Home Automation

Ben Seiber

Thomas Pionk

Jheryl Lezama

Jeff Wallace

Daniel Wilmot

## Table of Contents

|  |  |
| --- | --- |
| **Home Automation Cover Page** | 1 |
| **Section 1 - Project Vision** | 3 |
| Project Background | 3 |
| Business Objectives, Security and Ethical Concerns | 3 |
| Glossary of Key Terms | 3-4 |
| **Section 2 - Project Plan** | 4 |
| Team Information | 5 |
| Tools and Technology | 5-6 |
| Project Plan |  |
| Best Standards and Practices |  |
| **Section 3 - System Requirements Analysis** |  |
| Functional Requirements |  |
| Non-Functional Requirements |  |
| Wireframe Designs |  |
| **Section 4 - System Requirements Specifications and Diagrams** |  |
| User Stories, Scenarios and Use Cases |  |
| System Sequence / Activity Diagrams |  |
| **Section 5 - User Interface Specifications** |  |
| Preliminary Design |  |
| **Section 6 - Test Cases** |  |
| Unit Architecture and Strategy/Framework |  |
| Unit Test Definition, Test Data |  |
| **Section 7 - References** |  |

## Section 1: Project Vision

Project Background

Home automation or “the internet of things” is not a new concept, however the benefits of an effective automation and monitoring system is something that cannot be overlooked. Elements such as building security, utilities system monitoring and even energy consumption analytics can help both a tenant or building supervisor become alert to an issue before an incident occurs. Take for example a building’s water pressure, where a small leak in the piping can eventually lead to water main break that would not only leave the building’s residences without water, but can cost management thousands to repair. Should a monitoring system be implemented to identify these issues early on, these types of scenarios can be avoided. As a result, the purpose of the home automation system is to allow for the automation of a low income housing facility consisting of monitoring and controlling security, lighting, climate, all focusing on energy saving and cost reduction.

Business Objectives

* Provide building landlords with a cost effective means to remotely monitor property utilities.
* Provide building landlords with a cost effective means to remotely control property utilities.
* Provide building landlords with a convenient method of sending tenants alerts should there be any property utility failures.
* Provide building landlords with convenient cost-saving analytics based on sensor readings.

Glossary of Terms

* End-User - The intended users of the Home Automation system which is commonly referred to in this document as 1) Landlord and 2) Tenant.
* End-User Application - Refers to both the end-user web and mobile applications that are used to interface with the Home Automated System.
* Tenant - Refers to the building occupant/resident that is managed by the building landlord.
* Landlord - Refers to the building manager/supervisor that is an end user for the Home Automation system.
* Arduino Microcontroller - Refers to the microchips that directly interface with the various system sensors including lighting, temperature sensor and security.
* Python - Refers to the programming language that utilized by the arduino microcontrollers.
* MQTT Server - Refers to the back-end network server that allows for the integration of all the various system sensors (temperature, lighting, etc.) with the end user software applications and MySQL Database.
* MySQL Server - The back-end database that allows for the storing of end user account information in addition to the data recorded from the automated sensor information.
* Raspberry Pi - Refers to the physical device that hosts the virtual MQTT server in addition to the MySQL Server.
* Node - Refers to the backbone software framework that supports the communication between each of the following; MQTT Server, MySQL Server, Arduino Microcontrollers, end-user Web application and end-user mobile application.
* Android Studio - Refers to the software framework that was used to develop the end-user mobile application.
* Hypertext Markup Language - Abbreviated as HTML and refers to the scripting language that was used to develop the end-user web application.
* Cascading Style Sheets - Abbreviated as CSS and refers to the scripting language that was used to better enhance the visual appeal and ease of reading in the end-user web application.
* Microsoft Project - The scheduling software developed by Microsoft that was used in the team planning of this project.
* Gantt Chart - Refers to the visual work schedule chart as featured in Microsoft Project that outlines the various timeframes and deadlines for the team developing this project.
* Android - Refers to the required operating system that is required to use the end-user mobile application that accompanies the Home Automation System.

## Section 2: Project Execution and Planning

Team Information

* Ben Seiber
* Thomas Pionk
* Jheryl Lezama
* Jeff Wallace
* Daniel Wilmot

Tools and Technology

The tools utilized within this project were broken into three categories, 1) Automation Hardware, 2) Networking Hardware and 3) End-User Hardware. The software application frameworks that were used to code each hardware element are listed in the “Software Application Framework” section and lists the framework next to the respective device.

1. The physical Home Automation system hardware includes the following…
   1. LED Lighting - Responsible for simulating a building’s internal lighting system.
   2. Temperature Sensor - Responsible for simulating a building’s internal heating and cooling thermostat system.
   3. Humidity Sensor - Responsible for monitoring the humidity content of a simulated building space.
   4. Arduino Microcontrollers - Responsible for interfacing with the various Home Automation system sensors (lighting, temperature, humidity, etc.)
2. The networking hardware used in the Home Automation System includes the following…
   1. MQTT Server - Responsible for collecting the sensor data from the arduino microcontrollers and placing them within the raspberry pi.
   2. Raspberry Pi - Responsible for hosting the MQTT server, MySQL Server and the Node-Red framework architecture.
   3. MySQL Server - Responsible for storing the numerous sensor values that are used as part the cost saving analytic calculations.

1. The software application frameworks utilized in this project are as follows…
   1. Mobile Application (Android Studio)
   2. Web Application (Sublime Text Editor)
   3. MQTT Server Configuration (Command Line, Node-RED)
   4. Raspberry Pi (Command Line, Python, Node-RED)
   5. Database (Command Line, MySQL Workbench)
   6. Arduino Scripts (C Programming)
   7. Team Collaboration (Github, Google Drive, Google Hangouts, GroupMe)
2. The End User Hardware that is required to run the Home Automation system is as follows…
   1. Laptop or Desktop for use with web application
   2. Mobile Android OS Device for use with mobile application

Project Plan

Best Standards and Practices

## Section 3: System Requirements Analysis

Functional Requirements

1. **Req 1:** Building landlords shall be able to login to both the web and mobile application.
   1. **Description:** This will allow landlords to create a personal account from a registration page in addition to having secure access the Home Automation System.
      1. The system will use a MySQL Database to store account information.
      2. The system will save the landlord account information with no data loss.
      3. The system will hash the password entry as to improve system security.
2. **Req 2:** Building landlords shall be able to use both the web and mobile application to monitor the various sensors for lighting, temperature, humidity, etc.
   1. **Description:** This will provide the landlord with a means to remotely monitor the various sensor readings from within the web and mobile application.
      1. The system will implement a MQTT Server to provide the backbone networking framework.