Weather-Based Wind Turbine Energy Prediction

A machine learning project to predict wind turbine energy output based on weather conditions. Users can input weather data and get predicted energy output via a simple Flask web application.

🚀 Features

User Features:

- Input weather data (wind speed, temperature, etc.)
- Predict energy output of turbines

Admin / Developer Features:

- Train machine learning models
- Evaluate model performance (R^2, MAE, MSE)
- Save trained models for deployment

□ Tech Stack

Frontend:

- HTML, CSS
- Flask Templates

Backend / ML:

- Python
- Pandas, NumPy, Scikit-learn
- Flask for web integration

📁 Project Structure

```
Weather-Based-Wind-Turbine-Energy-Prediction/
│
├── dataset/            # CSV files for historical weather and turbine data
├── models/             # Saved ML models (.sav / .pkl files)
├── static/             # Images or CSS for Flask web app
├── templates/          # HTML pages for Flask web app
├── windApp.py          # Flask application
├── train_model.py      # Script for training ML models
└── README.md           # Project documentation
```

⚙ Installation & Setup

Backend Setup:

```
cd Weather-Based-Wind-Turbine-Energy-Prediction
pip install numpy pandas matplotlib scikit-learn flask
```

Run the App:

```
python train_model.py    # To train model
python windApp.py        # To start Flask web app
```

Open your browser at http://127.0.0.1:5000/ and input weather data to get predicted energy output.

Evaluation Metrics

- R^2 Score
- Mean Absolute Error (MAE)
- Mean Squared Error (MSE)

Dataset

- Collect historical wind turbine data with environmental conditions such as wind speed, wind direction, temperature, etc.
- Open sources: Kaggle, data.gov, UCI ML Repository

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