Use Case Model Template
[SmartHome+]

5/8/2020

Team 21

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1. Accessibility

According to the requirements listed, the smartHome+ system shall be controlled by voice, indoor panel and remote device platform in order to enhance the accessibility. This part is about the User Interface for the SmartHome+ system.

1.1 Actor-Goal List

Actor	Goal
User	1. control the smartHome+ system by voice controller 2. control the smartHome+ system by remote device platform 3. control the smartHome+ system by indoor panel controller
Voice Controller System	1. accept the voice command of users 2. analyse the user's voice command and transform it to machine language 3. send the command to the main controller system
Indoor Panel Controller	1. provide functions menu 2. send the command to the main controller system
IoT mobile platform	1. provide functions menu 2. send the command to the main controller system 3. accept alert from security system

1.2 Use Case Model

1.2.2 Use Case Diagram

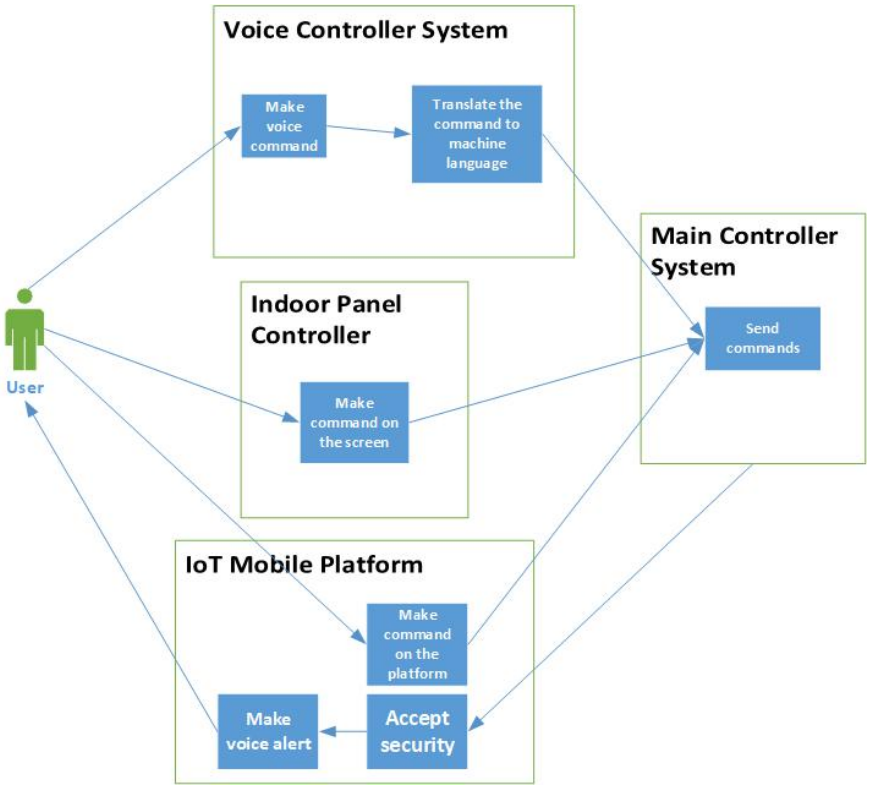

Diagram 1.1

1.2.2 Sequence Diagrams

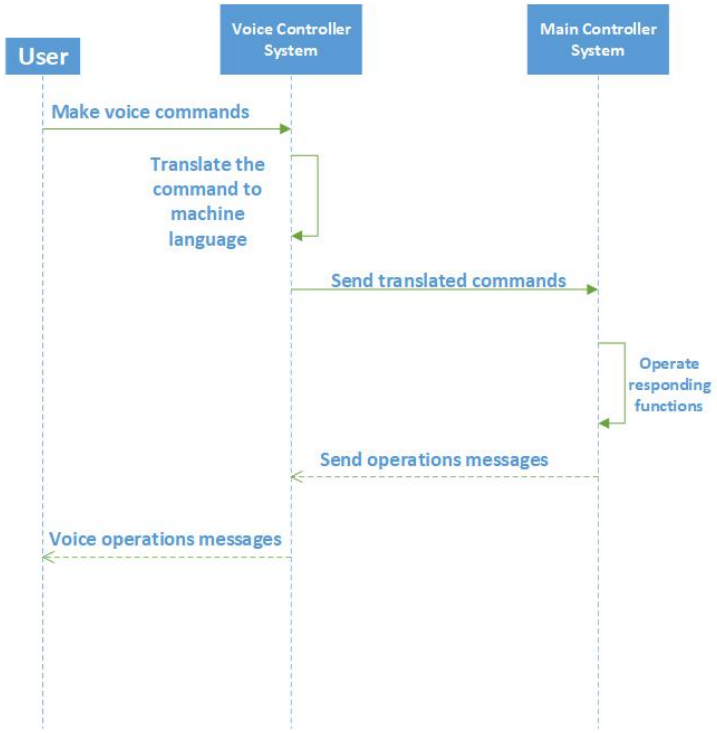

Diagram 1.2: Voice Control

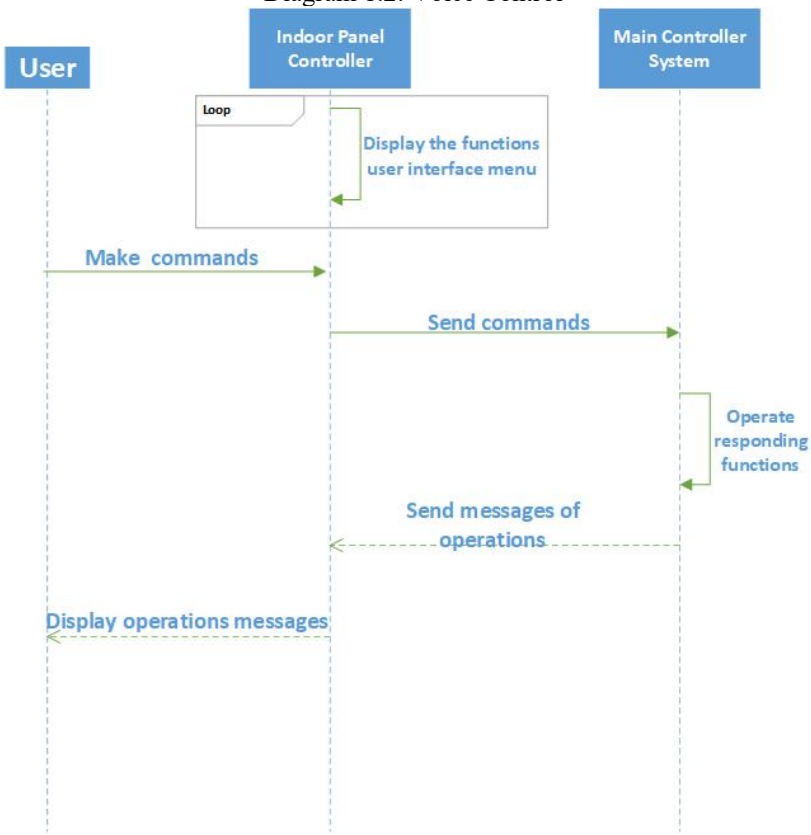

Diagram 1.3: Indoor Screen Panel Control

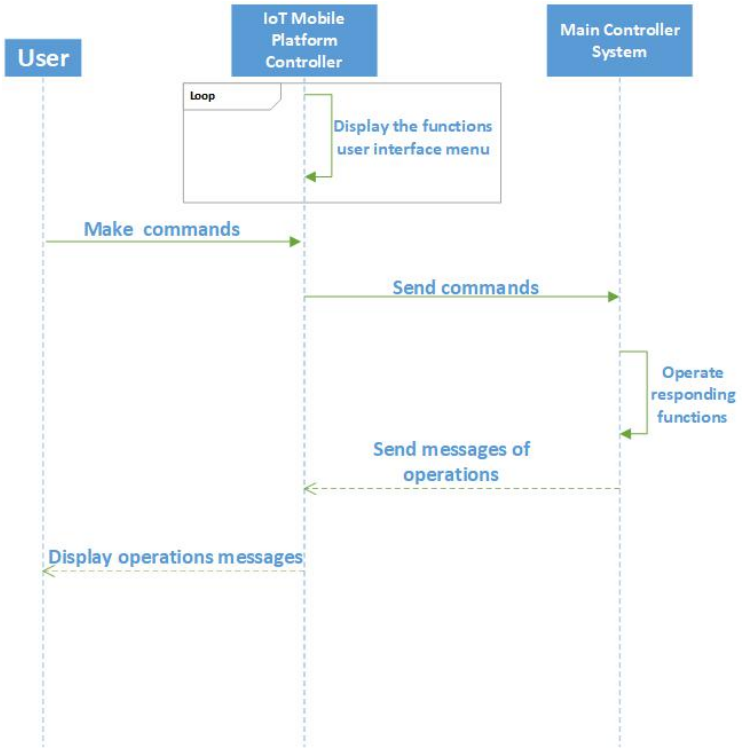

Diagram 1.4: Mobile Control

1.2.3 Activity Diagrams

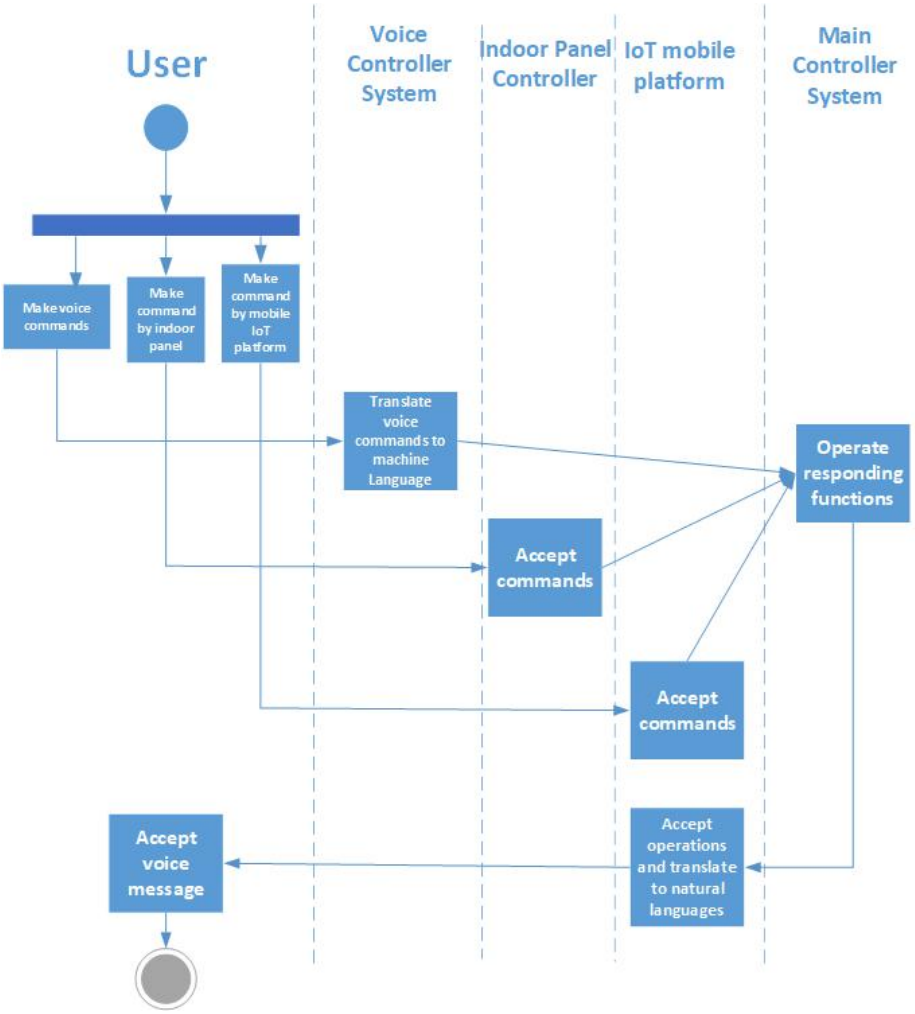

Diagram 1.5

1.2.4 State Machine Diagrams

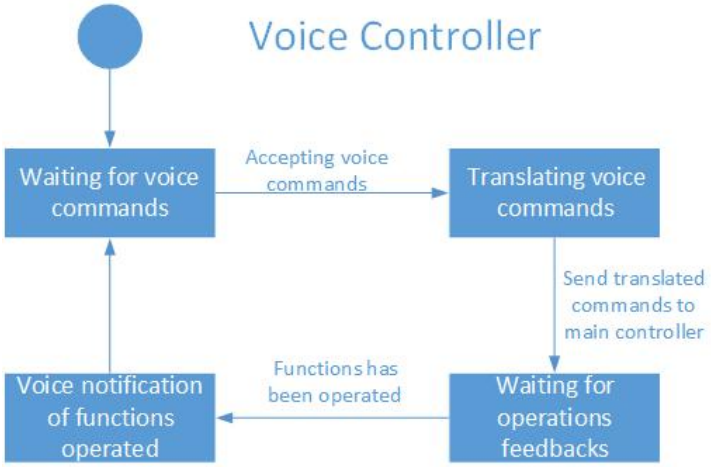

Diagram 1.6

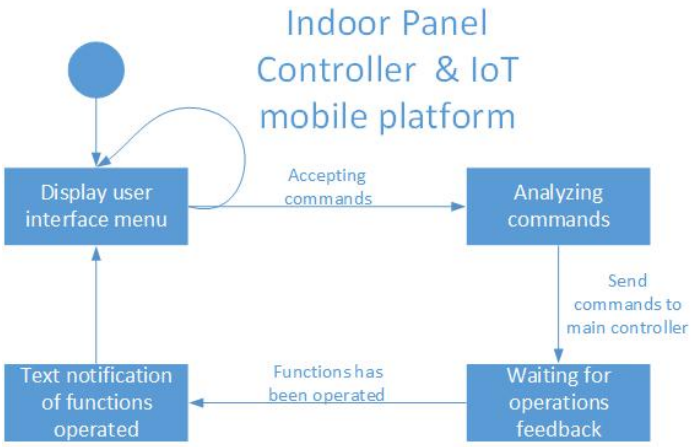

Diagram 1.7

1.3 Package: Main

Id	1.1
Use Case Name	User Interface
Level	User-level
Primary Actor	Users
Supporting Actors	Voice Controller System,Indoor Panel Controller,IoT mobile Platform, main controller
Stakeholders and Interests	User: Wants accurate, accessible operating system and fast responds
Pre-Conditions	1. user is authenticated 2. the Internet is stable 3. the system hardware is in good condition 4. the user's voice command is correct
Post Conditions	the functions operated are correct

Main Success Scenario:
1. User make voice command or choose functions on the panel/IoT mobile platform
2. the voice/panel/IoT platform analyze the command and send request to main controller
3. main controller operates corresponding functions and send feedback to the voice/panel/IoT platform system
4. voice controller system make voice messages to user. Panel/IoT platform display the successful operations/error messages to user.

Extensions:
1a: At any time, system fails:
To support user learn the specific reasons and correct the system errors:
- the system shall send error details to user
- the system records all the errors and generate a report every month

2a: insecure commands:

- If user makes insecure commands, such as the temperature set higher/lower than normal temperature, the system shall inform the user.

3a: response time:

- the response time of every command shall less than 0.5s.

Special Requirements:

1. Indoor touch screen UI on a large flat panel monitor
2. IoT mobile platform is deployed on Andriod and ios systems
3. Voice controller system shall provide user with voice guide.

