**SOFTWARE REQUIREMENTS SPECIFICATION**

**For**

**“Smart Street Lighting System”**

**Version: 1.0 (approved)**

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1. **Introduction:**
   1. **Purpose:**

The purpose of the "Smart Street Lighting System " document is to define and outline the necessary specifications and functional requirements for the development, implementation, and maintenance of a smart street lighting system. This document serves as a comprehensive guide for including developers, engineers, project managers. The key purposes of this document include:

* Scope Definition: Clearly define the scope of the smart street lighting system, detailing the features and functionalities it will include.
* Functional Requirements: Specify the expected behavior and functions of the smart street lighting system. This includes details about automation, control mechanisms, and communication protocols.
* System Architecture: Describe the overall architecture of the system, including hardware components, software modules, and their interactions.
* User Interfaces: Define the interfaces through which users, administrators, or other systems will interact with the smart street lighting system.
  1. **Intended Audience and Reading Suggestions:**

The primary audience includes:

* Development Team: Software engineers, architects, and programmers responsible for designing and implementing the smart street lighting system
* Project Managers: Individuals overseeing the planning, execution, and delivery of the smart street lighting project.
* System Integrators: Professionals involved in integrating the smart street lighting system with existing infrastructure or other smart city components.
  1. **Product Scope:**

The Smart Street Lighting System encompasses the following features and functionalities:

* Intelligent control of street lights based on time schedules, environmental conditions, and sensor inputs.
* Dimming capabilities for energy conservation during low-traffic periods.
* Remote monitoring of individual street lights for operational status, energy consumption, and faults.
* Alerts and notifications for maintenance and performance issues.

1. **Overall Description**
   1. **Product Perspective:**

The Smart Street Lighting System exists within the broader context of a smart city infrastructure. It interacts with various external entities and systems, contributing to and benefiting from the overall urban ecosystem.

* 1. **Product Functions:**
* The system shall automatically adjust the brightness of street lights based on predefined time schedules.
* Street lights will respond to environmental conditions (e.g., ambient light levels) by adjusting brightness to enhance visibility while conserving energy.
* Automated alerts and notifications shall be generated for maintenance teams in the event of system faults, malfunctions, or unusual energy consumption patterns.
* A web-based dashboard for administrators to monitor and manage the entire street lighting network, including configuration settings and system diagnostics.
* The Brighness of the lights will increase as the car or any vehichle is about to pass.
  1. **User Classes and Characteristics**
* Technical expertise in smart city technologies and systems.
* Responsible for overseeing the operation, configuration, and maintenance of the Smart Street Lighting System.
* Access the web-based administrator dashboard to monitor and manage the entire street lighting network.
* Configure system settings, schedules, and optimization parameters.
* Receive and respond to alerts and notifications regarding system faults or performance issues.
* Implement and configure interfaces between the smart street lighting system and other smart city components.
* Test and validate the integrated system to guarantee optimal performance.
  1. **Operating Environment**
* The Smart Street Lighting System operates on existing street lighting infrastructure, including poles, fixtures, and power supply components.
* Each street light is equipped with a control unit containing microcontrollers, sensors, and communication modules for local control.
* The central control system is hosted on dedicated servers or cloud infrastructure, with sufficient computing resources to handle data processing.
* The central control system and street light control units run on a compatible operating system, such as Linux or Windows, based on the system's software architecture.
* The system is designed to operate in varying environmental conditions, including temperature fluctuations, humidity, and exposure to outdoor elements.

## Design and Implementation Constraints

* The system must be compatible with the existing street lighting infrastructure, including poles, fixtures, and power supply systems. Any modifications should be within the constraints of the current setup.
* The system relies on a continuous and reliable power supply. Any disruptions in power may impact the operational capabilities of the street lights and the central control system.
* The implementation of sensor technologies for environmental sensing and motion detection is constrained by the availability of suitable, cost-effective sensors.
  1. **User Documentation**
* Detailed instructions for installing and configuring the Smart Street Lighting System, including requirements and step-by-step procedures.
* A comprehensive guide for administrators to configure system settings, lighting schedules, and optimization parameters using the central control system.
* Manuals for conducting training sessions for administrators, maintenance teams, end-users, and system integrators. Includes presentation materials and hands-on exercises.
* Short instructional videos demonstrating key functionalities and common tasks for various user classes.

## Assumptions and Dependencies

* The assumption is made that a stable and reliable power supply will be available to the street lighting infrastructure to ensure continuous operation.
* The system's functionality depends on compatibility with the existing street lighting infrastructure, including poles, fixtures, and power supply systems.

1. **External Interface Requirements**
   1. **User Interfaces**

* A web-based interface designed for administrators to monitor and manage the entire smart street lighting network.
* Configuration of system settings, schedules, and optimization parameters.
* Real-time monitoring of individual street lights.
* Reception and response to alerts and notifications.
* Reporting malfunctioning street lights.
* Providing feedback on lighting conditions.
* Accessing information about current lighting schedules and energy-saving initiatives.
  1. **Hardware Interfaces**
* The smart street lighting system interfaces with existing street lighting infrastructure, including poles, fixtures, and power supply components.
* Each street light is equipped with a control unit containing microcontrollers, sensors.

## Software Interfaces

* The smart street lighting system runs on a compatible operating system, such as Linux or Windows.
* Compatibility with the chosen operating system for seamless deployment and operation.

1. **System Feature**

**Integration with Raspberry Pi Camera:**

Description: Integration with a Raspberry Pi camera allows for visual data capture and analysis to enhance monitoring capabilities.

Requirements: Compatibility with the Raspberry Pi camera module and appropriate image processing algorithms.

* The system provides real-time monitoring of individual street lights, indicating operational status, energy consumption, and any faults.
* Requirements: Integration with sensors for monitoring and reporting status.