Software Requirement Specifications

# 1. Introduction

## 1.1 Purpose

The purpose of this document is to outline the software requirements for the development of an IoT-based Smart Lighting Green Technology Solution for street and highway lighting. It defines the functionality, constraints, and performance requirements of the system.

## 1.2 Intended Audience

This document is intended for developers, testers, project managers, and stakeholders involved in the development and implementation of the IoT-based Smart Lighting system for street and highway lighting.

## 1.3 Scope

The scope of this project includes the design and implementation of an intelligent street and highway lighting system that utilizes IoT technology to optimize energy consumption, promote sustainability, and enhance user experience.

## 1.4 Definitions

- **IoT**: Internet of Things

- **Smart Lighting**: Intelligent lighting systems that use sensors and automation to adjust lighting based on environmental conditions and user preferences.

# 2. Overall Description

## 2.1 User Interfaces

**2.1.1 Mobile Application Interface**

- The mobile application interface shall provide an intuitive design allowing users to easily adjust lighting preferences for street and highway lights.

- Users should be able to view real-time status updates and receive notifications regarding system activities, such as maintenance alerts or energy optimization reports.

**2.1.2 Web Interface for Administrators**

- The web interface shall offer administrators the capability to configure system settings, monitor energy usage, and generate reports.

- Administrators should be able to visualize the status of individual lights, identify areas of high or low energy consumption, and remotely troubleshoot issues.

## 2.2 System Interfaces

**2.2.1 Traffic Sensor Integration**

- The system shall integrate with traffic sensors to assess traffic density and adjust lighting accordingly to enhance safety and energy efficiency.

- Real-time traffic data will be used to dynamically control lighting levels in response to variations in traffic flow.

## 2.3 Constraints, Assumptions, Dependencies

**2.3.1 Infrastructure Dependency**

- The system is dependent on existing streetlight infrastructure for installation. Compatibility checks with the existing infrastructure must be conducted before deployment.

**2.3.2 Power Supply**

- The system assumes a stable power supply for the operation of both lighting and IoT devices. A backup power solution may be required in case of power outages.

**2.3.3 Connectivity**

- The system assumes reliable internet connectivity for data transmission between devices and the central server. Contingency plans should be in place for intermittent or lost connectivity.

**2.3.4 Environmental Conditions**

- The system assumes normal environmental conditions for optimal sensor functionality. Extreme weather conditions may affect sensor accuracy and should be considered in the system design.

## 2.4 User Characteristics

The users of the system for street and highway lighting include:

- **End Users**: Individuals using the mobile application to control lights.

- **Administrators**: Responsible for system configuration and monitoring.

Certainly! Let's continue the SRS document by expanding on the sections you've provided:

# 3. System Features & Requirements

## 3.1 Functional Requirements

**3.1.1 Lighting Control**

- The system shall be able to adjust the intensity and color temperature of the street and highway lights based on environmental conditions.

- Lights should automatically adjust brightness during different times of the day and under varying weather conditions.

**3.1.2 Energy Optimization**

- The system shall optimize energy consumption by dimming or turning off lights in low-traffic areas during specified time intervals.

- Energy usage data shall be logged for monitoring and analysis.

## 3.2 Use Cases

 **Manual Lighting Control:** In scenarios where immediate adjustments to lighting conditions are necessary, end users can leverage the mobile application to manually control the brightness and color temperature of streetlights in specific areas. This functionality allows for real-time customization to meet visibility or aesthetic preferences, providing a personalized experience for users.

 **Automated Lighting Adjustment Based on Time:** The system ensures optimal energy consumption by automatically adjusting the brightness of streetlights based on the time of day. As night falls, the lights brighten to enhance visibility, gradually dimming towards dawn. This automated process not only meets safety requirements but also aligns with the natural lighting needs of the environment.

 **Dynamic Lighting Based on Environmental Conditions:** Leveraging data from environmental sensors, the system dynamically adapts streetlighting to current conditions. For instance, on a moonlit night, the lights may be dimmed to conserve energy while still ensuring sufficient visibility. This use case highlights the system's responsiveness to the surrounding environment.

 **Traffic-Responsive Lighting:** Integrated traffic sensors enable the system to respond dynamically to varying traffic density. In high-traffic areas, streetlights brighten to enhance safety and visibility, while in low-traffic zones, the system conserves energy by dimming or turning off lights. This adaptive approach contributes to both safety and energy efficiency.

 **Energy Optimization:** To achieve sustainable energy consumption, the system identifies unoccupied or low-traffic zones during predefined hours. It then automatically adjusts the lighting in these areas, dimming or turning off lights as needed. This proactive energy optimization ensures efficient resource utilization without compromising safety standards.

## 3.3 External Interface Requirements

**3.3.1 User Interface**

- The system shall provide a user-friendly mobile application for users to control and monitor the smart lighting system for streets and highways.

**3.3.2 Sensor Interfaces**

- The system shall integrate with environmental sensors, traffic sensors, and other relevant infrastructure to gather data for intelligent lighting adjustments.

## 3.4 Logical Database Requirements

- The system shall maintain a database to store user preferences, usage history, and energy consumption data related to street and highway lighting.

## 3.5 Non-Functional Requirements

**3.5.1 Performance**

- The system shall respond to user inputs within 2 seconds.

- The lighting adjustments should be implemented in real-time, with a maximum delay of 5 seconds.

**3.5.2 Reliability**

- The system shall have an uptime of 99.9% to ensure continuous and reliable street and highway lighting.

**3.5.3 Security**

- User data and system communications shall be encrypted to ensure the confidentiality and integrity of information.

- Access to administrator interfaces shall be secured with multi-factor authentication.

**3.5.4 Scalability**

- The system should be scalable to accommodate an increasing number of connected devices and lights as the infrastructure expands.

# 4. Delivery for Approval

The SRS document is scheduled for review and approval by the project stakeholders. Any feedback or requested modifications will be incorporated into the document before final approval.