2. Environmental Considerations

2.1 Actor-Goal List

Actor	Goal
Environmental System	Control windows, air purifier, air conditioning and curtains operation and provide UI functional mode for different phases
House Monitor	Regularly monitor the outside weather, inside temperature, indoor path, air condition and input message from Environmental System
Users	select function modes they want through Environmental System, manually command operation through the System

2.2 Use Case Model

2.2.1 Use Case Diagram

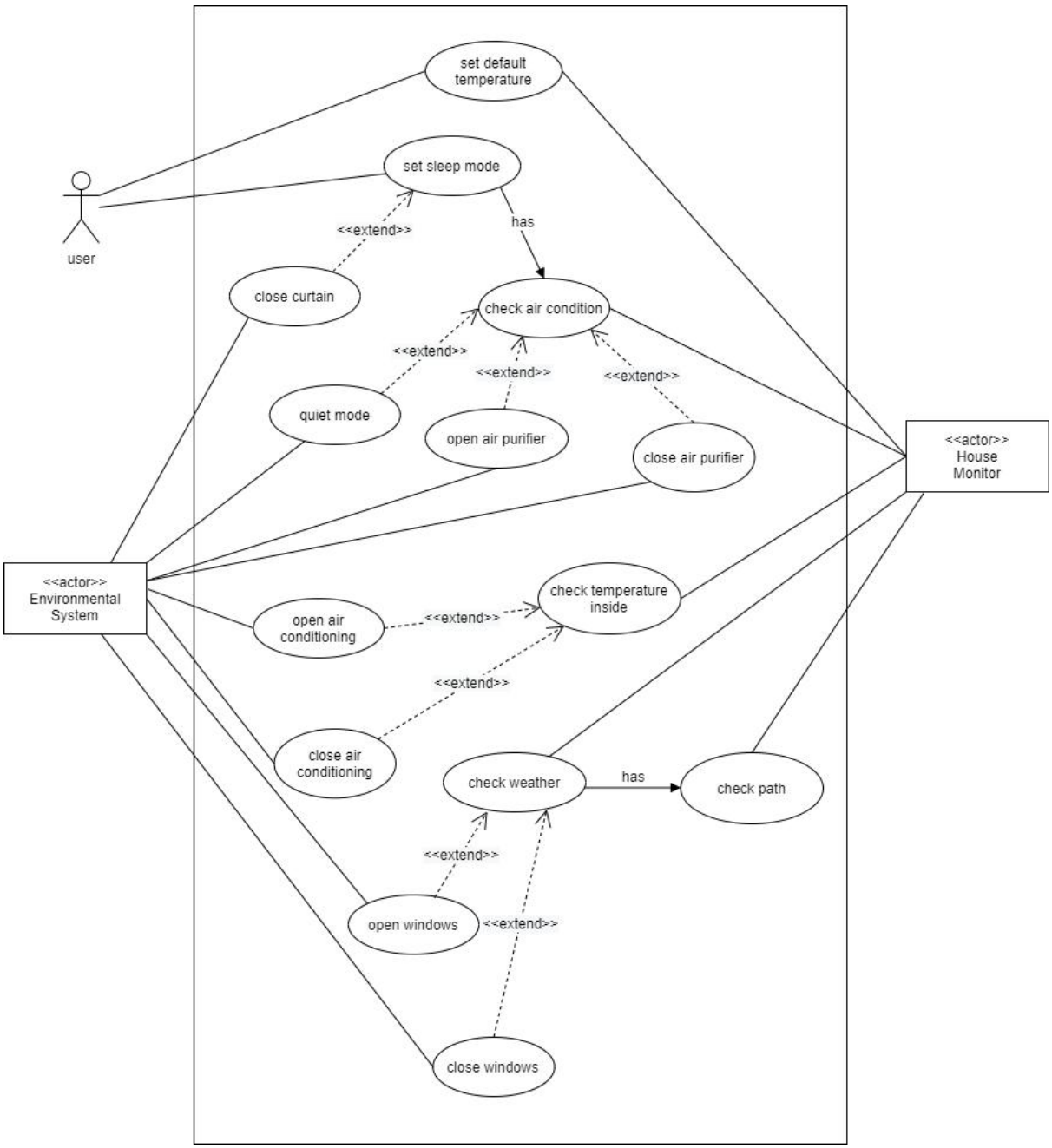

Diagram 2.1

2.2.2 Sequence Diagrams

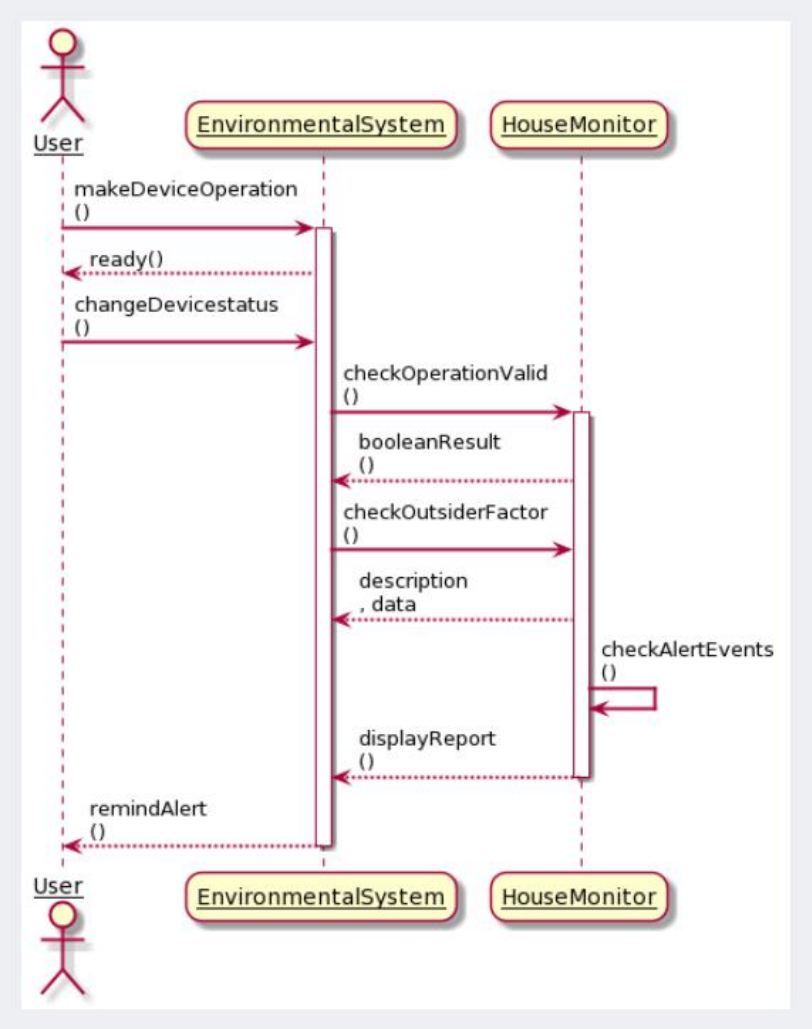

Diagram 2.2

2.2.3 Activity Diagrams

Temperature Control:

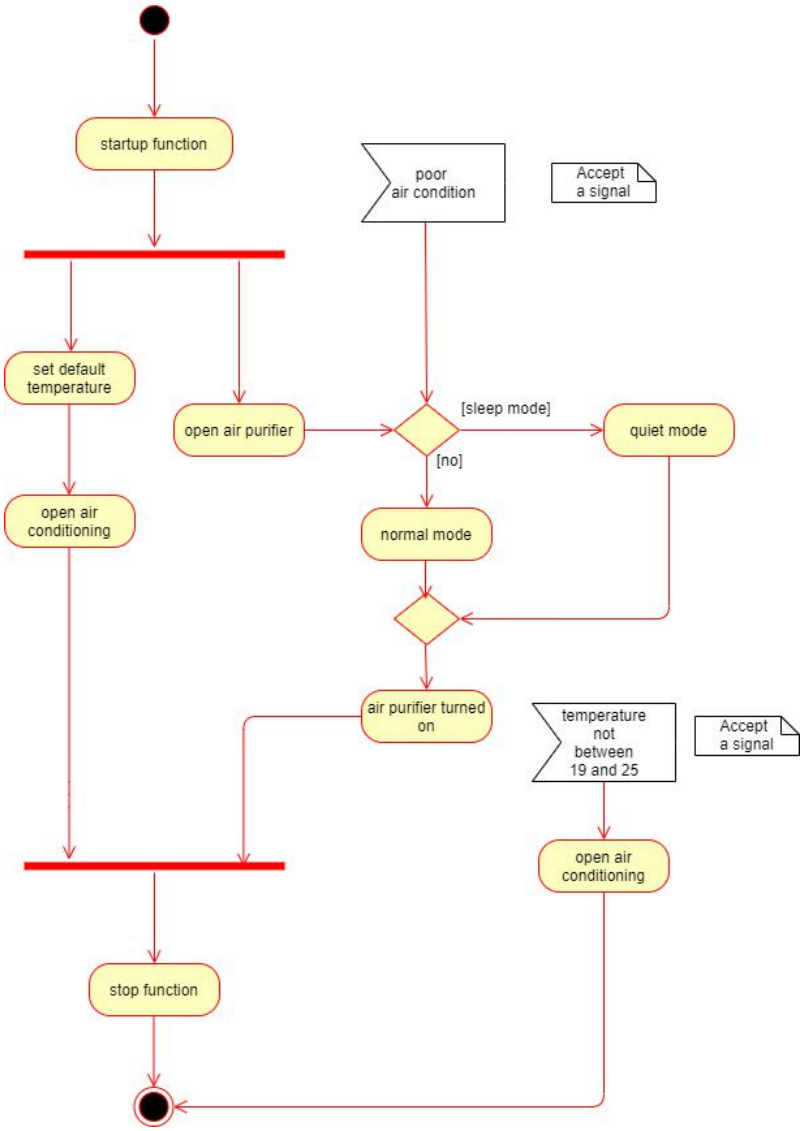

Diagram 2.3

Curtain Control:

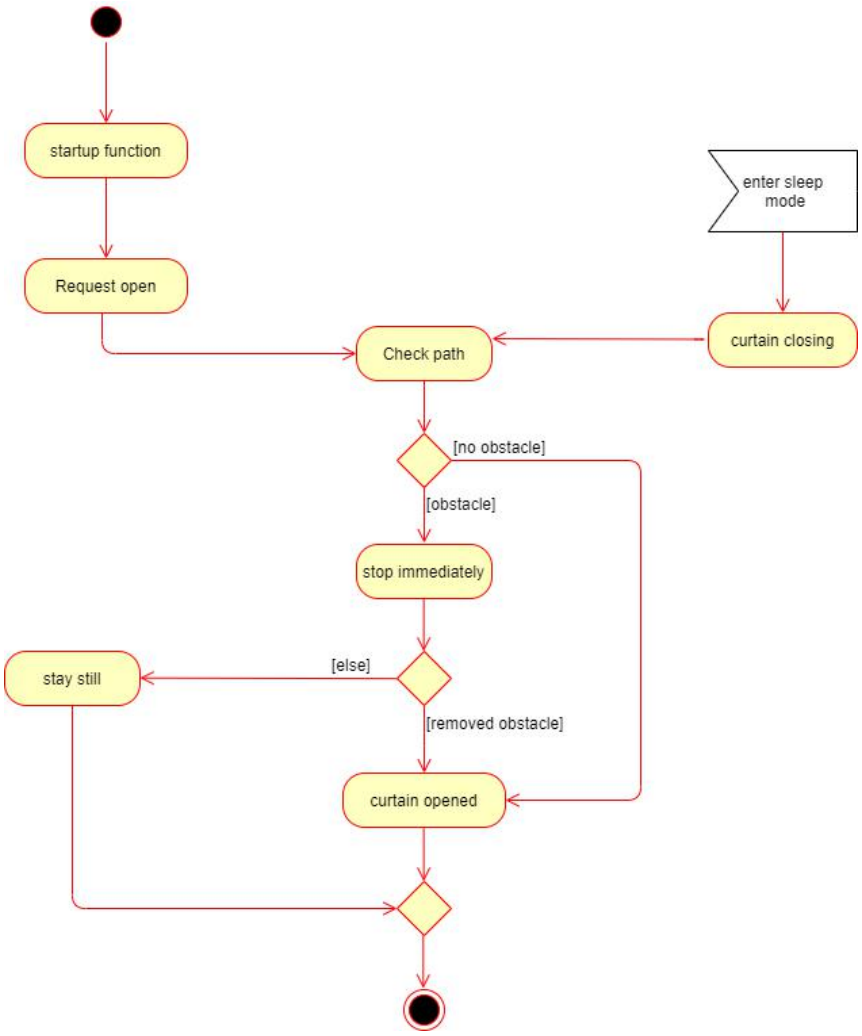

Diagram 2.4

Windows Control:

