Home Metrics

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ABSTRACT

HOME METRICS

In Pakistan, Real Estate Industry is worth around $700 billion and total number of big investors in Pakistan is 2608 but a unique aspect of Pakistan's real estate market is that the industry hits record highs and lows within a span of a few years. Elsewhere in the world, the real estate industry more or less follows a steady growth rate. So, due to the lack of knowledge about market position and variation in prices of properties of different areas, many investors lose their money in property business.

Home Metrics is a web application which helps investors, property dealers and home owners and buyers to analyze the property trends in Islamabad. It predicts the future prices based on location, area and previous prices. With the future price prediction investors have an idea where to invest the money and lessen the risk of money loss. Investors can also create their portfolio and add details of their properties in Home Metrics and it will display the current prices and estimates the future prices with the ROI of their properties. Different algorithms of Data Mining, Artificial Intelligence and Machine Learning are used to predict the future price. Home Metrics responds within 5 seconds. Depending upon the available data Home Metrics is capable of predicting future prices and ROI with 75% accuracy.

CERTIFICATE FOR CORRECTNESS AND APPROVAL

It is certified that work contained in the thesis – Home Metrics carried out by Muhammad Awwab Tahir, Amna Shaur, Haroon Khurshid, Jawad Ismail under supervision of Asst. Professor Athar Mohsin for partial fulfillment of Degree of Bachelor of Software Engineering is correct and approved.

Approved By

Asst.Professor Athar Mohsin

Department of CSE, MCS

Dated: _____ **_____**

Declaration

No portion of the work presented in this dissertation has been submitted in support of another award or qualification either at this institution or elsewhere.

Dedication

In the name of Allah, the Most Merciful, the Most Beneficent.

To our parents, without whose unflinching support and unstinting cooperation, a work of this magnitude would not have been possible.

To our supervisor Asst.Professor Athar Mohsin who has given us great support and valuable suggestions throughout the implementation process.

To our Friends and siblings who encourage us.

ACKNOWLEDGEMENT

There is no success without the will of ALLAH Almighty. We are grateful to ALLAH, who has given us guidance, strength and enabled us to accomplish this task. Whatever we have achieved, we owe it to Him, in totality. We are also grateful to our parents and family and well-wishers for their admirable support and their critical reviews. We would like to thank our supervisor Asst.Professor Athar Mohsin, for his continuous guidance and motivation throughout the course of our project. Without his help we would have not been able to accomplish anything.

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Chapter 1 Introduction

1.1. Overview

Home Metrics is basically built to help the people who intend to invest their money in real estate properties and don't know where to invest as there is a lot of fluctuation of prices. Usually, they invest their money anywhere without any knowledge of future market trends and then land in the situation where they have a lot of properties but of no use. This project will help them know about properties having better future.

1.2. Problem Statement

A unique aspect of Pakistan's real estate market is that the industry hits record highs and lows within a span of a few years. Elsewhere in the world, the real estate industry more or less follows a steady growth rate. So, due to the lack of knowledge about market position and variation in prices of properties of different areas, many investors lose their money in property business. Most of the time, investors make bad investing decisions which leads to the loss of money and time. Money can be stuck in properties and it gets extremely difficult to liquidate it. The biggest nightmare of investors is having a lot of property with no use. i.e. no one wants to buy them.

1.3. Approach

MEAN stack is used to develop the project. Mongodb is used as database which is hosted on cloud at mlab.com. For backend, express server from nodejs is used which acts as an

API. Angular 5 is used to manipulate the frontend which provides single page application (SPA) interface which makes user interface easy to use and beautiful.

Data is scraped from real estate listing website and stored in database. The data is cleaned and maintained. We have applied machine learning algorithm to manipulate the data and also, math functions to calculate different factors.

1.4. Scope

The project Home Metrics will help the investor of Islamabad to find the available property for better investment. The project has many modules like Data Scraper, CSV cleaner, Database and Predictor. First module will acquire the data to process from existing real estate websites, second module will process and clean the noisy data then data will be stored in third one and forth module have the prediction algorithms. The investor can login and create investment portfolio by adding properties with their price, location and area and Home Metrics will display the estimated future price and ROI.

1.5. Objectives

The main objective is to ease the investor life and help him to decide where to invest the money. Following objectives that are kept in mind:

- Display the area wise property graphs for different locations
- Predict the estimated future prices of properties
- Display the contact numbers of property dealers of specific location
- Help investors to develop their own real estate portfolio

During the course of this project, all the aspects of software engineering are covered i.e. survey and feasibility analysis, requirement gathering, architectural and detailed design, implementation and testing along with documentation (SRS, SDS, Test Document). Students are also expected to develop extensive knowledge and technical skills in the following fields:

- Angular 5
- NodeJs
- Mongodb
- TypeScript
- JavaScript
- HTML
- CSS

1.6. Deliverables

Sr	Tasks	Deliverables
1	Literature Review	Literature Survey
2	Requirements Specification	Software Requirements Specification document (SRS)
3	Detailed Design	Software Design Specification document (SDS)
4	Implementation	Project demonstration
5	Testing	Evaluation plan and test document
6	Deployment	Complete application with necessary documentation

Table 1.1

1.7. Overview of Document

This document serves the purpose of providing information needed to adequately design and implement Home Metrics that is a web application which is operating system independent. This document describes the overall description, system features and functional and non-functional requirements of Home Metrics. It starts with the system architecture which highlights the modules of the software. Further we discuss the dependencies of the system and its relationship with other products and the capacity of it to be reused. Then towards the end we shall discuss the Design Tradeoffs.

1.7.1. Purpose

This document aims to elaborate the purpose and features of the system, idea and design, the interfaces of the system, what the system will do, the constraints under which system must operate and how the system will react. This document is intended for both the stakeholders and the developers of the system. This project is basically a baseline work for further research that is ultimately helpful in real estate industry.

1.7.2 Document Conventions

The document is based on a standard IEEE format. This document follows a convention that involves bold-facing of headings, the use of indentions and numbering for major parts and subparts.

1.7.3 Headings

Heading are prioritized in a numbered fashion, the highest priority heading having a single digit and subsequent headings having more digits, according to their level. All of the main headings are titled as follows: single digit number followed by a dot and the name of the section (All bold

Times New Roman, size 18, Left align).All second level sub headings for every sub section have the same number as their respective main heading, followed by one dot and subsequent sub heading number followed by name of the sub section (All bold Times New Roman, size 13). Further sub headings, i.e. level three and below, follow the same rules as above for numbering and naming, and for font (All bold Times New Roman, size 12).

1.7.4 Basic Text

All other basic text appears in regular, size 12 Times New Roman. Every paragraph explains one type of idea in this document.

1.7.5 Figures

All figures in this document have captions, and are numbered. Module diagrams are based on UML standards.

1.7.6 Reference

All references in this document are provided where necessary, however where not present, the meaning is self-explanatory. All ambiguous terms have been clarified in the glossary at the end of this document. More about application can be retrieved from project development team.

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1.7.7 Reading suggestions

The document begins with the title and table of contents. All level 1, level 2 and level 3 headings are given in the table of contents, but the lower sub headings are not included. Each main heading is succeeded by a number of sub headings, which are all in bold format. The product overview is given at the start, succeeded by the complete detailed features, including both functional and non-functional requirements. The entire interfaces are also described. The document ends with appendices, including a glossary.

