

Library Energy During Exams

Overview

Library Energy During Exams is a time-series forecasting project that estimates semester-end library energy demand using historical environmental data. Since direct isolated library meter data was not available, outdoor temperature is used as a correlated proxy because heating and cooling loads significantly influence electricity consumption. The system applies exponential smoothing to recent trends and displays the predicted demand level on a Streamlit gauge dashboard for quick interpretation.

Problem Statement

During examination periods, libraries operate for longer hours and experience increased occupancy, which raises electricity consumption due to lighting and HVAC usage. The objective is to aggregate historical time-series data and forecast semester-end energy demand so that energy planning and resource allocation can be performed proactively.

Dataset

The project uses the Weather sheet from an Excel file containing Date and Outdoor temperature (°C) recorded at regular intervals. The Date column is converted into a time-series index and temperature is used as a proxy variable representing environmental influence on library energy consumption.

Workflow

Load the Weather sheet, clean column names, convert Date to datetime, and set it as the index. Rename the temperature column for easier processing. Aggregate high-frequency readings into daily averages to reduce noise. Train an Exponential Smoothing model with an additive trend to capture recent behavior. Forecast the next seven days representing the semester-end window. Compute the average predicted level and visualize it using a gauge chart on the Streamlit dashboard.

Technologies Used

Python, Pandas, Statsmodels (Exponential Smoothing), Plotly, Streamlit, OpenPyXL.

Installation

Install dependencies using: `pip install pandas statsmodels plotly streamlit openpyxl`

How to Run

Place the Excel file (energy_data.xlsx) in the project directory, ensure the Weather sheet contains Date and Outdoor temperature (°C), then run: `streamlit run app.py`

Key Features

Uses historical time-series data, applies exponential smoothing for short-term forecasting, represents predicted demand through an intuitive gauge visualization, and supports quick decision making for energy planning.

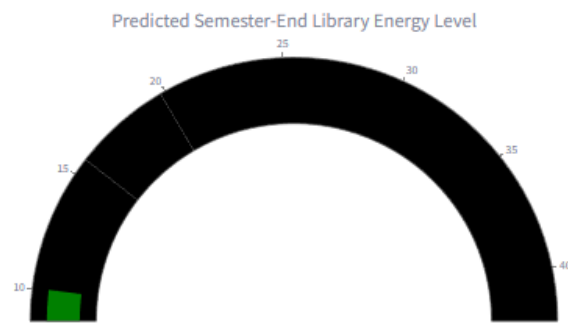
Applications

Smart campus energy management, library HVAC scheduling, semester exam resource planning, and proactive electricity demand monitoring.

Output

The dashboard displays a gauge showing the predicted semester-end library energy level and a numeric forecast summary. The gauge position indicates whether expected demand is low, moderate, or high relative to historical conditions.

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Forecast Summary

Predicted Level: 18.94

Limitations

Uses temperature as a proxy instead of direct library meter data, does not include explicit exam calendar variables, and relies on trend-based smoothing which may not capture sudden anomalies.

Future Enhancements

Integrate actual library electricity meter readings, incorporate exam calendar and occupancy data as exogenous variables, add seasonal components, and enable real-time dashboard updates.

Conclusion

The project demonstrates that exponential smoothing on historical environmental time-series can estimate semester-end library energy demand and present the result through a clear gauge dashboard, supporting efficient and proactive energy management during exam periods.