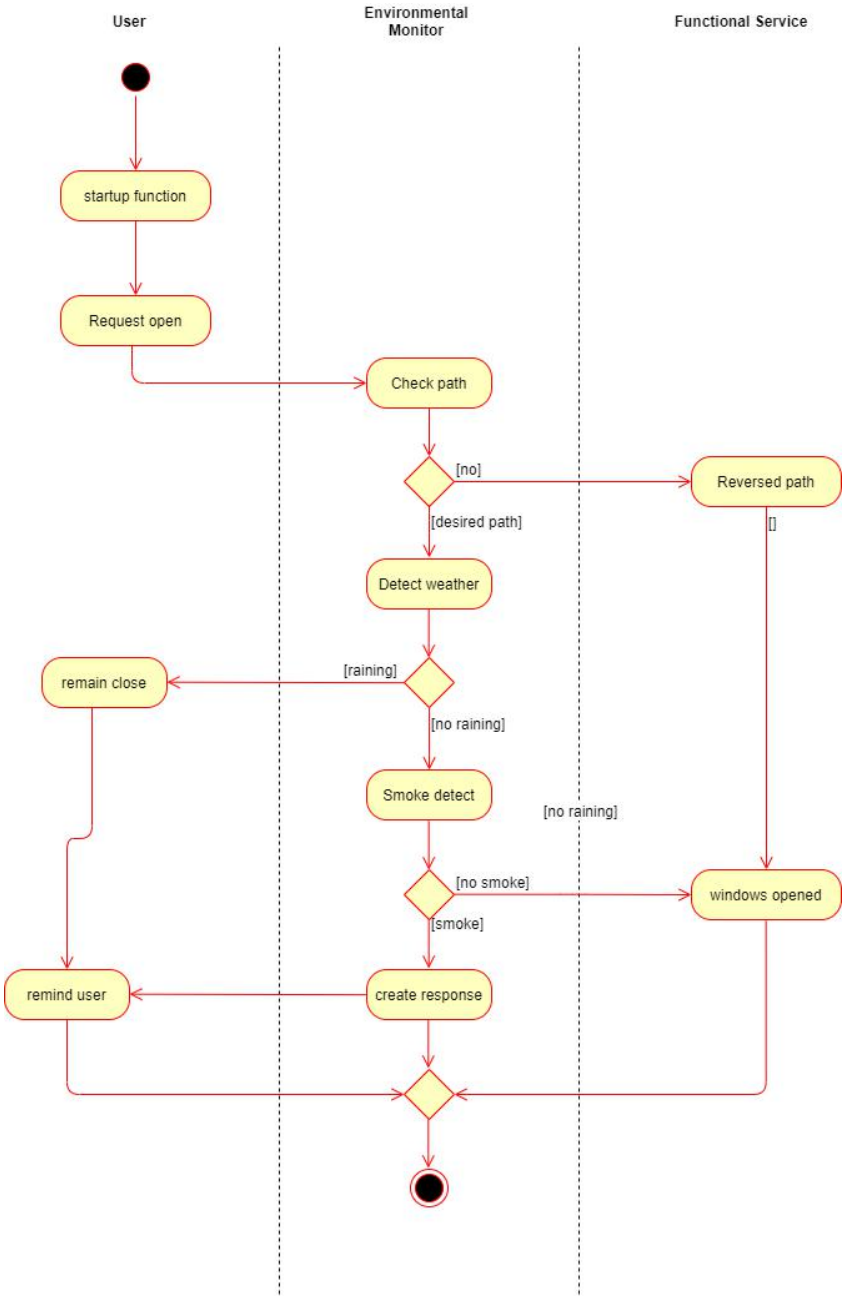

Diagram 2.5

2.2.4 State Machine Diagrams

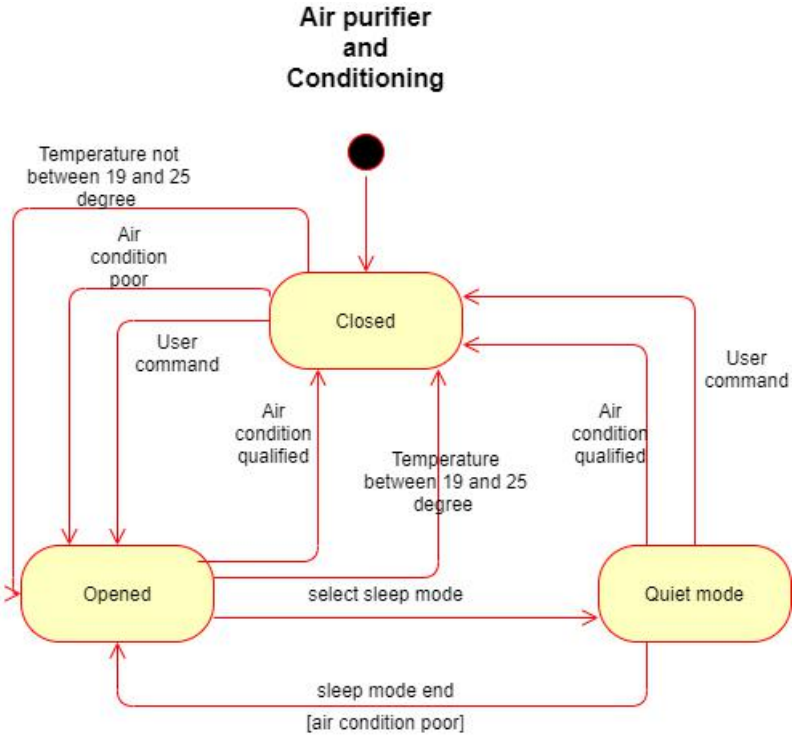

Diagram 2.6

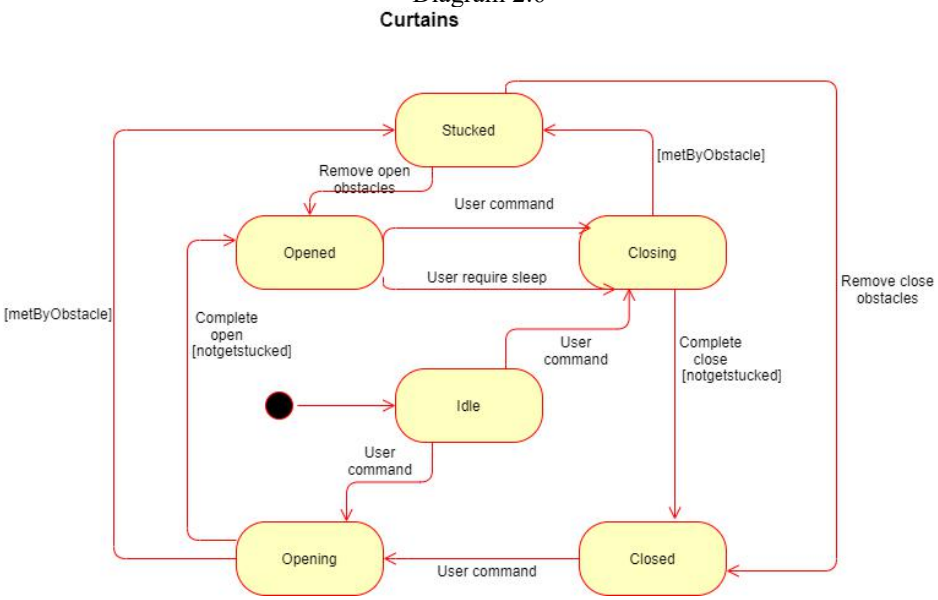

Diagram 2.7

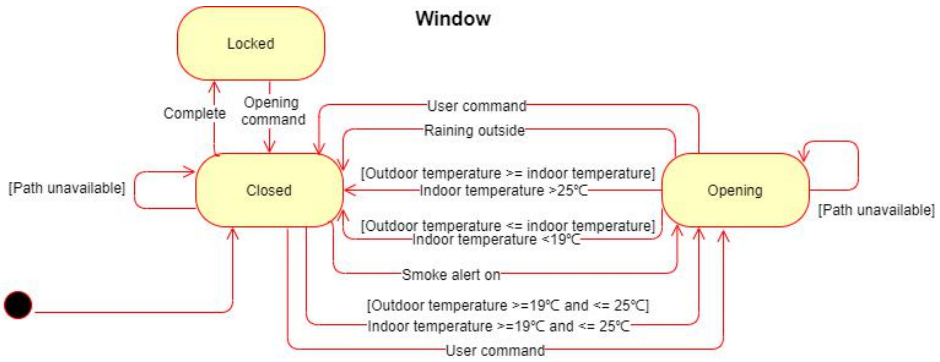

Diagram 2.8

2.3 Package: Main

Id	2.1
Use Case Name	Environmental Control
Description	Providing the most comfortable environment for Users living style, including Windows operation, temperature control adjustment, undisturbing mode control and air condition management.
Level	System-level
Primary Actor	Environmental System, Users
Supporting Actors	House Monitor
Stakeholders and Interests	**End users:** Wants accurate, automatic and no utility damage effort, as they looking for the best comfortable environment suit for them. **Service providers:** Wants to satisfy customer interests and benefit their future plan. **Device manufactures:** Wants to prolong the product life cycle by providing the most suitable environment to use them.
Pre-Conditions	End user must be inside the house and start the Smart Home system. Each device will function just fine and no need for maintenance.
Post Conditions	**Success end condition:** No damage for each of devices No alert events happen during operation **Failure end condition:** Smoke alert report Damaged devices report **Minimal guarantee:** No emergencies happened when user is not at home.

Main Success Scenario:
1. User arrives home and start up environmental system controller
2. User set their default prefer temperature on UI platform
3. Monitor check temperature inside
4. System open air conditioning
5. System request close windows
6. Monitor check desire path
7. Monitor check outside weather
8. Window controller open the window
9. Air sensor Regularly monitor air condition
10. System open air purifier
11. User select sleep mode
12. System turn air purifier to “quiet mode”

Extensions

2a: If user did not set default temperature:
- Use last time setting temperature as prefer

2b: If user did not set default temperature for over a week:
- Remind user through UI platform

3a: If temperature is between 19 and 25:
- close air conditioning

5a: If smoke alert is on:
- open the window with most priority

6a: If Monitor check the undesired path for windows
- windows should open or close in reverse way

7a: If outside is raining
- close the windows and lock it down

9a: If air condition is poor
- success execute with the step

9b: If air condition is good:
- Turn off air purifier

9c: If air condition is poor and system is in “sleep mode”
- Turn air purifier to “quiet mode”

3. Energy Efficiency

3.1 Actor-Goal List

Actor	Goal
User	choose energy-saving modes
User behaviour sensor	detect user’s condition(e.g. sleeping)
User location sensor	detect user’s location
Light sensors(indoor, outdoor)	detect the light levels
Energy-saving system	Control the energy-saving mode

3.2 Use Case Model

3.2.1 Use Case Diagram

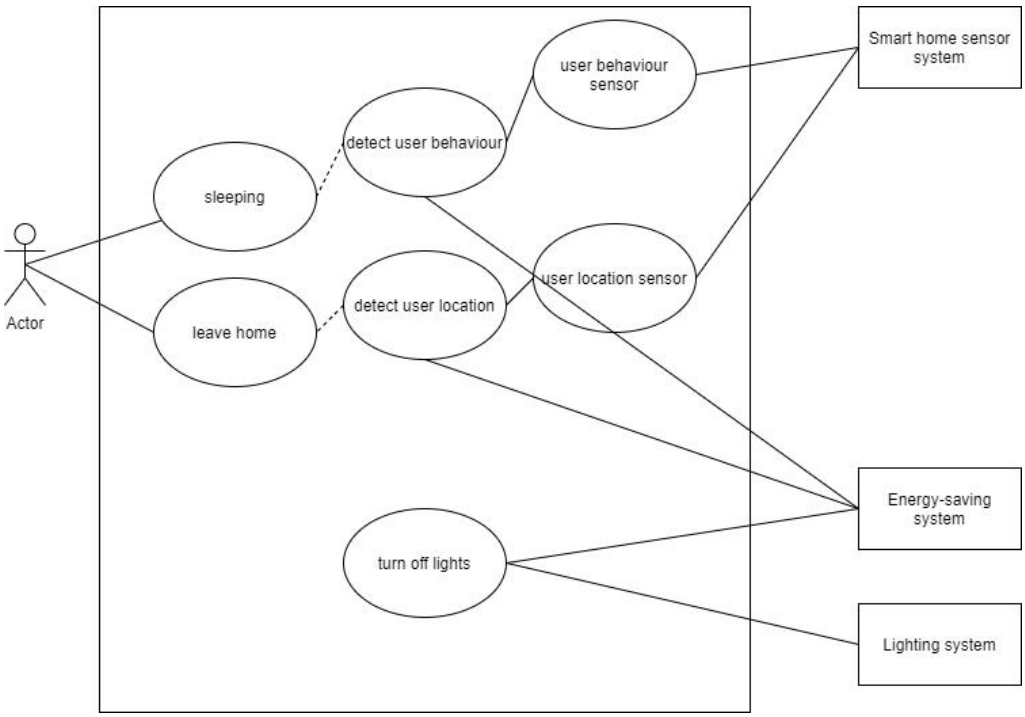

Diagram 3.1

3.2.2 Sequence Diagrams

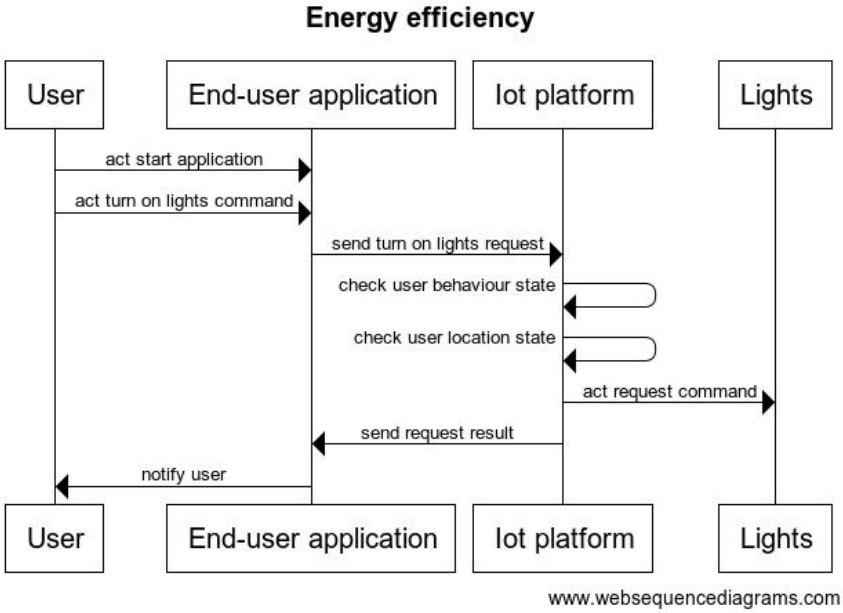

Diagram 3.2

3.2.3 Activity Diagrams

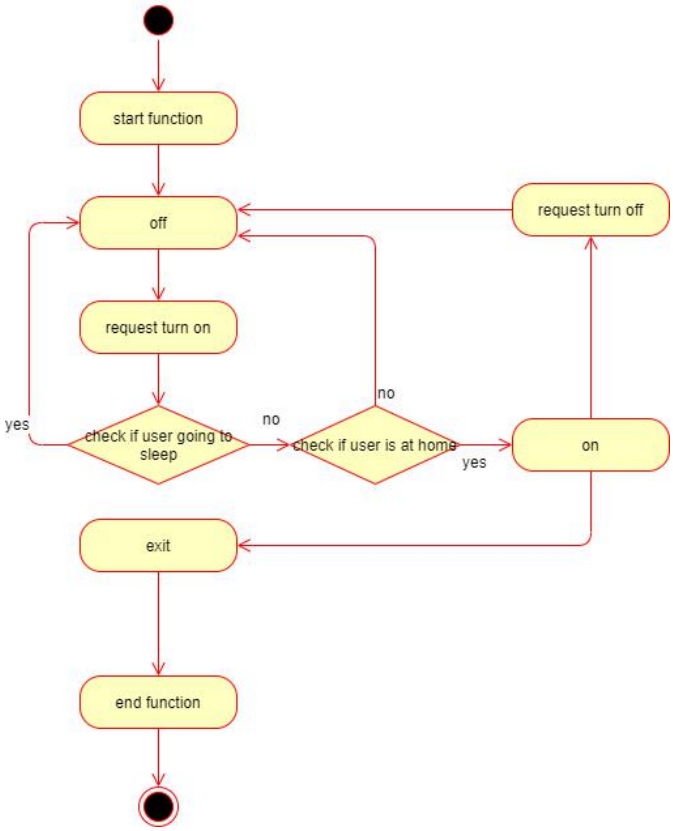

Diagram 3.3

3.2.4 State Machine Diagrams

Lights:

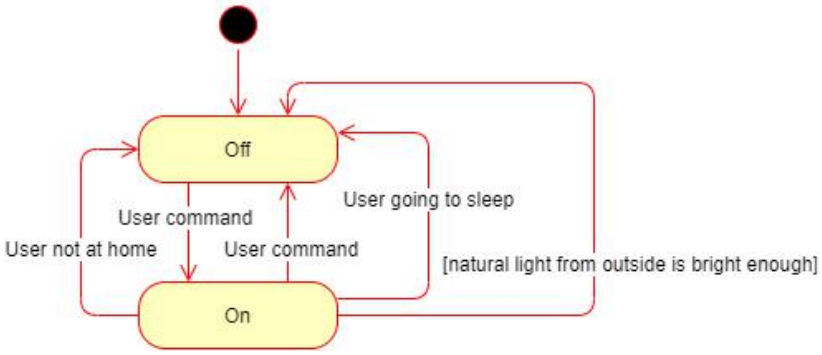

Diagram 3.4

3.3 Package: Main

Id	3.1
Use Case Name	Energy-saving
Description	When the user is sleeping, the curtain shall be closed, the lights shall be off, and the system shall keep the environment quiet enough. The energy-saving system shall turn off all the lighting when the users are not at home and the light shall be off if the natural light from outside is bright enough.
Level	User-level
Primary Actor	User
Supporting Actors	Energy-saving system, Light system
Stakeholders and Interests	User: Want to reduce energy waste. Energy-saving system: Want to save energy in some conditions.
Pre-Conditions	The Smart-Home+ system is operating normally, with the internet and electricity. Energy-saving system is working properly.
Post Conditions	**Success end condition:** When the user is sleeping, when the users are not at home and the natural light from outside is bright enough, the lights shall be off. **Failure end condition:** When the user is sleeping, when the users are not at home and the natural light from outside is bright enough, the lights are still on. **Minimal guarantee:** No energy waste for lighting system when user is not at home.

When the user is sleeping, the curtain shall be closed, the lights shall be off, and the system shall keep the environment quiet enough.
The energy-saving system shall turn off all the lighting when the users are not at home and the light shall be off if the natural light from outside is bright enough.

Main Success Scenario:
1. If users are sleeping, the Energy-saving system gets the user behaviour status from the user behaviour sensor, and then sends requests to the light system to turn off all the lights.
2. If users are not at home, the Energy-saving system sends requests to the light system to turn off all the lights.
3. The Energy-saving system sends requests to the light system to turn off all the lights if the natural light from outside is bright enough.

4. Security

4.1 Actor-Goal List

Actor	Goal
water/gas leakage detecting system	1. detect water/gas leakage 2. send the leakage report to alert system 3. send request of closing water/gas valves to security controller system
fire detecting system	1. detect smoke and fire 2. send the leakage report to alert system
security video monitor system	1. monitor the entrances of the house 2. send report if illegal break-in monitored
Alert system	1. accept reports 2. make alarming 3. send alert to users/authorized third party
User/authorized party	1. accept alert and alarming from alert system
security controller system	1. close water/gas valve 2. lock the windows and doors when they are closed

