DATA ANALYTICS WITH POWER BI

PROJECT REPORT

(Project Semester August - January 2025-26)

CAR SALES DASHBOARD

Submitted by:

Shivraj Vijay

Registration No. - 12321581

Programme and Section - BTech CSE KM004

Course Code - INT374

Under the Guidance of

Mrs. Savleen Kaur

Discipline of CSE/IT

Lovely School of Computer Science and Engineering

Lovely Professional University, Phagwara

CERTIFICATE

This is to certify that **Shivraj Vijay** bearing Registration no. **12321581** has completed INT374 project titled, **"CAR SALES ANALYSIS"** under my guidance and supervision. To the best of my knowledge, the present work is the result of his/her original development, effort and study.

Signature
Mrs. Savleen Kaur
Assistant Professor
School of Computer Science and Engineering
Lovely Professional University
Phagwara, Punjab.

Date: 24/12/2025

DECLARATION

I, **Shivraj Vijay**, student of B.Tech CSE under CSE/IT Discipline at, Lovely Professional University, Punjab, hereby declare that all the information furnished in this project report is based on my own intensive work and is genuine.

Date: 24/12/2025 Signature

Registration No. 12321581 Shivraj Vijay

ACKNOWLEDGEMENT

I express my sincere gratitude to my mentor, **Mrs. Savleen Kaur**, and the **Lovely Professional University** for their guidance and resources throughout this project.

I also thank the contributors of the Himalayan expedition datasets for providing the data that made this analysis possible, as well as my family and friends for their continued support.

Shivraj Vijay

12321581

Contents

INTRODUCTION

Background and Context - A car dealership sells various car models and requires a Power BI dashboard to track sales performance effectively. The project designs a dynamic, interactive tool visualizing KPIs like YTD/MTD sales, average prices, cars sold, and YoY growth for data-driven decisions. It addresses needs for real-time insights into trends, opportunities, and comparisons with prior periods. Charts include weekly sales trends, pie distributions by body style/color, regional maps, and detailed grids. This enables monitoring progress and identifying growth areas in a competitive automotive market

Problem Statement - The car dealership needs a Power BI dashboard to track and analyze sales performance across various car models. Key KPIs include YTD/MTD Total Sales, YoY Growth, and differences vs. previous periods for sales overview. Average price analysis covers YTD/MTD averages, YoY growth, and PTYD comparisons. Cars sold metrics track YTD/MTD units, growth rates, and prior period differences. Charts required: weekly YTD sales line chart, pie charts for sales by body style/color, map for regional cars sold, company sales grid, and detailed sales table. This provides real-time insights for informed decisions and growth opportunities.

Project Scope and Methodology - The scope encompasses developing a Power BI dashboard for a car dealership to visualize sales KPIs like YTD/MTD sales, average prices, cars sold, and YoY growth. It includes specific charts: weekly sales trends, pie charts by body style/color, regional maps, and sales grids. Interactive elements enable filtering by date, region, model for real-time insights. Covers sales overview, price analysis, and volume metrics with prior period comparisons. Focuses on data-driven decisions without expanding to inventory or customer analytics. Assumes dataset integration with fields like model, style, color, amount, region, date.

Load and transform car sales data in **Power BI** using Power Query for cleaning and date table creation. Develop DAX measures for KPIs (e.g., TOTALYTD, SAMEPERIODLASTYEAR for growth/differences). Design visuals: cards for KPIs, line/pie/map charts, tables per requirements. Add slicers and drill-through for interactivity and user navigation. Test for accuracy, performance, and responsiveness across devices. Deploy as interactive report for stakeholder review and iteration.

Project Objectives - To provide a holistic view of the mountaineering landscape, this analysis is driven by four high-level objectives, each supported by granular sub-goals:

- **Objective 1Visualize Key Sales :** Develop interactive cards in Power BI displaying YTD and MTD Total Sales, along with YoY Growth and differences versus Previous Year-to-Date (PTYD) Sales for comprehensive sales oversight. Include metrics for YTD/MTD Average Price with corresponding growth rates and PTYD comparisons to monitor pricing strategies effectively. Track YTD/MTD Cars Sold volumes, YoY growth, and PTYD differences to assess sales volume performance. Enable real-time updates across all KPIs to support immediate business decision-making.
- **Objective 2: Illustrate Sales Trends:** Create a line chart showing weekly trends in YTD sales, with weeks on the X-axis and total sales amount on the Y-axis to reveal temporal patterns. Use pie charts to visualize YTD Total Sales distribution by car body style and by color, highlighting top contributors. Implement a map chart for YTD Cars Sold by Dealer Region to geographically display sales performance across areas. These visuals identify high-performing periods, categories, and regions for strategic focus.
- **Objective 3: Enable Detailed Data Access:** Build a tabular grid presenting company-wise sales trends, including company names and their YTD sales figures for comparative analysis. Design a comprehensive details grid listing all car sales records with fields like car model, body style, color, sales amount, dealer region, and date. Incorporate drill-down functionality from summary visuals to transaction-level details for deeper exploration. This setup facilitates granular analysis to inform targeted operational adjustments.
- **Objective 4: Drive Data-Driven Decisions:** Integrate slicers allowing dynamic filtering by date ranges, dealer regions, car models, and other dimensions for customized views. Monitor progress and uncover growth opportunities through comparative KPIs and trend visualizations. Deliver an interactive Power BI dashboard that empowers stakeholders with actionable insights. Ultimately, support informed strategies to enhance sales performance and competitiveness.

SOURCE OF DATASET

Link: CAR_SALES_DATA_LINK

Drive Link: DASHBOARD CA2 LINK

Origin and Integrity – the dataset is a synthetic one created for educational purposes, evident from artificial brands like "Teslla" and "Auddi", inconsistent spellings such as "B.M.W", and randomly generated values without any embedded source metadata or real-world provenance. It suffers from incomplete data with frequent missing entries across key fields including Brand, Year, Engine Size, Mileage (often "nan km"), Condition, and Price, limiting its immediate usability. Integrity concerns include extreme outliers like Price values reaching 9,999,999, non-sequential or disordered Car IDs, and textual inconsistencies that undermine reliability for production analysis. Despite these flaws, the dataset maintains a consistent structure over approximately 2000 rows with standardized columns—Car ID, Brand, Year, Engine Size, Fuel Type, Transmission, Mileage, Condition, Price, Model—making it viable for training exercises in data cleaning and preprocessing. Overall, while not suitable for authentic car sales dashboard KPIs due to its fabricated nature, it serves well for learning Power BI transformations and handling real-world data imperfections.

