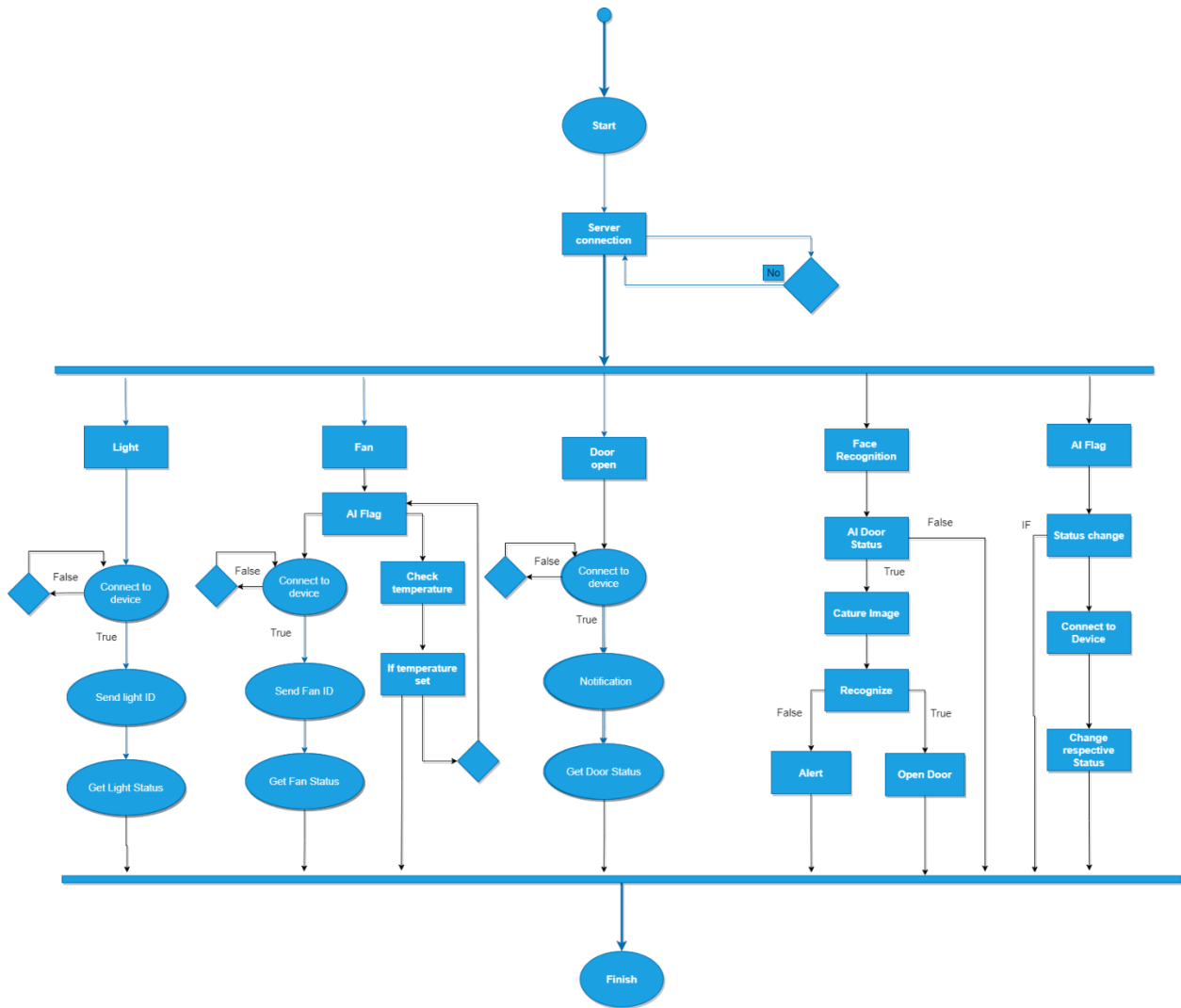
4.3. Class Diagram



4.4. Sequence Diagram

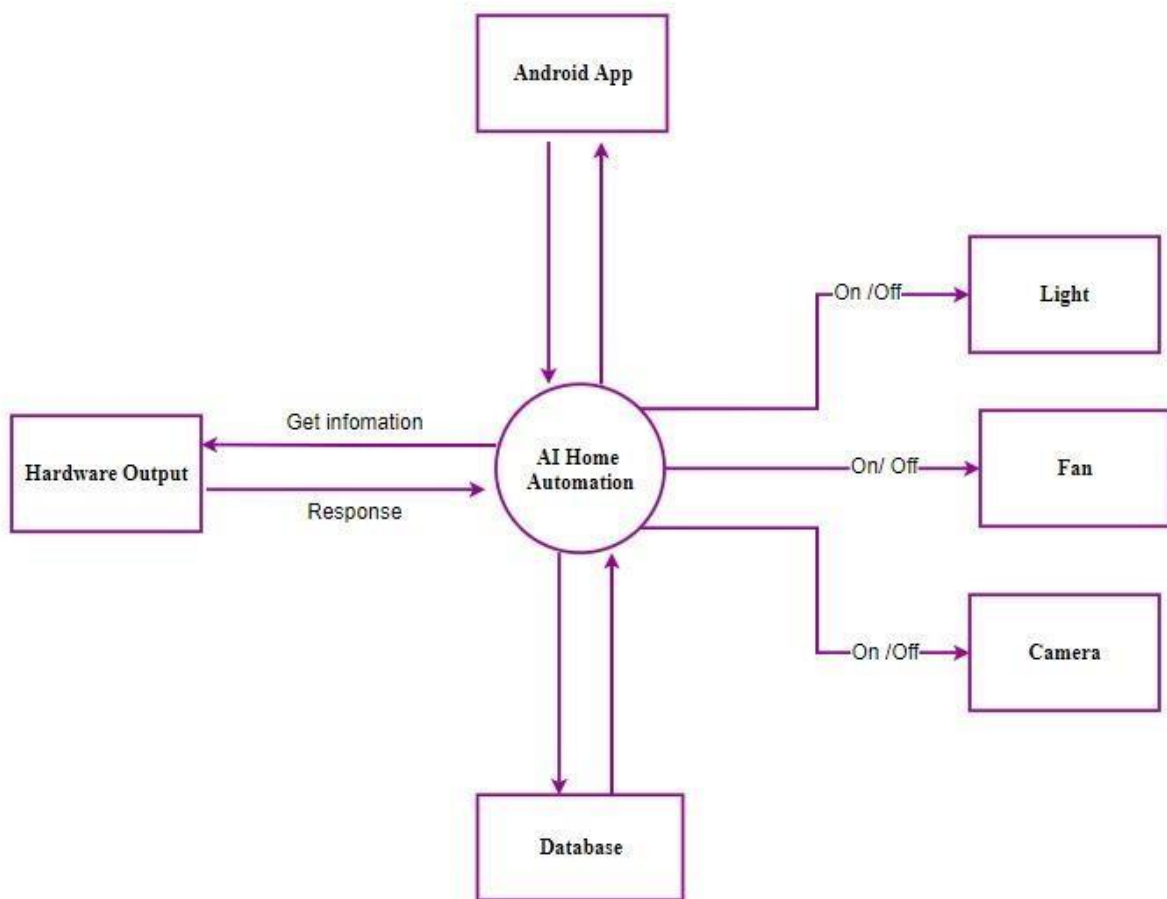


4.5. Activity Diagram

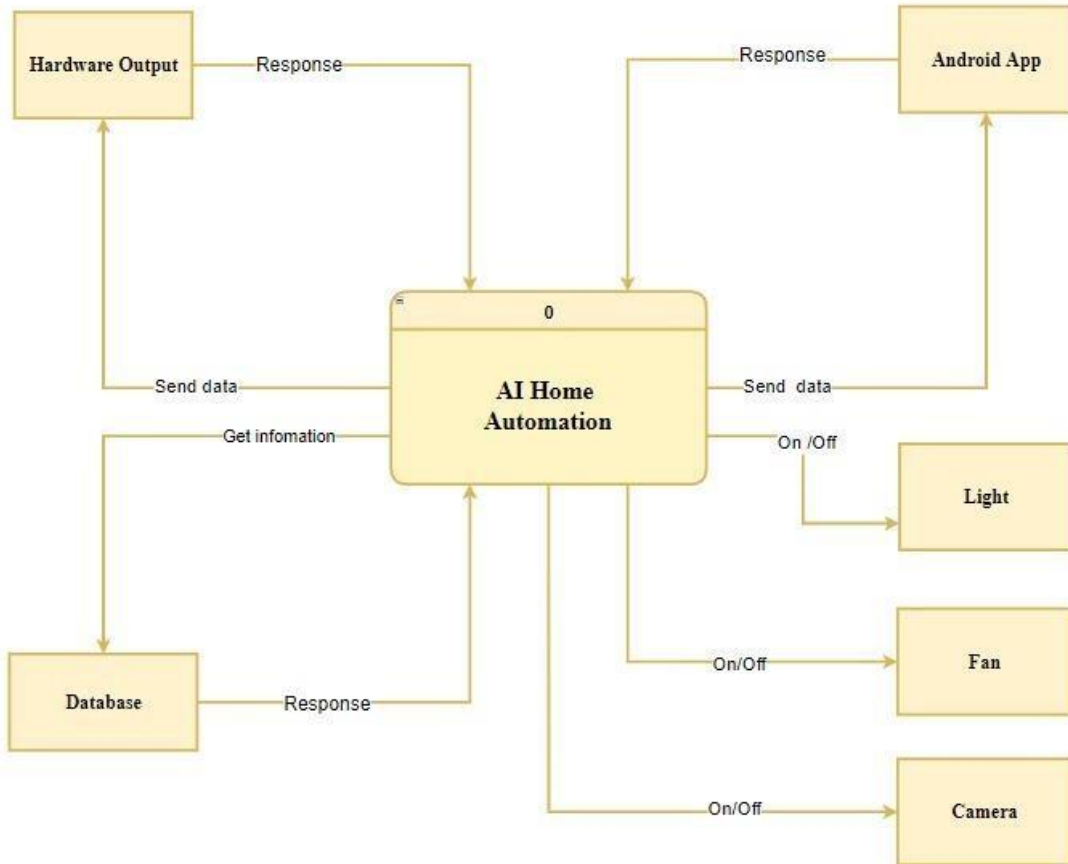


4.6 Data Flow diagram

4.6.1 Level Zero



4.6.2 Level One



Chapter 5

Implementation

Chapter 5: Implementation

This document describes the project implementation for developing our project AI based smart Home Solution and application. The project implements Android, Python, C and other analytical technologies. The project will be capable of running on phones, Tablet and devices.

The hardware part mainly consists of a digital computer, an Wemos , ESP 32 Cam , Temperature and Humidity sensor (DHT11), relay, which are being discussed along with their specific functions.