4.2 Use Case Model

4.2.1 Use Case Diagram

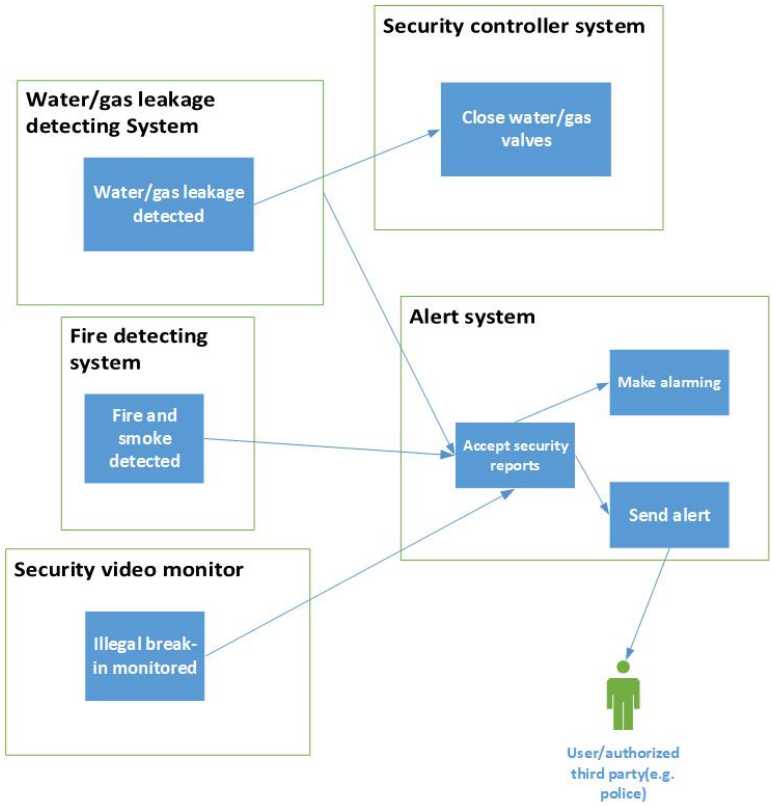

Diagram 4.1

4.2.2 Sequence Diagrams

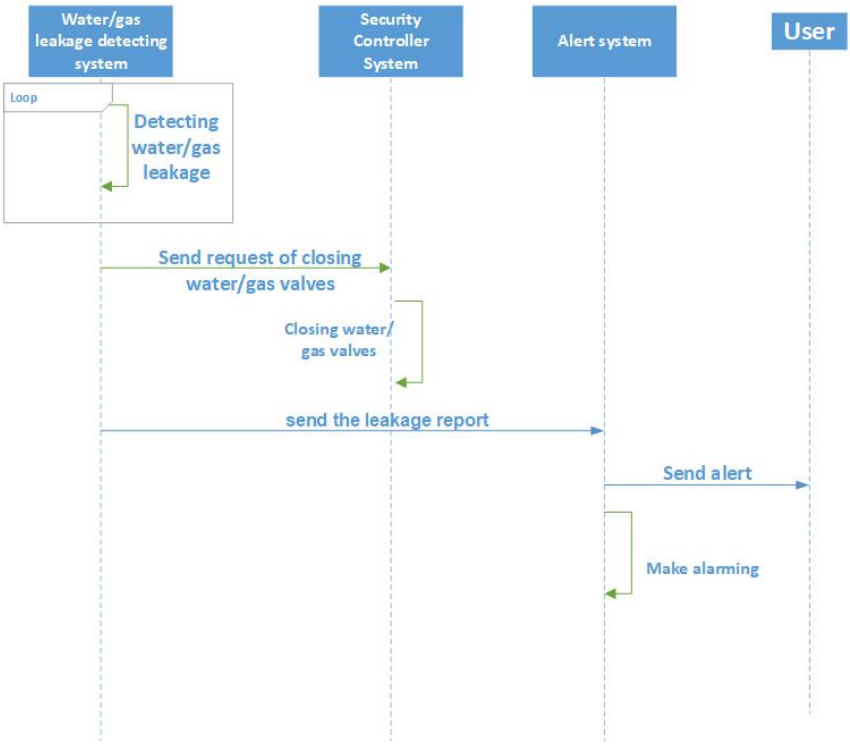

Diagram 4.2

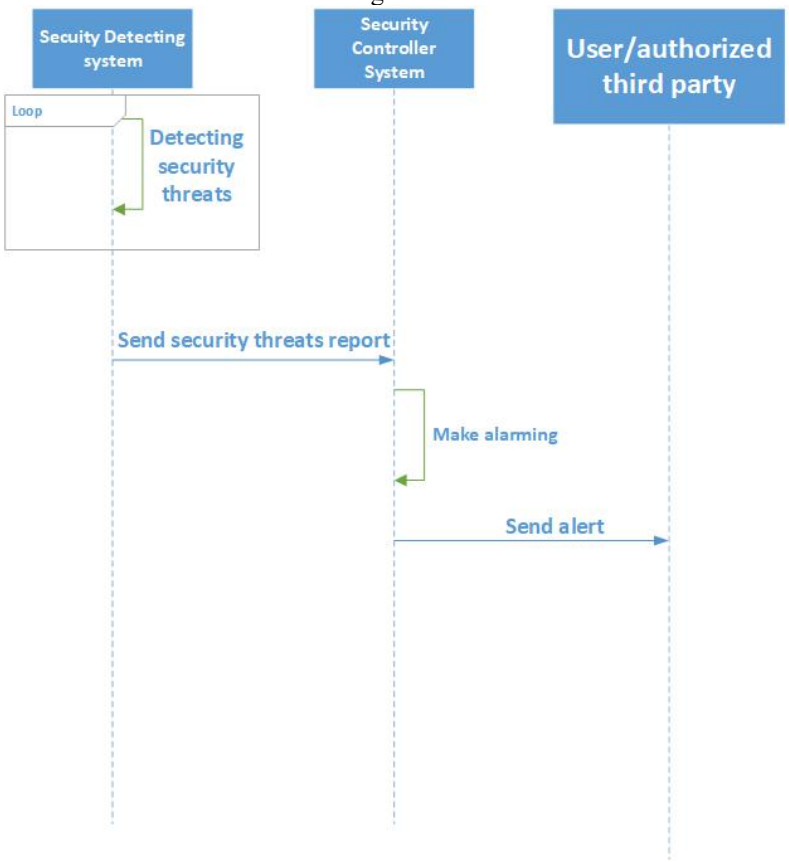

Diagram 4.3

4.2.3 Activity Diagrams

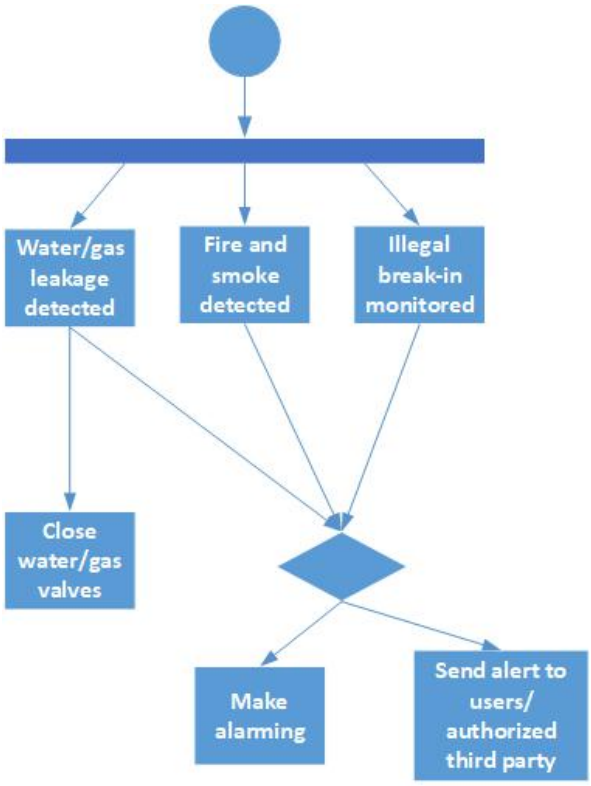

Diagram 4.4

4.2.4 State Machine Diagrams

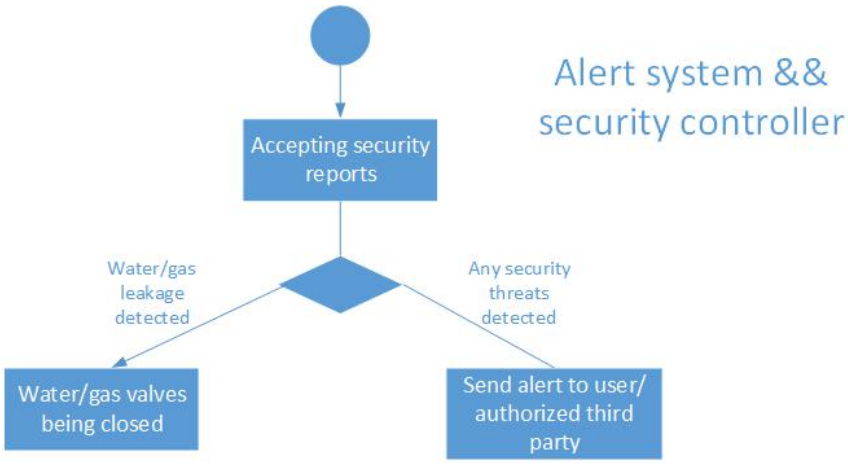

Diagram 4.5

4.3 Package: Main

Id	4.1
Use Case Name	Security System
Level	System-level
Primary Actor	Alert system
Supporting Actors	water/gas leakage detecting system, fire detecting system, security video monitor system, Alert system, security controller system
Stakeholders and Interests	user: wants security system to inform user security threats in time to guarantee properties safety and their own safety.
Pre-Conditions	1. Internet is stable 2. hardware is on good condition 3. users' telecommunication devices is connected
Post Conditions	the functions operated are correct

Main Success Scenario:
1. water/gas leakage detecting/fire detecting/security monitor system detect security threats
2. Alert system inform users the security threats and make alarming
3. security controller system close water/gas valves when water/gas leakage detected

Extensions :
2a: User shall set another authorized person as a emergency contact.

Special Requirements:
1. the security system shall keep working all the time.
2. emergency devices(e.g. fire extinguisher) shall be equipped with the security system

5. Media and Entertainment

5.1 Actor-Goal List

Actor	Goal
User	Manage Entertainment Modes
Media and Entertainment Controller	Operate corresponding functions by controlling media and entertainment devices(e.g. TV)

5.2 Use Case Model

5.2.1 Use Case Diagram

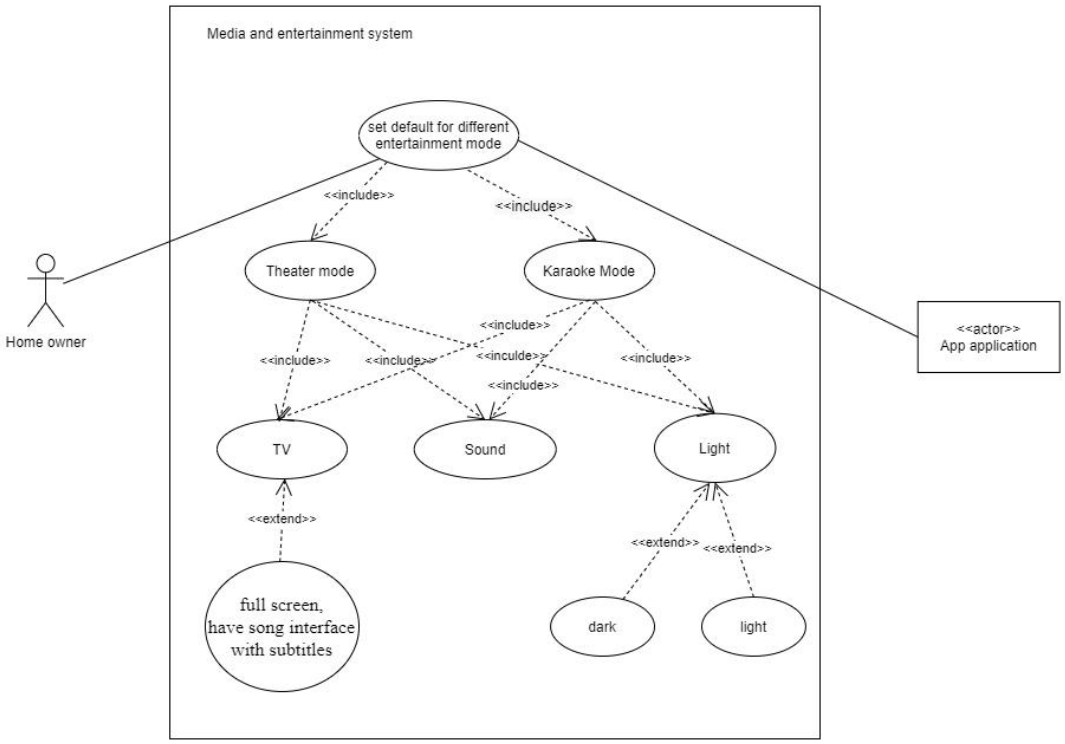

Diagram 5.1

5.2.2 Sequence Diagrams

User interaction with the smart home system scenario

I. User set states inputs for TV, Sound and Light data, which is accepted and stored in the IoT platform's database.

II. As for the end-user applications, the user set states inputs. Then, the application will request data from the platform, perform analysis, accept and store, and the results will be sent back to the user. Then, the user can request an action from the system. For example, to turn on the TV/Sound system, and obtain confirmation about these actions through the platform or directly from the analyze application.

III. The steps for requesting an action to the TV, Sound and Light are the following:

1. User request an action from the TV, Sound and Light to an end-user application
2. End-user application sends the action request to the IoT platform providing the device id.
3. IoT Platform sends the action request to the TV, Sound and Light.
4. The TV, Sound and Light set themselves.
5. The E-Node sends a confirmation message to the IoT Platform
6. IoT platform sends confirmation message to end-user application
7. End-user application sends confirmation message to user

