

SarmayaGhar

Project Team

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Chapter 1

Introduction

SarmayaGhar is a development-based project that makes real estate buying & investing easier and more reliable for people. SarmayaGhar bridges the gap between buyers & investors to get their fair market value share using data-driven tools to analyze property-specific factors and market trends. It eliminates lack of reliability, untrustworthiness, and helping users make informed decisions. It is specifically designed to address these issues that arise in the local real estate market of Pakistan.

1.1 Problem Statement

Take for an instance you have a potential amount to invest in real estate property or a homebuyer who is looking for a house/apartment. With lack of knowledge, insights, recommendations, an investor is at risk of losing their investment (market crash) and a homebuyer might not make the best value purchase. SarmayaGhar incorporates accurate and realistic price predictions with personalized recommendations and data-driven insights to make informed decisions, especially for those who are beginners in the real estate market.

1.2 Scope

The Property Valuation and Investment Platform aims to provide a data-driven approach to accurately assess property values and guide real estate investments. This project will leverage historical price trends, market demand fluctuations, and predictive analytics to precisely predict property prices. By integrating machine learning models, the system will analyze various property-specific characteristics, demand-supply ratio, historical price trends, and external data sources to offer data-backed property recommendations.

The platform will cater to home buyers, real estate investors, and property consultants, providing them with a comprehensive decision-making tool. The system will allow users to filter properties based on budget, expected return on investment, and long-term growth potential. The scope of this project will focus on price estimation, investment analysis, rental calculations & ROIs, geospatial data analysis, and personalized user interactions to ensure that users make well informed decisions in the dynamic real estate market.

1.3 Modules

1.3.1 AI-Powered Property Valuation Module

This module provides property price predictions using machine learning models trained on property-specific and historical price data. It analyzes features such as location, size, number of rooms, property type, amenities, and other external features to estimate property values.

1. **Price Prediction:** Generate accurate and realistic property price estimates using regression models.

1.3.2 Rental Yield Estimation & ROI Module

This module calculates potential rental income for properties based on historical rental data and market conditions. It helps investors maximize ROI on rental properties.

1. **Rental Yield:** Estimate rental yields using predicted property prices
2. **ROI Calculation:** Provide ROI estimates for rental properties.

1.3.3 Interactive Heatmap Module

This module visualizes high-ROI areas and market trends using geospatial data. It helps users identify lucrative investment opportunities.

1. **Geospatial Analysis:** Analyze location-based data to identify trends.
2. **Heatmap Visualization:** Display high-ROI areas on an interactive map.

1.3.4 Portfolio Management Module

This module allows users to track and manage their real estate investments in one place. It provides insights into portfolio performance and suggests optimization strategies.

1. **Portfolio Tracking:** Monitor property values and rental income.
2. **Performance Analytics:** Analyze portfolio performance over time.
3. **Optimization Suggestions:** Provide strategies & recommendations to maximize ROIs.

1.3.5 Market Crash & Boom Prediction

1. AI forecasts upcoming market trends using economic indicators.
2. Provides alerts for potential market crashes or booms.

1.3.6 AI Chatbot Module

This module provides instant property advice and recommendations via a conversational interface. It uses NLP to understand user queries and generate responses.

1. **Query Processing:** Understand and process user queries using NLP.
2. **Personalized Recommendations:** Provide tailored property suggestions.
3. **Real-Time Responses:** Generate instant, data-driven responses to user questions.

1.4 User Classes and Characteristics

Identify the various user classes that you anticipate will use this product, and describe their pertinent characteristics.

User class	Description
Home Buyers and Investors	Individuals looking for properties for personal use or investment. These users rely on the platform to explore property listings, compare market prices, and assess investment potential through data-driven insights and valuation models.
Real Estate Agents	Professionals who list and sell properties on behalf of clients. These users use the platform to manage listings, provide property valuations, and generate market reports for their clients. The system helps agents by offering automated pricing suggestions and investment analysis to enhance their sales process.
Real Estate Developers	Companies or individuals involved in building and selling properties. Developers use the platform to evaluate market trends, price their properties competitively, and attract potential buyers through investment insights and demand forecasting.
Technical Team (Developers & IT Support)	System administrators responsible for maintaining the platform's infrastructure, ensuring seamless data integration, and improving system performance. These users focus on database management, implementing AI-driven valuation models, and ensuring a smooth user experience through regular updates and security enhancements.

Example: User Classes and Characteristics

Chapter 2

Project Requirements

This chapter describes the functional and non-functional requirements of the project.

2.1 Use-case Diagram

A Use-Case Diagram with Detailed Use Cases is the best choice for our project as our platform involves multiple users interacting with different system features.

