CSE7302 – University Project

Review-1

RENEWABLE ENERGY MONITORING SYSTEM FOR MICROGRIDS

Batch No : CCS_14
Problem Statement No : SIH25051

Roll Number	Student Name
20221CCS0005	AMREEN J
20231CCS3006	AALIYA ZAINA

Under the Supervision of,

Tanveer Ahmed

Assistant Professor

Presidency School of Computer Science,

Presidency University

Name of the Program: University Project
Name of the HoD: Dr. Anandaraj
Name of the Program Project Coordinator: Dr. Sharmasth Vali
Name of the School Project Coordinators: Dr. Sampath A K , Dr. Geetha A

Abstract

Renewable energy based microgrids are essential for rural and remote areas due to increasing electricity demand and the depletion of non-renewable energy sources. This project presents an IoT-based Renewable Energy Monitoring System that enables real-time monitoring of energy generation, storage, and usage.Electricity is generated using solar panels and a dynamo and stored in a battery through a charging module. A microcontroller measures key parameters such as voltage, current, power, and battery status using power monitoring modules. This data is displayed locally and transmitted wirelessly to an Android application for remote monitoring.The system also provides alerts for low battery levels, inefficient power generation, and abnormal loads. The proposed solution is simple, low-cost, and scalable, helping improve microgrid reliability and energy efficiency in rural communities.

Literature Survey

- Previous studies highlight the importance of renewable energy–based microgrids in providing reliable electricity to rural and remote areas.
- Researchers have proposed solar and wind hybrid microgrid systems to reduce dependence on conventional power sources and improve energy availability.
- Several works demonstrate the use of IoT-based monitoring systems for real-time tracking of voltage, current, power, and energy consumption.
- Studies show that microcontroller-based systems such as Arduino and ESP modules are effective for low-cost energy monitoring and control applications..
- Existing research emphasizes the role of battery energy storage systems in stabilizing power supply and managing fluctuations in renewable energy generation.
- Mobile application based monitoring solutions have been developed to enable remote supervision and control of microgrids.
- This project addresses these limitations by proposing a simple, cost-effective, and scalable IoT-based renewable energy monitoring system.

Objectives

- To design and develop an IoT-based renewable energy monitoring system for microgrids.
- To monitor real-time voltage, current, power, and battery status of the system.
- To integrate renewable energy sources such as solar panels and dynamo for power generation..
- To enable remote monitoring of microgrid performance using an Android application
- To provide alerts and notifications for low battery, power loss, and abnormal load conditions
- To develop a low-cost, scalable, and energy-efficient solution suitable for rural microgrids

Existing Methods and Drawbacks

Existing Methods and Drawbacks:

- Manual monitoring systems: Battery level and power output checked physically.
- Drawbacks: Time-consuming, delayed fault detection.
- Standalone renewable systems: Solar or wind systems operate without real-time monitoring.
- Drawbacks: Inefficient energy usage and power loss.
- Basic metering systems:Uses local voltmeters and ammeters only.
- Drawbacks: No remote access or data logging.
- Centralized grid-dependent monitoring: Relies on main grid infrastructure.
- Drawbacks: Not suitable for rural or isolated areas.

