BAKLIWAL FOUNDATION

College of Arts, Commerce & Science

A

Project Report

On

Uber Trip Analysis

Submitted in partial fulfillment of the requirement for the award of degree of

Bachelor of Computer Applications (BCA)

of

Kavikulaguru Kalidas Sanskrit University

Submitted by

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Under the guidance of

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BATCH: 2022-2025

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CERTIFICATE

This is to certify that the project titled **Uber Trip Analysis** undertaken at Bakliwal Foundation of Arts, Commerce and Science, Vashi ,Navi Mumbai by **Miss.Gayatri Satyawan Auti** holding **Seat No.(PRN:2022018100095457)** studying **Bachelor of Computer Applications** Semester -VI has been satisfactorily completed as prescribed by the Kavikulaguru Kalidas Sanskrit University**,** during the year 2024-2025.

Project In- charge **Co-Ordinator**

External Examiner

Internal Examiner **Principal**

Declaration

I hereby declare that the project work titled **"UBER TRIP ANALYSIS USING POWER BI"** has been independently carried out and completed by me as a part of the partial fulfillment of the requirements for the award of the degree **Bachelor of Computer Applications** during the academic year **2024–2025**.

This project has been undertaken under the valuable guidance and supervision of **Prof. Sneha Lokhande**, whose support, expertise, and consistent feedback were crucial throughout the duration of this work. The analysis, design, implementation, and documentation included in this report are entirely my own original contributions, unless otherwise stated through appropriate citations and references.

I further declare that this project is a genuine and original work, and it has not been previously submitted to this or any other university/institute for the award of any **Degree, Diploma, Associateship, Fellowship**, or other similar qualifications by me or by any other individual. Any data, figures, or content borrowed from other sources has been duly acknowledged.

This declaration is made with utmost sincerity and in full honesty of the academic integrity upheld by my institution.

Gayatri Satyawan Auti

Acknowledgment

I avail this opportunity to express my sincere and deep gratitude to many who are a factor in helping me gain the knowledge and experience during the project and throughout the course.

I have great pleasure in presenting this project. The completion of this project is not merely due to only my own efforts but also due to the guidance given by our professors.

I am thankful to our project guide **Prof. Sneha Shashikant Lokhande** for her support, for their invaluable guidance, motivation, and support throughout the course of this project. Their continuous encouragement and insightful feedback played a pivotal role in the completion of this work.

I extend my sincere thanks to **Principal Dr. Sharadkumar Shah ,Head of Department Prof. Sneha Shashikant Lokhande ,Prof. Shaikh Mohammed Umar ,Prof. Divya Patil ,Prof. Kalyani Kulkarni ,Prof. Ankit Srivastava.**

I am grateful to my family and friends who stood by me during the ups and downs of this project journey.

Last but not the least, I would like to thank all those who directly or indirectly helped me in this end-over.

Table of Contents

1.ABSTRACT

1.1 Background

The modern world has seen an exponential growth in the field of data analytics. With the rise of ride-hailing services such as Uber, there has been an immense generation of trip-related data, which can be analysed to derive actionable insights. Business Intelligence tools like Power BI enable companies to understand, analyse, and act on this data through powerful dashboards and reports.

1.2 Objectives of the Project

The main objective of the project is to build a comprehensive Power BI dashboard that offers interactive and visual insights into Uber trips data. This includes trip count, revenue trends, time-based patterns, distance, vehicle insights, and location-based data segmentation.

1.3 Scope of the Project

The project focuses on data visualization using Uber's trip data, transforming raw data into meaningful insights through Power BI features such as charts, graphs, filters, tooltips, and bookmarks. Advanced visual interaction and drill-down capabilities are also within the scope.

1.4 Methodology

- Collection of Uber data
- Data cleaning using Power Query
- Data modelling and relationship mapping
- Creation of calculated columns and measures using DAX
- Designing of multiple dashboards (Overview, Time Analysis, Details)

1.5 Tools and Technologies Used

- Microsoft Power BI Desktop
- Microsoft Excel (for initial data inspection)
- DAX (Data Analysis Expressions)
- Power Query Editor

1.6 Organization of the Report

The report is organized into sixteen chapters. It begins with an introduction and company profile, followed by analysis and design chapters. It continues through implementation, testing, results, and ends with future scope, references, and appendices

2.Company Profile

2.1 About Uber

Uber Technologies, Inc. is a global technology company headquartered in San Francisco, California. Founded in 2009, Uber has revolutionized the transportation industry by introducing a ride-hailing mobile application that connects passengers with drivers of vehicles for hire. The company operates in over 900 metropolitan areas worldwide and has diversified its business into areas such as food delivery (Uber Eats), freight, electric bikes, and autonomous vehicles.

2.2 Services Offered

Uber offers a wide range of services under its platform:

- **UberX**: Standard rides for everyday use
- **UberPOOL**: Carpooling with other riders headed in the same direction
- **UberBLACK**: Premium rides with high-end vehicles and professional drivers
- **UberXL**: Larger vehicles for groups
- **UberEATS**: Food delivery from local restaurants
- **UberFreight**: Logistics services connecting shippers with truck drivers
- **Micro-mobility**: Scooter and bike rentals in select cities

2.3 Market Position and Reach

Uber has a dominant position in the ride-sharing market, particularly in North America. As of the latest data, it serves millions of customers globally and completes billions of rides annually. The platform’s scalability and technological innovation, including dynamic pricing and AI-driven route optimization, have enabled Uber to maintain a competitive edge in the global transportation sector.

Uber’s expansion into new markets and services has also helped diversify its revenue streams and reduce dependency on core ride-hailing services. The company's public listing on the NYSE in 2019 further solidified its status as a major player in the tech and mobility sectors.

3.System Analysis

3.1 Existing System

The traditional taxi system involved customers physically searching or calling for taxis, often with little to no transparency in pricing, vehicle details, or tracking. There was minimal data collection, which limited the ability of operators to optimize routes, pricing, or customer service. No visualization tools were available for analysis or decision-making.

3.2 Limitations of the Existing System

- Lack of real-time vehicle tracking
- Manual billing with little transparency
- Inconsistent fare pricing
- Poor customer support and communication
- No analytical insights for service improvement

3.3 Proposed System

The proposed system leverages Uber trip data to build a dynamic, interactive Power BI dashboard. It will offer:

- Visual analytics on total trips, revenue, vehicle usage
- Time-based insights (hourly, daily, monthly trends)
- Filters and drill-downs for region, date, vehicle, and more
- DAX-based calculations for KPIs and custom metrics

3.4 Feasibility Study

- **Technical Feasibility**: Power BI supports robust integration and data modelling
- **Economic Feasibility**: Minimal cost using open-source or freely available data
- **Operational Feasibility**: Easy to deploy and use by business stakeholders

3.5 Benefits of the Proposed System

- Enhanced visibility into operational metrics
- Better business decisions based on data-driven insights
- Quick identification of trends and anomalies
- Improved customer service through analytical support

4. Requirements and Specifications

4.1 Business Requirements

The business aims to analyse and visualize Uber trip data to:

- Monitor key performance indicators (KPIs) such as total bookings and revenue.
- Understand customer behaviour through trip frequency, duration, and location.
- Improve decision-making with time-based trends and vehicle utilization patterns.

4.2 Functional Requirements

- Import data from Excel/CSV into Power BI.
- Transform and model the data for analysis.
- Create calculated columns and DAX measures.
- Design interactive dashboards with slicers, filters, and drill-through functionality.
- Provide insights into bookings, revenue, trip metrics, and trends.

4.3 Non-Functional Requirements

- Dashboards must load within 5 seconds on a standard desktop.
- Visuals should be intuitive and user-friendly.
- The system must handle thousands of rows without performance degradation.
- Reports must be secure and shareable with relevant stakeholders.

4.4 Data Requirements

- Uber trip records including timestamps, locations, distances, fare amounts, and vehicle types.
- Cleaned and formatted datasets with proper column headers and data types.
- Relationships defined between tables (e.g., trips, vehicles, time dimension).

4.5 Acquisition of Knowledge

During the course of the Uber Trip Analysis Power BI project, I acquired a wide range of technical and analytical skills that contributed significantly to the successful implementation of the dashboard. The knowledge gained spans across data analysis, data visualization, business intelligence concepts, and tool-based skills.

A. Understanding Business Intelligence Tools

- Learned the importance and role of Business Intelligence (BI) tools in analyzing large datasets.

- Explored how Power BI helps transform raw data into meaningful insights for decision-making.
- Understood the differences between dashboards, reports, and datasets in BI environments.

B. Mastering Power BI Interface

- Navigated Power BI Desktop efficiently, working with features like **Fields Pane, Visualization Pane, Report View, and Data View**.
- Learned how to import and connect data from Excel/CSV files.
- Explored features like slicers, filters, tooltips, bookmarks, and drill-throughs.

C. Data Preparation & Cleaning

- Gained practical experience in preparing and cleaning Uber trip data.
- Used **Power Query Editor** to handle null values, format dates and timestamps, and convert data types.
- Learned the importance of ensuring data consistency and integrity before analysis.

D. Data Modeling and DAX (Data Analysis Expressions)

- Built data models with appropriate relationships between tables.
- Created **calculated columns** and **measures** using DAX for KPIs like:
    - Total Bookings
    - Total Revenue
    - Average Trip Time
    - Total Trip Distance
- Learned about DAX functions like CALCULATE(), SUM(), AVERAGE(), and FILTER().

E. Visualization Techniques

- Understood the different types of charts and when to use them:
    - Column and bar charts for categorical data
    - Line and area charts for trend analysis

  - Pie and donut charts for proportion analysis
  - Map visuals for geographical trip insights
- Developed skills in creating interactive and visually appealing dashboards.

F. UX and Dashboard Design Principles

- Gained knowledge of design best practices for readability and usability.
- Learned to use colour theory, spacing, alignment, and font size for better user experience.
- Used **bookmarks** and **navigation buttons** to simulate an app-like dashboard experience.

G. Testing & Validation

- Developed test cases to ensure all visualizations and filters worked correctly.
- Validated that the KPIs reflected accurate and meaningful insights.

H. Project Documentation & Reporting

- Learned how to structure a professional BI project report.
- Documented every step from data acquisition to insight generation.
- Used screenshots and visuals to enhance the clarity of explanations.

5. Data Collection and Preparation

5.1 Source of Data

The data used in this project was sourced from publicly available Uber trip datasets. These contain detailed records of trips made, including date, time, pickup and drop-off points, distance, fare, and vehicle details.

