

Smart Home Simulator

SOEN 343

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1. Problem Definition

a) Problem Statement

The problem of efficiently managing numerous connected devices in a smart home affects homeowners and users who struggle with the management of multiple connected devices within a home; such as heating, lighting, and ventilation. The impact of this problem is a suboptimal utilisation of smart home capabilities which lead to inconvenience and inefficiency for the stakeholders. A successful solution would result in an efficient and user-friendly smart home simulator that provides the stakeholders with a graphical representation of their home, and their connected devices for simplified interaction. Additionally, key benefits of a successful solution include reduced energy consumption via temperature and lighting control, convenience for users through remote monitoring and automation, and improved security.

The problem of	efficiently managing numerous connected devices in a smart home
Affects	homeowners and users who struggle with the management of multiple connected devices within a home; such as heating, lighting, and ventilation
The impact of which is	a suboptimal utilization of smart home capabilities which leads to inconvenience and inefficiency for the stakeholders
A successful solution would be	an efficient and user-friendly smart home simulator that provides the stakeholders with a graphical representation of their home and their connected devices for simplified interaction

b) Product Position Statement

For homeowners and users of smart home systems who struggle with efficient management of multiple connected devices within their homes, the Smart Home Simulator is a software solution that offers an intuitive and user-friendly graphical representation of their home and connected devices, simplifying interaction, and optimising smart home capabilities. Our product offers family members and their guests a customizable Smart Home Simulator that automates and regulates lighting, temperature, and ventilation. Our system also increases safety with an away mode which alerts authorities with motion detection. Other platforms such as SmartThings by Samsung, offer similar features, however, none offer automation that is catered to each user as does our product. Additionally, our system is not limited to simple voice-activated automation like other popular smart home products on the market, i.e., Google Home and Amazon Alexa, but gives our stakeholders the ability to fully customise their home devices to the needs of each member of the family.

For	homeowners and users of smart home systems
Who	struggle with efficient management of multiple connected devices within their homes
The Smart Home Simulator	is a software solution
That	automates and regulates lighting, temperature, and ventilation
Unlike	Other platforms such as SmartThings by Samsung
Our product	Offer automation that is catered to each user

c) Product Overview

i) Product Perspective

Our smart home system allows users to automate redundant tasks found around their home using our simple, easy to use software. The system relies on smart devices, similar to the well known Google Home or Amazon Alexa. The smart hardware for our system, however, will focus primarily on completing tasks around the house, rather than being a virtual assistant (ex: locking doors/windows, turning on/off the lights, etc.). Once the hardware is set up and the user logs into the system, they will have access to a plethora of different features, all broken up into different modules that provide different functionality.

Smart Home Core Functionality Module provides the ability to:

- Open and close windows/doors around the home
- Turn lights on or off
- Disable or enable auto mode, which turn lights on or off depending on if a User is entering or leaving a room

Smart Home Security Module provides the ability to:

- Allows users to turn on away mode, which notifies the user should any suspicious movement be detected while they are away
- Turn on lights in and outside the home upon detecting motion, as well as when doors or windows are open while the system is in away mode
- Set the time limit on when authorities should be alerted upon detecting motion in away mode

Smart Heating Module provides the ability to:

- Separate the home into regions/zones for heating and cooling
- Set your desired temperature settings for each region, for 1 to 3 periods of the day (i.e. morning, afternoon, night).
- Take input for desired room temperature of unoccupied room
- Adjust the temperature of the room once motion is detected, indicating a person has entered
- Display the current temperature of any room

- Monitor the temperature inside and outside the home
- Open windows and shut off A/C automatically when the outside temperature is cooler than the inside temperature (windows will not open or close if something is in the way)
- Should the windows encounter any sort of resistance when opening or closing, the system will immediately reverse the direction of the windows and send the user of the system a notification.
- Lower the temperature of the house during Winter when no person is detected within the house (saving on electricity costs)
- Sends an alert should the system encounter any unusual behavior with the temperature (temperatures too low can lead to pipes bursting, while temperatures too high can mean there is a fire).

