smart home automation system

Table of Contents

1. Introduction

1.1 Purpose

This Software Requirements Specification (SRS) document identifies and outlines the software requirements for our smart home automation system project, version 1.0. The scope of the product covered in this SRS encompasses the entire system, including the integration, control, and management of various smart devices and appliances within a residential setting.

The smart home automation system project aims to create an intelligent, energy-efficient, and secure living environment by leveraging cutting-edge technologies such as the Internet of Things (IoT), artificial intelligence (AI), and machine learning (ML). The primary objectives of the system are to improve user convenience, optimize energy consumption, and enhance home security through automated and remote control of connected devices.

The main benefits of our smart home automation system include:

Centralized control: The system provides a unified platform for managing various smart devices and appliances in a home, offering users an easy and convenient way to monitor and control their living environment.

Energy efficiency: By automating routine tasks and optimizing the use of energy-consuming devices, the system helps users reduce their energy consumption and minimize their carbon footprint.

Enhanced security: The smart home automation system incorporates advanced security features such as intrusion detection, access control, and real-time monitoring, ensuring a safe and secure living environment for users.

Customization and scalability: The system is designed to be flexible and easily adaptable to different user needs and preferences, allowing for seamless integration with a wide range of smart devices and appliances.

Our smart home automation system project is in line with corporate goals and business strategies that focus on promoting sustainable living and addressing the growing demand for smart home solutions in the market. This project aims to position our team as pioneers in the development of innovative and user-friendly smart home systems that cater to the evolving needs of modern households.

A separate vision and scope document is not available, as all relevant information is provided within this SRS.

1.2 Document Conventions

This software requirement specification (SRS) document follows the IEEE standard for software requirements specification, as well as any conventions specified by our honorable instructor.

All functional requirements are written using the imperative mood, starting with a verb that describes the desired action. Non-functional requirements are written using the appropriate adjectives and adverbs.

Requirements are prioritized using a three-level system, with "Must Have" requirements being the highest priority, "Should Have" requirements being the second priority, and "Nice to Have" requirements being the lowest priority. Each requirement statement has its own priority level.

Requirements are numbered using a hierarchical structure, with the first number indicating the level of the requirement (e.g., 1.1, 1.2), and subsequent numbers indicating sub-requirements or sub-components of the higher-level requirement.

Fonts or highlighting that have special significance are used to differentiate between different types of requirements or to emphasize important information. For example, bold text is used for headings and subheadings, while italics are used to highlight key terms or definitions.

In this document, priorities for higher-level requirements are assumed to be inherited by detailed requirements. The SRS is organized into several sections, starting with an overview of the system and its features, followed by the detailed functional and non-functional requirements. The document concludes with a glossary of terms and a list of references. We suggest that readers begin with the overview sections and then proceed to the sections that are most pertinent to their role, such as developers focusing on the functional requirements and testers focusing on the non-functional requirements.

1.3 Intended Audience and Reading Suggestions

This Smart Home Automation System software requirement specification (SRS) document is intended for a diverse audience, including developers, project managers, marketing staff, users, testers, and documentation writers.

Developers will use this document to understand the functional and non-functional requirements of the smart home automation system, as well as the technical details of its implementation. Project managers will use this document to plan and manage the project, including resource allocation and timelines. Marketing staff will use this document to understand the key features and benefits of the system to inform marketing campaigns. Users will use this document to understand the capabilities and limitations of the system. Testers will use this document to design and execute test cases to verify that the system meets all specified requirements. Documentation writers will use this document to develop user manuals and other documentation.

This SRS is organized into several sections. The introduction provides an overview of the document and its purpose. The system overview section describes the context and objectives of the smart home automation system. The functional requirements section details the specific features and functions of the system, while the non-functional requirements section describes the quality attributes of the system, such as performance, reliability, and security. The glossary of terms provides definitions for technical terms used throughout the document. We suggest that readers begin with the overview sections and then proceed to the sections that are most pertinent to their role. For example, developers may focus on the functional requirements section, while testers may focus on the non-functional requirements section.

1.4 References

This Smart Home Automation System software requirement specification (SRS) document refers to the following documents and resources:

IEEE Recommended Practice for Software Requirements Specifications (IEEE Std 830-1998)

Title: IEEE Recommended Practice for Software Requirements Specifications

Author: Institute of Electrical and Electronics Engineers

Version: IEEE Std 830-1998

Date: 1998

Source: [https://ieeexplore.ieee.org/document/720574]

User Interface Style Guide

Title: smart things User Interface Style Guide

Author: smart things

Version: 2.0

Date: January 2023

Location: Internal company document (contact the project manager for access)

Smart Home Automation: A Comprehensive Overview

Title: Smart Home Automation: A Comprehensive Overview

Author: Jane Smith

Date: March 2022

Source: [https://www.example.com/smart-home-automation-overview]

Vision and Scope Document

Title: Smart Home Automation System Project Vision and Scope

Author: Our Team

Version: 1.0

Date: February 2023

Location: Internal project document (available in the project repository)

Please note that some of the referenced documents may be subject to copyright, licensing, or other access restrictions. Readers are responsible for obtaining the necessary permissions or licenses to access these materials.

