

AI Product & Financial Modelling Report

Presented By:

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Step 1: Prototype Selection

Product Idea: AI-Based Metro Ridership Forecasting & Crowd Monitoring System

The proposed product aims to support urban metro systems with AI-driven tools to predict ridership patterns and detect real-time crowd density on platforms. This system leverages predictive analytics using historical entry data, along with live video feeds processed through object detection models.

Feasibility:

- The system can be developed in the short term (2-3 years) using existing models such as Prophet, SARIMA, and YOLOv5.
- Entry logs are already maintained by most metro systems; integrating with CCTV feeds is also technically straightforward.

Viability:

- With rapid urbanization, metro systems in India and globally are scaling up. Demand for intelligent transport systems will increase.
- The solution will stay relevant over the next 20-30 years as part of smart city and AI-in-infrastructure strategies.

Monetization:

- Direct monetization through annual B2G/B2B contracts with metro rail corporations and smart city departments.
- Optional SaaS model for additional analytics dashboards and crowd alert services.

Step 2: Prototype Development

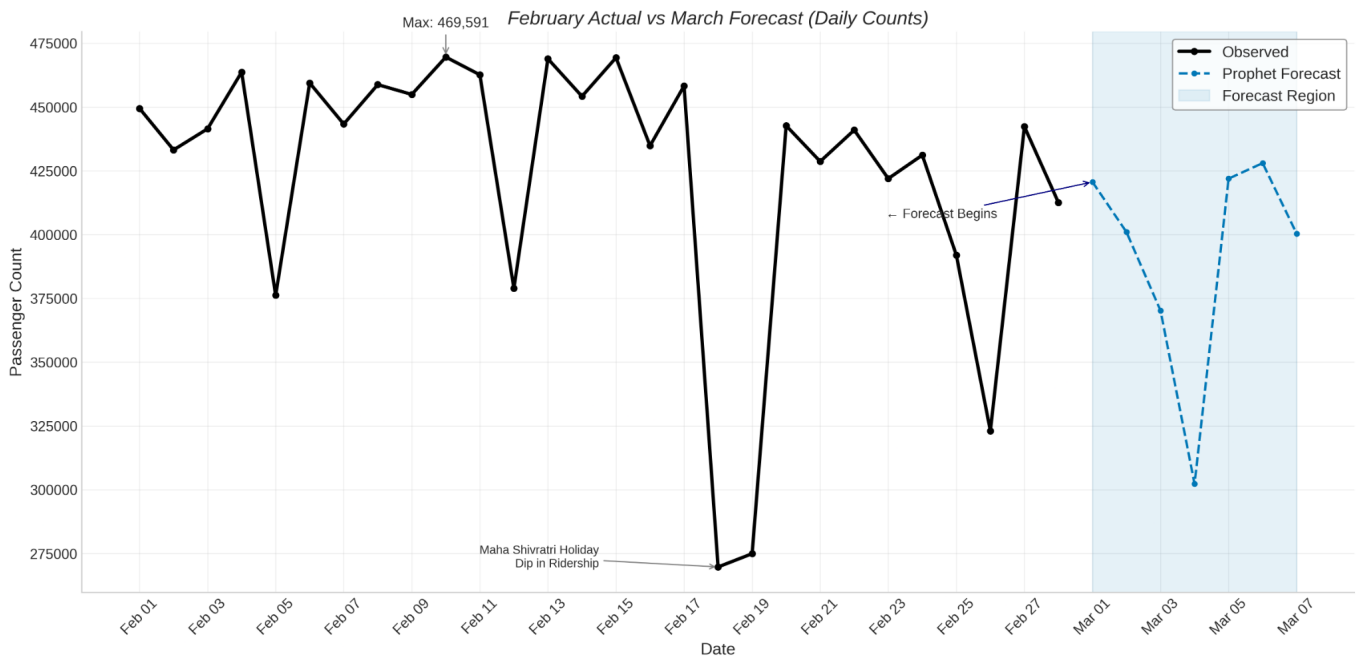
A proof-of-concept was implemented with the following modules:

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1. Forecasting Module:

- Utilized Prophet time series forecasting to model hourly ridership data.
- Included engineered features like rush hours, weekends, holidays (e.g., Holi), temperature, and humidity.
- Prophet model showed lowest MAE and RMSE among compared models.

