Project Synopsis

Title

Forecasting PV(Photovoltaic) System Power Generation

Objective

The rise of renewable energy presence in power grids globally necessitates the need for accurate solar power prediction as solar power is unpredictable by nature. Grid balancing is the matching of supply with demand; the failure to properly balance load distribution can damage transmission components.

Predicting solar power generation is crucial for power grid balancing; therefore, the archetype of solar power forecasting is a model that is accurate with minimal negative feedback.

Standard methods such as weather data are antithetical to this as they are generalized for an entire location nor, do they possess minimal negative feedback as weather data is generally available hourly.

Training prediction models with onsite data germane to forecasting, namely, historical solar power generation and influencing factors, are more accurate and possess minimal negative feedback if computed frequently.

The goal is to develop short-term power forecasting models that can be deployed onsite.

Modules

IoT Data Collection: Sensors, Arduino, Thingspeak, Wi-Fi Shield, etc.

- Sensors: Measures data germane to PV system power generation
    - Current and Voltage Sensors
- Arduino UNO: Collects data from sensors and stores it on a cloud storage system (Thingspeak)

Machine Learning Forecasting: Sci-kit learn, Tensorflow, and Keras

- Retrieving data from the cloud storage system
- Data preprocessing using digital signal processing techniques to denoise time series data
- Training forecasting models using machine learning algorithms

Methodology

We will start by collecting data pertinent to solar power prediction using sensors.

Power Generated: Calculated by measuring voltage and current separately (W)

The sensors connected to an Arduino will store measurements on a cloud storage system.

The time-series data will be retrieved by making API calls and engineered for analysis. The data will then be denoised using signal processing techniques before building machine learning models.

We'll then train the following machine learning models:

- Traditional time series forecasting method
- Neural Network forecasting algorithms

Finally, we'll compare the efficacy of each model using their MSE(Mean Squared Error) values.

Team & Function

Mishkat Neyazi: IoT Data Collection

Mukund Sureshkumar: Machine Learning Forecasting