CENG3004: Software Engineering

Smarty Home

Design Document

19 / 05 / 2020

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Contents

1 Overview

Our smart home system has controlling your entire building technology with only one smart device. Namely, homeowners can control the security, comfort and energy efficiency of their home with smart devices, smart applications installed on smartphones and tablets. Our consumers are people who have high socioeconomic level.

How it works?

Our customer should download a mobile app that can remote control their smart home technology., Homeowner can check security system, electricity system and heat system even change them, when nobody is at home.

- **Security System:** Security is clearly a requirement for smart home. While they are also miles away from your home, the system checks your doors, windows and shutters. Also, our system can check housebreaking with mechanic sensors on doors and if someone forces the door, system sends a notification to nearest police station.

- **Electricity System:** Redundant lambs, whiteware and electronic appliance are closed automatically. Lambs, whiteware and electronic appliance will switch on automatically or by voice commands.

- **Heat System:** Our heat system allows you to control your heating via smart device of homeowner when he/she is not at home. It is a great way to save the energy. The system optimizes the temperature of house when the temperature reaches the degree that is set.

Mobile Application

Mobile application is an **obligation**, not optional. User can be sign up with **Name, Surname, Phone Number(s), e-mail address** and **Home Address**. Also, user must create a **password**. Otherwise, user can sign in with their **fingerprints** if they determine it.

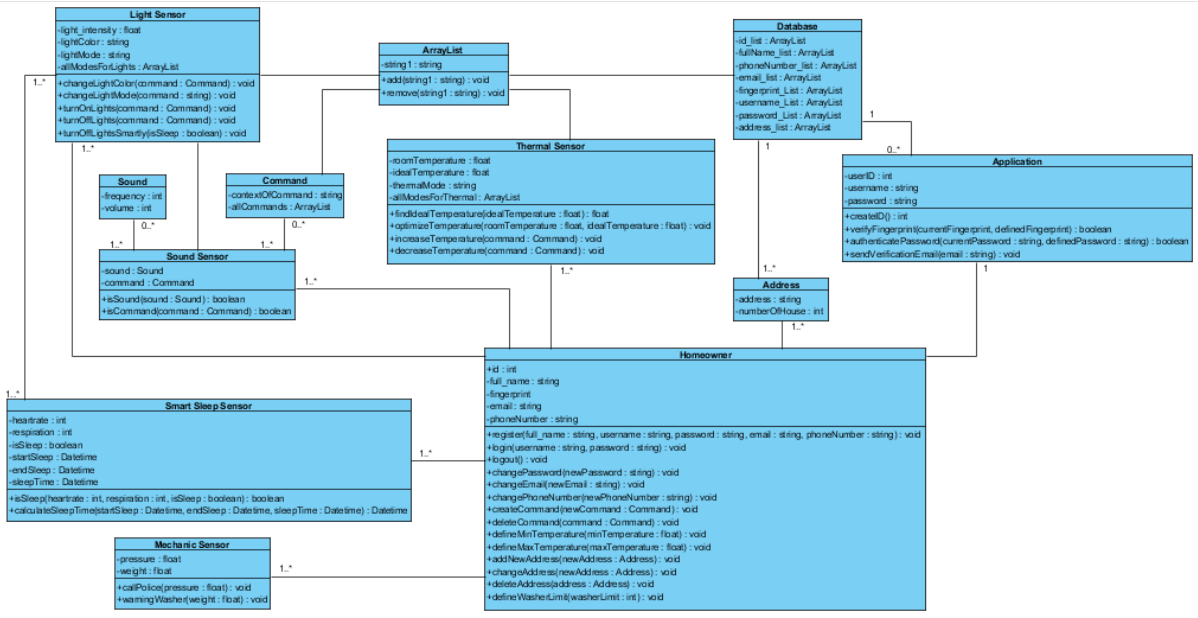
If user have two or more houses, he/she can choose one of houses in list at our application starting menu. Also, the users can give permission to other family members at starting menu, too. The allowed users sign in with their fingerprints.

