MCD412 B. Tech Project

Week2-(20-Jan to 26-Jan 2025) Report

Submission Due: 27-Jan-2025, 05:00 PM

Title of the project: Dynamic Freight Pricing

Area of the project: Industrial

Student Name with Entry number:

1. Sanidhya Mittal (2021ME21054)

2. Sanchit (2021ME21063)

Supervisor Name: Prof. Amber Srivastava & Prof. Prashant Palkar

Literature Review (Minimum 3 Papers to review individually):

1. Dynamic Pricing for Passenger Groups of High-Speed Rail Transportation_Zhang Xiaoqiang et al. Journal of Transportation Systems Engineering and Information Technology : This study presents a dynamic pricing model aimed at optimizing ticket prices for group travelers in China's high-speed rail system. The model seeks to balance demand fluctuations and maximize revenue by adjusting prices based on group size and travel time.

2. Dynamic Pricing by Indian Railway—A Way to Customer Loss_Jojo K. Joseph_International Journal of Research in Commerce and Management: This empirical analysis examines the dynamic pricing mechanism adopted by Indian Railways in select trains. The study highlights that while dynamic pricing can increase revenue, it may also lead to customer dissatisfaction if not implemented considerately.

3. A Study on High-Speed Rail Pricing Strategy for Thailand Based on Dynamic Optimal Pricing Model_Prasert Kanthachai et al._International Journal of Intelligent Engineering and Systems: This research explores the application of a dynamic pricing model for Thailand's upcoming high-speed rail. The proposed Dynamic Pricing Optimizer (DPO) system adjusts ticket prices based on service demand and purchase timing, aiming to enhance revenue management.

4. Dynamic Pricing Strategies for Railway Passenger Transport_Yang Liu et al._Transportation Research Part E: Logistics and Transportation Review: This paper investigates various dynamic pricing strategies in railway passenger transport, analyzing their effects on demand, revenue, and customer satisfaction. The study concludes that well-implemented dynamic pricing can lead to increased revenue without significantly impacting passenger satisfaction.

5. Revenue Management in Railway Operations: Models and Algorithms_Marc Goossens et al._European Journal of Operational Research: The authors develop models and algorithms for revenue management in railway operations, focusing on seat inventory

control and pricing strategies. The study demonstrates that dynamic pricing, combined with effective seat allocation, can substantially boost revenues.

6. Dynamic Pricing and Seat Allocation for Railway Revenue Management_Yingnian Wu et al. Journal of Revenue and Pricing Management: This research proposes a dynamic pricing and seat allocation model for railway services, considering factors like demand uncertainty and customer behavior. The findings suggest that integrating dynamic pricing with seat allocation strategies enhances overall revenue performance.

Methodology (Explain to meet set objectives):

1. Data Architecture & Collection Framework
    - Historical Data: Assimilated 1.5 years of past pricing data from Indian Railways, specifically for cement routes. Include both peak and off-peak seasons to capture monsoon impacts, festival periods, and construction cycle variations.
    - Operational Metrics: Collect daily/weekly capacity utilization per route, loading/unloading times at major cement plants, and rake availability data.
    - Market Indicators: Track road transport rates (your main competitor), diesel prices, regional cement demand, and major infrastructure project timelines that could impact demand.
    - Granularity: All data should be at route-level granularity with daily timestamps to capture short-term variations.
2. Deep Learning Model Strategy
    - Dual Input Processing: Design the model to handle both temporal patterns (like seasonal trends, weekly demand cycles) and static route features (distance, infrastructure type) simultaneously. This allows the model to balance long-term patterns with immediate market conditions.
    - Learning Approach: Implement deep learning layers that can capture complex pricing relationships while maintaining pricing stability. The model should learn from historical price-demand relationships while adapting to new market conditions.
    - Price Sensitivity: Build in mechanisms to ensure price recommendations remain within acceptable bounds while responding to market changes. The model should be more conservative with price increases than decreases to maintain customer relationships.
3. Implementation & Business Rules Integration
    - Model Deployment: Set up a staged rollout, starting with 2-3 major cement routes. These routes should have high traffic volume and good data availability.
    - Price Boundaries: Implement hard constraints based on:
        - Minimum: Operating cost + 15% margin
        - Maximum: Road transport cost - 10% (to maintain competitive advantage)
    - Response System: Create an automated monitoring system that alerts when:
        - Demand significantly deviates from predictions
        - Competitor prices change by more than 5%
        - Capacity utilization falls below 70%
    - Testing Framework: Develop a comprehensive A/B testing structure where new routes are added only after successful validation on existing routes.

Gantt Chart (Prepare week wise):

Activity Vs. week wise plan

Account of Time:

Sanidhya: Literature Review 6 hours, Gantt chart preparation 2 hours; **Sanchit**: Literature Review 5 hours, Gantt chart preparation 1 hour, Methodology 1 hour;

Declaration:

I/We have met our supervisor on ____NA____(Date) at __NA__(Time) and discussed the report before submission.

(Student 1 Signature) **(Student 2 Signature)** **(Supervisor Signature)**