ESP32 Firmware (Arduino IDE)

```
#include <WiFi.h>
#include <PubSubClient.h>
#include <OneWire.h>
#include <DallasTemperature.h>
#include <Wire.h>
#include <MPU6050.h>

// WiFi Credentials
const char* ssid = "YOUR_WIFI";
const char* password = "YOUR_PASSWORD";

// MQTT Broker
const char* mqtt_server = "broker.hivemq.com";

WiFiClient espClient;
PubSubClient client(espClient);

// Pins
#define VOLTAGE_PIN 34
#define CURRENT_PIN 35
#define RELAY_PIN 25
#define ONE_WIRE_BUS 4

OneWire oneWire(ONE_WIRE_BUS);
```

```
DallasTemperature sensors(&oneWire);
MPU6050 mpu;

void setup_wifi() {
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
  }
}

void reconnect() {
  while (!client.connected()) {
    client.connect("SunTracClient");
  }
}

void setup() {
  Serial.begin(115200);
  pinMode(RELAY_PIN, OUTPUT);
  digitalWrite(RELAY_PIN, HIGH);

  setup_wifi();
  client.setServer(mqtt_server, 1883);

  sensors.begin();
  Wire.begin();
  mpu.initialize();
}

void loop() {
```

```
if (!client.connected()) reconnect();
client.loop();

// Read Sensors
int voltageRaw = analogRead(VOLTAGE_PIN);
int currentRaw = analogRead(CURRENT_PIN);

float voltage = voltageRaw * (3.3 / 4095.0) * 5;
float current = currentRaw * (3.3 / 4095.0);

sensors.requestTemperatures();
float temperature = sensors.getTempCByIndex(0);

int16_t ax, ay, az;
mpu.getAcceleration(&ax, &ay, &az);

// Fault Detection Logic
if (temperature > 70 || voltage > 60) {
  digitalWrite(RELAY_PIN, LOW);  // Auto isolation
} else {
  digitalWrite(RELAY_PIN, HIGH);
}

// Create JSON payload
String payload = "{";
payload += "\"voltage\":" + String(voltage) + ",";
payload += "\"current\":" + String(current) + ",";
payload += "\"temperature\":" + String(temperature);
payload += "}";

client.publish("suntrac/data", payload.c_str());
```

```
  delay(5000);
}
```