Chapter 2 Literature Review

All over the world there are websites related to real estate industry. People use them to search, purchase and buy properties. There are many websites related to future trends of prices of different goods. Many systems estimate the future prices of stocks and shares. In Pakistan some websites are working as a medium to advertise the properties available for sale and rent. By the help of these websites one can estimate the current prices of available property but they don't give any idea about the future trends.

Pakistan has the very growing real estate industry. People take deep interest in investing money in properties. To make investing easy and safe, Home Metrics is developed. It takes data from several real estate listing website. Clean them, store them in database, manipulate the data and display the result i.e. future trend in beautiful format.

To make this possible, MEAN stack is used. Mongodb is used as database, NodeJs library express is used for server and angular handles the frontend. Software architecture is module based to ensure encapsulation and making software maintainable.

MEAN is a free and open-source JavaScript software stack for building dynamic web sites and web applications.

The MEAN stack is MongoDB, Express.js, AngularJS (or Angular), and Node.js. Because all components of the MEAN stack support programs are written in JavaScript, MEAN applications can be written in one language for both server-side and client-side execution environments.

Chapter 3 Software Requirement Specification

3.1 Introduction

This document serves the purpose of providing information needed to adequately design and implement home metrics that is a web application which is operating system independent. This document describes the overall description, system features and functional and non-functional requirements of Home Metrics. This part of the document specifically provides an overview of the entire SRS with purpose, scope, definitions, acronyms, abbreviations, references and overview of the SRS.

3.2 Overall Description

3.2.1 Product Perspective

Home Metrics is basically a web application which helps investors, property dealers and home owners/buyers to analyze the property trends in Islamabad and also, predict the future prices based on previous data. Investors can add details of their properties in Home Metrics and it will show them the current price and estimates the future prices with the ROI of their properties.

3.2.2 Product Features

Following are the salient features:

- Area wise property graphs for different locations
- Prediction of future property prices

- Option to select between residential and commercial properties
- Providing assistant to find best properties
- Displays the contact numbers of property dealers in an area
- Shows bank loan options in case of less investment money

3.2.3 User Classes and Characteristics

The application can be used by investors, dealers and home owners to analyze the properties to make better investments and selling decisions. The different types of users are:

3.2.3.1 Investors (frequent user)

Home Metrics will be used by investors to find better locations to invest their money and check the condition of their investment portfolio.

3.2.3.2 Home Owners/Buyers (occasional user)

To find current homes prices and make better decisions when selling or buying home.

3.2.3.3 Property Dealers (occasional user)

Property dealers use Home Metrics to find the trends and expected rise in property prices in certain areas.

3.2.4 Operating Environment

3.2.4.1 Hardware:

Home Metrics uses the following hardware:

Laptop/Tablets: Home Metrics is a web based application intended for laptop and tablet users.

3.2.4.2 Software

- Windows: 7, 8, 8.1, 10
- Software: Visual Studio Code, Microsoft SQL, Anaconda

3.2.5 Design and Implementation Constraints

- The data which will be scraped from different property listing website might not be correct.
- The model generated for property prediction may not fit perfectly.
- There will be outlier in data which will be removed to provide consistency.

3.2.6 User Documentation

Web Application will include user manual.

3.3 External Interfaces Requirements

3.3.1 User Interfaces

User interface will contain:

- A login screen for investors
- A tab for Residential Area
- A tab for Commercial Area

3.3.2 Hardware Interfaces

- Laptops/Desktops/Mobile Phone can assess the web application anywhere in world

3.3.3 Software Interfaces

- View will be controlled by View Controller
- Modules are used to get and manipulate the data in views
- Microsoft SQL Server will be used for databases

3.4 System Features

This section describes in detail the system features of the Home Metrics. System features are classified into following use cases:

- Register the investor
- Login the investor
- Allow the investor to add properties with purchase prices
- Estimated ROI of Investor Properties will be displayed
- Option to select between Residential and Commercial Properties
- Area wise selection option
- Display the prices based on area of homes, shops and buildings
- Display the trends of properties prices in particular areas.

3.5 Functional Requirements

REQ-1: The system shall display selling prices of homes, shops and buildings.

REQ-2: The system shall display rents of homes, shops and buildings.

REQ-3: The system shall display the past prices of homes, shops and buildings.

REQ-4: The system shall display the expected future prices of homes, shops and buildings.

REQ-5: The system shall allow the user to choose between homes, shops and buildings.

REQ-6: The system shall allow the user to add location.

REQ-7: The system shall display the minimum to maximum prices of homes shops and buildings of 5 Marlas, 7 Marlas, 10 Marlas, 1 kanal and 2 kanals of different sectors in Islamabad.

REQ-8: The system shall display the names and contact numbers of all the property dealers available in selected location.

REQ-9: The system shall allow the user to add investment amount.

REQ-10: The system shall display homes, shops and buildings according to the entered amount.

REQ-12: The system shall allow user to create an account.

REQ-13: The system shall allow user to login his account.

REQ-14: The system shall allow user to add area, price and location of his properties.

REQ-15: The system shall display the future prices of user's properties.

REQ-16: The system shall display Return on Investment (ROI) of user's properties.

3.6 Non-functional Requirements

3.6.1 Safety Requirements

The system shall not change database if system crash during addition, deletion or editing.

3.6.2 Security Requirements

The system shall only allow the registered users to login.

3.6.3 Performance Requirements

The system response time shall be of 2 seconds.

3.6.4 Software Quality Attributes

3.6.4.1 Usability

The system shall be easy to navigate.

3.6.4.2 Interoperability

The system shall be operating system independent.

3.6.4.3 Portability

The system shall be portable and can be accessed on all devices.

3.6.4.4 Availability

The system shall be available 24/7.

3.6.4.5 Flexibility

The system shall be flexible to adopt new requirements.

3.6.4.6 Data Integrity

The system shall not change if crash occurs during addition, deletion or editing.

3.6.4.7 Scalability

The system shall allow 500 users to access it at same time.

Chapter 4 Software Design and Implementation

4.1 Introduction

This document serves the purpose of providing information needed to adequately design and implement home metrics that is a web application which is operating system independent. This document describes the overall architecture of Home Metrics. This part of the document specifically provides an overview of the entire SDS with purpose, scope, definitions, acronyms, abbreviations, references and overview of the SDS.

4.2 System Architectural Description

This section provides detailed system architecture of Home Metrics. Overview of system modules, their structure and relationships are described in this section. User interfaces and related issues are also discussed.

4.2.1 Structure and Relationship

This section covers the technical description of Home Metrics. It shows relationships between different components and how system modules are connected. This section also covers working with respect to different point-of-views. This also covers its higher and lower levels details, user interfaces, and system architecture and design pattern.

4.2.1.1 System Block diagram

This diagram shows the higher level description of the application. It shows all the modules of the system and their associations and flow of data between modules.