5.2 Data Cleaning

The dataset underwent thorough cleaning using Power Query:

- Removal of null or blank values
- Filtering irrelevant columns
- Correction of date/time formats
- Standardizing location and vehicle fields

5.3 Data Transformation

- Added calculated columns for additional insights (e.g., trip duration, fare per km)
- Merged date and time for timestamp analysis
- Created time hierarchy (Year, Month, Day, Hour)

5.4 Data Modelling

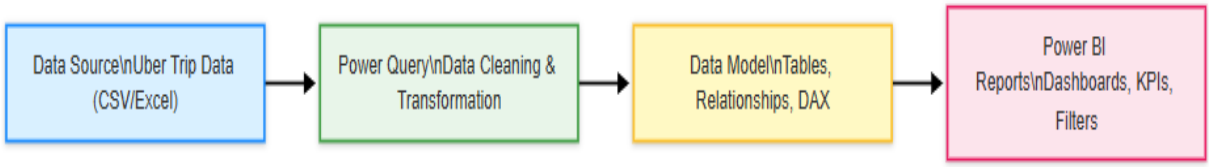
Data modelling was performed in Power BI:

- Defined relationships between tables (e.g., Time Table, Vehicle Table, Trips Table)
- Set primary and foreign keys
- Star schema was followed to optimize query performance

6.System Design

6.1 Architecture Diagram Description of Each Block:

- Data Source: Your input files (CSV/Excel) containing raw Uber trip data.
- Power Query: Where the data is cleaned, transformed, and shaped.
- Data Model: Relationships created, DAX measures written, and tables structured.
- Visual Reports: Where interactive dashboards and KPIs are built.

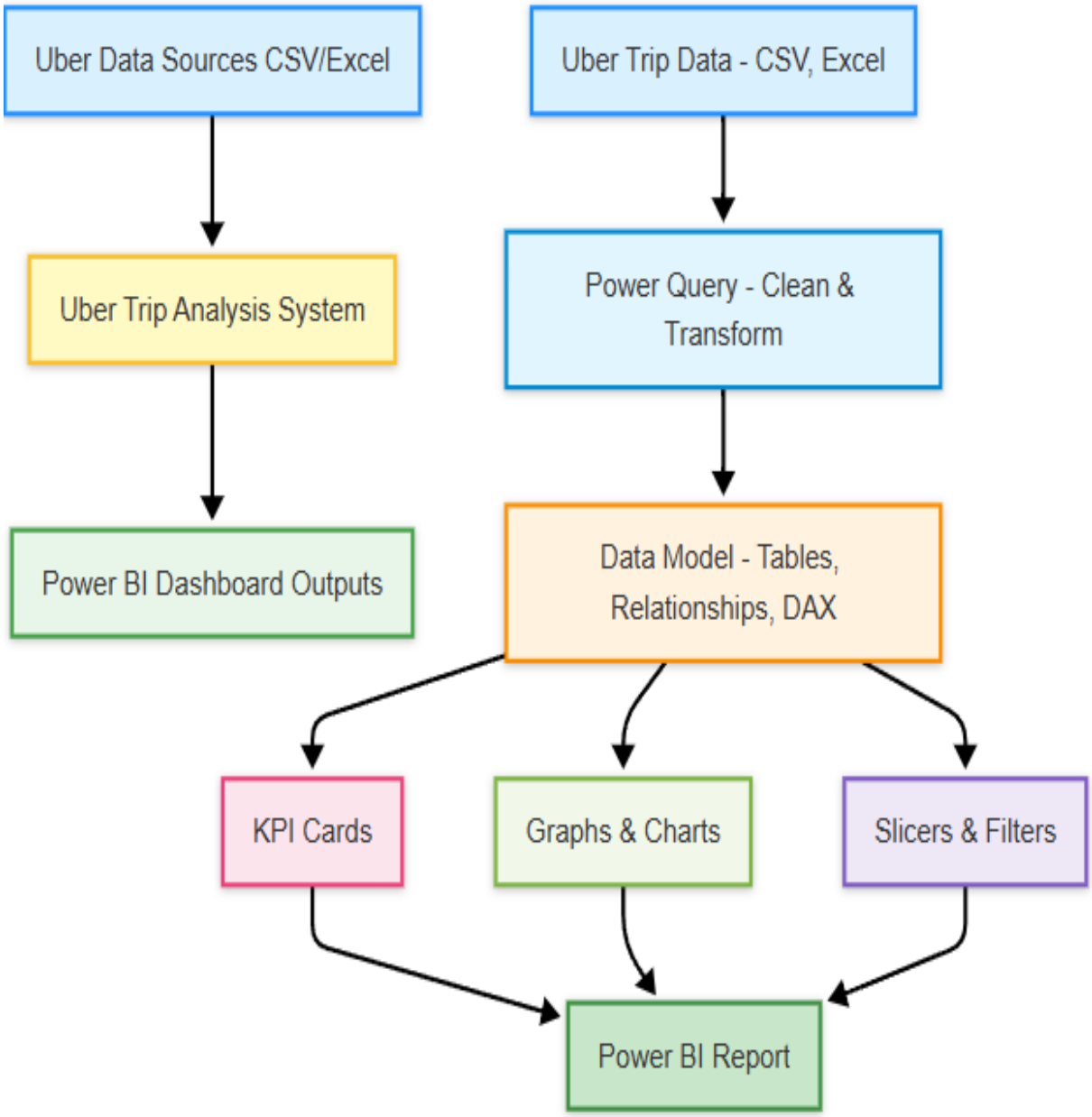


6.2 Data Flow Diagram (DFD)

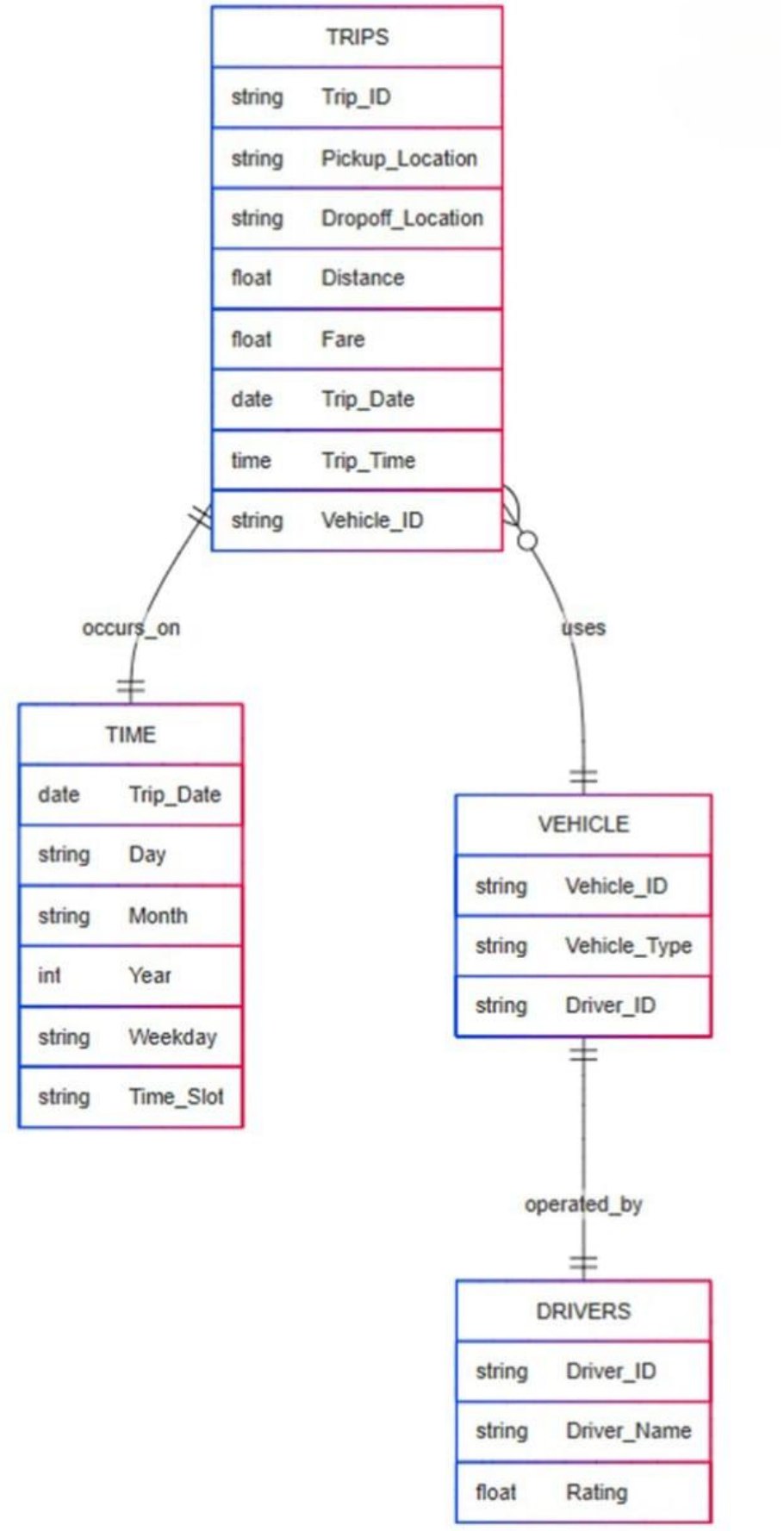
Level 0 gives a top-down view: source → system → output.

Level 1 expands the system into Power Query, Data Modelling, and Reporting layers.

Each process block can be customized with more detail (e.g., adding drill-through, bookmarks, tooltips).



6.3 ER Diagram


TRIPS
string Trip_ID
string Pickup_Location
string Dropoff_Location
float Distance
float Fare
date Trip_Date
time Trip_Time
string Vehicle_ID
occurs_on
uses
TIME
date Trip_Date
string Day
string Month
int Year
string Weekday
string Time_Slot
VEHICLE
string Vehicle_ID
string Vehicle_Type
string Driver_ID
operated_by
DRIVERS
string Driver_ID
string Driver_Name
float Rating

What This Represents:

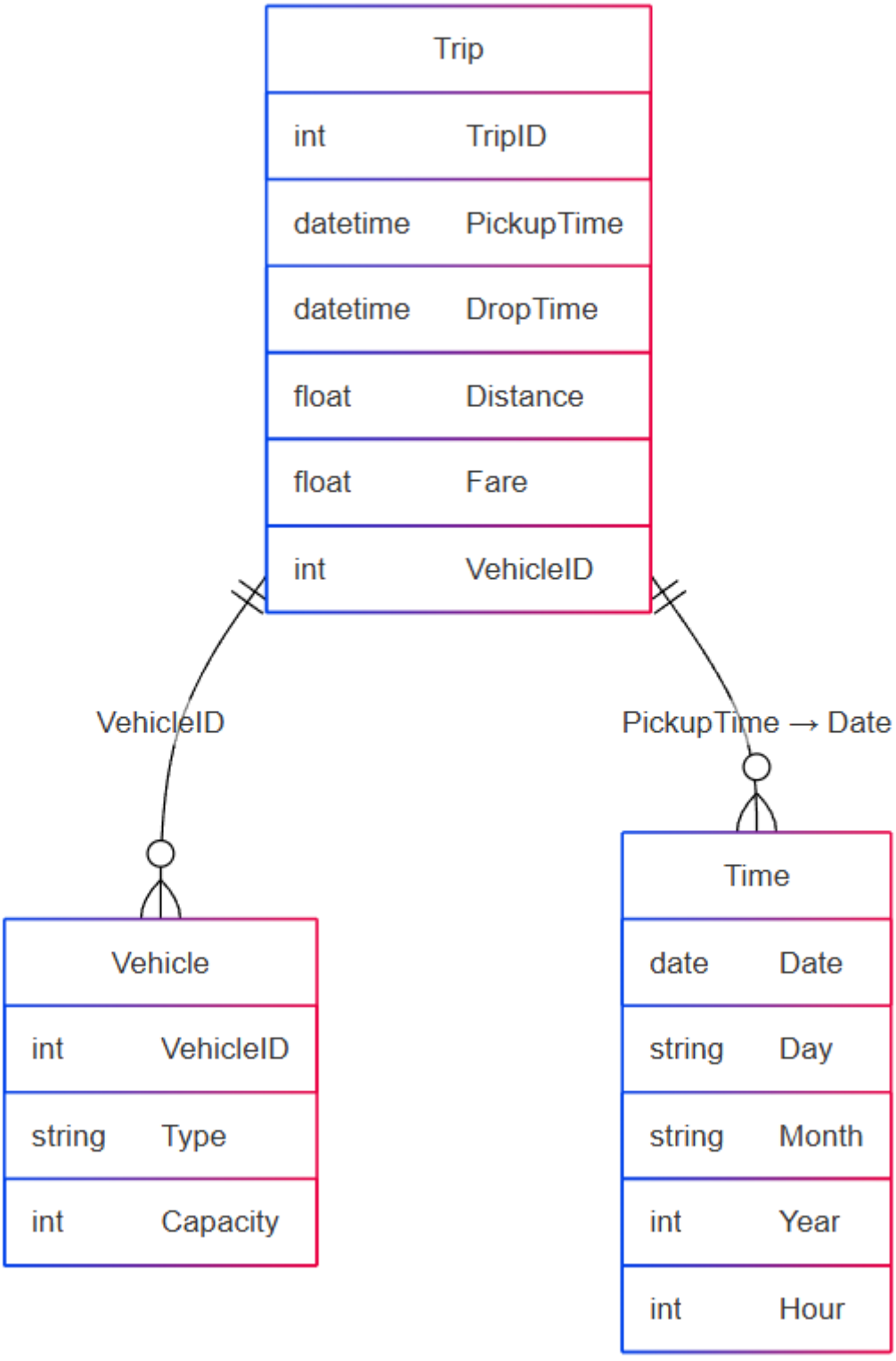
- TRIPS: The fact table with trip-related data.
- TIME: Date dimension table with breakdowns for time-based analysis.
- VEHICLE: Holds data about the vehicle used in each trip.
- DRIVERS: Info about drivers, their names, and ratings.
- Relationships:
    - Each trip occurs on a specific time (TRIPS ↔ TIME)
    - Each trip uses a vehicle (TRIPS ↔ VEHICLE)
    - Each vehicle is assigned to a driver (VEHICLE ↔ DRIVERS)

6.4 Schema Design

- Trip Table: TripID, Pickup Time, Drop Time, Distance, Fare, VehicleID
- Vehicle Table: VehicleID, Type, Capacity
- Time Table: Date, Day, Month, Year, Hour
- Relationships defined using Power BI's model view

• The `Trip` table links to the `Vehicle` table via `VehicleID`.

• The `Trip` table also connects to the `Time` table based on the `PickupTime` matching the `Date` (you can adjust this if you're using a surrogate key or have a normalized Time dimension).


Trip
int TripID
datetime PickupTime
datetime DropTime
float Distance
float Fare
int VehicleID
VehicleID
PickupTime → Date
Vehicle
int VehicleID
string Type
int Capacity
Time
date Date
string Day
string Month
int Year
int Hour

6.5 Gantt Chart

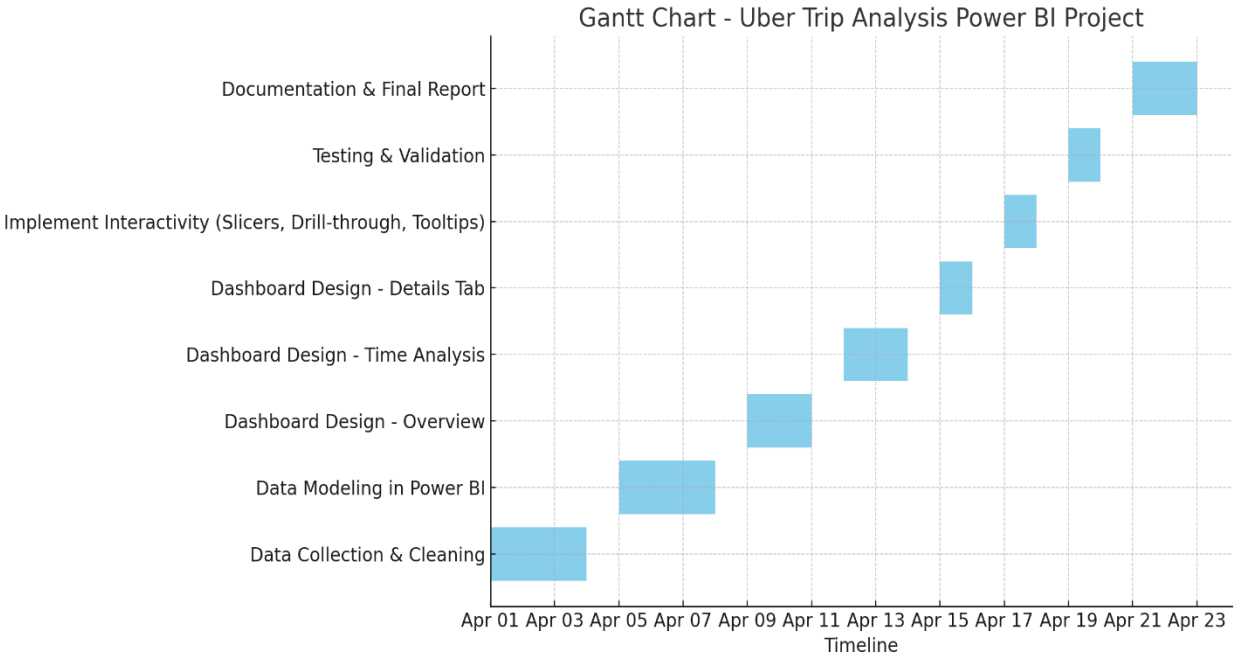
The Gantt chart provides a visual representation of the project timeline and task scheduling. It illustrates the phases involved in building the Uber Trip Analysis Power BI Dashboard, highlighting the duration and sequence of each task from start to completion.

- Key Phases Explained:

1. Data Collection & Cleaning (Apr 1 – Apr 4)
    - This phase involved gathering the raw Uber trip data, cleaning null values, formatting timestamps, and ensuring all necessary columns (like location, vehicle type, trip duration, etc.) were accurate and consistent for further analysis.
2. Data Modelling in Power BI (Apr 5 – Apr 8)
    - Data was imported into Power BI, and relationships between tables were defined. Measures and calculated columns were created using DAX to support analysis across the dashboard tabs.
3. Dashboard Design – Overview (Apr 9 – Apr 11)
    - Focused on building the high-level summary dashboard showing KPIs like total bookings, revenue, trip count, and trip distance. Clean layout and visuals were implemented for easy interpretation.
4. Dashboard Design – Time Analysis (Apr 12 – Apr 14)
    - Visuals related to time-based patterns (daily, hourly, monthly trends) were created to uncover peak booking hours, seasonal variations, and performance over time.
5. Dashboard Design – Details Tab (Apr 15 – Apr 16)
    - This tab includes granular trip-level details, allowing users to drill into specific rides based on filters like location, vehicle type, or time. It supports drill-through actions from other dashboards.
6. Implement Interactivity (Apr 17 – Apr 18)

- Added slicers, tooltips, bookmarks, and drill-through functionality to enhance user interaction and analytical capabilities of the dashboard.

7. Testing & Validation (Apr 19 – Apr 20)
    - Rigorous testing was done to verify accuracy of KPIs, filter behavior, and interactivity. Test cases were defined to ensure quality and consistency of output.
8. Documentation & Final Report (Apr 21 – Apr 23)
    - All findings, visuals, and insights were compiled into a professional report. Supporting screenshots and explanations were added for clarity.



7.Implementation

7.1 Power BI Desktop Overview

Power BI Desktop is a free application that lets users connect to, transform, and visualize data. It provides advanced modeling and reporting capabilities essential for this project.

7.2 Importing Data

Data files (Excel/CSV) were loaded into Power BI via the 'Get Data' interface. Initial column types were assigned, and unnecessary data rows were removed.

7.3 Data Model Creation

A structured data model was created linking all tables with correct relationships. A star schema format ensured optimal performance and clarity.

7.4 DAX Calculations and Measures

DAX expressions were written to compute:

- Total Bookings
- Total Revenue
- Average Fare per Trip
- Total Trip Distance and Duration
- Time-based Aggregates (Month, Hour, Day of Week)

7.5 Report Layout

Reports were split into:

- Overview Dashboard
- Time-Based Analysis
- Trip and Vehicle Detail View
- Filtered Views for custom insights

Each page used slicers, cards, charts, and custom visuals to deliver a smooth analytical experience.

8.Dashboard Design and Visualization

8.1 Overview Dashboard

The Overview Analysis dashboard provides a comprehensive summary of Uber trips, focusing on key business KPIs. This dashboard helps stakeholders monitor the operational performance and make informed decisions based on high-level metrics.

Key Performance Indicators (KPIs) presented:

- Total Bookings: Indicates the overall demand.

- Total Booking Value: Reveals total revenue generated.

- Average Booking Value: Helps analyze average fare per trip.

- Total Trip Distance: Measures the total distance covered across all rides.

- Average Trip Distance and Time: Evaluate travel efficiency and customer behavior.

This dashboard also integrates filters (slicers) for Date, City, and Trip Type, enabling dynamic analysis. Measures are updated using a disconnected table to allow user selection of KPIs that reflect across all visuals, improving interaction and usability.

8.2 Time-Based Analysis Dashboard

The Time Analysis Dashboard uncovers user behavior based on hourly, daily, and weekly patterns.

Visualizations include:

- Area Chart: Trip demand by 10-minute intervals throughout the day.

- Line Chart: Weekday trends from Monday to Sunday.

- Heatmap: Hour vs. Day booking patterns, exposing peak hours across the week.

Dynamic Measure Interaction: A selector allows switching between metrics like Bookings, Revenue, Distance, ensuring all visuals reflect the selected KPI.

8.3 Trip Details Dashboard/Tab

This tab is designed for in-depth exploration. Features:

- Drill-through functionality: Clickable insights from Overview and Time dashboards lead here, where individual records can be examined.

- Grid Table: All major trip attributes are presented in a structured tabular view.

- Bookmarks: Toggle between drill-through filtered view and complete data with the 'View Full Data' bookmark.

- Export Options: A button provides functionality to download the raw dataset for external analysis.

8.4 Filters and Slicers Used

Dynamic Measure Selector: A disconnected table was created to allow selection of KPIs using a slicer. Based on the selection, a SWITCH DAX measure dynamically updates visual content.

Dynamic Titles: Chart titles adapt based on selected KPI, providing contextual clarity.

