SMART HOME SYSTEM

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SMART HOME SYSTEM

BRAW ARAZ MOHAMMED

A thesis submitted in fulfilment of the
requirements for the award of the degree of
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DEDICATION

I want to thank everyone involved in this initiative. I'd like to thank my Supervisor (Mr.Ako Abubakr) who helped me learn a lot about this project. His ideas and comments aided in the completion of this project. I am grateful to the college administration for providing me with such a significant chance. I believe I will participate in more such activities in the future. I guarantee that this project was created entirely by me and is not a forgery. Finally, I'd like to express my gratitude to my parents and friends for their excellent comments and guidance during the completion of this project.

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ABSTRACT

The smart home industry is experiencing rapid growth and is poised to transform the way people live. With its cutting-edge technologies and innovative solutions, smart homes have the potential to revolutionize residential living on a large scale. These sophisticated home automation platforms offer a myriad of features and functionalities, catering to the needs and preferences of individuals seeking a luxurious and technologically advanced lifestyle. At the heart of a typical wireless home automation system lies a centralized control unit, which serves as the nerve center for managing and controlling various household appliances and devices. This wireless connectivity empowers users with the freedom to remotely control and monitor their homes, effortlessly managing lighting, temperature, security systems, entertainment devices, and more from a single, user-friendly interface. The elimination of cumbersome and complex wiring installations not only simplifies the setup process but also allows for greater flexibility in terms of device placement and integration.
However, the seamless operation of a home automation system relies heavily on compatibility. To ensure optimal functionality and interoperability, appliances within the smart home ecosystem must be designed to be compatible with each other and with the central control unit. This compatibility enables seamless communication and coordination between devices, creating a cohesive and unified smart home experience for users. The proliferation of commercially available home automation systems has brought about a diverse range of options for homeowners. From off-the-shelf solutions to customizable platforms, there is a solution to suit various needs and budgets. The continuous advancement of technology and the increasing adoption of open standards are driving the industry forward, resulting in greater interconnectivity and interoperability between devices from different manufacturers. As the smart home industry continues to evolve, its potential for transforming daily life is becoming increasingly evident. Smart homes not only enhance convenience and comfort but also contribute to energy efficiency, sustainability, and security. With the ability to automate routine tasks, adapt to user preferences, smart homes offer a truly personalized and intelligent living environment. In conclusion, the smart home industry is undergoing a significant transformation, offering a range of sophisticated home automation solutions that have the power to reshape the way we live. With the advent of wireless technologies, centralized control units, and enhanced compatibility, smart homes are poised to deliver unparalleled convenience, efficiency, and quality of life for homeowners around the world.

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LIST OF ABBREVIATIONS

ESP32	-	Espressif 32
HNS	-	Home Network System
IoT	-	Internet of Things
SHS	-	Smart Home System
WHAS	-	Wireless Home Automation System

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CHAPTER 1

INTRODUCTION

1.1 Problem Background

Technologies that help to live a quality life and to be more self-sufficient in everyday life are being developed. One of the fields of this development and innovation of modern technologies is Smart Home to ensure independent. The home network system (HNS) is a core technology of the next- generation smart house, achieving value-added services by networking various household appliances. Introduction for demography of the world population shows a trend that the population worldwide is increasing rapidly as a result of the increase of the average life expectancy of people. Caring for and supporting this growing population is a concern for governments and nations around the globe. Home automation is one of the major growing industries that can change the way people live. The aim of the reported Wireless Home Automation System (WHAS) is to provide those with special needs with a system that can control the on/off status of electrical devices, such as lamps, fans, television etc. The system should be reasonably cheap, easy to configure, and easy to run. There have been several commercial and research projects on smart homes.

When considering smart thermostats, motion-activated lighting, and automated heating and ventilation systems, the concept of home automation, also known as smart home systems or demotics, comes to mind. It involves utilizing a range of devices to automatically regulate fundamental home features and operations, often from a distance. Building automation could be defined as follows: an automation system that controls all major system requirements for one or more facilities in a thorough and coordinated manner. [1]

1.2 Problem Background

Smart home technology provides homeowners security, comfort, and convenience by allowing them to control smart devices, often by a smart home app on their smartphone or other networked device. Smart home system SHS is a term that is commonly used to refer to homes where the appliances, light, door, fan etc. are capable of communicating with each other and can be controlled only remotely according to a predefined schedule or via some kind of interface.

The smartest home application is ruling based application where they work based on pre-defined rules by the users. In this project voice command and modes has been added, the user can change the house mode with only one command and by using voice.

1.3 Project Aim

The aim of this project is to develop an efficient and user-friendly smart home system that stands out from conventional setups. By utilizing ESP as the core hardware and C++ as the programming language, we will create a unique smart home design and prototype. The key focus of this project is to integrate advanced functionality into the smart home system. Through intelligent algorithms, we aim to enable the smart devices to respond to voice command and activate more than one device at a time. This approach will enhance the overall user experience and make the smart home more intuitive and responsive. Our goal is to provide homeowners with a seamless and enjoyable smart home experience. By utilizing ESP and C++, we can develop a robust and customizable system that meets individual needs and preferences. The system will allow users to control and manage their smart devices effortlessly, adding convenience and comfort to their daily lives. In summary, this project aims to create an innovative smart home system that goes beyond traditional setups. By leveraging ESP, C++, and advanced functionality, we strive to develop an efficient and user-friendly prototype that brings automation and convenience to the forefront of residential living.

1.4 Research Objectives

I. To investigate and study current home system and smart home system.
II. To build a smart home prototype using ESP.
III. To test the developed smart home based on user acceptance test.
IV. To build a smart home that can respond to voice command.

1.5 Scope

The scope of this project is to design and implement a smart controller compatible with IoT technology and standards to control home devices remotely such as (light system, Door, and windows, etc.), connect the controller with smartphone. This smart controller enables users to DIY it with devices they want, the user can connect the smart Controller with anything at home. To construct the system, ESP will be utilized, along with the Python programming language for device programming. The IFTTT system will be employed to enable manual control of the smart devices via the user's phone.

1.6 Project Importance

There are many problems with non-smart homes, for example it’s terrible to get home and wait to the room to get warm or see that you forgot to turn off the AC and you have to pay extra bills for extra energy. The core purpose of designing the smart home is to save energy and create automation so that you can control devices when you want where you want. Smart homes are energy-sufficient, safe, and modern standards. In a smart home, you can do a lot of things while relaxing on the couch, including turning on the TV, locking the door, adjusting the temperature, turning on and off the lights, and much more. It helps user in every situation.

1.7 Report Organization

At the end this project Smart home system there will be a prototype design that include some smart device that will be controlled with a phone or they will work on a schedule based on user performance. User can use their smart devices online or they can let it work on itself. At the end of this project consists of five chapters:

1. Chapter 1: stands for Introduction, problem background, objective, aim, scope, and the project importance. In this chapter the overview of the project will be discussed.

2. Chapter 2: will be the literature review and comparison between existing system and this system and to the ones without system, and also disadvantage and advantage of the system.

3. Chapter 3 will be the system development methodology, in this chapter methodology type of the approach to the system development will be discussed and how the system will be developed phase by phase and how it will be implemented, so that the project can be managed well and efficiently.

4. Chapter 4 will be System analysis and development. Requirement Analysis and Design the Requirement Analysis is going to be discussed

5. Chapter 5 will be the conclusion of the project and will cover both development and testing, as well as testing and coding part.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter Literature review will be implemented as a report, in the Inter-organization Case Study part gathering requirements to understand low and source of problems will be gathered. Purpose of this literature review is to study, evaluate and compare existing System. System for smart houses traditional house (non-smart house). Besides, a study will be conducted on available systems on the market that have similarity in terms of features.

Then, focusing on problems that they are facing in the existing System. This can be considered as a crucial aspect that needs to be pointed out before the development process. All results will be used by the developer as information in fulfilling the requirement.

