CSE7101- Capstone Project

Review-1

AUTOMATED PUBLIC LIGHTNING SYSTEM USING ESP NOW

PSCS_14

Batch Number: CSE_248

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Problem Statement Number: PSCS_17

- Manual public lighting systems waste energy by operating on fixed schedules, ignoring ambient light conditions. Rural/remote areas lack adaptive solutions due to high costs and dependency on centralized networks.

Key Features

1. Energy inefficiency due to non-adaptive lighting schedules.
2. High deployment costs of IoT solutions requiring cloud infrastructure.
3. Lack of real-time responsiveness to environmental changes.

Content

- Problem Statement
- Objectives
- Background and Related work for title Selection
- Analysis of Problem Statement
- Innovation or Novel Contributions
- Git-hub Link
- Timeline of the Project
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Objectives

1. Design a low-cost, *offline* lighting system using ESP8266.
2. Implement *ESP-NOW* for decentralized master-slave communication.
3. Optimize energy usage via ambient light sensor.
4. Enable automatic light activation/deactivation without human intervention.

Analysis of Problem Statement

Technology Stack: Hardware: ESP8266 D1 mini, Light sensors, Relay modules, LEDs

Communication: ESP-NOW (for peer-to-peer data transfer)

Software: Arduino IDE, C/C++

Challenges:

Challenge	Solution
Packet loss in ESP-NOW	Use acknowledgment messages
LDR calibration	Calibrate dynamically under different light levels
Power supply to relays	Use external 5V source to avoid brownouts

Analysis of Problem Statement (contd...)

Software Requirements

- IDE: Arduino IDE
- Libraries: ESP8266WiFi, ESP-NOW, Adafruit_Sensor
- Protocol: ESP-NOW (for peer-to-peer communication)

Hardware Requirements

Item	Specification
Microcontrollers	ESP8266 (NodeMCU) ×6 units
Sensors	Ambient Light Sensor ×1
Actuators	5V Single-Channel Relay Modules ×6
Lights	LEDs (for simulation)
Power	5V Power Supply

Analysis of Problem Statement

- **Challenges Identified:**
  - Language barrier for rural users
  - Manual, time-consuming navigation
  - No job-matching intelligence

- **Opportunities:**
  - Use AI to predict and serve user needs instantly
  - Increase adoption by making the system accessible to non-tech-savvy users

- **Expected Benefits:**
  - Shorter query resolution time
  - Improved user engagement
  - Higher job placement success rates

Github Link

Github Link

https://github.com/Amreen-552/Automated-Public-Lighting-System-Capstone-2025-

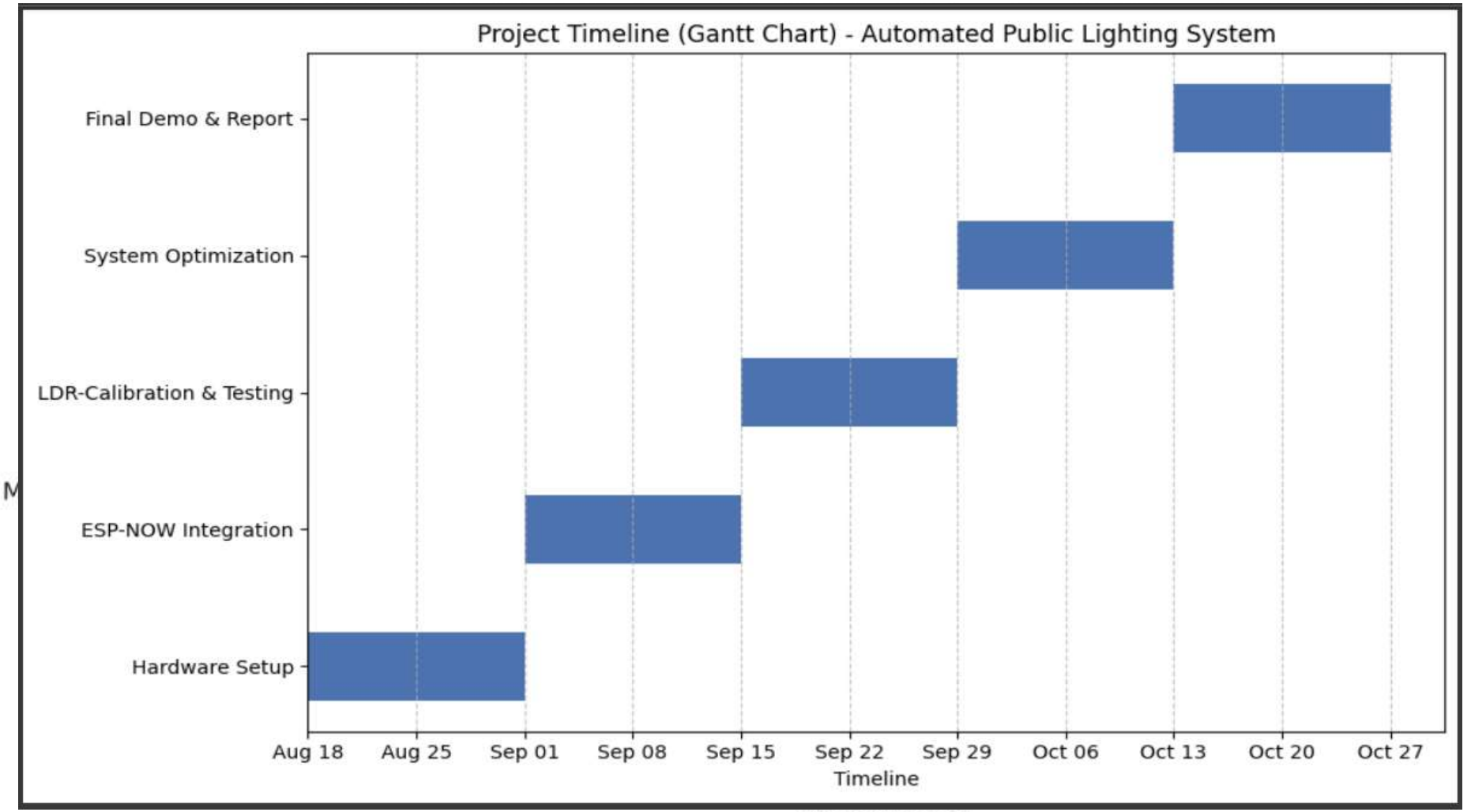
Background & Related Work

Existing Solutions:

- Timer-based systems: Inflexible, ignore weather/seasonal changes.
- Cloud-IoT systems: Expensive, require stable internet (unsuitable for remote areas).
- Smart city projects: Centralized, high-cost (e.g., Philips Hue).
- Gap Identified:

No cost-effective, offline solution using peer-to-peer communication for public lighting.

Timeline of the Project (Gantt Chart)



References (IEEE Paper format)

1. P. K. Sahoo et al., “IoT-Based Smart Lighting System for Energy Efficiency,” IEEE Access, vol. 9, pp. 112158–112173, 2021.

2. Espressif Systems, “ESP-NOW Protocol Documentation,” 2023. [Online]. Available: https://docs.espressif.com/projects/esp-idf/en/latest/esp32/api-reference/network/esp_now.html

3. A. Gupta, “Low-Cost Automation Using ESP8266,” Journal of Embedded Systems, vol. 7, no. 4, pp. 45–59, Dec. 2022.


Thank
You!