<1.1 Use Case Name> for System X

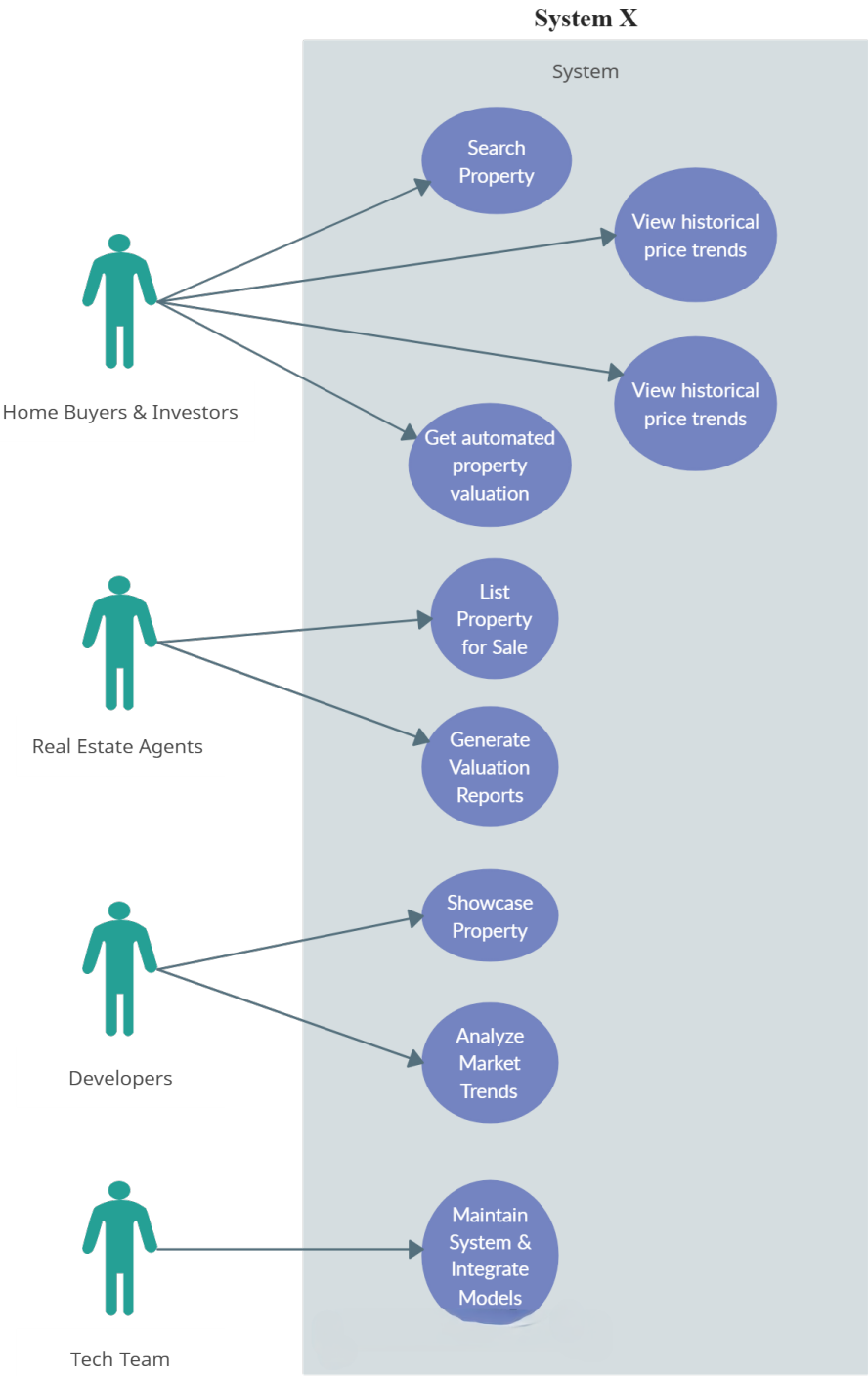


Figure 2.1: Use Case Diagram

2.2 High Level Use Cases

The high-level use cases for SarmayaGhar based on the analysis and workflow are mentioned:

2.2.1 User Registration and Authentication

- **Actors:** Home buyers, renters, real estate agents, developers

Precondition: The user must have access to the platform (web, mobile, or VR system).

- **Description:** Users can create an account by providing personal details (name, email, and password). After registration, users can log in to access the platform.

- **Main Success Scenario:**

- The user provides valid registration details.
- The system verifies and stores user information.
- The user successfully logs in.

- **Alternate Scenarios:**

- Registration with invalid information results in a failure message.
- Failed login attempts after multiple tries prompt the user to reset their password.

- **Postcondition:** Users gain access to the system's features (e.g., property recommendations, AI chat assistance).

2.2.2 Property Search and Filtering

- **Actors:** Home buyers, renters, investors

- **Precondition:** The user must be logged into the system.

- **Description:** Users can search for properties based on various filters like location, price range, property type, and amenities. AI-powered recommendations assist users in finding the best-matching properties.

- **Main Success Scenario:**

- The user enters search criteria.
- The system retrieves and displays relevant properties.
- The user refines the search results using filters.

- **Alternate Scenarios:**

- No matching properties are found, and AI suggests similar alternatives.
- The user enters incomplete or incorrect filters, and the system prompts corrections.

- **Postcondition:** The user views a list of relevant properties and can select properties for further exploration.

2.2.3 AI-Powered Property Valuation

- **Actors:** Home buyers, investors, real estate agents

- **Precondition:** The user selects a property for valuation.

- **Description:** AI analyzes property data (historical price trends, location, amenities, market demand) to generate an estimated valuation.

- **Main Success Scenario:**

- The user requests a property valuation.
- The AI model processes property data and market trends.
- The system displays an estimated property value with a confidence score.

