Project: Designing a Virtual Smart Home System for Adaptive Environment Management

Overview:

In this project, you will develop a conceptual model for a virtual smart home system focused on adaptive and intelligent management of the household environment to enhance occupant satisfaction. Your task is to explore and define how intelligent behaviors and adaptive mechanisms can be integrated into such a system. This will involve identifying the key components, their relationships, constraints, and simplifications within the model. Your deliverable will be a comprehensive document that provides all the information required for a software engineer to implement the model. While resources like training data, plans, and suggestions are available, you will also need to engage with the client, prepare insightful questions, and identify any additional data relevant to the project.

Part 1: Defining the System Context (6/30)

1. **Understanding the Problem Domain:**

   Focus on creating a conceptual model of a virtual house shown in figure 1, specifically addressing its environmental management system. Think about how intelligence and adaptability can enhance this domain. Begin by defining what intelligence, adaptation, and system mean in the context of your model.

2. **Stakeholder and Objective Analysis:**

   Identify who will use this system and their goals. Clearly define the target audience's interests in the project and how they intend to benefit from the simulation. Establish the desired outcomes, such as improved learning, informed decision-making, or enhanced user experiences.

3. **Establishing Scope and Boundaries:**

   Establish the boundaries of your model, focusing on specific aspects of the chosen domain to represent within the chosen timeframe and discuss why these boundaries were chosen. Review software engineering requirements and how best to deliver the resulting product.

Part 2: Conceptual Model Development (24/30)

1. **Choosing a Conceptual Modelling Technique:**

   Select 2 to 3 modeling approaches that best represent your solution. Options include Entity-Relationship Diagrams (ERDs), Unified Modeling Language (UML), Activity Diagrams, or Statecharts. Consider the system's complexity and the level of abstraction needed. You may also include pseudocode to clarify your design.

2. **Defining System Components:**

   Identify and describe the key entities, attributes, and relationships in your system. Use your chosen technique to create a clear visual representation of these components and their interactions.

3. **Simplifications and Data Considerations:**

   Outline any simplifications, exclusions, or aggregations used in your model. Provide a detailed discussion of the datatypes for the entities and attributes and demonstrate an understanding of the data available for the system.

4. **Incorporating Adaptation and Intelligence:**

   Develop mechanisms that allow your system to adapt and learn. This could include feedback loops, rule-based decision-making, fitness functions, or machine learning techniques. Explain how these mechanisms enable the system to adjust to stimuli or changes in the environment, contributing to intelligent behavior.

5. **Evaluation Plan:**

   Define a method for assessing the performance and effectiveness of your system. Include criteria for success, such as system responsiveness, user satisfaction, or adaptability, and describe how these will be measured.

Deliverable:

Prepare a concise report (maximum 4 pages) detailing Parts 1 and 2. Submit this as a PDF file to the Canvas Assignment 1.

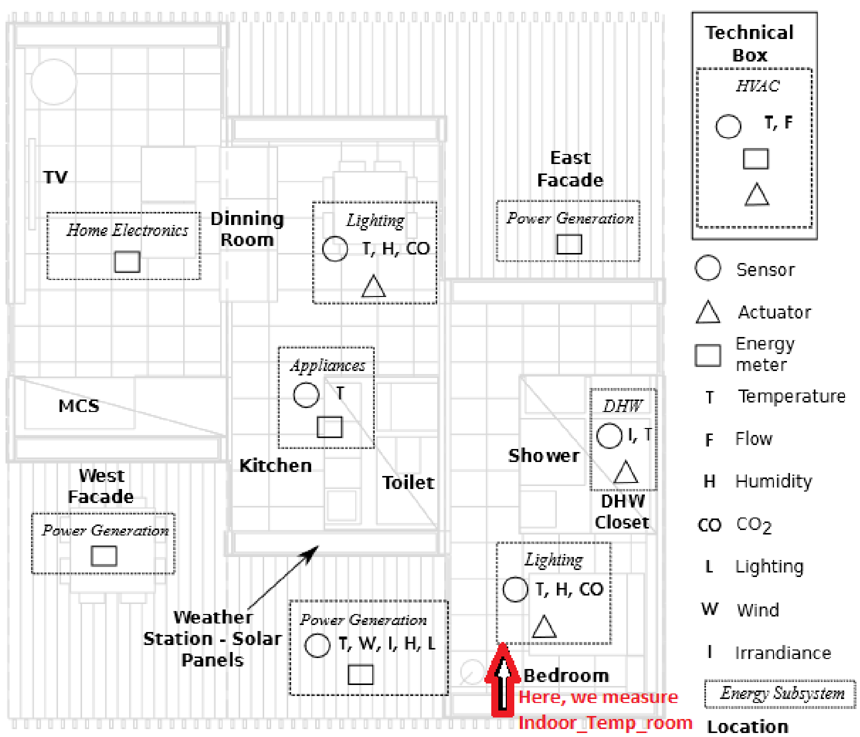

Fig. 1 House Layout

Notes on Temperature and Humidity Control Options:

There are two methods available for controlling temperature and humidity in the system, each operating under specific assumptions:

1. **Mechanical Ventilation:**
   - This method adjusts the indoor temperature, humidity, and CO2 levels to match those of the outdoor environment. Outdoor CO2 is fixed at 250 ppm.
   - The process takes 15 minutes to complete.
   - Once the mechanical ventilation is turned off, the indoor temperature and humidity gradually return to their original values over 15 minutes.

2. **Storage Heaters:**
   - Storage heaters increase the indoor temperature by 0.5 degrees after 15 minutes of operation.
   - The heating effect lasts for 4 hours.
   - This method can only be used twice per day.

Interaction between methods:

If both mechanical ventilation and storage heaters are used simultaneously, mechanical ventilation takes precedence. During this time, the effects of storage heaters are negated for the remainder of the 4-hour period. The decision to use these methods should be managed by the system's software.

Associated Files and Resources:

6FTC2088.csv: A sample dataset for the modeling process. The data is adapted from: https://www.kaggle.com/competitions/smart-homes-temperature-time-seriesforecasting