

**An internship in**  
**Data Analytics with Tableau**

by

**SmartInternz**

**Project Name:** Visualizing housing market trends: an analysis of sale prices and features

**Project Id:** LTVIP2025TMID59137

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- |                         |                     |
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**DEPARTMENT OF CSE**

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## **ACKNOWLEDGEMENT**

I am pleased to acknowledge my sincere thanks to **Institute of SRINIVASA RAMANUJAN** for their kind encouragement in doing this project and for completing it successfully.

I convey my thanks to **Dr. G.Balakrishna**, principal of Srinivasa Ramanujan Institute of technology and **Mr. P. Veera Prakash, M.Tech, (ph.D.)**, Head of the Department of CSE for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project mentor **Mr. M. Ganesh**, for his valuable guidance, suggestions and constant encouragement pavedway for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **CSE** who were helpful in many ways for the completion of the project.

## ABSTRACT

This project, titled “Visualizing Housing Market Trends: An Analysis of Sale Prices and Features using Tableau,” focuses on transforming complex real estate data into clear, actionable insights through interactive data visualization. By cleaning and preparing a dataset containing various housing attributes—such as sale price, area, number of bedrooms, renovation status, and location—key trends were uncovered using Tableau’s powerful visual analytics. The project involved the creation of calculated fields (e.g., TotalAreaSqft, SalePriceBin), the use of filters (e.g., condition, renovation status, zipcode group), and the development of dashboards and stories that narrate insights across multiple dimensions. These dashboards were then embedded into a Flask web application, ensuring easy accessibility and deployment. The resulting solution empowers users—including buyers, real estate agents, and policy makers—to make data-driven decisions. With its scalability and modular structure, the project lays a foundation for further enhancements like live data integration, predictive analytics, and expanded geographic coverage.

### ***Key Words:***

- Tableau Dashboard
- Housing Market Analysis
- Data Visualization
- Sale Price Prediction
- Property Features
- Renovation Insights

# **Project Report Format**

## **1. INTRODUCTION**

- 1.1 Project Overview
- 1.2 Purpose

## **2. IDEATION PHASE**

- 2.1 Problem Statement
- 2.2 Empathy Map Canvas
- 2.3 Brainstorming

## **3. REQUIREMENT ANALYSIS**

- 3.1 Customer Journey map
- 3.2 Solution Requirement
- 3.3 Dataflow Diagram
- 3.4 Technology Stack

## **4. PROJECT DESIGN**

- 4.1 Problem Solution Fit
- 4.2 Proposed Solution
- 4.3 Solution Architecture

## **5. PROJECT PLANNING & SCHEDULING**

- 5.1 Project Planning

## **6. FUNCTIONAL AND PERFORMANCE TESTING**

- 6.1 Performance Testing

## **7. RESULTS**

- 7.1 Output Screenshots

## **8. ADVANTAGES & DISADVANTAGES**

## **9. CONCLUSION**

## **10. FUTURE SCOPE**

## **11. APPENDIX**

Dataset Link

GitHub & Project Demo Link

# **1. Introduction**

The real estate market is influenced by various factors such as house age, renovation status, number of bedrooms and bathrooms, and overall size. This project aims to analyze housing market trends and visualize key insights using Tableau to better understand how different features impact sale prices.

## **1.1. Project overviews**

The dataset contains Transformed housing data and 21,609 house sale records, including Property features such as Sales price, area, bedrooms, bathrooms, floors and location. There are a total of 31 columns, out of which Sale Price can be supposedly taken as a dependent variable. The other variables are different features, locations and date, etc. regarding the houses. This project, "Visualizing Housing Market Trends: An Analysis of Sale Prices and Features using Tableau," aims to explore and analyze housing market trends using the Transformed Housing Data 2 dataset from Kaggle. The objective is to identify key factors influencing house prices, such as location, size, number of bedrooms, bathrooms, floors and basement area.

By leveraging Tableau, the project will create interactive dashboards, story, bar chart, histogram, summary dashboard to visualize patterns, compare regional price variations, and gain insights into how different features impact house sale prices. The analysis will help in making datadriven decisions for buyers, sellers, and real estate professionals.

## **1.2. Objectives**

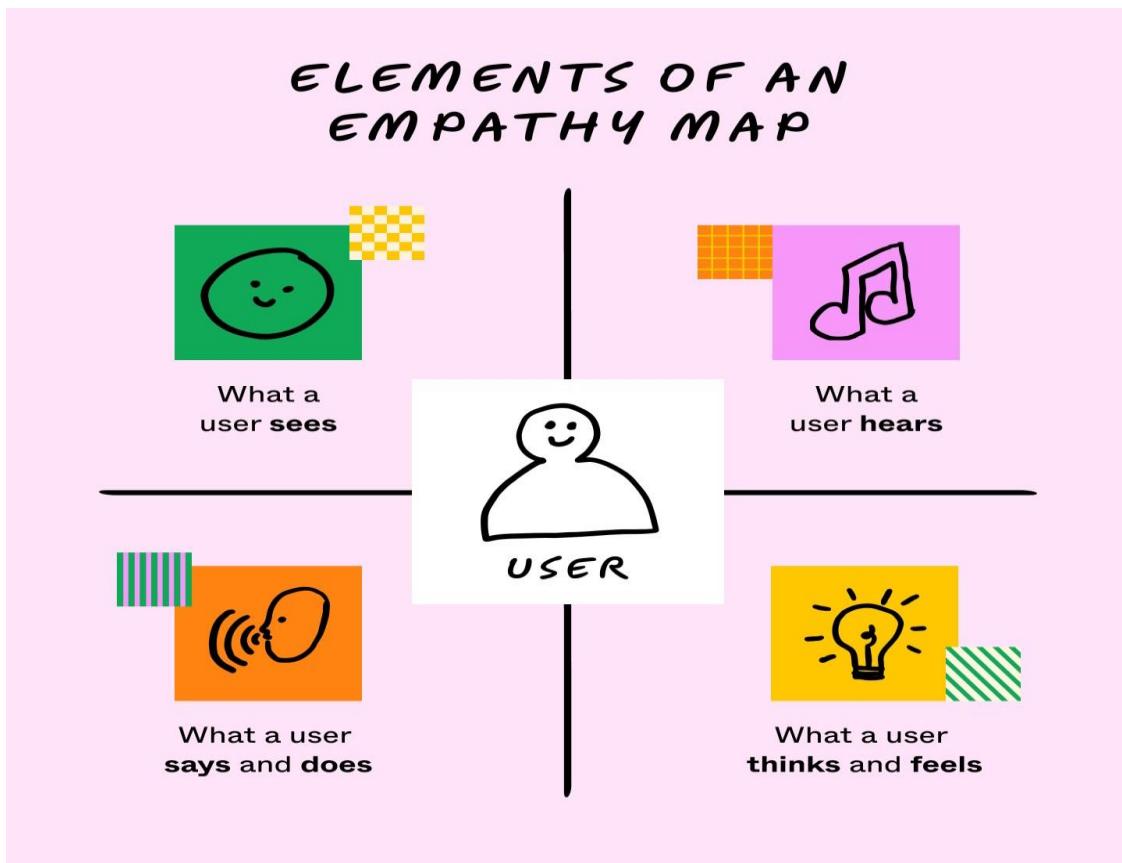
- Identify key factors influencing house prices.
- Analyze the effect of renovations on property value.
- Explore the distribution of house sales across different price ranges.
- Create interactive Tableau dashboards to present findings effectively.

