Scope of Work (SOW)

Monitoring and Control System Development

Project Objective

Design, develop, and deploy a robust, modular, and scalable monitoring and control system with integrated Power Line Carrier (PLC) communication, load disaggregation, mobile/web apps, and cloud backend.

1. Project Deliverables

A. Hardware Design & Prototyping

1. Selection of the microcontroller, and PLC module.
2. Design of relay control circuits with appropriate power ratings.
   Creation of wiring schematics and PCB layout (including opto-isolation, fuses, protection circuits).
3. Assembly and bench testing of full hardware prototype with:
    a. 14 relays
    b. 6 Analogue sensors
    c. 4 Analogue Environmental sensors
4. PLC modules
    a. Sender
        i. PLC Module (KQ-130F)
        ii. Sensors
        iii. Relay
    b. Receiver
        i. PLC Module (KQ-130F)

B. Embedded Software Development

1. Development on ESP-IDF or Arduino framework.
2. Implementation of:
    a. Sensor data acquisition routines
    b. Relay control logic with safety interlocks
    c. Integration of analytical algorithm
    d. PLC communication protocol integration (UART-based)
    e. Wi-Fi and Bluetooth dual-mode communication stack
    f. OTA firmware update capability

C. Backend Development

1. Design and deploy backend with Firebase or MongoDB.
    a. Develop REST APIs or MQTT endpoints for:
    b. Device data ingestion (every 5–10 seconds)

c. Control commands (relay on/off)
d. Implement authentication, security, and data retention policies.
e. Setup cloud infrastructure on AWS, Firebase, or MongoDB Atlas as required.

D. Mobile and Web Application Development

1. Design UI/UX wireframes.
    a. Develop cross-platform mobile app (Flutter or React Native) with:
    b. Bluetooth-based local control
    c. Wi-Fi/cloud-based remote control
    d. Real-time status and sensor data visualization
2. Develop web dashboard (React.js, Next.js, or Vue.js) for:
    a. Device management
    b. Control interface
    c. Historical data graphs

E. Testing & Quality Assurance

1. Conduct unit tests, hardware-in-loop tests, High Availability (HA), and regression tests.
    a. Perform end-to-end system integration testing under real situation.
    b. High Availability (HA) testing is a crucial process to ensure a system can maintain continuous operation, even when encountering failures or disruptions.
    c. Document all test cases and results.

F. Documentation

1. Full technical documentation (schematics, PCB files, BOM)
2. Firmware source code with inline comments
3. API documentation
4. Mobile and web app deployment guide
5. User manual for system setup and operation

2. Timeline

Provide an estimated work plan with milestones, such as:

Phase	Deliverable	Timeline	Hours	Hourly Rate	Budget
Hardware design & prototyping	Functional prototype assembled				
Firmware development	Sensor data acquisition and relay control operational				
Backend & database setup	APIs live and database integrated				
Mobile and Web app development	Beta apps ready for testing				
System integration & testing	End-to-end testing completed				

Final delivery & documentation	Handover of all deliverables				
Follow-Up Support	Ongoing support or maintenance options				

3. Required Skills

1. Embedded systems development
2. Circuit design and PCB layout (high current switching circuits)
3. Mobile app development (Flutter or React Native)
4. Web app development (React.js, Next.js, or Vue.js)
5. Backend development (Node.js, Firebase, MongoDB)
6. PLC communication protocol integration

4. Payment terms

The total fund will be paid to the contractor after the final delivery of the product and the document submission.