Dynamic Pricing for Urban Parking Lots

Project Overview:

This project analyzes urban parking lot occupancy data to understand usage patterns and predict Dynamic Pricing of each lot. The dataset contains information about parking lot including capacity, real-time occupancy, vehicle types, traffic conditions, and timestamps. The aim is to provide insights into parking space utilization and help optimize parking management.

Teck Stack:

Python: Primary programming language.
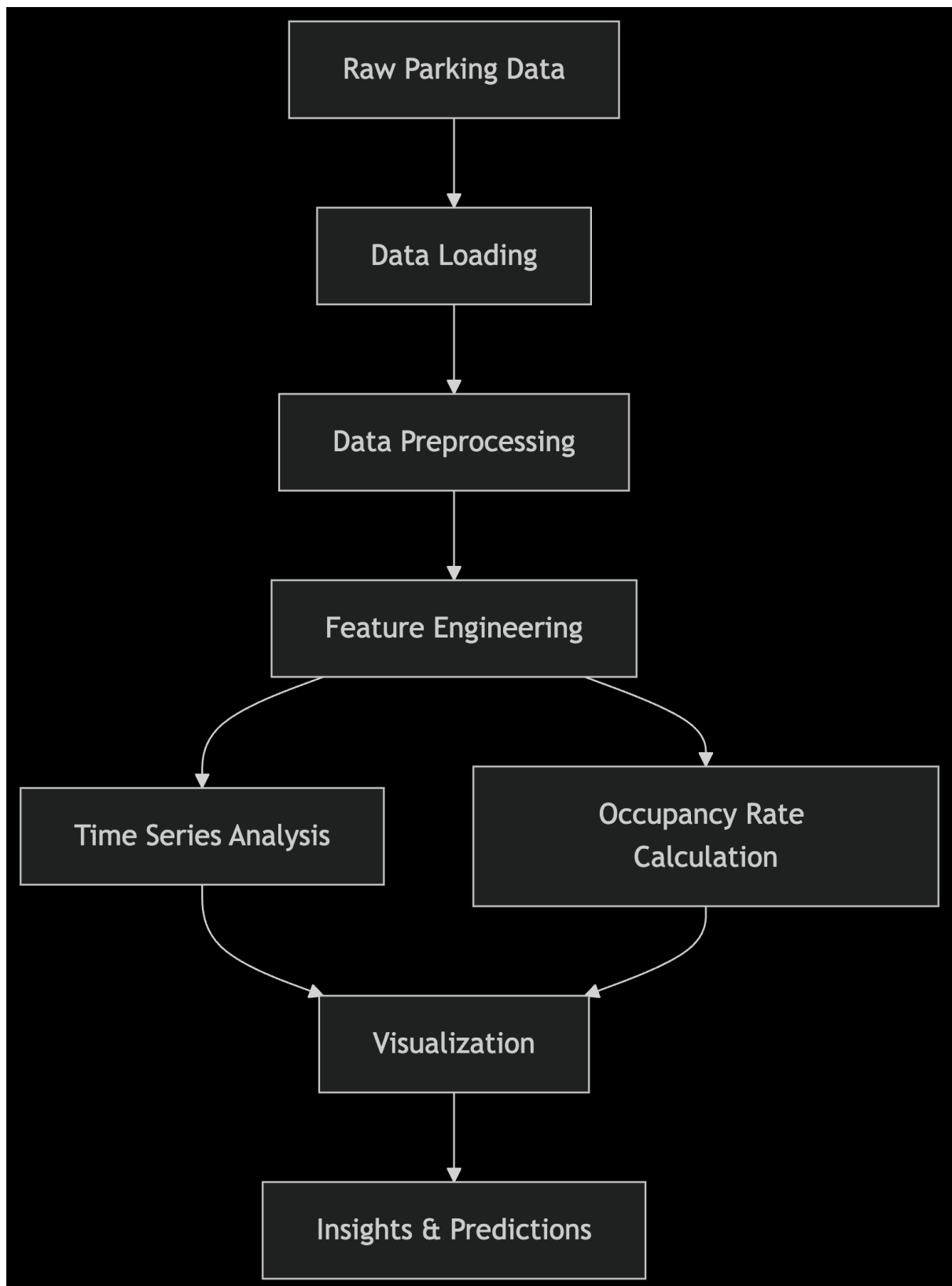
Pandas: Data manipulation and analysis.

NumPy: Numerical computations.

Matplotlib/Seaborn: Data visualization.

Pathway: Real-time data processing.

Bokeh/Panel: Interactive visualizations.

Architecture Diagram:

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│    Raw Parking Data     │
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┌─────────────────────────┐
│      Data Loading       │
└─────────────────────────┘
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┌─────────────────────────┐
│    Data Preprocessing   │
└─────────────────────────┘
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┌─────────────────────────┐
│   Feature Engineering   │
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┌──────────────────┐  ┌──────────────────────┐
│ Time Series      │  │   Occupancy Rate     │
│ Analysis         │  │   Calculation        │
└──────────────────┘  └──────────────────────┘
         │         │
         ▼         ▼
    ┌─────────────────────┐
    │    Visualization    │
    └─────────────────────┘
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    ┌─────────────────────┐
    │ Insights & Predictions │
    └─────────────────────┘
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Project Architecture and Workflow:

1) Data Loading:

The dataset is loaded from a CSV file containing urban parking lot data.

Key fields include ID, SystemCodeNumber, Capacity, Occupancy, Vehicle Type, TrafficConditionsNearBy, Timestamps etc.

2) Data Preprocessing:

Handling missing values (though none were found in this dataset).

Creating a parking lot Id based upon SystemCodeNumber.

Sorting data by timestamp for time series analysis.

Mapping vehicle types to weights for weighted occupancy calculations.

3) Feature Engineering:

Datetime stamp is formed by merging Date and Time stamp.

Added vehicle weight mapping (bike=0.5, car=1, truck=1.5).

Calculated occupancy rate (Occupancy/Capacity).

4) Analysis Capabilities:

Time-based occupancy patterns (hourly, daily, weekly trends).

Parking lot comparison by prices.

5) Visualization:

Time series plots of prices.

Interactive dashboards for exploration