2.2 Inter-Organization Case Study

Based on the survey that was made to user of traditional homes and current smart homes, answers too many question that were supposed to be asked were collected through them. Based on the survey majority of people are uncomfortable with non-smart homes and find it hard to live like that. Some individuals in Kurdistan were previously unaware of the presence of such a concept. However, after providing them with some hints about it, they showed genuine interest and expressed a desire to learn more. Based on the survey we conducted, the main problem they encountered was:

They find it hard to save energy, they think that they waste too much energy and use the devices a lot because their no automation in the house. Another problem they had was that they forget to turn off the device or lock the door when they leave their home. And another problem was security of the house when something like gas lick or fire happens their nothing to warn them

The smart house user also had their own question to answer and base on their answer they sound more comfortable than the non-smart home user but they had their own problem as well, they were asking for a smarter house not only controlling the devices After being provided with hints about the potential capabilities of their smart home. That they can control their devices with voice command and they can add any mode to their house like cinema mode, dinner mode any many more they got interested. Based on the survey majority the problem of smart home users was they thought that only controlling the device is not enough and more features must be added for their smart houses.

2.3 Internet of things (IoT)

The Internet of Things (IoT) is a rapidly growing and pervasive technology that is bringing numerous benefits to our daily lives. With the IoT, everyday objects can be connected to the internet, enabling new and innovative applications that enhance our quality of life. By linking items through the IoT, people can experience a greater level of convenience and efficiency. For example, imagine being able to remotely control your home's temperature, lighting, and security systems through a smartphone app. With the IoT, this level of control and automation is becoming increasingly accessible and user- friendly. Not only does the IoT offer convenience, but it also has the potential to improve various aspects of our lives. For instance, wearable devices connected to the IoT can help individuals monitor their health and fitness goals, providing real-time feedback and motivation. Connected healthcare devices can enable remote patient monitoring, allowing for more personalized and efficient medical care. The IoT also contributes to resource efficiency and sustainability. By integrating smart energy management systems, we can optimize

energy consumption, reduce waste, and lower utility costs. In agriculture, IoT solutions can monitor soil moisture levels and weather conditions, enabling farmers to make informed decisions about irrigation and crop management, leading to improved yield and reduced environmental impact.

As the IoT continues to evolve, new applications and opportunities will arise, enhancing our everyday experiences and enabling us to live smarter and more connected lives. However, it is important to address the challenges associated with data privacy and security to ensure that individuals' information is protected and the IoT remains a trusted and reliable technology. A typical Internet of Things system operates by collecting and exchanging data in real-time. There are three parts to an IoT system:

2.3.1 Smart Devices

This is a piece of equipment that contains computer capabilities, similar to those seen in televisions, security cameras, and exercise machines. It gathers data from its surroundings, user inputs, or use patterns and transmits it to and through its IoT application via the internet.

2.3.2 IoT application

IoT applications are transforming various aspects of our lives, enabling us to connect and control everyday objects through the internet. From smart homes and wearable devices to industrial automation and healthcare monitoring, the IoT offers convenience, efficiency, and improved experiences. By leveraging data and connectivity, IoT applications enhance our quality of life, optimize resource management, and drive innovation across industries. As the IoT continues to evolve, it holds the potential to revolutionize how we live, work, and interact with the world around us.

2.3.3 An interface with graphics

With a user-friendly graphical interface, individuals can effortlessly register and manage their IoT devices, whether it's a smartphone app or a dedicated website. This streamlines the process and empowers users to have complete control over their connected smart devices and their functionalities. [3]

2.4 IoT Software

IoT software includes a broad variety of applications and programming languages, ranging from general-purpose languages like C++ and Java to options tailored for embedded systems like Google's Go or Parasail.

2.4.1 C++

The C programming language was first used to program telephone switches, although its origins are in embedded systems. It may be used practically everywhere and is well known among programmers, making it rather pervasive. The object-oriented variant of the C programming language, which is a favorite of the Linux operating system and the raspberry pi embedded IoT software systems, is C++. These languages are very simple to use since they were essentially created for hardware devices.

2.4.2 Java

The code in JAVA is more portable compared to C and C++, which are hardware-specific. It is more akin to a language where you install libraries, spend time creating programs just once, and you are ready to go.

2.4.3 Python

Due to a recent increase in users, it is currently considered one of the "go-to" languages for Web development. Its application, particularly with the Raspberry Pi CPU, is steadily expanding to the embedded control and IoT sector. As an interpreted language, Python is simple to understand, simple to learn, and simple to write. It's also a powerhouse for providing apps with plenty of data.[4]

2.4.4 Data Collection

It is done for data protection, data filtering, data sensing, and data measuring. The protocols use real- time object sensing to assist in decision-making. Both data distribution to devices and data collection from devices are possible. To a central server, all the data is sent.

2.4.5 Device Integration

With the help of this software, devices are connected to networks in a way that makes exchanging information easier. Multiple gadgets work together and communicate well.

2.4.6 Real-Time Analytics

In this, user input is used as prospective data for doing real-time analysis, drawing conclusions, and offering suggestions to address issues and enhance a company's strategy. As a consequence, automation is possible, and productivity is raised.

2.4.7 IFTTT System

By connecting popular applications, the free online service and mobile app IFTTT enables users to automate web-based activities and increase productivity. IFTTT, which pays tribute to the programming conditional statement, stands for "If This Then That." Users may specify task automations using formulae referred to as "recipes," so that when something occurs in one app, the event initiates an action in another app.

2.4.8 Google Assistance

Google Assistant is a powerful virtual assistant developed by Google. It uses natural language processing and machine learning to provide users with a wide range of services and functions. From answering questions and performing tasks to controlling smart devices and providing personalized recommendations, Google Assistant serves as a convenient and intelligent voice-activated companion. With its integration across various devices and platforms, users can easily access and interact with Google Assistant to streamline their daily routines and enhance their overall productivity and convenience.

2.5 IoT Device

IoT systems' hardware consists of servers, a routing or bridge device, sensors, devices for a remote dashboard, control devices, and devices. In order to support certain objectives and activities, these devices control crucial jobs and operations such system activation, action specifications, security, communication, and detection.

2.5.1 IoT – Sensors

The IoT's sensors may be the most crucial piece of hardware. RF modules, sensor modules, energy modules, and power management modules make up these gadgets. Through signal processing, Wi-Fi, ZigBee, Bluetooth, radio transceiver, and duplexer, RF modules control communications. The following is a list of some of the IoT measuring tools [5]:

Table 2.1 IoT Measuring Tools

devices	
accelerometers	temperature sensors
magnetometers	proximity sensors
pressure sensors	gas RFID sensors
acoustic sensors	light sensors
humidity sensors	micro flow sensors

2.5.2 IOT Gateways

Industrial IoT Gateways are devices that operate as a gateway for the flow of data by collecting data from equipment, processing that data, and transmitting it between a local network and the cloud.

2.6 Smart Home

Traditionally, homes, apartments, commercial spaces, and buildings used for a variety of purposes have separate electrical devices and systems that must all be handled separately and operate independently of one another. Typically, it’s unable to open doors with the TV remote or change the radio station with wall switches in our homes. This is due to the fact that each system operates independently and does not interact with the others.

An organized home automation system links all the electrical components of a "smart house" to control lighting, heating, air conditioning, ventilation, security (burglar) alarm systems, audio and video systems, call devices, energy control equipment's, presence, automation (door, windows, gates), and technical alarms (for instance, in case of unintentional water spillage) etc.

As a result, a smart home is created by integrating various home installation components, such as lighting, heating, cooling, blinds, sensors, etc., into a single system. With this type of automation, there is less need for human interaction, which increases comfort and safety, opens up new opportunities, and boosts energy efficiency.

It is essential to recognize that both the electrical system and the house itself are not inherently intelligent. They lack the capability to self-program or learn autonomously. Consequently, they are unable to identify and rectify mistakes unless equipped with an artificial intelligence system. Intelligent apparatus! However, in terms of marketing, "smart home systems" or "smart houses" The words "concerned" are widely used and can be found in all media. Secondly, reducing our carbon footprint can be achieved by enhancing energy efficiency, which involves consuming less electricity. [1]

2.6.1 Function That Can Be Done with Smart Home

Lighting is an essential and widely utilized electrical component within a household. Our daily routines often require us to spend a significant portion of our evenings at home, necessitating the use of artificial lighting to compensate for the absence of natural light during that time.

