Sports Facility Night Usage Prediction

Overview

Sports Facility Night Usage Prediction is a deep learning–based energy analytics project that forecasts post-event night-time electricity consumption using historical hourly patterns. A simple LSTM (Recurrent Neural Network) model learns sequential usage behavior, and an interactive Streamlit dashboard allows filtering by day type such as weekday or weekend.

Problem Statement

Sports facilities often experience fluctuating electricity demand during evening and night hours after matches, practice sessions, or events. The objective is to predict upcoming night-time electricity usage so that energy supply, HVAC, and lighting systems can be managed efficiently and peak demand can be avoided.

Dataset

The project uses the Electricity Load Diagrams dataset containing smart meter readings recorded every 15 minutes for multiple clients. The data is converted from kW to kWh and aggregated into hourly consumption. One meter is treated as the sports facility to analyze night-time usage patterns.

Workflow

Load the smart meter dataset and convert the timestamp column to datetime. Convert 15-minute kW readings into kWh and resample to hourly consumption. Select one meter to represent the sports facility. Filter records for night hours between 7 PM and 2 AM. Create a day-type feature to separate weekday and weekend patterns. Normalize the time-series data using MinMaxScaler. Generate sequences using the past 24 hours as input. Train a simple LSTM model to learn sequential usage behavior. Predict the next night electricity consumption and visualize recent night trends on the dashboard.

Technologies Used

Python, Pandas, TensorFlow/Keras (LSTM), Scikit-learn (MinMaxScaler), Matplotlib, Streamlit.

Installation

Install dependencies using: pip install pandas tensorflow scikit-learn matplotlib streamlit

How to Run

Place the electricity load dataset file in the project directory and run: streamlit run c.py

Key Features

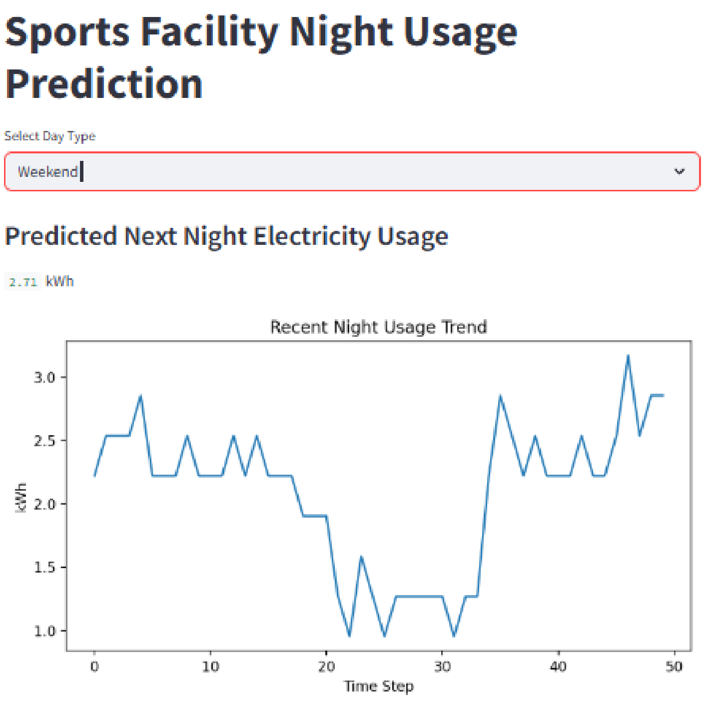
Uses LSTM for sequential time-series forecasting, analyzes night-time energy patterns, supports day-type filtering, and provides interactive visualization of recent consumption behavior.

Applications

Sports complex energy planning, post-event load forecasting, smart campus facility management, and peak demand reduction.

Output

The dashboard displays the predicted next night electricity usage in kWh along with a line chart showing recent night consumption trends. Users can filter results by weekday or weekend to observe different usage patterns.



Limitations

Only one meter is used as a proxy for a sports facility, event schedules are not explicitly included, and the model is trained with a small number of epochs for faster execution.

Future Enhancements

Integrate actual event calendars, include weather and occupancy features, increase training epochs for higher accuracy, and connect to real-time smart meter streams.

Conclusion

The project demonstrates that LSTM-based sequence learning can effectively capture night-time electricity usage patterns and predict upcoming demand, enabling proactive and energy-efficient management of sports facility operations.