SMART INDIA HACKATHON 2025

“UrjaLink” - Protector and Optimizer of Renewable Energy.

- **Problem Statement ID –** SIH25051
- **Problem Statement Title-** Renewable Energy

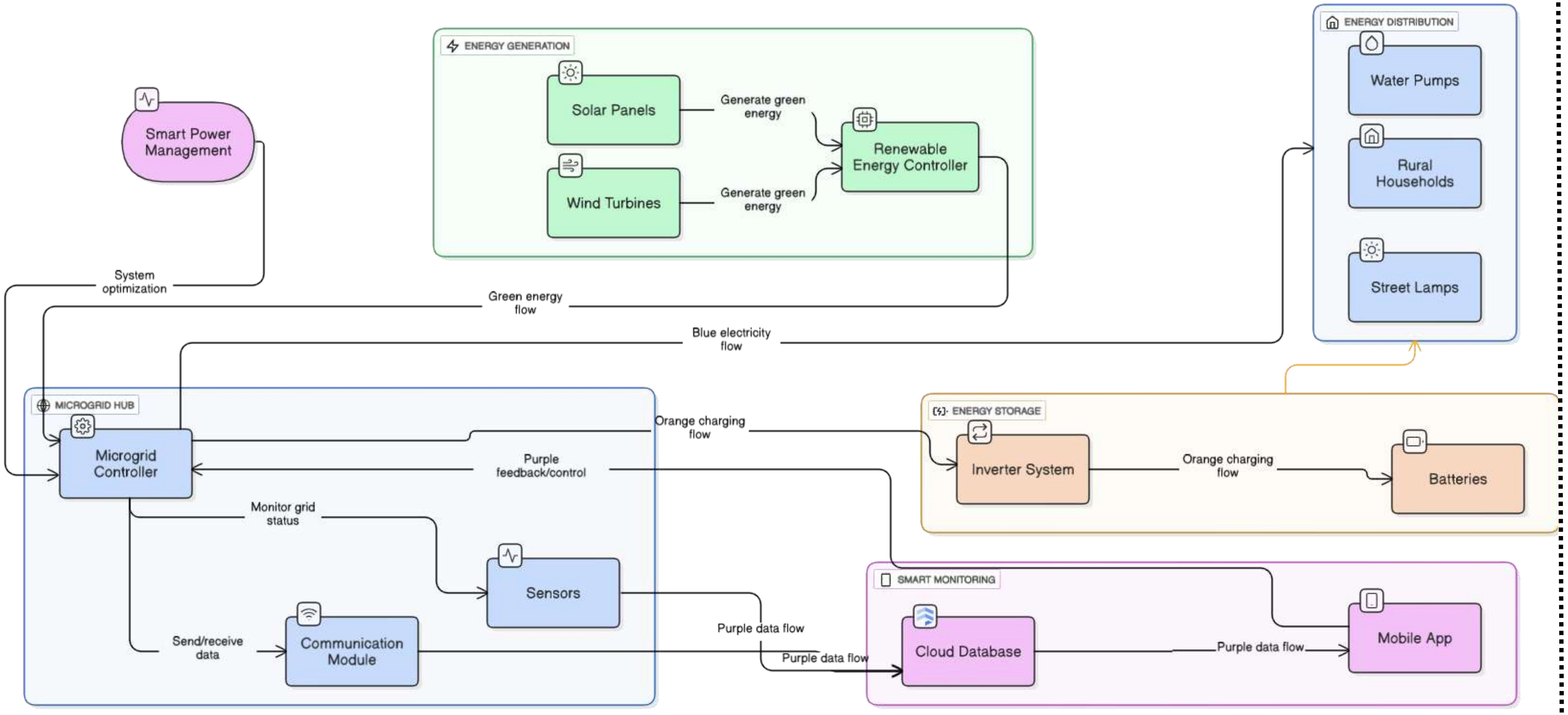
  Monitoring System for Microgrids
- **Theme-** Renewable / Sustainable Energy
- **PS Category-** Hardware
- **Team ID-**
- **Team Name -** BrajCoders

UrjaLink

- UrjaLink is a **low-cost IoT** system that continuously monitors solar and wind microgrids in rural areas. By combining **sensors**, **GPS-based tracking**, and **cloud analytics**, it identifies energy losses, predicts maintenance needs, and guides operators through a **user-friendly mobile app**, helping communities achieve **smarter energy use** and **improved reliability**.