Heating: Heating is a subsystem that is constantly present in a home. Some users might reside in a building with radiator-based central heating. In this situation, thermostatic valves can be installed, connected to a smart home system, and controlled individually by setting different temperatures in each room. Some people might reside

in a villa or a townhouse. In this scenario, you can install additional zone valves with actuators connected to the smart home system, as well as an underfloor heating system with a hydraulic manifold.

Anti-burglary system: Most manufacturers of smart home systems offer antitheft devices, ranging from the most basic (just presence sensors and a siren) to the most advanced (connection with the police or with a security service in case the anti-theft system fires).

Alarm clock and room control: if you want to be sure to wake up at the right moment, for sure you will use an alarm clock.

Automation: You can program the remote control or smartphone to open the garage door and the door to the house when you arrive at your residence

Energy efficiency: Homes use energy for a variety of purposes, including cooking, lighting, heating and cooling of indoor space, running electrical appliances, and other uses. Most of the time, a user is unaware of the amount of energy that the used equipment consumes, so in this situation, simply having the chance to monitor it could cut down on energy waste.[6]

Figure 2.1 Functionality

2.7 System Analysis:

2.7.1 Traditional Home

Now days in Kurdistan most of the home are non-smart. Smart home is still like a fiction for many people. It's hard to live in a traditional home in today world that technology is used in every corner. There is no futures in traditional home like saving energy, electronic device work by them self and many more futures. Imagine waking up in a cold winter morning and get out of warm bed and see no warming device works or while leaving to work and need a coffee to go but u can't make it yourself because its late and the most important one is energy saving is so hard when you live in a non-smart home. Day by day people realize that traditional home is hard to live that's when smart home come in. [7]

2.7.2 Smart Home

Smart home began to increase in popularity in the early. As such different technology began to emerge, smart home suddenly became a more affordable option, and therefore a viable technology. However Smart home in my country is not popular but there are some companies that trying to do that like:

ISMART that established in 2013 as a low current solutions provider, covers Kurdistan Province in Iraq state, specialized in providing, installing, and operating all low current Systems with all latest related technologies.

High-Smart is a Kurdish company that work in home automation area. They work on smart lighting, audio system, security & safety and intercom & doors. The problem of this smart houses is common, what they really focus on is just controlling the smart devices or more on securing the house. [7]

Table 2.2 System Analysis

Features	Traditional home	Smart Home
Smart Home Infrastructure	X	✓
Smart Home Lightening	X	✓
Smart Home Security	X	✓
Smart Home Entertainment	X	✓
Smart Home Heating and Cooling	X	✓
Smart Voice command	X	✓

CHAPTER 3

SYSTEM DEVELOPMENT METHOLODOGY

3.1 Introduction

This chapter will discuss the methodology type of approach used to develop the system, how it will be developed step-by-step, and how it will be put into use so that the project can be managed effectively and efficiently. Each methodology type has strengths and weaknesses, so it is important to select the one that works best for the project being created. The phases of the methodology type will be covered along with the execution of this project in the phases of the selected methodology.

The technologies or tools used to develop the system, a description of the tools and technologies that are used to implement this project, and an explanation of their uses will all be covered in section 3.4. The hardware and software requirements for the user to run and use the website that is going to be implemented are going to be covered in section 3.5 of the specification, which also describes the tools used for system development and operation. Last but not least, the chapter summary will be a summary of this chapter. (Methodology).

3.2 Methodology Choice and Justification

For this project Agile methodology type is going to be chosen, because this project is for 'users of smart house and traditional home users’ and based on their requirements the system is going to be made.

Through iterative development, the agile project management and software development methodology enables teams to provide value to clients more quickly. The waterfall methodology's complete antithesis is the agile approach. An agile approach sees requirements, design, and testing as ongoing processes involving developers, management, and customers rather than as discrete activities. The Agile Manifesto's values and principles for software development are upheld by agile techniques, which are product development methodologies.

Agile development methods aim to produce the best possible product by forming small, cross- functional, self-organizing teams that regularly deliver functional bits, allowing for frequent user feedback and necessary course corrections. The ability to release software in iterations is agile software development's main benefit. Iterative releases increase productivity by enabling teams to spot problems early on in the development process, fix them, and set clear expectations. They also make it possible for users to enjoy the benefits of software earlier thanks to routine incremental upgrades. [8]

3.3 Phases Within the Chosen Methodology

The Key agile software development lifecycle phases are six phases for the chosen Methodology – Agile development process:

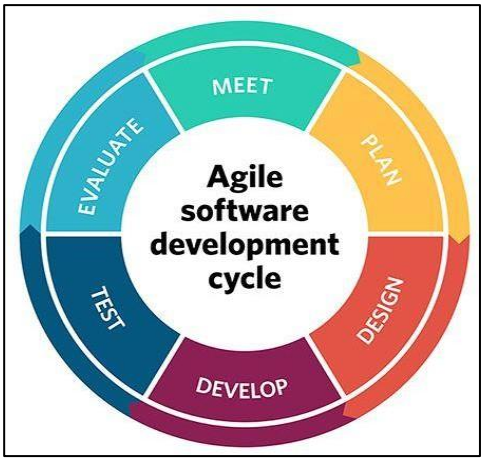

Figure 3.1 Agile software development cycle

1. Phase 1: Requirements

Stakeholders will compile requirements and assess the whole project to determine how much time and effort will be needed to complete the development process. The owner also ranks the various functions according to how important they are to the System while simultaneously identifying the risks. For the proposed project, requirements have been gathered in Chapter 2 – 2.2 Inter- organization Case Study, and it has been discussed that the users of non-smart house are not satisfied with their non-smart house system and also the users of smart house are not satisfied with the current system that exist and the proposed system must contain the users request for such system customer satisfaction is the top priority.

2. Phase 2: Design

The software developer meets with the software development team to decide on the sequence in which features will be introduced and to specify the tools required for the project. Prototypes for the intended User Interface can be created concurrently. The proposed system will have a Design that will be created as a prototype so that the developer can make decisions with ease. Since this system interacts with users most of the time, it is important to create an interface that is simple to use and engaging for all parties involved.

3. Phase 3: Development and Coding

The product will be made available in phases, with each sprint aiming to advance the one before it. The first edition will be going through a lot of changes to enhance functionality and add new features. Testing is necessary for the final product as well as every cycle. The coding portion of the project will be written for the proposed system

during this phase of development and coding, and it will be put into use.

4. Phase 4: Integration and Testing

The team must go through several tests to ensure that the product is fully functional before it is made available to the general public. Any potential flaws orerrors will be fixed by the developers as soon as they are found. They also got user feedback at this time. The proposed system will go through this phase, where it will be made available to users for use and tested to ensure that there are no bugs and that it is fully functional. When the system is made available, user feedback will also be gathered.

5. Phase 5: Implementation and Development

The software is now accessible to customers because it has been put into use. This action has caused it to enter the maintenance phase. The software developer provides ongoing support during this phase to guarantee that the system continues to function and that any new problems are fixed. Iterations to add new features or update an existing product are always possible. When the proposed system reaches this stage, it is fully developed and prepared for launch. The system will then be made available to the public, after which the developer will update it in response to user feedback, keeping in mind that, customer satisfaction is the project's top priority. And as you continue to use the system, you update it with any modifications you make in the future. If any problems arise, the developer is responsible for fixing them and keeping the system up to date.

6. Phase 6: Review

The cycle of agile development ends at this point. The development team presents to the owner the output achieved in meeting the goals after completing all prior production rounds. Then, either through a new iteration or by moving on to the following stage and scaling up Agile, the phases of agile software development are restarted. The agile process for the proposed system comes to an end in this phase because no team members were involved in its creation; instead, the software developer must complete all remaining tasks by himself.

3.4 Describing the technology or tools used to develop the system

This section will go over the tools and technologies that will be used to carry out the suggested project as well as their advantages.

