**sales**

transaction\_id

timestamp

product\_id

category

customer\_type

unit\_price

quantity

total

payment\_type

**sensor\_storage\_temperature**

id

timestamp

temperature

**sensor\_stock\_levels**

id

timestamp

product\_id

estimated\_stock\_pct

This data model diagram shows:

* 3 tables:
  + sales = sales data
  + sensor\_storage\_temperature = IoT data from the temperature sensors in the storage facility for the products
  + sensor\_stock\_levels = estimated stock levels of products based on IoT sensors
* Relations between tables
  + These are shown by the arrows. Make note of the columns that connect the start and end of the arrows, this indicates how you can merge the tables using these linked columns.   
      
      
      
    ### Strategic Plan and Data Model Analysis
  + #### Step 1: Data Modeling
  + After reviewing the provided data model, the following tables and columns will be used for the analysis:
  + 1. \*\*Sales Table\*\*
  + - `transaction\_id`
  + - `timestamp`
  + - `product\_id`
  + - `quantity`
  + 2. \*\*Sensor Storage Temperature Table\*\*
  + - `id`
  + - `timestamp`
  + - `temperature`
  + 3. \*\*Sensor Stock Levels Table\*\*
  + - `id`
  + - `timestamp`
  + - `product\_id`
  + - `estimated\_stock\_pct`
  + \*\*Relationships:\*\*
  + - The `sales` table can be linked to the `sensor\_stock\_levels` table using `timestamp` and `product\_id`.
  + - The `sensor\_storage\_temperature` table can be linked using `timestamp`.
  + #### Step 2: Strategic Planning
  + To predict the stock levels of products based on sales data and sensor data on an hourly basis, we will take the following steps:
  + 1. \*\*Data Integration and Preprocessing\*\*
  + - \*\*Merge Tables\*\*: Integrate sales data with sensor stock levels using `timestamp` and `product\_id`. Incorporate temperature data based on the `timestamp`.
  + - \*\*Clean Data\*\*: Handle missing values, outliers, and ensure time alignment between sales and sensor data.
  + 2. \*\*Feature Engineering\*\*
  + - \*\*Temporal Features\*\*: Extract features such as hour, day of the week, and seasonal indicators.
  + - \*\*Aggregate Sales Data\*\*: Calculate hourly sales volume for each product.
  + - \*\*Temperature Impact\*\*: Analyze and include the temperature's effect on stock levels.
  + 3. \*\*Modeling\*\*
  + - \*\*Select Algorithms\*\*: Use time series forecasting methods such as ARIMA, Prophet, or machine learning models like LSTM (Long Short-Term Memory) for sequence prediction.
  + - \*\*Training and Validation\*\*: Split data into training and testing sets to validate model performance. Use cross-validation for robust model selection.
  + 4. \*\*Evaluation\*\*
  + - \*\*Metrics\*\*: Use metrics such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and Mean Absolute Percentage Error (MAPE) to evaluate model accuracy.
  + - \*\*Model Optimization\*\*: Fine-tune model parameters to improve prediction accuracy.
  + 5. \*\*Deployment and Monitoring\*\*
  + - \*\*Deploy Model\*\*: Implement the predictive model in a real-time system to forecast hourly stock levels.
  + - \*\*Monitor Performance\*\*: Continuously monitor model performance and retrain periodically with new data.
  + #### Step 3: Communication (PowerPoint Slide)
  + \*\*Slide Title: Strategic Plan for Predicting Stock Levels\*\*
  + \*\*Objective:\*\* Accurately predict stock levels on an hourly basis using sales and sensor data to optimize procurement.
  + ---
  + \*\*Data Used:\*\*
  + - \*\*Sales Data\*\*: Transaction records including `timestamp`, `product\_id`, and `quantity`.
  + - \*\*Sensor Data\*\*:
  + - \*\*Storage Temperature\*\*: `timestamp` and `temperature` readings.
  + - \*\*Stock Levels\*\*: `timestamp`, `product\_id`, and `estimated\_stock\_pct`.
  + ---
  + \*\*Strategic Plan:\*\*
  + 1. \*\*Data Integration\*\*
  + - Merge sales with sensor data based on `timestamp` and `product\_id`.
  + - Align temperature data using `timestamp`.
  + 2. \*\*Feature Engineering\*\*
  + - Create temporal features (hour, day, season).
  + - Aggregate hourly sales volume.
  + - Analyze temperature impact.
  + 3. \*\*Model Development\*\*
  + - Choose time series and machine learning models.
  + - Train and validate models using historical data.
  + 4. \*\*Evaluation and Optimization\*\*
  + - Evaluate with MAE, RMSE, MAPE.
  + - Optimize model parameters.
  + 5. \*\*Deployment and Monitoring\*\*
  + - Implement real-time forecasting system.
  + - Monitor and retrain model periodically.
  + ---
  + \*\*Expected Outcome:\*\*
  + Enhanced accuracy in stock level predictions leading to more intelligent procurement decisions, reducing overstock and stockouts, and improving overall operational efficiency.
  + ---
  + This slide summarizes the strategic plan for leveraging sales and sensor data to predict stock levels accurately on an hourly basis. This approach will enhance procurement processes and optimize inventory management.
  + ---
  + \*\*Next Steps:\*\*
  + 1. Align on data integration specifics.
  + 2. Begin feature engineering.
  + 3. Develop and validate predictive models.
  + 4. Plan for deployment and monitoring.
  + ---
  + \*For further details or questions, please contact the Data Science team.\*
  + ---
  + \*\*End of Presentation\*\*
  + ---
  + This slide provides a concise and clear strategic plan for the Data Science team leader and the client, outlining the use of data and the steps to achieve accurate stock level predictions.