**DUAL-VOLTAGE RECHARGEABLE TORCH LIGHT**

**Objective**

The primary objective of a dual-voltage rechargeable torch light is to provide a versatile, reliable, and portable lighting solution that can operate at multiple voltage levels. This adaptability makes it suitable for various environments and usage scenarios, ensuring optimal performance regardless of the available power supply.

**EXAMPLE CODE:**

// Define pins for voltage detection, LED control, and battery status

const int voltagePin = A0; // Analog pin to read voltage level

const int ledPin = 9; // Digital pin to control LED

const int batteryStatusPin = A1; // Analog pin to read battery status

const int buttonPin = 2; // Digital pin to read button input

// Define voltage thresholds

const float lowVoltageThreshold = 3.0; // Low voltage threshold in volts

const float highVoltageThreshold = 5.0; // High voltage threshold in volts

// Define battery status thresholds

const float batteryLow = 3.2; // Battery low level in volts

const float batteryFull = 4.2; // Battery full level in volts

// Variables to store voltage and battery status

float currentVoltage = 0.0;

float batteryLevel = 0.0;

// Variable to store LED state

bool ledState = false;

void setup() {

// Initialize serial communication for debugging

Serial.begin(9600);

// Initialize pins

pinMode(voltagePin, INPUT);

pinMode(ledPin, OUTPUT);

pinMode(batteryStatusPin, INPUT);

pinMode(buttonPin, INPUT\_PULLUP);

// Initialize LED state

digitalWrite(ledPin, LOW);

}

void loop() {

// Read the current voltage and battery level

currentVoltage = analogRead(voltagePin) \* (5.0 / 1023.0);

batteryLevel = analogRead(batteryStatusPin) \* (5.0 / 1023.0);

// Print voltage and battery status for debugging

Serial.print("Current Voltage: ");

Serial.println(currentVoltage);

Serial.print("Battery Level: ");

Serial.println(batteryLevel);

// Check for button press to toggle LED state

if (digitalRead(buttonPin) == LOW) {

delay(50); // Debounce delay

if (digitalRead(buttonPin) == LOW) {

ledState = !ledState;

digitalWrite(ledPin, ledState ? HIGH : LOW);

delay(500); // Prevent multiple toggles

}

}

// Adjust LED brightness based on voltage level

if (ledState) {

if (currentVoltage < lowVoltageThreshold) {

analogWrite(ledPin, 128); // Dim LED for low voltage

} else if (currentVoltage > highVoltageThreshold) {

analogWrite(ledPin, 255); // Full brightness for high voltage

} else {

analogWrite(ledPin, 192); // Medium brightness for normal voltage

}

}

// Indicate battery status

if (batteryLevel < batteryLow) {

Serial.println("Battery Low! Please recharge.");

} else if (batteryLevel > batteryFull) {

Serial.println("Battery Full.");

}

// Delay for stability

delay(1000);

}

**Advantages**

Versatility: The ability to operate at multiple voltage levels makes it suitable for use in different regions with varying power standards.

Portability: Being rechargeable eliminates the need for constant battery replacement, making it a convenient and eco-friendly choice.

Cost-Effective: Reduces the long-term cost associated with disposable batteries.

Environmental Impact: Rechargeable batteries contribute to less environmental waste compared to single-use batteries.

Reliability: Provides consistent performance and is often built to withstand various environmental conditions, making it suitable for outdoor activities.

**Disadvantages**

Initial Cost: The upfront cost of a dual-voltage rechargeable torch light can be higher compared to standard single-voltage or non-rechargeable torches.

Charging Dependency: Requires access to a power source for recharging, which might not be available in all situations.

Battery Life: Rechargeable batteries have a limited lifespan and may require replacement after a certain number of charge cycles.

Weight: Dual-voltage and rechargeable mechanisms can add to the weight, making the torch less lightweight compared to some alternatives.

**Applications**

Outdoor Activities: Ideal for camping, hiking, and other outdoor adventures where a reliable and portable light source is essential.

Emergency Situations: Useful during power outages, roadside emergencies, and other urgent scenarios where immediate light is required.

Professional Use: Employed by security personnel, law enforcement, and maintenance workers who need a dependable light source in varying conditions.

Home Use: Handy for household tasks, repairs, and as a backup during unexpected power cuts.

Travel: Convenient for travelers who might encounter different power standards and need a versatile light source.

**Conclusion**

The dual-voltage rechargeable torch light is a practical and efficient tool designed to meet the lighting needs of a wide range of users. Its versatility, environmental benefits, and reliability make it an attractive option for both personal and professional use. Despite some disadvantages like initial cost and the need for regular recharging, its overall benefits in providing adaptable and sustainable lighting solutions are substantial. Whether for everyday use, emergency preparedness, or outdoor adventures, this torch light proves to be a valuable asset.