2 Design Goals

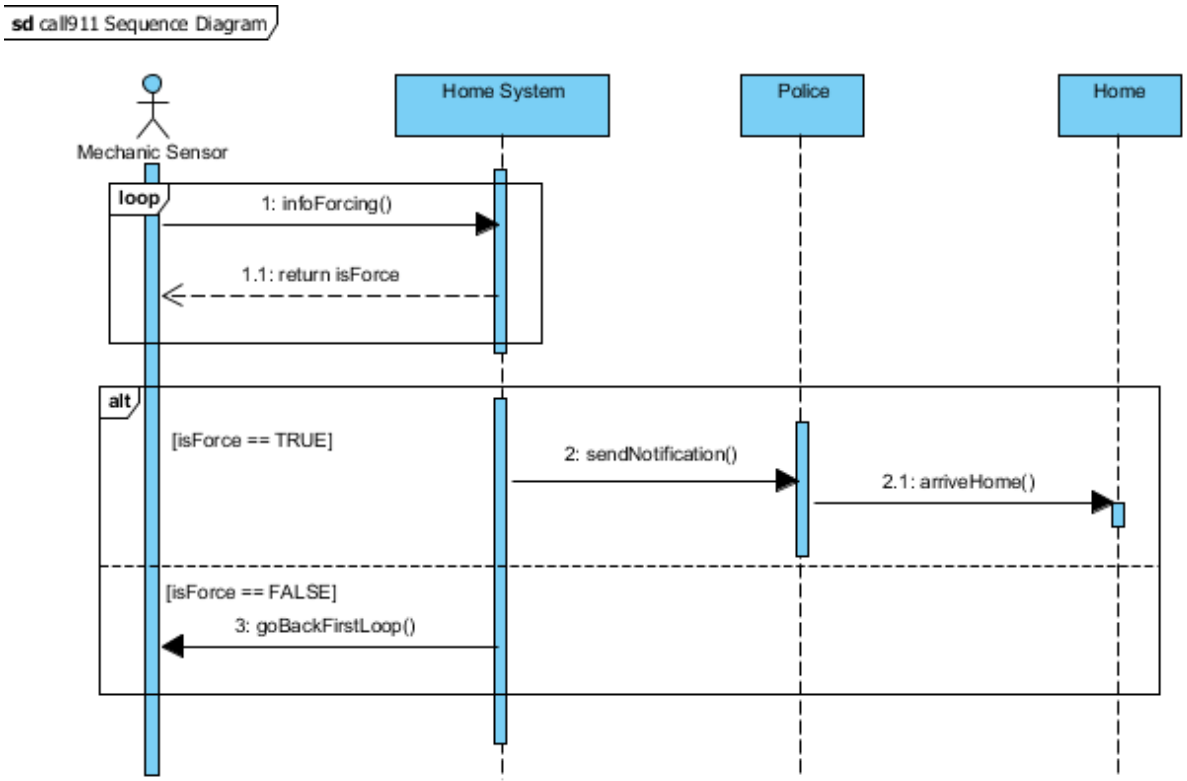
Goal's Concern	Related Requirement Identifier	Description
Reliability	lockDoors	Process of locking doors provides that system is reliable.
Efficiency	cutOffElectricityRemotely	Process of cutting electricity remotely provides that system is efficient.
Portability		User replaces the location of sensors.
Good Documentation		User guide is provided to our customer.
User-friendliness		Our pricing policy is regulated based on socio-economic level of countries.
High Performance	calculateSleepTime	Process of calculating time of sleep provides that system is high-performance.
Flexibility	voiceCommand	Process of adding a new voice command provides that system is flexible.