Our smart home solution is a fully self-contained system since we do not rely on external services. That being said, the system itself is broken up into the various modules listed above. The main system has access to each one of these modules and can fully utilise their functionality from our easy to use dashboard.

ii) Assumptions and dependencies

Assumptions	Dependencies
Sensors are installed in all doors and windows, as well as motion detectors in each room.	Proper installation and functioning of sensors are crucial for the SHP module to accurately detect intruders and trigger appropriate actions.
The house layout file accurately represents the physical layout of the simulated house	Proper interpretation of the house layout file is necessary for the Smart Home Simulator to visualize the house and execute commands accurately based on the simulated environment.
Internet Connection is stable and available	Uninterrupted Internet access is required for fetching weather data and ensuring seamless communication with external services.
Virtual tenants are present	The functionality of the simulator heavily relies on the presence and actions of virtual tenants to simulate real-life scenarios and interactions with the Smart Home modules.
Sensor data is accurate	Any discrepancies or inaccuracies in sensor data could affect the reliability and effectiveness of automation and decision-making within the simulator.
Multiple heating zones are implemented within the home and are controlled by their respective thermostats.	Accurate heating zoning configuration is necessary for the SHH module to effectively manage temperature settings on occupancy and desired comfort levels in different areas of the house.

2. Technology used

a. Control version system

- Git

b. Team collaboration

- Discord
- Github

c. Monitoring and verification

- JUnit

d. Design and modeling work

- Draw.io

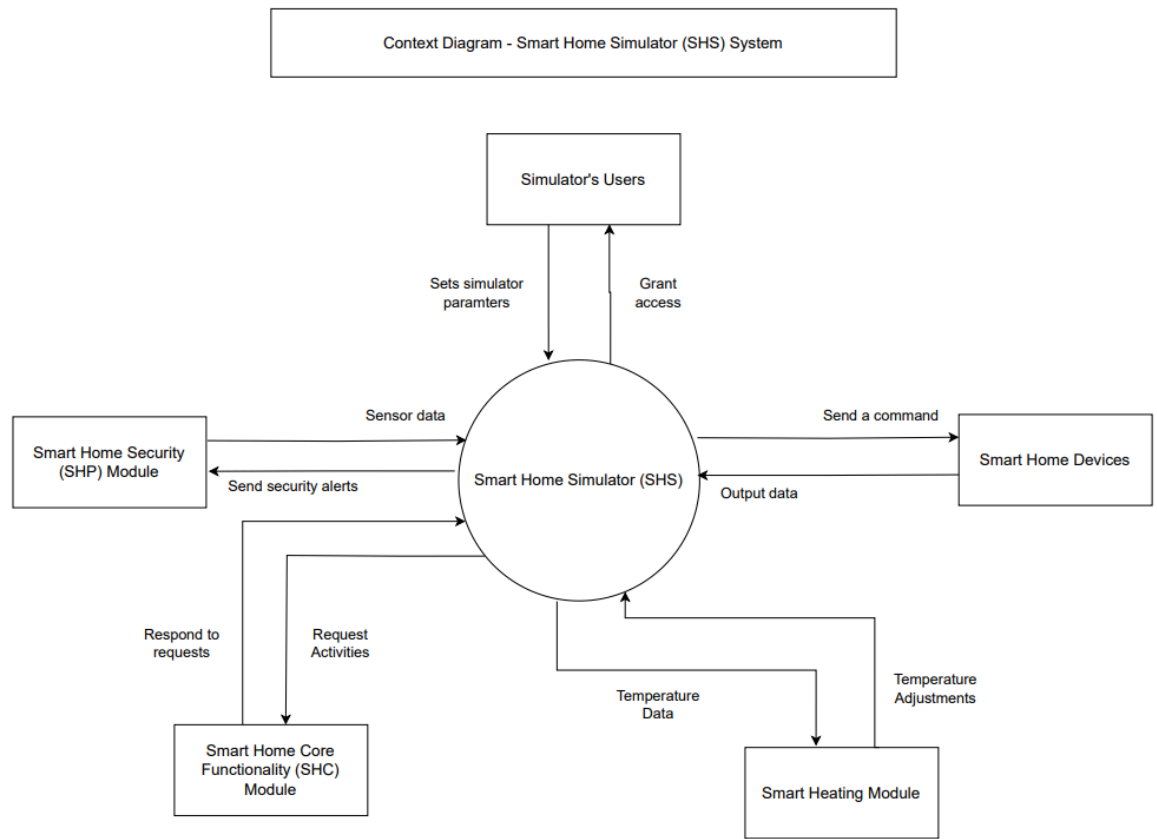
e. Development framework

- Struts
- React

f. Coding

- Java

3.Context Diagram



4. Domain model