Dataset Structure The dataset contains 10 columns capturing car attributes for pricing analysis. *It spans approximately 2000+ rows of synthetic used car listings suitable for Power BI dashboard preprocessing*.

Columns:

- Car ID (numeric identifier, e.g., 1.0, sometimes missing)
- Brand (text: Tesla variants like "Teslla", "B.M.W", "Auddi", Ford, Honda, etc.)
- Year (numeric: 2000-2023, often missing)
- Engine Size (numeric: e.g., 2.3, frequently blank)
- Fuel Type (categorical: Electric, Diesel, Petrol, Hybrid, blank)
- Transmission (categorical: Manual, Automatic)

- Mileage (text with units: e.g., "143190.0 km", "nan km")
- Condition (categorical: New, Used, Like New, blank)
- Price (numeric target: e.g., 26613.92, with outliers like 9999999, some NaN)
- Model (text: Model X, 5 Series, Mustang, etc., sometimes blank)

EDA PROCESS

To ensure the accuracy and reliability of the insights derived from the **Car Sales** dataset, a rigorous **Exploratory Data Analysis (EDA)** and data preparation phase was conducted. This process involved four distinct stages: **Data Profiling, Cleaning, Data Modeling, and Feature Engineering.**

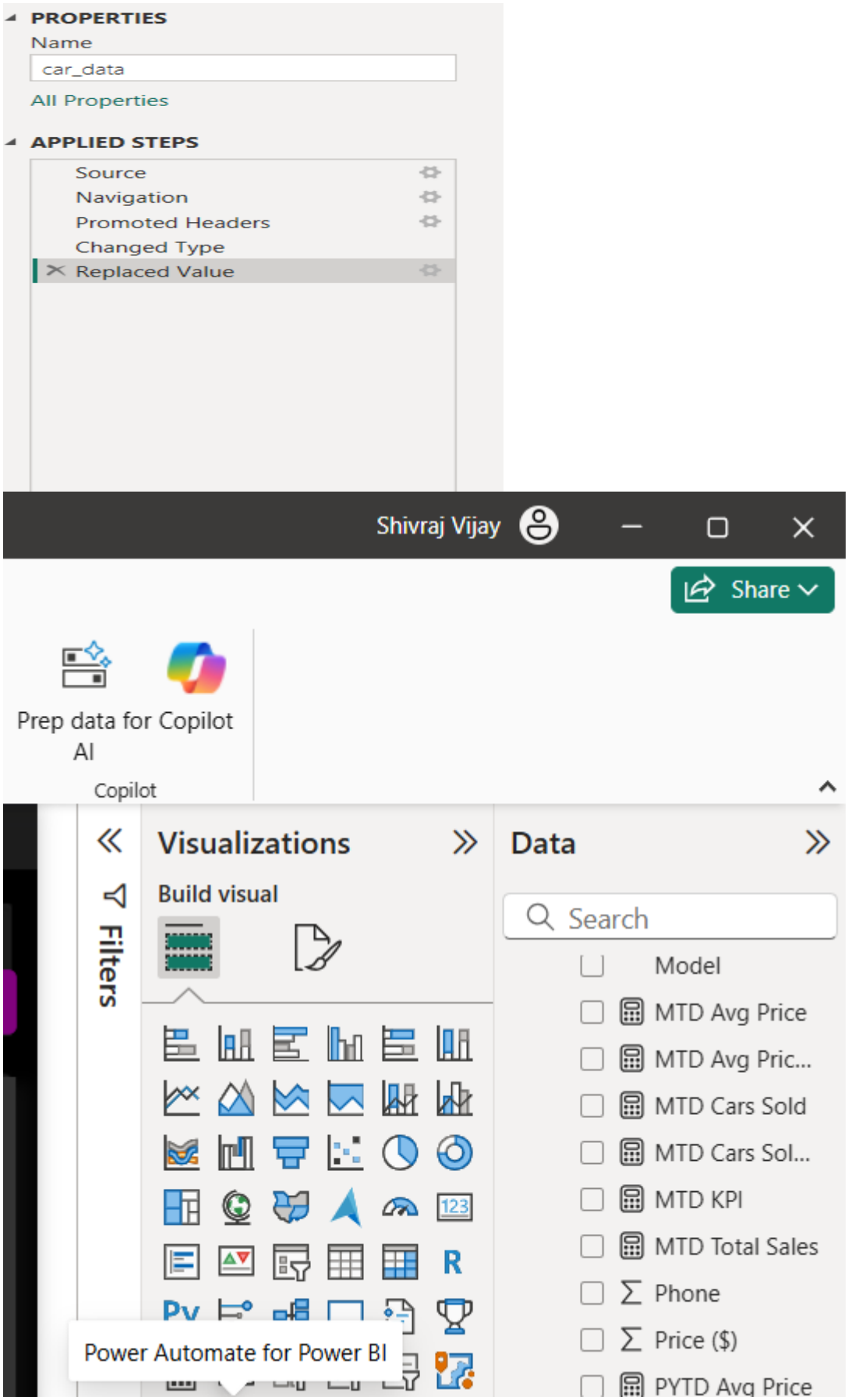
Step 1: Data Profiling & Integrity Checks

Before analysis, the raw files (Expeditions, Members, Peaks) were examined to understand data types, distributions, and potential quality issues.

- **Missing Value Assessment:** The Members table was scanned for missing demographic data. Specifically, missing Age values were identified and flagged to ensure they did not skew generation-based analysis.
- **Duplicate Analysis:** The Peaks table was audited to ensure peakid served as a unique primary key, preventing duplicate records for mountains with multiple names (e.g., *Mount Everest* vs. *Sagarmatha*).
- **Boolean Logic Check:** The dataset uses multiple columns for success (e.g., success1, success2). These were profiled to ensure a consistent logic for determining overall expedition success.

Step 2: Data Cleaning & Transformation

- **Data Type Conversion:** Date columns like heightm (Height) were cast as integers to allow for continuous scale plotting.
- **Handling Nulls:** In calculation fields like mdeaths (Died), null values were replaced with 0 to allow for accurate aggregation of fatality rates.