□ Prophet Forecast vs Observed Metro Ridership



2. Crowd Detection Module:

- Implemented YOLOv5 to detect and count passengers in real-time from camera footage.
- Detected people with >90% accuracy using bounding boxes.
- Helps verify anomalies when forecasted vs real crowds differ drastically.

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HO-PTZ Via 1



3. Anomaly Detection:

- Compared forecasted ridership with real-time camera count.
- Triggered alert if real crowd exceeded 25% above predicted value.

Development Tools: Python, Pandas, fbprophet, OpenCV, YOLOv5, matplotlib.

Step 3: Business Modelling

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Target Market: Metro transport systems in Tier-1 and Tier-2 Indian cities (e.g., Hyderabad, Bangalore, Pune).

Customer Segments:

- Government-owned Metro Corporations
- Smart City Control Centers
- Urban Transport Planners

Revenue Model:

- Annual licensing fee for each city
- Optional analytics dashboard as monthly subscription
- Customization or data integration as one-time setup fees

Value Proposition:

- Reduced crowd congestion and risk through predictive alerts
- Optimization of train frequency based on demand forecast
- Better deployment of metro staff during peak hours
- Improved passenger satisfaction and safety

Customer Acquisition Strategy:

- Government tenders and pilot programs
- Live demos at Smart City forums and Transport Summits
- Partnering with metro contractors and AI solution providers

Step 4: Financial Modelling & Forecasting

a. Market Overview:

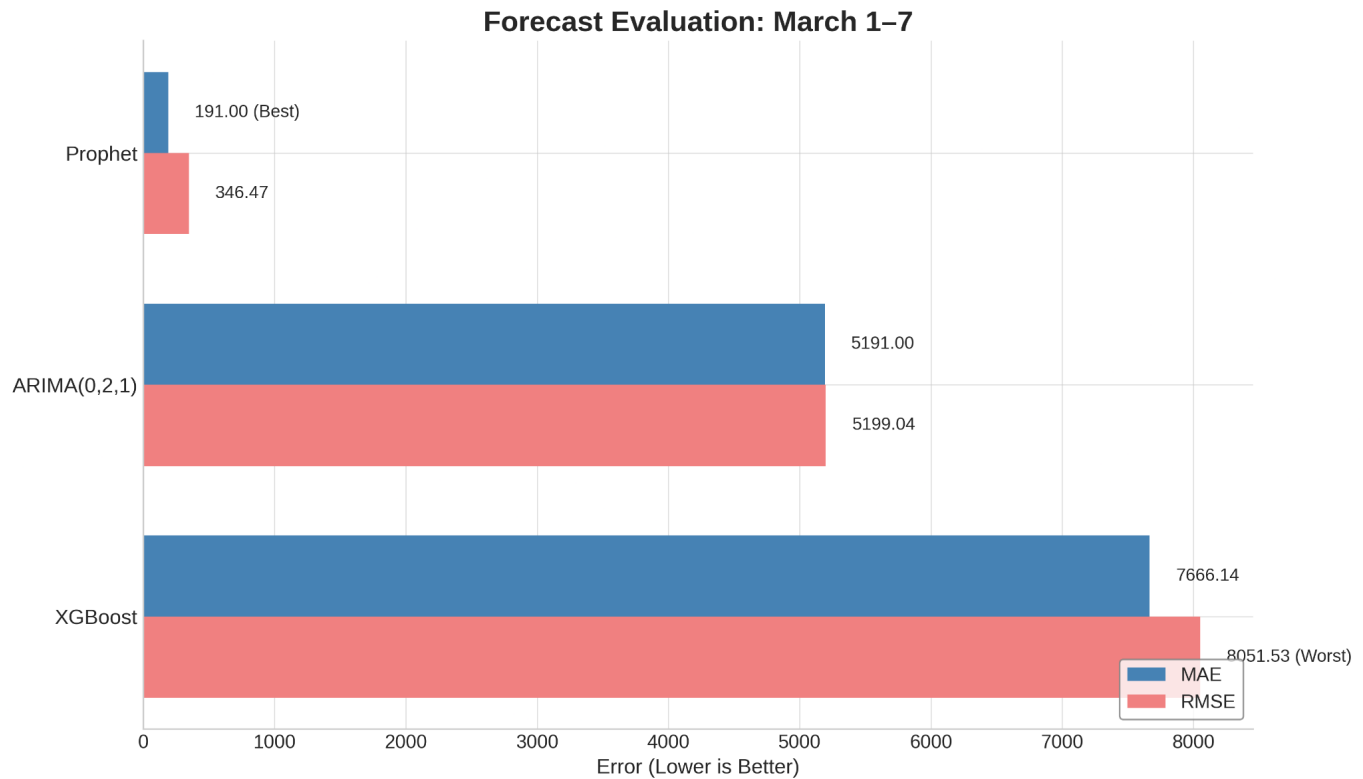
- Hyderabad Metro sees daily ridership of ~4.5?5 lakh passengers.
- Total estimated addressable market includes ~10 cities with active or expanding metro networks.
- Budget allocated under Smart City Mission for AI and Transport Systems: ?1000+ crores nationally.

