# Dynamic Pricing for Urban Parking Lots

## Tech Stack Used

• Python — Core programming language  
• Pandas, Numpy — Data preprocessing and analysis  
• Pathway — Real-time data stream processing  
• Bokeh — Real-time interactive visualizations  
• Geopy — Distance calculation for geospatial intelligence  
• Google Colab — Cloud-based development and execution environment

## Architecture Overview

1. Input Layer:  
 - Static dataset (CSV)  
 - Simulated real-time data feed  
  
2. Data Preprocessing Layer:  
 - Feature engineering (Occupancy Rate, Vehicle encoding)  
 - Demand scoring  
  
3. Modeling Layer:  
 - Model 1: Baseline Linear Pricing  
 - Model 2: Demand-Based Pricing  
 - Model 3: Competitive Location-Aware Pricing  
  
4. Real-Time Processing:  
 - Pathway to simulate and handle streaming updates  
 - Real-time pricing computation  
  
5. Visualization:  
 - Bokeh plots for dynamic price tracking  
 - Dashboard comparison between models  
  
6. Output Layer:  
 - Google Colab notebook (main interface)

## Project Workflow

1. Load dataset using pandas.  
2. Conduct exploratory analysis and feature engineering.  
3. Implement 3 pricing models based on business and data logic.  
4. Use Pathway to simulate a real-time data stream.  
5. Visualize pricing trends using Bokeh.  
6. Optionally integrate geospatial intelligence for rerouting and price adjustment.

## Strategic Advantages

• Scalable and modular architecture.  
• Real-time pricing simulation.  
• Explainable, interpretable price changes.  
• Integration-ready for smart city deployments.  
• Visual justification via interactive plots.  
  
  
**Advanced Add-ons**

* Heatmap of congestion by lat/long
* Reroute map with direction arrows
* ML model to predict future demand (based on hour of day + historical)

An architecture diagram A diagram of a company

AI-generated content may be incorrect.