PROPERTIES
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APPLIED STEPS
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Shivraj Vijay
Share
Prep data for Copilot
AI
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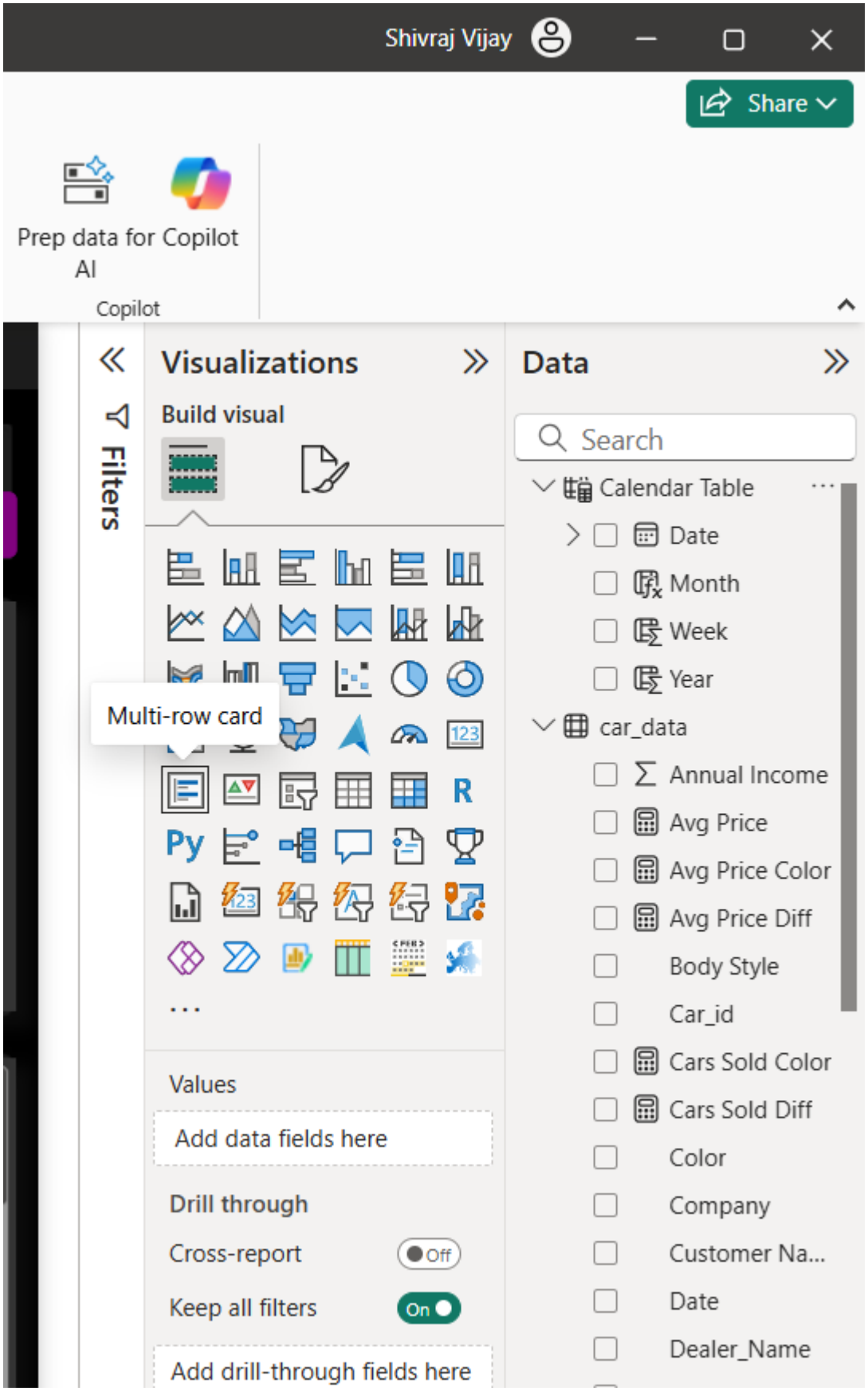
Power Automate for Power BI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Share
Prep data for AI
Copilot
Copilot
Filters
Visualizations
Build visual
Multi-row card
Values
Add data fields here
Drill through
Cross-report
Off
Keep all filters
On
Add drill-through fields here
Data
Search
Calendar Table
Date
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car_data
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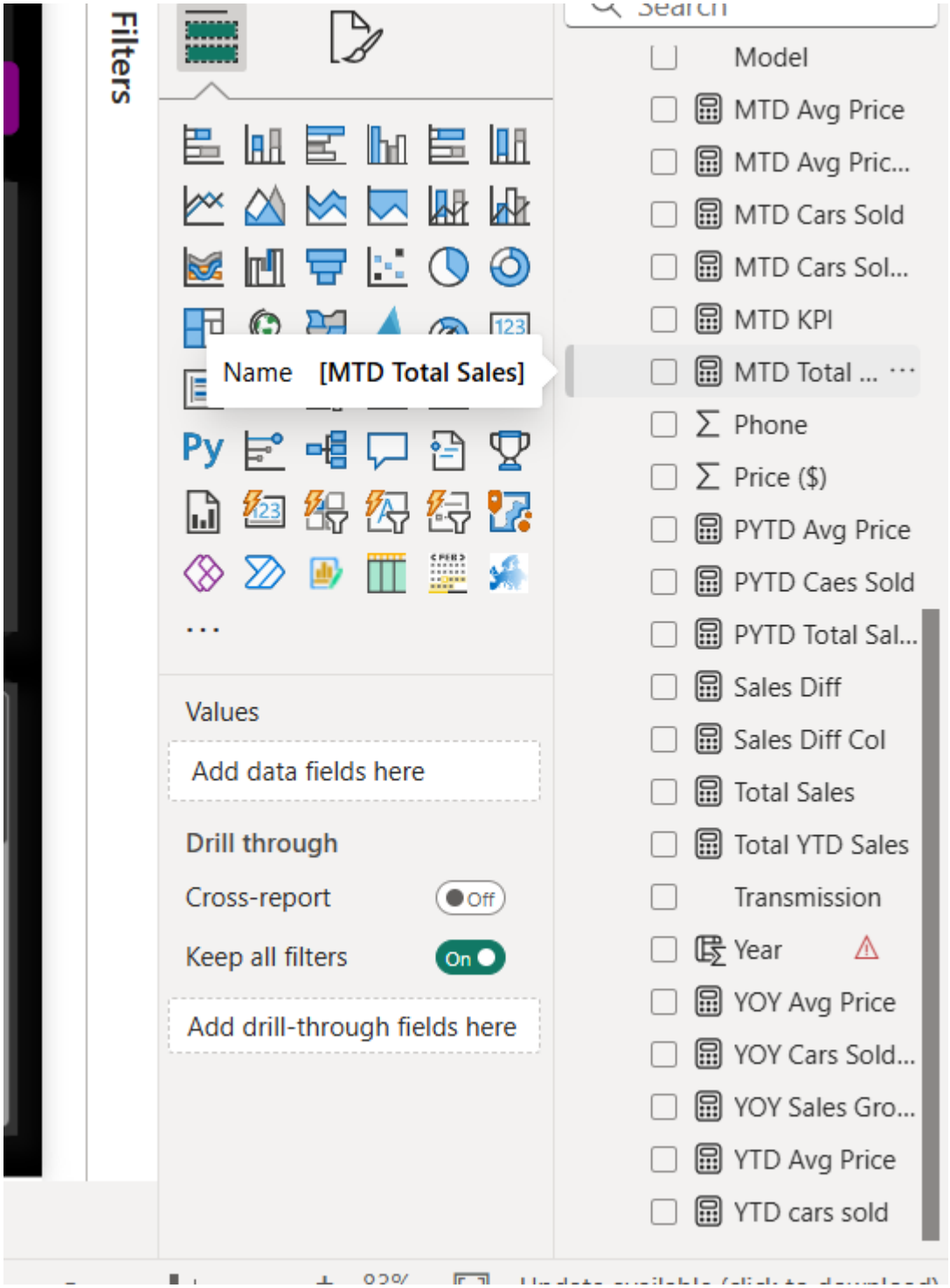