5.1 Important Flow Control/Pseudo codes

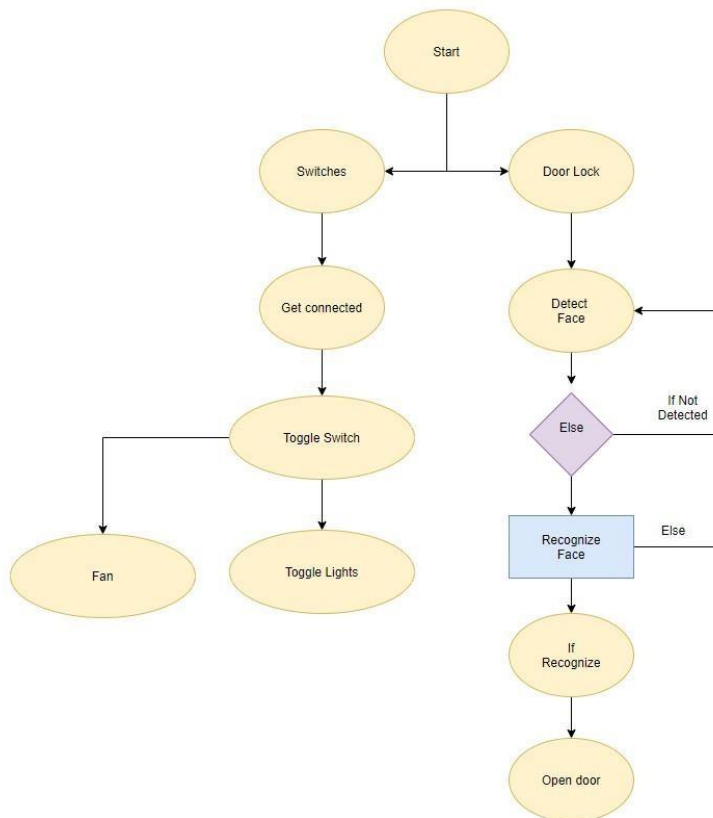


Figure 5.1: System Flow Diagram

5.2. Components, Libraries

In this thesis our main aim is to propose model for home automation system. Proposed system component is shown in Figure 5.1. The home automation system consists of two main hardware components: the computer which runs the Python, Visual Basic, and the Wemos microcontroller board which is flexible, inexpensive, offers a variety of digital and analog inputs, serial interface and digital and PWM outputs. A PC home server hosts the Python-GUI platform management and Wemos controls the home appliances and also enables the user to access them through commands. The App communicates with the Wemos microcontroller board through WIFI. A number of appliances and sensors are connected to ports of the microcontroller board. The home Appliances can be monitored and accessed remotely.

5.3. Deployment Environment

We deployed this project in Windows 10 and We've connected an Open-Source Dashboard for setting up our App theme and we've provided a solution that is both IOS and Android based.

5.4. Tools and Techniques

The tools that are required are Listed below

Development Tools

1. Android Studio
2. Python
3. Notepad
4. C(Database Testing) **Auditing and**

Analytics Tools

5. Arduino
6. Serial monitor
7. Testing Hardware

Front End:

For our App we've used comprehensive languages like Python and C for Little alteration in third party plugins. Mobile Application is based in python & C. Both of them are responsive for every browser, device and operating system. With increasing end user expectations in relation to the quality, expressiveness and performance of web-based applications, we have given more attention to satisfy the customer.

Back End:

For our App We've used Shared hosting with Cloud Share. We've made our database with python that is secured.

For Android Application we are using Google Cloud Computing's Module i.e.

5.5. Best Practices / Coding Standards

- Defined Life Cycle and Milestones
- Stable Requirements and Scope
- Defined Organization, Systems, and Roles
- Quality Assurance
- Planned Commitments
- Scope and mission
- Search Engine Optimization – On-Page
- Search Engine Optimization- Off-Page
- Ad-Placement
- Structure Data Setup

5.6. Version Control

We have this complete documentation that completely represents all the factors that are related to our project. In addition, we've used technical pages in our application we've developed consists of web links to them too. That will consist of all the privacy policies, queries and about us pages. A video with complete functionality usage of application is also uploaded at YouTube for a naïve user. The name of our document that we are currently writing is **Project Report Documentation**.

Chapter 6

Testing and Evaluation

Chapter 6: Testing and Evaluation

This chapter is about understanding the testing of our project with respect to the use cases we've developed as well as the stress testing of our prototype. This chapter helps us to understand the capability of the system to handle users and the navigation that helps the user to reach at specific point.

