# Dynamic Pricing Model with Row-wise Adaptive Coefficients

## Objective:

To implement a demand-driven dynamic pricing model that adjusts parking prices in real time based on situational factors. This model calculates coefficients dynamically for each row of data, enabling responsive, context-aware pricing.

## Key Features of the Model:

### 1. Base Price Determination:

The starting price (BasePrice) is assigned based on the vehicle type:

- Car: ₹5.00
- Bike: ₹3.00
- Truck: ₹10.00
- Cycle: ₹2.00

### 2. Occupancy Ratio (OccRatio):

Defined as: Occupancy / Capacity

Reflects the current space utilization of a parking lot.

### 3. Dynamically Calculated Coefficients:

For each row, coefficients are computed based on real-time data values:

- Alpha (α): Impact of occupancy ratio.
  - Based on hour of the day, special day status, and traffic condition.
- Beta (β): Impact of queue length.
- Gamma (γ): Impact of traffic level.
- Delta (δ): Impact of special day.
- Epsilon (ε): Impact of vehicle type weight.

### 4. Component-wise Price Contributions:

Each price factor is calculated individually:

$$Price\_alpha = BasePrice * Alpha * OccRatio$$
$$Price\_beta = BasePrice * Beta * QueueLength$$
$$Price\_gamma = -BasePrice * Gamma * TrafficLevel$$
$$Price\_delta = BasePrice * Delta * IsSpecialDay$$
$$Price\_epsilon = BasePrice * Epsilon * VehicleTypeWeight$$

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### 5. Final Predicted Price Calculation:

$$PredictedPrice = BasePrice + Price\_alpha + Price\_beta + Price\_gamma + Price\_delta + Price\_epsilon$$

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## Pathway Workflow:

- Input live parking dataset (with occupancy, queue, traffic, etc.)
- Apply dynamic coefficient logic row-by-row
- Use component formulas to calculate final PredictedPrice
- Output a DataFrame/table of real-time prices with breakdowns

## Benefits:

- Each row (time instance) receives a personalized pricing strategy.
- Enables adaptive and fair pricing based on real-time demand signals.
- Transparent breakdown of price components for audit or public explanation.

## Use Case:

This model is suitable for smart urban parking management systems, enabling real-time dynamic pricing for optimal utilization of parking spaces while balancing demand and fairness.

## Note:

Replace placeholder image URLs with actual screenshots or diagrams during final presentation export.