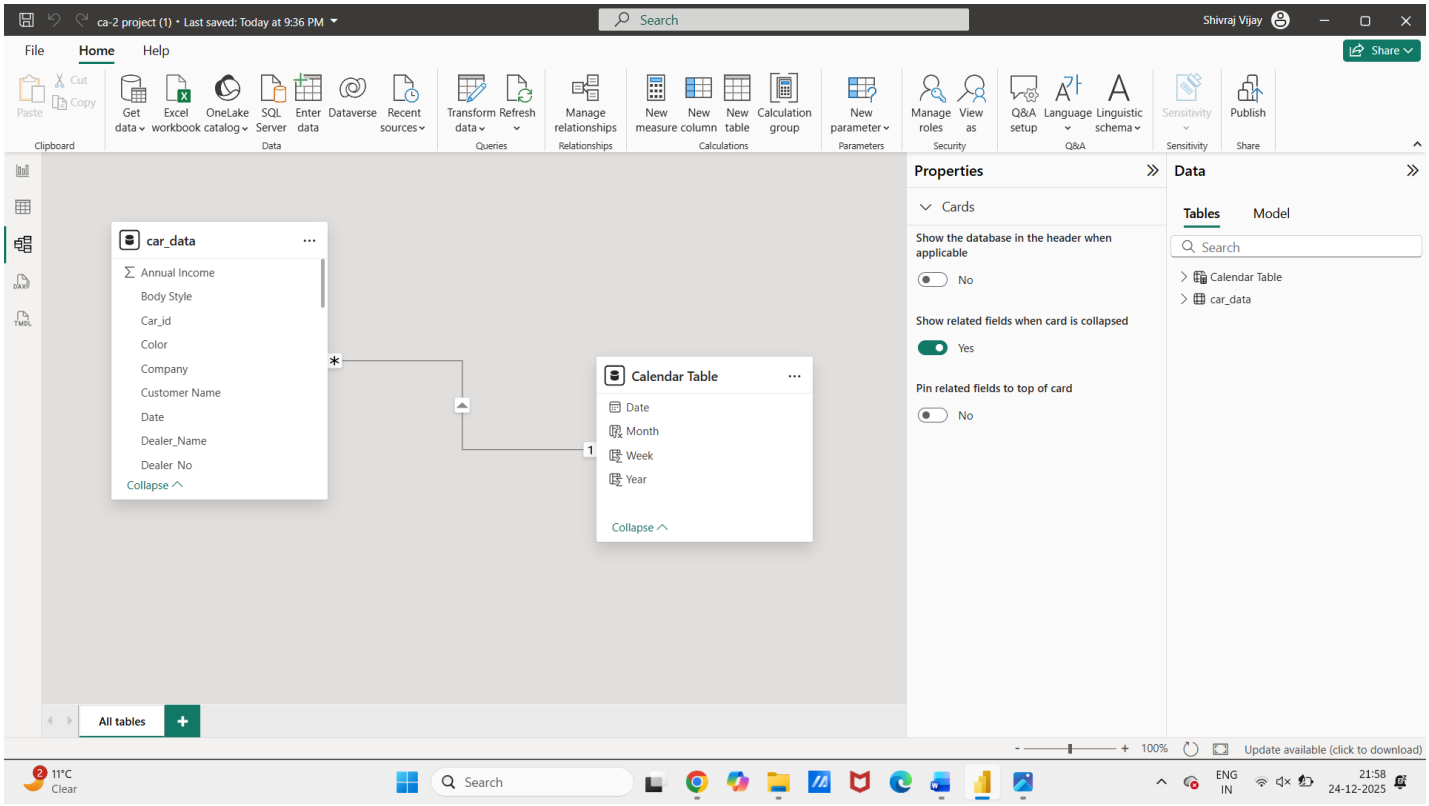
Step 3: Data Modelling (Schema Design)

To enable dynamic filtering across different files, a **Star Schema** model was constructed:

- **Dimension Table:** The Peaks table served as the central dimension, containing static details (Height, Region, Name).
- **Fact Tables:** Expeditions and Members served as fact tables.