## 2. Project Initialization and Planning Phase

### 2.1. Define Problem Statement

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	A first-time homebuyer who wants to make an informed decision	Find a home within my budget that meets my needs	The available market data is difficult to interpret and scattered across multiple sources	There is no centralized, easy-to-use tool that visualizes housing trends based on historical sales data	Confused and overwhelmed, making me hesitant to proceed
PS-2	A real estate investor looking for high-return properties	Identify profitable properties based on price trends and key influencing factors	Existing datasets require extensive manual analysis and lack clear insights	No interactive visualization tool allows me to compare property appreciation trends effectively	Frustrated and uncertain about making investment decisions
PS-3	A real estate agent aiming to assist clients efficiently	Provide accurate and insightful recommendations based on market data	The data is time-consuming to analyze and spread across various reports	There is no comprehensive tool to aggregate and visualize pricing trends for quick insights	Less efficient, unable to provide quick, data-backed advice to clients

## 2.2 Empathy Map Canvas



## 2.3 Brain Storming

### Step 1: Team Gathering, Collaboration and Problem Statement

Our team collaborated to identify pressing challenges in the real estate market, particularly in understanding how various property features influence housing sale prices. After exploring themes like housing affordability, real estate investment planning, urban development, and smart property insights, we narrowed down our focus to uncover actionable insights hidden in housing data. The objective was to visually explore trends using Tableau that would help buyers, sellers, investors, and policy makers understand patterns of sale prices based on features like area, bedrooms, renovation status, condition, location (zipcode groups), and more.

## **Problem Statement:**

How can housing sale price trends and property characteristics be visualized and analyzed using Tableau to identify patterns, improve buyer/seller decision-making, and uncover insights that support strategic real estate planning?

Team Members:

- Team Leader: Varsha S
- Team Member: Yamunasree Mylari
- Team Member: Sukanya M
- Team Member: Manidhar M
- Team Member: Navadeep P

## **Step 2: Brainstorming, Idea Listing and Grouping**

S.No	Idea Description	Category
1	Visualize average sale price by SalePriceBin	Pricing Insights
2	Analyze impact of number of bedrooms on sale price	Property Features
3	Explore relationship between Total Area and Price (scatter plot)	Size-Based Pricing
4	Compare prices for renovated vs. non-renovated homes	Renovation Analysis
5	Group insights by Zipcode Clusters	Geographical Comparison
6	Analyze house condition vs. price using dummy variables	Quality-Based Pricing
7	Add calculated field: TotalAreaSqft	Data Preparation
8	Create SalePriceBin with 100k intervals	Binning / Categorization
9	Use Tableau dashboard to combine insights	Dashboard Design
10	Build a Story in Tableau for narrative	Storytelling & Reporting
S.No	Idea Description	Category
11	Embed Dashboard in Web Application using Flask	Deployment & Integration
12	Add filters for Bedrooms, Condition, Renovation in Dashboard	Interactive Exploration

## **Step 3: Idea Prioritization Table**

S.No	Idea Description	Impact	Feasibility	Priority
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1	Visualize average sale price by SalePriceBin	High	Easy	High
2	Analyze impact of number of bedrooms on sale price	High	Easy	High
3	Explore TotalArea vs Price (scatter plot)	High	Easy	High
4	Compare prices for renovated vs. non-renovated homes	High	Medium	High
5	Group insights by Zipcode Clusters	Medium	Medium	Medium
6	Analyze house condition vs. price	High	Medium	High
7	Add calculated field: TotalAreaSqft	Medium	Easy	High
8	Create SalePriceBin with 100k intervals	Medium	Easy	High
9	Use Tableau dashboard to combine insights	High	Easy	High
10	Build a Story in Tableau	High	Medium	High
11	Embed Dashboard in Web Application	High	Hard	Medium
12	Add filters for Bedrooms, Condition, Renovation	Medium	Easy	Medium