3.4.1 Google Assistance

Google Assistant is a powerful virtual assistant developed by Google. It uses natural language processing and machine learning to provide users with a wide range of services and functions. From answering questions and performing tasks to controlling smart devices and providing personalized recommendations, Google Assistant serves as a convenient and intelligent voice-activated companion. With its integration across various devices and platforms, users can easily access and interact with Google Assistant to streamline their daily routines and enhance their overall productivity and convenience.

3.4.2 C++

Python is a popular programming language for computers that is used to create software and websites, automate processes, and analyze data. Python is a general-purpose language, which means that it can be used to make a wide range of programs and isn't tailored for any particular issues.

3.4.3 Adafruit

All of your work has a home on Dropbox. Whether working alone or with coworkers and clients, you can store and share files, work together on projects, and implement your best ideas. With Dropbox, all of your files are online and stored in the cloud.

3.5 System requirement analysis

The system requirements for this project cover both software and hardware. Hardware is any physical item, such as a device or piece of computer hardware that is used to carry out multiple tasks, including input, output, calculation, processing, and storage. On the other hand, software is a set of instructions that shows a computer how to carry out specific tasks, like writing code and creating a system.

3.5.1 Hardware Justification

In order to ensure that the project or product will function optimally in any given user context, hardware requirements are crucial during project development. The necessary hardware is shown in the following table: [10]

3.5.2 Description of the Hardware system requirements.

Table 3.1 Description of the Hardware

Hardware	Specification
ESP	ESP microcontrollers, like ESP8266 and ESP32, are popular choices for IoT projects. With built-in Wi-Fi and Bluetooth, they offer seamless connectivity and control. Programmable using Arduino IDE and supporting various applications, they are compact, affordable, and widely used for home automation, sensor networks, and industrial monitoring.
Smart Devices	All commonplace items that have been given intelligence using cutting-edge computing, such as AI and machine learning, and connected to create the internet of things are referred to as smart devices (IoT).
Temperature Sensor	In order to record, monitor, or signal temperature changes, a temperature sensor is an electronic device that measures the temperature of its surroundings and converts the input data into electronic data. Temperature sensors come in a wide variety of forms.
Smartphone	Simple smartphone to use as a tablet to control the smart devices

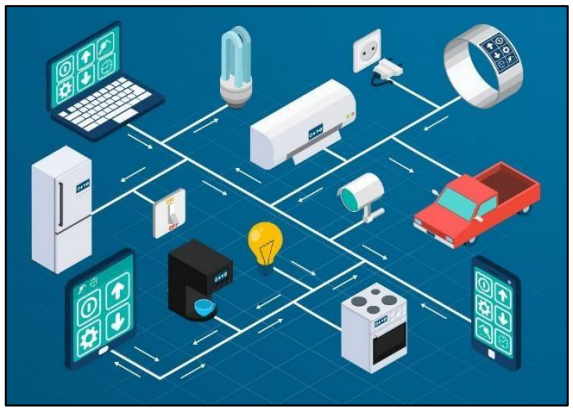

Figure 3.2 Smart devices

3.5.3 Description of smart devices

Table 3.2 Smart Devices Description

Device	Specification
Esp 32	The ESP32 is a powerful, low-cost, and highly versatile microcontroller module that is widely used in the field of Internet of Things (IoT) and embedded systems development.
fan	A smart fan is a type of electric fan that incorporates connectivity and intelligent features to enhance its functionality and convenience.
Oled 0.96	An OLED 0.96 refers to a specific type of OLED (Organic Light-Emitting Diode) display module with a screen size of 0.96 inches
Breadboard	A breadboard is a fundamental tool used in electronics prototyping and circuit design. It provides a convenient way to build and test electronic circuits without the need for soldering.

3.5.4 Software Justification

Software requirements are the minimal standards that must be met by a platform in order to execute the proposed project. The proposed project's minimal requirements are listed in the table below:

Table 3.3 Software Justification

Software	Specification
Operation system	Google Home, Google assistance, IFTTT
Cloud service	Adafruit
Web Browser	Google, brave, Safari
Hardwar	Mobile phone

3.5.5 Project Planning

Gantt charts will be used to schedule the project's timetable planning during the project planning phase. A common visual representation of a project schedule is the Gantt chart. It is a type of bar chart that shows the beginning and ending dates of project-related elements. The Gantt chart is the most popular chart used in project management. These diagrams are crucial for project planning and defining the required sequence of tasks. The graph is frequently displayed as a horizontal bar graph.

3.6 Chapter Summery

This chapter concludes with a discussion of how to use the agile development process technique that was selected for the project. Each phase of the development process is then defined and supported with examples from how they were used in this project. Each technology or tool used in the project is explained, supported, and the purpose for which it was selected. Software and hardware requirements are listed in the system requirements.

CHAPTER 4

REQUIREMENT ANALYSIS AND DESIGN

4.1 Introduction

This chapter is about how the Smart home system works, how it designed by analyzing the steps in diagrams like use case to tell who are involved in this system, Sequence diagram to tell how objects interacts and activity diagram to analysis the process of the system. The design of the System estimate how the system in real life looks like.

4.2 Requirement Analysis

Requirement's analysis or is a process used to determine the needs and expectations of a new product. The requirements user in this system involve an actor which is System controller of the smart house. System controller it's the user of the system to control the system and make sure it works properly.

- System Controller can manage the detail of the devices list
- System Controller can do maintain to the system
- System Controller can record all attempts to the system

The system has 3 ways to control the smart house devices:

I. Controlling it by manually, when they need to turn on the TV they will go on the IFTTT system and turn on the TV.

II. Controlling it with the modes that the system have: the system has 4 modes sleeping mode. Cinema mode, dinner mode, going out mode. Each mode has different functions.

III. Controlling it with the reinforcement learning: each day that user use the smart house system the data will all go to cloud and the reinforcement learning will learn, for example in the first day user turn dinner mode at 5pm so the next day the reinforcement learning will automatically turn on the dinner mode at 5pm and so on for the next days.

4.2.1 Use Case Diagram

As seen in Figure 4.1, a use case is a documented explanation of how users will carry out certain system-related activities, including a description of the specific responsibilities of each involved party.

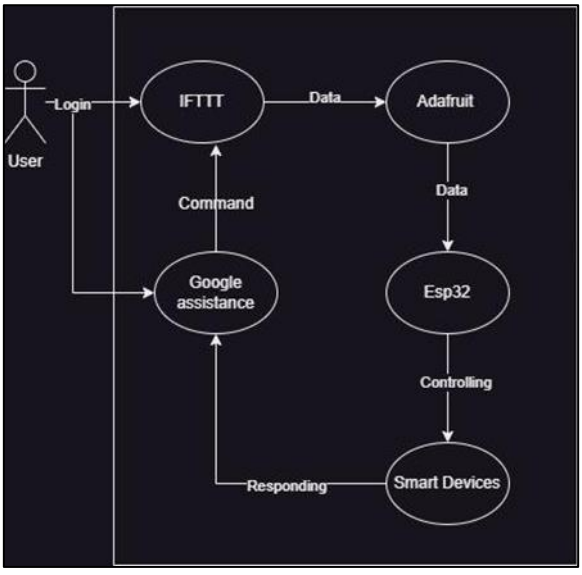

Figure 4.1 Use Case Diagram

The use diagram explain how the smart house system work First user need to login to IFTTT and Google assistance with the same account then user can give a command throw google assistance the command will go to IFTTT that will work as a bridge between google assistance and adafruit turn command to data then send it to adafruit then to Esp, esp must be connected to Internet and finally the device will respond to the command throw the esp.

4.2.2 Sequence Diagram

Sequence diagram is a type of interaction diagram because it used to describe how and in what order a group of objects works together. The system will incorporate four sequence diagrams, each representing a different mode available within the system.

