

**CSE7302 – University Project
Review-1**

RENEWABLE ENERGY MONITORING SYSTEM FOR MICROGRIDS

Batch No : CCS_14

Problem Statement No : SIH25051

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Name of the Program: University Project

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Approved by University Grants Commission under Act No. 25 of 1956

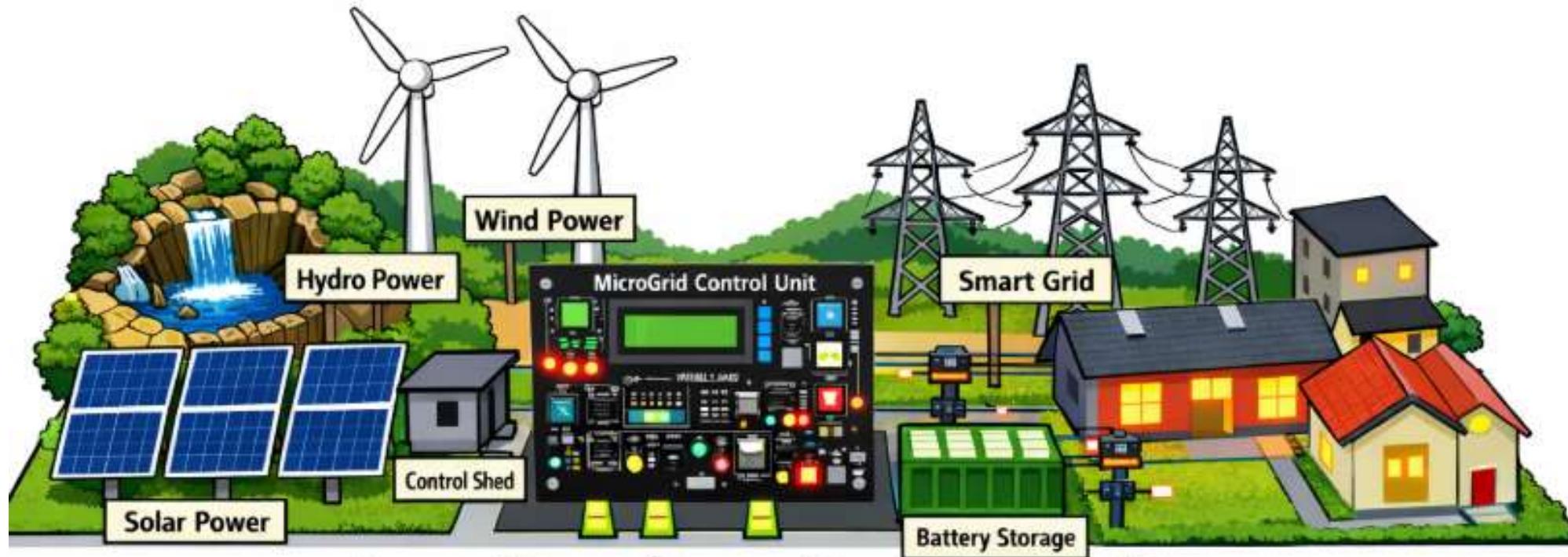
Abstract

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.