6.1. Use Case Testing

Login Test Case for Admin # 1

| | |
|-----------------------------|---|
| Test Suit ID | 001 |
| Actor | Admin |
| Test Case ID | Admin_Login01 |
| Test Case Summary | If registration is already done login to the system |
| Related Requirements | Admin must register first |
| Pre- Requisites | Visit App login page Internet connection is must Registration must be done |
| Test Procedures | Visit the App Add admin after the App to move to login page Enter credentials Click login button |
| Test Data | Username: SpaceX Password: Qwerty12345 |

| | |
|-------------------------|---|
| Expected Results | After successful login dashboard should be appeared |
| Status | Pass |

Login Test Case for Admin # 2

| | |
|-----------------------------|---|
| Test Suit ID | 001 |
| Actor | Admin |
| Test Case ID | Admin_Login02 |
| Test Case Summary | Trying to login with wrong credentials |
| Related Requirements | He must be first login into the system |
| Pre- Requisites | Visit App login page Internet connection is must Registration must be done |
| Test Procedures | Visit the App Add admin after the website to move to login page Enter credentials Click login button |
| Test Data | Username: SpaceX Password: Qwerty12345 |

| | |
|-------------------------|--|
| Expected Results | A dialogue box will appear which will tell the credentials are wrong |
| Status | Pass |

Register Test Case for Admin # 1

| | |
|-----------------------------|---|
| Test Suit ID | 001 |
| Actor | Admin |
| Test Case ID | Admin_Register01 |
| Test Case Summary | Should register by providing correct credentials |
| Related Requirements | Admin will be able to login into the system after correctly providing the details |
| Pre- Requisites | Visit App login page Internet connection is must Registration must be done |

| | |
|-------------------------|--|
| Test Procedures | Visit the App Add admin after the website to move to login page Enter credentials Previous admin can make another admin if someone wants the rights Make admin in the dashboard setting panel Take valid credentials from the 2 nd admin Done Then he can login into the dashboard |
| Test Data | Username: SpaceX Password: Qwerty12345 |
| Expected Results | The new admin must be able to login into the App dashboard after successful registration |
| Status | Pass |

6.2. Equivalence partitioning

Equivalence class partitioning is a software or application Testing technique in which input data of a software unit divides into partitions of equivalent data. These test cases are designed to cover each and every portion at least once.

Derived Equivalence Classes

- Email with @ and .com. (Valid)
- Email without @ or .com. (Invalid)
- Password should be more than 5 characters. (Valid)

| Serial Number | Test Data | Results |
|---------------|--|---------|
| 1 | Muhammadrabeel@gmail.com | Valid |

| | | |
|---|------------------|---------|
| 2 | Muhammadrabeel@% | Invalid |
| 3 | 11225544887755 | Valid |

6.3. Boundary value analysis

Boundary Value Analysis is another Black Box Test Design Technique, which is utilized to discover the mistakes at limits of information area instead of discovering those blunders in the focal point of info.

| Serial Number | Test Data | Results |
|---------------|-----------|---|
| 1 | 1212 | It will not be accepted as it is less than 5 characters |
| 2 | 136251482 | It will be accepted as it is greater than 5 characters |

6.4. Data flow testing

Data Flow testing is a group of test techniques dependent on choosing ways through the program's control stream to investigate groupings of occasions identified with the situation with factors or information objects. Dataflow Testing centers around the focuses at which factors get values and the focuses at which these qualities are utilized.

In Data Flow Testing we will monitor the accompanying things:

- Behavior of App based on user input
- Reaction of App in the happening that it crashes
- App status under thorough testing and stress
- User input.

6.5. Unit testing

The tools which we've used for unit testing have their own specifications and specialized search for ambiguity and code. Let me list down some tools that we've used for unit testing of our prototype.