b. Data Forecasting Insights:

- Prophet model was trained using 672 hourly records for February.

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- Evaluation Metrics: MAE = 191, RMSE = 346
- Successfully predicted dips during holidays and spikes in rush hours.



c. Financial Equation:

- Product licensing cost per city = ₹5,00,000/year
- Monthly operational and update cost = ₹50,000
- Yearly total cost = ₹6,00,000

Revenue (y) based on city count (x):

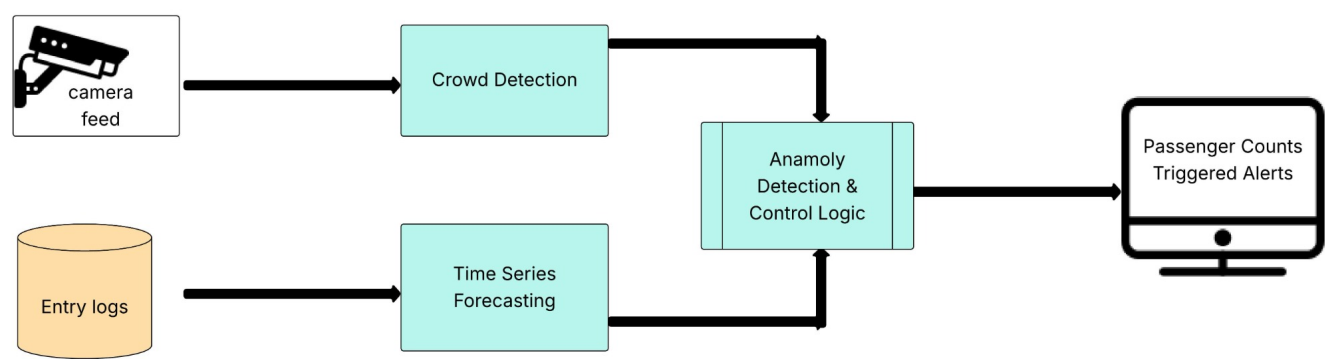
$$y = 500000x - 600000$$

Example Calculation:

- If 6 cities onboard: $y = 500000 \times 6 - 600000 = ₹24,00,000$ net revenue
- Break-even achieved at 2 cities (₹10,00,000 revenue vs ₹6,00,000 cost)

System Architecture Diagram

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Conclusion

The AI-Based Metro Forecasting and Crowd Monitoring product offers a powerful blend of predictive analytics and real-time AI. It addresses urban mobility needs and fits well within the smart city framework. With a working prototype and a clear business model, this solution has the potential to be deployed across India's growing metro systems and beyond, improving operational efficiency and passenger safety.