## 3.Requirement analysis

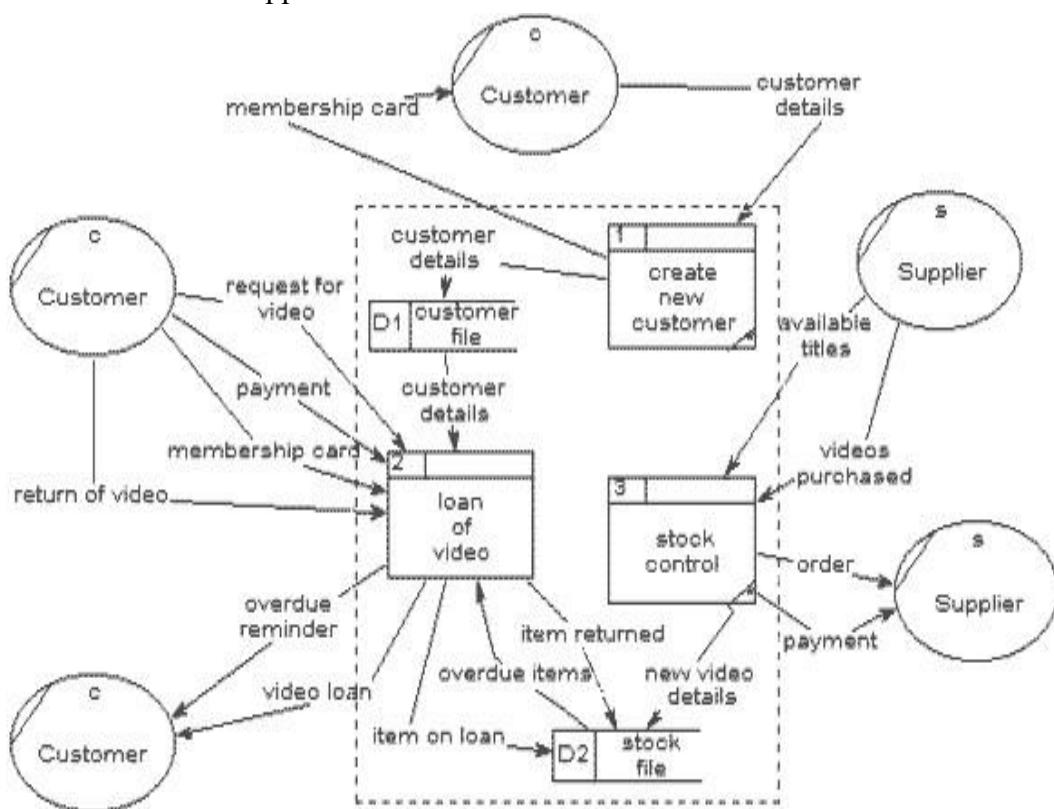
### 3.1 Customer journey map

Stage	User Goal	Actions	Touchpoints	Pain Points	Opportunities
1. Awareness	Understand the availability of housing data & visual tools	Searching online for real estate trend data or tools like Tableau dashboards	Google search, blog posts, social media, Tableau Public, real estate forums	Overwhelming amount of data sources, low trust in sources	Create SEO-friendly landing pages, share Tableau dashboards on popular platforms
2. Discovery	Identify relevant data visualizations for housing trends	Browses Tableau dashboards, real estate datasets, looks for ZIP-level trends	Tableau Public, Zillow Research, Redfin Data Center, local government sites	Dashboards are too complex, or not relevant to user's location	Provide clear filters by region, date, and property type; concise summary views
3. Consideration	Explore features and trends (e.g., prices, sqft, # of beds)	Uses filters in Tableau dashboard to explore data	Interactive Tableau filters, maps, charts, tooltips	Charts may be slow or not mobile-friendly; data may not be current	Optimize performance, provide refresh dates, include predictive insights
4. Engagement	Dive into detailed comparisons by neighborhood or time	Interacts with dashboards, compares ZIP codes, views time series, histograms, scatter plots	Tableau story points, dashboards, maps, price trend lines, correlation plots	Confusion over interpreting complex visualizations or statistical terms	Add explanatory tooltips, glossary popups, embed guided analysis or scenarios
5. Decision	Draw insights or make decisions (buy, wait, invest)	Screenshots or exports	Dashboard download/export, shared links, printed visuals	Lack of ability to share/export easily, insights not personalized	Enable story exports, PDF download, user-specific bookmarks
6. Feedback/Follow-up	Revisit or subscribe to housing updates	Tableau visuals, discusses with partner/agent	Returns to dashboard for updated insights, subscribes to alerts	Email alerts, Tableau subscriptions, follow-up surveys	No clear way to stay updated or submit feedback or star-rating for dashboards
					Add newsletter, alert system, feedback form or star-rating for dashboards

## 3.2 Data Flow Diagram

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

1. Data collected from POSOCO in CSV format.
2. Cleaned and transformed, with calculated fields like Year and Lockdown.
3. Visualizations built in Tableau using multiple worksheets.
4. Users review the dashboard and may request changes.
5. Final version archived after approval.



## User Stories – Visualizing Housing Market Trends

Use Agile-style user stories based on different personas:

### As a Homebuyer...

1. ...I want to see how housing prices have changed over time in my neighborhood, so I can decide when to buy.
2. ...I want to compare median home prices across nearby ZIP codes, so I can find more affordable areas.

- ...I want to filter listings by number of bedrooms and square footage, so I can see trends specific to my needs.

**As a Real Estate Analyst...**

- ...I want to analyze trends in home features (e.g., garage, pool, lot size), so I can identify what's driving price changes.
- ...I want to export charts and data from the dashboard, so I can include them in market reports.
- ...I want to overlay housing price trends with demographic data (e.g., income, population growth), so I can assess market potential.

**As an Investor...**

- ...I want to identify ZIP codes where housing prices are increasing fastest, so I can find investment opportunities.
- ...I want to forecast price trends for the next year, so I can plan my purchases.
- ...I want to receive alerts when certain market conditions are met, so I don't miss critical timing.

### 3.3 Solution Requirements

<b>FR No.</b>	<b>Functional Requirement (Epic)</b>	<b>Sub Requirement (Story / Sub-Task)</b>
FR-1	User Registration	- Registration through Form - Registration through Gmail - Registration through LinkedIn
FR-2	User Confirmation	- Confirmation via Email - Confirmation via OTP
FR-3	User Login	- Login with Email/Password - Login via Gmail - Login via LinkedIn
FR-4	Profile Management	- View Profile - Edit Profile Information - Upload Profile Picture - Change Password
<b>FR No.</b>	<b>Non-Functional Requirement</b>	<b>Description</b>
NFR-1	Usability	The user interface should be intuitive, easy to navigate, and responsive across all devices.
NFR-2	Security	All data should be encrypted in transit and at rest. Multi-factor authentication (MFA) should be supported.
NFR-3	Reliability	The system should be highly reliable with a failure rate of less than 0.1%. Daily backups should be maintained.
NFR-4	Performance	The system should load within 3 seconds under normal network conditions.
NFR-5	Availability	The system should maintain 99.9% uptime on a monthly basis.
NFR-6	Scalability	The application should be able to scale horizontally to handle increasing numbers of users without performance degradation.

## 3.4 Technology Stack

### 1. Architecture Overview:

#### Client-Server Architecture (Three-Tier Architecture)

- **Presentation Layer (Frontend):** Handles the user interface and user interactions.
- **Application Layer (Backend):** Handles business logic, authentication, and data processing.
- **Data Layer (Database):** Manages data storage and retrieval.

### 2. Technology Stack:

Component	Technology	Purpose
Frontend	React.js / Next.js / Angular / Vue.js	Build interactive and responsive UI
Mobile App (Optional)	React Native / Flutter	Cross-platform mobile application
Backend	Node.js with Express.js / Django / Spring Boot	API development, business logic
Authentication	Firebase Auth / OAuth 2.0 / JWT	User authentication and authorization
Database	PostgreSQL / MySQL / MongoDB	Persistent data storage
Cloud Hosting	AWS / Google Cloud / Azure / Vercel / Netlify	Deploying frontend/backend applications
CI/CD	GitHub Actions / GitLab CI / Jenkins	Continuous integration & deployment
Version Control	Git (GitHub / GitLab / Bitbucket)	Code versioning and collaboration
Email Service	SendGrid / Mailgun / Firebase	For sending email confirmations
Storage (if needed)	AWS S3 / Firebase Storage	For storing profile pictures or files
Monitoring & Logging	Sentry / LogRocket / New Relic	Error tracking and performance monitoring

