Business Intelligence

IT 7123 - Business Intelligence
Final Research Report

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Title: Uber Under the Lens: Interactive Visualization and Predictive Analysis of Ride Data Using Power BI

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Abstract

In today's world of on-demand mobility, services like Uber generate an enormous amount of data every day. While much of this data holds the potential to drive smarter decisions, it often goes untapped—especially when it comes to forecasting and real-time insights. This project set out to change that by using Power BI to turn Uber's ride data into a meaningful, interactive story. The result is a set of user-friendly dashboards that not only show trends in bookings, revenue, and efficiency but also help predict future demand. From analyzing hourly booking patterns to spotting high-traffic pickup zones, this dashboard brings valuable insights to the surface. It's a hands-on, scalable tool that shows just how much value can be unlocked when good data meets smart visualization.

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Introduction

Apps like Uber have completely transformed how we move through cities. With a few taps, people can request a ride, and drivers are routed to where they're needed. Behind every one of these trips lies a wealth of data—about where people are going, when they're traveling, and what types of rides they prefer. Yet, despite this data goldmine, much of it remains underused, especially when it comes to planning ahead or adjusting operations in real-time.

This project explores how we can use Power BI to uncover the stories hidden in Uber's ride data. The goal is simple: make the data easy to explore, understand, and use for smarter decisions.

What are we trying to solve?
We want to understand: How can we take all this Uber trip data and turn it into something useful—something that helps predict demand, monitor performance, and guide better business choices?

Questions we asked:
- When and where are most rides happening?
- Can we predict which times and places will be busiest?
- What are the key numbers (KPIs) that tell us how well Uber is doing?

Our Objectives:
- Build a dashboard in Power BI that makes the data come to life.
- Show patterns in bookings, trip distances, and ride durations.
- Use forecasting tools to help predict future trends.

Scope & Limitations:
The data used in this project comes from a limited geographic area and time period. Because we didn't have access to Uber's real-time feed, we simulated live data updates. And while the forecasting is powerful, it doesn't take into account every possible variable like economic shifts or traffic disruptions.

Why it matters:
By visualizing this data, companies like Uber—and even cities—can make more informed decisions. This kind of dashboard can help with everything from scheduling drivers to planning city transport.

Literature Review

Researchers have already explored how to make sense of transportation data. For example, past studies have used statistical models to predict when ride demand will spike or to understand traffic flow across neighborhoods. But many of these studies use tools that aren't accessible to everyday business users. Often, they rely on complex code in Python or R—powerful, but not exactly easy to use.

Where this project stands out is in its use of Power BI. It brings all the insights into a single dashboard that anyone can explore, without needing to write code. That's the gap we're trying to fill: making powerful data analysis easy and visual.

Methodology

How we approached it:
This was a hands-on, data-driven project. We took historical Uber trip data and built it into something interactive, insightful, and predictive.

Data Sources:
- Uber trip data - Kaggle
- Weather and event data
- Simulated real-time ride data

Tools we used:
- Power BI (for dashboards, data modeling, visuals)
- Power Query (to clean and prep the data)
- DAX (for creating meaningful metrics)
- Optional: Python (for advanced forecasting models like Prophet)

How we made sense of the data:
We cleaned the data, filled in missing values, and organized it into a star schema (a fancy term for how data tables are linked together). From there, we created measures like:
- Total Bookings
- Revenue per Ride
- Average Trip Duration
- Booking trends by hour and day

Then we applied forecasting models to predict future demand—and brought it all together in a visual dashboard.

DASHBOARDS OVERVIEW:

DASHBOARD 1: OVERVIEW ANALYSIS

Analyse Uber trip data using Power BI to gain insights into booking trends, revenue, and trip efficiency, helping stakeholders make data-driven decisions.

KPI's

1. **Total Bookings** – How many trips were booked over a given period?
2. **Total Booking Value** – What is the total revenue generated from all bookings?
3. **Average Booking Value** – What is the average revenue per booking?
4. **Total Trip Distance** – What is the total distance covered by all trips?
5. **Average Trip Distance** – How far are customers traveling on average per trip?
6. **Average Trip Time** – What is the average duration of trips?

Expected Outcomes:

✓ Identify trends in ride bookings and revenue generation.

✓ Analyse trip efficiency in terms of distance and duration.