Tooltips: Custom tooltips offer deeper insights, such as average trip values and total distance, on hover-over visuals.

Slicer Enhancements: Include filter resets (Clear Filters Button), slicers for Date, Trip Type, and City, all aimed at improving navigation and user experience

8.5 Visual Elements

Charts used:

- Bar Charts for time comparisons
- Donut Charts for vehicle usage
- Maps (if location data available)
- Cards for KPIs

9.Results and Findings

9.1 Insights from the Dashboard

The analysis of the Uber trip dataset using Power BI has led to several meaningful observations:

◈ 1. Peak Activity During Weekend Evenings

The data indicates that Saturday and Sunday evenings experience the highest number of trips. This trend aligns with increased social and recreational travel during weekends. Time-based visualizations clearly show traffic spiking between 6 PM to 10 PM.

◈ 2. Revenue Peaks During Rush Hours

Revenue analysis reveals that morning (7 AM–10 AM) and evening (5 PM–8 PM) periods generate the highest income. These times correspond to work commute hours, suggesting that ride demand is closely tied to office hours and urban commuting behaviour.

◈ 3. Sedans Dominate Vehicle Preferences

Among the various vehicle types offered (e.g., UberX, UberXL, Sedan, SUV), Sedans are the most frequently used. This could be due to their balance of cost, comfort, and availability, making them the preferred choice for most customers.

◈ 4. Local Trips are Most Common

A large proportion of trips fall under the short-distance category, indicating that the Uber service is primarily being used for intra-city or local travel. The average distance per trip is relatively low, confirming its use for daily errands or short commutes.

9.2Business Benefits

The insights derived from the dashboard contribute to various operational and strategic advantages for the business:

- Data-Driven Decision Making
  The dashboard offers real-time, visual analytics that enable managers to make informed, evidence-based decisions rather than relying on assumptions or manual reporting.

- Demand Pattern Identification
  By identifying high-demand time slots and popular pickup/drop locations, Uber can better plan resource allocation and forecast ride volumes more accurately.

- Efficient Vehicle Allocation
  Understanding usage patterns allows for optimized vehicle distribution across different areas and times, reducing wait times and increasing trip fulfillment.

- Performance Monitoring & Benchmarking
  The KPIs and filters help evaluate driver performance, vehicle utilization, and revenue trends over time—essential for goal tracking and performance reviews.

9.3 Strategic Recommendations

Based on the insights and patterns observed, the following strategies are suggested to enhance operations and user engagement:

1. Increase Vehicle Supply During Peak Hours

Since demand surges during rush hours and weekends, it is recommended to scale up vehicle availability during these times to avoid missed trips and reduce customer wait times.

2. Launch Weekday Promotions

Trips decline slightly on weekdays outside of peak hours. Incentive campaigns such as discounts or loyalty offers during off-peak hours could help smoothen demand and increase ridership during typically slower periods.

3. Use Heatmaps for Driver Placement

Leverage Power BI's mapping capabilities to identify hotspot zones and direct drivers accordingly. Dynamic heatmaps can guide drivers to areas with higher booking rates, improving trip efficiency and customer satisfaction.

10.Performance Evaluation

10.1 Performance Metrics

- Report Refresh Time: < 5 seconds
- Data Volume Handled: ~ 30,000 records
- Response Time to Filters: < 2 seconds

10.2 Visual Performance

- Smooth visual transitions and interaction
- Proper colour coding and contrast for user clarity
- All visuals updated dynamically with slicer changes

10.3 Optimization Techniques

- Applied filters in Power Query to reduce unnecessary rows
- Used summary tables and pre-calculated columns
- Minimized use of heavy DAX functions like CALCULATE with FILTER

11.Testing

Testing is a crucial phase in the project lifecycle to ensure that the Power BI dashboard functions as intended and delivers accurate, reliable, and user-friendly insights. Various forms of testing were carried out to verify the correctness, usability, and robustness of the Uber Trip Analysis dashboard.

11.1 Functional Testing

Functional testing was performed to verify that all features and calculations in the dashboard are working correctly and returning the expected results.

- Validation of DAX Measures:
  All DAX (Data Analysis Expressions) measures used to calculate KPIs such as total bookings, total revenue, average trip distance, trip time, and other metrics were thoroughly validated using manual calculations and cross-verification with the raw data. This ensured accuracy and reliability in data representation.
- Slicer and Filter Functionality:
  The interactivity of slicers and filters was tested to confirm that each user selection correctly modifies the visuals and metrics. Tests were conducted with various combinations of filters including time period, location, and vehicle type to confirm that the dashboard adapts dynamically and accurately.
- Dynamic KPI Card Updates:
  KPI cards were checked to ensure they dynamically respond to slicer inputs and other interactive elements. For example, selecting a specific month or city dynamically updated metrics such as trip count, revenue, and trip distance, ensuring contextual insight delivery.

11.2 Usability Testing

Usability testing focused on evaluating how user-friendly and accessible the dashboard is to the end-user, ensuring smooth navigation and clarity of insights.

- Screen and Layout Visibility:
  The layout was tested on various screen resolutions to ensure that all visuals, slicers, and data cards are completely visible without requiring excessive scrolling. The content was optimized for both wide-screen monitors and standard laptops.

- Consistency in Layout and Theme:
  Uniformity in design elements such as fonts, colors, background shades, and visual styles was ensured throughout the report. This helped maintain a consistent look and feel, enhancing visual coherence and professional presentation.

User Navigation and Insight Extraction:

User testing was conducted by involving sample users to navigate the report. Observations were made on how easily users could interpret the visuals, apply filters, and extract meaningful insights. Based on feedback, minor adjustments were made to improve tooltip clarity, visual labelling, and navigation flow.

11.3 Error Handling

Robust error handling techniques were implemented to maintain dashboard stability and provide meaningful user experiences even when data issues arise.

- Handling Missing or Null Data:
  Scenarios where data was missing or incomplete were managed through the use of fallback logic in DAX formulas. For instance, where trip data was unavailable, measures were configured to return zero or "N/A" instead of throwing errors.
- Visual Integrity During No Results:
  When filters result in no data being returned (e.g., no trips for a selected city and date range), visual placeholders display appropriate messages such as “No Data Available” instead of blank charts, maintaining a smooth and understandable interface.
- Calculation Error Logging:
  During development, errors in DAX logic were logged and addressed systematically. Special attention was paid to divide-by-zero scenarios, improper data type conversions, and filter context issues. These were debugged using Power BI’s performance analyzer and DAX studio where necessary.

Test Cases:

Test Case ID	Test Scenario	Test Description	Input Data	Expected Output	Actual Output	Status
TC_01	Dashboard Load	Verify that the Power BI dashboard loads successfully without any error	Power BI File (Uber Analysis.pbix)	Dashboard opens with all visuals loaded correctly	As Expected	Pass
TC_02	KPI Cards Accuracy	Validate that the KPIs (Total Bookings, Revenue, Distance, Trip Time) show correct values	Uber dataset	KPI Cards display correct aggregated values	As Expected	Pass
TC_03	Date Slicer Functionality	Ensure the date slicer filters all visualizations dynamically	Selected specific date range	All visuals update according to selected dates	As Expected	Pass
TC_04	Map Visualization	Verify that the map chart correctly shows pickup/drop locations	Latitude & Longitude columns	Map displays data points accurately based on coordinates	As Expected	Pass
TC_05	Vehicle Type Filtering	Test if filtering by vehicle type updates visuals accordingly	Selected “UberX”, “UberXL”, etc.	Charts and KPIs update based on selected vehicle type	As Expected	Pass
TC_06	Drill-Through to Details Tab	Validate the drill-through from main dashboard to Details tab	Right-click on a location → Drill-through	Navigates to Details tab showing filtered data	As Expected	Pass
TC_07	Time Analysis Breakdown	Ensure the trip time analysis visuals show correct hour/day/month trends	Uber datetime fields	Time charts show accurate distribution based on trip timestamps	As Expected	Pass

TC_08	Bookmarks Navigation	Test if bookmark buttons switch between views correctly	Click on navigation/bookmark buttons	Selected view is displayed accordingly	As Expected	Pass
TC_09	Tooltip Information	Check whether hovering over visuals shows accurate tooltips	Hover over bars/pie/map points	Tooltip displays relevant trip and revenue info	As Expected	Pass
TC_10	Revenue Analysis by Location	Validate revenue data shown per pickup/dropoff area	Selected location filter	Revenue by area visuals display accurate totals	As Expected	Pass
TC_11	No Data Scenario	Check behavior when applying filters with no data result	Filter on dates/locations with no data	Visuals show “No data available” message or blank charts	As Expected	Pass

12. Challenges Faced and Solutions

12.1 Data Quality Issues

- Problem: Null values and inconsistent formats
- Solution: Applied data transformation rules in Power Query

12.2 Complex Calculations

- Problem: Time-of-day aggregation and fare per km logic
- Solution: Created helper columns and used nested DAX functions

12.3 Visual Clutter

- Problem: Overloading dashboards with too many charts
- Solution: Used bookmarks and tooltips to hide/show additional information

13.Future Scope

While the current Uber Trip Analysis dashboard provides a comprehensive view of historical trip data, there are several promising areas for future enhancements. These improvements would not only increase the analytical depth of the dashboard but also expand its usability, real-time capabilities, and strategic value for stakeholders.

13.1 Expansion of Data Sources

To provide a more holistic view of Uber operations, integrating additional data sources is essential. These sources can enhance the richness of the analysis and offer deeper operational insights.

- Integration
- of Real-Time APIs:
  Future iterations of the dashboard can incorporate real-time APIs that track live Uber trip statuses. This would enable dynamic monitoring of ongoing trips, wait times, traffic impacts, and demand surges, providing immediate operational oversight.
- Inclusion of Customer Review Data:
  By integrating customer feedback and star ratings, the system can support sentiment analysis. This would allow identification of service satisfaction trends, common complaints, and areas needing improvement from a customer perspective.
- Driver Performance Metrics and Feedback:
  An expanded dataset could include driver-specific KPIs such as trip completion rates, cancellation frequency, customer ratings, and punctuality. These metrics would facilitate performance evaluation and help with driver incentive planning and training.

13.2 Advanced Analytics

As data complexity and availability increase, the implementation of advanced analytical techniques can provide predictive and prescriptive insights.

- Predictive Analytics for Demand Forecasting:
  Machine learning models can be trained on historical trip data to forecast future demand by region, time, or event. This would aid in optimizing resource allocation and surge pricing strategies.

- Customer and Route Segmentation:
  Clustering algorithms can be used to segment customers based on travel behavior, frequency, and preferences. Similarly, route optimization through segmentation can
- enhance efficiency in high-density or high-delay areas.
- AI-Driven Anomaly Detection:
  Artificial intelligence can be employed to detect unusual patterns such as fraudulent trips, inconsistent revenue spikes, or operational outliers. These insights would support fraud prevention and operational audit functions.