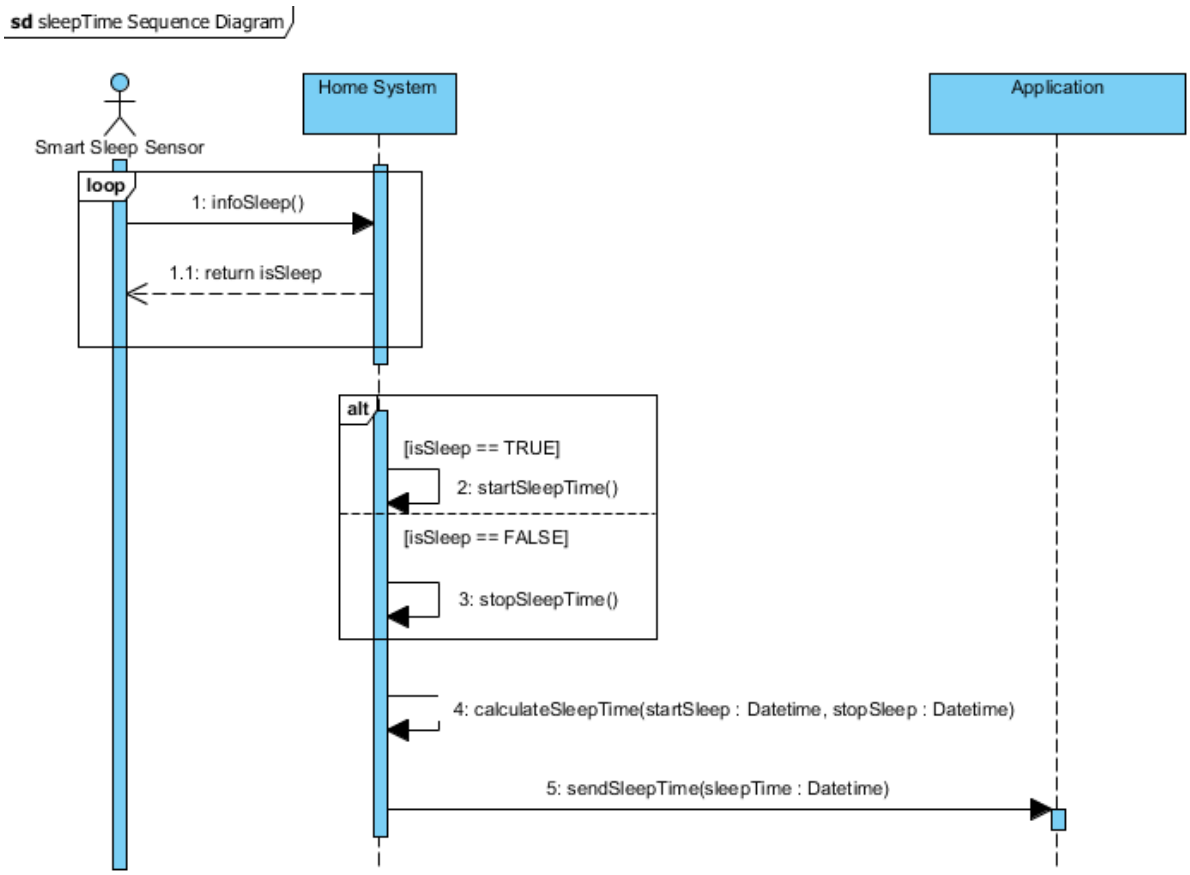
3 System Models

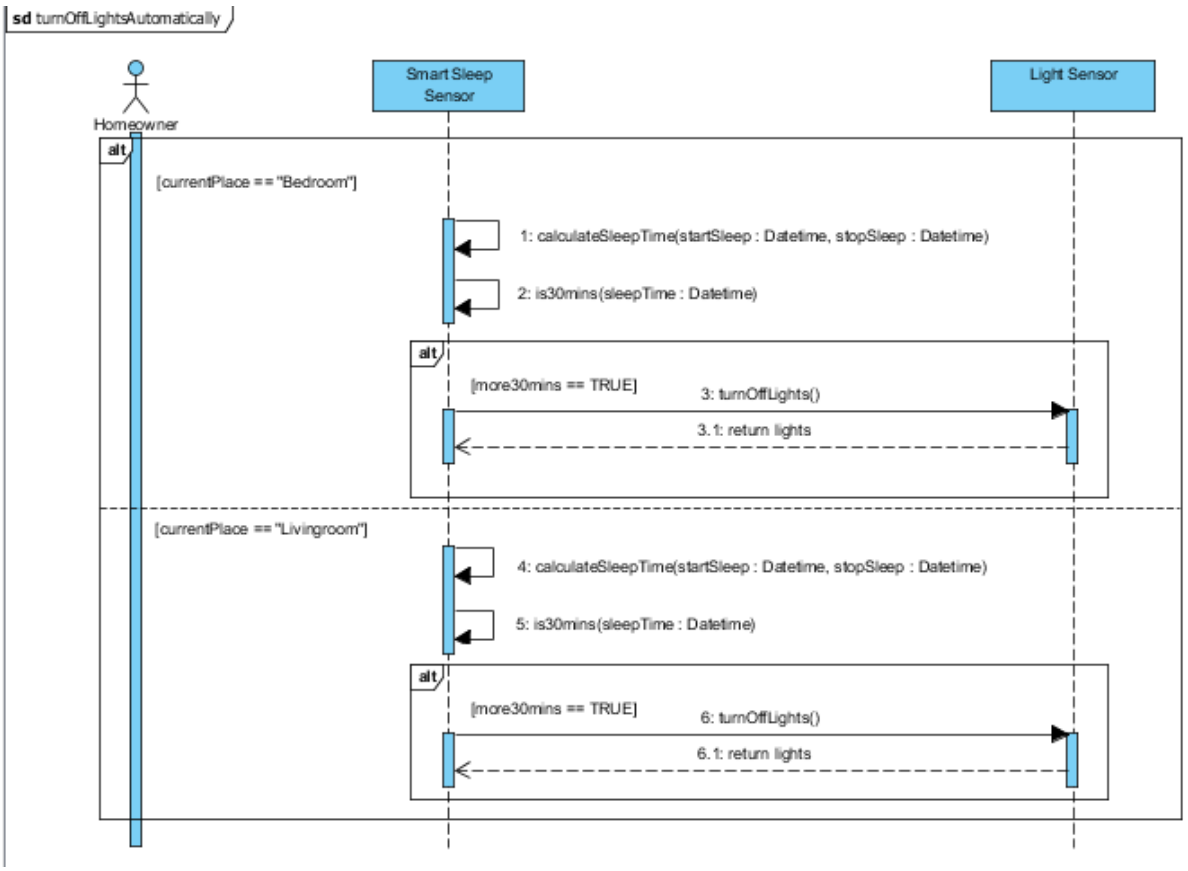
3.1 Class Diagram



3.2 Sequence Diagrams

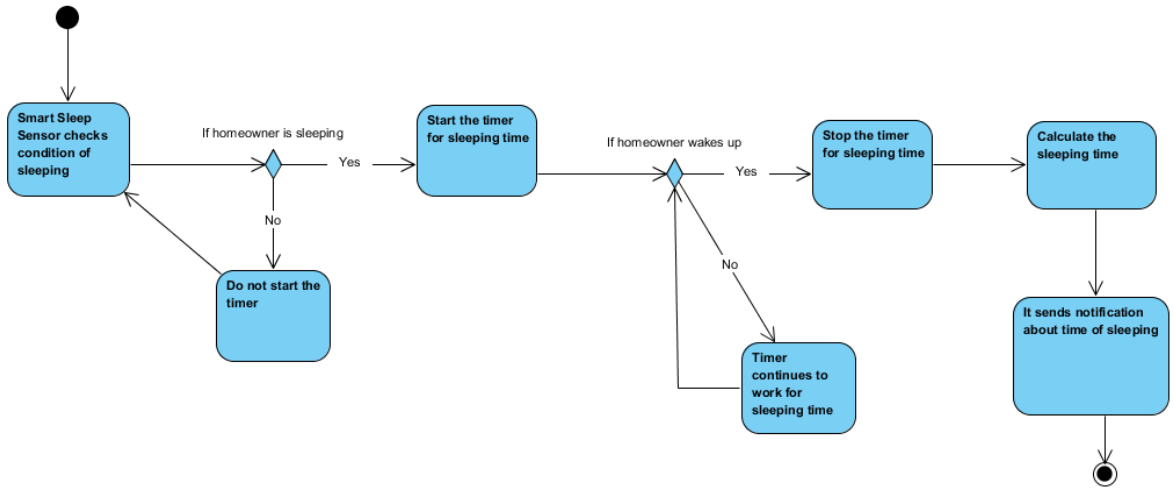



sd sleepTime Sequence Diagram
Smart Sleep Sensor
Home System
Application
loop
1: infoSleep()
1.1: return isSleep
alt
[isSleep == TRUE]
2: startSleepTime()
[isSleep == FALSE]
3: stopSleepTime()
4: calculateSleepTime(startSleep : Datetime, stopSleep : Datetime)
5: sendSleepTime(sleepTime : Datetime)