2. Overall Description

2.1 Product Perspective

Business Requirements:

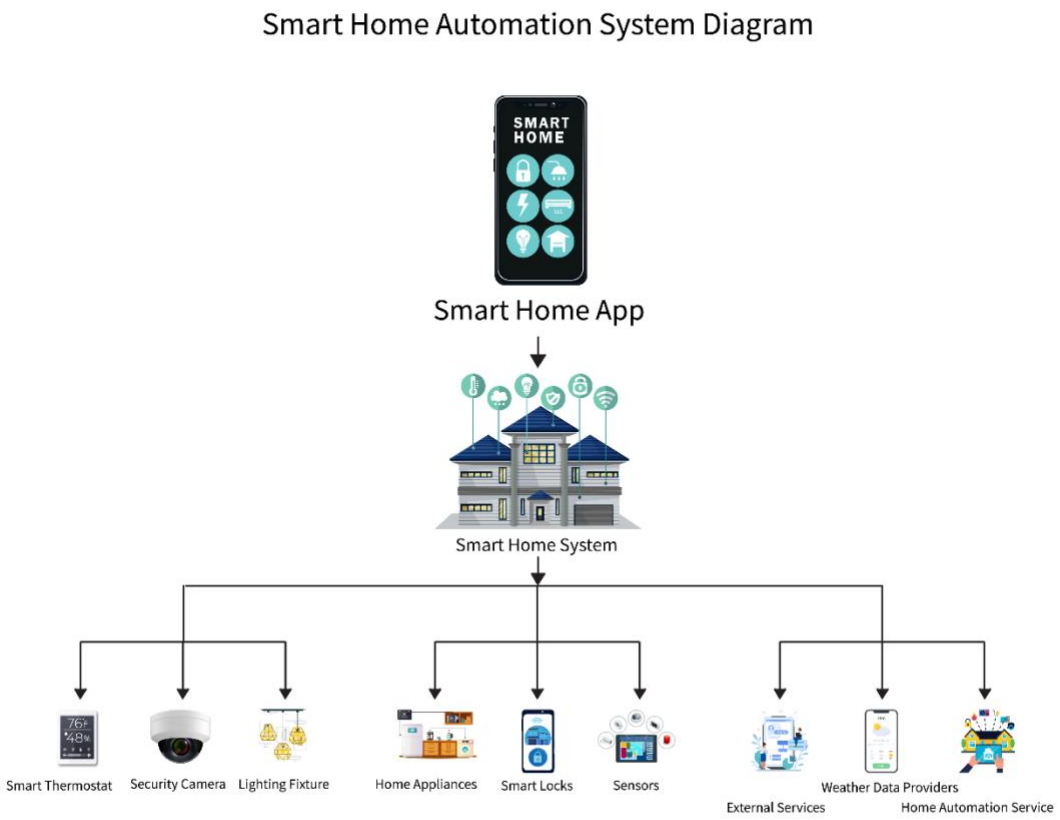
In our project, we developed a smart home automation system that is designed to meet the needs of modern homeowners who are looking for ways to enhance the comfort, convenience, and security of their homes. Our goal was to create a self-contained system that integrates with a variety of hardware devices and sensors, including smart thermostats, security cameras, and lighting fixtures. We developed the product to meet the growing demand for smart home automation systems in the consumer market and to differentiate ourselves from competitors.

Context and Origin:

Our smart home automation system is a new, self-contained product that is not a follow-on member of a product family or a replacement for any existing systems. We designed the product from the ground up to provide users with a comprehensive and intuitive home automation experience. The system was designed to integrate seamlessly with existing home appliances and devices and to be easy to set up and use.

The smart home automation system is a part of a larger system that includes a range of hardware devices and sensors. The system communicates with these devices and sensors using various communication protocols, including Wi-Fi, Bluetooth, and Zigbee. The system also interfaces with external services, such as weather data providers, to provide users with accurate and timely information about their home environment.

As shown in the diagram below, the Smart Home App serves as the primary interface between the user and the Smart Home System. The Smart Home System communicates with the various hardware devices and sensors using different communication protocols. The Home Appliances, Smart Locks, and Sensor interface with the Smart Home System to provide users with full control over their home environment. The External Services, such as Weather Data Providers and Home Automation Services, provide additional functionality and features to the system.



2.2 Product Functions

The smart home automation system provides users with a wide range of functions and features, including:

Lighting control: The system allows users to control the lighting in their home, including turning lights on and off, dimming lights, and setting schedules.

Temperature control: The system allows users to control the temperature in their home, including setting the thermostat, creating heating/cooling schedules, and monitoring the temperature remotely.