13.3 Enhanced Visualization Features

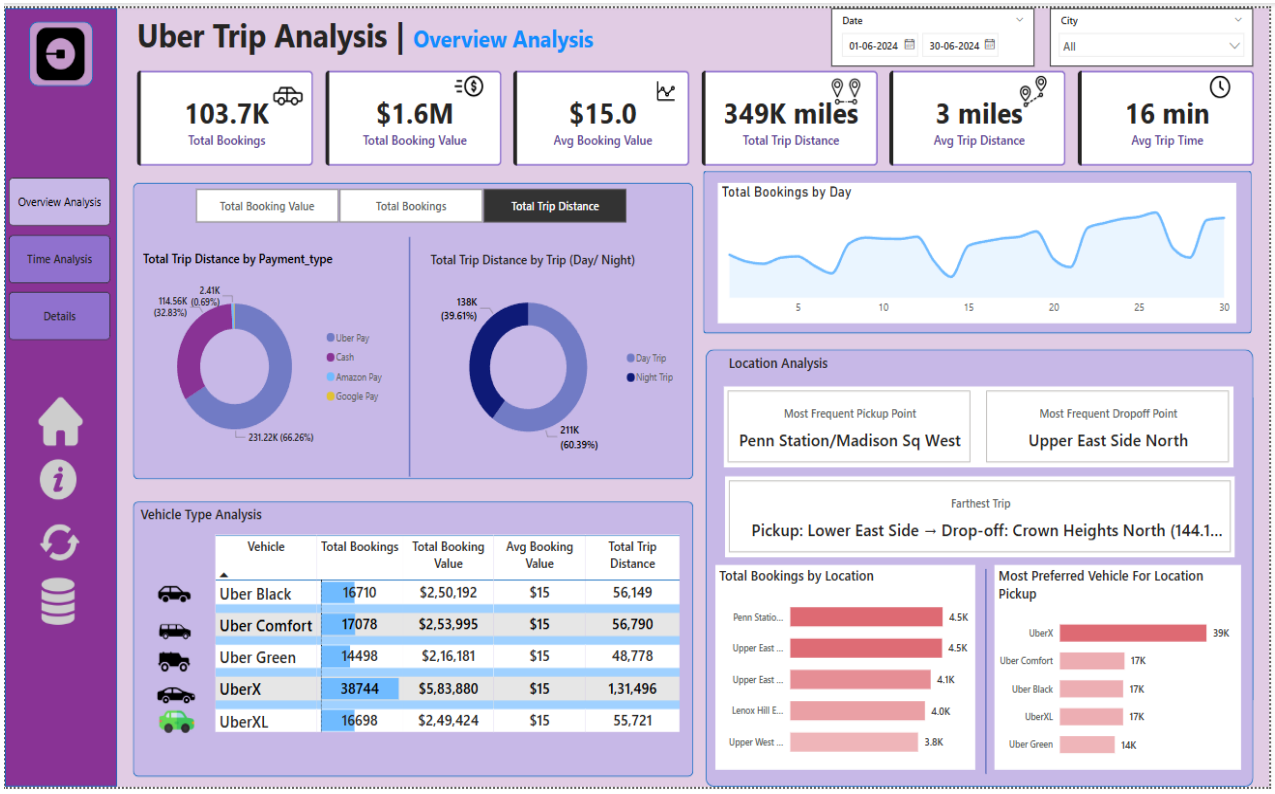
Improving the dashboard's design and interaction elements can further increase user engagement, comprehension, and usability.

- Custom Themes and Templates:
  Developing tailored themes aligned with corporate branding or user preferences will enhance the dashboard's aesthetic appeal and adoption across departments.
- Animation-Based Storytelling:
  Incorporating animations to show changes over time—such as a time-lapse of trip volumes or map-based animations—can help users visualize trends more intuitively and compellingly.
- Mobile-Optimized Dashboards:
  As decision-makers increasingly rely on mobile devices, creating mobile-friendly versions of the dashboards will allow access to key metrics and alerts on-the-go, improving agility in data-driven decision-making.

