SMART INDIA HACKATHON 2024

SMART INDIA HACKATHON 2024

- **Problem Statement ID – 1524**
- **Problem Statement Title-** Innovating for Sustainability: Driving Smart Resource Conservation (Energy & Water) in Home Appliances (Refrigerators, Air Conditioners, Washing Machines and Desert Air Coolers)
- **Theme -** Smart Resource Conservation
- **PS Category - Software/Hardware**
- **Team ID -** 11356
- **Team Name (Registered on portal) - Nirman**

NIRMAN

Real-Time Sustainable Power Monitoring System

SMART INDIA HACKATHON 2024

IDEA Approach:

- Implementing smart energy monitoring system utilizing Microcontroller ESP32 and PZEM-004T sensors to enhance resource conservation in home appliances.
- This System will evaluate energy consumption to determine how much and when it is being used and suggest us how to minimize needless loss of energy.

Transmitter draws mains power from any socket and directs it to the connected appliance through the PZEM-004T.

↓

Power Parameters will be measured as well as data will be collected

↓

This data will sent to the AI Model and then it will be analysed by AI algorithms

↓

The system will generate personalized recommendations for energy saving based on the data trends.

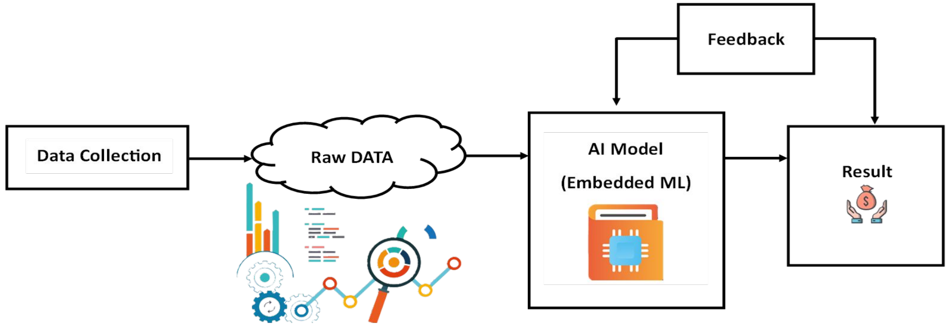
↓

With the help of web dashboard we would be able to view the data and also control the appliance on the go

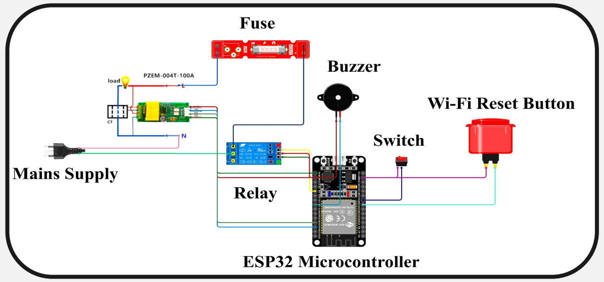
INNOVATION

AI Integration:

- Smart meters and AI: offers personalized energy-saving tips, like the best times to run appliances.
- Fault Detection: enabling timely maintenance or repairs