- **Alternate Scenarios:**

- Insufficient property data results in a request for additional inputs.
- The AI valuation suggests alternative investment opportunities if the price is unstable.

- **Postcondition:** The user receives an AI-driven valuation, aiding in decision-making.

2.2.4 AI Chatbot Assistance

- **Actors:** Home buyers, renters, real estate agents
- **Precondition:** The user accesses the AI chatbot for property-related queries.
- **Description:** The AI chatbot provides real-time assistance, answering user queries on property listings, pricing, and investment insights.
- **Main Success Scenario:**
 - The user asks a property-related question.
 - The AI chatbot retrieves and presents relevant information.
 - The user receives recommendations or next-step guidance.
- **Alternate Scenarios:**
 - The chatbot fails to understand the query, prompting the user to rephrase.
 - The chatbot escalates complex queries to a human agent.
- **Postcondition:** The user receives AI-driven guidance for property-related decisions.

2.2.5 Rental Yield and ROI Calculation

- **Actors:** Home buyers, investors, real estate agents
- **Precondition:** The user selects a property for investment analysis.
- **Description:** The system calculates rental yield and return on investment (ROI) based on rental income, purchase price, and market trends.
- **Main Success Scenario:**
 - The user inputs property price, expected rental income, and other details.
 - The AI model calculates rental yield and ROI.
 - The system displays a detailed financial breakdown.
- **Alternate Scenarios:**
 - Missing or incorrect financial details prompt the user to re-enter values.
 - The system suggests alt properties with better ROI if the selected one is suboptimal.
- **Postcondition:** The user receives an AI-driven financial analysis for investment decisions.

2.2.6 Interactive Market Heatmaps

- **Actors:** Home buyers, investors, real estate agents
- **Precondition:** The user accesses the market insights dashboard.
- **Description:** The system visualizes market trends using heatmaps, showing demand, pricing fluctuations, rental hotspots, and growth potential in different areas.
- **Main Success Scenario:**
 - The user selects a region on the map.
 - The system overlays heatmap data, displaying real estate insights.
 - The user analyzes market demand and price trends.
- **Alternate Scenarios:**
 - Insufficient market data results in a general summary instead of heatmap details.
 - The user refines the filters to see more specific data points.
- **Postcondition:** The user gains data-driven insights for property investment decisions.

2.3 Functional Requirements

This section describes the functional requirements of the system expressed in the natural language style. This section is typically organized by feature as a system feature name and specific functional requirements associated with this feature. It is just one possible way to arrange them. Other organizational options include arranging functional requirements by use case, process flow, mode of operation, user class, stimulus, and response depend on what kind of technique has been used to understand functional requirements. Hierarchical combinations of these elements are also possible, such as use cases within user classes.

2.3.1 Module 1: AI-Powered Property Recommendations

Following are the requirements for module 1:

1. The system should use machine learning algorithms to analyze user preferences and suggest relevant properties.
2. The recommendation engine should consider factors such as location, budget, past searches, saved properties, and market trends.

3. The AI should continuously learn and refine recommendations based on user behavior.
4. Users should be able to like, save, or dismiss recommendations, which should affect future suggestions.

2.3.2 Module 2: AI Chatbot

Following are the requirements for module 2:

1. The system should provide an AI-powered chatbot to assist users in searching for properties, answering FAQs, and scheduling visits.
2. The chatbot should process natural language queries and provide real-time responses.
3. Users should be able to request investment insights and get recommendations via the chatbot.
4. The chatbot should connect users to real estate agents if they need human assistance.

2.3.3 Module 3: Interactive Market Heatmaps & Investment Insights

Following are the requirements for module 3:

1. The system should generate heatmaps showing high-demand areas, price fluctuations, and rental yields.
2. The system should allow users to filter heatmaps by property type, price range, and neighborhood growth rate.
3. Users should receive ROI predictions and insights on investment potential using real-time data.
4. The system should allow users to compare multiple properties based on their investment potential.

2.4 Non-Functional Requirements

This section specifies nonfunctional requirements. These quality requirements should be specific, quantitative, and verifiable. The following are some examples of documenting guidelines.

2.4.1 Reliability

The platform should notify users within 5 minutes in case of critical failures or downtime.

2.4.2 Usability

USE-1: The platform shall allow users to search for properties using filters (location, price, property type, rental yield, ROI, etc.) with minimal effort.

USE-2: The system shall provide interactive heatmaps to display real-time market trends, making it easy for users to analyze investment opportunities.

USE-3: The platform should have a guided onboarding process that helps new users understand features within 2 minutes.

USE-4: The system shall offer real-time chat support for users needing assistance.

2.4.3 Performance

The real-time analytics dashboard should refresh every 10 seconds to provide up-to-date investment insights.

The system should have an API response time of less than 500ms for third-party integrations.

2.4.4 Security

1. The platform shall support multi-factor authentication (MFA) to enhance user account security.

2. The platform shall ensure that all user and transaction data is encrypted both at rest and in transit using industry-standard encryption protocols.

2.5 Domain Model

Create a representation of the domain model for your project.