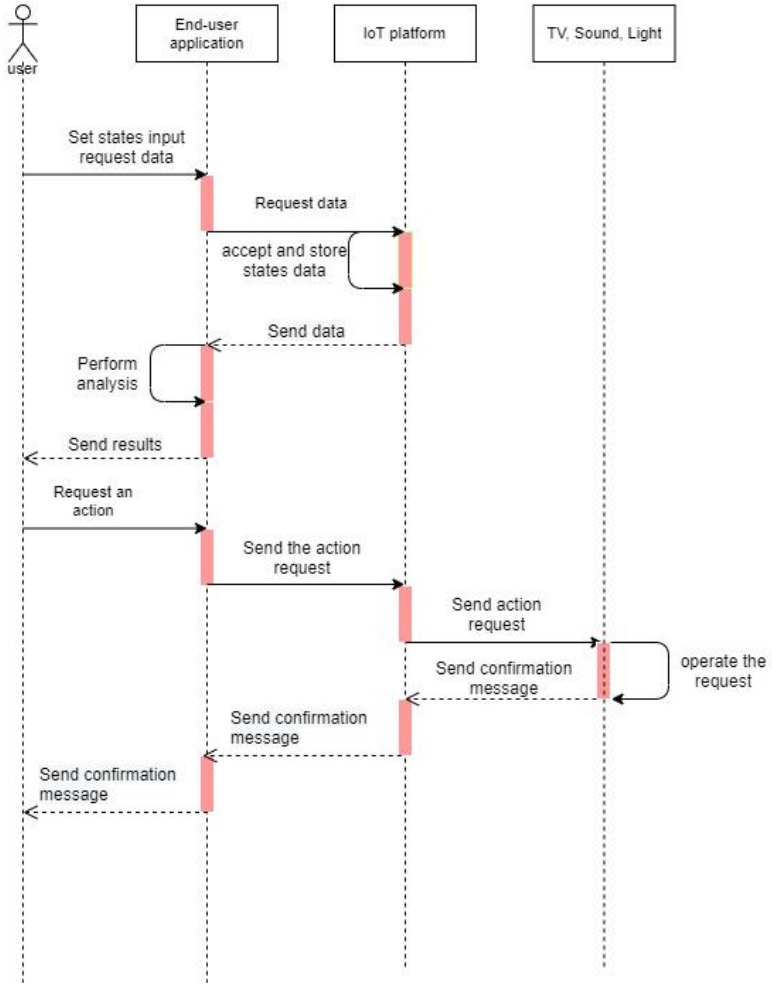

Diagram 5.2

5.2.3 Activity Diagrams

1. System shall set states for TV, Sound and Light when they are open for entertainment.

2. System shall accept user input for setting the state of the TV, Sound and lights.

3. System shall allow users to start the system.

4. System shall start the TV, Sound and lights.

5. Alert messages shall be sent if fails when starting TV, Sound and lights

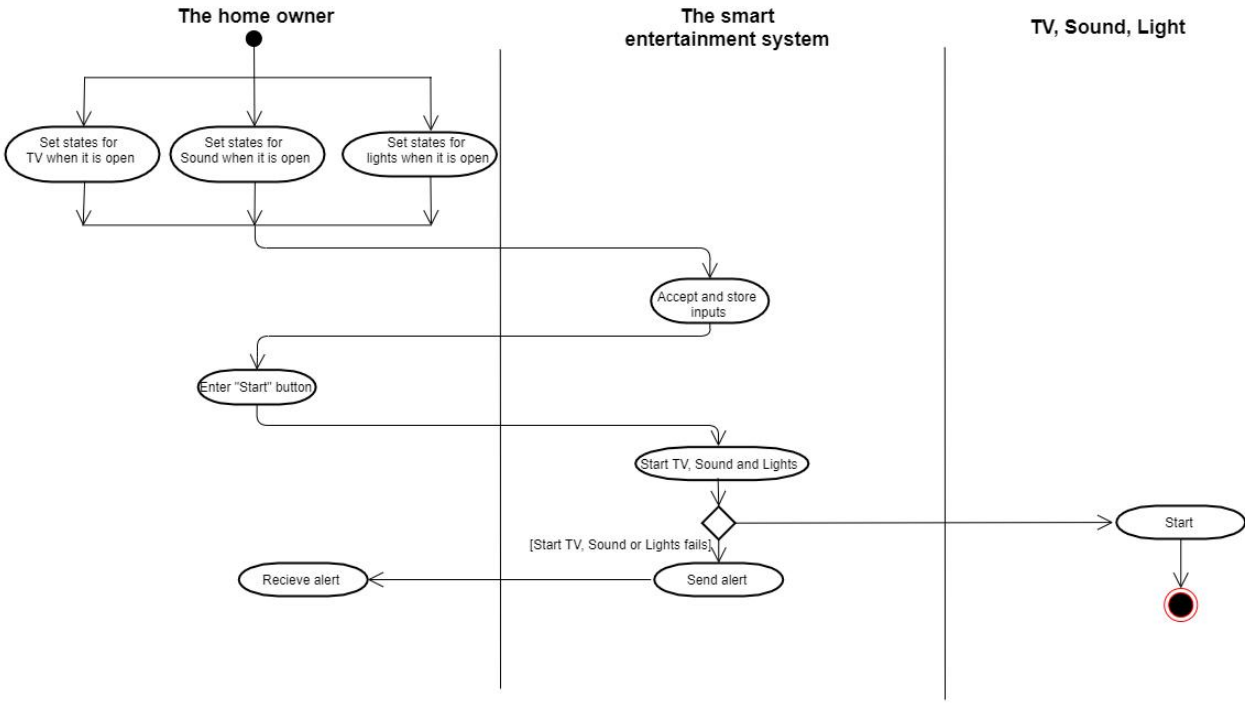

Diagram 5.3

5.2.4 State Machine Diagrams

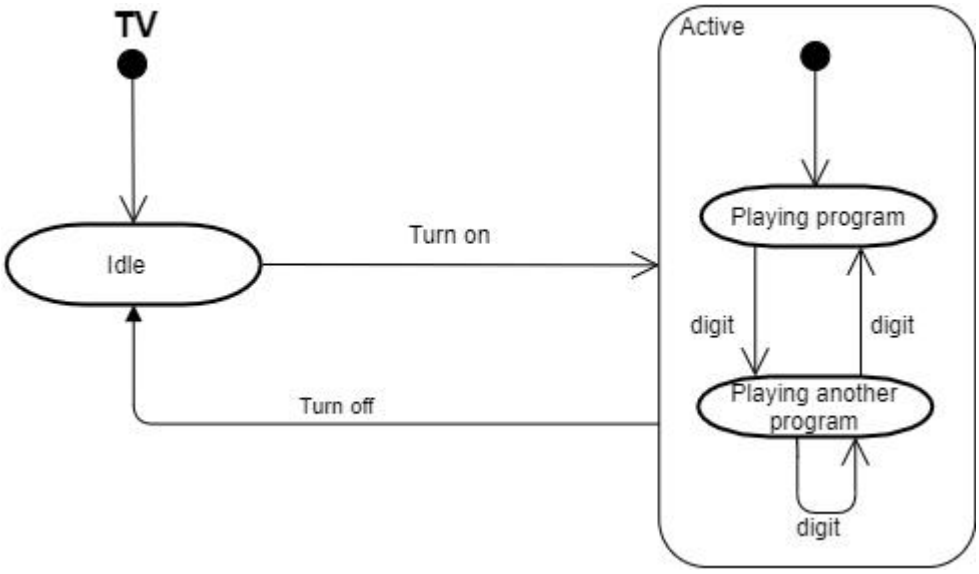

Diagram 5.4: TV State Machine Diagram

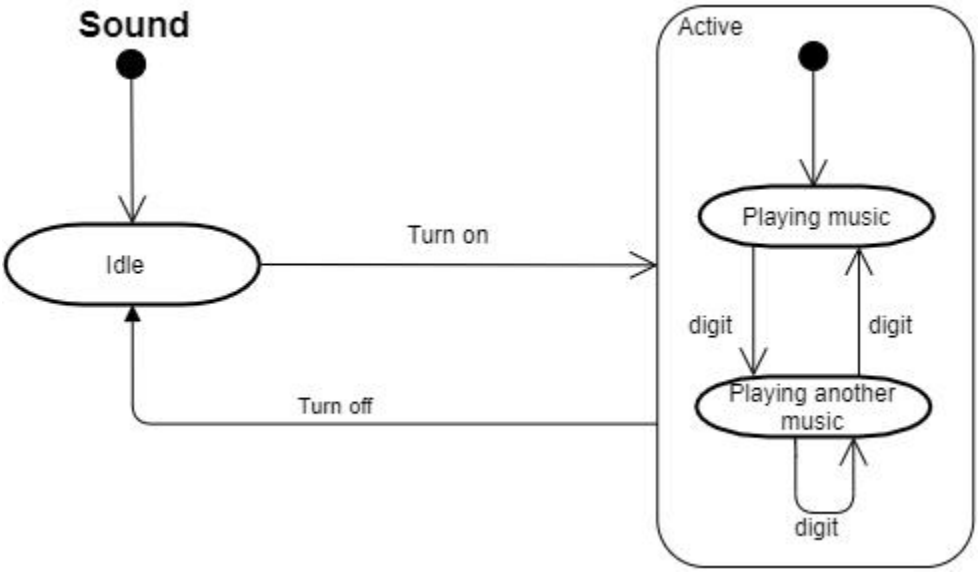

Diagram 5.5: Sound State Machine Diagram

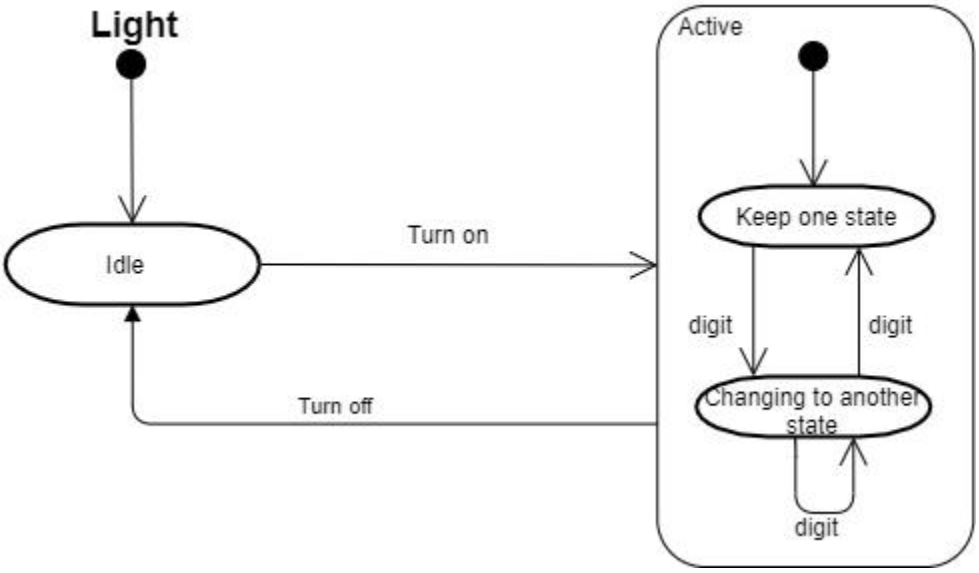

Diagram 5.6: Lighting State Machine Diagram

5.3 Package: Main

Id	5.1
Use Case Name	The family karaoke
Description	Users set the states of TV, Sound and Lights when the karaoke mode starts. Users use karaoke mode. Users play karaoke mode. Users end karaoke mode.
Level	User-Goal
Primary Actor	Home user
Supporting Actors	App application
Stakeholders and Interests	Home users: use karaoke mode when they want to have fun.
Pre-Conditions	The App application has authorized the TV, Sound and Light. There is no damage in the TV, Sound, Light. The TV, Sound, Light are connected with the Internet and the IoT platform.
Post Conditions	**Success end condition:** The TV, Sound, Light are turned on. **Failure end condition:** The TV, Sound, Light fail to turn on.
Success end condition	The TV, Sound, Light are turned on in proper mode when the user uses karaoke mode.

Failure end condition:	The TV, Sound or Light is not turned on when the user starts karaoke mode.

Main Success Scenario:
1. Users set the start screen of the karaoke mode of TV on app application to full screen, add the song interface with subtitles.
2. Users set the stereo will turn on automatically when the karaoke mode starts on app application. Users set the light will turn dark automatically when the karaoke mode starts on the app application.
3. Users press the " Start" button on the app application.
4. The TV, Sound, Light are turned on as set before.
5. Users have fun.
6. Users press the " End" button on the app application.

Extension:
1a: If the TV, Sound or Light are in damage, the application will inform users and ask for an alternative.
1b: If the TV, Sound or Light do not have access to the internet, the application will inform users.

6. Housework Automation

6.1 Actor-Goal List

Actor	Goal
User	Select automatic housekeeping tasks
Pet feeder	Feed pets according to user preset timing
Crib	Taking care of the baby to sleep
Washing machine	Complete the laundry task at the time preset by the user
coffee machine	Automatically complete coffee making tasks according to user presets
Baby monitor	Monitor infant status and health data
User location sensor	Monitor the user's location at home