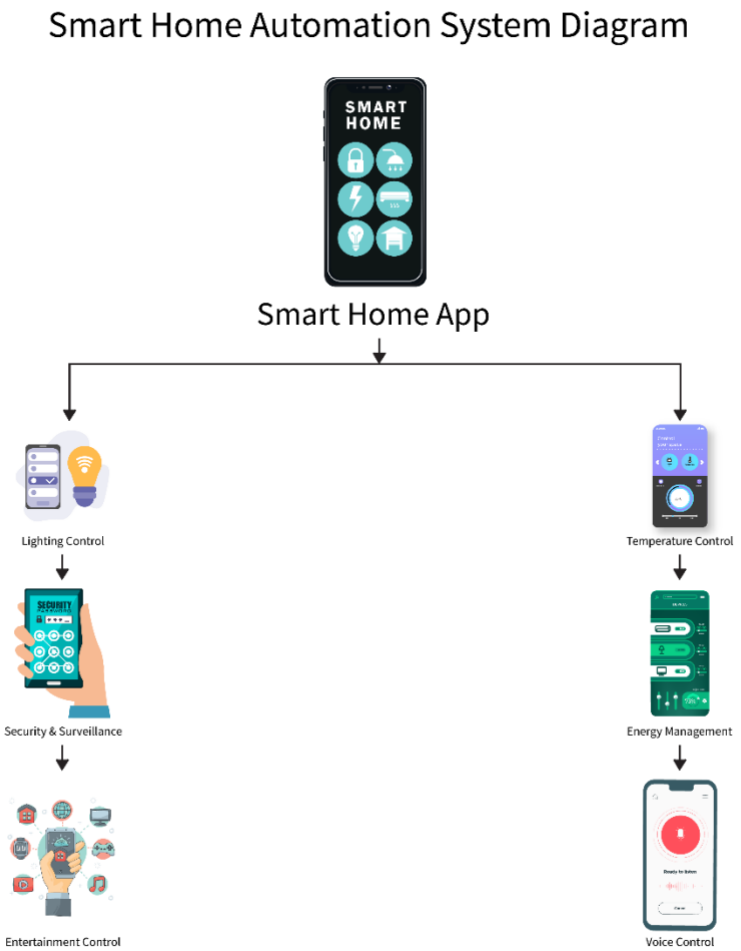
Security and surveillance: The system allows users to monitor their home using security cameras, motion detectors, and door/window sensors. Users can receive alerts and view live video feeds from their smartphone or tablet.

Energy management: The system allows users to monitor and control their energy usage, including tracking electricity and water consumption and setting energy-saving schedules.

Entertainment control: The system allows users to control their home entertainment systems, including audio and video components, using their smartphone or tablet.

Voice control: The system allows users to control various functions using voice commands, such as turning on/off lights, adjusting the thermostat, and playing music.

The functions are organized into logical groups related to the main areas of control in a smart home environment. A top-level data flow diagram is presented below to show how the functions are related:



The diagram shows the Smart Home App as the main interface through which users can control the different functions. The functions are organized into groups related to Lighting Control, Temperature Control, Security and Surveillance, Energy Management, Entertainment Control, and Voice Control.

2.3 User Classes and Characteristics

The smart home automation system is designed for a variety of user classes, including:

Homeowners: The primary user class of the system. Homeowners are expected to use all the features of the system, including lighting control, temperature control, security and surveillance, energy management, entertainment control, and voice control. Homeowners may have varying levels of technical expertise, but the system is designed to be easy to use and understand.

Family members: Other family members who live in the home, such as children or elderly parents, may also use the system. Family members may have different levels of technical expertise and may only use certain functions of the system, such as lighting control or entertainment control.

Guests: Guests may use the system temporarily during their stay in the home. Guests may have limited access to certain functions of the system, such as lighting control or temperature control.

Service providers: Service providers, such as cleaning or maintenance staff, may use the system temporarily while performing their duties in the home. Service providers may have limited access to certain functions of the system, such as lighting control or security and surveillance.

The pertinent characteristics of each user class are as follows:

Homeowners: Homeowners are expected to have a high level of interest in the system and may have varying levels of technical expertise. Homeowners may be concerned about the security and privacy of the system and may require different levels of access to different functions.

Family members: Family members may have varying levels of technical expertise and may only use certain functions of the system. Family members may be concerned about the ease of use and accessibility of the system.

Guests: Guests may have limited technical expertise and may only use certain functions of the system. Guests may require limited access to certain functions for the duration of their stay.

Service providers: Service providers may have limited technical expertise and may only use certain functions of the system while performing their duties. Service providers may require limited access to certain functions for the duration of their service.

The most important user class for the system is the Homeowners class, as they are the primary users of the system and are expected to use all the features of the system. The other user classes are also important but may have different levels of access and usage of the system.

2.4 Operating Environment

The smart home automation system will operate in the following environment:

Hardware Platform:

Smartphones and tablets running on Android and iOS platforms

Smart home devices, such as smart thermostats, security cameras, lighting fixtures, home appliances, and smart locks

Operating System:

Android 6.0 (Marshmallow) or later

iOS 10.0 or later

Software Components:

Smart Home App: The main interface through which users can control the different functions of the system.

Smart Home System: The central hub that connects and manages all the smart home devices in the network.

External Services: The system may interact with external services, such as weather services, to provide more accurate and personalized temperature control.