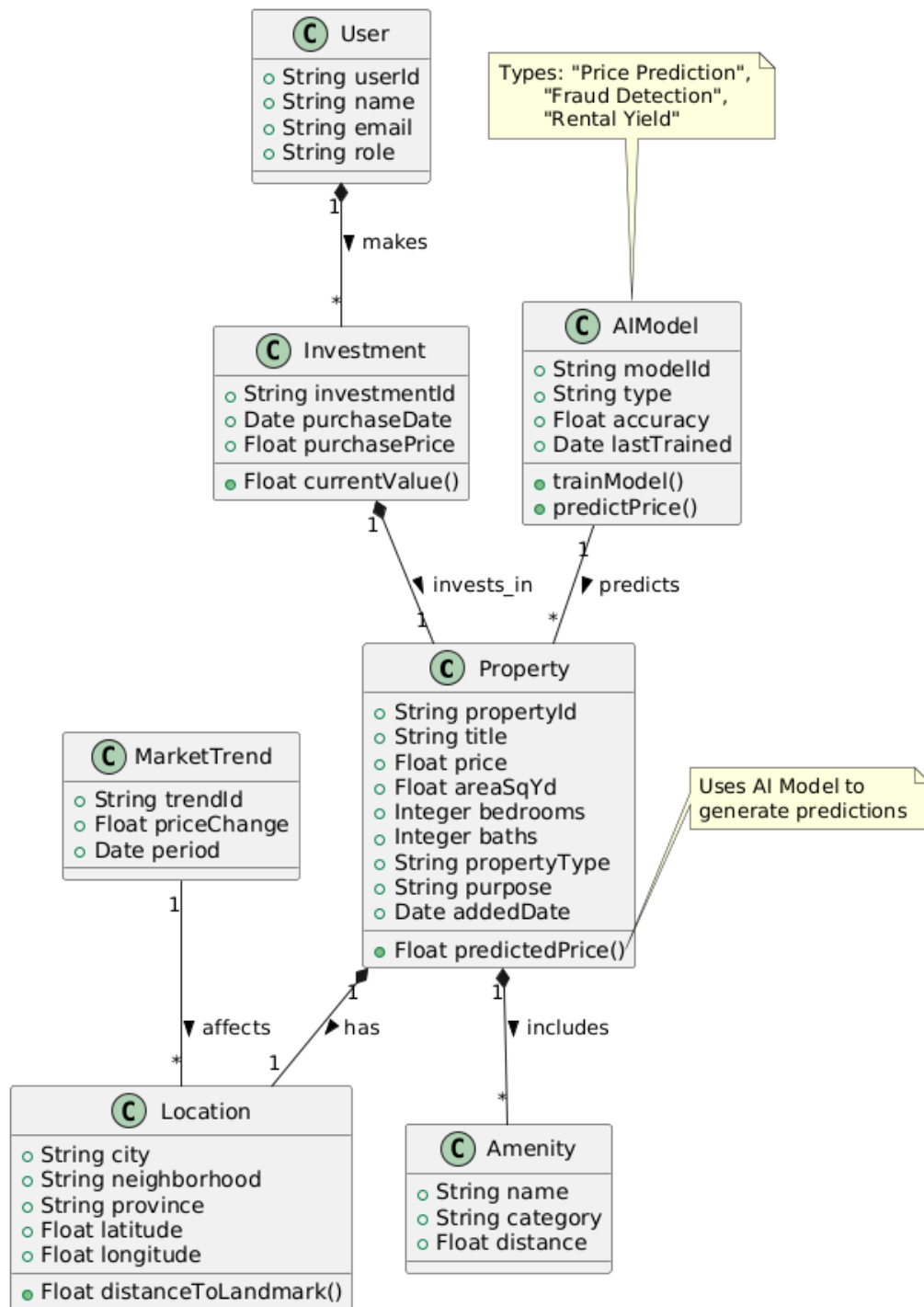


Figure 2.2: Domain Model

Chapter 3

System Overview

Give a general description of the functionality, context, and design of your project. Provide any background information if necessary.

3.1 Architectural Design

The system adopts a layered architecture to ensure scalability, maintainability, and clear separation of concerns. Each layer has distinct responsibilities and communicates through well-defined interfaces, enabling modular development and dynamic data processing.