4.2.2.1 Sleeping Mode Sequence Diagram and Activity Diagram

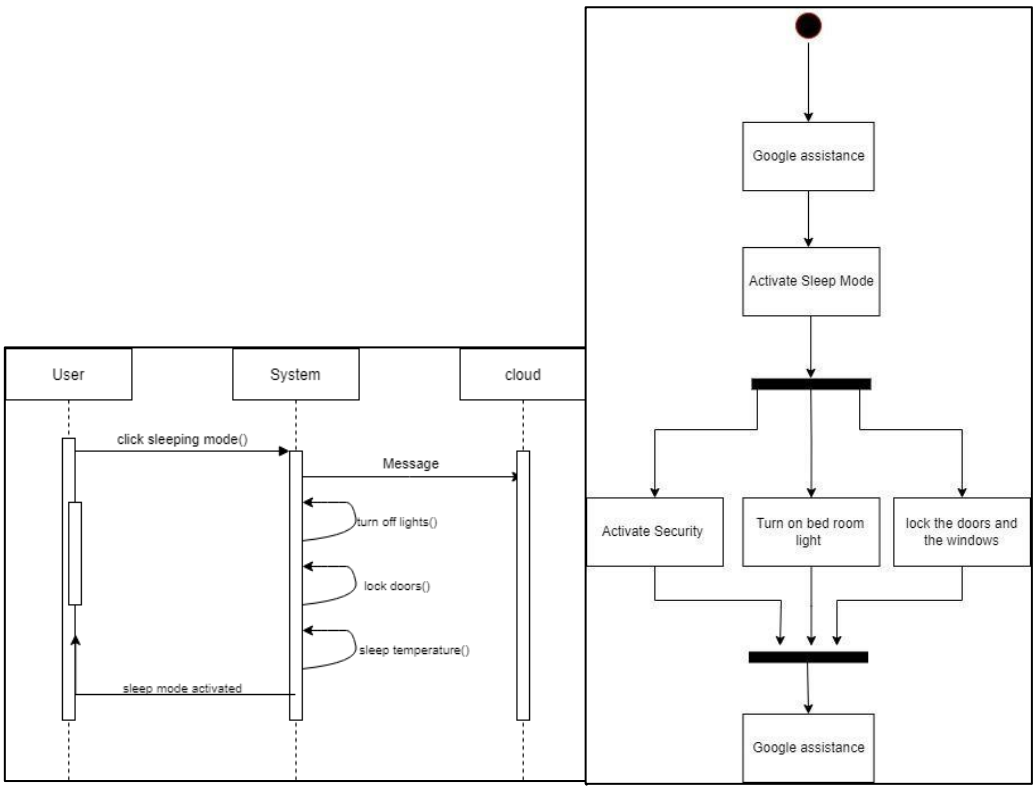

Figure 4.2 Sleeping Mode

Figure 4.2.2.1 showcases the sequence diagram for the sleeping mode. Upon the user selecting the sleeping mode, the system initiates the corresponding functions automatically. Additionally, a message is transmitted to the cloud server. Finally, a notification message is sent to the user, confirming the activation of the sleeping mode.

4.2.2.2 Cinema Mode Sequence Diagram and Activity Diagram

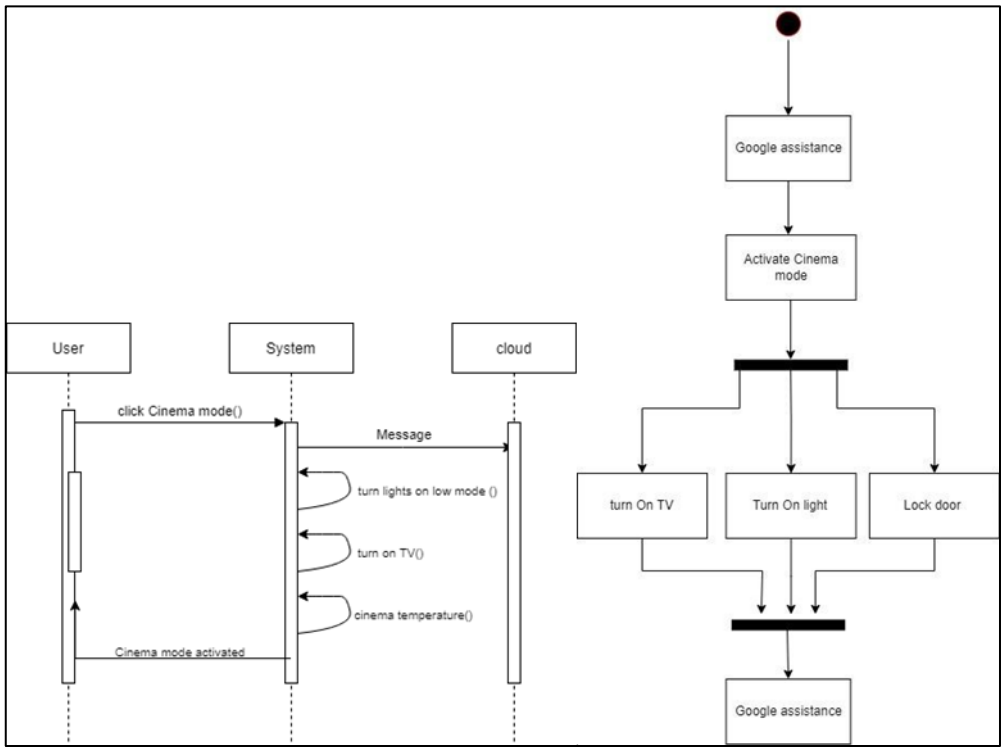

Figure 4.3 Cinema Mode

Figure 4.2.2.2 depicts the sequence diagram for the Cinema mode. When the user selects the Cinema mode, the system proceeds to execute the corresponding functions automatically. Simultaneously, a message is transmitted to the cloud server, enabling the system to acquire knowledge of the user's behavior over time. Finally, a notification message is sent to the user to confirm the activation of the cinema mode.

4.2.2.3 Dinner Mode Sequence Diagram and Activity Diagram

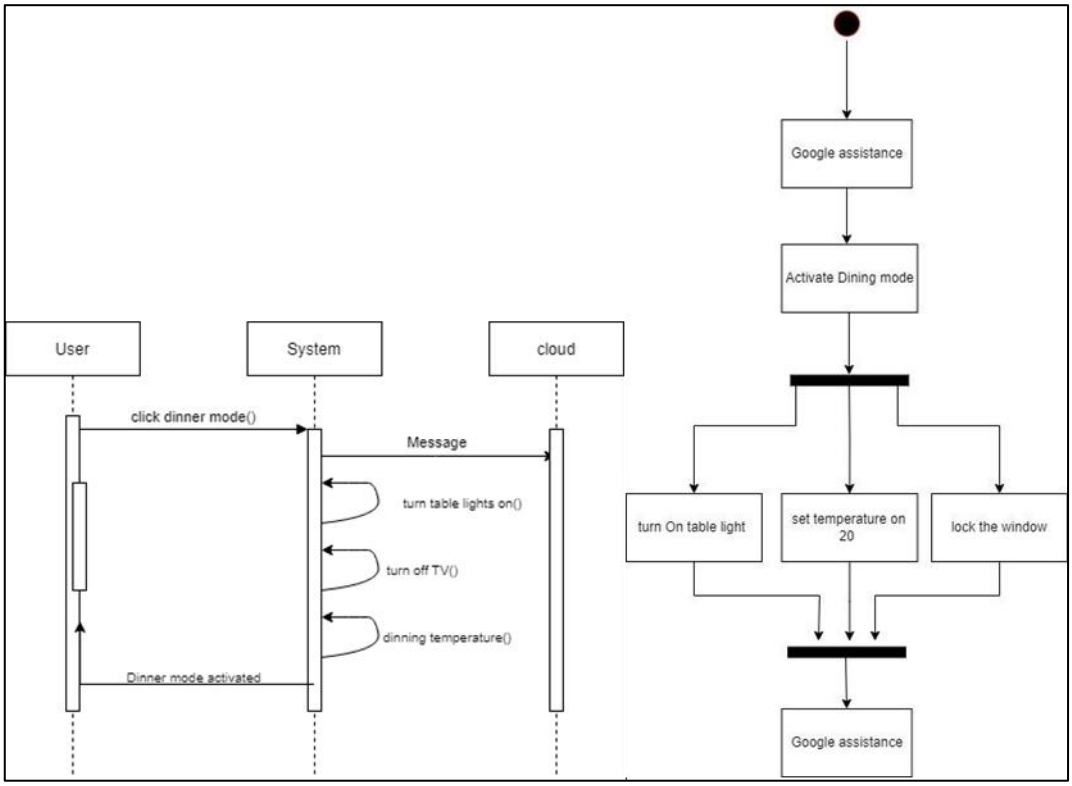

Figure 4.4 Dinner Mode

Figure 4.2.2.3 illustrates the sequence diagram for the Dinner mode. Upon the user selecting the Dinner mode, the system initiates the respective functions automatically. Additionally, a message is transmitted to the cloud server to facilitate the system's learning of the user's behavior. Finally, a notification message is sent to the user, confirming the activation of the Dinner mode.