The system must peacefully coexist with other software applications and components that may be running on the user's devices, such as other smart home apps or security software. The system must also be compatible with a wide range of smart home devices from different manufacturers.

The smart home automation system must operate reliably and efficiently in a range of environmental conditions, such as different levels of humidity and temperature. The system must also be able to handle intermittent connectivity issues or power outages, and recover gracefully from any system failures or errors.

To ensure optimal performance and user experience, the system will require regular updates and maintenance. The Smart Home App and Smart Home System will be updated regularly to fix any bugs, improve functionality, and add new features. Users will be notified of these updates and will be prompted to update their devices accordingly.

2.6 User Documentation

The smart home automation system will be delivered with the following user documentation components:

User Manual: A comprehensive manual that provides detailed instructions on how to install, configure, and use the system. The manual will be available in both digital and print formats.

Online Help: A searchable online help system that provides users with quick access to information on how to use the system and troubleshoot common issues.

Tutorials: Step-by-step tutorials that walk users through common tasks and features of the system. The tutorials will be available in both video and written formats.

The user documentation will conform to industry standards for content, format, and delivery. The user manual and online help system will be designed with a clear and intuitive user interface to ensure ease of use and accessibility. The tutorials will be presented in a concise and engaging manner to facilitate user learning.

The user documentation will be regularly updated and maintained to reflect changes to the system, such as new features or bug fixes. The documentation will be delivered in electronic format and made available through the Smart Home App and the company's website. Print versions of the user manual will also be available upon request.

3. System Requirements

3.1 System Features

Software Login

Functional Requirements (FRs):

1.1 The software shall allow users to log in with their given username and password.

1.2 The login credentials (username and password) will be verified with database records.

1.3 If the login is successful, the home page of the user account will be displayed.

1.4 If the username and/or password are entered incorrectly, a random verification code will be generated and sent to the user's email address by the system to retry login.

1.5 If the number of login attempts exceeds its limit (3 times), the system shall block the user account login for one hour [optional function].

Priority Level: High

Precondition: The user has a valid user ID and password.

Cross-References: 4.1 (Definitions), 7.2 (Non-Functional Requirements), 9 (Example)

User Registration

Functional Requirements (FRs):

2.1 The software shall allow new users to register by providing their personal information.

2.2 The user shall be able to set up their account by entering their username and password.

2.3 The user shall receive a confirmation email with a verification link to activate their account.

2.4 The system shall verify that the email address is valid and unique.

2.5 The system shall encrypt the user's password for security purposes.

Priority Level: High

Precondition: None

Cross-References: 4.1 (Definitions), 7.2 (Non-Functional Requirements), 9 (Example)

Device Management

Functional Requirements (FRs):

3.1 The software shall allow users to add and remove devices from their account.

3.2 The system shall identify the devices that are compatible with the software and can be integrated.

3.3 The system shall provide a way for users to control and monitor their devices through the software.

3.4 The system shall send alerts to users in case of any device malfunction.

Priority Level: High

Precondition: User has registered and logged into their account.

Cross-References: 4.1 (Definitions), 7.2 (Non-Functional Requirements), 9 (Example)

Automation and Scheduling

Functional Requirements (FRs):

4.1 The software shall allow users to create automation rules for their devices based on time, events, and other conditions.

4.2 The software shall allow users to set schedules for their devices based on specific times or days of the week.

4.3 The system shall execute automation rules and schedules automatically.

4.4 The system shall provide a way for users to override automation rules and schedules manually.

Priority Level: Medium

Precondition: User has registered and logged into their account.

Cross-References: 4.1 (Definitions), 7.2 (Non-Functional Requirements), 9 (Example)

Energy Management

Functional Requirements (FRs):

5.1 The software shall provide users with real-time energy consumption data of their devices.

5.2 The software shall allow users to set up energy-saving rules and schedules for their devices.

5.3 The system shall provide recommendations to users on how to optimize energy consumption based on usage patterns.

5.4 The system shall notify users of any unusual energy consumption patterns or energy usage anomalies.

Priority Level: Medium

Precondition: User has registered and logged into their account and has devices connected to the software.

Cross-References: 4.1 (Definitions), 7.2 (Non-Functional Requirements), 9 (Example)

Smart Lighting Control

Functional Requirements (FRs)

4.1 The software shall allow users to control smart lighting devices.

4.2 The system shall automatically turn on/off lights based on user-defined schedules.

4.3 Users shall be able to dim the lights to a specified level.

4.4 The software shall enable users to turn off all the lights in the house with a single command.

4.5 The system shall turn on/off lights based on user's presence in the room using motion sensors.

Priority Level: High

Precondition: Smart lighting devices are installed and configured

Cross-references: 3.2, 5.1, 7.1

Voice-Activated Assistance

Functional Requirements (FRs)

5.1 The system shall integrate with voice-activated assistants such as Amazon Alexa and Google Assistant.

5.2 Users shall be able to control connected devices using voice commands.

5.3 The software shall provide users with voice-based feedback on the status of connected devices.

5.4 The system shall recognize and respond to user-defined voice commands.

Priority Level: Medium

Precondition: Voice-activated assistant is configured with the system

Cross-references: 3.2, 4.1, 7.3

Advanced Security

Functional Requirements (FRs)

6.1 The software shall provide real-time monitoring of the security system.

6.2 The system shall alert users of any suspicious activity or intrusion attempts.

6.3 The software shall incorporate facial recognition technology to allow or deny access to the home.

6.4 Users shall be able to remotely lock/unlock doors and windows.

Priority Level: High

Precondition: Security devices are installed and configured

Cross-references: 3.2, 7.2, 8.1

Each feature will be further elaborated upon in the functional requirements section (3.1.1) with detailed descriptions of the inputs, outputs, and processing requirements.

