Transport Data Analytics and Forecasting Project

Key Insights from Transport Data:

Insight 1: Light Rail Usage Trends
The Light Rail system experienced a peak in ridership during January 2024. Following this peak, usage declined steadily over the subsequent months, indicating possible seasonal effects or changes in commuter behavior.

Insight 2: School Services Operation Patterns
School transport services operate exclusively on weekdays. Data shows notable dips in ridership during school holidays, confirming that service demand is directly tied to the academic calendar.

Insight 3: Peak Hour Passenger Volume
Morning hours (7 AM–10 AM) and evening hours (4 PM–7 PM) are consistently the busiest across most transport modes. This aligns with standard commute times, highlighting the need for increased service frequency during these periods.

Insight 4: Route Delays and Bottlenecks
Certain routes experience recurrent delays during afternoon peak hours. Analysis suggests these delays correlate with traffic congestion hotspots, requiring potential route optimization or traffic management interventions.

Insight 5: Service Disruptions and Weather Impact
Service interruptions are more frequent during adverse weather conditions such as heavy rain or storms, underscoring the importance of integrating weather forecasts into transport planning.

Forecasting Report: Bandwidth Usage Prediction Using Prophet

1. Introduction

This report presents the forecasting of daily **bandwidth usage** in a telecommunications network using the **Prophet algorithm**. Accurate bandwidth forecasts help optimize network capacity and improve service quality.

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2. Data Preparation

- The dataset contains daily bandwidth usage values with two columns:
    - ds: Date (daily timestamps)
    - y: Bandwidth usage (numeric, in Mbps)
- Data was preprocessed to fill missing values and convert date formats to fit Prophet's requirements.

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3. Prophet Algorithm Overview

- Prophet is an additive time series model that captures:
    - Trend changes in bandwidth usage
    - Seasonal patterns (weekly or monthly)
    - Robust to missing data and outliers
- It automatically detects changepoints in trends without manual intervention.

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4. Model Training and Forecasting

- The Prophet model was trained on historical daily bandwidth data.
- Forecast horizon set to 100 future days.
- Model outputs include predicted bandwidth usage (yhat) and uncertainty intervals (yhat_lower, yhat_upper).

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5. Results

- The forecast shows an overall (state the trend observed: increasing, decreasing, or stable) bandwidth usage trend.
- Seasonal weekly patterns are evident with peaks on (e.g., weekdays or weekends) reflecting network usage habits.
- Uncertainty intervals widen in the forecast horizon, reflecting less confidence farther into the future.

6. Insights

- Bandwidth demand is expected to (increase/decrease/remain stable) over the next 100 days, suggesting potential capacity planning needs.

- Periodic peaks indicate times when network load is highest, useful for scheduling maintenance or scaling resources.

7. Recommendations

- Use this forecast for proactive network resource allocation to prevent congestion.

- Regularly retrain the model with updated data for improved accuracy.

- Consider incorporating additional variables (e.g., special events or outages) for refined predictions.

Forecast for Local Route

Forecast for Light Rail

Forecast for Other

Forecast for Peak Service

Forecast for Rapid Route

Forecast for School