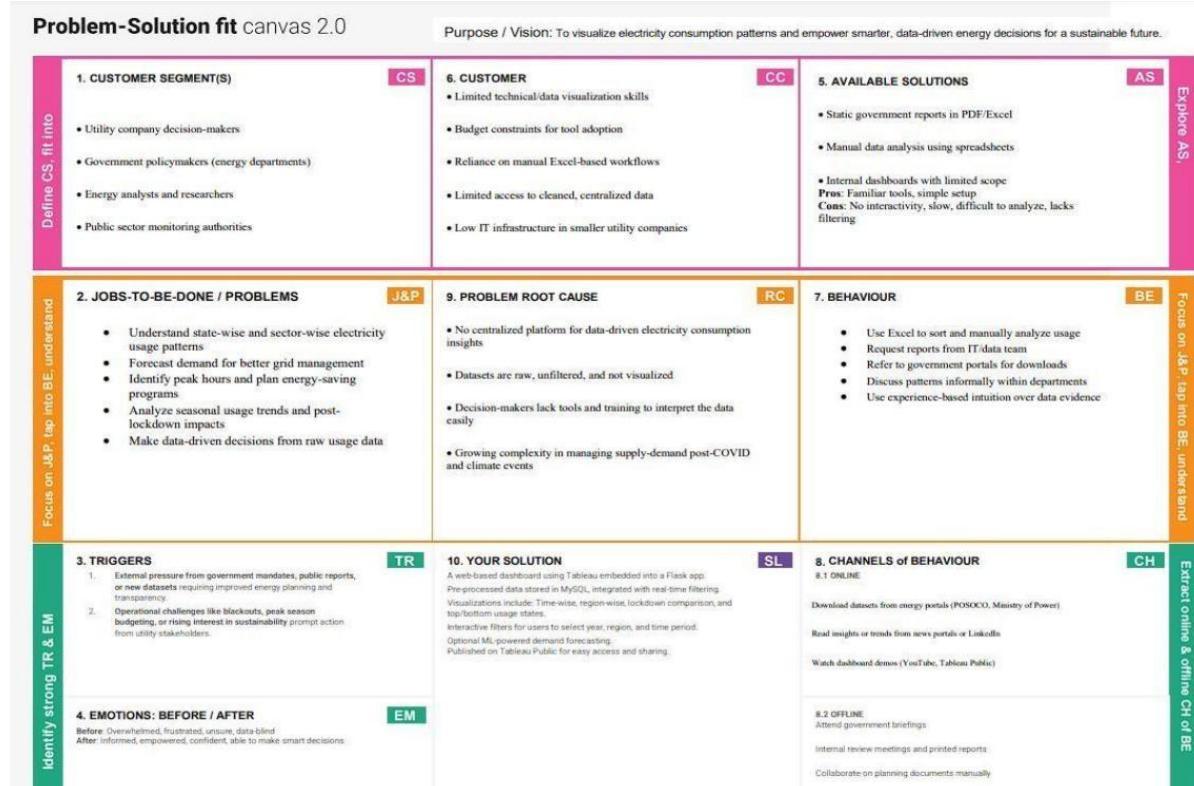
## 4. Project design

### 4.1 Problem Solution Fit

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why.

#### Purpose:

- Solve complex problems in a way that fits the state of your customers.
- Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behavior.
- Sharpen your communication and marketing strategy with the right triggers and messaging.
- Increase touch-points with your company by finding the right problem-behavior fit and building trust by solving frequent annoyances, or urgent or costly problems.
- Understand the existing situation in order to improve it for your target group.



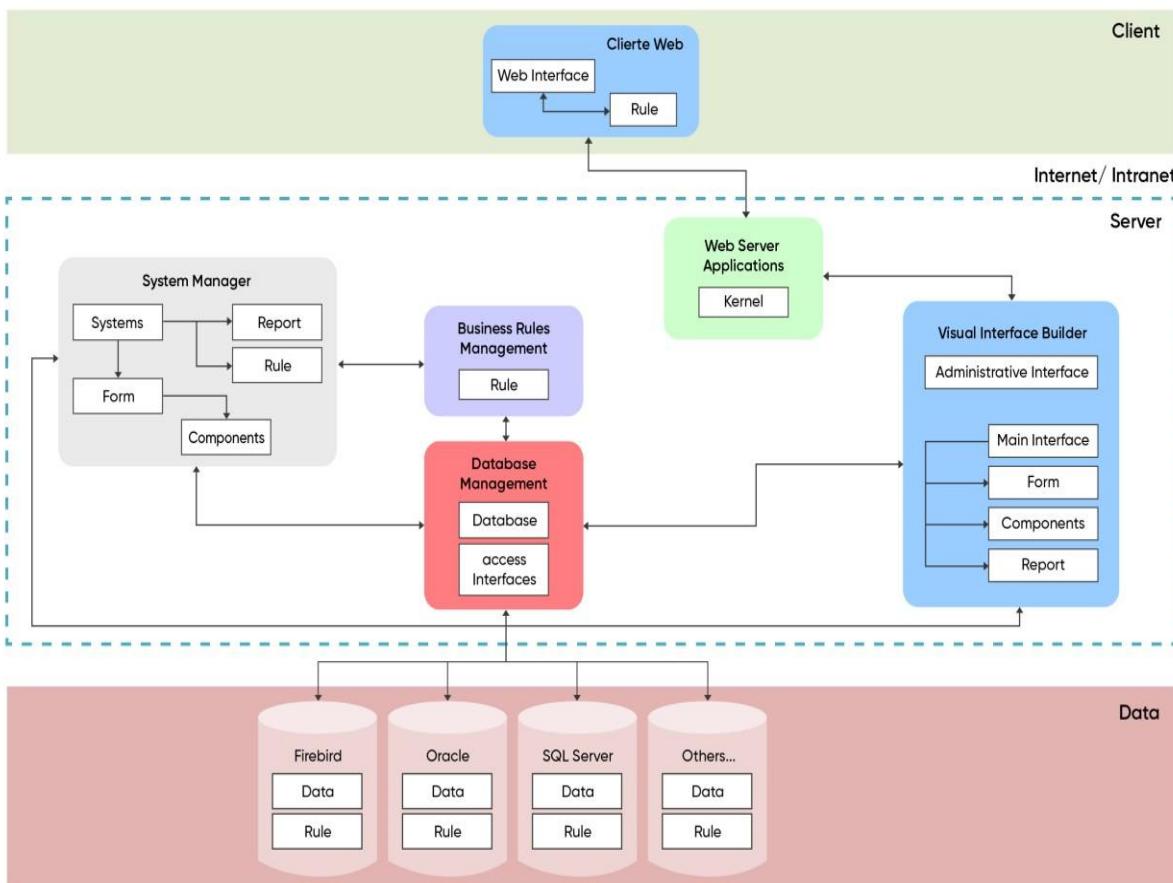
## 4.2 Proposed Solution

### Proposed Solution Template

S. No.	Parameter	Description
1	Problem Statement (Problem to be solved)	<p>There is a lack of an accessible, real-time, and user-friendly platform for analyzing housing market trends. Homebuyers, investors, planners, and policymakers struggle to make data-driven decisions due to fragmented and non-visual data sources.</p>
2	Idea / Solution Description	<p>The proposed solution is an interactive web platform that aggregates housing data from various sources (e.g., Zillow, Census APIs), visualizes pricing and availability trends on maps and charts, and provides predictive analytics to forecast future trends. Users can filter data by location, time range, property type, and more.</p>
3	Novelty / Uniqueness	<p>Unlike typical real estate platforms, this solution focuses on visual intelligence, trend prediction, and open data integration. It combines geospatial visualization (Mapbox/Leaflet), real-time data ingestion, and machine learning models for housing forecasts, delivering more than just static listings.</p>
4	Social Impact / Customer Satisfaction	<p>The platform empowers users to make informed decisions on housing, which is a critical aspect of financial planning and quality of life. It benefits low-income communities by providing free access to housing trends, and helps governments plan infrastructure and housing policies more effectively.</p>
5	Business Model (Revenue Model)	<p>The core platform can be freemium: free for basic features, with premium access for advanced analytics, custom reports, and API access. Revenue can also be generated from B2B partnerships with real estate agencies, urban planning departments, and property developers. Advertisements and sponsorships may also be integrated.</p>
6	Scalability of the Solution	<p>The system is designed using scalable cloud services and modular architecture. It can easily support additional cities, countries, or data types. The backend is capable of processing large datasets, and the frontend is optimized for high-performance rendering even with millions of data points.</p>

### 4.3 Solution Architecture

- The architecture separates data preprocessing, storage, visualization, and UI layers—making it easy to maintain, scale, and enhance.
- Cleaned data from MySQL is visualized using Tableau dashboards, offering region-wise, year-wise, and seasonal insights with filtering capabilities.
- Dashboards are embedded into a Flask-based web interface, allowing end users to interact with visual data through a user-friendly portal.
- The solution supports future extensions like forecasting models and can be deployed locally or on cloud platforms like Heroku or AWS.



