TITLE PAGE

- **Problem Statement ID – SIH1624**
- **Problem Statement Title- To develop an Artificial Intelligence (AI) based model for electricity demand projection including peak demand projection for Delhi Power system**
- **Theme- Smart Automation**
- **PS Category- Software**
- **Team Name: The Neural Knights**

IDEA TITLE

❖ Proposed Solution:

Our solution integrates **multiple data types** such as temporal, weather, historical and demographic information into a **meta-modal**, utilizing Deep Learning models and Machine Learning techniques. By integrating these models for each type of data, we significantly **boost accuracy**. This innovative approach utilizes multi-model integration for prediction, offers adaptability for **real-time**, accurate forecasting, making it a highly **effective solution**.

- Develop a system using various **deep learning** and **machine learning** methods for prediction of electricity demand for a **Delhi-NCT Domestic & Commercial regions**.
- Combine the outputs of various models that deliver the **accurate results** for each data type into a meta-model for precise prediction.
- The model will be trained using data from the **previous day** to generate predictions for the current day.
- User can view **demand forecast**, **graphical analysis** and **alerts** for next coming days through the system.
- System will be helpful for **government & private companies** for reducing last minute power purchase to generate electricity and **power outages** in the region.

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TECHNICAL APPROACH

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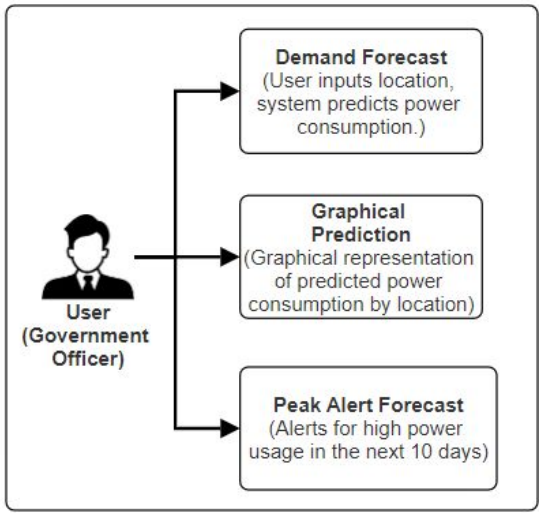
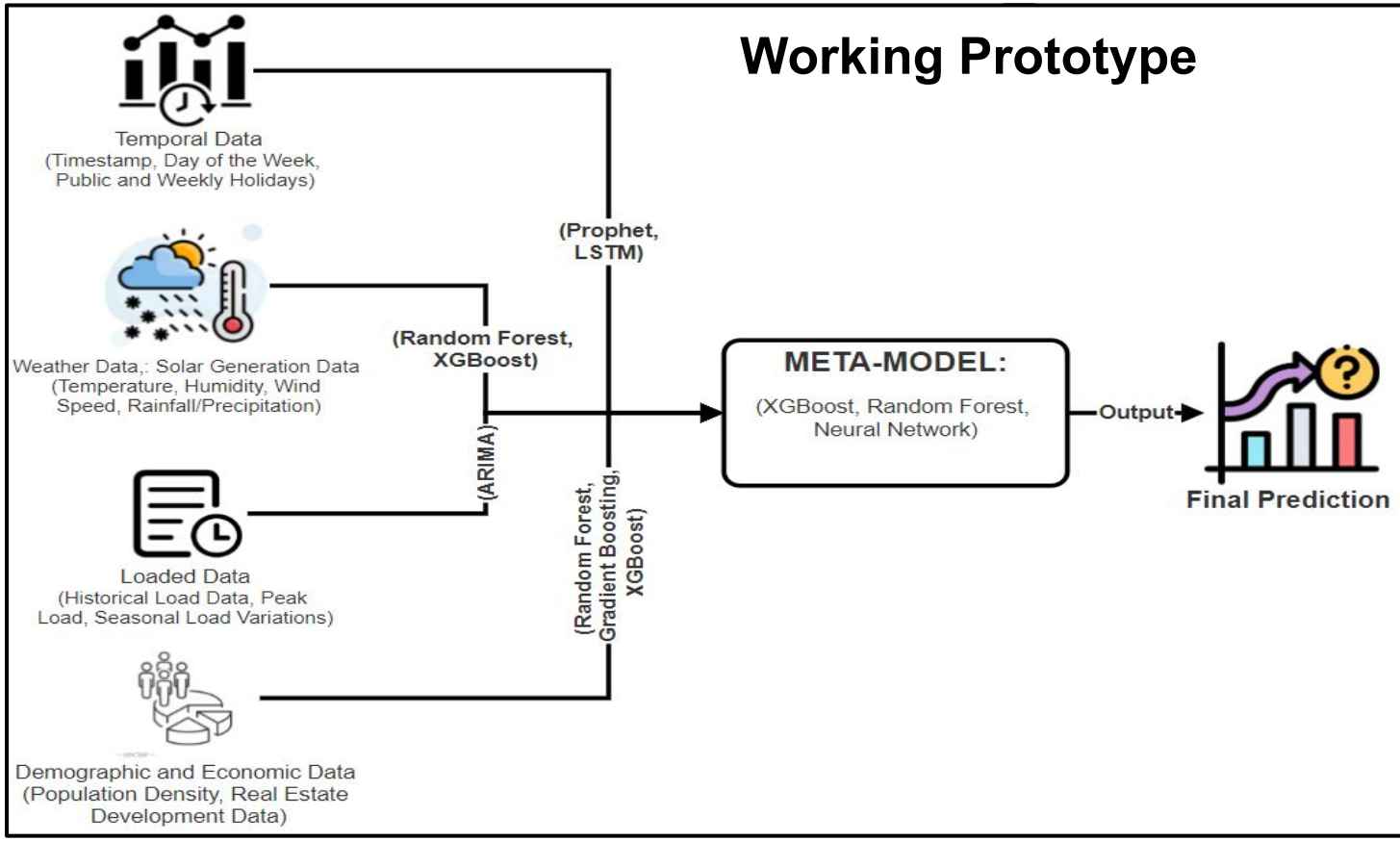
- **Web Framework:**
  - Front-end :- React
  - Back-end :- Django
- **Deep Learning Models:**
  - LSTM
  - Neural Network
- **ML Models:**
  - Prophet
  - Random Forest
  - XGBoost
  - ARIMA
  - Gradient Boosting
- **Tools :**
  - Google Colab
  - Figma
- **Data Analysis:**
  - Numpy
  - Pandas
  - Matplotlib