6.2 Pet feeding

6.2.1 Use Case Model

6.2.1.1 Use Case diagram

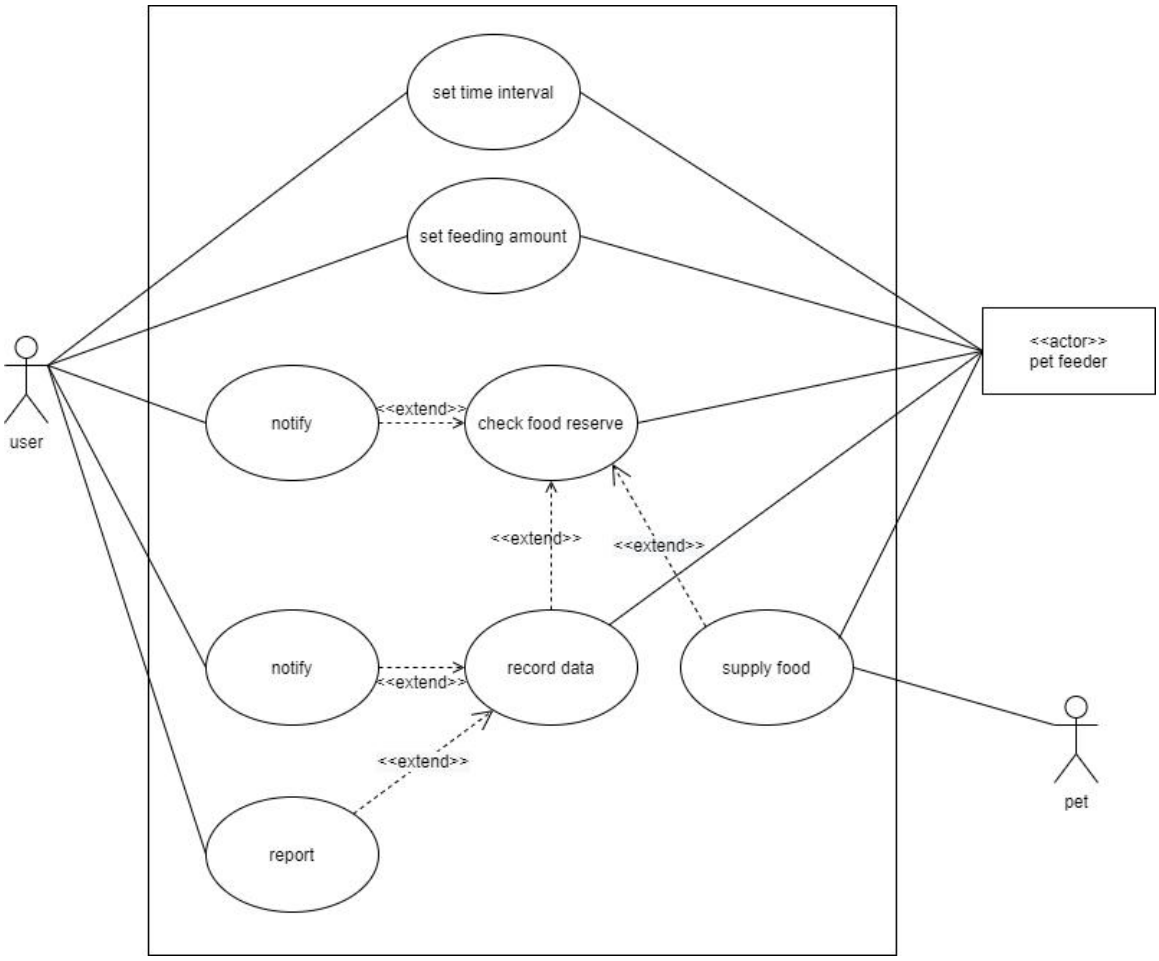

Diagram 6.1.1

6.2.1.2 Sequence diagrams

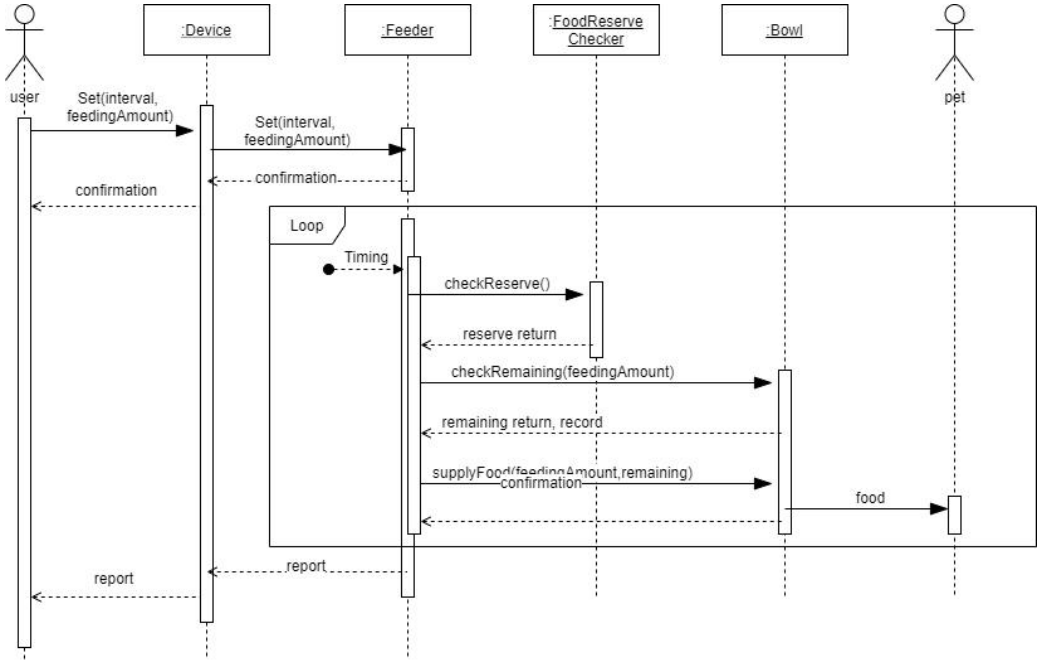

Diagram 6.1.2

6.2.1.3 Activity diagrams

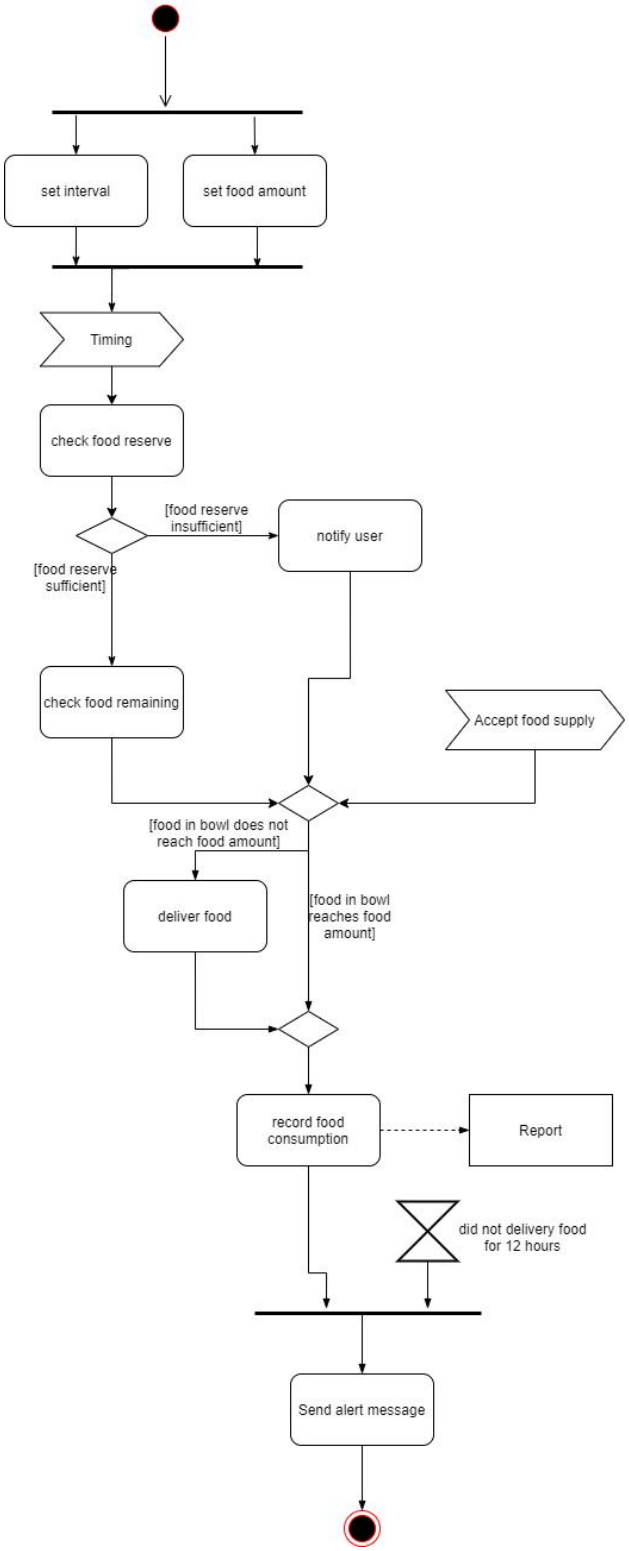

Diagram 6.1.3

6.2.1.4 State Machine diagrams

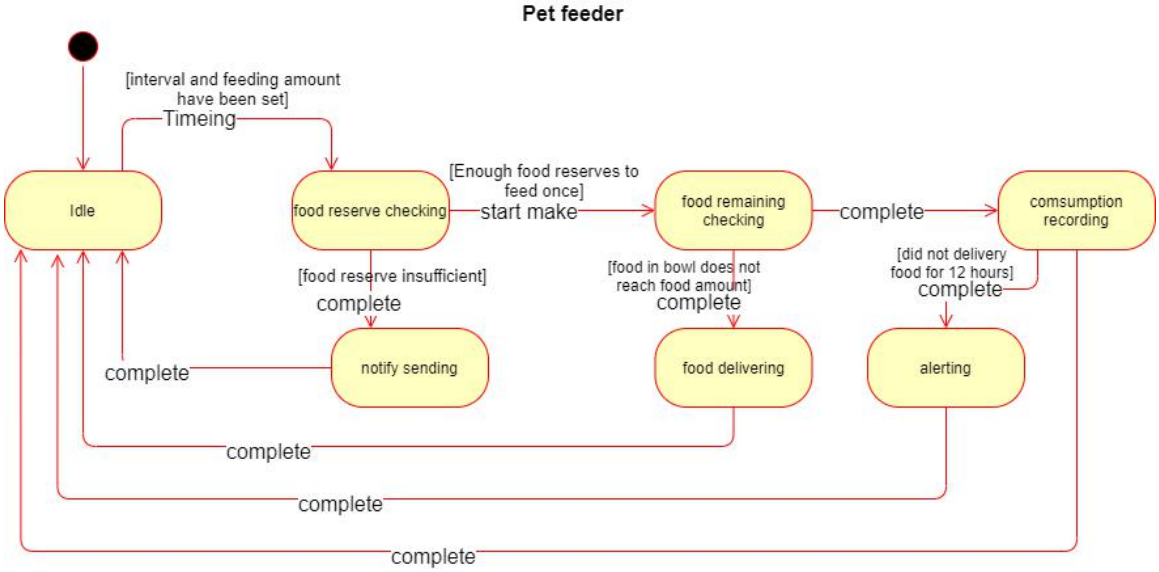

Diagram 6.1.4

6.2.2 Package: Main

Id	6.1
Use Case Name	Pet feeding
Description	The user can set the time interval and feeding amount of each feeding. The pet feeder regularly feeds pets and sends notifications to users when the food is less than the amount of food fed in a day. An alert is issued to the user when the pet has not eaten for more than 12 hours. And send pet health reports to users every week.
Level	User-level
Primary Actor	User
Supporting Actors	Pet feeder, pet
Stakeholders and Interests	User: Wants to feed pets automatically, and know the status of pets. Pet: Wants to get food and keep healthy. Pet feeder: Want to complete the task of feeding pets.
Pre-Conditions	The Smarthome+ system is operating normally, with the internet and electricity. Keep pets in the user's home.
Post Conditions	**Success end condition:** The pet eats normally, and the eating data is recorded in the report. **Failure end condition:** The pet is not eating normally, and the feeder sends an alert to the user.

Main Success Scenario:
1. The user sets the time interval and feeding amount of each feeding.
2. The pet feeder checks the food reserve and sends a notification to the user when it is less than the daily feeding amount.
3. The pet feeder checks whether there is food left, and feeds the pet regularly according to the feeding amount and the remaining amount.
4. Pet eats food.
5. The pet feeder records the pet's eating data.
6. The pet feeder sends a pet health report to the user every week.

Extensions:
3a: Food is not enough to one feeding and the user has not supplied food to the feeder.
3b: An alert is issued to the user when the pet has not eaten for more than 12 hours.

6.3 Baby care

6.3.1 Use Case Model

6.3.1.1 Use Case Diagram

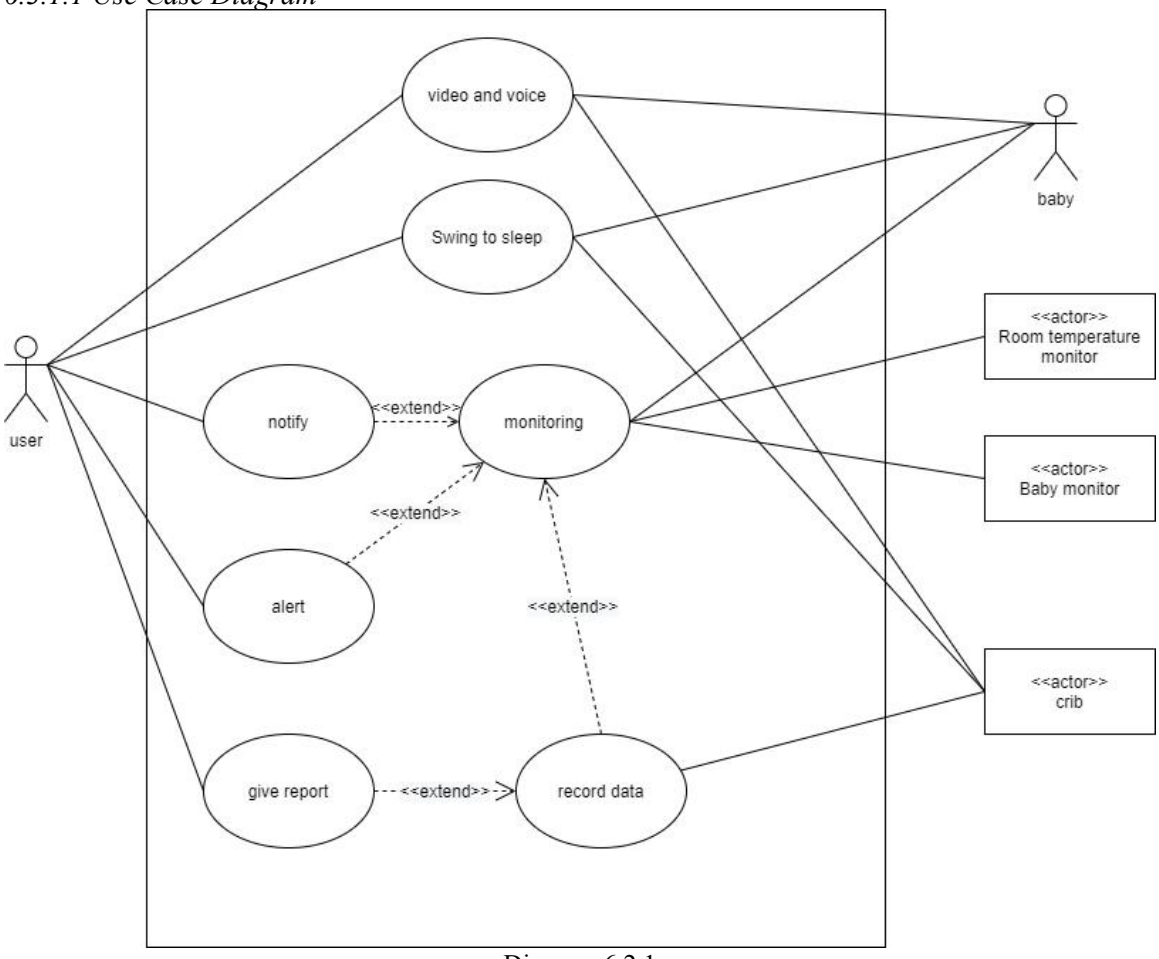

Diagram 6.2.1

6.3.1.2 Sequence Diagrams

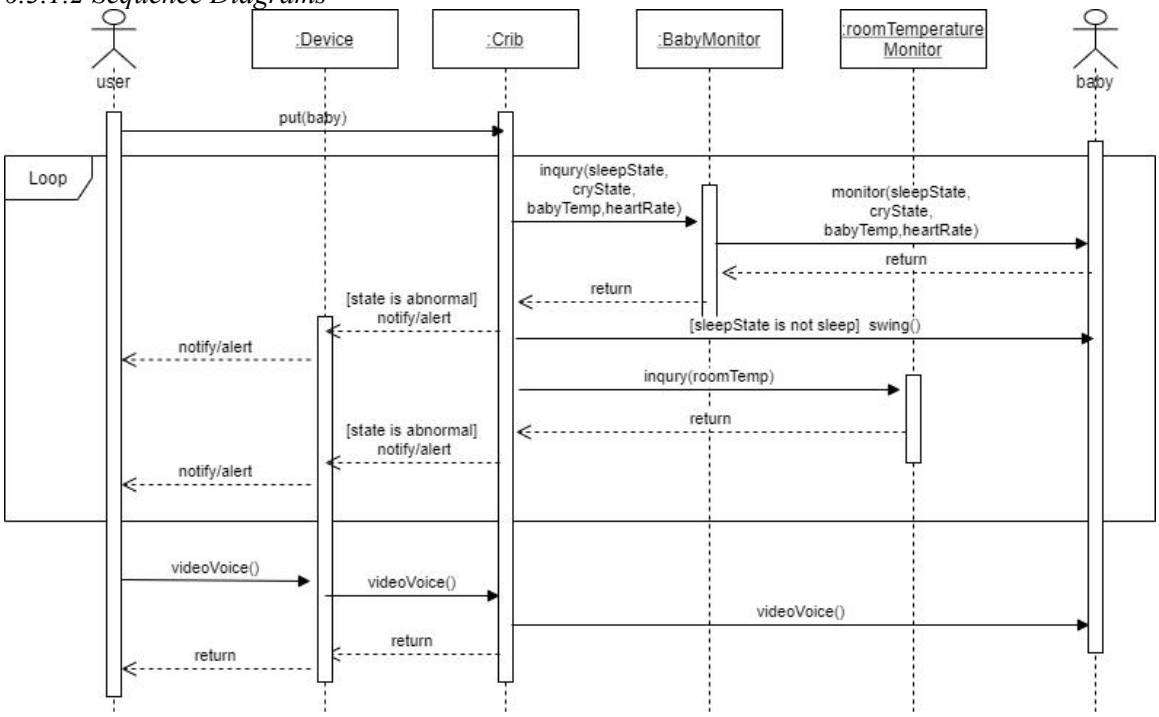

Diagram 6.2.2

6.3.1.3 Activity Diagrams

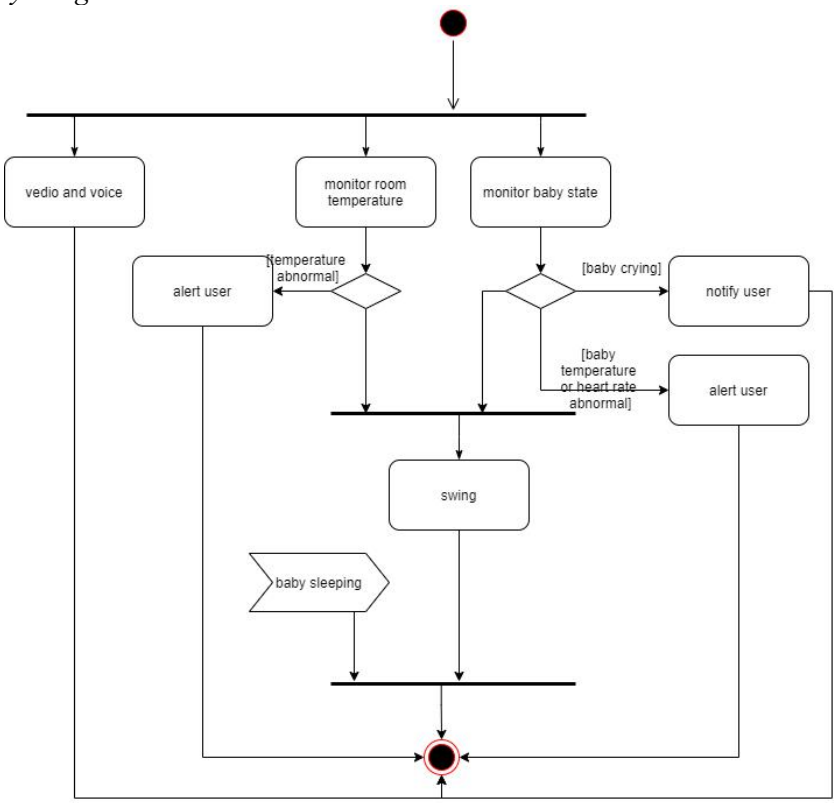

Diagram 6.2.3

6.3.1.4 State Machine Diagrams

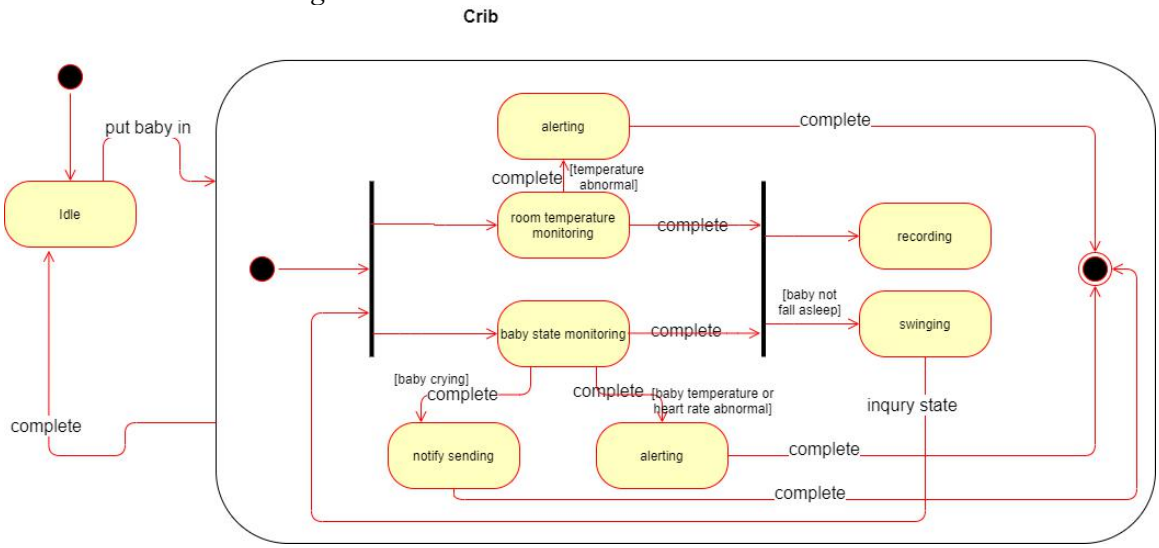

Diagram 6.2.4

6.3.2 Package: Main

Id	6.2
Use Case Name	Baby care
Description	The crib automatically swings to sleep the baby. Users can accompany the baby with remote video and voice. When a baby wets the bed, the baby's body temperature or heart rate is abnormal, or the room temperature is abnormal, the crib sends an alert to the user. When the baby is crying, the crib can automatically swing to soothe the baby and send a notification to the user. The crib sends users the baby's health data every week.
Level	User-level
Primary Actor	User
Supporting Actors	Crib, baby, Baby monitor, Room temperature monitor
Stakeholders and Interests	User: Wants to accompany the baby, and keep abreast of the baby's condition to ensure the baby's safety. Baby: Wants a comfortable sleeping environment. Crib: Want to complete the task of taking care of the baby.
Pre-Conditions	The Smarthome+ system is operating normally, with the internet and electricity.
Post Conditions	**Success end condition:** Everything is normal for the baby, and the crib records health data. **Failure end condition:** An abnormal situation occurs, send an alert.

Main Success Scenario:
1. The user puts the baby in the crib.
2. The crib automatically swings to sleep the baby.
3. Users can accompany the baby with remote video and voice.
4. The crib stopped swinging when the baby fell asleep according to baby monitor.
5. The crib regularly records the baby's status and health data according to baby monitor and room temperature monitor.
6. The crib sends the user a health report of the baby every week.

Extensions:
4a: When a baby wets the bed, the baby's body temperature or heart rate is abnormal, or the room temperature is abnormal, the crib sends an alert to the user.
4b: When the baby is crying, the crib automatically swings to soothe the baby and send a notification to the user.