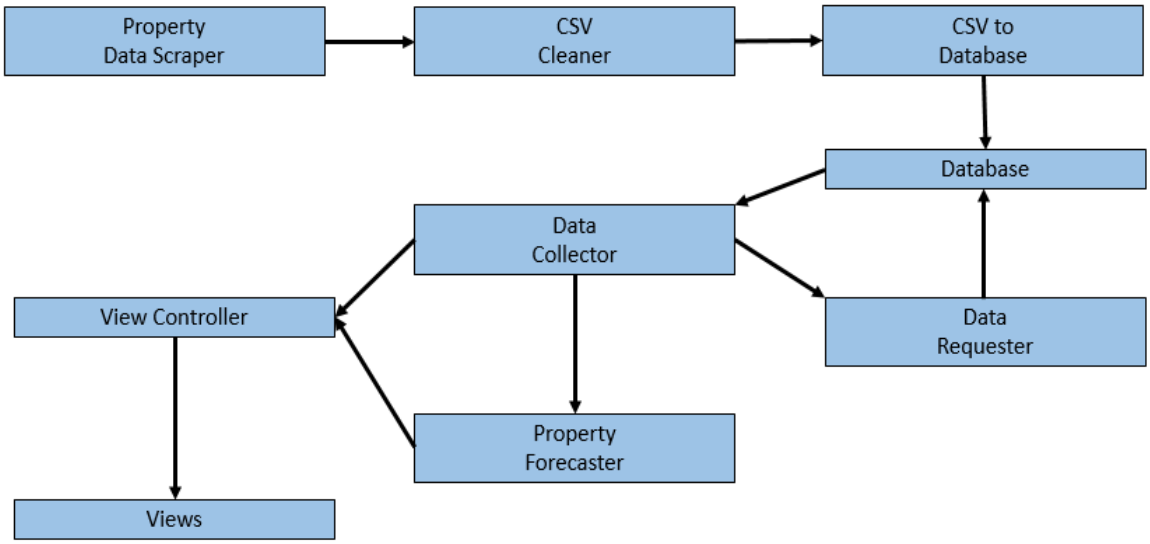


Figure 4.1 Block Diagram

4.2.1.2 Use case Diagram

Following diagram shows course of events that take place when an actor (investor and other allowed interactions) interacts with system.

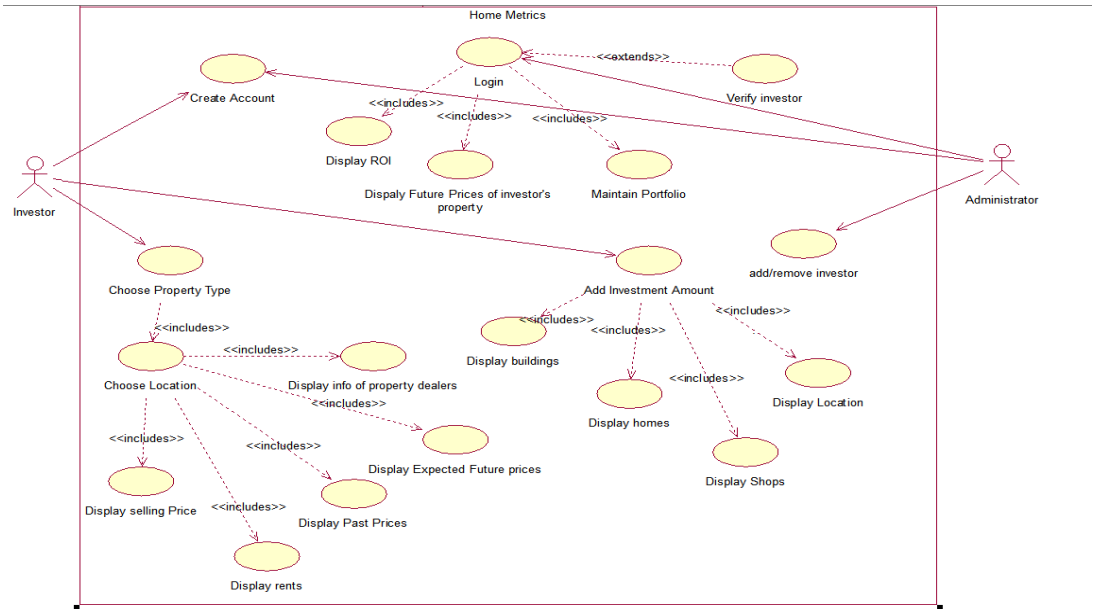


Figure 4 Use Case Diagram

4.2.1.2.1 Actors

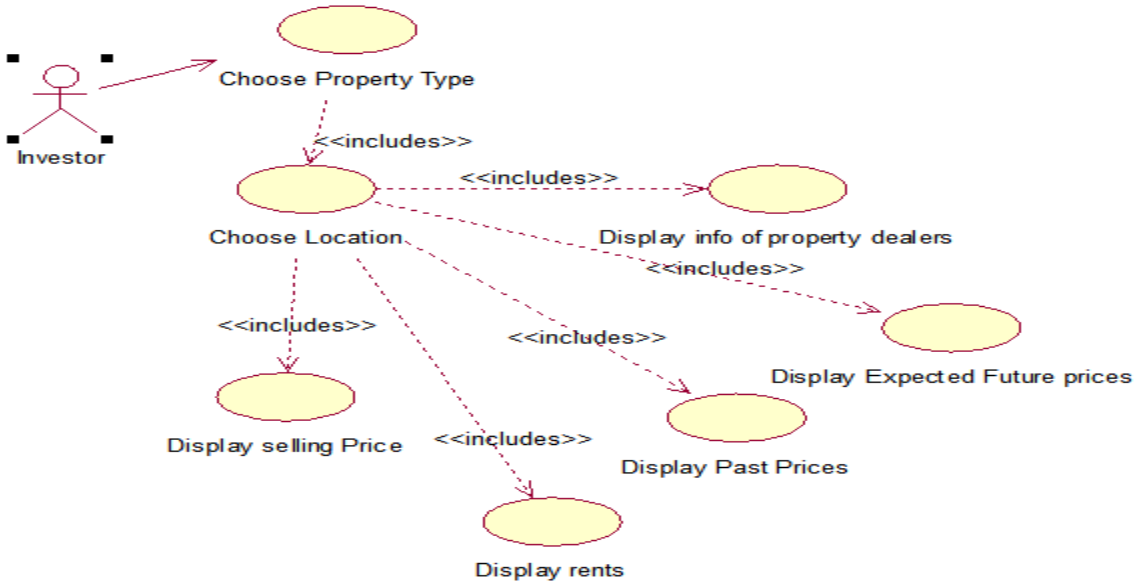
- Investor
- Administrator

4.2.1.2.2 Use Cases

- Choose property type
- Choose location
- Create account
- Add investment amount
- Login
- Add/Remove Investor