User Interface



This AI-based tool enables government officers to predict power demand, visualize consumption trends, and receive alerts for high usage, ensuring efficient power management in Delhi-NCT.

Working Prototype



This AI model predicts electricity demand by processing Temporal, Weather, Load, and Demographic data. The best-performing algorithm (e.g., *LSTM* or *Prophet* for temporal data) is selected for each type of data. The Meta-Model then combines predictions from these four models, and one chosen algorithm (e.g., *XGBoost*, *Random Forest*, or *Neural Networks*) will generate the final power consumption forecast, optimizing power management in Delhi-NCT.

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FEASIBILITY AND VIABILITY

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Analysis of feasibility of Idea:

- **Technical:** AI model can be incorporated into existing power systems for real-time demand forecasting and improved decision-making.
- **Economical:** Reduces operational costs, optimizes power generation, and enhances grid stability, minimizing energy wastage.
- **Legal and Regulatory:** Adheres to current energy management practices, ensures high-quality data, and involves continuous model refinement to mitigate risks.
- **Scalability:** AI model can handle increasing amounts of data and more complex computations as demand grows without significant infrastructure changes or performance issues.

Challenges and Strategies to overcome them:

- **Weather and Domestic Consumption:** Use historical and real-time weather data to improve demand forecasting across seasons.
- **Duck Curve Effect:** Predict solar output fluctuations and optimize transitions between conventional power sources.
- **Extreme Weather Events:** Integrate temperature, humidity, and wind speed data to manage impact across Delhi NCT.
- **Inconsistent Model Accuracy:** To address poor predictions from a single model, a multi-model strategy was implemented, training different models for each data type and integrating their outputs to enhance overall forecast accuracy.

IMPACT AND BENEFITS

- **Potential Impact on Target Audience**
  - **Improved Reliability:** Accurate demand forecasts ensure residents and businesses have a stable electricity supply, reducing the risk of blackouts.
  - **Cost Efficiency:** Power companies can optimize purchases, lowering costs for consumers through more efficient energy use.
  - **Enhanced Planning:** Government and utilities can make informed decisions on infrastructure and energy investments, benefiting future development.
- **Benefits of the Solution**
  - **Social:** Improves the quality of life by ensuring uninterrupted power supply, reducing stress on daily activities.
  - **Economic:** Reduces electricity costs, boosts grid efficiency, and supports economic growth by minimizing power outages.
  - **Environmental:** Enhances the integration of renewable energy sources, reducing carbon emissions and supporting sustainable energy use.

RESEARCH AND REFERENCES

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