6.4 Indoor cleaning

6.4.1 Use Case Model

6.4.1.1 Use Case Diagram

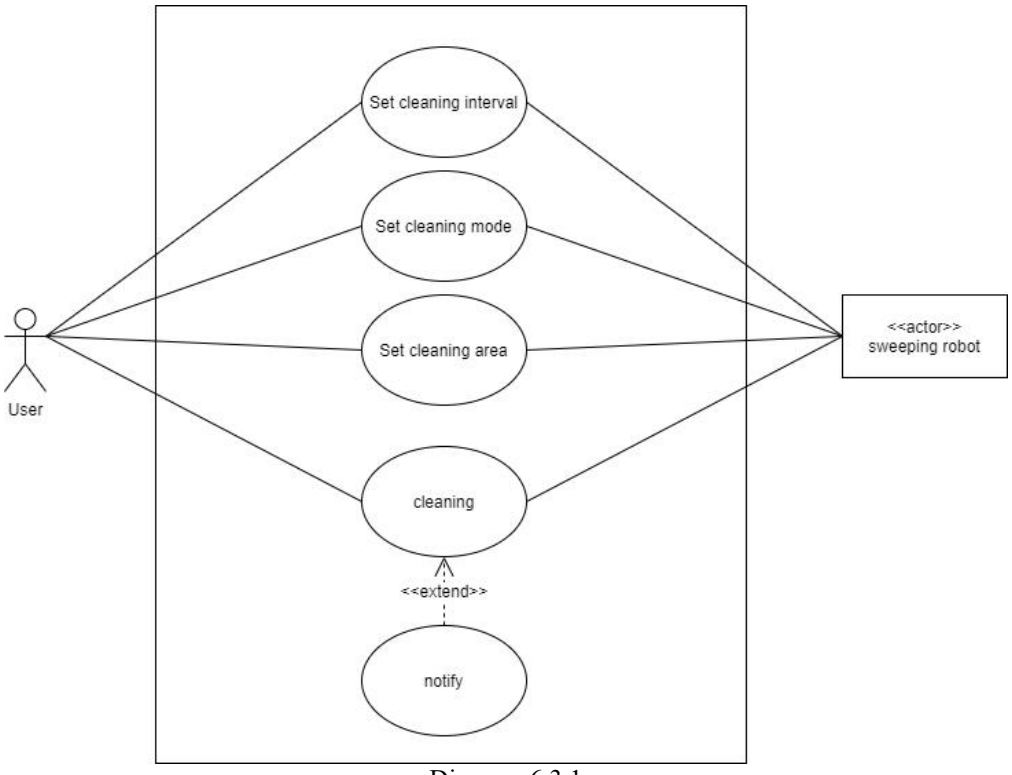

Diagram 6.3.1

6.4.1.2 Sequence Diagrams

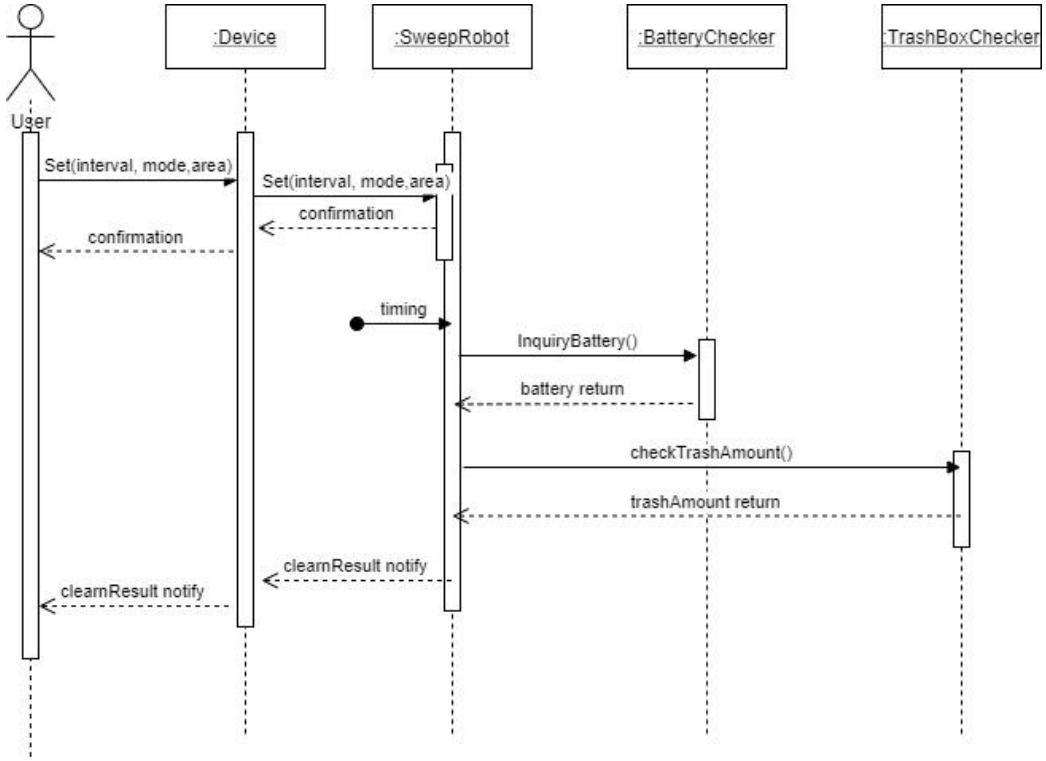

Diagram 6.3.2

6.4.1.3 Activity Diagrams

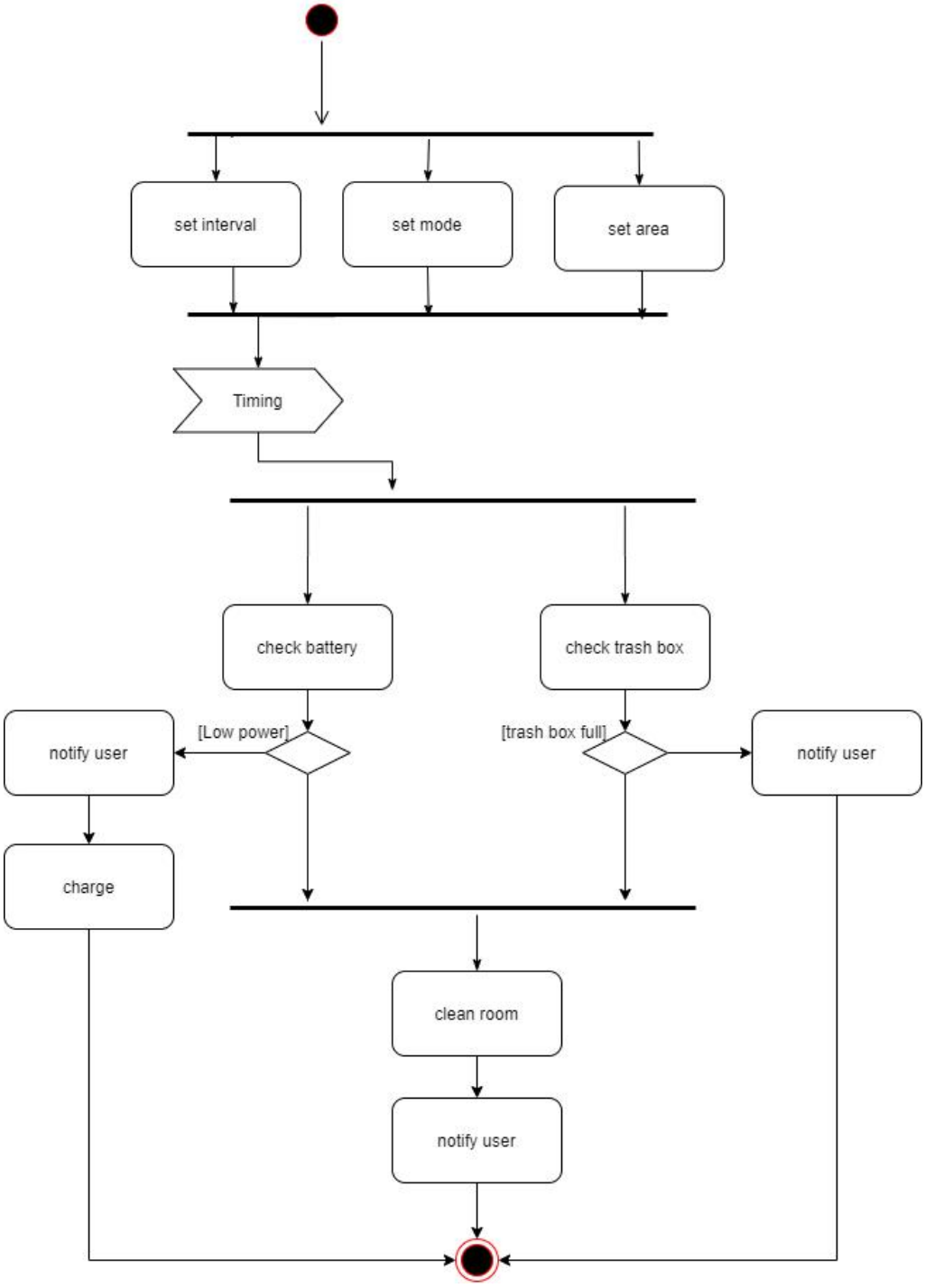

Diagram 6.3.3

6.4.1.4 State Machine Diagrams

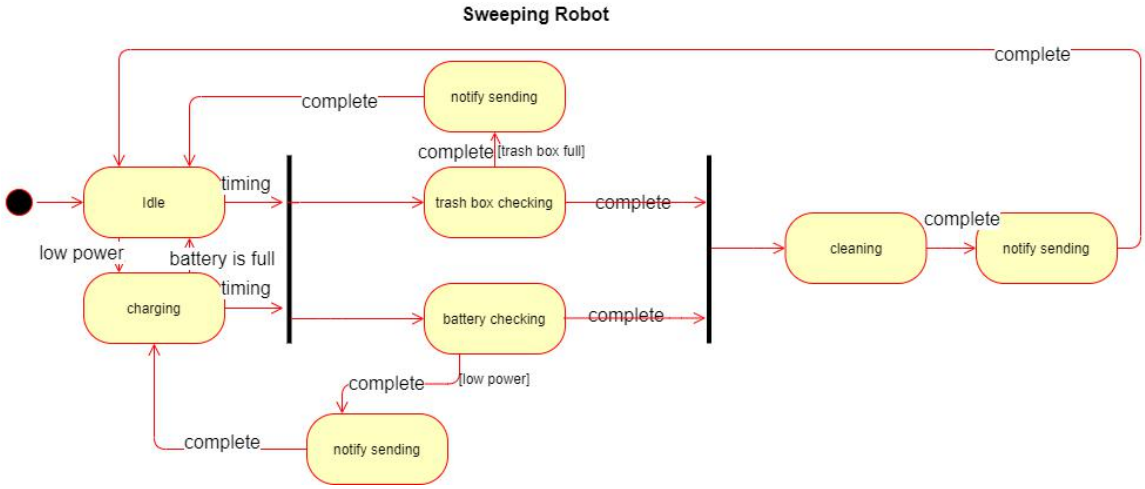

Diagram 6.3.4

6.4.2 Package: Main

Id	6.3
Use Case Name	Indoor cleaning
Description	The sweeping robot performs automatic indoor cleaning according to the time interval, cleaning mode, and area preset by the user. The cleaning will end and the sweeping robot notifies the user when the battery is low or the trash box is full.
Level	User-level
Primary Actor	User
Supporting Actors	sweeping robot
Stakeholders and Interests	User: Wants to have a clean indoor environment. Sweeping robot: Wants to complete the task of indoor cleaning.
Pre-Conditions	The Smarthome+ system is operating normally, with the internet and electricity.
Post Conditions	**Success end condition:** The sweeping robot completes the cleaning task and sends a notification of completion to the user. **Failure end condition:** The sweeping robot failed to complete the cleaning task and send a failure notification to the user.

Main Success Scenario:
1. The user sets the cleaning interval, cleaning mode, and area.
2. When the scheduled time comes, the sweeping robot starts automatic indoor cleaning according to the user's preset.The pet feeder checks whether there is food left, and feeds the pet regularly according to the feeding amount and the remaining amount.
3. The sweeping robot completes the cleaning task and sends a notification of completion to the user.

Extensions:
3a: the sweeping robot will end cleaning and charge, then notify the user, when the battery is low.
3b: The cleaning will end and the sweeping robot notifies the user when the trash box is full.