CIRCUIT DIAGRAM



NIRMAN

TECHNICAL APPROACH

SMART INDIA HACKATHON 2024

Technology to be used

- Arduino IDE
- C
- Blynk IoT
- ESP32

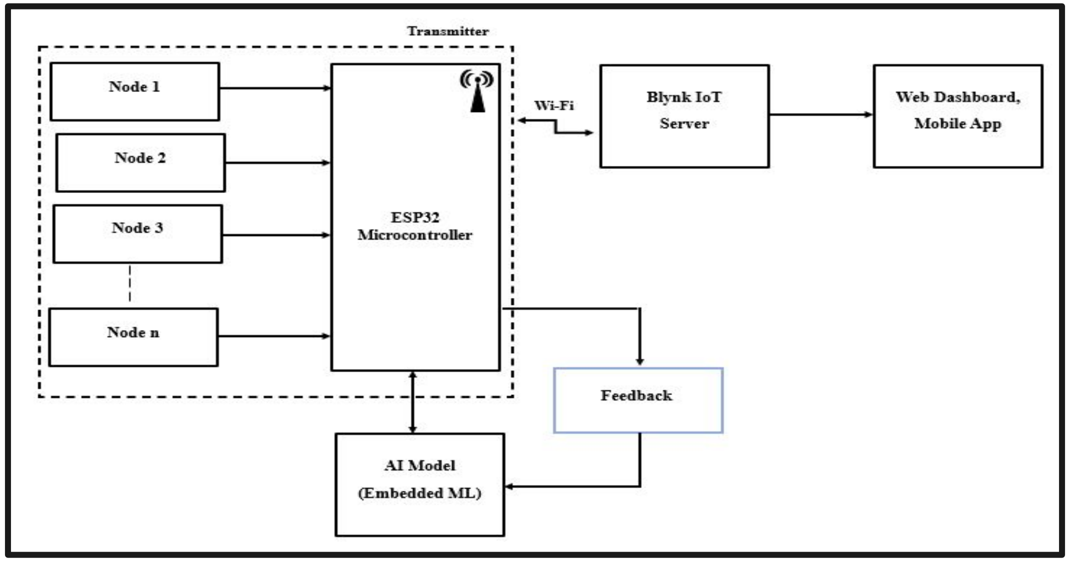


Fig: shows the flow of data in our project.

PROTOTYPE IMAGES:

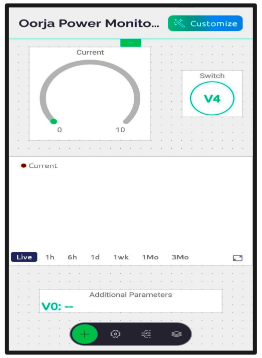


Fig. Mobile App UI

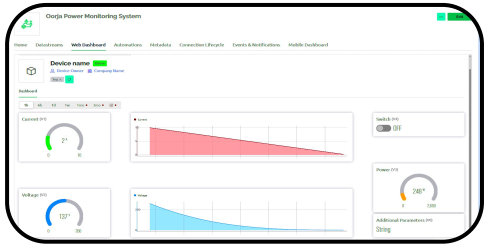


Fig. Website Dashboard

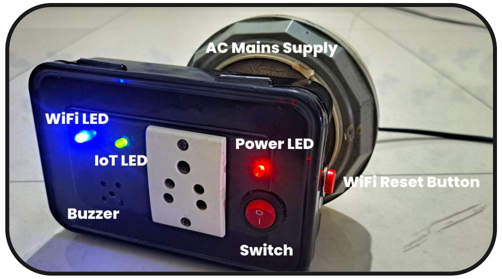


Fig. Actual Device

Real-Life Implementation

Fig (a)

Fig (b)

Figure (a) is the real-time view of the appliance when plugged in to the device.
Figure (b) is the dashboard view of the result.

FEASIBILITY AND VIABILITY

Analysis of the feasibility of the idea:

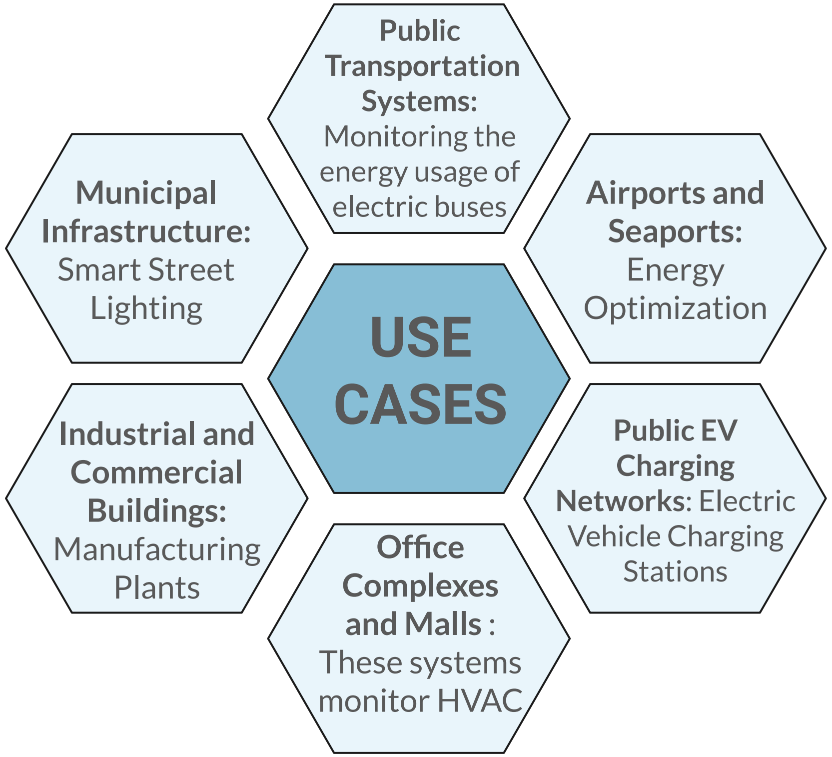
- **Technical feasibility -** Assess the maturity and availability of sensors, existing software platforms for data acquisition, processing, and visualization.
- **Economic feasibility -** Calculate the cost of sensors, develop a detailed budget, and estimate potential energy saving.
- **Operational feasibility -** Determine the training needs for users and technical staff to effectively operate and manage the system.

Potential challenges and risks:

- **Technical challenges -** Difficulty in integrating new monitoring system with existing infrastructure, and in ensuring seamless data exchange.
- **Economic risks -** Difficulty in accurately predicting energy savings and financial benefits.
- **Operational risks -** Chances for human error while operating or interpreting the system.

Strategies for overcoming these challenges:

- **Data accuracy and reliability -** Use high quality sensors with low error margin.
- **Feedback mechanism -** Improve energy efficiency
- **Mitigation plans -** Use high quality sensors, regular calibration