Proposed Idea	Uniqueness
1. Simple sensors monitor solar and wind power usage in real time. 2. Collected data is analyzed to find energy loss or system issues. 3. A mobile app shows updates and alerts in local languages. 4. Low-cost design ensures reliable electricity and better efficiency for villages.	1. **Affordable & Scalable** – Low-cost IoT hardware enables wide rural deployment. 2. **User-Friendly App** – Local-language interface helps operators manage energy easily. 3. **Predictive Maintenance** – Analytics forecast faults early, reducing downtime and losses. 4. **Hybrid Compatibility** – Supports both solar and wind microgrids for flexibility.

TECHNICAL APPROACH



Tech Stack

C++

Reac
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Pytho
n

Djang
o

Flas
k

Firebas
e

Arduin
o

Java
Script

Tensor
Flow

FEASIBILITY AND VIABILITY

- **Feasibility of the idea**

1. **Technical Feasibility –** Affordable IoT hardware and cloud ensure seamless microgrid integration.
2. **Economic Feasibility –** Low costs and efficiency improvements guarantee long-term financial sustainability.
3. **Operational Feasibility –** Local language mobile app allows villagers to monitor and act.
4. **Social & Environmental Feasibility –** Clean energy strengthens communities while reducing harmful generator dependence.

- **Potential challenges & Overcomes**

1. **Connectivity Issues –** Use offline caching and periodic sync to tackle weak internet.
2. **Power Instability –** Add backup batteries to ensure continuous device operation.
3. **User Adoption –** Provide local-language apps with training for easier acceptance.
4. **Durability –** Use rugged enclosures and remote diagnostics for long-lasting reliability.