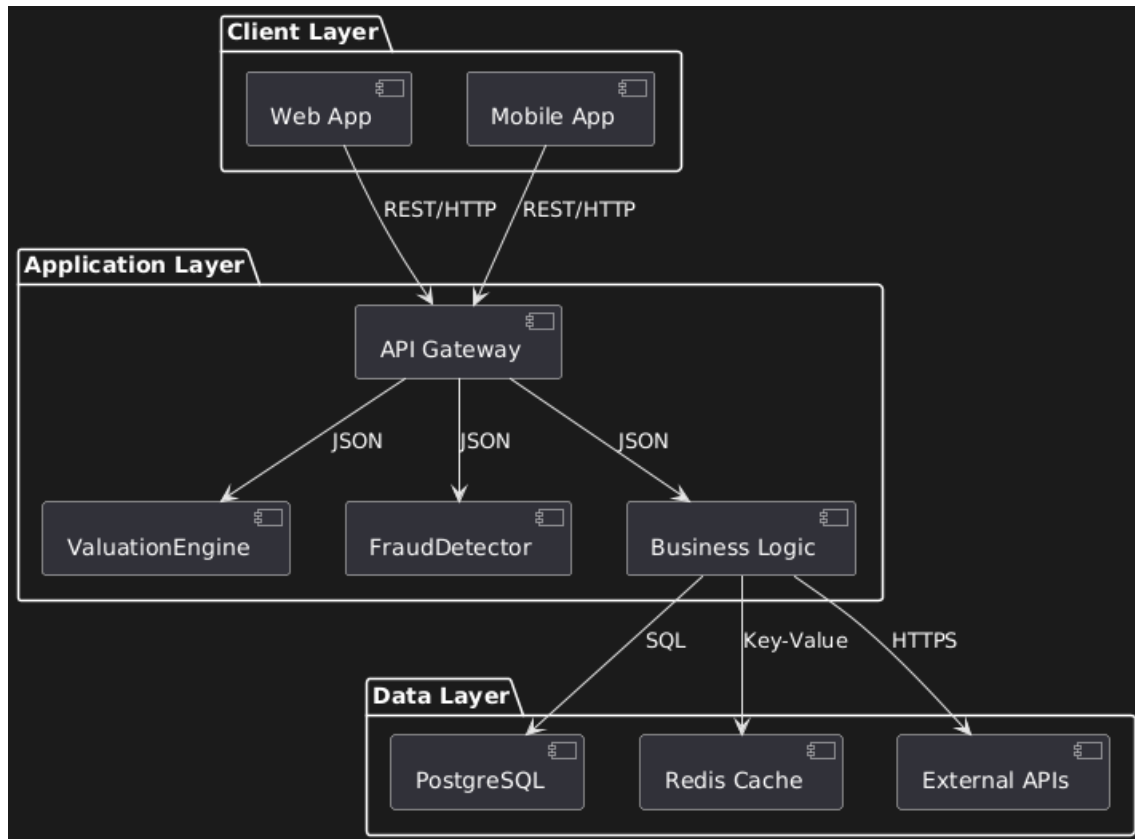


Figure 3.1: Architectural Design

3.2 Design Models

Create design models as are applicable to your system. Provide detailed descriptions with each of the models that you add. Also ensure visibility of all diagrams.