1. Local unit tests (For Java testing of our App)

2. Instrument testing (Php Testing our databases)

Local unit tests

Located at ***module-name***/src/test/java/.

These are tests that run on your machine's local Java Virtual Machine (JVM). Use these tests to minimize execution time when your tests have no Android framework dependencies or when you can mock the Android framework dependencies.

At runtime, these tests are executed against a modified version of android.jar where all final modifiers have been stripped off. This lets you use popular mocking libraries, like Mockito.

Instrumented tests

Located at ***module-name***/src/android Test/java/.

These are tests that run on a hardware device or emulator. These tests have access to Instrumentation APIs, give you access to information such as the Context of the app you are testing, and let you control the app under test from your test code. Use these tests when writing integration and functional UI tests to automate user interaction, or when your tests have Android dependencies that mock objects cannot satisfy. Because instrumented tests are built into an APK (separate from your app APK), they must have their own AndroidManifest.xml file. However, Gradle automatically generates this file during the build so it is not visible in your project source set. You can add your own manifest file if necessary, such as to specify a different value for `minSdkVersion` or register run listeners just for your tests. When building your app, Gradle merges multiple manifest files into one manifest.

6.6. Integration testing

| Test ID | Test Case Description | Procedures | Expected Results | Actual Results |
|---------|--|--|--|----------------------|
| 1 | When admin click login button, he should be login into the App | Provide username and password | If credentials are correct show the dashboard | Login successful |
| 2 | When user clicks the download | Only visit the App with active internet connection | If download, App must be downloaded. | Download successful. |
| 3 | Crude operations on courses by admin like Add, Delete, Update, | Provide username and password to enter into the dashboard. | Crude operations must be performed successfully. | Successful. |

6.7. Performance testing

For Performance testing we've used tools which tells about the server side and speed indexes of our prototype. Most common and easy to use tool for this is serial monitor. I've attached the screenshot of that online available tool that tests our prototype.

6.8. Stress Testing

While doing stress testing our App performed great even when our App is getting high number of users that is 1k users.

With the help of this testing, we observed our App vitals and ensured our App is working great in stress kind of situations. This performance is high because of the Apk we are using.

Chapter 7

Summary, Conclusion and Future Enhancements

Chapter 7: Summary, Conclusion & Future Enhancements

7.1 Project Summary

The work of this project is cost-effective for individually controllable home automation systems to control a wide range of appliances, from locally available components to security lights to TVs, air conditioners and even. It shows that it can be manufactured by the method. You can use the lighting system for the entire house. Further advantages: The required components are very small and few in number, so they can be packed in small, unobtrusive containers. The developed home automation system has been tested and certified several times to control various home appliances used in lighting systems, air conditioners, home entertainment systems and more. Therefore, this system is scalable and flexible.

7.2 Achievements and Improvements

The experimental model was made according to the circuit diagram and the results were as expected. The home appliances could be remotely switched over App. Both the switch mode and the voice mode control methodologies were successfully achieved. The Blynk application was also successful in displaying the status of every application.

Lessons Learnt

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. There hence lies an ambiguity in result.

7.3. Critical review

The critical review is collected by our users and different tech head referred to us by Innovation CAXTEK Trainings in which we are doing this project.

User perspective: According to the user App is fine the most common review we got is to provide more relative button according to the user need.

Tech Head Perspective: According to the industry tech head we got the review of calling our Apk directly from the base instead of using a third party like Android studio. It will load our content faster as compared to the traditional structure we are following.

7.4 Lesson learnt

The most important lesson that we learnt by doing this project is to stick to one tech stack instead of going with multiple and approach should be followed by doing proper user research because the user satisfaction is what we want at the end.