✓ Compare booking values and trip patterns across different time periods.

✓ Provide insights to optimize pricing models and improve customer satisfaction.

CHARTS

Create a Measure Selector using a Disconnected Table with the following values:

- Total Bookings
- Total Booking Value
- Total Trip Distance

Then, use a measure to dynamically update the visualizations based on user selection.

By Payment Type (Card, Cash, Wallet, etc.)

By Trip Type (Day/Night)

Additional Enhancements:

- **Dynamic Title** – Update the chart title based on the selected measure.

- **Slicers** – Add filters for Date, City, and other interactive filters for deeper analysis.
- **Tooltips** – Show additional details like Average Booking Value or Trip Distance.

Vehicle Type Analysis - Grid View in Power BI

Create a grid table (matrix or table visual) to analyse key performance indicators like Total Bookings, Total Booking Value, Avg Booking Value, Total Trip Distance across different Vehicle Types in Uber trips.

Power BI Implementation:

- **Use a Table or Matrix Visual** to display Vehicle Type with the KPIs.
- **Apply Conditional Formatting** to highlight high and low values.
- **Enable Sorting & Filtering** for user interaction.

Total Bookings by Day

- Detecting trends and fluctuations in daily trip volumes.
- Identifying peak and off-peak booking days.
- Understanding the impact of external factors (holidays, events, weather) on ride demand.
- Supporting strategic planning for resource allocation and pricing adjustments.

Location Analysis

Understanding trip locations is crucial for optimizing ride distribution, demand forecasting, and operational efficiency. This analysis focuses on:

- **Most Frequent Pickup Point**
  - Identify the most common starting locations for trips.
  - Helps in optimizing driver availability and dynamic pricing strategies.
- **Most Frequent Drop-off Point**
  - Find the most common drop-off locations.

- Requires activating an **inactive relationship** in Power BI between **Pickup Location and Drop-off Location** in the data model.

➢ **Farthest Trip**

- Determine the longest trip based on distance travelled.
- Useful for analysing outlier trips, long-distance demand, and fare optimization.

Total Bookings by Location (Top 5)

- Identify the **top 5 locations** with the highest trip bookings.
- Helps in demand forecasting and optimizing driver availability in high-traffic areas.

Most Preferred Vehicle for Location Pickup

- Determine the most frequently booked **vehicle type** at each pickup location.
- Supports strategic vehicle distribution based on customer preferences and location demand.

Other Implementation Enhancements for Uber Trip Analysis Dashboard

➢ **Bookmark for Data Details**

- Add a **"Data Details"** bookmark to display a pop-up or side panel explaining:
    - Meaning of key metrics (Total Bookings, Total Trip Distance, etc.).
    - Description of tables used in the analysis.
    - Data source and refresh frequency.

➢ **Clear Slicer Button**

- Add a **"Clear Filters"** button using a **blank button with a Reset Slicers action** to reset all selections in one click.
- Improves user experience for quick dashboard resets.

- **Download Raw Data Button**
  - Add a **button to export raw data** in CSV or Excel format.
  - Use **Power Automate or built-in Power BI Export functionality**.
  - Enables users to analyse raw data outside Power BI if needed.

DASHBOARD 2: TIME ANALYSIS

To understand trip patterns based on time, Uber needs to analyse ride demand and trends across different time intervals. This dashboard will help in optimizing operations, pricing, and driver availability.

Global Dynamic Measure (Filters All Charts)

A **measure selector** will be created for:

✓ Total Bookings

✓ Total Booking Value

✓ Total Trip Distance

This dynamic measure will update all visuals based on user selection.

Visualizations:

By Pickup Time (10-Minute Intervals) - Area Chart

- Groups trip bookings into **10-minute intervals** throughout the day.
- Helps in identifying peak and off-peak demand periods.

By Day Name - Line Chart

- Shows booking trends across **Monday to Sunday**.
- Useful for analysing weekday vs. weekend demand.

By Hour and Time - Heatmap (Matrix Grid)

- **Rows:** Hours of the Day (0–23)
- **Columns:** Days of the Week (Mon-Sun)
- **Values:** Selected Dynamic Measure (e.g., Total Bookings)
- Highlights peak booking hours across different days.

DASHBOARD 3: DETAILS TAB

To provide in-depth insights and allow users to explore granular data, a **Grid Tab** will be created. This tab will enable drill-through functionality, allowing users to access detailed records based on selections made in other dashboards.

