3rd Year Group Project - Project Specification 2024-2025

2030 Future Home

This document describes the Group Project Specification and is meant to be read in conjunction with the Group Project Guide and the Stage 1 and Stage 2 documents, which contain important information about completing the project.

Aim

At Heriot-Watt University, we are working toward the future of housing and care homes. We have presented Net-Zero houses at COP23 in Dubai, have several startup companies in the area of sustainable house building, from the materials used to sensor usage, and have multiple research projects dedicated to helping people with frailty live independently.

A key part of any efficient and functional house or care facility is an effective control system and user interface for the home. This will take the form of a new application that will mediate between the user (the home-dweller) and user activity, as well as various Internet-enabled smart devices and robots in the home. Most importantly, the system will record data on energy use, energy generation, robot usage and robot status throughout the home and be able to present this information to users in several forms depending on context. Research shows that it is essential that we become more conscious of energy in the home and how we interact with our environment, with the aim that this knowledge suggests and enables changing behaviours to improve energy efficiency or updates users on their latest usage statistics, allowing them to make their own informed decisions.

You are a small software company who have come up with an idea that meets the needs of the a care home provider to better engage home-dwellers with their new home environment. In order to properly demonstrate your idea, you need to create a functioning end-to-end prototype and demonstrate it with appropriate data. Your product should be intuitive and integrate well with users' daily lives; for example being compatible with different mobile platforms as well as home computing or other electronic systems (Raspiberry Pi Wall Display). You may wish to consider gamification strategies to incentivise user engagement.

Accessibility and diversity must be considered in design. Home users may include everyone from young children to busy working adults to retired elderly residents. Home Managers (this could be residential management companies or just the main bill-payer) might want more granular information on energy and appliance use in a detailed form. Each set of users must be able to interact with the application in a way that best provides them with the tools that are appropriate for their specific needs.

Scope

Think who your users/stakeholders are, how they interact with their home, and develop a set of use cases. The desired solution is to be scalable and flexible enough to support the different types of users who may each require different types of information to be presented to them in a different form (e.g., simple infographic messages and interface, integration with daily task reminders, detailed technical information, etc.). Consider this in your system design. For your demonstration, you will need to simulate live energy generation and storage levels, and smart product use. Teams may also wish to include contextual data to assist clients in making decisions about their behaviour, such as internal climate condition data (e.g., temperature, humidity), the carbon footprint of the National Grid at a given time, occupation of rooms around the house, and/or integration with other apps.

Outline Requirements

Use some prioritisation technique (e.g., MoSCoW) to enable a common understanding to be reached on the relative importance placed on the delivery of each requirement. Requirements are purposely underspecified in this document and it will be up to your team to specify a comprehensive set of requirements that enables you to design, implement, and deliver your proposed system. Outline requirements include:

- Create a system that simulates, records, and displays energy generation, use, robot usage and statistics and the activity of Internet-enabled smart appliances in the home in an easy-to-understand, user-friendly format. The application should enable the user to display simple statistics for the house as a whole and for individual devices based on energy profiles and usage over a period of time (e.g., comparing this week to last week, today to this day last year, etc.).
- Create a control system that manages the operation of Internet-enabled smart devices in the house. Consider possibilities for automation (e.g., activating/deactivating devices remotely or autonomously) where possible. The system should also be able to simulate faults in smart devices, including those that generate energy.
- Create a system that enables Home Managers access to detailed energy and device/robot usage data in a form that enables patterns of use to be understood.
- Users must be able to quickly interact with the various systems to easily manipulate devices and the relevant information that is presented. Think about appropriate interface systems: be ambitious!
- Key pieces of information should be distilled visually in a form that is appropriate for particular users.
- Home users should be incentivised to adapt their behaviour using the system based on the information they can access through the system.
- Care should be taken to ensure the security of sensitive data. Teams should consider the sensitivity of the data collected and the means of storing and recalling this data and make design decisions accordingly.
- Teams should be able to demonstrate the security design of their system.

- The solution should be tested and be fully responsive across all the common web browsers (e.g., Google Chrome, Mozilla Firefox, Apple Safari, and Microsoft Edge), on all mobile and tablet devices (e.g., Android, iOS, or Windows), while providing a good user experience.
- A mechanism that enables users to share statistics, perhaps via social media, could be useful.
- A system that makes simple recommendations to users about usage could be useful (e.g., a good time to run device X would be time T; device X is still running, should it be turned off?).
- Daily summary reports for energy use and the overall system would be useful.
- The client is interested in new and useful features that (ideally) aren't available in other control/display system solutions available on the market.