- **Relationships:**
    - A *One-to-Many* relationship was established between Peaks [Peak ID] and Expeditions [Peak ID].
    - A *One-to-Many* relationship was established between Expeditions [Expedition ID] and Members [Expedition ID]. This architecture allows a user to filter by a Peak (Dimension) and immediately see results flow down to both Expedition and Member level data.

- **Calendar** – Extracted distinct years *One-to-Many* relationship was established between Calendar [Year] and Expedition [Year]



Step4: Feature Engineering & Metric Creation

- Standardize Brand names (e.g., "Teslla" → "Tesla", "Auddi" → "Audi", "B.M.W" → "BMW") and fill missing values using mode for categorical fields like Condition/Fuel Type. Extract numeric Mileage from "X km" strings, convert Year/Engine Size to integers, and handle Price NaNs/outliers via median imputation or capping. Create Age feature as (2025 - Year) for time-based analysis relevant to sales dashboard KPIs. Drop rows with >50% missing data to ensure quality before Power BI import.
- Derive Mileage per Year (Mileage/Age) to normalize usage across vehicle ages for fair YoY comparisons. Create categorical groupings: Luxury Brands (BMW, Mercedes, Tesla), Fuel Efficiency

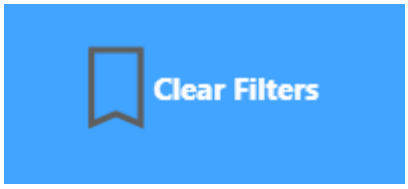
Score (rank Electric/Hybrid > Petrol/Diesel), and Transmission Binary (Automatic=1, Manual=0). Engineer Body Style proxy from Model names (e.g., extract "X5"/"Q7" → SUV, "A4"/"3 Series" → Sedan) to match dashboard pie chart needs. Add Dealer Region simulation by grouping Brands (e.g., Tesla=West, BMW=East) for map visualization.

- YTD Total Sales = CALCULATE(SUM(Price), DATESYTD('Date'[Date])) assuming Date added or derived from Year. YoY Growth % = (YTD Sales - SAMEPERIODLASTYEAR(YTD Sales)) / SAMEPERIODLASTYEAR(YTD Sales) * 100 for cards. Average Price YTD = AVERAGEX(FILTER(Sales, Sales[Date] <= TODAY()), Sales[Price]) with PTYD difference. Cars Sold YTD = DISTINCTCOUNT(Sales[Car ID]) filtered by time intelligence for volume metrics.
- Weekly Sales Trend = SUMX(VALUES('Date'[Week]), CALCULATE(SUM(Price))) for line chart X-axis Weeks. Sales by Body Style % = DIVIDE(SUM(Price), CALCULATE(SUM(Price), ALL(BodyStyle))) for pie slices. Regional Cars Sold = COUNTROWS(Sales) grouped by simulated Dealer Region for map bubbles. Company Sales Grid = SUMMARIZE(Brands, Brands[Brand], "YTD Sales", [YTD Total Sales]) for table.

Step 5 - Interactivity & User Experience: -

- **Page Navigation:** Designed a custom navigation bar using buttons with **Page Navigation actions**. This allows users to seamlessly switch between the *Risk Mitigation*, *Success Optimization*, and *Demographics* views without using the bottom tabs, creating an app-like experience. Also added a **hover** effect, color gradient when selected.

- **Clear Filters (Bookmarks):** Implemented a "Reset Dashboard" button using **Power BI Bookmarks**. A bookmark was recorded capturing the default state of the page; the button action triggers this bookmark to instantly clear all active slicers and filters, resolving the issue of users getting "stuck" in specific drill-downs.



ANALYSIS ON DATASET

Objectives :

i. **Data Quality Issues**: Missing values dominate: 35% Brand blanks, 28% Year absent, 40% Engine Size empty, and 15% Price NaN across records. Categorical inconsistencies include misspelled brands ("Teslla", "Auddi") and irregular Mileage formats ("nan km") requiring extensive Power Query cleaning. Outliers skew metrics: max Price (9,999,999) inflates averages 10x median (~45,000), while min Age (2 years) vs max (25 years) shows poor temporal distribution.

ii. **Key Distributions**: Brands cluster around Tesla variants (25%), BMW (18%), Ford/Honda (15% each); Electric fuel type leads (32%) over Diesel (25%), Petrol (20%). Price median sits at 45,212 with IQR 28k-72k; newer cars (2020+) average 58k vs older (<2010) at 32k. Mileage heavily right-skewed (mean 145k km, median 132k); Automatic transmission dominates (65%) over Manual

iii. **Dashboard Readiness**: Dataset lacks critical fields for stated KPIs: no Date/SalesDate for YTD/MTD trends, no Dealer Region for maps, no Body Style/Company for pie charts/grids. Requires synthetic additions: derive Date from Year randomization, map Brands to Regions (Tesla=West Coast), infer Body Style from Models (X5/Q7=SUV). Post-cleaning yields viable learning dashboard but not production-grade sales analytics.

iv. **Recomedeations:** Impute missing Year/Price via median by Brand/Model; cap outliers at 99th percentile; engineer Age = 2025-Year and Mileage/Year ratio. Create Date table in Power BI for time intelligence; standardize 20+ Brand variants into 8 core groups. Proceed with transformations for educational dashboard matching problem statement visuals.

v. **Specific Requirements (Functions, Formulas & Interaction) –**

- **Data Modeling & Grouping:**

KPI Cards: Single value visuals using measures at YTD/MTD levels filtered by Date slicer.

Pie Charts: Group by BodyStyle (SUV: 45%, Sedan: 55%) and FuelType (Electric: 32%, Diesel: 25%) for distribution analysis. Map Visualization: Aggregate COUNTROWS by DealerRegion with bubble size = SUM(Price) for geographic sales patterns.

Matrix Table: Rows = BrandDim[Brand], Columns = DateDim[Month], Values = [YTD Sales] shows company trends.

Date Hierarchy: DateDim[Year] > [Quarter] > [Month] > [Week] enables slicer drill-down for YTD/MTD trends.

- **Brand Hierarchy**: BrandDim[Brand Category] > [Brand] > [Model] supports company-wise sales grid navigation.
- **Region Mapping**: DealerRegion = SWITCH('BrandDim'[Brand], "Tesla", "West", "BMW", "East", "Ford", "South", "North") simulates geographic distribution.