4.2.2.4 Going Out Mode Sequence Diagram and Activity Diagram

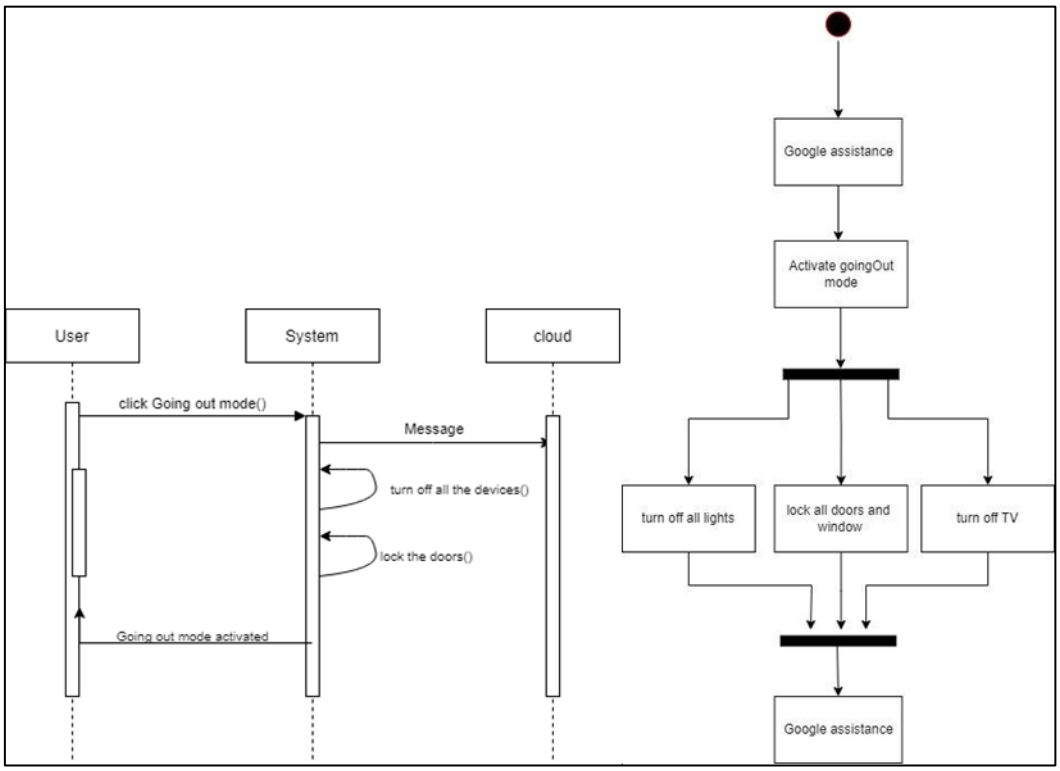

Figure 4.5 Going Out Mode

Figure 4.2.2.4 represents the sequence diagram for the Going out mode. When the user selects the Going out mode, the system performs the associated functions automatically. Furthermore, a message is sent to the cloud server, enabling the system to learn from the user's behavior over time. Ultimately, a notification message is sent to the user, confirming the activation of the Going out mode.

4.3 Activity Diagram

Active diagram are diagrams that show the individual operations that make up a procedure. It's a flexible, general-purpose tool that may be used to define many different kinds of processes.

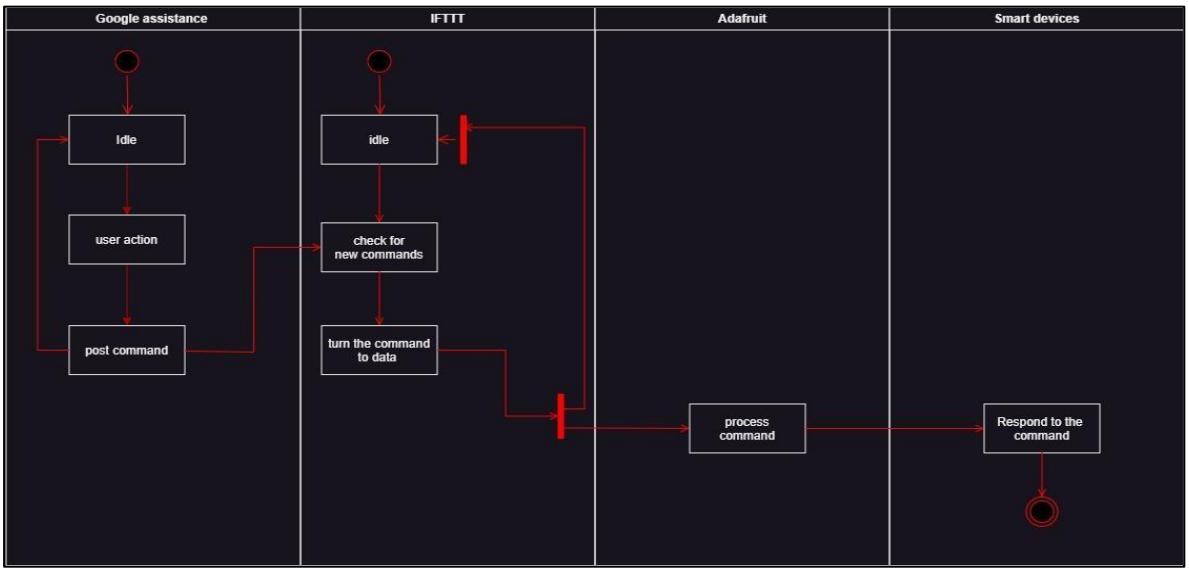

Figure 4.6 Activity Chart Diagram

4.4 Chapter Summary

This chapter focused on the requirements and design of the system. To capture the requirements, various diagrams such as the use case diagram, sequence diagram, and activity diagram were utilized. Since the system utilizes the IFTTTT system, there is no need for a specific user interface. Additionally, a cloud server is employed, eliminating the necessity for a separate database.

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 Introduction

The chapter will concentrate on the project implementation and testing. As long as the project has main functions and features, there will be explanations and examples of each system code. The processes included in the stage are coding, and testing.

5.2 System's Primary Function

The Smart house system was created using C for programming and IFTTT for controlling the devices. The primary function of the smart house project, utilizing temperature and motion sensors, as well as various devices including a fan, OLED display, large LED, small LED, and smart lock-enabled doors, is to create an automated and responsive home environment.