## 5. Project planning & scheduling

→ Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection & Extraction	USN-1	As a user, I can collect housing market data from reliable sources, including prices, property types, and trend.	2	High	2
Sprint-1	Data Preprocessing	USN-2	As a user, I can preprocess data to clean and filter out unnecessary information, such as outliers, duplicates, or missing values	3	High	2
Sprint-2	Data Visualization	USN-3	As a user, I can visualize housing trends using charts, graphs, and heatmaps to understand the current market dynamics and pricing fluctuations	3	High	3

Sprint-2	Interactive Dashboard	USN-4	As a user, I can interact with a dashboard that displays live market trends, data filters, and performance insights for better decision-making	2	High	1
Sprint-3	User Stories (Dashboard Views)	USN-5	As a user, I can set custom views of the dashboard to save preferences for quick future reference (e.g., specific locations, budget, etc.)	3	Medium	2
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3	Web Integration	USN-6	As a user, I can integrate the dashboard and data visualizations into a website for online accessibility and usability	2	Medium	1

#### **Project Tracker, Velocity & Burndown Chart: (4 Marks)**

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	5	2 Days	18 Jun 2025	19 Jun 2025	5	19 Jun 2025
Sprint-2	5	3 Days	21 Jun 2025	23 Jun 2025	5	23 Jun 2025
Sprint-3	5	2 Days	24 Jun 2025	25 Jun 2025	5	25 Jun 2025

#### **Velocity:**

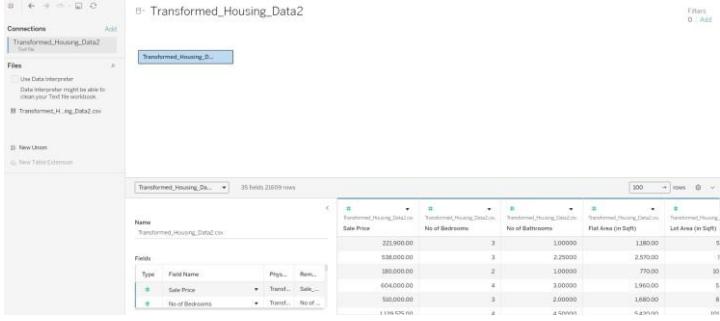
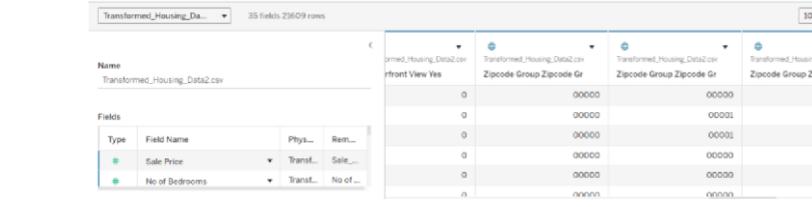
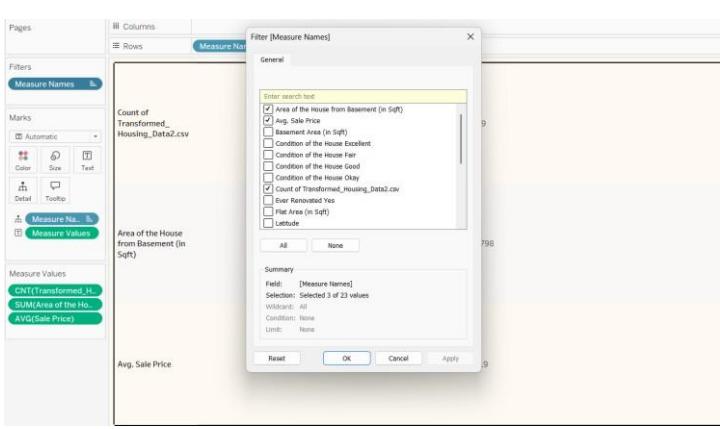
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

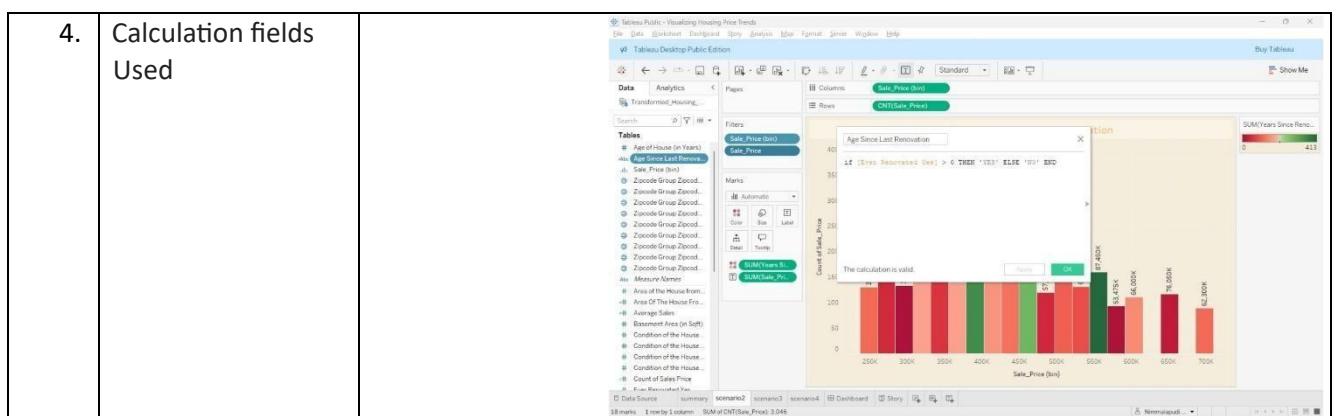
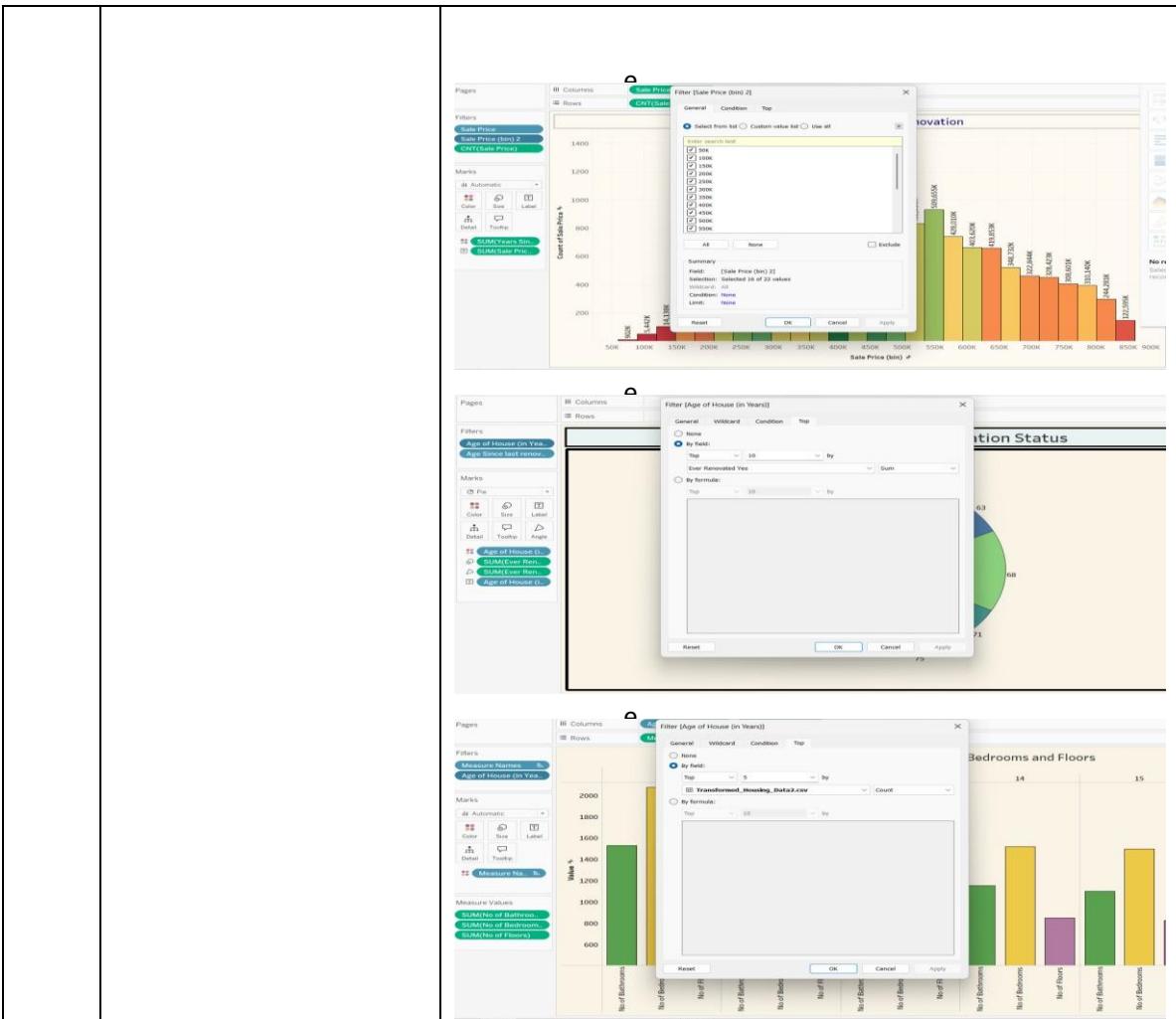
$$AV=15/3=5$$