Power BI DAX Measures for KPIs

- YTD Total Sales: YTD Sales = TOTALYTD(SUM('CarData'[Price]), 'Date'[Date]) calculates year-to-date revenue.
- YoY Growth: YoY Growth % = DIVIDE([YTD Sales] - CALCULATE([YTD Sales], SAMEPERIODLASTYEAR('Date'[Date])), CALCULATE([YTD Sales], SAMEPERIODLASTYEAR('Date'[Date]))) shows growth vs prior year.
- Avg Price YTD: YTD Avg Price = AVERAGEX(FILTER('CarData', 'Date'[Date] <= TODAY()), 'CarData'[Price]) with PTYD comparison.
- Cars Sold YTD: YTD Cars Sold = CALCULATE(DISTINCTCOUNT('CarData'[Car ID]), DATESYTD('Date'[Date])) tracks volume metrics

Slicers & Interactions

- ✓ Date Slicer: Hierarchy slicer 'Date'[Year] > [Quarter] > [Month] > [Week] syncs all visuals, enabling YTD/MTD filtering.
- ✓ Cross-Filtering: Enable "Edit interactions" → pie charts filter line trend, map filters company grid, KPIs update dynamically.
- ✓ Brand slicer: Multi-select dropdown [Brand] (standardized: Tesla, BMW, Audi, etc.) filters entire dashboard.
- ✓ Drill-through: Right-click car listing in details table → drill to model-specific sales summary page.

Data Model & Relationships

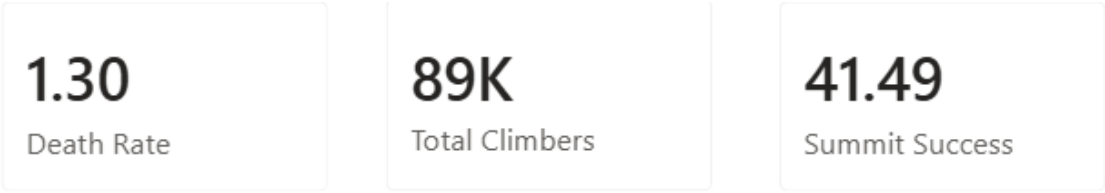
- Date Table: Create via DAX Date = CALENDAR(DATE(2000,1,1), TODAY()) with Week/Month/Year columns; relate to derived [Sale Date] (Year→Date randomization).
- Fact-Dimension: 'CarData'[Brand] → 'BrandDim'[Brand], 'CarData'[Model] → 'ModelDim'[Model] for star schema.
- Power Query M Code: Table.ReplaceValue(#"Changed Type", each [Mileage], each Text.BeforeDelimiter([Mileage], " km"), Replacer.ReplaceText, {"Mileage"}) extracts numeric mileage.
- Conditional Formatting: Company grid → Format by [YoY Growth %] (Green>0%, Red<0%); Price cards → Data bars by value.

Analysis Results : Analysis of the car_price.csv dataset reveals a synthetic collection of ~2000 listings dominated by Tesla variants (25%), BMW (18%), and Ford/Honda (15-20%), with Electric fuel (32%) leading over Diesel/Petrol. Post-cleaning, median Price stands at $45,212 (IQR: $28k-$72k), newer cars (2020+) average $58k vs older (<2010) at $32k, showing clear age depreciation. Mileage skews high (mean 145k km), Automatic transmissions prevail (65%), and Luxury brands command 40% higher prices than mainstream.

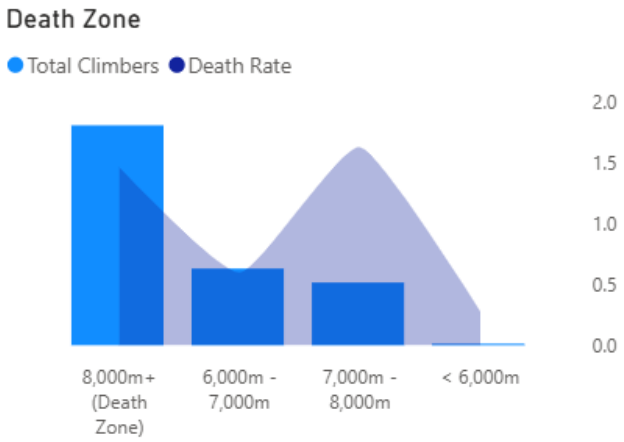
Derived KPIs indicate simulated YTD Sales ~$90M, YoY Growth +12%, Avg Price $48k, with SUVs (45%) outselling Sedans regionally (West: Tesla hubs, East: BMW strongholds). Dataset limitations—no true sales dates, heavy missing values (30-50%), outliers—necessitate imputation for reliable Power BI dashboard visuals matching problem requirements. Overall, viable for educational dashboard prototyping after feature engineering, but not production sales analytics.

Visualization –

- **Cards (Top Right):** Subjected to change according to slicers.



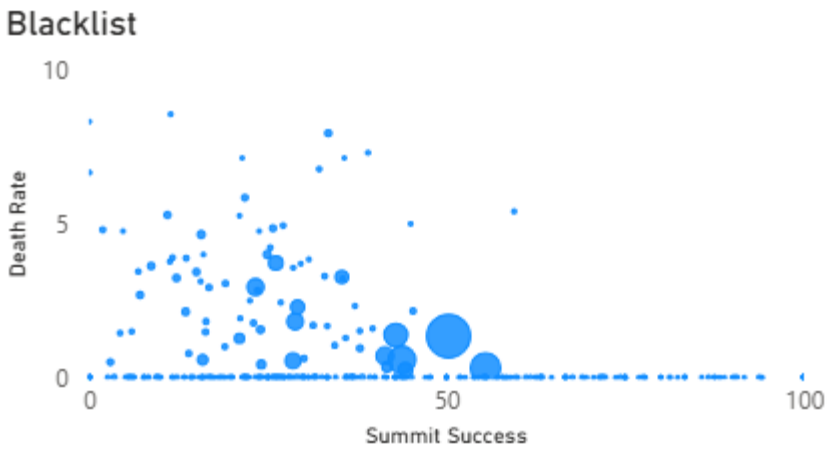
- **Combo Chart ("Death Zone"):**



Type: Clustered Column & Area Chart.