Design Models for Object Oriented Development Approach

3.2.1 Activity Diagrams

- Activity Diagram 1

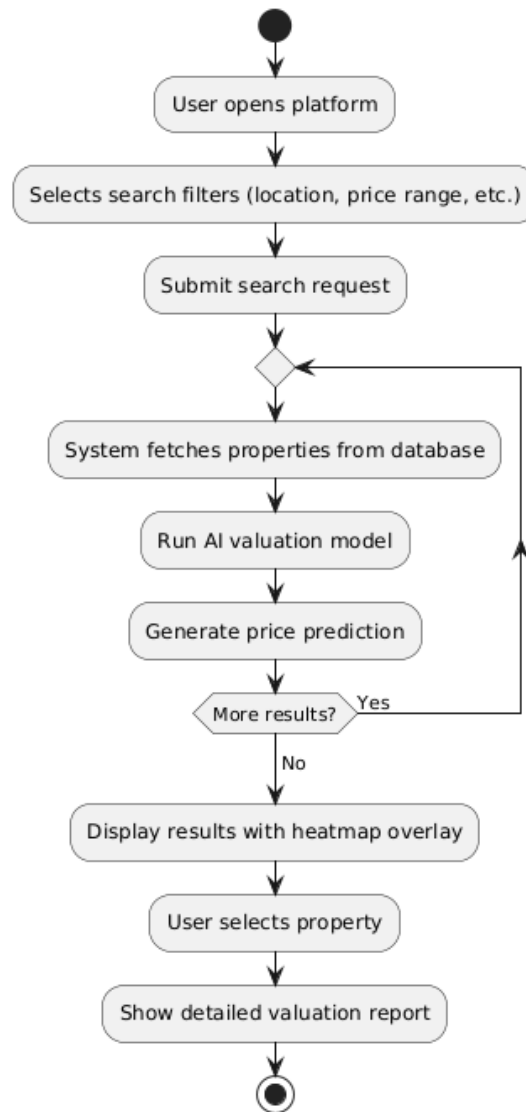


Figure 3.2: Activity Diagram 1

- Activity Diagram 2

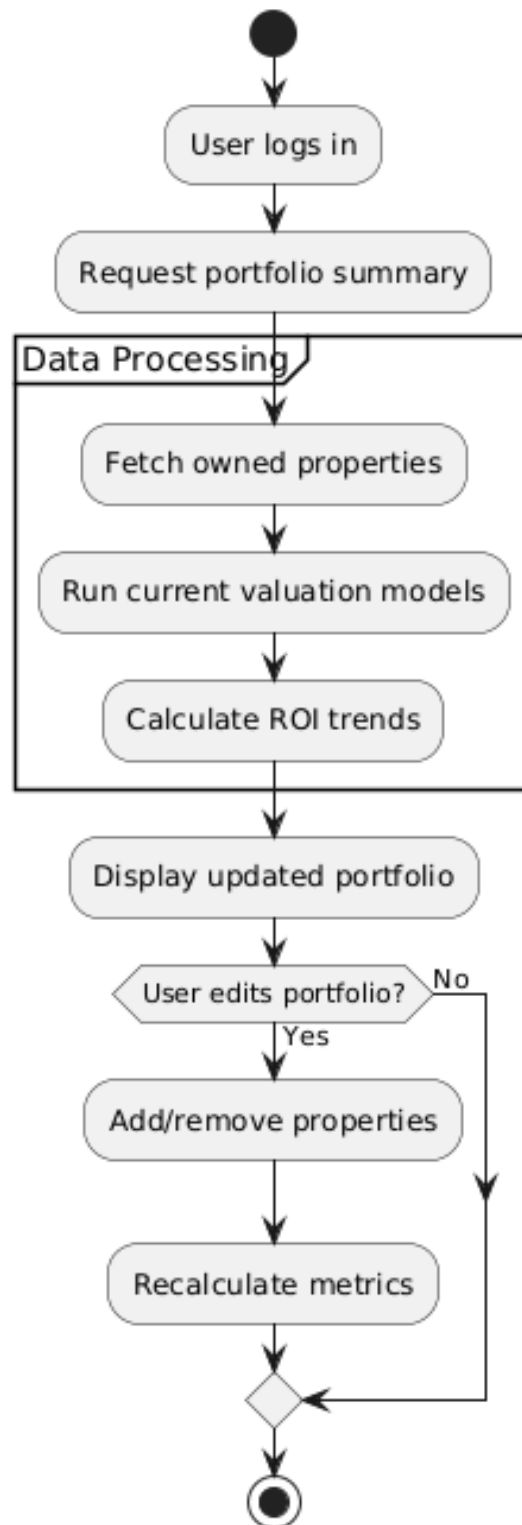


Figure 3.3: Activity Diagram 2

- Activity Diagram 3

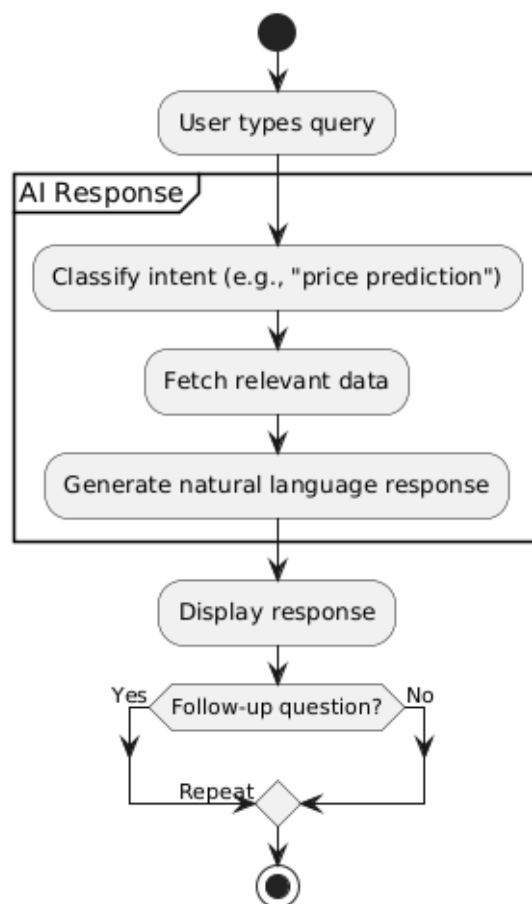


Figure 3.4: Activity Diagram 3

3.2.2 Class Diagram

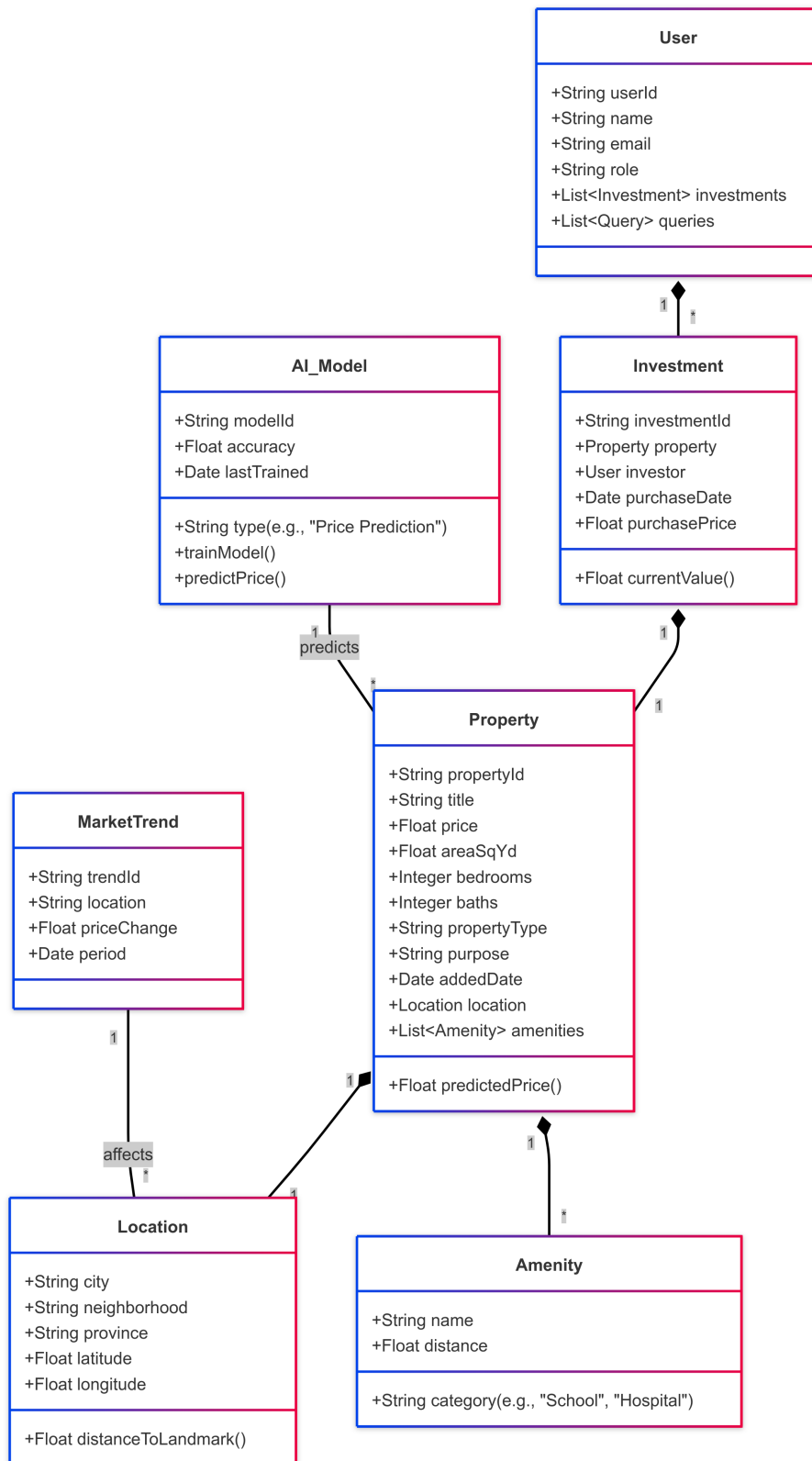


Figure 3.5: Class Diagram

3.2.3 Class-level Sequence Diagram

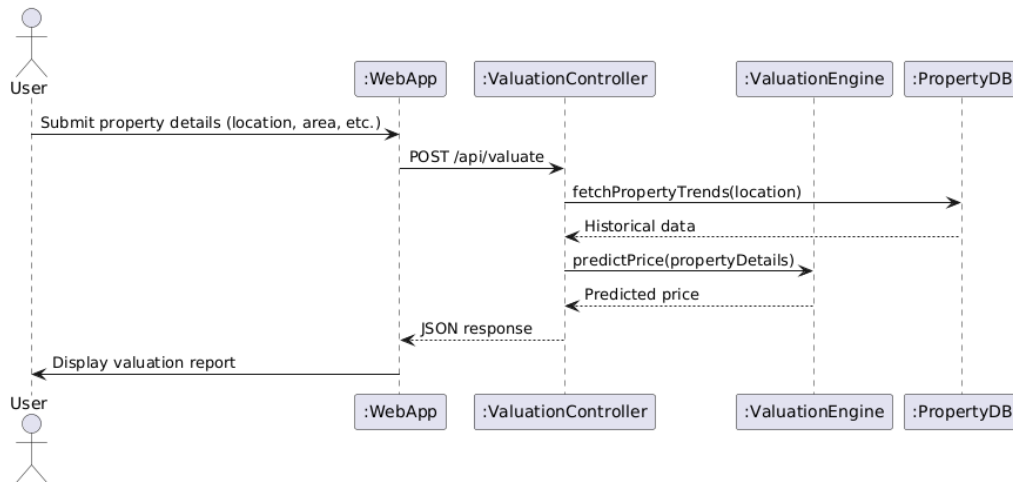