## **6.Functional and Performance Testing**

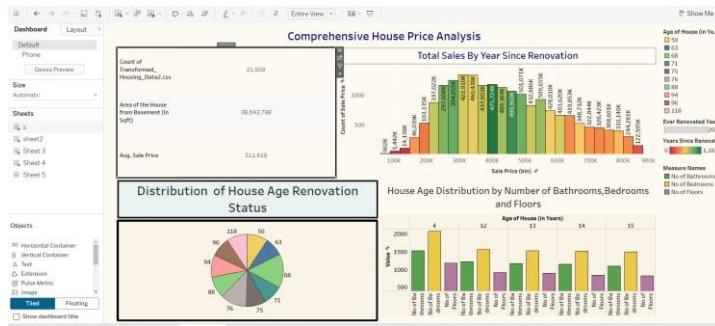
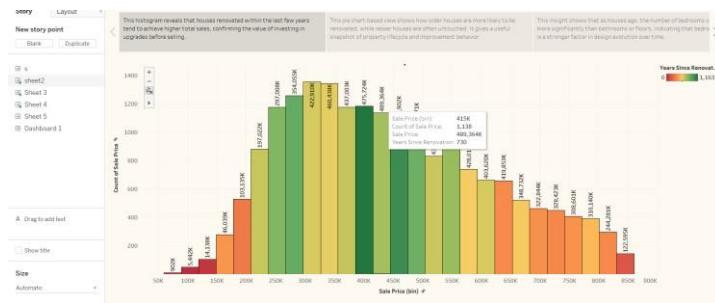
#### **Performance Testing:**

S.No.	Parameter	Screenshot / Values

	<p><b>1. Data Rendered</b></p>	 <p>Contains 35 fields 21609 rows</p>
	<p><b>2. Data Preprocessing</b></p>	 <p>Removed unnecessary columns zipcodes or null values</p>
	<p><b>3. Utilization of Filters</b></p>	 <p>For Scena</p>



#### 4. Calculation fields Used

5.	Dashboard design	 <p><b>Dashboard</b>  <a href="https://public.tableau.com/views/dasboard_17512864065580/Dashboard1?:language=en-US&amp;publish=yes&amp;sid=&amp;:redirect=auth&amp;&amp;:display_count=n&amp;origin=viz_share_link">https://public.tableau.com/views/dasboard_17512864065580/Dashboard1?:language=en-US&amp;publish=yes&amp;sid=&amp;:redirect=auth&amp;&amp;:display_count=n&amp;origin=viz_share_link</a></p>	No of Visualizations / Graphs – 4
6	Story Design	 <p><b>Story</b>  <a href="https://public.tableau.com/views/MyStory_17510922375570/Story1?:language=en-US&amp;publish=yes&amp;sid=&amp;:redirect=auth&amp;&amp;:display_count=n&amp;origin=viz_share_link">https://public.tableau.com/views/MyStory_17510922375570/Story1?:language=en-US&amp;publish=yes&amp;sid=&amp;:redirect=auth&amp;&amp;:display_count=n&amp;origin=viz_share_link</a></p>	No of Visualizations / Graphs – 3

## 7. Results

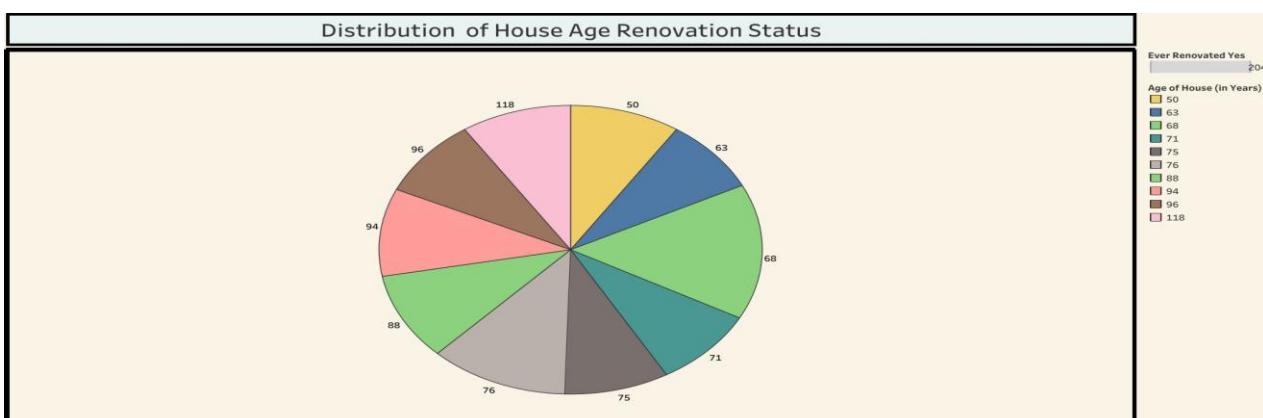


output of scenario 1:

