Coding & Solutioning

Utilization of Algorithms

Date	13 MAY 2023
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Project Name	IoT Based Weather Adaptive Street Lighting System

Introduction:

The weather adaptive street lighting system utilizes algorithms to analyze sensor data, make intelligent decisions, and control the lighting accordingly. This section discusses the key algorithms employed in the code snippet and their role in achieving weather-adaptive lighting.

Sensor Data Analysis:

The code utilizes algorithms to analyze the sensor data acquired from various weather sensors. These algorithms process the data and extract meaningful insights to determine the current weather conditions. Some of the algorithms used in this process include:

a. Threshold Comparison:

The code compares the sensor readings against predefined threshold values to determine if certain weather conditions are met. For example, the LDR (light-dependent resistor) reading is compared against the threshold value to decide if the ambient light is below a certain level.

b. Mapping:

The code employs the mapping algorithm to convert the LDR readings to LED brightness levels. By mapping the analog sensor readings to a desired range (0-255), the appropriate brightness level for the street lights is determined based on the detected light intensity.

Lighting Control:

The weather adaptive street lighting system uses algorithms to control the behavior of the street lights based on the analyzed weather conditions. The following algorithms are utilized:

a. Digital Output Control:

The code uses digital output control algorithms to turn on or off specific LEDs based on the received commands. For example, when the command "lighton1" is received, the algorithm sets the corresponding LED pin to a high state, turning on the respective street light.

b. Condition-based Control:

The code employs conditional algorithms to determine the appropriate lighting behavior based on weather conditions. For instance, if the LDR reading surpasses the threshold value, the algorithm activates the LED with a corresponding brightness level, providing adequate illumination for the given light intensity.

Efficiency Considerations:

The code takes into account the efficiency of the algorithms to ensure optimal performance and resource utilization. Considerations include:

a. Time Complexity:

The algorithms implemented in the code strive for efficiency by maintaining a low time complexity. This ensures fast and responsive execution, enabling real-time weather adaptive lighting adjustments.

b. Resource Management:

The code optimizes resource usage, such as memory and processing power, to minimize the system's footprint. This allows the system to operate smoothly on resource-constrained devices like the ESP32.

Conclusion:

The utilization of algorithms in the weather adaptive street lighting system plays a vital role in analyzing sensor data, making intelligent decisions, and controlling the street lights accordingly. By employing algorithms for data analysis, threshold comparison, mapping, digital output control, and condition-based control, the system achieves weather adaptive lighting functionality. The algorithms are designed for efficiency, ensuring optimal performance and resource utilization.