Features of the Grid Tab:

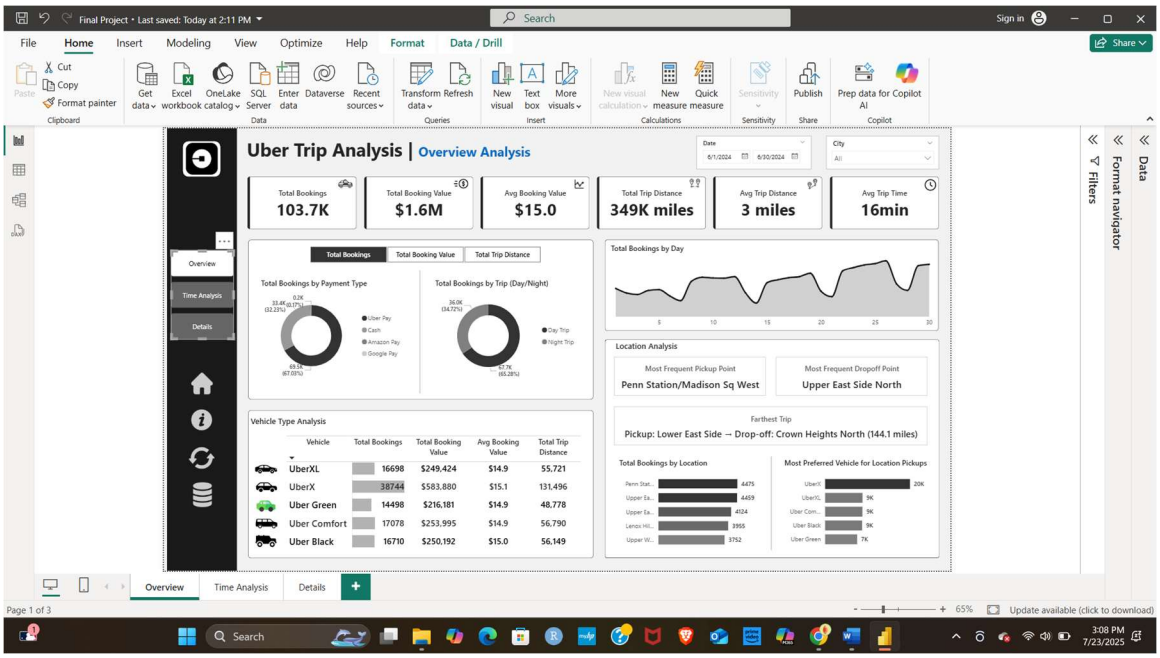
- **Grid Table with Key Fields:**
  - Displays essential trip details
- **Drill-Through Functionality:**
  - Users can right-click on a data point from other visuals (e.g., charts, heatmaps) and **drill through to this Grid Tab**.
  - Displays detailed records related to the selected data point.
- **Bookmark for Full Data View:**
  - A **"View Full Data"** bookmark to toggle between filtered drill-through data and the complete dataset.
  - Allows users to reset filters and see all records easily.

Results

The final product is a three-part dashboard that tells a story from different angles:

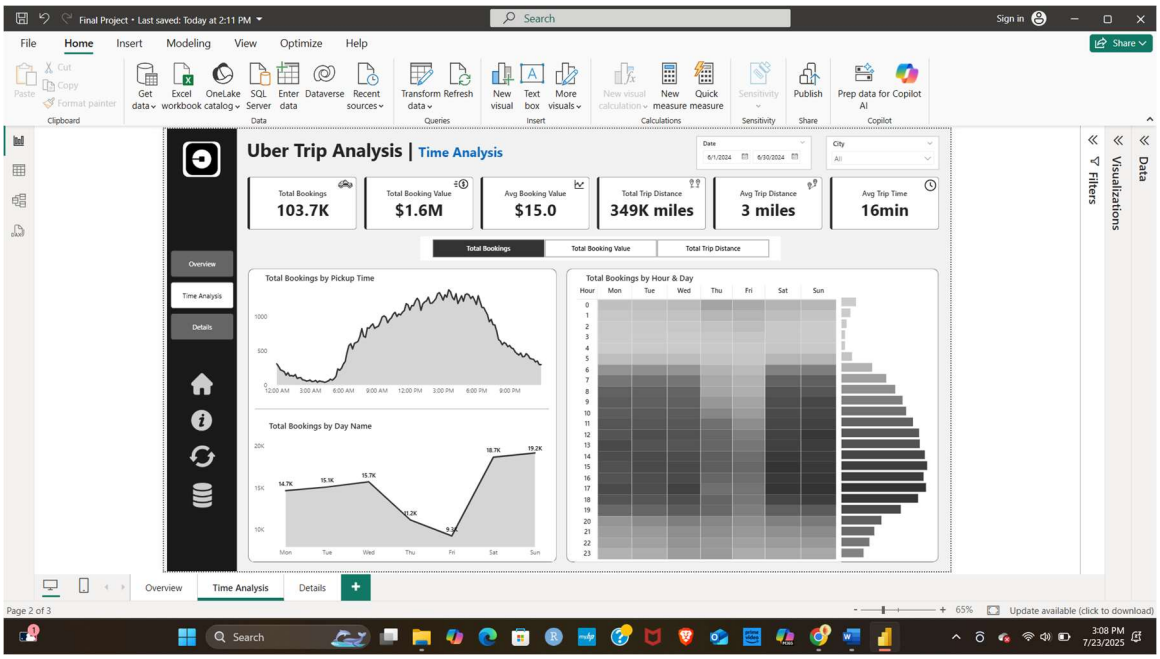
1. Overview Dashboard:

This is the big-picture view. You can see how many rides were booked, how far people traveled, how much they paid, and what the average trip looked like. Users can choose which metrics to focus on, and the visuals update dynamically. We even added filters for day, city, vehicle type, and payment method.



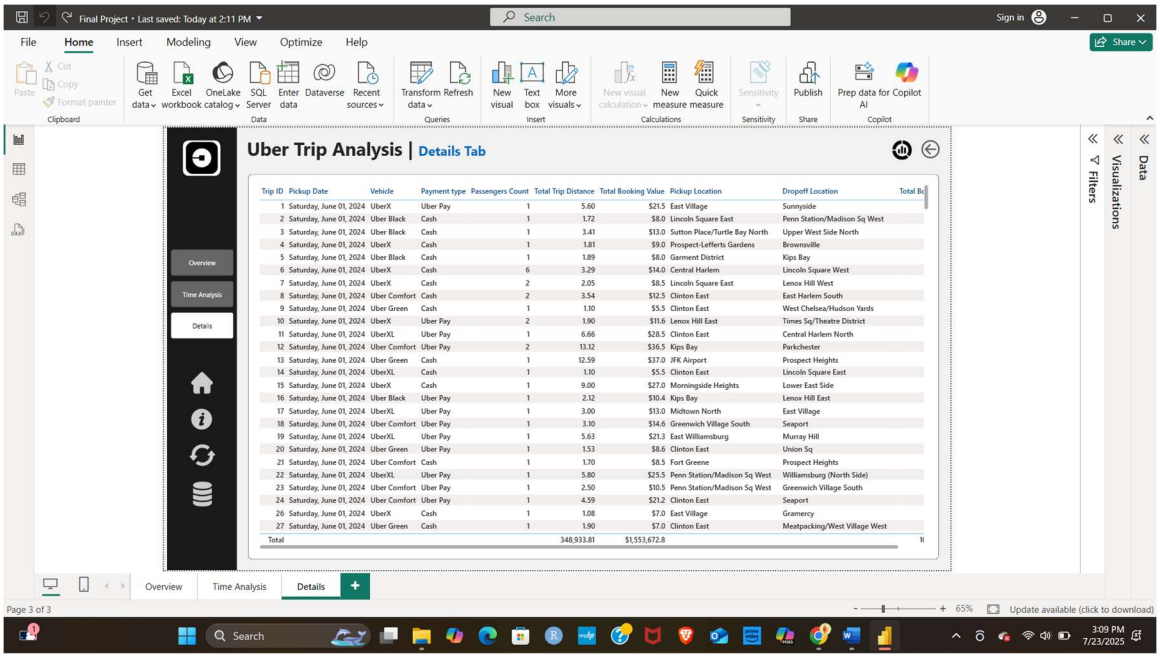
2. Time Analysis Dashboard:

This zooms in on when people are traveling. We grouped ride data into 10-minute time slots, revealing sharp peaks around morning and evening rush hours. A heatmap shows how demand varies across each hour of the day and each day of the week. It’s a great tool for planning driver schedules.