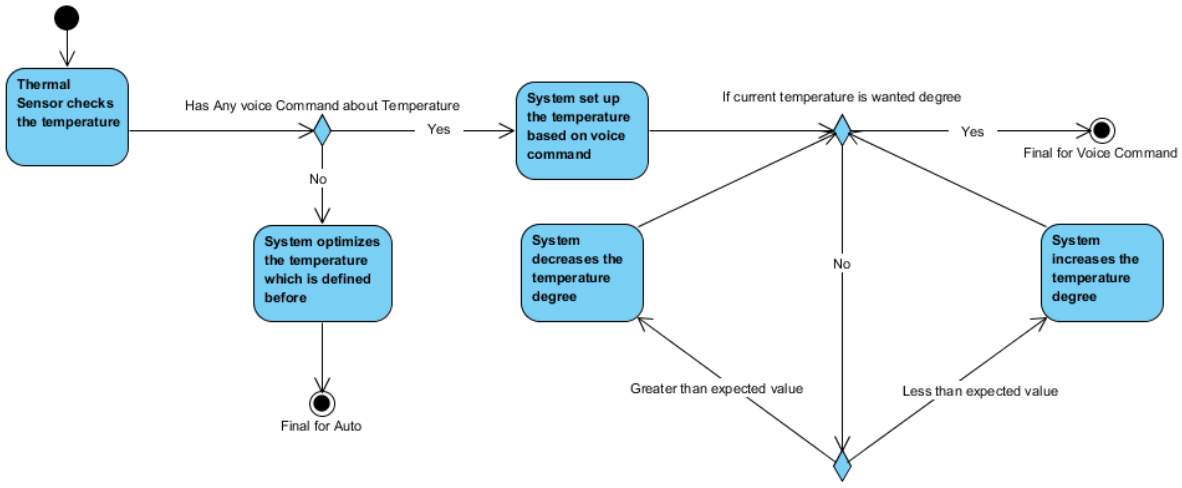

sd turnOffLightsAutomatically
Homeowner
Smart Sleep Sensor
Light Sensor
alt
[currentPlace == "Bedroom"]
1: calculateSleepTime(startSleep : Datetime, stopSleep : Datetime)
2: is30mins(sleepTime : Datetime)
alt
[more30mins == TRUE]
3: turnOffLights()
3.1: return lights
[currentPlace == "Livingroom"]
4: calculateSleepTime(startSleep : Datetime, stopSleep : Datetime)
5: is30mins(sleepTime : Datetime)
alt
[more30mins == TRUE]
6: turnOffLights()
6.1: return lights