7.5 Future Enhancements/Recommendations

Given the current situation, you can create a cross-platform system that can be deployed on a variety of platforms such as iOS and Windows. The limitation of controlling only multiple devices can be removed by extending the AI automation of all other home devices. The prototype may include sensors that implement automatic control for consumer electronics, such as: With an LDR that can detect sunlight and switch lamps accordingly, a PIR used for security purposes to detect movement and generate alarms, or a DHT11 sensor that detects ambient temperature and humidity in the atmosphere. Fan / Air Conditioning Switch accordingly. The scope of this project can be extended to many areas by limiting it to small offices, not just at home.

Appendices

Appendix A: User Manual

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[Between 4 to 8 lines describe what is this appendix all about]

Appendix A: Appendix Title

[Appendix Heading 1]: [20 pt, Calibri, Bold, Left aligned]

Text in 12-Point Size, Times New Roman, 1.5 Line Spacing.

A.1. First Level heading [16 pt, Calibri, Bold, Left aligned]

[Paragraph Text 12 pt, Calibri, 1.5 Line Spacing, Justified]

A.1.1. Second level heading [14 pt, Calibri, Bold, Left aligned]

[Paragraph Text 12 pt, Calibri, 1.5 Line Spacing, Justified]

A.1.1.1. Third level heading [12 pt, Calibri, Bold, Left aligned] [Paragraph Text

12 pt, Calibri, 1.5 Line Spacing, Justified]

Appendix B: Administrator Manual

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B.1. First Level heading [16 pt, Calibri, Bold, Left aligned]

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B.1.1. Second level heading [14 pt, Calibri, Bold, Left aligned]

[Paragraph Text 12 pt, Calibri, 1.5 Line Spacing, Justified]

B.1.1.1. Third level heading [12 pt, Calibri, Bold, Left aligned]

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Appendices

Appendix C: Information / Promotional Material

This appendix tells about all the promotional material that helps us to understand the things we used in marketing of our prototype as well the presentation or exhibition.

C.1. Broacher C.2. Flyer C.3. Standee C.4. Banner C.5. First Level heading

AI based Smart home Solution

C.1.1. Second level heading

Get Every Learning Resource for Free

C.1.1.1. Third level heading

If you want to learn for free and you want to publish your course as well. You can do all that at a single platform.

Reference and Bibliography

7

Reference and Bibliography

- [1] “Smart Energy Efficient Home Automation System using AI”, by Satyendra K. Vishwakarma, Prashant Upadhyaya, Babita Kumari, Arun Kumar Mishra.
- [2] “IOT Based Smart Security and Home Automation”, by Shardha Somani, Parikshit Solunke, Shaunak Oke, Parth Medhi, Prof. P. P. Laturkar.
- [3] “A Dynamic Distributed Energy Management Algorithm of Home Sensor Network for Home Automation System”, by Tui-Yi Yang, Chu-Sing Yang, Tien-Wen Sung; in 2016 Third International Conference on Computing Measurement Control and Sensor Network.
- [4] “Enhance Smart Home Automation System based on Internet of Things”, by Tushar Churasia and Prashant Kumar Jain; in Proceedings of the Third International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2019) IEEE Xplore Part Number: CFP19OSVART; ISBN:978-1-7281-4365-1
- [5] “Visual Machine Intelligence for Home Automation”, by Suraj, Ish Kool, Dharmendra Kumar, Shovan Barman.
- [6] “A Low Cost Home Automation System Using Wi-Fi based Wireless Sensor Network Incorporating”, by Vikram.N, Harish.K.S, Nihaal.M.S, Raksha Umesh, Shetty Aashik Ashok Kumar; in 2017 IEEE 7th International Advance Computing Conference.

Reference and Links

1. https://smartinnovations.pk/?gclid=EAlaIQobChMIhYipt_XT9AIVNI9oCR2q1AerEAAAYAiAAEgLS1vD_BwE
2. <https://concord-technologies.com/Smart-Home-Automation.html>
3. <https://internetofthingsagenda.techtarget.com/definition/smart-home-or-building>

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[A]

[B]

[C]