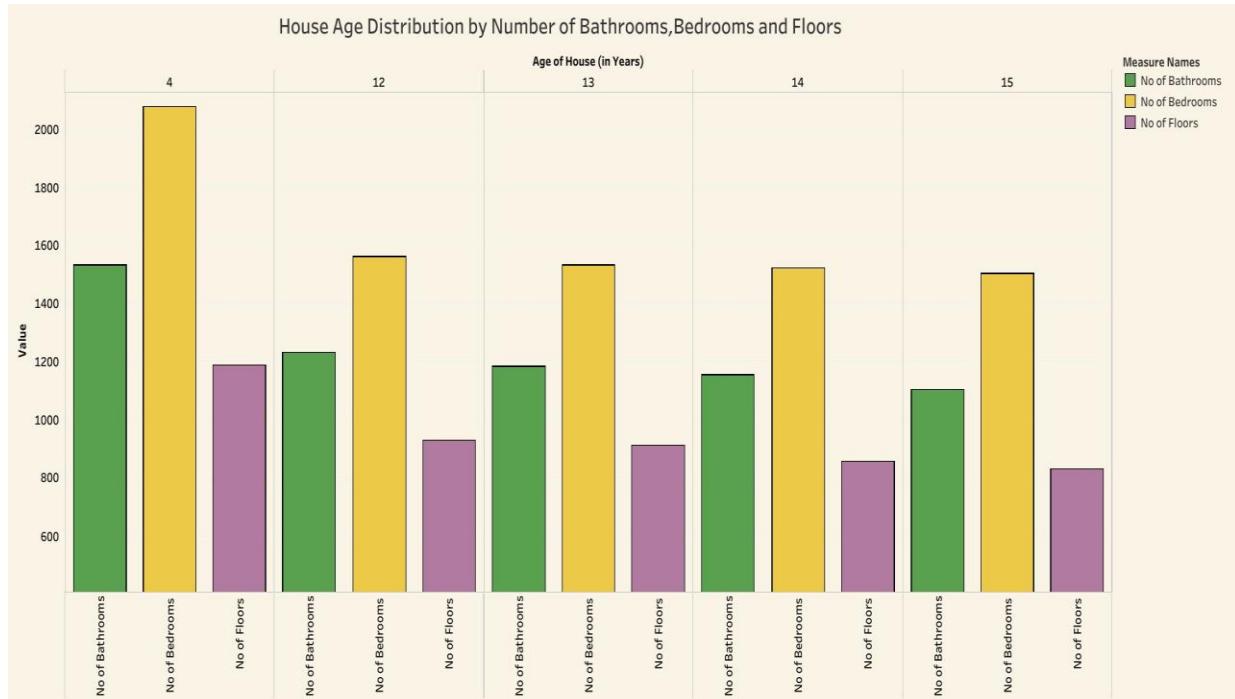


output of Scenario 2:

output of Scenario 3

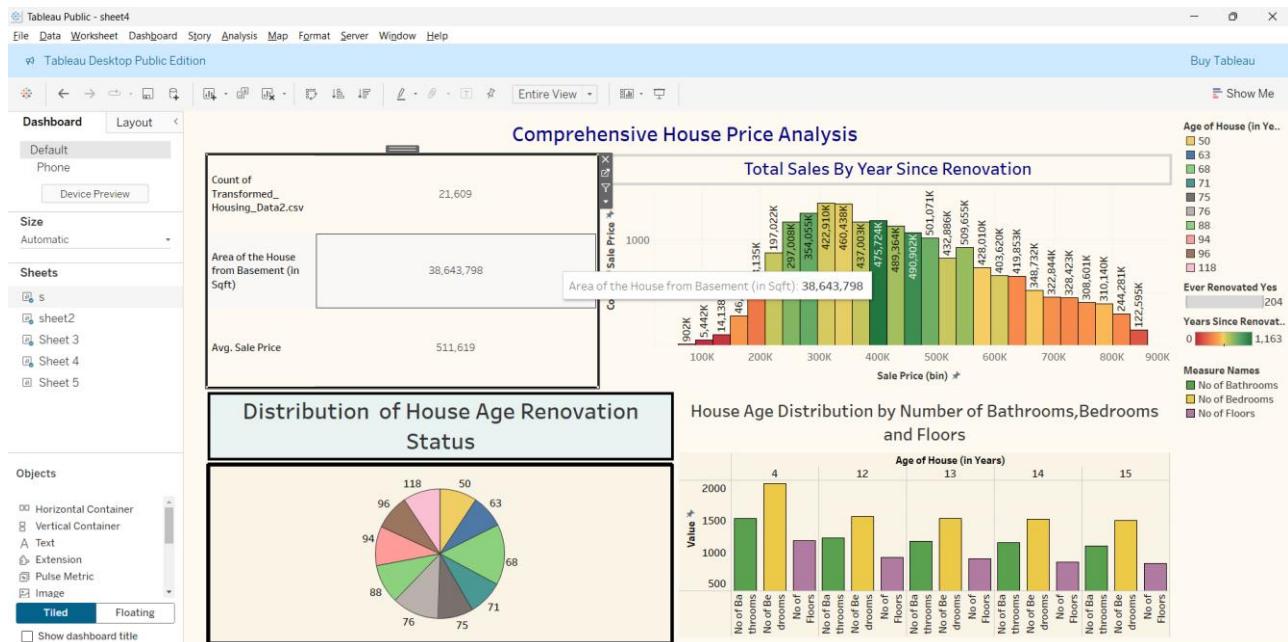


## output of Scenario 4:



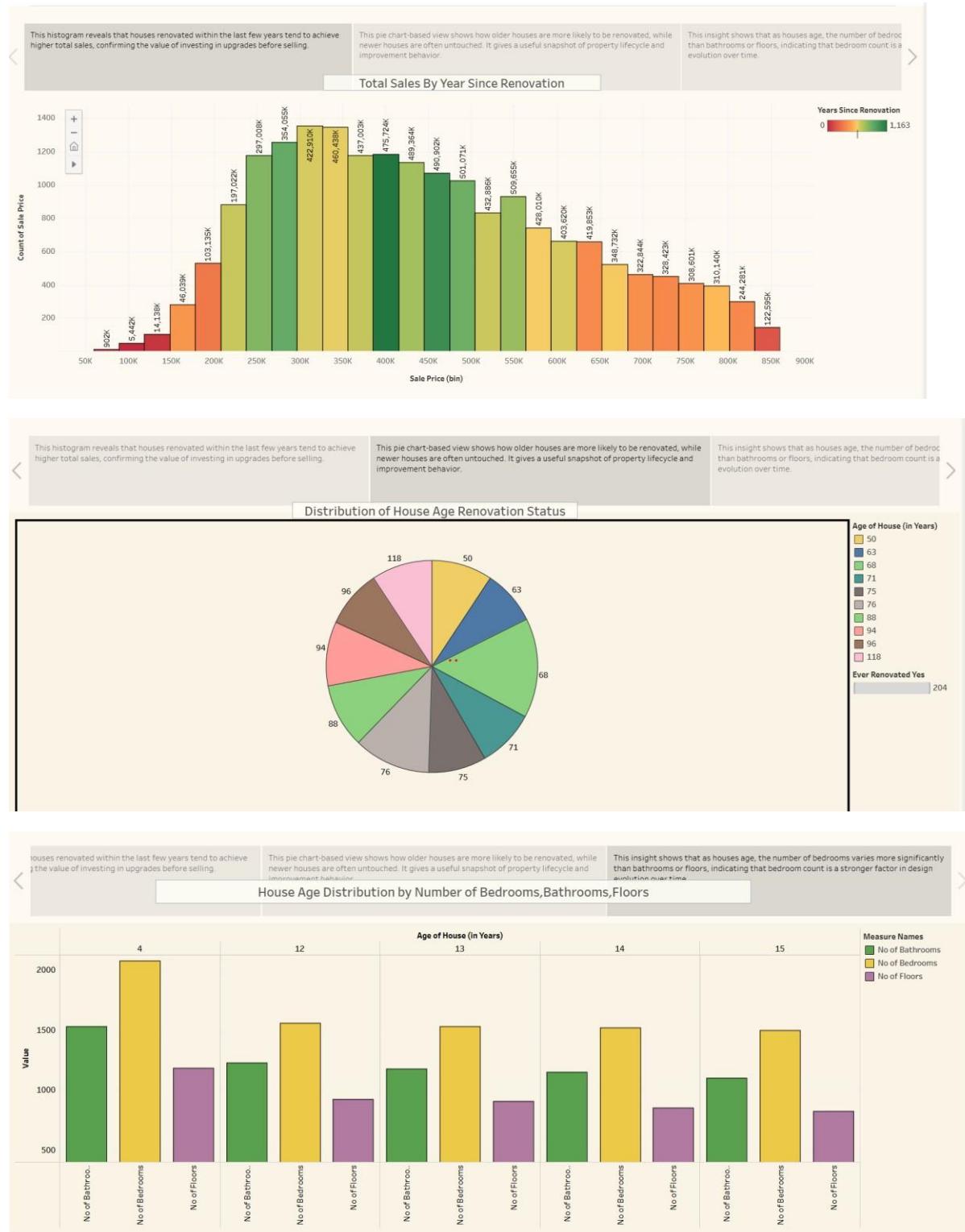
## Dashboard:

[https://public.tableau.com/views/dasboard\\_17512864065580/Dashboard1?:language=en-US&publish=yes&:sid=&:redirect=auth&:&display\\_count=n&:origin=viz\\_share\\_link](https://public.tableau.com/views/dasboard_17512864065580/Dashboard1?:language=en-US&publish=yes&:sid=&:redirect=auth&:&display_count=n&:origin=viz_share_link)



## Story:

[https://public.tableau.com/views/MyStory\\_17510922375570/Story1?:language=en-US&:sid=&:redirect=auth&:display\\_count=n&:origin=viz\\_share\\_link](https://public.tableau.com/views/MyStory_17510922375570/Story1?:language=en-US&:sid=&:redirect=auth&:display_count=n&:origin=viz_share_link)



## **8. Advantages & disadvantages**

### **Advantages:**

#### **1. Interactive Analysis:**

The Tableau dashboard allows users to explore data with filters (e.g., bedrooms, renovation status, price bins), enhancing understanding through dynamic interactions.

#### **2. Informed Decision-Making:**

Buyers, sellers, agents, and investors can make data-driven decisions by identifying which features (e.g., area, renovations, number of floors) impact property value.

#### **3. Data Storytelling:**

The Tableau Story feature presents insights in a sequential, digestible narrative—great for business reports or stakeholder presentations.

#### **4. Geographic Visualization:**

Zipcode grouping allows regional comparison of price trends and property types, revealing market opportunities and local disparities.

#### **5. Calculated Metrics & KPIs:**

Metrics like Average Sale Price and Total Area improve business clarity and enable fast comparisons across categories.

#### **6. Web Accessibility:**

Embedding the dashboard into a Flask web app increases accessibility—users can view it from any browser without needing Tableau Desktop.

#### **7. Modular & Scalable Design:**

The project structure supports additional data (e.g., rental prices, future years), making it expandable to other regions or market conditions.

#### **8. Minimal Coding Required:**

Most of the visualizations are created using Tableau's drag-and-drop interface—making it ideal for analysts without deep programming expertise.

### **Disadvantages:**

#### **1. Static Dataset Limitation:**

The analysis depends on a preloaded CSV file; it doesn't support real-time updates unless integrated with live databases or APIs.

## **2. Tool Dependency:**

The system relies on Tableau Public, which has limitations like no row-level security and requires dashboards to be public.

## **3. Learning Curve for Tableau:**

While Tableau is user-friendly, new users may need time to understand calculated fields, filters, and advanced charting options.

## **4. Limited Predictive Power:**

This is a descriptive and visual analytics project—it does not use machine learning or predictive modeling to forecast housing prices.

## **5. Browser Compatibility:**

Older browsers or low-resolution screens may not render complex dashboards optimally, especially if not designed responsively.

## **6. Manual Data Preprocessing:**

Initial data cleaning, renaming, and transformation were done manually using Python or within Tableau, which might be error-prone at scale.

## **9. Conclusion:**

The project "Visualizing Housing Market Trends: An Analysis of Sale Prices and Features using Tableau" successfully demonstrates how complex real estate data can be transformed into meaningful, interactive visual insights. By leveraging Tableau's powerful visualization capabilities, we have made it easier for buyers, sellers, investors, and analysts to understand the key factors influencing house prices. Our dashboard enables quick comparisons based on features like number of bedrooms, renovations, house age, and geographic location. The integration with Flask provides a seamless web interface, enhancing accessibility and usability. Overall, this project bridges the gap between raw housing data and strategic real estate decision-making, allowing users to gain actionable insights with minimal technical expertise.

## **10. Future scope:**

### **1. Live Data Integration:**

Future versions can integrate live property listings or transaction data via APIs or real-time databases to provide up-to-date market insights.

### **2. Machine Learning Forecasting:**

Incorporating regression models or time-series forecasting can help predict future housing prices based on historical trends and features.

### **3. Rental Market Visualization:**

Extend the dashboard to include rental data analysis, enabling a broader comparison between buying vs. renting decisions.

### **4. Mobile Optimization:**

Responsive design enhancements can be implemented to ensure the dashboard performs well across tablets and smartphones.

### **5. Advanced User Access Control:**

By using Tableau Server or Tableau Online, dashboards can be secured with role-based access for different stakeholders.

## **6. Location Intelligence Enhancements:**

Integration of geospatial data, satellite maps, or demographic overlays can improve locationbased insights (e.g., school zones, crime rates).

## **7. Recommendation Engine:**

Develop a recommendation system to suggest optimal property types using user-input filters.

# **11. Appendix**

## **Dataset Link**

[https://docs.google.com/spreadsheets/d/1blBKrwunCQaiccy5sLP6mG4TsanJkO0C/edit?usp=drive\\_link&ouid=117818466889783119367&rtpof=true&sd=true](https://docs.google.com/spreadsheets/d/1blBKrwunCQaiccy5sLP6mG4TsanJkO0C/edit?usp=drive_link&ouid=117818466889783119367&rtpof=true&sd=true)

## **Project Demo Video Link**

<https://drive.google.com/file/d/1rdKNYVobCVs0dW4LR0dLs9seehRL0JHP/view?usp=sharing>

## **GitHub Repository Link**

<https://github.com/sapare-11/visualizing-housing-market-trends-an-analysis-of-sale-prices-and-features-using-tableau.git>