Proposed Method & Feasibility

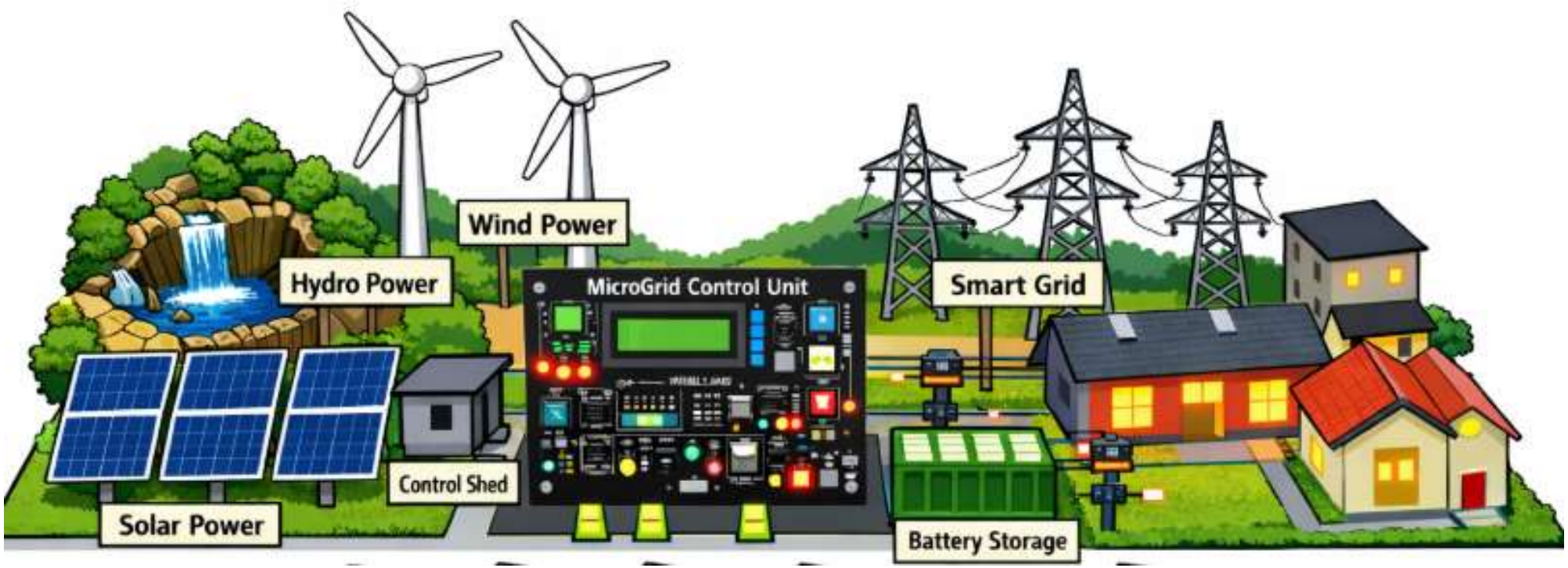
Proposed Method:

- **IoT-based Monitoring System:** Uses a microcontroller with power-monitoring modules to measure voltage, current, power, and battery status in real time.
- **Wireless Data Transmission:** Sends monitored data to an Android application via RF/Wi-Fi for remote monitoring and alerts.

Feasibility:

- **Technical Feasibility:** Uses easily available components like Arduino/ESP, sensors, and simple circuitry.
- **Economic Feasibility:** Low-cost hardware makes the system affordable for rural deployment.
- **Operational Feasibility:** Simple design and Android app enable easy usage and maintenance.
- **Scalability Feasibility:** Can be expanded to include mo.re energy sources or loads in future