3.3 Activity Diagrams

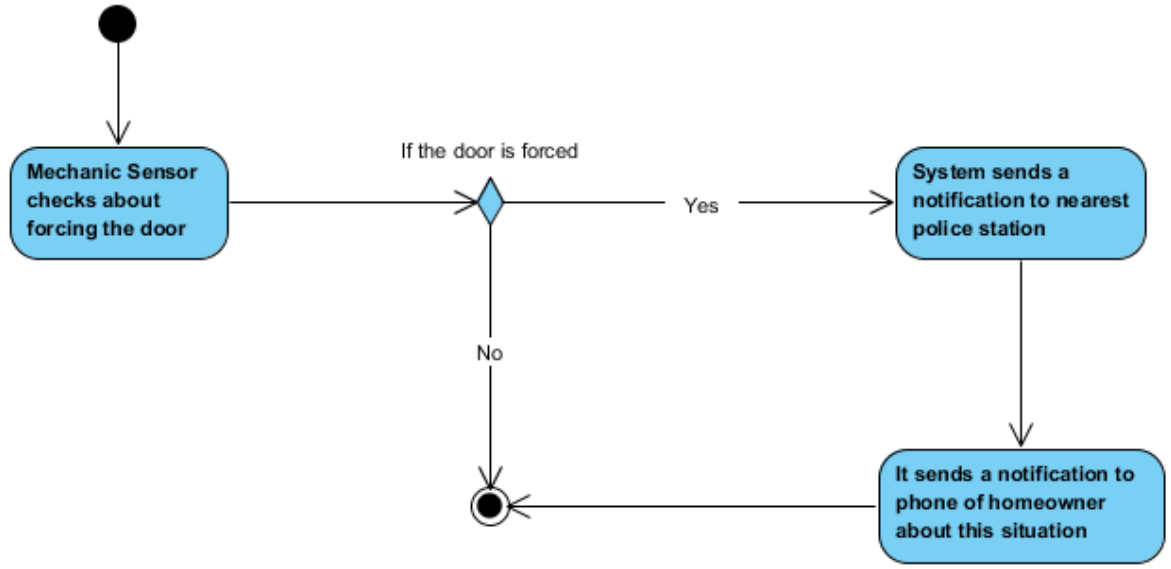
Calculation Time of Sleep:



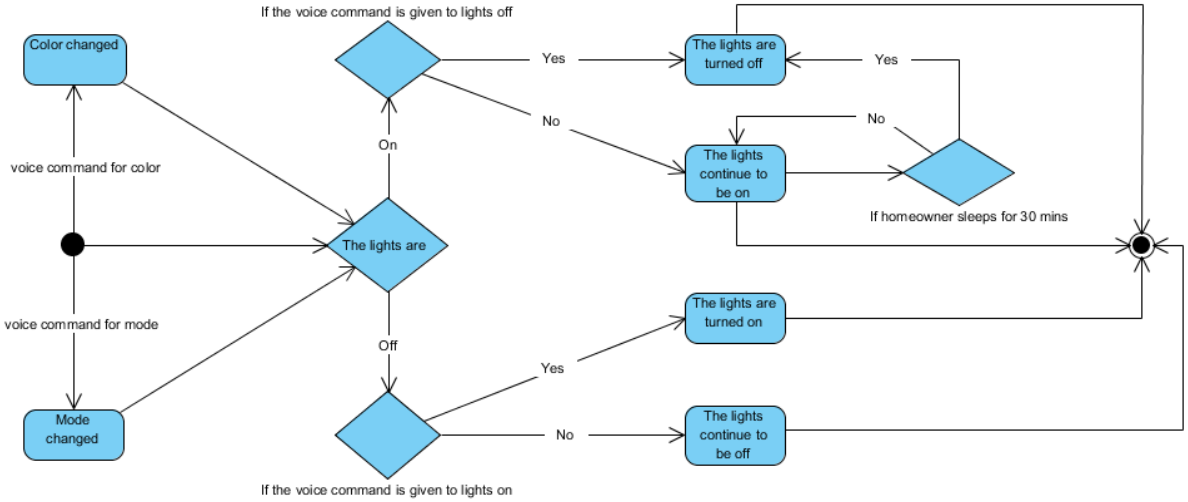
Settings of Temperature:



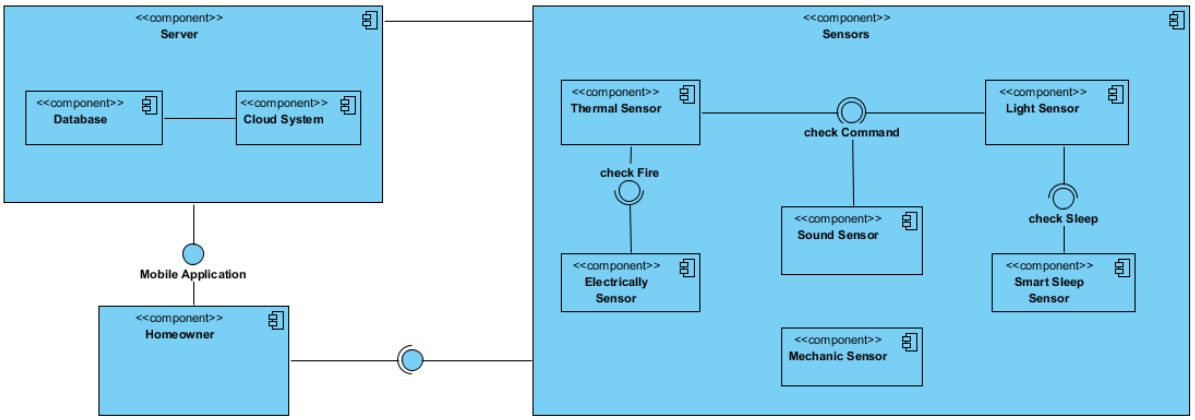
Thief Detector on the Doors:



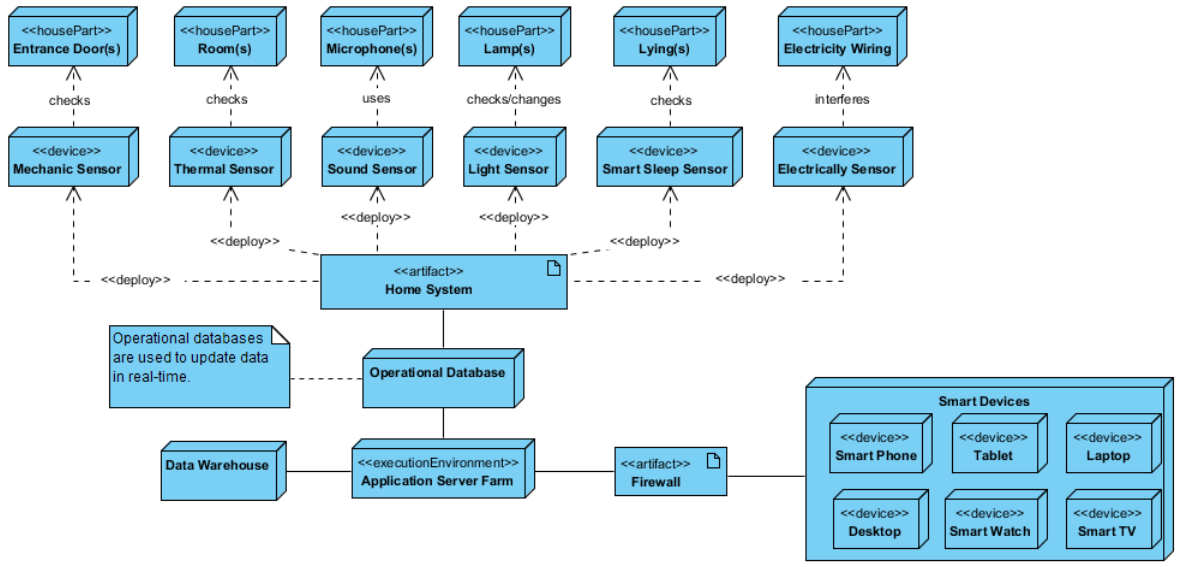
3.4 State chart Diagrams



4 Subsystem Decomposition



5 Hardware / Software mapping



6 Other Design Concerns (use relevant subsections)

6.1 Concurrency

For ‘call911’ Sequence Diagram:

Case: If there are two or more doors that have mechanical sensor in the one smarty home, and they are forced simultaneously

Method: Our system sends notification to police according to address of home to avoid multi-notifying the same police station.