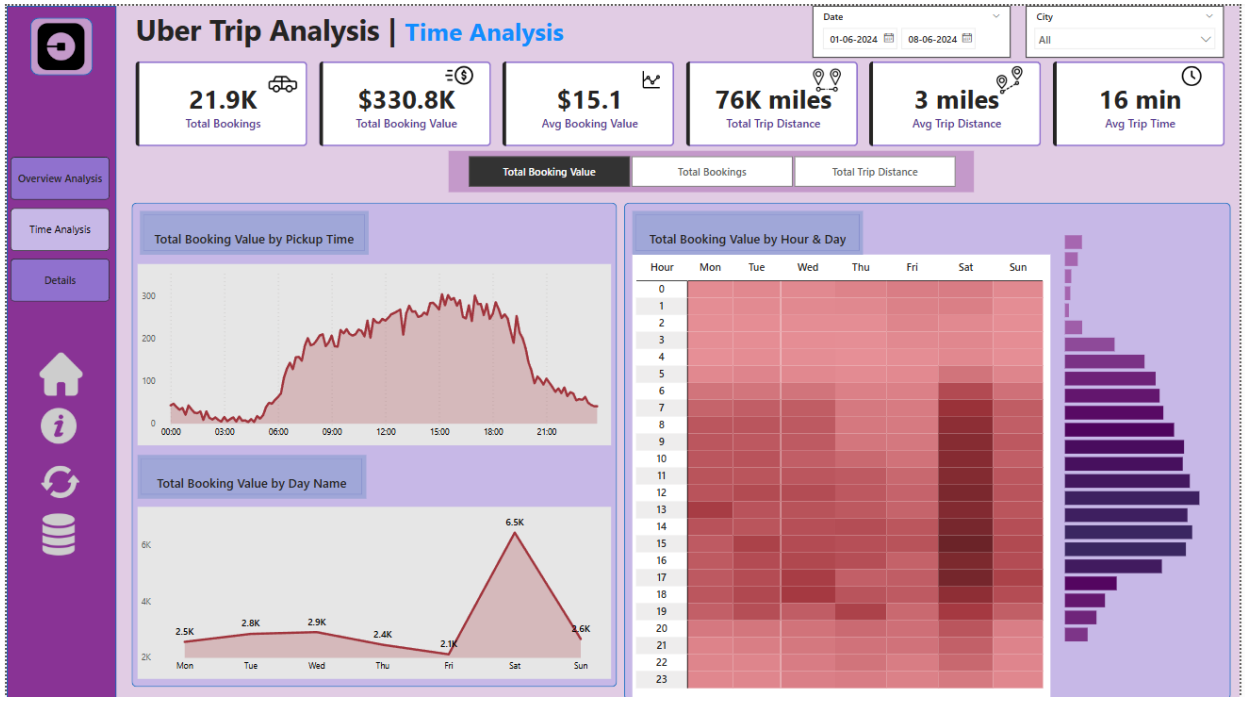
14: Appendices and Screenshots

Appendix A: Screenshots of Dashboards

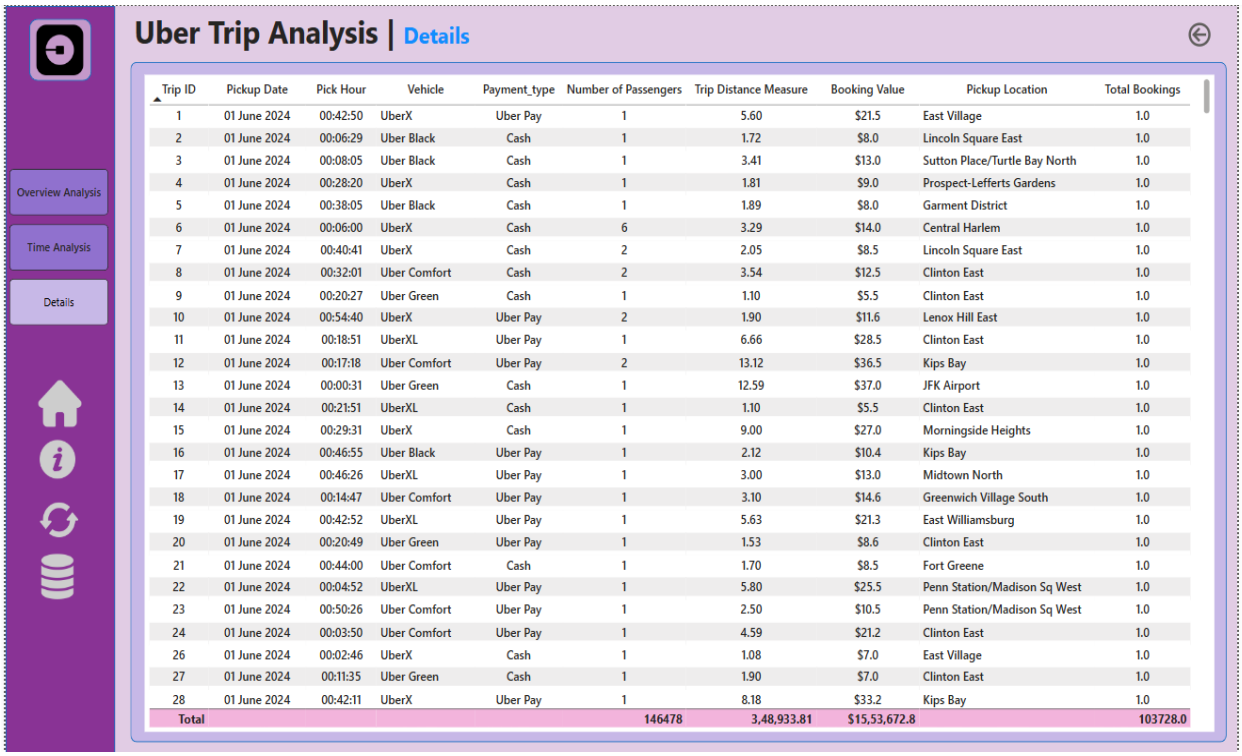
1.Overview Analysis



2.Time Analysis

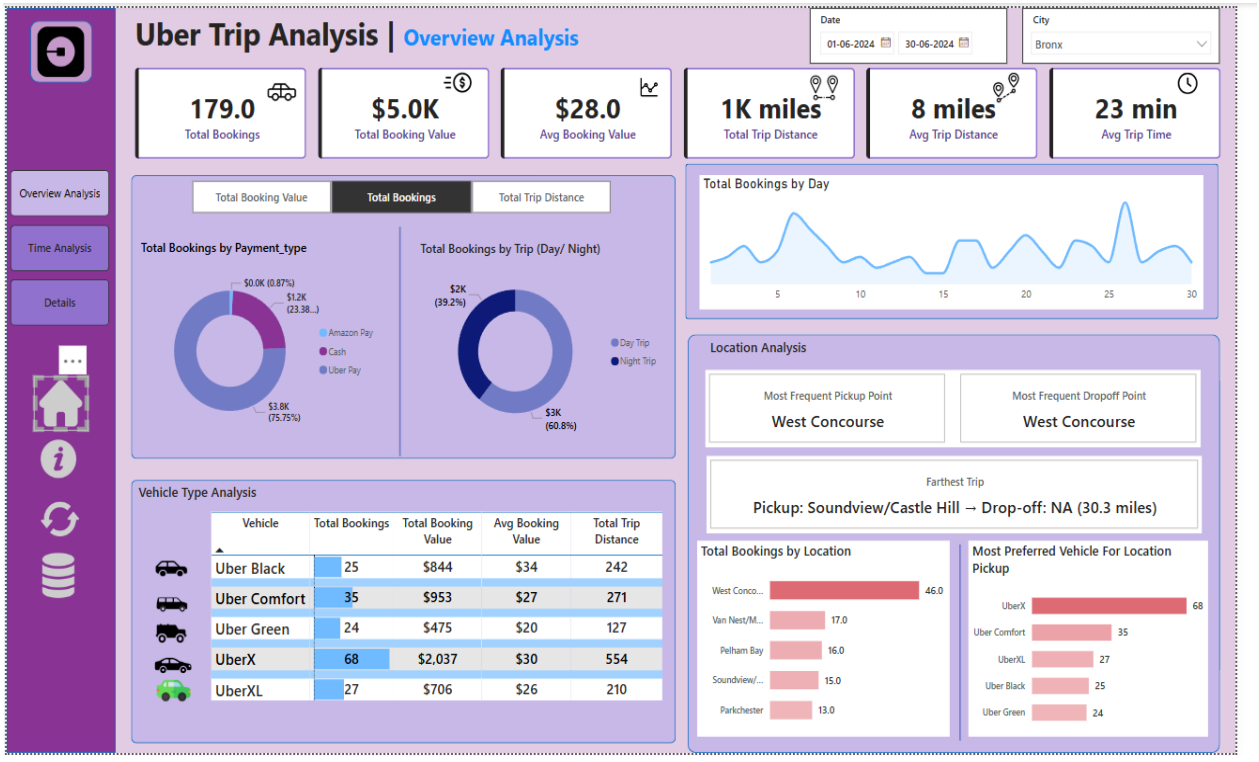


3.Details Table



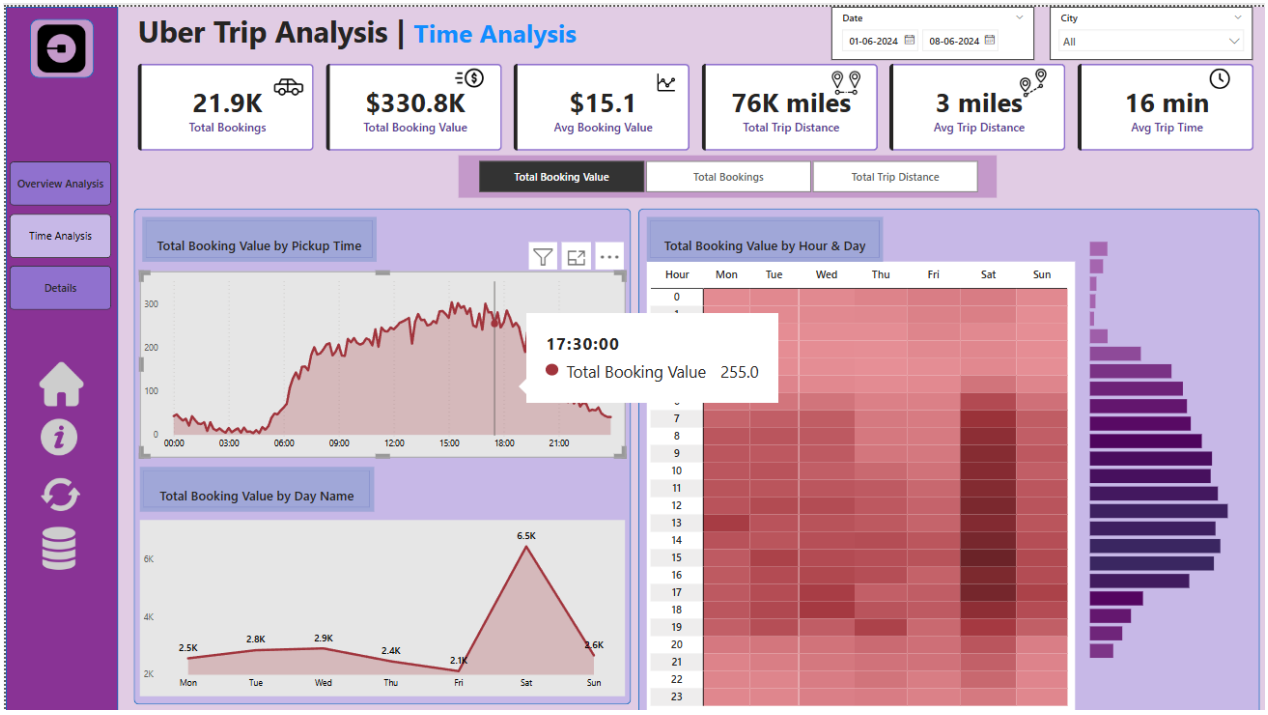
Trip ID	Pickup Date	Pick Hour	Vehicle	Payment_type	Number of Passengers	Trip Distance Measure	Booking Value	Pickup Location	Total Bookings
1	01 June 2024	00:42:50	UberX	Uber Pay	1	5.60	$21.5	East Village	1.0
2	01 June 2024	00:06:29	Uber Black	Cash	1	1.72	$8.0	Lincoln Square East	1.0
3	01 June 2024	00:08:05	Uber Black	Cash	1	3.41	$13.0	Sutton Place/Turtle Bay North	1.0
4	01 June 2024	00:28:20	UberX	Cash	1	1.81	$9.0	Prospect-Lefferts Gardens	1.0
5	01 June 2024	00:38:05	Uber Black	Cash	1	1.89	$8.0	Garment District	1.0
6	01 June 2024	00:06:00	UberX	Cash	6	3.29	$14.0	Central Harlem	1.0
7	01 June 2024	00:40:41	UberX	Cash	2	2.05	$8.5	Lincoln Square East	1.0
8	01 June 2024	00:32:01	Uber Comfort	Cash	2	3.54	$12.5	Clinton East	1.0
9	01 June 2024	00:20:27	Uber Green	Cash	1	1.10	$5.5	Clinton East	1.0
10	01 June 2024	00:54:40	UberX	Uber Pay	2	1.90	$11.6	Lenox Hill East	1.0
11	01 June 2024	00:18:51	UberXL	Uber Pay	1	6.66	$28.5	Clinton East	1.0
12	01 June 2024	00:17:18	Uber Comfort	Uber Pay	2	13.12	$36.5	Kips Bay	1.0
13	01 June 2024	00:00:31	Uber Green	Cash	1	12.59	$37.0	JFK Airport	1.0
14	01 June 2024	00:21:51	UberXL	Cash	1	1.10	$5.5	Clinton East	1.0
15	01 June 2024	00:29:31	UberX	Cash	1	9.00	$27.0	Morningside Heights	1.0
16	01 June 2024	00:46:55	Uber Black	Uber Pay	1	2.12	$10.4	Kips Bay	1.0
17	01 June 2024	00:46:26	UberXL	Uber Pay	1	3.00	$13.0	Midtown North	1.0
18	01 June 2024	00:14:47	Uber Comfort	Uber Pay	1	3.10	$14.6	Greenwich Village South	1.0
19	01 June 2024	00:42:52	UberXL	Uber Pay	1	5.63	$21.3	East Williamsburg	1.0
20	01 June 2024	00:20:49	Uber Green	Uber Pay	1	1.53	$8.6	Clinton East	1.0
21	01 June 2024	00:44:00	Uber Comfort	Cash	1	1.70	$8.5	Fort Greene	1.0
22	01 June 2024	00:04:52	UberXL	Uber Pay	1	5.80	$25.5	Penn Station/Madison Sq West	1.0
23	01 June 2024	00:50:26	Uber Comfort	Uber Pay	1	2.50	$10.5	Penn Station/Madison Sq West	1.0
24	01 June 2024	00:03:50	Uber Comfort	Uber Pay	1	4.59	$21.2	Clinton East	1.0
26	01 June 2024	00:02:46	UberX	Cash	1	1.08	$7.0	East Village	1.0
27	01 June 2024	00:11:35	Uber Green	Cash	1	1.90	$7.0	Clinton East	1.0
28	01 June 2024	00:42:11	UberX	Uber Pay	1	8.18	$33.2	Kips Bay	1.0
Total					146478	3,48,933.81	$15,53,672.8		103728.0

4.Filter (Overview on total bookings where city is Bronx)

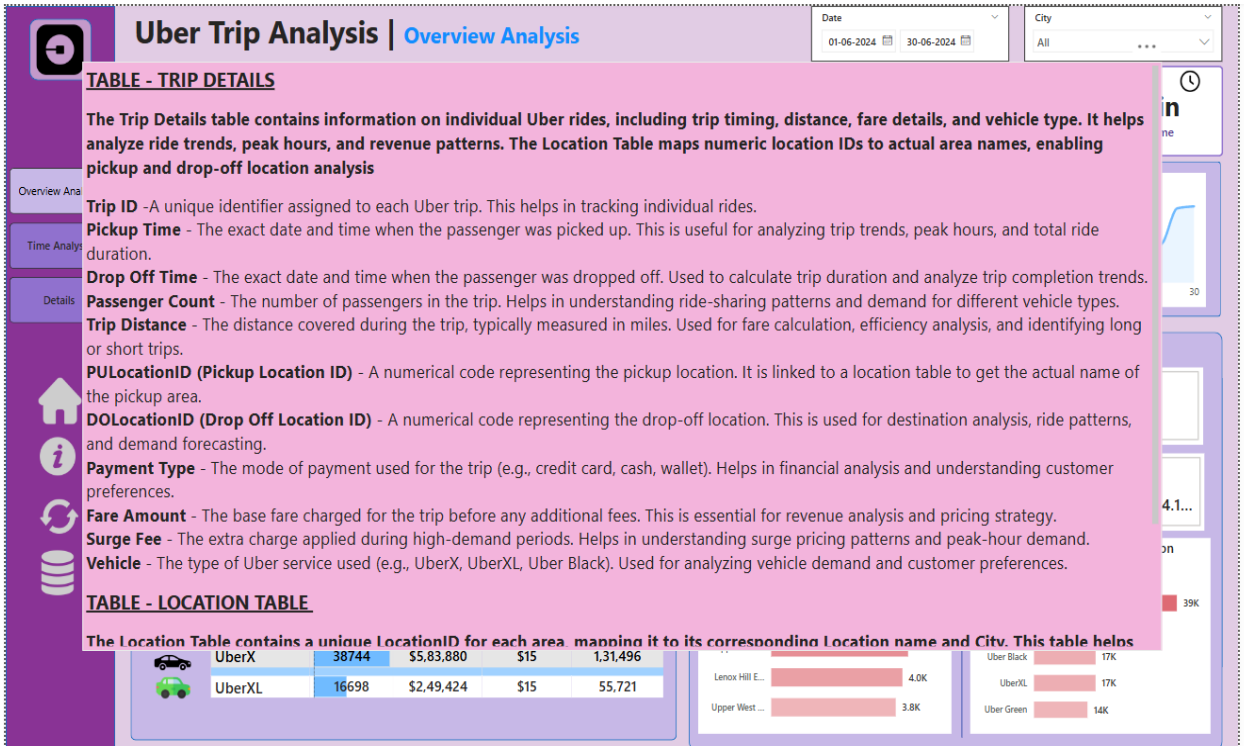


Vehicle	Total Bookings	Total Booking Value	Avg Booking Value	Total Trip Distance
Uber Black	25	$844	$34	242
Uber Comfort	35	$953	$27	271
Uber Green	24	$475	$20	127
UberX	68	$2,037	$30	554
UberXL	27	$706	$26	210

