**Document on problem definition and design thinking**

Making an automated system that measures energy use, analyzes the data, and gives visualizations for strategic decision-making is the issue at hand. This system intends to improve energy consumption management across multiple industries' efficiency, accuracy, and understandability.

**Design Thinking Methodology:**

1. Data Source:

The first step is to locate a dataset with energy consumption metrics that is readily available. We will use the "PJM Hourly Energy Consumption Data" from PJM Interconnection LLC for this research. This dataset offers hourly electricity usage figures in megawatts (MW) for different US areas.

2. Data pre-treatment:

To ensure the accuracy and dependability of our analysis, data pre-treatment is essential. We'll carry out the following actions:

Data cleaning involves locating and handling any missing or incorrect data points.

Data transformation includes converting data formats, handling outliers, and, if necessary, normalizing the data.

Data integration: If necessary, combine data from several sources.

Validate your data to make sure it is accurate and consistent.

3. Extracting Features:

Meaningful analysis requires the extraction of pertinent features and metrics from the energy usage data. This action entails:

Determining important factors such the date, time, location, and amount of energy used.

Determining new parameters, such as total daily or monthly intake.

If necessary, combining data for certain areas or industries.

4. Model Development:

To find trends, patterns, and anomalies in the data, use statistical analysis and machine learning approaches. The objectives of this stage are:

Determine seasonal patterns, trends, and cyclical behavior in time seriesconsumption of energy.

Anomaly Detection: Create algorithms to identify odd increases or decreases in energy use.

Using historical data, create predictive models to project future energy demand.

5. Effective visualization is essential for communicating ideas and promoting decision-making. We'll do:

To illustrate patterns in energy use, create several visualizations, including line charts, bar graphs, and heat maps.

Make interactive dashboards so that people may explore the data and discover new information.

Include geographic maps to illustrate regional differences in consumption.

6.Automation

We will create a script that streamlines and automates the subsequent procedures in order to make the procedure effective:

Data gathering: Obtain current energy consumption statistics on a regular basis from the PJM website.

Data analysis: Apply feature extraction, data preprocessing, and modeling to fresh data.

creation of visualizationsAutomatically update graphics using the most recent data.

**Regarding the Dataset:**

The "PJM Hourly Energy Consumption Data" is obtained from PJM Interconnection LLC and includes information on numerous American states and areas. We must take into account whether data are readily available for particular times and locations because the regions may have changed throughout time. The information, which is given in megawatts (MW), is useful for examining trends in energy use.

**Action Items:**

Obtain the dataset for PJM hourly energy consumption.

Create pipelines for feature extraction and data preprocessing.

Create statistical models and analytical techniques.

Next Steps:

1. Acquire the PJM hourly energy consumption dataset.

2. Develop data preprocessing and feature extraction pipelines.

3. Build statistical models and algorithms for analysis.

4. Create visualization templates.

5. Develop an automation script to regularly update and present the analysis.

6. Test the system with historical data.

7. Implement user interfaces for data exploration and decision-making.

8. Monitor and maintain the system for ongoing accuracy and efficiency.

This design thinking approach outlines the key steps and considerations for developing an automated energy consumption analysis system. By systematically addressing each phase, we aim to provide a valuable tool for informed decision-making in managing energy consumption.