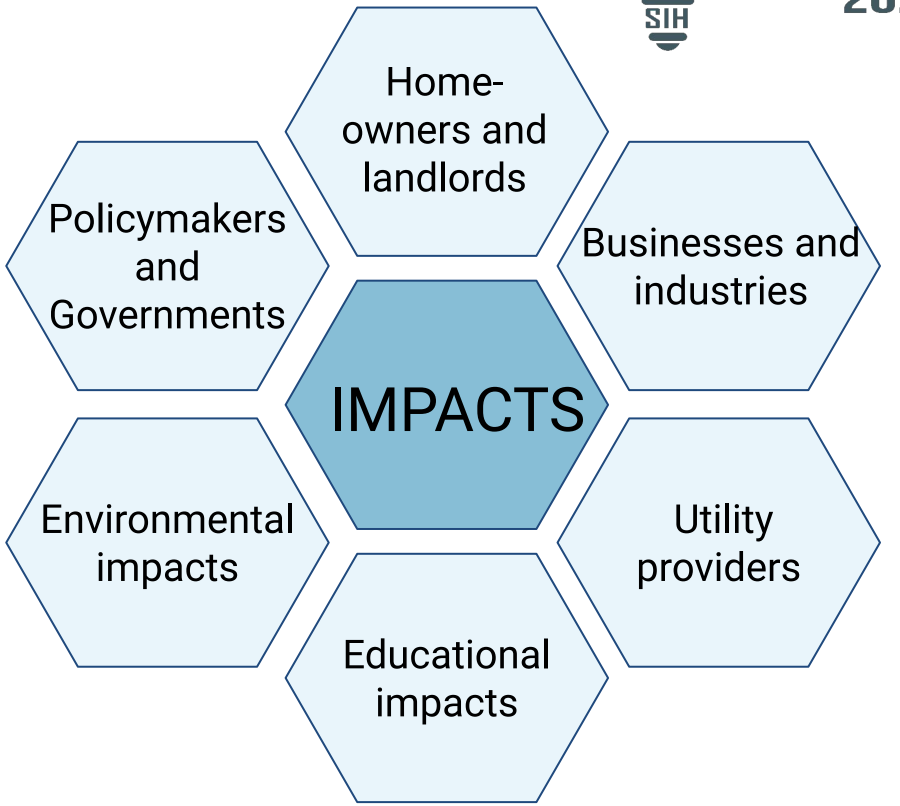
NIRMAN

IMPACT AND BENEFITS

SMART INDIA HACKATHON 2024

BENEFITS

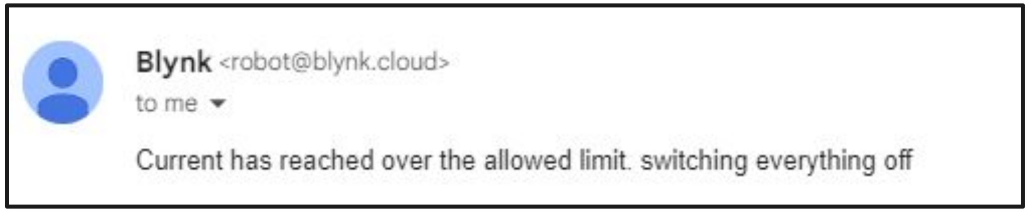
- **Energy Efficiency:** Helps identify high-consumption devices and optimize their use.
- **Cost Savings:** Reduces electricity bills by optimizing power usage.
- **Environmental Impact:** Promotes the use of renewable energy, reducing carbon footprint.
- **Real-Time Insights:** Provides immediate feedback and actionable insights on energy usage.



FUTURE SCOPE

- **PCB CONVERSION:** It can be easily converted into a PCB to make its mass production and assembly quick and efficient.
- **AWS IoT-CORE:** The IoT server of choice, keeping future-proofing in mind, will be transitioned into AWS IoT-core, which has become an industry standard.
- **INTEGRATION WITH SMART GRIDS:** For automatic power switching between grid and renewable sources.

FOR SAFETY: If there happens to be any state of short circuit or overcurrent that could damage the device and the appliance connected to it, the system automatically shuts off preventing any electrical and fire hazard.



NIRMAN

RESEARCH AND REFERENCES

SMART INDIA HACKATHON 2024

REFERENCES:

- H. G. R. Tan, C. H. Lee, and V. H. Mok, "Automatic power meter reading system using GSM network," International Power Engineering Conference (IPEC 2007), 2007, pp. 465-469.
- M. Wasi-ur-Rahman, M. T. Rahman, T. H. Khan, and S. M. L. Kabir, "Design of an intelligent SMS based remote metering system," International Conference on Information and Automation, 2009, pp. 1040-1043.
- L. Labib, M. Billah, G. M. S. M. Rana, M. N. Sadat, M. G. Kibria, and M. R. Islam, "Design and implementation of low-cost universal smart energy meter with demand side load management," IET Generation, Transmission & Distribution, vol. 11, no. 16, pp. 3938- 3945, 2017.
- E. Taktak and I. B. Rodriguez, "Energy Consumption Adaptation Approach for Smart Buildings," IEEE/ACS 14th International Conference on Computer Systems and Applications (AICCSA), 2017,pp. 1370-1377.
- A. H. Primicanta, N. Mohd Yunus, and M. Awan, "ZigBee-GSM based Automatic Meter Reading system," International Conference on Intelligent and Advanced Systems, 2010, pp. 1-5.
- V. Kotech, S. Jadhav, "GSM Technology based Smart Energy Meter," Open Access Journal of Science and Engineering, 2018.
- B. K. Sahani, T. Ravi, "IoT Based Smart Energy Meter," International Research Journal of Engineering and Technology, Apr -2017.
- I. M. Nayyef, A. A. Husein, "Design and implementation of iot based smart power monitoring and management system using wsns," International Journal of Embedded Systems and Applications (IJESA), Vol 8, No.4, December 2018