Position: System Designer

Appliance: Smart Vacuum Cleaner in HACS

1. Introduction

In our HACS project, my responsibility was to act as the System Designer for the Smart Vacuum Cleaner. My contribution was to create the system architecture, diagrams, and data flow so that the developer could code easily and the tester could verify the work.

Design is like a bridge between requirements and coding. Without design, a project can become unorganized and confusing. Just like a house cannot be built without a plan, software cannot be built properly without system design.

2. Role of System Designer (Theory)

In software engineering, the System Designer focuses on structure, not code. The designer’s work is to:

Translate requirements into a clear system model.

Show how different modules interact.

Prepare diagrams such as context diagrams and data flow diagrams.

Ensure scalability, reliability, and maintainability.

This role is important because it gives clarity to the whole team.

3. Purpose of My Contribution

The main purpose of my work was to:

Design how the vacuum cleaner module connects to the HACS system.

Define the internal components like authentication, scheduler, and alert manager.

Provide diagrams that guided the development and testing.

Make sure that all requirements were covered in the design.

4. System Design Work I Did

I began my work by carefully checking the requirements written by the analyst. After understanding the needs, I prepared the following designs:

1. External Context Design – shows the user, HACS server, and vacuum cleaner communication.

2. Internal Module Design – includes smaller parts like:

Authentication module

Command processor

Scheduler

Alert manager

3. Data Flow Design – explains how commands travel from the user to the HACS server, then to the vacuum cleaner, and back as a response.

4. Use Case Diagram – simple diagram to show how the user interacts with the vacuum cleaner (ON/OFF, schedule, cancel, alerts).

5. Theory of System Design

System design can be explained in two levels:

High-Level Design (HLD): Focuses on the big picture of the system and shows how the main parts interact.

Low-Level Design (LLD): Focuses on each small part, with detailed structure and algorithms.

For this project, I mainly worked on high-level design because it was more important to show the flow of operations rather than the exact code details.

6. Scenarios Considered in My Design

While making the design, I thought of practical scenarios such as:

A user turning ON the vacuum cleaner remotely.

Scheduling cleaning for 7 pm every day.

The vacuum cleaner stopping when the user presses Cancel.

The system showing an alert when the battery is low.

The dust bin becoming full and sending a notification.

These scenarios helped me make sure the design covered real user needs.

7. Challenges Faced

Some challenges I faced during this process were:

Deciding the level of detail for the diagrams. Too much detail would make it complicated, but too little would confuse the developer.

Making sure all requirements were included in the design. I had to double-check with the analyst’s document.

Keeping the design simple enough for a student project, without unnecessary complexity.

8. Outcome of My Work

The result of my contribution was that the developer had a clear guideline for implementation, and the tester had a clear expectation of system behavior. The team was able to follow my diagrams to complete their tasks without confusion.

9. Learning and Reflection

From theory, I learned that system design is the backbone of software engineering projects. From practice, I learned how to balance between too much detail and too little. I also realized that diagrams make communication easier than long text.

10. Conclusion

As the System Designer, my contribution was to prepare the design models for the Smart Vacuum Cleaner in HACS. I created diagrams, showed data flow, and considered scenarios. My work provided structure to the developer and tester, making the project smooth and organized.

This experience taught me that design is not just theory but a real step that ensures the success of the project.