5.2.1 Central Control Point

"checkCommand" function serves as a central control point for interpreting and executing various commands based on the "command_ parameter". It updates variables, triggers actions, and calls other functions accordingly, allowing for control and automation of different aspects of the smart house system as we see in Figure 5.1.

```
void checkCommand(String command_){
  if(command_ == "Cinma Mode"){
    currentMode = CINEMA;
    sendRTCData("Cinema");
    getModes();
  }
  else if(command_ == "Drining Mode"){
    currentMode = DINING;
    sendRTCData("Drining");
    getModes();
  }
  else if(command_ == "Sleeping Mode"){
    currentMode = SLEEPING;
    sendRTCData("Sleeping");
    getModes();
  }
  else if(command_ == "Going Mode"){
    currentMode = GOING;
    sendRTCData("Going");
    getModes();
  }
  else if(command_ == "Turn On TV"){
    isTV = true;
  }
  else if(command_ == "Turn Off TV"){
    isTV = false;
    display.clearDisplay();
    display.display();
  }
  else if(command_ == "Enable Security"){
    isSecurity = true;
  }
  else if(command_ == "Disable Security"){
    isSecurity = false;
  }
  else if(command_ == "Enable Temp System"){
    isTempSystem = true;
  }
  else if(command_ == "Disable Temp System"){
    isTempSystem = false;
    digitalWrite(FAN_PIN, LOW);
    digitalWrite(HEATER_PIN, LOW);
  }
  else if(command_ == "Turn On Cinema LED"){
    digitalWrite(CINEMA_LED_PIN, HIGH);
  }
  else if(command_ == "Turn On Dining LED"){
    digitalWrite(DINING_LED_PIN, HIGH);
  }
  else if(command_ == "Turn On Sleep Room LED"){
    digitalWrite(SLEEP_ROOM_LED_PIN, HIGH);
  }
  else if(command_ == "Turn Off Cinema LED"){
    digitalWrite(CINEMA_LED_PIN, LOW);
  }
  else if(command_ == "Turn Off Dining LED"){
    digitalWrite(DINING_LED_PIN, LOW);
  }
  else if(command_ == "Turn Off Sleep Room LED"){
    digitalWrite(SLEEP_ROOM_LED_PIN, LOW);
  }
  else if(command_ == "Open Indoor"){
    openIndoor();
  }
  else if(command_ == "Close Indoor"){
    closeIndoor();
  }
  else if(command_ == "Open Window"){
    openWindow();
  }
  else if(command_ == "Close Window"){
  closeWindow();
  }
```

Figure 5.1 Code

5.2.2 Modes Functionality

"getModes()" function handles different modes of operation based on the value of the "currentMode" variable. It sets variables, controls LEDs, performs display operations, and triggers additional actions specific to each mode. This allows the smart house system to adapt and respond accordingly to different modes or settings as we in figure 5.2.

```
void getModes(){
  switch (currentMode) {
    case CINEMA:
      Serial.println("Cinema Mode");
      isTV = true;

      digitalWrite(CINEMA_LED_PIN, HIGH);
      digitalWrite(DINING_LED_PIN, LOW);
      digitalWrite(SLEEP_ROOM_LED_PIN, LOW);
      break;

    case DINING:
      Serial.println("Dining Mode");
      isTV = false;
      display.clearDisplay();
      display.display();

      digitalWrite(CINEMA_LED_PIN, LOW);
      digitalWrite(DINING_LED_PIN, HIGH);
      digitalWrite(SLEEP_ROOM_LED_PIN, LOW);
      break;

    case SLEEPING:
      Serial.println("Sleeping Mode");
      isTV = false;
      display.clearDisplay();
      display.display();

      digitalWrite(CINEMA_LED_PIN, LOW);
      digitalWrite(DINING_LED_PIN, LOW);
      digitalWrite(SLEEP_ROOM_LED_PIN, HIGH);
      closeIndoor();
      closeWindow();
      isSecurity = true;
      break;

    case GOING:
      Serial.println("Going Mode");
      isTV = false;
      display.clearDisplay();
      display.display();

      digitalWrite(CINEMA_LED_PIN, LOW);
      digitalWrite(DINING_LED_PIN, LOW);
      digitalWrite(SLEEP_ROOM_LED_PIN, LOW);
      closeIndoor();
      closeWindow();
      isSecurity = true;
      break;
```

Figure 5.2 Code

5.2.3 Security

"Security()" function is responsible for checking the status of the security system (is Security variable) and reading the states of indoor and window infrared sensors. If any of the sensors detect an event or presence, an alert is generated by calling the "Alert()" function with the corresponding location ("Indoor" or "Window")as see in figure 5.3.

```
void Security() {
  if(isSecurity){
    bool IR_SENSOR_INDOOR_STATE = digitalRead(IR_SENSOR_INDOOR_PIN);
    bool IR_SENSOR_WINDOW_STATE = digitalRead(IR_SENSOR_WINDOW_PIN);
    if(IR_SENSOR_INDOOR_STATE == IR_AVAILABLE){
      Alert("Indoor");
    }
    if(IR_SENSOR_WINDOW_STATE == IR_AVAILABLE){
      Alert("Window");
    }
  }
}
```

Figure 5.3 Code

5.2.4 Adafruit IO MQTT

"ConnectToMQTT ()" function is responsible for establishing a connection to the Adafruit IO MQTT broker. It checks if the MQTT client is disconnected and attempts to reconnect. Upon successful reconnection, it subscribes to a specific MQTT topic and sets an error LED pin to indicate the connection status. If the reconnection fails, it prints an error message and waits for a brief period before attempting to reconnect again as in figure 5.4.

```
void connectToMQTT() {
  // Connect to Adafruit IO
  if (!mqttClient.connected()) {
    digitalWrite(error_LED_PIN, HIGH);
    Serial.println("Disconnected from MQTT, reconnecting...");
    if (mqttClient.connect("ESP8266Client", username, key)) {
      Serial.println("Reconnected to MQTT");
      mqttClient.subscribe(commandTopic);
      digitalWrite(error_LED_PIN, LOW);
    } else {
      Serial.print("Failed to reconnect to MQTT, rc=");
      Serial.println(mqttClient.state());
      delay(2000);
      return;
    }
  }
```

Figure 5.4 Code

5.3 Home Design

The design contain 3 rooms' dining room, cinema room and bed room. Cinema room contain a screen and LED as lights with one door and window. Dining room contain small LED as light and same for bed room. The house contain a big LED as heater and fan as a cooler with doors and window that can be locked and unlocked as in figure 5.5.

Figure 5.5 Design

5.4 User Interface of Main Function

5.4.1 Google Assistance Page

As in figure 5.6 the user can give the command in google assistance, by voice or by writing it and then in IFTTT it will give the user a notification that it has been activated.

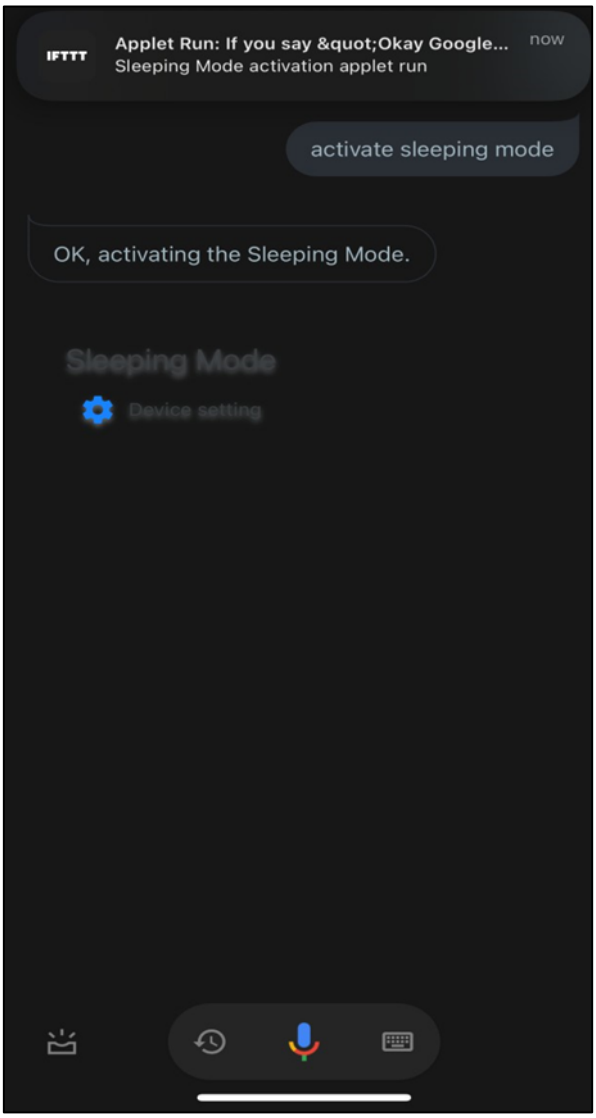

Figure 5.6 Google Assistance Page

5.4.2 IFTT Page

In IFTTT pages as in Figure 5.7 user can do some there are some edit that user can do. In the first page user can see what his command that has been added before is and they also can change the voice command for whatever they want. In second page user can create new command for their smart house. Third page is notification page every time user send a command they also will be notified here.