For ‘sleepTime’ Sequence Diagram:

Case: If there are two people in the same bed for sleeping

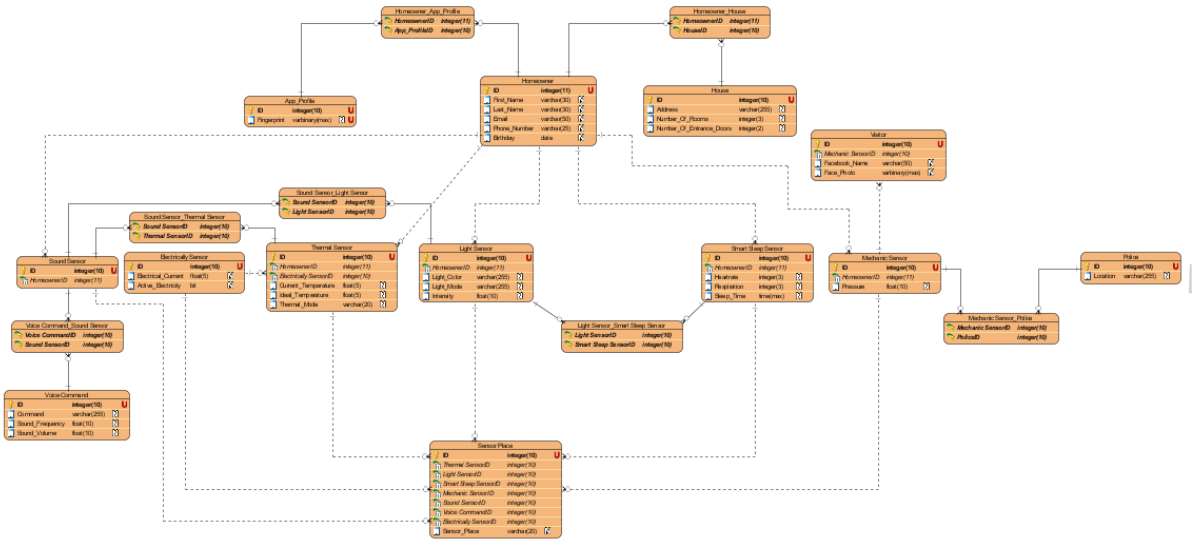
Method: Our system uses two smart sleep sensors and these sensors will be activated depending on how many people are in the bed.

For ‘turnOffLightsAutomatically’ Sequence Diagram:

Case: If there are two people on the bed but one of them is not slept

Method: Our system changes light mode for sleeping when one of people on the bed is slept. Also, the vigilant gives voice command to lights off if he/she wants.

6.2 Data Management



6.3 Global Resource Handling

Class/Actor	Homeowner
Light Sensor	• changeLightColor(command : Command) • changeLightMode(command : Command) • turnOffLights(command : Command) • turnOnLights(command : Command) • turnOffLightsSmartly(isSleep : boolean)
Sound Sensor	• isSound(sound : Sound) • isCommand(command : Command)
Sound	
Command	
ArrayList	
Thermal Sensor	• increaseTemperature(command : Command) • decreaseTemperature(command : Command)
Database	
Application	• createID() • verifyFingerprint(currentFingerprint, definedFingerprint) • authenticatePassword(currentPassword : string, definedPassword : string)
Address	
Homeowner	• register(full_name : string, username : string, password : string, email : string, phoneNumber : string) • login(username : string, password : string) • logout() • changePassword(newPassword : string) • changeEmail(newEmail : string) • changePhoneNumber(newPhoneNumber : string) • createCommand(newCommand : Command) • deleteCommand(command : Command) • defineMinTemperature(minTemperature : float) • defineMinTemperature(maxTemperature : float) • addNewAddress(newAddress : Address) • changeAddress(newAddress : Address) • deleteAddress(address : Address) • defineWasherLimit(washerLimit : int)
Mechanic Sensor	
Smart Sleep Sensor	• isSleep(heartrate : int, respiration : int, isSleep : boolean) • calculateSleepTime(startSleep : Datetime, endSleep : Datetime, sleepTime : Datetime)

Class/Actor	Police
Light Sensor	
Sound Sensor	
Sound	
Command	
ArrayList	
Thermal Sensor	
Database	
Application	
Address	
Homeowner	
Mechanic Sensor	• callPolice(pressure : float)
Smart Sleep Sensor	

Class/Actor	Mechanic Sensor
Light Sensor	
Sound Sensor	
Sound	
Command	
ArrayList	
Thermal Sensor	
Database	
Application	
Address	
Homeowner	
Mechanic Sensor	• warningWasher(weight : float) • callPolice(pressure : float)
Smart Sleep Sensor	

