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| **Programme:** | HDCSDEV\_INT |
| **Module:** | Distributed System | |
| **Lecturer:** | Caitriona Nic Lughadha | |
| **Submission Due Date:** | Friday 14th March 2025; 23:59pm | |
| **Project Title:** | Proposal for Smart Home (Connected Device , Smart Security, Automated Climate Control) | |
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| **Date:** | 23rd Feburary 2025 |

**Project Proposal: Intelligent SmartHome Automation System**

As homes become increasingly connected, there is a growing demand for intelligent automation systems that enhance convenience, security, and energy efficiency. This project delivers a SmartHome automation system designed to integrate multiple smart services and devices, enabling real-time interaction and seamless automation.

The system is built using a gRPC-based service architecture, ensuring fast and efficient communication between smart devices and a central controller. The solution prioritizes scalability, security, and user control, offering remote access via a Graphical User Interface (GUI) while maintaining robust authentication and data logging capabilities.

**System Overview and Objectives**:

This project focuses on developing a fully functional SmartHome automation system that simulates real-world smart devices. The primary objectives are:

* Seamless device communication through gRPC messaging.
* Automation of key household functions (lighting, climate control, and security).
* Remote monitoring and control via a user-friendly GUI.
* Secure authentication using API keys or JWT.
* Comprehensive data logging for analytics, troubleshooting, and optimization.
* The system ensures real-time automation and control, allowing users to manage their home environment effortlessly.

**SmartHome Services**

The system consists of three key services, each representing a critical SmartHome functionality:

1. **Smart Lighting System:**

**Features:**

* Remote on/off control for lights.
* Brightness adjustments and color changes.
* Scheduled automation (e.g., lights turn off at bedtime).
* Energy monitoring to track electricity usage.

**Importance:**

This service optimizes energy consumption and improves home ambiance and convenience, reducing unnecessary power usage while maintaining a comfortable lighting environment.

1. **Smart Climate Control (HVAC System):**

**Features:**

* Adjusts temperature and humidity levels based on user preferences.
* Scheduled climate control for energy efficiency.
* Real-time temperature and humidity monitoring.
* Integration with external weather data for smart climate adjustments.

**Importance:**

This service ensures an optimal indoor climate while reducing energy costs, automatically adjusting conditions to maximize comfort and efficiency.

1. **Smart Security System:**

**Features:**

* Remote door locking/unlocking via a secure authentication system.
* Motion detection alerts for unauthorized access.
* Live security camera streaming and event logging.
* Security logs retrieval for audit purposes.

**Importance:**

By integrating remote access and real-time monitoring, this service enhances home security, giving homeowners control and peace of mind regardless of their location.

**gRPC Service Definitions (Proto Files):**

Each SmartHome service is defined using gRPC .proto files, ensuring a structured and efficient communication framework, the Proto files are listed attached in this zip file. I took the liberty of adding comments to aid your understanding of my work.

**Explanation of Proto Files:**

Each service follows gRPC communication standards, ensuring a structured, efficient, and lightweight approach to inter-device messaging.

* Smart Lighting Service defines methods for toggling lights, adjusting brightness, and tracking energy usage.
* Smart Climate Service allows for temperature control and real-time climate monitoring.
* Smart Security Service provides methods for remote door locking/unlocking and retrieving security logs.

Each service exchanges structured messages, ensuring high interoperability between different components of the SmartHome ecosystem.