Final Project Proposal

Topic: IoT Smart Home Energy Analytics

Group Members

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1. Domain & Dataset

We have selected the domain of IoT – Smart Home Energy Analytics.
 Our dataset, Appliances Energy Prediction (CSV, Kaggle), contains 10-minute interval measurements collected over ~4.5 months in a low-energy house in Belgium.

It includes:

- **Energy data:** Appliances and lighting consumption (Wh).
- **Indoor sensor data:** Temperature (T1–T9) and Humidity (RH_1–RH_9) across different rooms (kitchen, living room, laundry, office, bedrooms, bathrooms).
- **Outdoor weather data:** Temperature, humidity, pressure, wind speed, visibility, and dewpoint.
- **Random variables (rv1, rv2):** To be excluded as they are non-predictive.

This dataset allows us to understand how indoor environmental conditions and outdoor weather impact smart home energy usage.

2. Star Schema Design

Fact Table – EnergyUsage_Fact

- Keys: Date_Key, Time_Key, Room_Key, Weather_Key
- Measures: Appliances_Wh, Lights_Wh, Avg_Temperature, Avg_Humidity

Dimension Tables

- **Date_Dim**: Date, Day, Month, Year, Weekday, Weekend_Flag
- **Time_Dim**: Hour, Minute, Part_Of_Day (Morning/Afternoon/Evening/Night)
- **Room_Dim**: Room_Name (Kitchen, Living Room, Laundry, Office, Bedroom, Bathroom, etc.)
- **Weather_Dim**: Outdoor_Temp, Outdoor_Humidity, Pressure, Windspeed, Visibility, Dewpoint

This star schema will allow efficient querying of time-based, room-based, and weather-related energy usage patterns.

3. ETL / ELT Workflow

➔ **Extract**
   Import dataset (CSV) from Kaggle.

➔ **Transform**

➢ Handle missing values.
➢ Convert timestamp into Date_Dim and Time_Dim.
➢ Map indoor measurements to specific rooms.
➢ Calculate average room temperature & humidity.
➢ Remove random/non-predictive variables (rv1, rv2).

➔ **Load**

◆ Load cleaned dimensions into DW.
◆ Populate fact table referencing dimension keys.

4. BI / Analytics Outputs

We will design BI dashboards and KPIs (Power BI/Tableau) to provide:

- **Energy Usage Trends:** Appliance & lights usage over time (daily, weekly, monthly).
- **Room Consumption Analysis:** Which rooms drive the highest energy consumption.
- **Weather Impact Dashboard:** Correlation of outdoor temperature, humidity, and pressure with appliance usage.
- **Peak Load Identification:** Hours and days with maximum demand.
- **KPIs:**
    ➔ Avg daily appliance consumption.
    ➔ % share of lights vs appliances.
    ➔ Energy efficiency index (consumption vs weather).

Optional: predictive dashboards for next-day energy forecasting.