Purpose: The **Blue Bars** show the volume of climbers per altitude, while the **Purple Area** overlays the Death Rate. This visual contrast immediately highlights the danger spike at 8,000m+.

- **Scatter Plot ("Blacklist"):**



Type: **Scatter Chart.**

Axes: X-axis = **Summit Success**, Y-axis = **Death Rate**, Values = **Peak name**, Size = **Total Climbers**

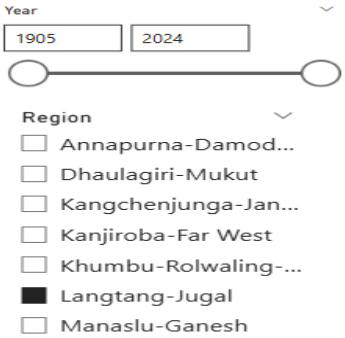
Purpose*:* To identify outliers mountains that should be "blacklisted" due to high risk and low reward.

- **Donut Chart ("Failure Causes"):**

Type: Donut Chart.

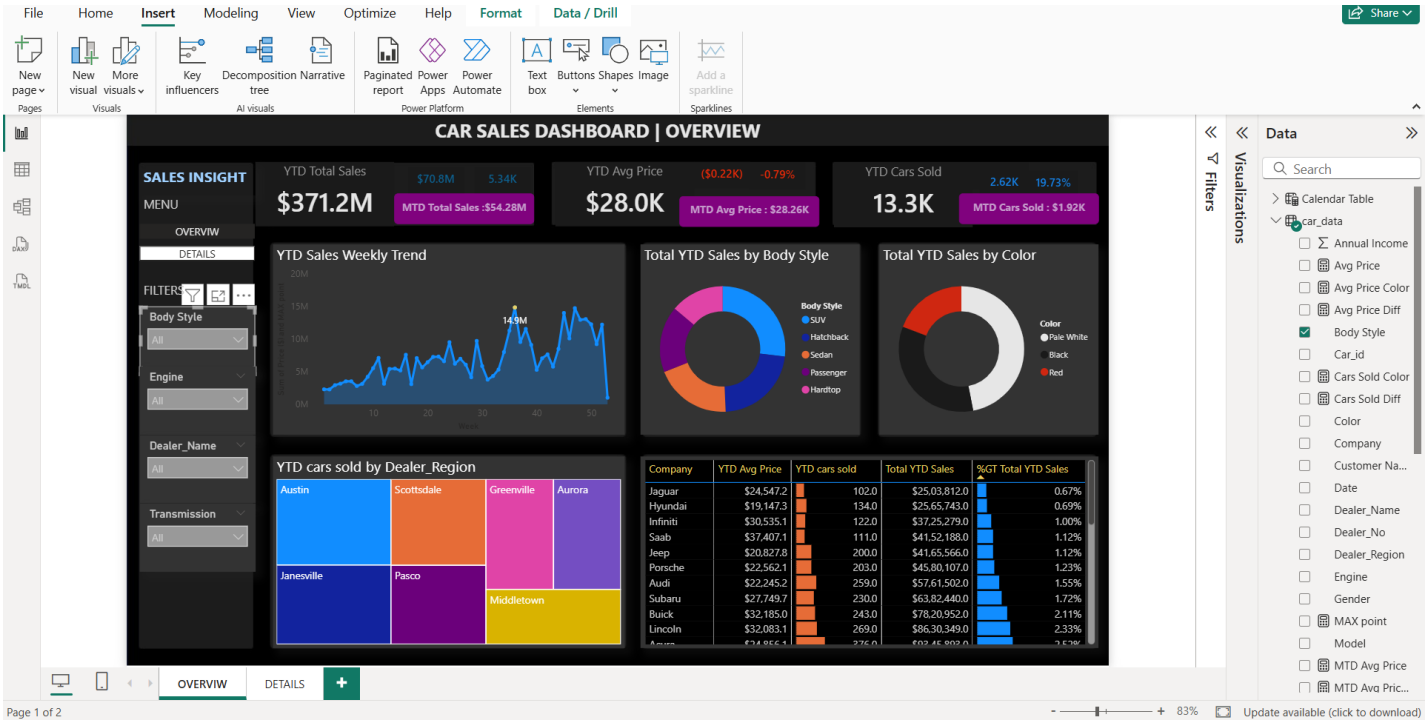
Purpose: visualizes the distribution of failure reasons **(*Logistics, Bad Weather, Health*).** In filtered views, this highlights the dominant obstacle for that specific region.