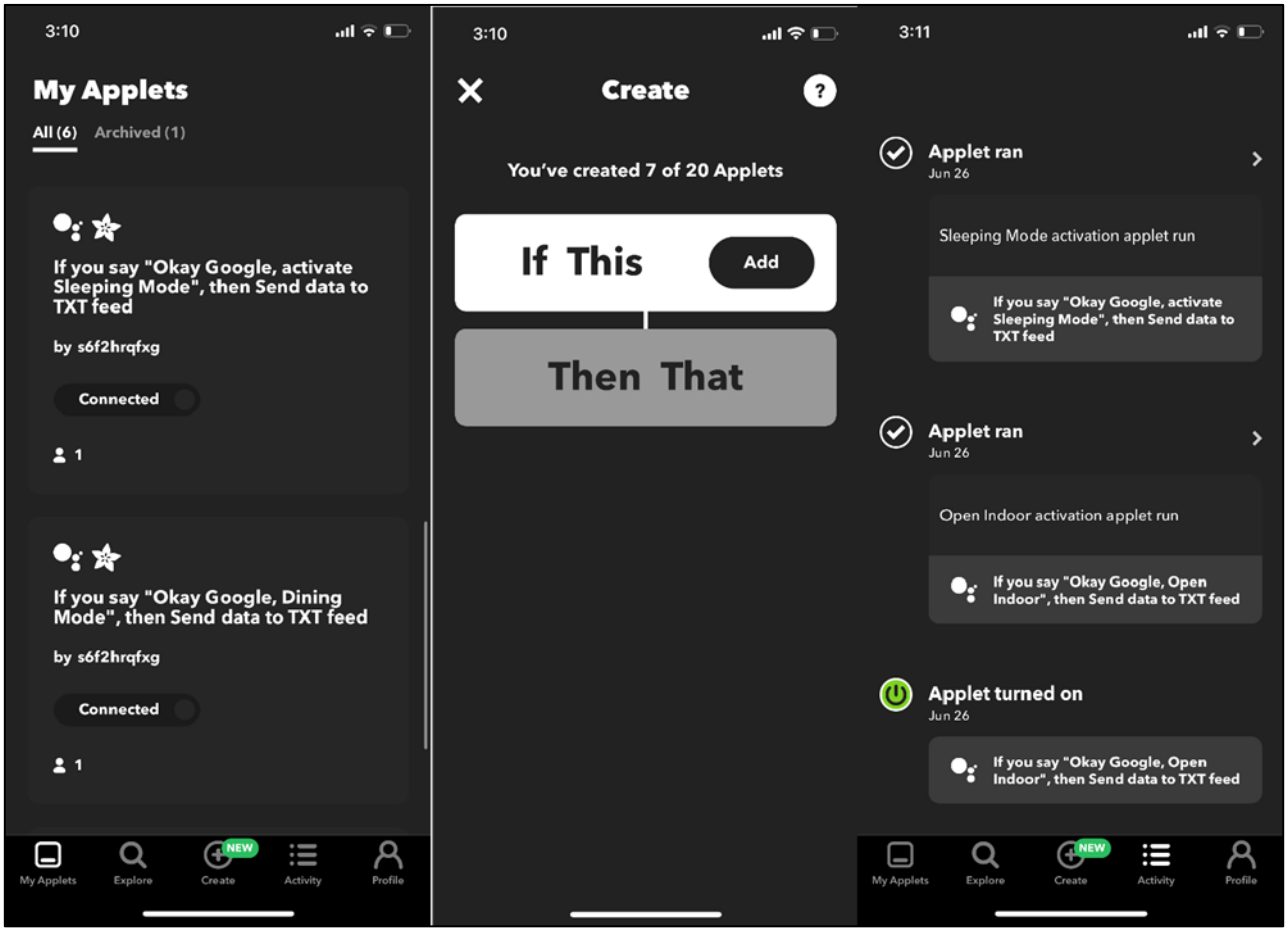

Figure 5.7 IFTT Page

CHAPTER 6

CONCLUSION

6.1 Introduction

This chapter is recap of the smart home system, it will discuss the results and the achievement of the system and it will discuss the suggested plan for the project.

6.2 Achievement of Project Objectives

The project's first chapter covered the project's introduction, the system's process (which described how it was carried out), some problems that were identified and properly addressed by the system, as well as the system's goal—which included some significant objectives—and the project's scope and importance.

The second chapter discusses the system's significance for Kurdistan and why our nation needs this effort. It also outlines the challenges Kurdistan is now facing. The discussion of the recent system studies related to this system will present a short analysis of these researches, examine their strengths and weaknesses in terms of performance, security, integrity, and design, and choose strengths for application in this project. Display a few of the hardware and software electrical components that were utilized in this project to discuss them, their functionality, and the reason for their usage in the system.

The third chapter explains the agile technique that was utilized to design this system and why it is appropriate for this project. This project's use of the agile

approach is described in full in the first phase. Hardware and software tools have been ordered, and their importance to this project has been discussed and analyzed.

In Chapter 4, the topic of system requirements and design, use case, sequence, and activity diagrams were applied to requirements.

6.3 Suggestions For Future Improvement

Intent for the FYP 2 is to implement the system in proper way by using the methodologies that have been created on FYP1 which was agile methodology, it means the changes can be happen in the phase's base on agile methodology.

Last point for FYP 2 will be testing of the system which is very important to find any problem that could be faced through implementing of the system.

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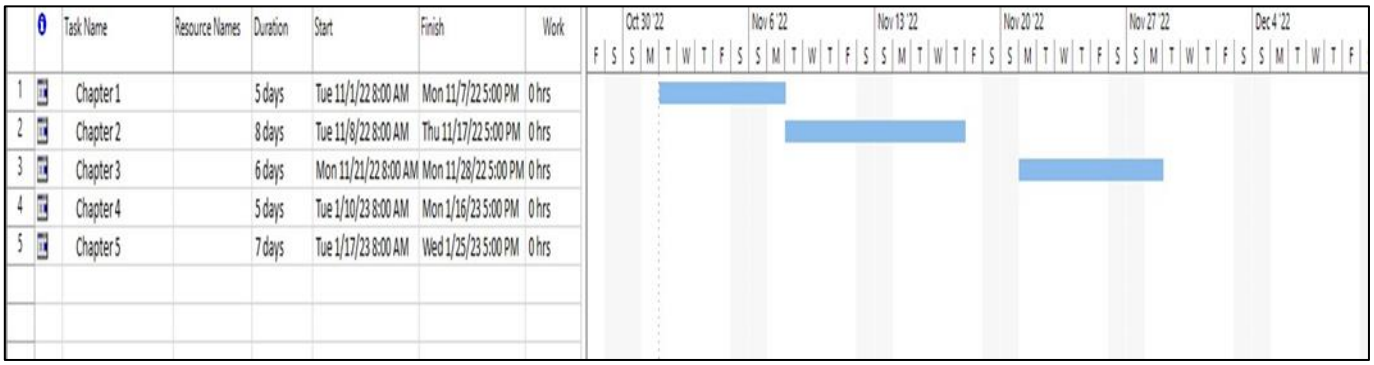
Appendix A

Gantt Chart:

Gantt charts will be used to schedule the project's timetable planning during the project planning phase. A common visual representation of a project schedule is the Gantt chart. It is a type of bar chart that shows the beginning and ending dates of project-related elements. The Gantt chart is the most popular chart used in project management. These diagrams are crucial for project planning and defining the required sequence of tasks. The graph is frequently displayed as a horizontal bar graph.



	Task Name	Resource Names	Duration	Start	Finish	Work
1	Chapter 1		5 days	Tue 11/1/22 8:00 AM	Mon 11/7/22 5:00 PM	0 hrs
2	Chapter 2		8 days	Tue 11/8/22 8:00 AM	Thu 11/17/22 5:00 PM	0 hrs
3	Chapter 3		6 days	Mon 11/21/22 8:00 AM	Mon 11/28/22 5:00 PM	0 hrs
4	Chapter 4		5 days	Tue 1/10/23 8:00 AM	Mon 1/16/23 5:00 PM	0 hrs
5	Chapter 5		7 days	Tue 1/17/23 8:00 AM	Wed 1/25/23 5:00 PM	0 hrs

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