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

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



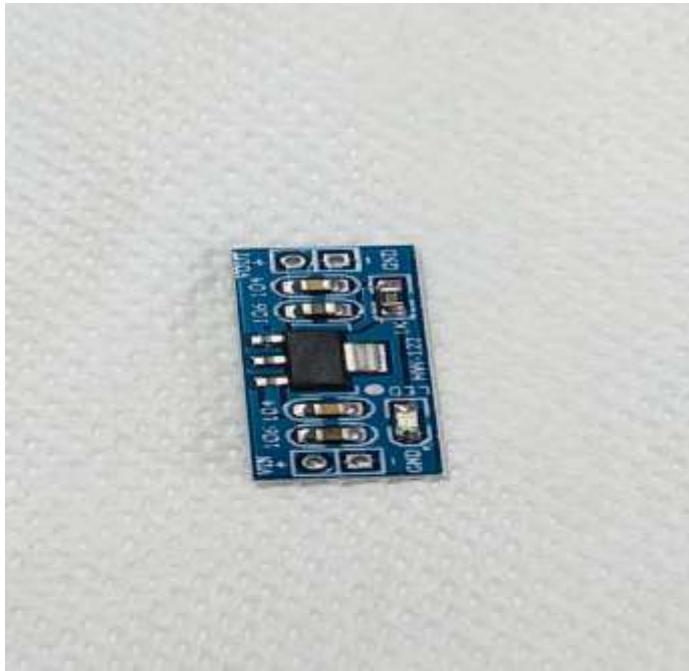
Software Requirements

- 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

Components



Raspberry Pi Zero 2 W



Step – down Power Supply

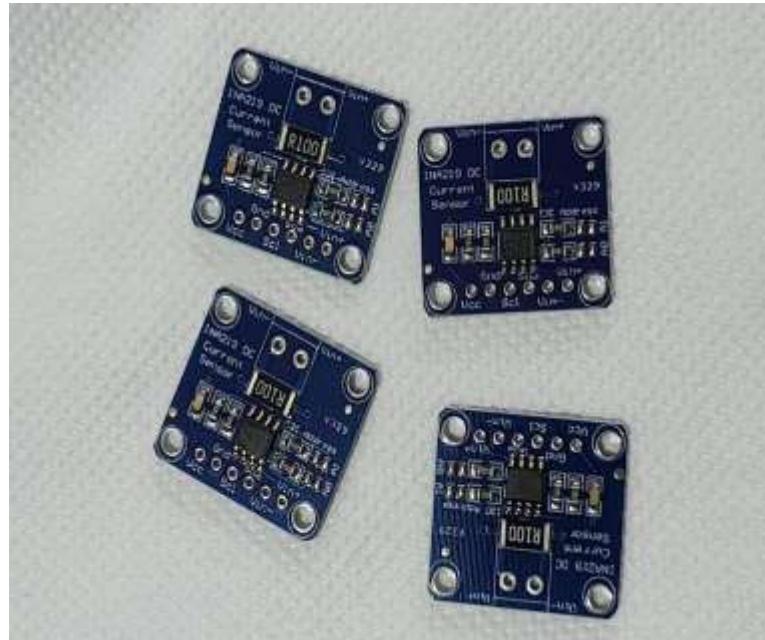


Batteries

Components



- LED Lights



- INA219 I2C bi-directional DC Current and Power Monitor



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Timeline (Gantt Chart)

Project: Renewable Energy Monitoring System for Microgrids

Activities	Jan 2026	Feb 2026	Mar 2026	Apr 2026				
	Jan 10	Jan 16	Jan 31	Feb 6	Feb 28	Mar 6	Apr 3	Apr 26
Problem & Survey (CA-01)		10-Jan						CA-01
System Design & Hardware Setup (CA-02)			31-Feb					CA-02
Sensor Integration & Coding (CA-03)				28-Mar				CA-03
App Development & Testing (CA-04)					04-Mar			CA-04
Final Demo & Documentation (CA-05)						20-Apr		CA-05



References

1. IEEE, “*IoT-Based Monitoring and Control of Renewable Energy Microgrids*,” IEEE Access, 2021.
2. A. Gupta, R. Kumar, “*Design of Smart Microgrid Using Renewable Energy Sources*,” International Journal of Engineering Research & Technology (IJERT), 2020.
3. N. Hatziargyriou, *Microgrids: Architectures and Control*, Wiley-IEEE Press, 2014.
4. M. A. Hannan et al., “*Internet of Things for Smart Energy Management*,” Renewable and Sustainable Energy Reviews, Elsevier, 2018.
5. Arduino Documentation, “*Arduino-Based Energy Monitoring Systems*,” Arduino Official Website.

GitHub: <https://github.com/Amreen-552/Renewable-Energy-Monitoring-System-For-Microgrids>

1. P. K. Sahoo et al., “*IoT-Based Smart Lighting System for Energy Efficiency*,” IEEE Access, vol. 9, pp. 112158–112173, 2021.

2. Espressif Systems, “*ESP-NOW Protocol Documentation*,” 2023, [Online]. Available: https://docs.espressif.com/projects/esp-idf/en/latest/esp32/api-reference/network/esp_now.html

3. A. Gopin, “*Low Cost Automation Using ESP8266*,” Journal of Embedded Systems, vol. 7, no. 4, pp. 45–59, Dec. 2022.