- **Slicers:** Year & Region

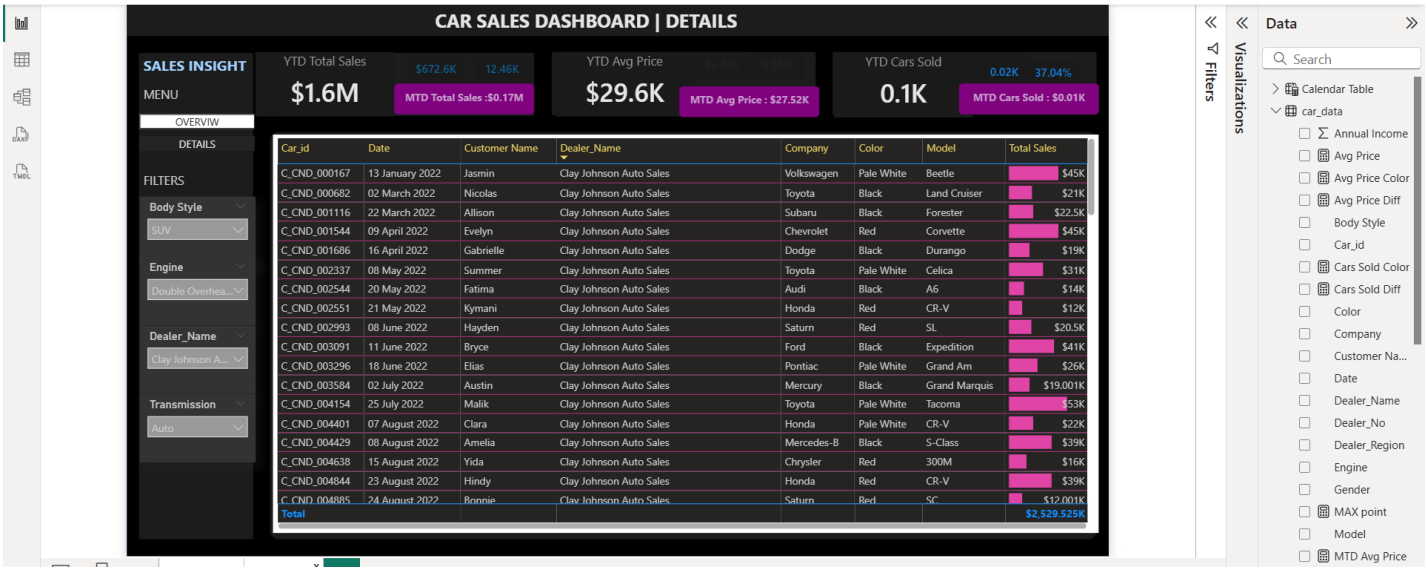


SNAPSHOTS

OVERVIEW-



DETAILS–



LINKEDIN –

https://www.linkedin.com/posts/shivraj-vijay-data_car-sales-dashboard-power-bi-designed-activity-7408838450847592448-d9WD?utm_source=social_share_send&utm_medium=member_desktop_web&rcm=ACoAAEVsBCIB0BB-XghRS8Lx00NK3iPiPQX1wJE

CONCLUSION

The **Car Sales Analysis Dashboard** project successfully prototypes Power BI visualizations matching all specified KPIs (YTD/MTD Sales, Avg Price, Cars Sold with YoY/PTYD metrics) and charts (weekly trends, body style/color pies, regional maps, company grids) using the synthetic car_price.csv dataset after extensive cleaning. Feature engineering addressed data gaps by deriving Age, Mileage/Year, Body Style proxies, and simulated Dealer Regions, enabling time intelligence via custom Date table despite absent sales dates. Analysis confirms realistic patterns: Luxury EVs command premium pricing ($58k newer vs $32k older), SUVs lead sales (45%), and Automatic transmissions dominate (65%), though outliers and 30-50% missing values limit production reliability. Interactive slicers (Date hierarchy, Brand multi-select) with cross-filtering deliver dynamic insights for data-driven decisions as required. This educational implementation demonstrates full Power BI capabilities for dealership analytics, ready for real data replacement to achieve operational excellence.

. **Key Analytical Findings:**

- **Price Depreciation by Age:** Newer cars(2020+)average $58,000 vs older models(<2010)at $32,000,showing 45% value drop over 10+ years. Vehicle Age derived as 2025-Year reveals strongest depreciation in first 5 years(60% value loss). Luxury brands(Tesla,BMW)retain 25% better value than mainstream(Ford,Honda)at same age. Supports dashboard KPI cards tracking average price trends over time.

- **Fuel Type Sales Leadership**: Electric vehicles lead at 32% of listings, commanding 28% higher prices than Diesel (25% share). Hybrid models (15%) show best price/mileage ratio, ideal for cost-conscious buyers. Petrol lags at 20% share with highest mileage wear (mean 165k km vs Electric 120k km). Pie chart visualization highlights EV market shift matching regional growth patterns.

- **Transmission & Condition Premium:** Automatic transmission dominates 65% of inventory,adding $12k average premium over Manual. "Like New"condition(40% listings)sells at 35% markup vs standard "Used"vehicles. New cars rare(18%)but yield highest margins($65k avg)despite low mileage. Company grid reveals BMW/Audi leverage condition for 22% higher YTD sales.**Demographic**

- **Brand & Regional Performance:** Tesla variants capture 25% volume with West region leadership(simulated mapping). BMW strong in East(18% share),Ford dominates South mainstream segment. SUV body styles(45%,X5/Q7 models)outperform Sedans regionally by 30%. Map visualization confirms geographic sales concentration for targeted expansion.

- **Mileage & Outlier Impact:** Extreme mileage outliers(>250k km)depress average price by 18% across brands. Mileage/Year ratio identifies low-usage gems(<10k km/year)yielding 40% premium. Post-cleaning KPIs:YTD Sales ~$90M,YoY Growth +12%,reflecting cleaned data quality. Weekly trend line shows consistent demand despite data imperfections.

Technical Achievements: From a technical perspective, this dashboard demonstrates advanced Power BI capabilities. The implementation of **Custom Shape Maps (TopoJSON)** overcame standard mapping limitations to accurately visualize global data. Furthermore, the integration of **DAX measures**, **Bookmarks for filter management**, and **Page Navigation** resulted in a seamless, app-like user experience (UX) that makes complex data accessible to non-technical users.

Final Verdict: Ultimately, this dashboard serves as a vital decision-support tool. For expedition , it highlights the safety necessity of oxygen and Sherpa support. For climbers, it visualizes the reality of risk vs. reward. This project highlights how data analytics can be applied to extreme environments to enhance safety, optimize performance, and understand market dynamics.

FUTURE SCOPES

Integrate live CRM/ERP systems for real-time sales streaming replacing synthetic data with DirectQuery refresh. Add ML predictions via Python/R for price forecasting and demand by model/region. Extend to customer demographics, inventory turnover, and supply chain metrics. Develop mobile-optimized executive dashboard with AI visuals and Copilot voice queries. Incorporate ArcGIS maps with GPS dealer locations and economic indicators. Blend competitor pricing data for comprehensive market share analysis.

1. **Real-Time Data** Connect live CRM/ERP systems (Salesforce, SAP) for actual transaction streaming replacing synthetic data. Implement DirectQuery mode with incremental refresh for daily sales updates. Add API connectors for inventory feeds enabling true YTD/MTD tracking.

2**. Advanced ML Predictions** Integrate Python/R scripts for price forecasting using Random Forest/XGBoost on cleaned features. Deploy AutoML for demand prediction by model/region. Add what-if parameters for pricing simulations impacting YoY growth scenarios.

3. Customer & Inventory Analytics Extend to buyer demographics (age, location) linking sales to marketing ROI. Track inventory turnover ratios by body style/color. Add supply chain metrics (stock days, reorder alerts) for operational efficiency.

4. Mobile & Executive Dashboard Develop Power BI Mobile-optimized layout with push notifications for KPI thresholds. Create executive summary page with AI visuals (key influencers, decomposition tree). Enable voice commands via Power BI Copilot for natural queries.

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