3.2 Non-Functional/Quality Requirements

In addition to the functional requirements outlined in Section 3.1, the smart home automation system project must also meet certain non-functional or quality requirements to ensure its overall performance, reliability, and usability. These requirements include:

QA1: Usability - A trained user shall be able to operate and navigate the system interface easily and efficiently, without requiring extensive training or support. Specifically, a trained user shall be able to submit a complete request for a specific smart device or appliance to be controlled or monitored by the system in an average of four minutes and a maximum of six minutes.

Priority Level: Medium

Precondition: The user has undergone basic system training and has access to the user manual and help resources.

Cross-references: QA3 (Performance), QA5 (Documentation)

QA2: Reliability - The system shall operate continuously without interruption or failure for a minimum of 99% of the time during any given month, with downtime not exceeding 60 minutes per month.

Priority Level: High

Precondition: The system is properly installed and maintained according to the provided instructions.

Cross-references: QA4 (Availability), QA6 (Supportability)

QA3: Performance - The system shall respond to user requests and commands within 3 seconds, and shall be capable of processing up to 1000 simultaneous requests or connections.

Priority Level: High

Precondition: The system is operating within the specified hardware and software environment.

Cross-references: QA1 (Usability), QA4 (Availability)

QA4: Availability - The system shall be available for use by users for a minimum of 99.5% of the time during any given month, excluding scheduled maintenance periods.

Priority Level: High

Precondition: The system is properly installed and maintained according to the provided instructions.

Cross-references: QA2 (Reliability), QA3 (Performance)

QA5: Documentation - The system shall be accompanied by comprehensive and up-to-date user documentation, including user manuals, online help resources, and tutorials, in a format that is easy to understand and accessible to all user classes.

Priority Level: Medium

Precondition: The system is released for use by end-users.

Cross-references: QA1 (Usability), QA6 (Supportability)

QA6: Supportability - The system shall be designed and developed using standard and widely used technologies and tools, to ensure that it can be easily maintained and supported by the development team and third-party service providers.

Priority Level: Low

Precondition: The system is released for use by end-users.

Cross-references: QA2 (Reliability), QA5 (Documentation)

3.3 Project Requirements

The following table describes the project requirements for the development of the smart home automation system:

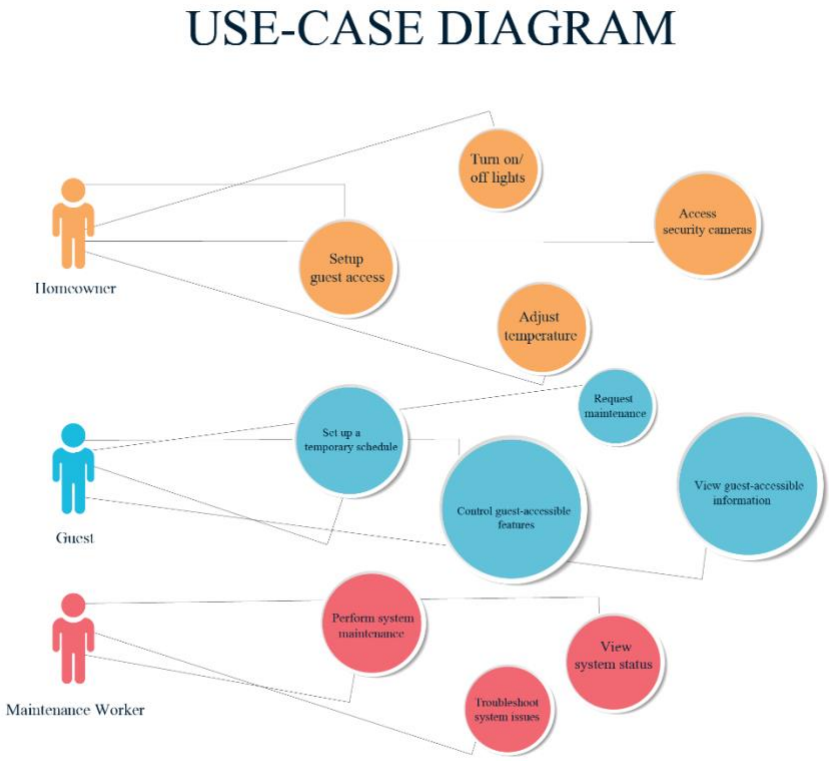
As the system developer for the smart home automation system, we had needed to use Selenium tools to perform testing activities during week 6 of the development process. By that point, we had already completed the initial development and integration of the system's major components and were preparing for the testing and quality assurance phase. The use of Selenium tools was necessary to ensure that the system functioned correctly across multiple web browsers and operating systems, and to identify and address any potential defects or issues. We had successfully integrated the use of Selenium into our testing process and were able to efficiently and effectively identify and resolve any issues that arose during testing.