6.5 Clothes Washing

6.5.1 Use Case Model

6.5.1.1 Use Case Diagram

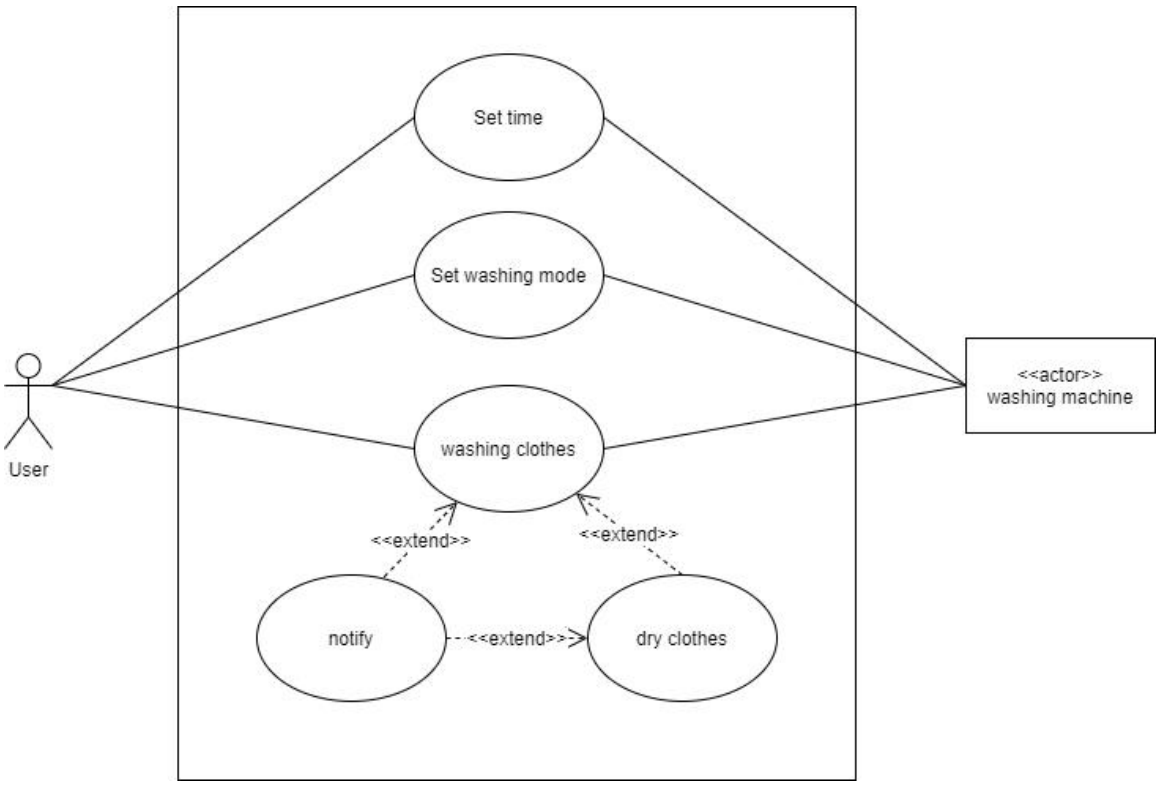

Diagram 6.5.1

6.5.1.2 Sequence Diagrams

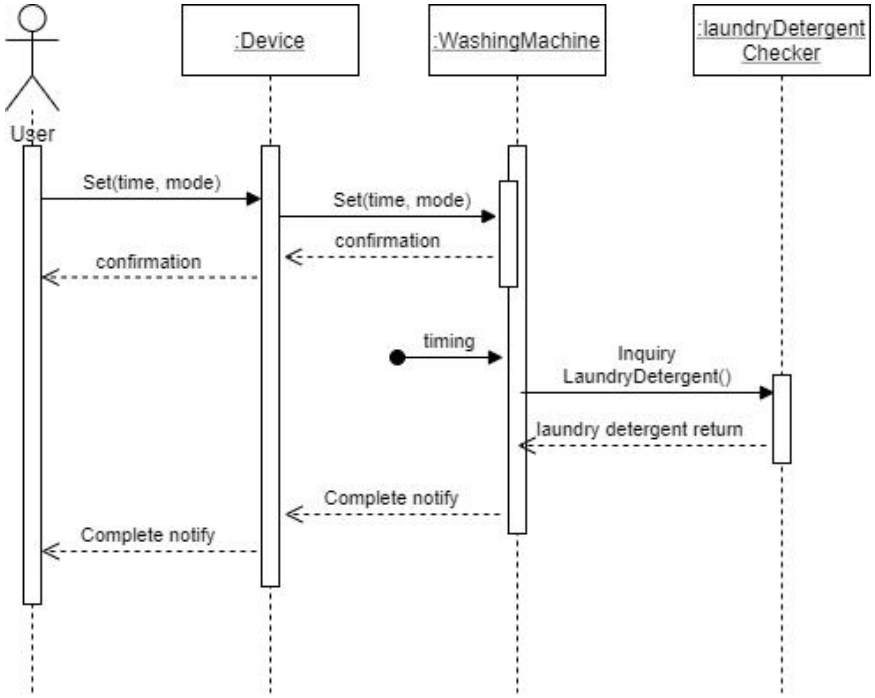

Diagram 6.5.2

6.5.1.3 Activity Diagrams

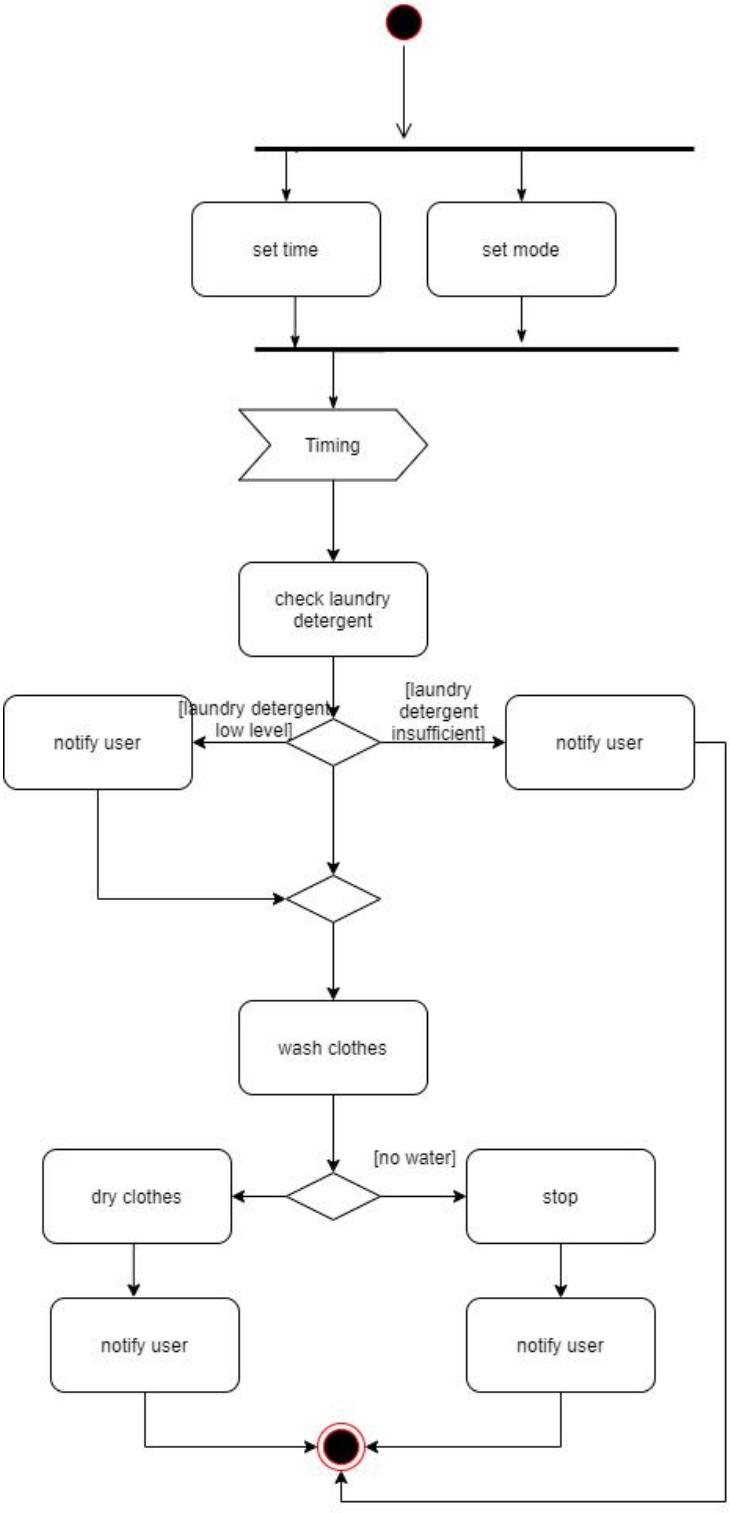

Diagram 6.5.3

6.5.1.4 State Machine Diagrams

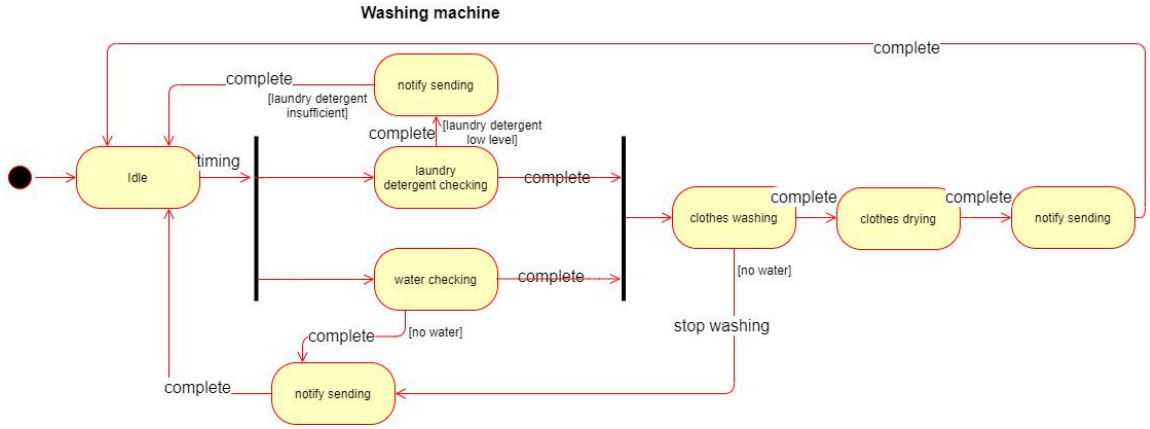

Diagram 6.5.4

6.5.2 Package: Main

Id	6.4
Use Case Name	Washing Clothes
Description	The washing machine automatically washes clothes according to the time and mode preset by the user. Send a notification to remind users when the laundry detergent is insufficient for the next usage.
Level	User-level
Primary Actor	User
Supporting Actors	Washing machine
Stakeholders and Interests	User: Wants to have a timer automatic laundry function. Washing machine: Wants to complete the task of washing clothes.
Pre-Conditions	The Smarthome+ system is operating normally, with the internet and electricity.
Post Conditions	**Success end condition:** The washing machine completes the laundry task and sends a notification to the user. **Failure end condition:** The washing machine cancels the laundry task and sends a notification to the user.

Main Success Scenario:
1. The user sets the washing time and washing mode.
2. When the preset time is up, the washing machine checks the remaining amount of laundry detergent.
3. The washing machine performs laundry according to the user's preset.
4. The washing machine dries clothes.
5. After the task is completed, the washing machine sends a notification to the user.

Extensions:
2a: The laundry detergent is insufficient. The task is canceled and the user is notified.
3b: If there is no water during the washing process, the washing task will be terminated and a notification will be sent to the user.

6.6 Coffee making

6.6.1 Use Case Model

6.6.1.1 Use Case Diagram

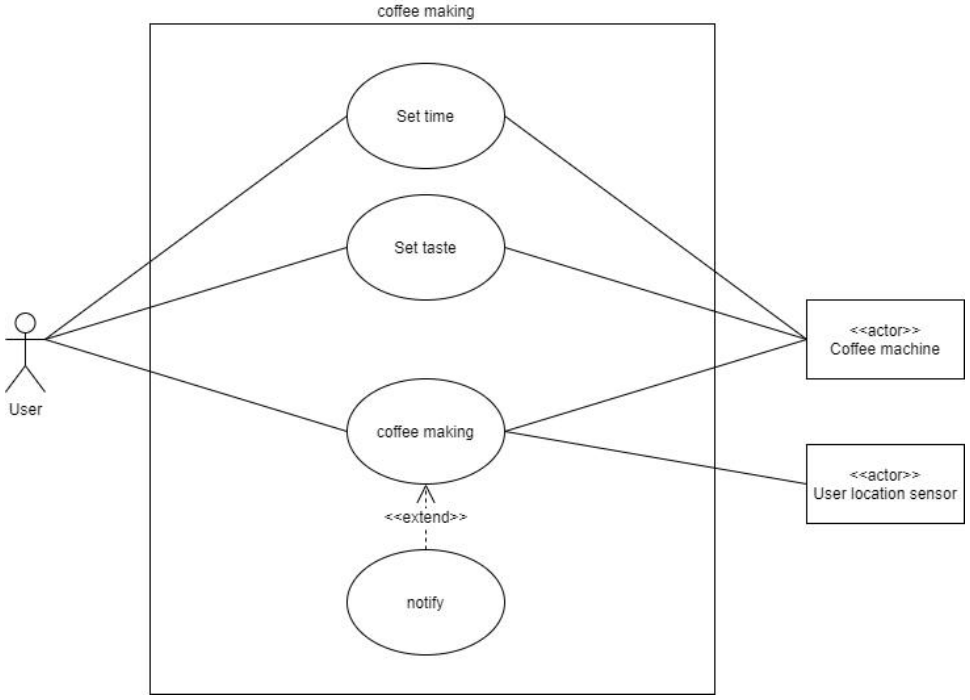

Diagram 6.5.1

6.6.1.2 Sequence Diagrams

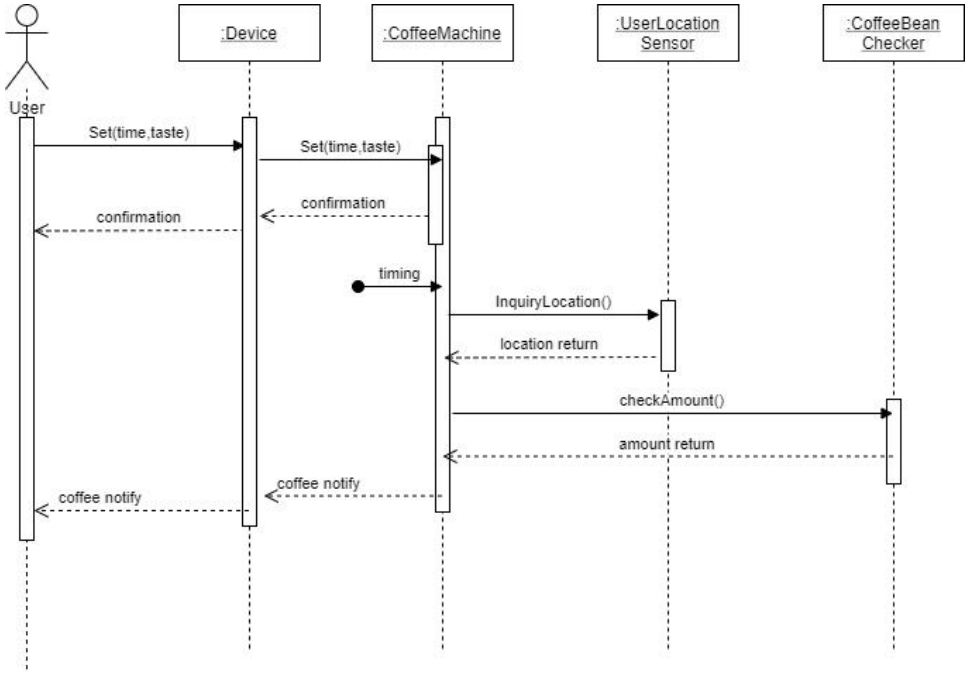

Diagram 6.5.2

6.6.1.3 Activity Diagrams

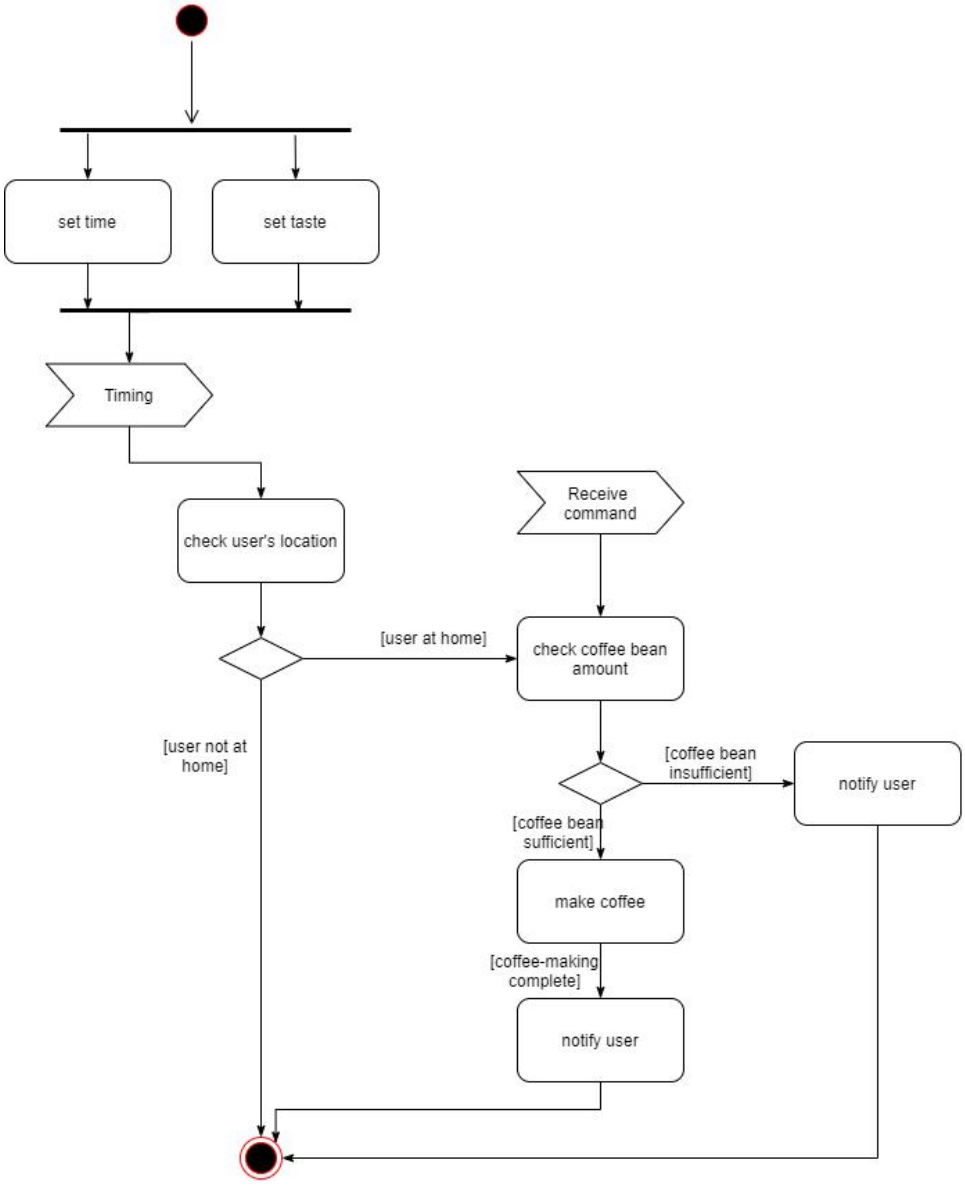

Diagram 6.5.3

6.6.1.4 State Machine Diagrams

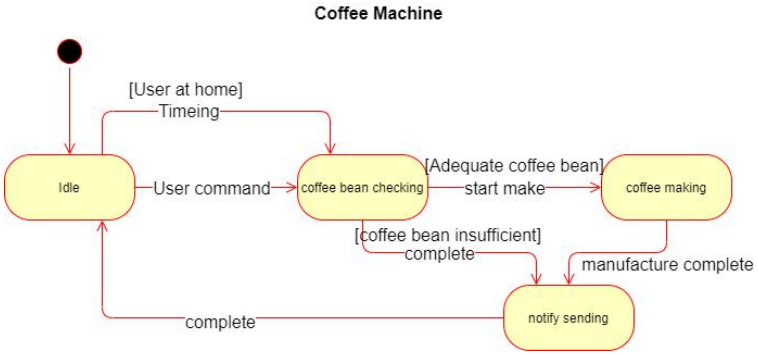

Diagram 6.5.4

6.6.2 Package: Main

Id	6.5
Use Case Name	Coffee making
Description	When the user is at home, the coffee machine regularly prepares coffee according to the user's taste everyday.
Level	User-level
Primary Actor	User
Supporting Actors	Coffee machine, User location sensor
Stakeholders and Interests	User: Wants to drink favourite coffee every day. Coffee machine: Wants to complete the task of making coffee every day.
Pre-Conditions	The Smarthome+ system is operating normally, with the internet and electricity.
Post Conditions	**Success end condition:** The coffee-making is finished and the user is notified. **Failure end condition:** The user is not at home, cancel the task of making coffee on the day.

Main Success Scenario:
1. The user sets the time and taste for coffee.
2. The coffee machine checks the remaining amount of ground coffee or coffee beans, and notifies the user when it is insufficient to make coffee.
3. When the user is at home according to user location sensor, the coffee machine makes coffee for the user according to the set time and taste.
4. Notify the user after the coffee-making is finished.

Extensions:
3a: The balance of coffee powder or coffee beans is insufficient to make coffee, and users have been unable to replenish it.
3b: The user is not at home, cancel the task of making coffee on the day.