4.2.1.2.3 Use case Description

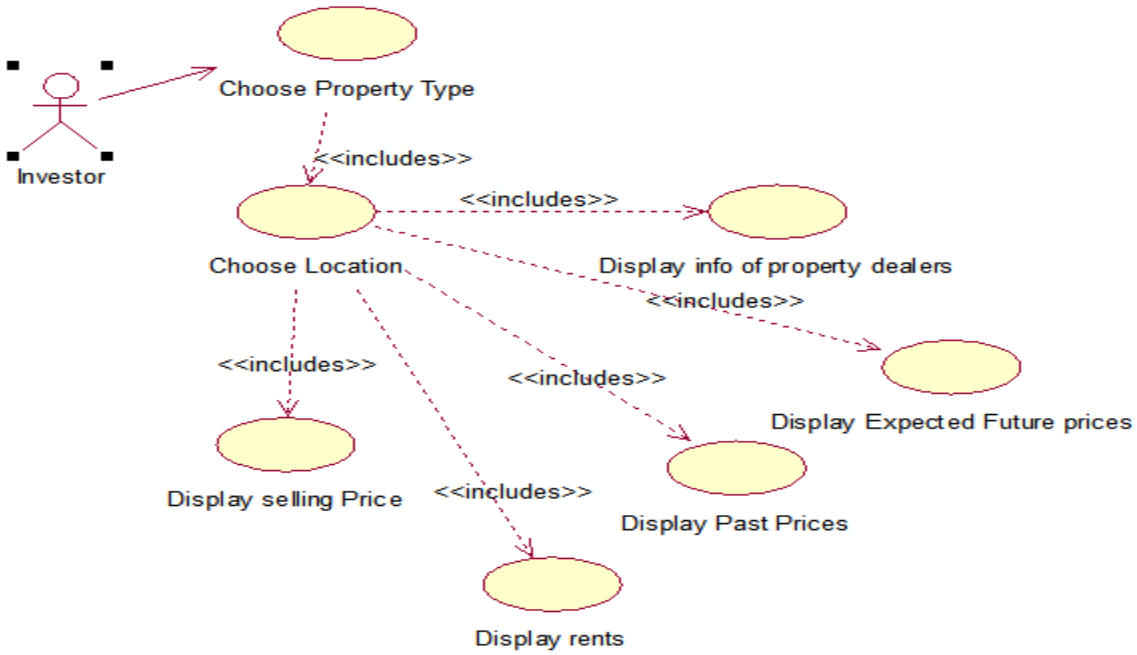
- **Use case 1: Choose Property Type**



Use Case: Choose Property Type
Actors: Investor
Use Case Description: This use case provides the property types which can be home, shop or building. It enables user to look for the right property.
Normal Flow: • User will select the property type.
Alternate Flow: • An error message is generated if the server is down.
Preconditions: System will display the property types.
Post conditions: System will take the user to display locations page based on his selection.
Includes: Choose Location
Extends: N/A

Table 4.1

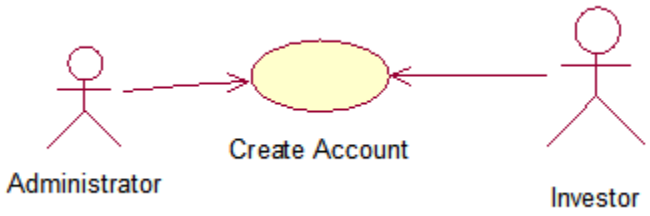
- **Use case 2: Choose Location**



Use Case: Choose Location
Actors: Investor
Use Case Description: This use case provides the locations in particular property type to enable user to look more specific in an area.
Normal Flow: • User will select the desired location.
Alternate Flow: • An error message is generated if location is not available.
Preconditions: System will display the locations in particular property type as selected.
Post conditions: System will show the user the properties information in that particular location.
Includes: Display Past Prices, Display Selling Prices, Display Rents, Display Expected Future Prices, Display Info of Property Dealers
Extends: N/A

Table 4

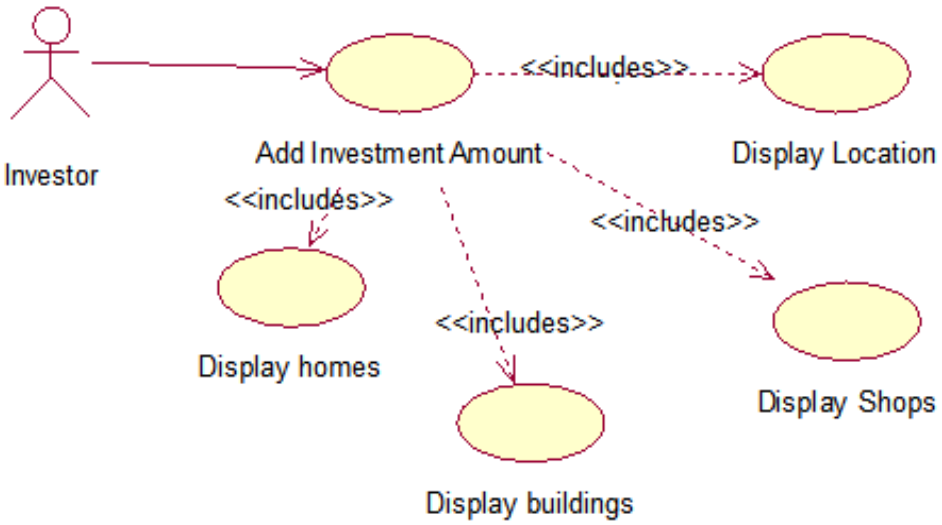
- **Use case 3: Create Account**



Use Case: Create Account
Actors: Investor, Administrator
Use Case Description: This use case provides the facility for the user to create an account with email address and password.
Normal Flow: • User will click the create account button. • User will fill first name, last name, email address and password. • User will click the create account button. • User will be required to confirm email address. • After email address confirmation, user will be taken to account page.
Alternate Flow: • An error message is generated if user already exists. • An error message is generated if user has not confirmed the email address.
Preconditions: N/A
Post conditions: User will be taken to login page.
Includes: N/A
Extends: N/A

Table 4.3

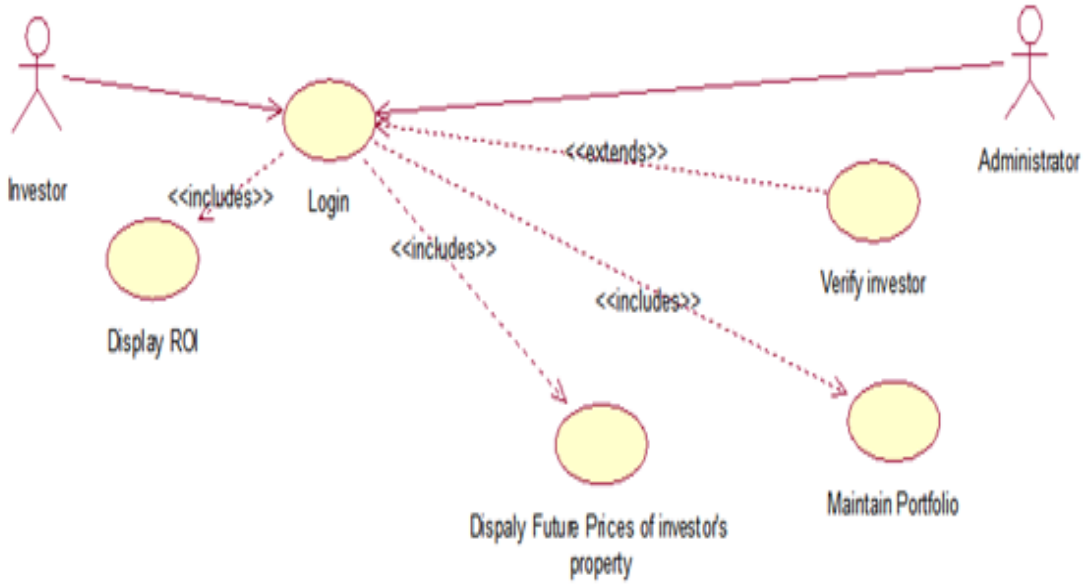
- **Use case 4: Add Investment Amount**



Use Case: Add Investment Amount
Actors: Investor
Use Case Description: This use case provides the facility for the user to search the properties by entering the investment amount.
Normal Flow: • User will add investment amount in the box. • User will click the search button.
Alternate Flow: • An error message is generated if investment amount is not valid. • An error message is generated if no property is available against the amount entered.
Preconditions: N/A
Post conditions: User will be taken to properties information page.
Includes: Display Location, Display Homes, Display Buildings, Display Shops
Extends: N/A