Figure 3.6: Sequence Diagram 1

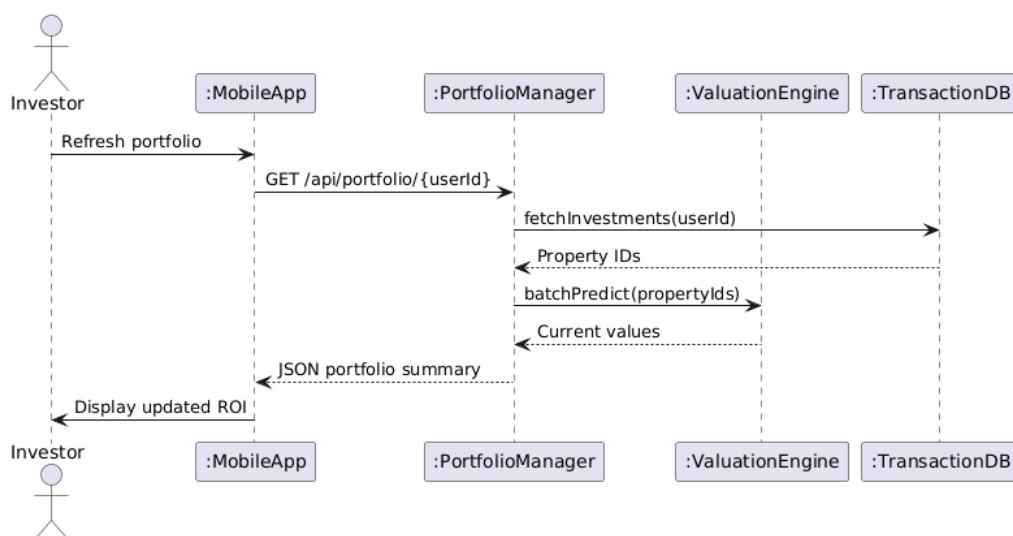


Figure 3.7: Sequence Diagram 2

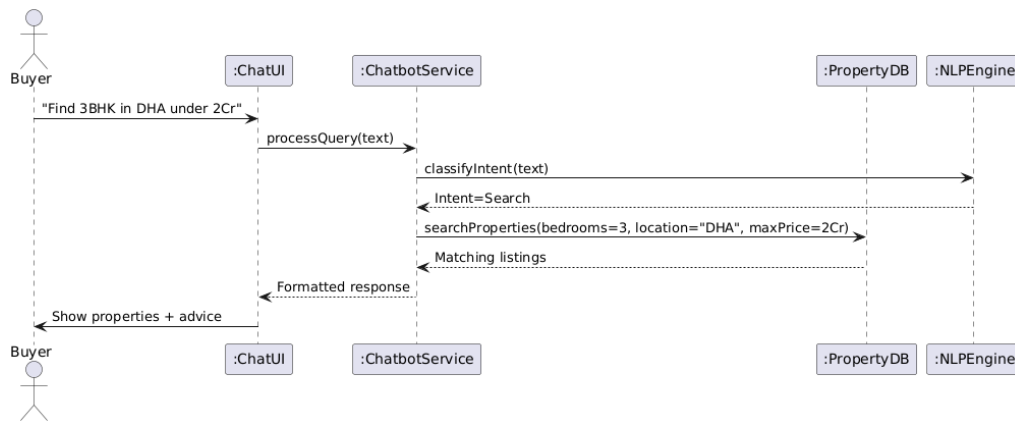


Figure 3.8: Sequence Diagram 3

3.3 Data Design

The data design for the AI-Powered Real Estate Agent platform focuses on efficiently managing property listings, user interactions, financial transactions, and AI-driven insights. The system utilizes a relational database (PostgreSQL) for structured data like user accounts and transactions, while NoSQL databases (MongoDB) handle unstructured data such