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#include <WiFi.h>
#include <WebServer.h>
#include <Adafruit_INA219.h>

// WiFi credentials
const char *ssid = "test";
const char *password = "123456";

// Web server instance
WebServer server(80);
Adafruit_INA219 ina219;

// GPIO pins for the relay module
const int relay1Pin = 26; // Relay 1
const int relay2Pin = 27; // Relay 2
const int relay3Pin = 32; // Relay 3
const int relay4Pin = 33; // Relay 4

// Variables to store relay states
bool relay1State = false;
bool relay2State = false;
bool relay3State = false;
bool relay4State = false;

const float batteryCapacityAh = 240.0; // Your battery capacity in Ah
Lithium Battery

// Variables to store the state
float totalChargeAh = 0.0; // Cumulative charge in Ah

void setup() {
  Serial.begin(115200);
  delay(1000); // Allow time for the serial monitor to start

  Serial.println("Setting up INA219...");
  if (!ina219.begin()) {
    Serial.println("Failed to find INA219 chip");
    // Continue setup to see if Wi-Fi AP is working
  } else {
    ina219.setCalibration_32V_2A();
    Serial.println("INA219 setup complete");
  }
}
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pinMode(relay1Pin, OUTPUT);
pinMode(relay2Pin, OUTPUT);
pinMode(relay3Pin, OUTPUT);
pinMode(relay4Pin, OUTPUT);

// Ensure all relays are off initially
digitalWrite(relay1Pin, HIGH);
digitalWrite(relay2Pin, HIGH);
digitalWrite(relay3Pin, HIGH);
digitalWrite(relay4Pin, HIGH);

Serial.println("Setting up WiFi AP...");
WiFi.softAP(ssid, password);

IPAddress IP = WiFi.softAPIP();
Serial.print("AP IP address: ");
Serial.println(IP);

server.on("/", handleRoot);
server.on("/toggle", toggleRelay);
server.on("/data", HTTP_GET, handleData);

server.begin();
Serial.println("HTTP server started");
}

void loop() {
    server.handleClient();

    // Update totalChargeAh based on current measurement if INA219 is
    present
    if (ina219.begin()) {
        float current_mA = ina219.getCurrent_mA();
        totalChargeAh += (current_mA / 1000.0) / 3600.0; // Convert mA to
A, then to Ah
    }
}

void handleRoot() {
    String html = "<!DOCTYPE html><html>";
    html += "<head><title>Control Panel & Battery Monitor</title>";
    html += "<meta name='viewport' content='width=device-width,
initial-scale=1.0'>";
}

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html += "<style>";
html += "body { display: flex; justify-content: center; align-items:
center; height: 100vh; margin: 0; flex-direction: column;
background-color: #f0f0f0; }";
html += "h1 { font-size: 30px; font-weight: bold; color: black; }";
html += ".container { width: 100%; max-width: 900px; margin: 0 auto;
text-align: center; }";
html += ".monitor { border: 2px solid green; padding: 20px;
border-radius: 10px; margin-top: 20px; background-color: white;
display: inline-block; text-align: center; }";
html += ".battery { margin-bottom: 10px; }";
html += ".battery-level { font-size: 2em; font-weight: bold; }";
html += ".metrics { text-align: center; margin-top: 10px; }";
html += ".metrics p { margin: 5px 0; font-size: 1.2em; }";
html += ".button-group { display: flex; flex-wrap: wrap;
justify-content: center; }";
html += "button { padding: 15px; margin: 10px; font-size: 18px;
background-color: black; color: white; border: none; border-radius:
5px; width: calc(50% - 20px); }";
html += ".on { background-color: green !important; color: white; }";
html += ".relay-button { border: 1px solid #666; }"; // Less
prominent border for relay buttons
html += "@media (min-width: 600px) {";
html += "  .button-group { flex-direction: row; flex-wrap: wrap; }";
html += "  button { width: calc(50% - 20px); }";
html += "}";
html += "@media (min-width: 900px) {";
html += "  button { width: calc(25% - 20px); }";
html += "}";
html += "</style>";
html += "</head>";
html += "<body>";
html += "<h1>Hilux</h1>";
html += "<div class='container'>";
html += "<div class='monitor'>";
html += "<div class='battery'>";
html += "<div class='battery-level' id='batteryLevel'>84Ah</div>";
html += "</div>";
html += "<div class='metrics'>";
html += "<p><b>Voltage:</b> <span id='voltage'>13.2V</span></p>";
html += "<p><b>Current:</b> <span id='current'>-10.3A</span></p>";
html += "<p><b>Power:</b> <span id='power'>136W</span></p>";
html += "<p><b>State of Charge:</b> <span id='soc'>85%</span></p>";