Table 4.4

- **Use case 5: Login**



Use Case: Login
Actors: Investor, Administrator
Use Case Description: This use case provides the facility for the user to login in his account by entering email address and password.
Normal Flow: • User will enter email address and password. • User will click the login button.
Alternate Flow: • An error message is generated if email address or password is invalid. • An error message is generated if email address is not verified.
Preconditions: N/A
Post conditions: User will be taken to his account.
Includes: Display ROI, Maintain Portfolio, Display Future Prices of Investor's Property
Extends: Verify Investor

Table 4.5

- **Use case 6: Add/Remove Investor**

Use Case: Add/Remove Investor
Actors: Administrator
Use Case Description: This use case provides the facility for the Admin to add or remove the investor.
Normal Flow: • User will select the investor for the list. • User will press the delete button.
Alternate Flow: • An error message is generated if investor is not present in database.
Preconditions: User should be registered and logged in his account.
Post conditions: User will be displayed new list of investors.
Includes: N/A
Extends: N/A

Table 4.6

4.2.1.3 State Transition Diagram (Logical View)

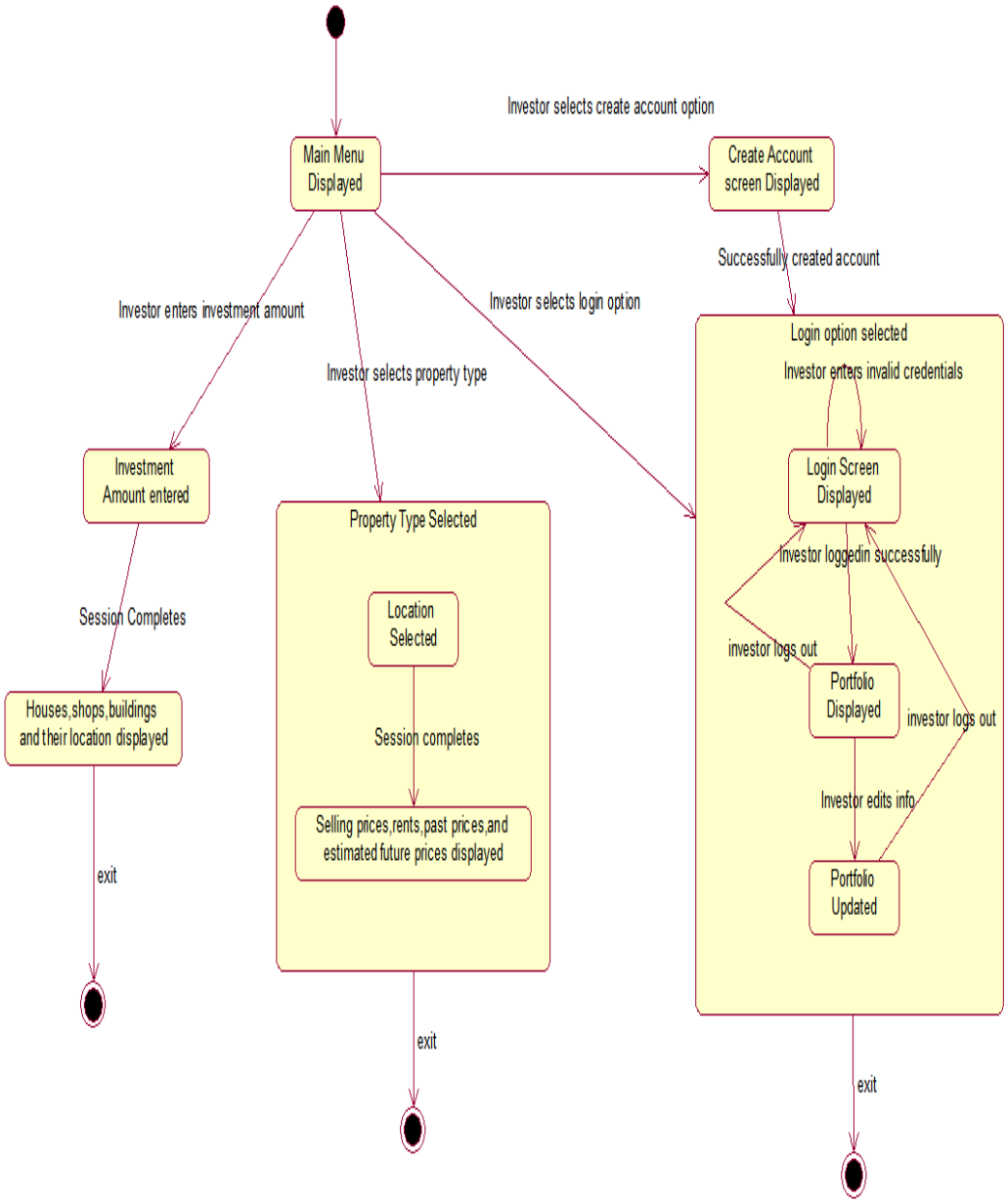


Figure 4.3 State Transition Diagram

4.2.1.4 Activity Diagram (Dynamic View)

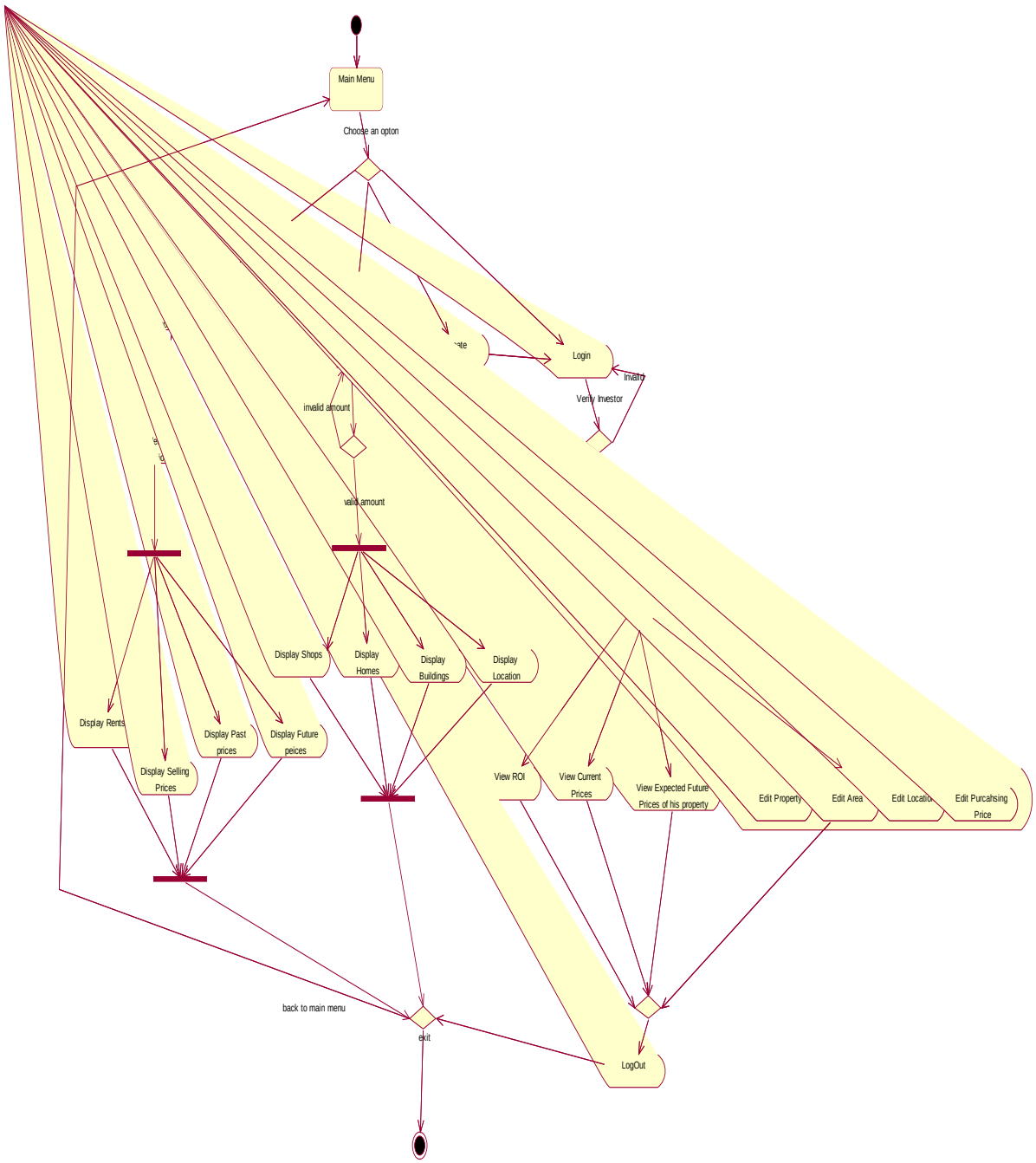


Figure 4.4 Activity Diagram

4.2.1.5 Class Diagram (Implementation View)

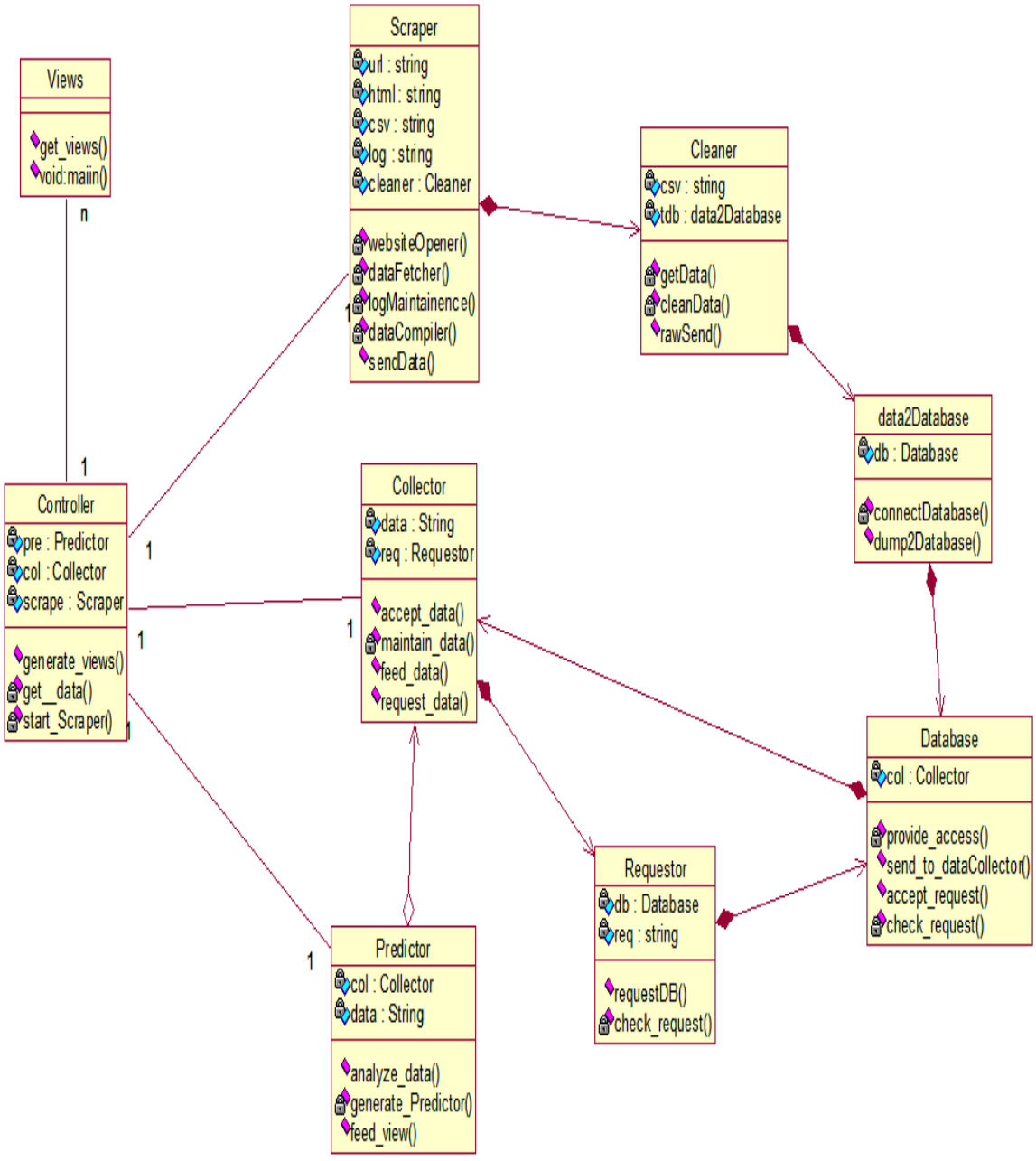


Figure 4.5 Class Diagram

4.2.1.6 Sequence Diagram

Following sequence diagrams show the sequence of activities of Home Metrics.