4. Design and Interface Requirements

4.1 UML Diagrams

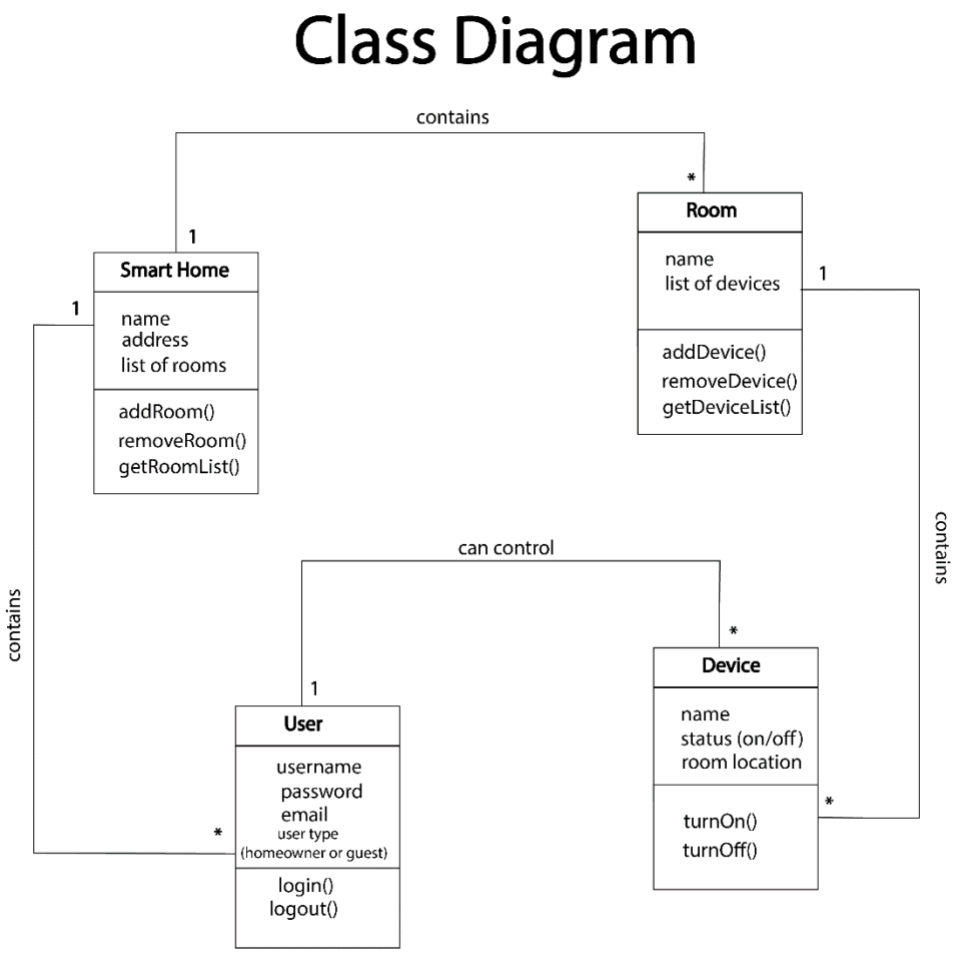
The following UML diagrams have been created to describe the solution software for the smart home automation system:

Use Case Diagram:



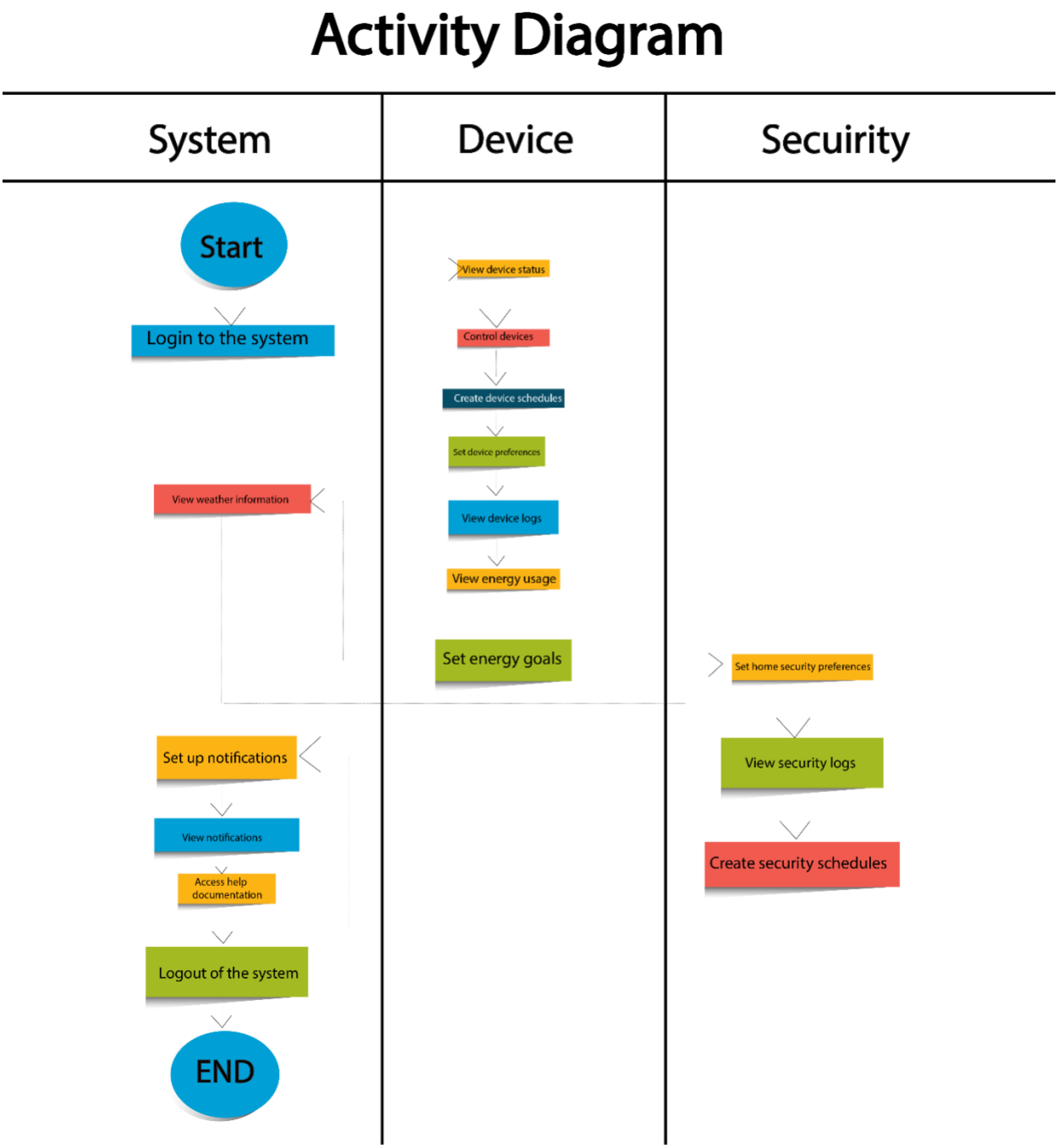
This diagram shows the various actions or use cases that a user, maintenance worker, or guest can perform in the smart home automation system, and how those actions are related to each other.

Class Diagram:



This diagram shows the various classes, attributes, and methods that are required for the smart home automation system to function. It also shows the relationships between those classes, such as how a user can control a device or how a maintenance worker can perform maintenance on a device.

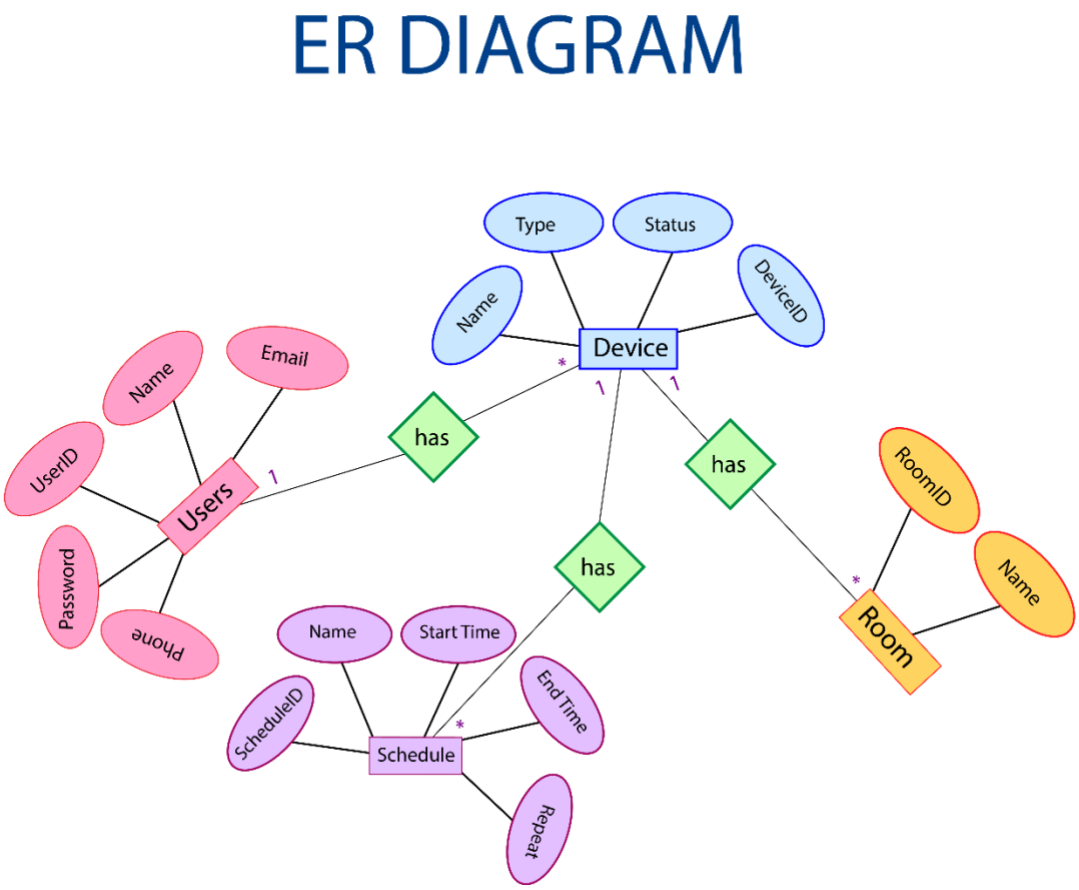
Activity Diagram:



This diagram shows the various activities that a user, maintenance worker, or guest can perform in the smart home automation system, and how those activities are

sequenced and related to each other. It also shows decision points, such as whether a user has the right credentials to control a device.

Entity-Relationship Diagram:



This diagram shows the various entities in the smart home automation system and their relationships, such as how a device belongs to a room or how a user can schedule a device to turn on or off at a specific time. It helps to visualize the data requirements and design the database schema for the system.

These UML diagrams provide a clear and concise representation of the smart home automation system's functionality, data, and processes. They will be used to guide the development process and ensure that the system meets the requirements specified in the SRS.

4.2 Data Dictionary

Entity Name	Attribute Name	Type/Size	Validation	Key
User	UserID	Integer	Not null, unique	PK
	Username	Varchar(50)	Not null, unique	
	Password	Varchar(50)	Not null	
	Email	Varchar(100)	Not null	
	Phone	Varchar(20)	Not null	

Entity Name	Attribute Name	Type/Size	Validation	Key
Room	RoomID	Integer	Not null, unique	PK
	RoomName	Varchar(50)	Not null	
	RoomType	Varchar(50)	Not null	
Device	DeviceID	Integer	Not null, unique	PK
	DeviceName	Varchar(50)	Not null	
	DeviceType	Varchar(50)	Not null	
	RoomID	Integer	Not null, FK to Room(RoomID)	
Sensor	SensorID	Integer	Not null, unique	PK
	SensorName	Varchar(50)	Not null	

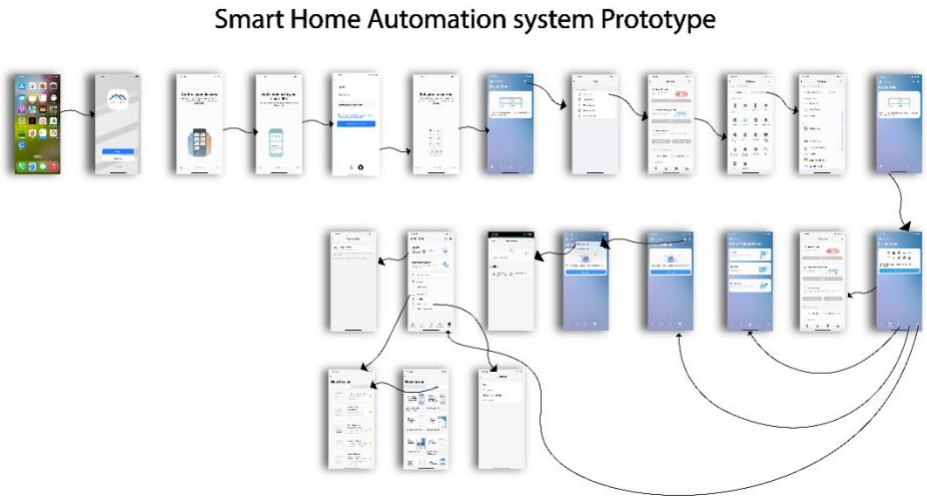
Entity Name	Attribute Name	Type/Size	Validation	Key
	SensorType	Varchar(50)	Not null	
	DeviceID	Integer	Not null, FK to Device(DeviceID)	
	RoomID	Integer	Not null, FK to Room(RoomID)	
Actuator	ActuatorID	Integer	Not null, unique	PK
	ActuatorName	Varchar(50)	Not null	
	ActuatorType	Varchar(50)	Not null	
	DeviceID	Integer	Not null, FK to Device(DeviceID)	
	RoomID	Integer	Not null, FK to Room(RoomID)	
Schedule	ScheduleID	Integer	Not null, unique	PK

Entity Name	Attribute Name	Type/Size	Validation	Key
	ScheduleName	Varchar(50)	Not null	
	ScheduleTime	Datetime	Not null	
	UserID	Integer	Not null, FK to User(UserID)	
	DeviceID	Integer	Not null, FK to Device(DeviceID)	

4.3 UI/UX Design Specification

We have selected Adobe XD, Figma , and Illustrator for Prototyping.

Prototype of Smart Home Automation Software is given below:



************************************THANK YOU************************************