Architecture Diagram



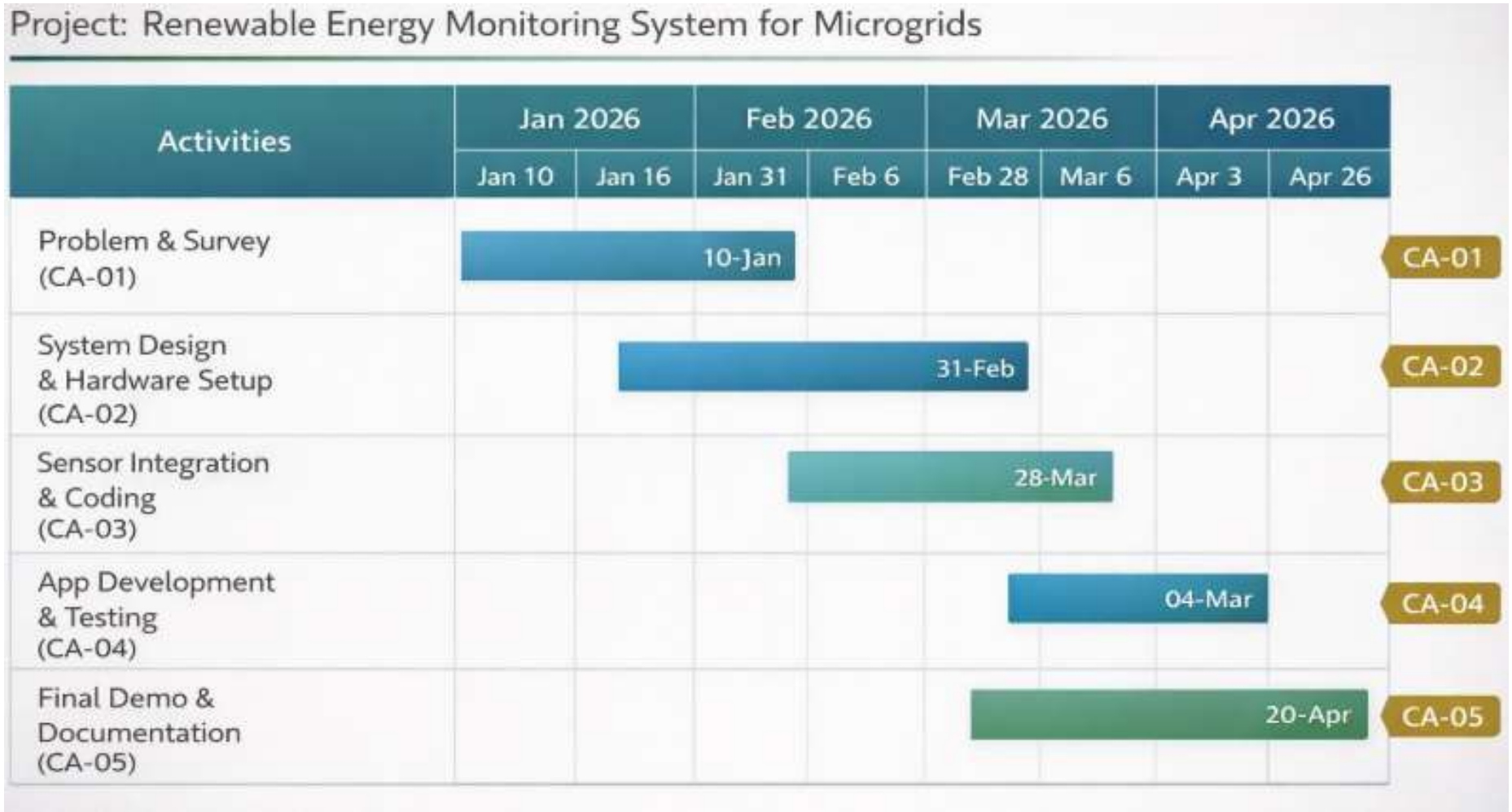
Hardware Requirements

ITEM	SPECIFICATION
Microcontroller	ESP8266
Energy Sources	Solar Panel, Dynamo (Wind Simulation)
Power Monitoring Modules	Voltage Sensor, Current Sensor
Battery	Rechargeable Battery (Li-ion / Lead Acid
Battery Charging Module	Charge Controller
Load	LED Module
Communication Module	Wi-Fi / RF Module
Connecting Components	Wires, Breadboard, Resistors, Switches

Software Requirements

- Arduino IDE – For microcontroller programming
- C++ / Arduino Programming Language
- Raspberry Pi (Local Cloud) Mosquitto (MQTT Broker)
- Node-RED (For creating the Dashboard)
- Serial Monitor – For debugging and testing
- Operating System – Linux

Timeline (Gantt Chart)



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