Smart Light System for home

Sommario

System Description

Smart Home Lighting System is designed to optimize energy usage and improve user experience in residential lighting. By leveraging a combination of sensors, data analytics, and automated control systems, this smart lighting system ensures that lighting conditions within the home are tailored to real-time environmental factors.

Functional requirements

Real time monitoring

The system continuously monitors environmental conditions through a network of sensors, including light sensors and motion sensors.

Automated lighting control

When the ambient light intensity falls below a certain threshold or motion is detected in a room, the system triggers smart lighting devices to adjust brightness levels or turn on/off accordingly.

User interface

The user interface provides real-time status updates, allows users to adjust lighting settings, offers energy consumption information, and influences the rule-based decision-making process.

Data storage

The system stores sensor data for further analysis and system configuration settings, such as light intensity thresholds.

Non-functional requirements

Reliability

The system must operate reliably under varying lighting conditions and user preferences.

Scalability

The system should be able to accommodate additional sensors or smart lighting devices as needed.

System components

Sensors

These are crucial for **monitoring** and gathering real-time data about light conditions. The main sensors are:

- Light intensity sensor
- Motion sensor

Smart lighting devices

Examples of lighting devices:

- Smart bulbs

Central Control System

The Central Control System analyzes data from sensors and considers user preferences determine optimal lighting conditions. The system creates a plan based on rule-based decisions, adjusting lighting levels or turning lights on/off as needed.

Adaptation goals

Goal	**Description**	**Evaluation metric**
Adjust Lighting	Adjust lighting levels when ambient light intensity falls below or exceeds a certain threshold and motion is detected in the room.	$((Li < Lit) \vee (Li > Lit)) \wedge Md$
Turn off lights	Turn off lights when the room is unoccupied or when lights are disabled.	$Ld \vee \neg Md$

- Li: Light intensity
- Lit: Light intensity threshold
- Md: Motion detected
- Ld: Lights disabled.

Decision function

The Smart Home Lighting System employs a rule-based decision-making approach to determine optimal lighting conditions. The decision logic is governed by predefined rules that consider environmental conditions and user preferences.

User Interface

The user interface allows users to monitor the system's status, adjust lighting settings, and view energy consumption reports.

Data storage

The data collected by sensors and system configuration settings are stored in a database.

Technologies

The system will be developed with the following technologies:

- MQTT: as communication protocol.
- Mosquitto: to collect real-time data from sensors and communication between the central control system, devices, and actuators.
- Paho MQTT
- InfluxDB: for storing historical sensor data.
- Grafana: for visualizing system performance and historical data.
- Docker: for containerizing the application.
- Git: for version control.
- Express.js: for the implementation of the backend.
- MongoDB: store system configuration settings.
- NodeRED: for the implementation of the dashboard and storing sensor and actuator data on Influxdb.
- Node.js: for the simulation of the sensors and actuators.