Class/Actor	Thermal Sensor
Light Sensor	
Sound Sensor	
Sound	
Command	
ArrayList	• add(string1 : string) • remove(string1 : string)
Thermal Sensor	• increaseTemperature(command : Command) • decreaseTemperature(command : Command) • findIdealTemperature(idealTemperature : float) • optimizeTemperature(roomTemperature : float, idealTemperature : float)
Database	
Application	
Address	
Homeowner	• defineMinTemperature(minTemperature : float) • defineMinTemperature(maxTemperature : float)
Mechanic Sensor	
Smart Sleep Sensor	

Class/Actor	Sound Sensor
Light Sensor	• changeLightColor(command : Command) • changeLightMode(command : Command) • turnOffLights(command : Command) • turnOnLights(command : Command)
Sound Sensor	• isSound(sound : Sound) • isCommand(command : Command)
Sound	
Command	
ArrayList	
Thermal Sensor	• increaseTemperature(command : Command) • decreaseTemperature(command : Command)
Database	
Application	
Address	
Homeowner	• createCommand(newCommand : Command) • deleteCommand(command : Command)
Mechanic Sensor	
Smart Sleep Sensor	

Class/Actor	Light Sensor
Light Sensor	• changeLightColor(command : Command) • changeLightMode(command : Command) • turnOffLights(command : Command) • turnOnLights(command : Command) • turnOffLightsSmartly(isSleep : boolean)
Sound Sensor	• isSound(sound : Sound) • isCommand(command : Command)
Sound	
Command	
ArrayList	• add(string1 : string) • remove(string1 : string)
Thermal Sensor	• increaseTemperature(command : Command) • decreaseTemperature(command : Command)
Database	
Application	
Address	
Homeowner	
Mechanic Sensor	
Smart Sleep Sensor	

Class/Actor	Smart Sleep Sensor
Light Sensor	• turnOffLightsSmartly(isSleep : boolean)
Sound Sensor	
Sound	
Command	
ArrayList	
Thermal Sensor	• increaseTemperature(command : Command) • decreaseTemperature(command : Command)
Database	
Application	
Address	
Homeowner	
Mechanic Sensor	
Smart Sleep Sensor	• isSleep(heartrate : int, respiration : int, isSleep : boolean) • calculateSleepTime(startSleep : Datetime, endSleep : Datetime, sleepTime : Datetime)

Class/Actor	Electrically Sensor
Light Sensor	• changeLightColor(command : Command) • changeLightMode(command : Command) • turnOffLights(command : Command) • turnOnLights(command : Command) • turnOffLightsSmartly(isSleep : boolean)
Sound Sensor	
Sound	
Command	
ArrayList	
Thermal Sensor	
Database	
Application	
Address	
Homeowner	
Mechanic Sensor	
Smart Sleep Sensor	

6.4 Boundary Conditions

Discuss boundary conditions initialization, termination and failure. See below for some questions relevant:

Initialization

- What data need to be accessed at start-up time?
  - 'Homeowner', 'House' and 'Sensor_Place' need to be accessed at start-up time.
- What services have to be registered?
  - 'First_Name', 'LastName', 'Email', 'Birthday', 'Phone_Number' and 'Address' have to be registered during initialization.
- What does the user interface do at start-up time?
  - User interface shows login page at the start-up time.

Termination

- Is single subsystem is allowed to terminate?
  - No, our system has required two or more subsystems to terminate.
- Are subsystems notified if a single subsystem terminates?
  - Yes, 'Server' subsystem notifies synchronously when a single subsystem terminates.
- How are updates communicated to the database?
  - Our system uses an operational database to update data in real-time.

Failure

- How does the system behave when a node or communication link fails?
  - Our system transmits the error report to homeowner and error report system.
- How does the system recover from failure?
  - Our company has a technical support team and they will fix all errors.

7 Glossary

Smarty Home: Name of the project which is designed by us.

Voice Command: A human command which provides interaction with the house system parts.

Visitor: A person who comes to smarty home.

Thief: A person who comes to smarty home without homeowner's permission and forces the door.

Smart Device: An electronic appliance, generally connected to other devices or networks via different wireless protocols.

Mode: A concept which is consists of information about the lights and temperature condition.

- **Thermal Modes:**
  1. Winter Mode
  2. Spring Mode
  3. Summer Mode
  4. Autumn Mode

- **Lights Modes:**
  1. Sleeping Mode
  2. Relax Mode
  3. Reading Mode
  4. Party Mode
  5. Romance Mode

<<housePart>>: A concrete stuff that has been in the house.

Operational Database: A type of database where it is used to update data in real-time.

Application Server Farm: All types of application to manipulate the smart house.

Multi-notifying: A term that is about sending two or more notifications for one smarty home to police.

Active_Electricity: A variable of boolean type for situation of electricity activation.

8 References

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9 Appendix

We have no appendix part.