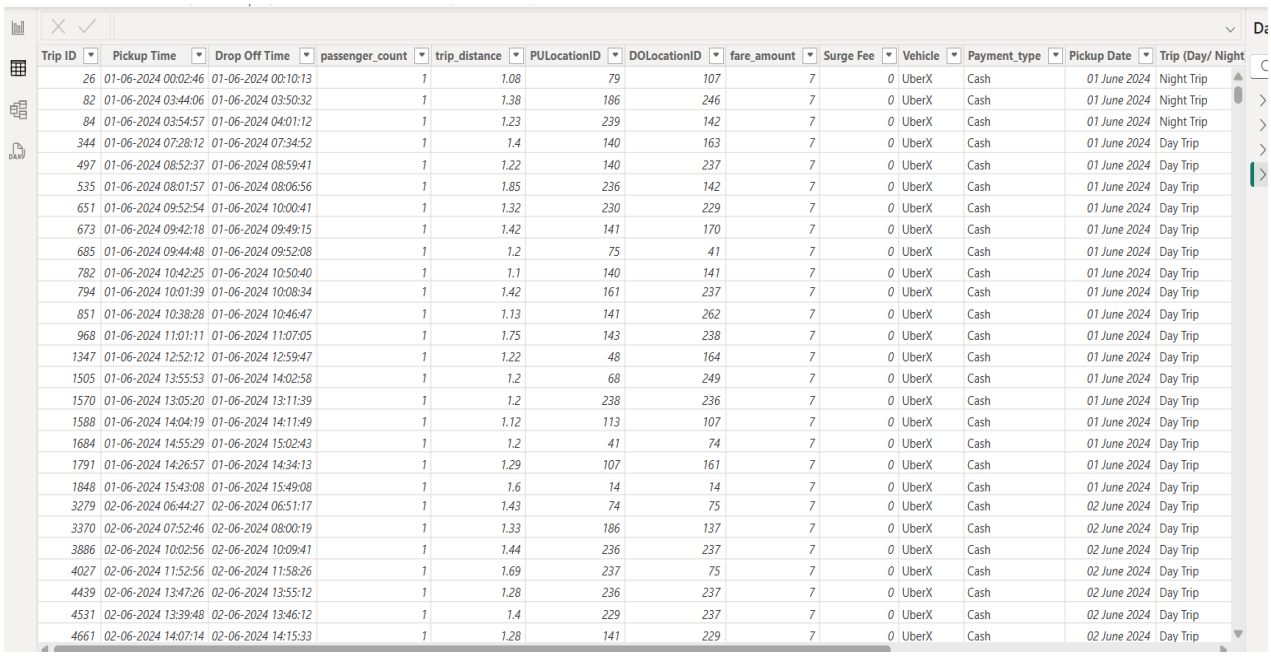
5.Filter (Total booking values according to pickup time)



6. Showing details information

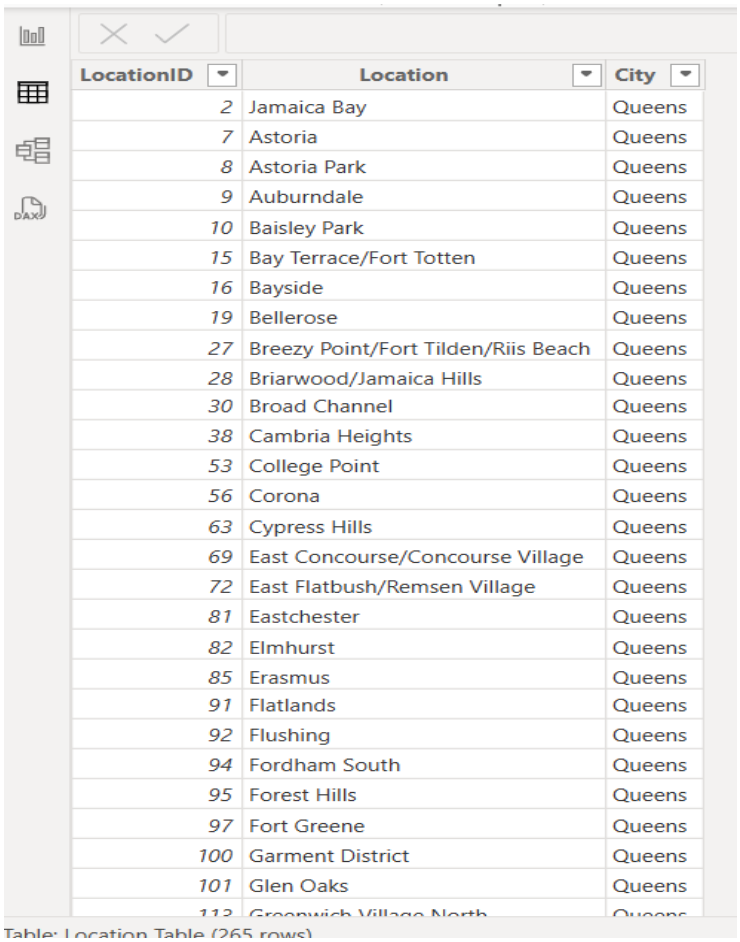


7.Trip Detail Table



Trip ID	Pickup Time	Drop Off Time	passenger_count	trip_distance	PULocationID	DOLocationID	fare_amount	Surge Fee	Vehicle	Payment_type	Pickup Date	Trip (Day/ Night
26	01-06-2024 00:02:46	01-06-2024 00:10:13	1	1.08	79	107	7	0	UberX	Cash	01 June 2024	Night Trip
82	01-06-2024 03:44:06	01-06-2024 03:50:32	1	1.38	186	246	7	0	UberX	Cash	01 June 2024	Night Trip
84	01-06-2024 03:54:57	01-06-2024 04:01:12	1	1.23	239	142	7	0	UberX	Cash	01 June 2024	Night Trip
344	01-06-2024 07:28:12	01-06-2024 07:34:52	1	1.4	140	163	7	0	UberX	Cash	01 June 2024	Day Trip
497	01-06-2024 08:52:37	01-06-2024 08:59:41	1	1.22	140	237	7	0	UberX	Cash	01 June 2024	Day Trip
535	01-06-2024 08:01:57	01-06-2024 08:06:56	1	1.85	236	142	7	0	UberX	Cash	01 June 2024	Day Trip
651	01-06-2024 09:52:54	01-06-2024 10:00:41	1	1.32	230	229	7	0	UberX	Cash	01 June 2024	Day Trip
673	01-06-2024 09:42:18	01-06-2024 09:49:15	1	1.42	141	170	7	0	UberX	Cash	01 June 2024	Day Trip
685	01-06-2024 09:44:48	01-06-2024 09:52:08	1	1.2	75	41	7	0	UberX	Cash	01 June 2024	Day Trip
782	01-06-2024 10:42:25	01-06-2024 10:50:40	1	1.1	140	141	7	0	UberX	Cash	01 June 2024	Day Trip
794	01-06-2024 10:01:39	01-06-2024 10:08:34	1	1.42	161	237	7	0	UberX	Cash	01 June 2024	Day Trip
851	01-06-2024 10:38:28	01-06-2024 10:46:47	1	1.13	141	262	7	0	UberX	Cash	01 June 2024	Day Trip
968	01-06-2024 11:01:11	01-06-2024 11:07:05	1	1.75	143	238	7	0	UberX	Cash	01 June 2024	Day Trip
1347	01-06-2024 12:52:12	01-06-2024 12:59:47	1	1.22	48	164	7	0	UberX	Cash	01 June 2024	Day Trip
1505	01-06-2024 13:55:53	01-06-2024 14:02:58	1	1.2	68	249	7	0	UberX	Cash	01 June 2024	Day Trip
1570	01-06-2024 13:05:20	01-06-2024 13:11:39	1	1.2	238	236	7	0	UberX	Cash	01 June 2024	Day Trip
1588	01-06-2024 14:04:19	01-06-2024 14:11:49	1	1.12	113	107	7	0	UberX	Cash	01 June 2024	Day Trip
1684	01-06-2024 14:55:29	01-06-2024 15:02:43	1	1.2	41	74	7	0	UberX	Cash	01 June 2024	Day Trip
1791	01-06-2024 14:26:57	01-06-2024 14:34:13	1	1.29	107	161	7	0	UberX	Cash	01 June 2024	Day Trip
1848	01-06-2024 15:43:08	01-06-2024 15:49:08	1	1.6	14	14	7	0	UberX	Cash	01 June 2024	Day Trip
3279	02-06-2024 06:44:27	02-06-2024 06:51:17	1	1.43	74	75	7	0	UberX	Cash	02 June 2024	Day Trip
3370	02-06-2024 07:52:46	02-06-2024 08:00:19	1	1.33	186	137	7	0	UberX	Cash	02 June 2024	Day Trip
3886	02-06-2024 10:02:56	02-06-2024 10:09:41	1	1.44	236	237	7	0	UberX	Cash	02 June 2024	Day Trip
4027	02-06-2024 11:52:56	02-06-2024 11:58:26	1	1.69	237	75	7	0	UberX	Cash	02 June 2024	Day Trip
4439	02-06-2024 13:47:26	02-06-2024 13:55:12	1	1.28	236	237	7	0	UberX	Cash	02 June 2024	Day Trip
4531	02-06-2024 13:39:48	02-06-2024 13:46:12	1	1.4	229	237	7	0	UberX	Cash	02 June 2024	Day Trip
4661	02-06-2024 14:07:14	02-06-2024 14:15:33	1	1.28	141	229	7	0	UberX	Cash	02 June 2024	Day Trip

8. Location Table



LocationID	Location	City
2	Jamaica Bay	Queens
7	Astoria	Queens
8	Astoria Park	Queens
9	Auburndale	Queens
10	Baisley Park	Queens
15	Bay Terrace/Fort Totten	Queens
16	Bayside	Queens
19	Bellerose	Queens
27	Breezy Point/Fort Tilden/Riis Beach	Queens
28	Briarwood/Jamaica Hills	Queens
30	Broad Channel	Queens
38	Cambria Heights	Queens
53	College Point	Queens
56	Corona	Queens
63	Cypress Hills	Queens
69	East Concourse/Concourse Village	Queens
72	East Flatbush/Remsen Village	Queens
81	Eastchester	Queens
82	Elmhurst	Queens
85	Erasmus	Queens
91	Flatlands	Queens
92	Flushing	Queens
94	Fordham South	Queens
95	Forest Hills	Queens
97	Fort Greene	Queens
100	Garment District	Queens
101	Glen Oaks	Queens
113	Greenwich Village North	Queens

Table: Location Table (265 rows)