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    html += "<p><b>Time Left:</b> <span
id='time'>08:44</span></p></div></div>";
    html += "<div class='button-group'>";
    html += "<button class='relay-button' id='relay1'
onclick='toggleRelay(1)'><b>LEFT LIGHT</b></button>";
    html += "<button class='relay-button' id='relay2'
onclick='toggleRelay(2)'><b>RIGHT LIGHT</b></button>";
    html += "<button class='relay-button' id='relay3'
onclick='toggleRelay(3)'><b>REAR LIGHT</b></button>";
    html += "<button class='relay-button' id='relay4'
onclick='toggleRelay(4)'><b>CAMP LIGHT</b></button>";
    html += "<button class='relay-button' id='allLights'
onclick='toggleAllRelays()'><b>ALL LIGHTS</b></button>";
    html += "</div>";
    html += "</div>";
    html += "</div>";
    html += "<script>";
    html += "function toggleRelay(relay) {";
    html += "    fetch('/toggle?relay=' + relay).then(response =>
response.text()).then(state => {";
    html += "        var button = document.getElementById('relay' + relay);";
    html += "        if (state == '1') {";
    html += "            button.classList.add('on');";
    html += "        } else {";
    html += "            button.classList.remove('on');";
    html += "        }";
    html += "    });";
    html += "}";
    html += "function toggleAllRelays() {";
    html += "    var allOn =
document.getElementById('allLights').classList.contains('on');";
    html += "    var relays = [1, 2, 3];"; // List of all relay numbers
except camp light
    html += "    relays.forEach(function(relay) {";
    html += "        fetch('/toggle?relay=' + relay).then(response =>
response.text()).then(state => {";
    html += "            var button = document.getElementById('relay' +
relay);";
    html += "            if (state == '1') {";
    html += "                button.classList.add('on');";
    html += "            } else {";
    html += "                button.classList.remove('on');";
    html += "            }";

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    html += "    });";
    html += "  });";
    html += "  var allLightsButton =
document.getElementById('allLights');";
    html += "    if (allOn) {";
    html += "      allLightsButton.classList.remove('on');";
    html += "    } else {";
    html += "      allLightsButton.classList.add('on');";
    html += "    }";
    html += "  }";
    html += "function updateBatteryMetrics() {";
    html += "  fetch('/data').then(response => response.json()).then(data
=> {";
    html += "    document.getElementById('batteryLevel').innerText =
data.totalChargeAh.toFixed(1) + 'Ah';";
    html += "    document.getElementById('voltage').innerText =
data.voltage.toFixed(2) + 'V';";
    html += "    document.getElementById('current').innerText =
data.current_mA.toFixed(1) + 'A';";
    html += "    document.getElementById('soc').innerText =
data.soc.toFixed(1) + '%';";
    html += "    document.getElementById('time').innerText =
data.timeToFlat.toFixed(1) + ' hours';";
    html += "  });";
    html += "  }";
    html += "setInterval(updateBatteryMetrics, 5000);"; // Update every 5
seconds
    html += "</script></body></html>";

    server.send(200, "text/html", html);
}

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void toggleRelay() {
  if (server.hasArg("relay")) {
    int relay = server.arg("relay").toInt();
    bool state = false;
    switch (relay) {
      case 1:
        relay1State = !relay1State;
        state = relay1State;
        digitalWrite(relay1Pin, state ? LOW : HIGH); // Relay is
active low
        break;

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    case 2:
        relay2State = !relay2State;
        state = relay2State;
        digitalWrite(relay2Pin, state ? LOW : HIGH);
        break;
    case 3:
        relay3State = !relay3State;
        state = relay3State;
        digitalWrite(relay3Pin, state ? LOW : HIGH);
        break;
    case 4:
        relay4State = !relay4State;
        state = relay4State;
        digitalWrite(relay4Pin, state ? LOW : HIGH);
        break;
    default:
        break;
}
server.send(200, "text/plain", state ? "1" : "0");
} else {
    server.send(400, "text/plain", "Bad Request: No relay specified");
}
}

void handleData() {
    if (!ina219.begin()) {
        server.send(500, "text/plain", "INA219 not detected");
        return;
    }

    float voltage = ina219.getBusVoltage_V();
    float current_mA = ina219.getCurrent_mA();
    float soc = 100.0 * (batteryCapacityAh - totalChargeAh) /
batteryCapacityAh;
    float timeToFlat = totalChargeAh / (current_mA / 1000.0); // Time in
hours

    String json = "{";
    json += "\"voltage\":" + String(voltage, 2) + ",";
    json += "\"current_mA\":" + String(current_mA, 1) + ",";
    json += "\"soc\":" + String(soc, 1) + ",";
    json += "\"totalChargeAh\":" + String(totalChargeAh, 1) + ",";
    json += "\"timeToFlat\":" + String(timeToFlat, 1);

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json += "}";  
  
server.send(200, "application/json", json);  
}
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