as images and chat logs. Google Cloud Storage stores high-resolution property images and interactive heatmaps. The platform incorporates machine learning models to analyze historical price trends, predict future valuations, and generate investment insights. Additionally, real-time data processing supports dynamic rental yield and ROI calculations and personalized property recommendations, ensuring a seamless and intelligent real estate experience.

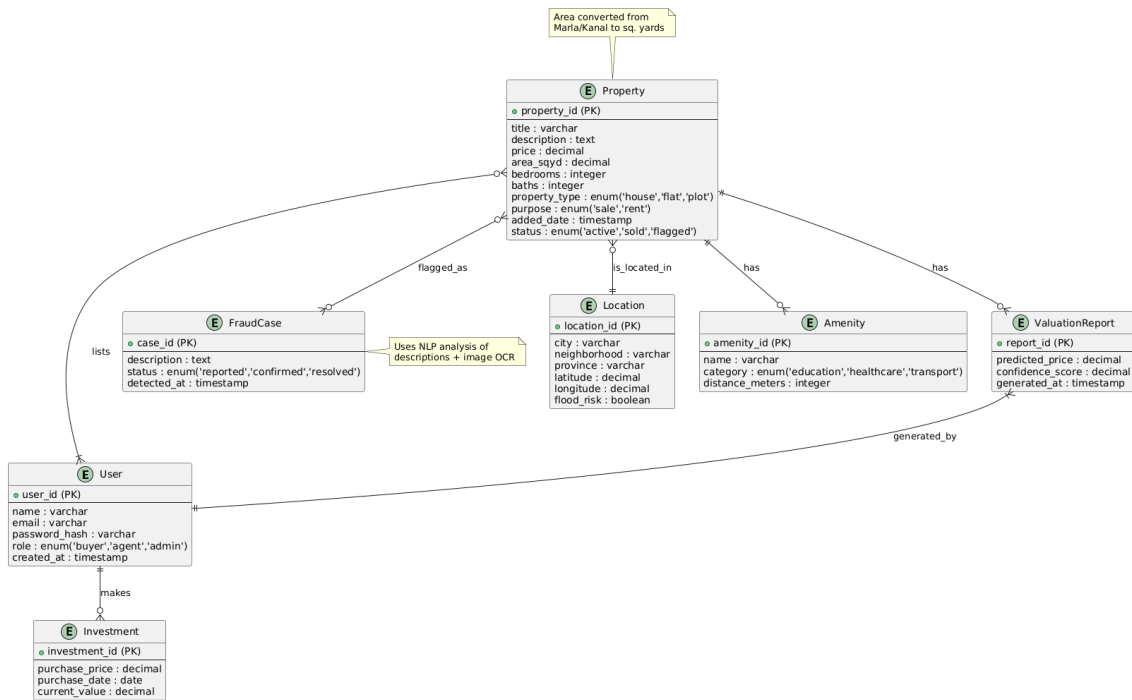


Figure 3.9: Entity Relationship Diagram

Bibliography