9.Calendar Table

```
1 Calendar Table = CALENDAR(MIN('Trip Details'[Pickup Date] ),MAX('Trip Details'[Pickup Date]))
```

Date	Day Name	Day Num
01 June 2024	Sat	6
02 June 2024	Sun	7
03 June 2024	Mon	1
04 June 2024	Tue	2
05 June 2024	Wed	3
06 June 2024	Thu	4
07 June 2024	Fri	5
08 June 2024	Sat	6
09 June 2024	Sun	7
10 June 2024	Mon	1
11 June 2024	Tue	2
12 June 2024	Wed	3
13 June 2024	Thu	4
14 June 2024	Fri	5
15 June 2024	Sat	6
16 June 2024	Sun	7
17 June 2024	Mon	1
18 June 2024	Tue	2
19 June 2024	Wed	3
20 June 2024	Thu	4
21 June 2024	Fri	5
22 June 2024	Sat	6
23 June 2024	Sun	7
24 June 2024	Mon	1
25 June 2024	Tue	2
26 June 2024	Wed	3
27 June 2024	Thu	4

10.Dynamic Measure

```
1 Dynamic Measure = {
2     ("Total Booking Value", NAMEOF('Trip Details'[Total Bookings] ), 0),
3     ("Total Bookings", NAMEOF('Trip Details'[Total Booking Value]), 1),
4     ("Total Trip Distance", NAMEOF('Trip Details'[Total Trip Distance Measure]), 2)
5 }
```

Dynamic Measure	Dynamic Measure Fields	Dynamic Measure Order	Dynamic Title
Total Booking Value	'Trip Details'[Total Bookings]	0	Total Booking Value
Total Bookings	'Trip Details'[Total Booking Value]	1	Total Bookings
Total Trip Distance	'Trip Details'[Total Trip Distance Measure]	2	Total Trip Distance

Appendix B: DAX Formulas Used

- Total Bookings

```
1  Total Bookings = COUNT('Trip Details'[Trip ID])
```

- Distance per Trip

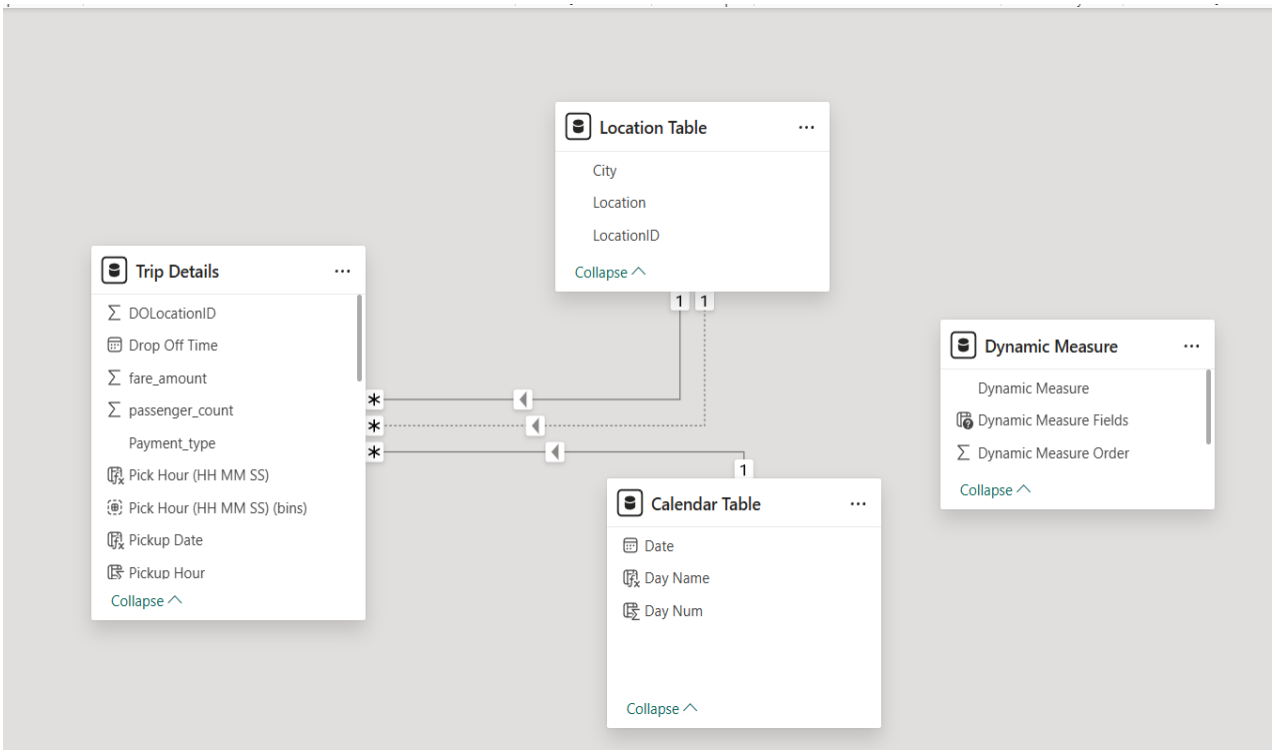
```
1  Avg Trip Distance =
2
3  VAR AvgMiles = ROUND(AVERAGE('Trip Details'[trip_distance]),0)
4   RETURN CONCATENATE(AvgMiles," miles")
```

- Pickup Hour

```
1  Pick Hour (HH MM SS) = TIME(HOUR('Trip Details'[Pickup Time]),
2  MINUTE('Trip Details'[Pickup Time]),SECOND('Trip Details'[Pickup Time]))
```

- **Appendix C: Data Model Diagram**

Power BI model view with relationships marked



Appendix D: Glossary

- **KPI: Key Performance Indicator**

The KPIs evaluate an association's performance in different areas by assessing quantifiable measure values. In businesses, KPIs play an essential part as visual cues that indicate growth by assessing values and measurable pretensions. A KPI always has a base value or measure which is estimated against a target value. That is, comparing the factual performance with the target set. You can estimate the performances in an analysis just by seeing the KPIs.

KPI Advantages

- Monitoring the target: This KPI helps the organization to monitor their performance in a visual manner
- Timely reports: With This KPI the organization will be able to check whether they are able to execute their plan or not
- Simplify Process: Modern businesses can use KPIs for their advancement of profit

Uses of KPI

Working with KPIs is easy and you can use them to display inversely complex information. The two main reasons why you should use KPIs in your Power BI are

- We use KPIs to measure progress i.e., positive or negative change over time. For illustration – whether you're getting correct results or not, meeting targets or lagging before.
- We also use KPIs to measure the distance to a target or a thing. In this case, you dissect how far behind you're in meeting your target.

- **DAX: Data Analysis Expressions**

DAX is a formula and query language that is designed to work with tabular data models and is primarily used to simplify data analysis and calculation tasks in Power BI, Microsoft PowerPivot, SQL, and Server Analysis Services (SSAS). It provides users with the ability to create sophisticated calculations, define custom metrics, and perform complex data manipulation.DAX has many powerful functions which Excel does not have.

-Importance of DAX

DAX provides tools and features that enable flexible and customized data analysis, reporting, and modeling capabilities.

- Advanced Calculations and Data Analysis: DAX provides a comprehensive set of functions and operators for performing advanced calculations and data analysis tasks on large datasets. It allows users to create complex formulas and expressions, enabling calculations that go beyond simple arithmetic operations. With DAX, you can perform aggregations, apply conditional logic, perform statistical calculations, and more.
- Integration with Microsoft Tools: DAX is the formula language used in Microsoft's business intelligence tools like Power BI and Power Pivot. It seamlessly integrates with these tools, allowing users to leverage DAX's capabilities for data modeling, calculations, and analysis within a familiar environment.
- Flexibility and Customization: DAX offers a high degree of flexibility and customization options. Users can define calculated columns, measures, and tables to create custom calculations and derive insights specific to their business requirements. This flexibility enables users to tailor their analysis and reporting to the unique needs of their organization.

- **ETL: Extract, Transform, Load**

The Extract Transform And Load process extracts, transforms, and loads data from multiple sources to a data warehouse or a unified data repository. This centrally collected data in the repository makes it easier to analyze and handle it further. It also acts as a single point for teams' and businesses' accurate and consistent data requirements.

Need for Extract Transform Load

- **Data Integration:** Power BI ETL allows you to combine data from multiple sources into a unified format for better analysis.
- **Data Transformation:** Enables cleaning, filtering, and transforming raw data into a usable format, ensuring data quality and consistency.
- **Performance Optimization:** By transforming data and pre-processing it, ETL reduces the load on Power BI during analysis, leading to faster performance.

- **Automation of Data Processes:** Power BI's ETL process can automate repetitive data preparation tasks, saving time and reducing manual errors.
- **Enhanced Data Analytics:** ETL prepares data for advanced analytics and reporting, helping businesses derive meaningful insights.

- **API: Application Programming Interface**

API (Application Programming Interface) is a set of tools and services that allow developers to interact programmatically with the Power BI platform. This is a game-changer for organizations looking to automate tasks, embed analytics, or integrate Power BI with other systems in their digital ecosystem.

- Types of Power BI APIs

1. REST API

- Core API provided by Microsoft.
- Enables operations like:
- Embedding dashboards and reports
- Creating and managing workspaces
- Pushing data into datasets
- Refreshing datasets
- User and workspace management

2. Push Data API

- Allows real-time data push into Power BI from external sources.
- Great for streaming data dashboards (e.g., IoT, live analytics).

3. Power BI JavaScript API

- Used primarily to embed Power BI reports, dashboards, or visuals into web applications.
- You can programmatically control:

- Page navigation
- Filter application
- Visual events

- Key Use Cases

- Embedded Analytics: Integrate Power BI visuals into a custom web or mobile application using Power BI Embedded and REST + JavaScript APIs.

- Automation: Automate report refreshes, manage users, or create dashboards using the REST API.

- Custom Integrations: Connect Power BI with third-party apps or enterprise platforms like Azure, SharePoint, or ERP systems.

14.Conclusion

Uber’s ride data reveals significant insights that influence both operational strategy and customer satisfaction. The Uber data analysis project provided a practical approach to data-driven decision-making in the transportation industry.

The Power BI dashboards created in this project empower decision-makers to:

- Monitor demand patterns and revenue.

- Optimize driver allocation based on location and time.

- Evaluate vehicle type performance.

- Improve user experience with interactive analytics.

Using Power BI, we transformed raw data into actionable insights through visual storytelling.

Key outcomes include:

Better understanding of peak demand times

Geographic concentration of trips

Improved operational planning capability

By incorporating advanced Power BI features such as disconnected slicers, dynamic measures, drill-throughs, and bookmarks, the project offers a full-scale analytical environment.

This project demonstrates how business intelligence tools like Power BI can unlock the value hidden in large datasets, turning numbers into insights and insights into strategy.

15. References

- Microsoft Power BI Documentation: https://learn.microsoft.com/power-bi/
- Uber Movement Datasets: https://movement.uber.com/
- DAX Guide: https://dax.guide/
- SQLBI: https://www.sqlbi.com/
- Power Query M Reference: https://learn.microsoft.com/en-us/powerquery-m/