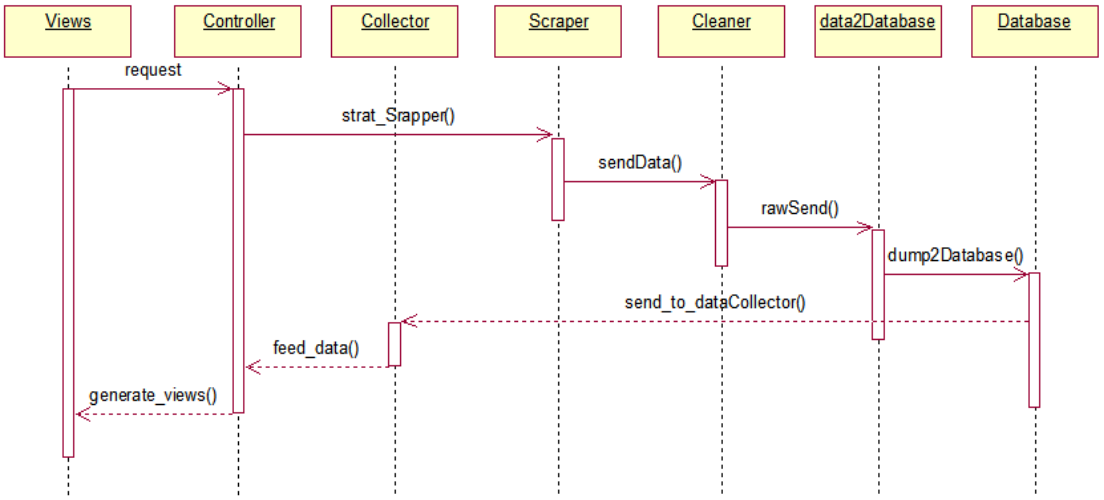


Figure 4.6 Sequence Diagram

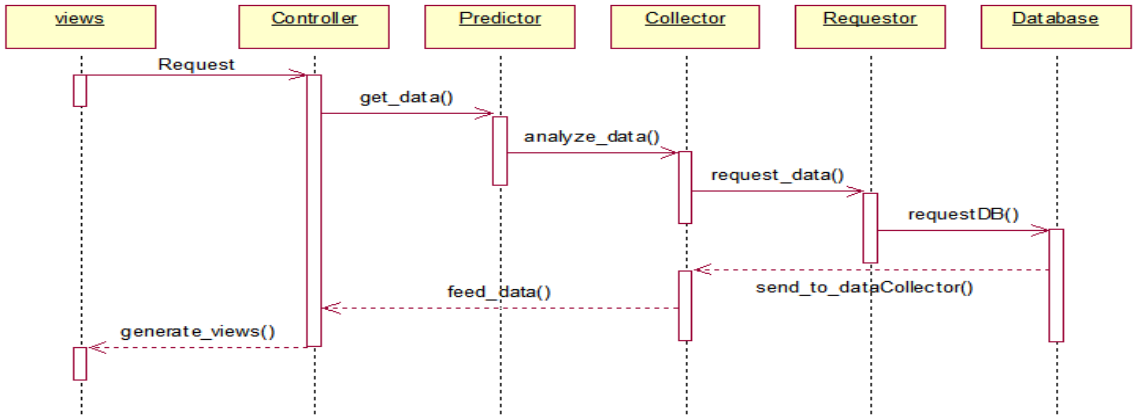


Figure 4.7 Sequence Diagram

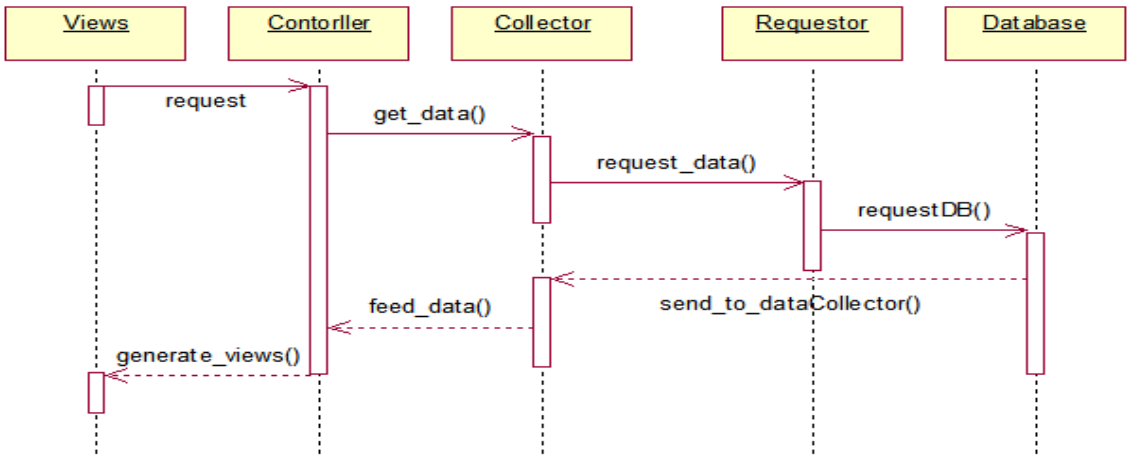


Figure 4.8 Sequence Diagram

4.2.1.7 Work Breakdown Structure

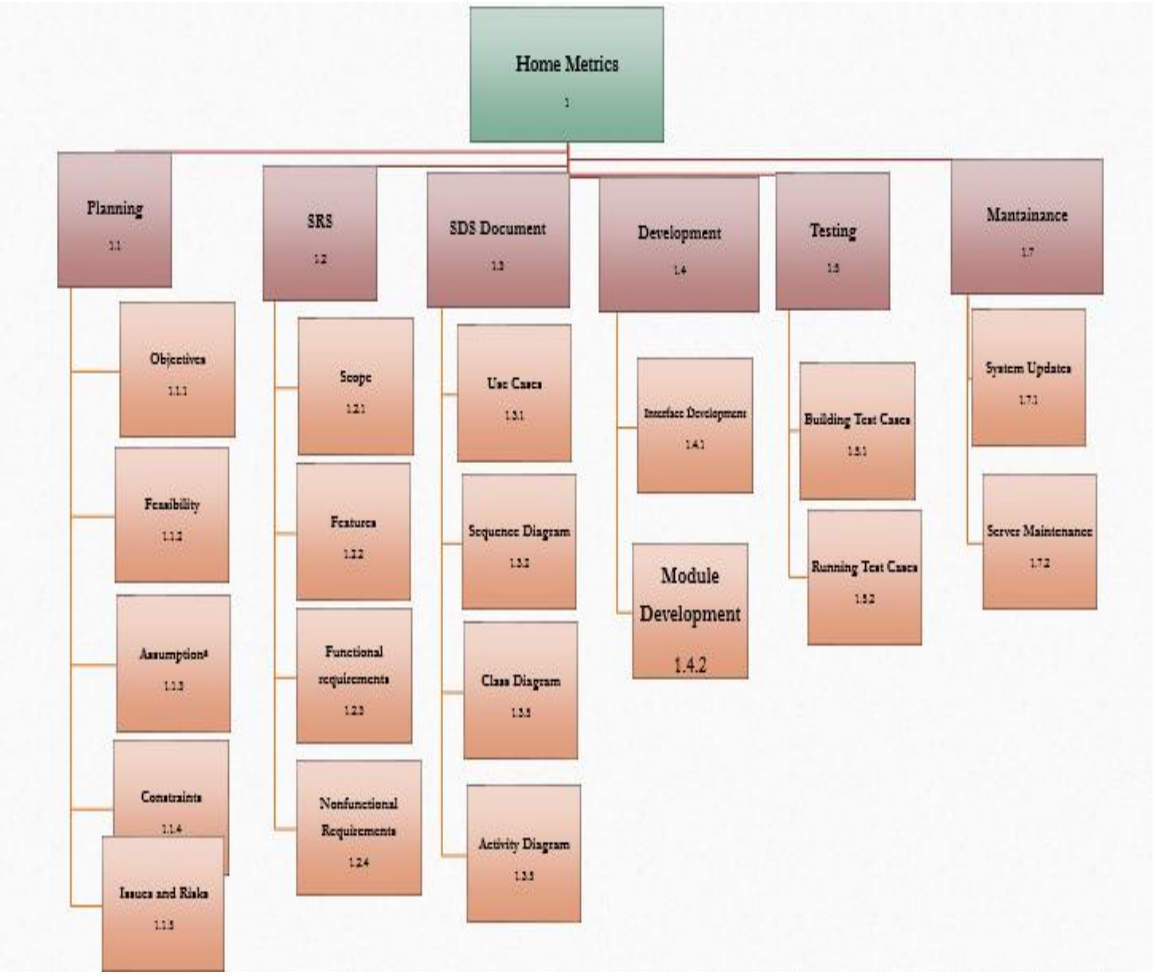


Figure 4.9 Work Breakdown Structure

4.3 Detailed Description of Components

This section describes in detail all the modules of Home Metrics.

