Title:
Integrated Data Approach: Effect of Traffic and Urban Events on Uber Fare Prices

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1. Introduction

Ride-sharing apps like Uber rely on dynamic pricing, which changes fares based on demand, traffic congestion, and city events. In cities like Hyderabad, conditions such as weather and special events regularly trigger price surges. This report presents:

- **An analysis of how traffic and external conditions influence Uber fares,**
- **The methodology for collecting, integrating, and engineering a dataset suited for traffic impact predictions.**

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2. Effect of Traffic on Uber Fare Pricing

2.1 Direct Effects of Traffic:

- **Longer Travel Time: Higher traffic congestion increases trip duration, resulting in more time-based charges.**
- **Surge Pricing: Rapid spikes in demand during jams or events trigger surge multipliers, raising fares.**
- **Route Deviations: Customers and drivers are often diverted due to congestion, which can increase fare by extending trip distances.**

2.2 Impact on Stakeholders:

- **Passengers: Experience higher fares and longer wait times.**
- **Drivers: While surge pricing may raise earnings, traffic delays increase fatigue and costs.**

2.3 External Conditions Worsening Traffic:

- **Weather:**
    - **Rain creates slippery roads and longer trip times.**
    - **Fog (from local humidity) reduces speeds and increases journey uncertainty.**
    - **Temperature extremes affect both demand for rides and vehicle performance.**
    - **Strong winds or storms may cause road closures and event cancellations.**
- **Special Events:**
    - **Sports, festivals, concerts, and public holidays can double or triple local traffic volumes.**
    - **Demonstrations/parades disrupt regular flows and force detours.**

City Note:
In Hyderabad, event-driven congestion near stadiums and IT hubs often kicks in surge pricing during peak hours!

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3. Data Collection & Integration Methodology

3.1 Data Sources:

- **Traffic Data: Hourly vehicle counts at major junctions**
- **Weather Data: Temperature, precipitation, humidity, wind speed from meteorological APIs**
- **Event Data: Sports, concerts, holidays, demonstrations from news and public calendars**
- **Weekend Indicator: Captures weekly differences in travel demand**

3.2 Data Cleaning Steps:

- **Filled gaps using forward-fill for time-series accuracy**
- **Removed duplicates and formatting errors**
- **Unified date and time formats to sync all data**

3.3 Data Integration:

- **Datasets merged using exact timestamp matching for all rows**
- **Produced a synchronized processed dataset: Trafficproject_processed_unique.csv**
- **Features engineered for specific Hyderabad urban conditions**

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4. Feature Engineering Details

Engineered Columns:

- **Vehicles: Normalized hourly traffic volumes**
- **TempC: Median hourly temperature**
- **Rain: Maximum hourly rain index**
- **IsEvent/IsWeekend: Binary indicators for event and weekend timing**
- **Hour, DayOfWeek: Time features for daily/weekly pattern detection**
- **IsMorning: Highlights morning congestion**
- **IsPeakHour: Marks classic urban rush hours (8-10 AM, 5-7 PM)**
- **Lag_2h, Lag_4h, Lag_8h: Previous traffic volumes to predict future trends**

Scaling and Normalization:
All numerical features normalized to a common scale for accurate model training and comparison.

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5. Results & Insights

5.1 Correlation Analysis:

- **High correlation between current and lagged traffic volumes (Lag_2h, Lag_4h, Lag_8h)—key for short-term predictions.**

- **Strong rush hour effects reflected in ‘Hour’ and ‘IsPeakHour’ columns.**
- **Weather and event features show moderate but meaningful influence on fare volatility.**

Unique Findings:
Novel features like ‘IsMorning’ and ‘IsPeakHour’ enhance model ability to predict when and where fare spikes occur, particularly during major Hyderabad events.

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6. Conclusion

This integrated dataset and report equip stakeholders to forecast Uber fare trends, plan for peak-hour management, and provide real-time recommendations. Traffic, weather, and event features together offer a robust platform for further predictive modeling and smart urban transport planning.