IMPACT AND BENEFITS

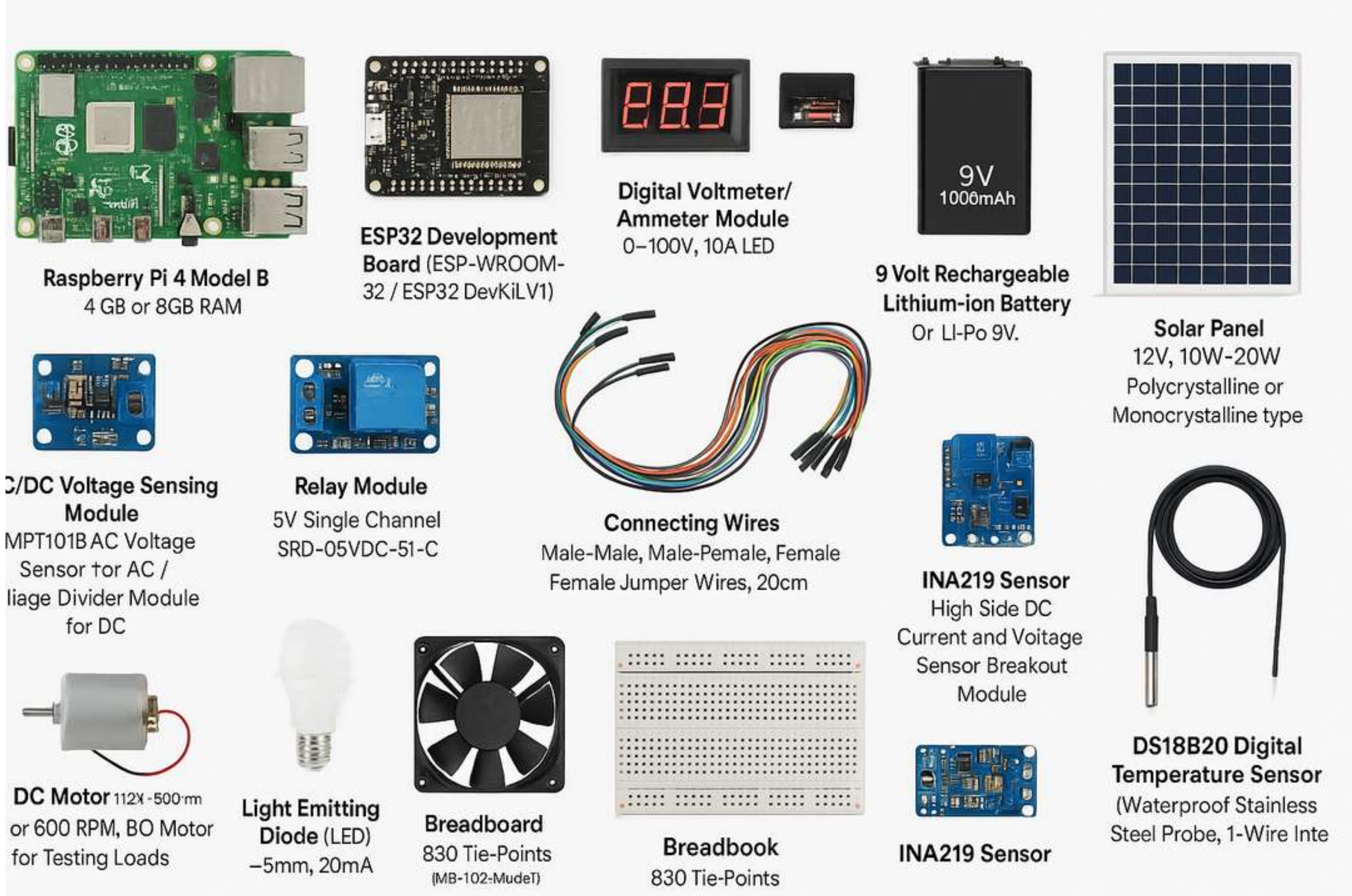
- **Potential impact on the target audience**

1. **Rural Communities –** Reliable electricity could reduce outages by 40%, boosting productivity and improving quality of life.
2. **Operators –** Mobile-based monitoring can cut maintenance time by 30%, simplifying technical management.
3. **Policy Makers & NGOs –** Data-driven insights can improve rural energy planning efficiency by 25%.
4. **Students & Entrepreneurs –** Renewable energy sector may create 500,000 rural jobs in India by 2030.

- **Benefits of the solution (social, economic, environmental, etc.)**

1. **Social –** Stable electricity access can improve rural education outcomes by 25% and healthcare efficiency by 30%.
2. **Economic –** IoT-based monitoring reduces energy losses by 20% and can create 1M green jobs by 2030.
3. **Environmental –** Expanding renewables in microgrids may cut rural carbon emissions by 35%.
4. **Technological –** Smart IoT systems improve grid efficiency by 15% and scale across diverse geographies.

Hardware Requirements



Component
Raspberry Pi 4 Model B
ESP32 Development Board
Digital Voltmeter/Ammeter Module
Rechargeable Battery
Solar Panel
AC/DC Voltage Sensing Module
Relay Module
Connecting Wires
DC Motor
Electricity Consumers (Loads)
LED
Breadboard
INA219 Sensor
DS18B20 Temperature Sensor

RESEARCH AND REFERENCES

- Western Power Website - https://www.westernpower.com
- Ar duino Official Website – https://www.arduino.cc
- Raspberry Pi Foundation – https://www.raspberrypi.org
- IoT World Today – https://www.iotworldtoday.com
- IEEE IoT Journal – https://iot.ieee.org
- MDPI Sensors Journal – https://www.mdpi.com/journal/sensors
- ResearchGate (IoT Studies) – https://www.researchgate.net
- ScienceDirect (IoT Research Papers) – https://www.sciencedirect.com