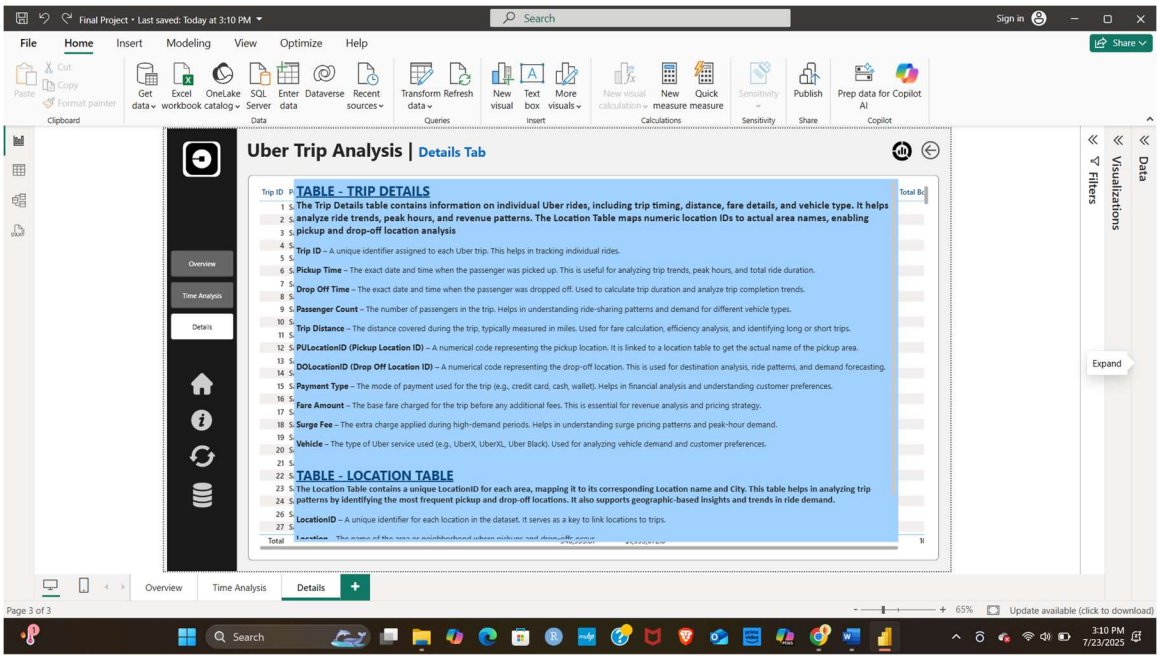
3. Location Analysis Dashboard:

Here, we explored where people are going. Which pickup points are busiest? Where are the longest trips happening? What's the most popular vehicle type in different zones? These insights help optimize both vehicle placement and pricing.



4. Drill-Down Details Tab:

This tab gives users the power to dig into the details. Click on a chart, and you can drill through to see the exact data behind it—every trip, distance, and fare.



Discussion

What the data told us:
Some things were expected: rides peak during rush hours, weekends tend to have longer trips, and certain zones are always buzzing. But the dashboard helped confirm these patterns and make them actionable.

Where it surprised us:
A few areas with long trips showed surprisingly low revenue—maybe flat rates are capping earnings. And late-night bookings, while fewer, often had high booking values, possibly due to premium pricing.

Why this matters:
These insights aren't just interesting—they're useful. Operations teams can use them to manage fleets better. Pricing teams can test new strategies. Even cities could use these dashboards to understand traffic flow and plan public transit.

In comparison to existing studies:
While others have identified similar trends, this project brought them into a single, visual, and interactive tool. It's the combination of prediction, exploration, and accessibility that makes it stand out.

Conclusion

At its core, this project was about making data useful. We took raw Uber ride data and turned it into a tool that helps people understand, plan, and predict. By combining the power of Power BI with a thoughtful approach to analysis, we created dashboards that do more than show numbers—they tell a story.

Whether you're managing a ride-hailing fleet or trying to understand city traffic patterns, this kind of dashboard gives you the power to make smarter decisions. And with the framework built here, the same approach can be scaled to other companies, services, or cities looking to unlock the value in their data.