IoT based Load Management System (Project 9)

Team 9

Project Proposal

INTRODUCTION:

Solar energy is becoming a significant solution to renewable energy supply for future needs. Increased rooftop solar systems are integrated into networks such as grids and industrial locations, and there is a growing need to track the real-time generation of solar power to improve the overall output of solar systems and achieve good stability. Power generation from solar panels is variable due to variations in solar irradiance, temperature and other components. Often when a system is entirely based on solar powering, it tends to compromise on the regularity and availability of power especially when the load goes above a threshold. The intermittency and variability in nature of renewable energy sources results in power system instability if an intelligent interface is not provided.

On the other hand, conventional energy sources guarantee 24/7 availability of power but are limited on a long term basis and come at the cost of serious environmental damages like climate change and resource depletion.

What the current situation demands is striking the right balance between the two or in other words maximize the use of solar energy and minimize that of conventional while ensuring uninterrupted power supply.

Thus the problem statement boils down to maintaining a balance between the two and enjoying the pros of both while eliminating the cons. As is the emerging trend, whenever humans become greedy, IoT comes to the rescue. The impressive variety of sensors and integration with cloud networks allows us to be ambitious and when it comes to the environment, IoT has to be exhaustively used.

The aim of the project is to design an intelligent IoT based system that efficiently switches between Solar and Conventional Energy based on the load requirements of the user while ensuring a regular power supply.

OBJECTIVE:

Our objective is to **maximize the utilization of solar energy** and **minimize the use of conventional energy** while ensuring a **stable power supply** to meet the load demand. The model is designed to meet the load demand at all times with the best possible source. Moreover it will be scalable and adaptable to different situational requirements and solar energy production levels.

DELIVERABLES:

1. Automatic switching between Solar and Conventional depending on load requirements
2. User Interface based notifications of abnormal energy consumption
3. User interface based readings of power outages and consumption
4. User interface based prompts giving energy saving suggestion
5. Integration with other renewable energy sources (wind) to reduce dependence on now renewable energy sources
6. Predictive analysis of energy usage patterns based on user behavior
7. Automatic optimization of energy usage based on the user's schedule and energy usage patterns
8. Real time monitoring and control of energy consumption of various devices and appliances
9. Priority wise supply of power in various buildings for example hospital would be on top priority while deciding distribution and mode of power supply

10. Failure analysis of the model
11. Table top working model demonstrating our idea and implementation

HARDWARE REQUIREMENTS:(Quantities in bracket)

1. Light sensors (20) (Optical Light sensors)
   https://www.amazon.in/Photoresistor-Photo-Sensitive-Resistor-Dependent/dp/B082FHNNQP/ref=sr_1_1?keywords=photo+diode+sensitive+diode&qid=1680021425&sr=8-1
2. Solar Panel (6)
   https://www.amazon.in/Electronicspices-Solar-Panels-Caravans-Campers/dp/B0845VVQW5/ref=sr_1_3_mod_primary_new?keywords=solar+panels+6v&sbo=RZvfv%2F%2FHxDF%2BO5021pAnSA%3D%3D&sr=8-3
3. 5V battery (20) (2 pack of 10)
   https://www.amazon.in/MILLETS-Long-Carbon-Hi-Watt-Battery/dp/B09KH6QR97/ref=sr_1_2?keywords=hi+watt+5v+battery&sr=8-2
4. ESP-32 (3)
   https://www.amazon.in/SquadPixel-ESP-32-Bluetooth-Development-Board/dp/B071XP56LM/ref=sr_1_3?keywords=esp32&qid=1680021573&sr=8-3
5. Wires
6. Breadboard
7. MicroUSB Cable(x2)
8. ESP32 D-Type Cable(x3)
9. LEDs Bulbs(1 pack of 100)
   https://www.amazon.in/MILLETS-BRANDED-LED-Emitting-100Pcs/dp/B09KH75WD3/ref=sr_1_3_sspa?sr=8-3-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&psc=1
10. 100 Watt Bulb (1)
    As a light source to drive the solar panel.
11. Relays (10)
    https://www.amazon.in/Scriptronics-Channel-Isolation-Compatible-Raspberry/dp/B08K823M1P/ref=sr_1_7?crid=K7AF3KHMSBDS&keywords=relay+switches+esp+32&qid=1680023070&sprefix=relay+switches+esp+3%2Caps%2C234&sr=8-7
12. Motor (10) (2 packs of 5)
    https://www.amazon.in/Electronicspices-Electric-Carbon-Torque-Models/dp/B082Z5SS5N/ref=sr_1_1?keywords=dc+motor&sr=8-1
13. Current and voltage sensor(10)

https://www.amazon.in/REES52-CJMCU-interface-Bi-directional-monitoring/dp/B07P4DN719/ref=sr_1_1?crid=1HXVQE1JO1JBZ&keywords=ina219+current+sensor&qid=1680023031&sprefix=INA219%2Caps%2C260&sr=8-1

14. Fan(10) (1 pack of 10)
https://www.amazon.in/AVS-COMPONENTS-Plastic-Propeller-Projects/dp/B0BB31FRSJ/ref=sr_1_6?keywords=plastic+fan+for+dc+motor&sr=8-6
15. Resistors of various resistances

DATA COLLECTION PLAN:

We plan to collect and analyze the data generated by the system. The data will be collected for at least 1 month at 1 min per day.We also plan to imitate various real life scenarios such as power cuts, bad weather to get a set of data points and also check how our management system distributes the power on priority basis with a few sets of buildings with higher priority. We also plan to test for failures by creating failure scenarios and conducting failure analysis. One such failure scenario is that if we are using 5 solar panels and one solar panel fails ,the backup solar panel activates and starts functioning.
The analysis of the data collected, will help in developing the User Interface to give appropriate suggestions to improve efficiency in various scenarios.

CONCLUSION:

As Thomas Edison said “I’d put my money on the sun and solar energy. What a source of power. I hope we won’t have to wait until oil and coal run out before we tackle that”.

Our project follows exactly this philosophy.

In a nutshell, this project is a very small step towards a smarter, more efficient and greener future of energy. The major points we aim to achieve through this model are:

1. Automated switching between solar and conventional energy without loss in continuity of power supply.
2. Maximize the use of solar energy and minimize that of conventional energy
3. User interface with features like energy conserving suggestions, notifications alerting abrupt power usage and so on
4. Optimisation of energy usage based on predictive user patterns

We will also try to look into priority wise power distribution like hospitals at the top importance with commercial buildings at lower importance.

We immensely believe in the “bright” future of solar energy and shall showcase this belief through our model.