4.3.1 Application UI

Identification	**Name**: Application UI **Location**: View

Type	Component
Purpose	• The purpose of this component is to display the menu
Function	**What the component does:** It takes input from the user and displays the required views.
Subordinates	**Constituents of the component:** The component has no sub-components.
Dependencies	**Components using this component:** This component is dependent on controller which provides views based on user inputs.
Interfaces	The external hardware interfaces interacting with this component will be: • Any device which can open web application.
Resources	The resources used by this component are controller objects which controls its views.
Processing	The processing required for this component is receiving the user's input and giving this input to the controller module.
Data	JSON Format (includes text which will be handled by controller)

Table 4.7

4.3.2 Property Data Scraper

Identification	**Name**: Scraper **Location**: Modules
Type	Module
Purpose	• The purpose of this module is to scrape data from property websites.
Function	**What the module does:** It takes input from the controller module to invoke the scraping process.
Subordinates	**Constituents of the module:**

	The module has no sub-modules.
Dependencies	**Modules using this module:** This module is dependent on controller which provides instructions for starting scraping process.
Interfaces	• Controller module will interact with this using functions.
Resources	The resources used by this module is internet access and property website to be scraped.
Processing	The processing required for this module is receiving the controller instructions and scraping data from property website.
Data	CSV Format (property data will be contained in CSV format)

Table 4.8

4.3.3 CSV Cleaner

Identification	**Name**: CSV Cleaner **Location**: Modules
Type	Module
Purpose	• The purpose of this module is to clean csv data.
Function	**What the module does:** It takes csv data from scraper and delete any row which contains missing or invalid data.
Subordinates	**Constituents of the module:** The module has no sub-modules.
Dependencies	**Modules using this module:** This module is dependent on scraper which provides the csv data.
Interfaces	• Scraper module will interact with this using functions.
Resources	The resources used by this module is computation power.
Processing	The processing required for this module is receiving the csv data from scraper, reading all the rows and deleting any row with missing

	or invalid data.
Data	CSV Format (property data will be contained in CSV format)

Table 4.9

4.3.4 Database

Identification	**Name**: Scraper **Location**: Modules
Type	Module
Purpose	• The purpose of this module is to scrape data from property websites.
Function	**What the module does:** It takes input from the controller module to invoke the scraping process.
Subordinates	**Constituents of the module:** The module has no sub-modules.
Dependencies	**Modules using this module:** This module is dependent on controller which provides instructions for starting scraping process.
Interfaces	• Controller module will interact with this using functions.
Resources	The resources used by this module is internet access and property website to be scraped.
Processing	The processing required for this module is receiving the controller instructions and scraping data from property website.
Data	CSV Format (property data will be contained in CSV format)

Table 4.10

4.3.5 Data Collector

Identification	**Name**: Collector **Location**: Modules

Type	Module
Purpose	• The purpose of this module is to collect data from database.
Function	**What the module does:** It takes data from database which will be used in generating views and will be used by predictor.
Subordinates	**Constituents of the module:** The module has no sub-modules.
Dependencies	**Modules using this module:** This module is dependent on database to provide the data.
Interfaces	• Database module will interact with this using functions.
Resources	The resources used by this module is computation power.
Processing	The processing required for this module is receiving data from database and maintaining it for use.
Data	JSON Format (it helps in generating views and further processing)

Table 4.11

4.3.6 Data Requester

Identification	**Name**: Collector **Location**: Modules
Type	Module
Purpose	• The purpose of this module is to collect data from database.
Function	**What the module does:** It takes data from database which will be used in generating views and will be used by predictor.
Subordinates	**Constituents of the module:** The module has no sub-modules.
Dependencies	**Modules using this module:** This module is dependent on database to provide the data.
Interfaces	• Database module will interact with this using functions.
Resources	The resources used by this module is computation power.

Processing	The processing required for this module is receiving data from database and maintaining it for use.
Data	JSON Format (it helps in generating views and further processing)

Table 4.12

4.3.7 Property Predictor

Identification	**Name**: Predictor **Location**: Modules
Type	Module
Purpose	• The purpose of this module is to analyze data from collector and generate models.
Function	**What the module does:** It takes data from collector and analyze it using algorithms which generates models. These models will be used in generating views.
Subordinates	**Constituents of the module:** The module has no sub-modules.
Dependencies	**Modules using this module:** This module is dependent on collector module to provide the data.
Interfaces	• Controller module will interact with this using functions.
Resources	The resources used by this module is computation power.
Processing	The processing required for this module is receiving data from collector module, analyzing it and making models.
Data	JSON Format (it helps in generating views and further processing)

Table 4.13

4.4 Reuse and Relationships to Other products

Home Metrics is basically a web application which helps investors, property dealers and home owners/buyers to analyze the property trends in Islamabad and also, predict the future prices based on previous data. Investors can add details of their properties in Home

Metrics and it will show them the current price and estimates the future prices with the ROI of their properties.

Home Metrics is not an extension of any other applications at any level but it is based on the techniques of Data Mining and Machine Learning. It can be evolved into a bigger and more complex system with more features and functionality. Developers can also reuse the modules of the software. The practical usage of the system can be increased by adding more and more data from the other cities.

4.5 Design, Decision and Tradeoffs

Home Metrics is an interactive application which requires multiple types of user interface. Developing such systems require thorough consideration on the design factors as it might result in complexity problem. A poorly-designed system results in a system consuming more resources with very little efficiency and a slower response time which directly affects the experience of the target user besides this, poor designs make testing and maintenance activities difficult. Façade design pattern will be used for the implementation of this application.

Chapter 5 Project Test and Evaluation

5.1 Introduction

This test plan document describes the appropriate process and methods used to plan testing of the Home Metrics. The test plan will ensure that Home Metrics works as intended without any failure.

Manual Testing will be followed which includes testing a software manually, i.e., without using any automated tool or any script. In this type, the tester takes over the role of an end-user and tests the software to identify any unexpected behavior or bug. Each Unit will be tested separately and then will be integrated with other units; therefore Unit Testing and Integration testing will be followed. For each unit Black box Testing is done and for combined units Acceptance Testing is done. Software testing, depending on the testing method employed, can be implemented at any time in the development process. However, most of the test effort occurs after the requirements have been defined and the coding process has been completed.

The test scope includes the Testing of all functional, application performance and use cases requirements listed in the requirement document. This document includes the plan, scope, approach and procedure of Home Metrics test. The pass/fail criteria of the test items are also defined. The Test Plan document documents and tracks the necessary information required to effectively define the approach to be used in the testing of the product.

5.2 Test Items

Based on the Home Metrics requirements and design description and non-functional scenario will be tested. The Requirements Defined in Software Requirements Specification and the Design entities as explained in Software Design Document will be tested.

5.3 Features to be tested

Following features are being tested:

- Ability to allow user to create an account.
- Ability to allow user to login his account.
- Ability to allow user to add area, price and location of his properties.
- Ability to display the future prices of user's properties.
- Ability to Return on Investment (ROI) of user's properties.
- Ability to allow the user to select property type.
- Ability to allow the user to add location.
- Ability to display prices of homes, shops and buildings.
- Ability to display the expected future prices of homes, shops and buildings.
- Ability to display the names and contact numbers of the property dealers available in selected location.
- Ability to allow the user to add investment amount.
- Ability to display homes, shops and buildings according to the entered amount.

5.4 Test Approach

Acceptance test will be executed based on this acceptance test plan. And after all test cases are executed, a test report will be summarized to show the quality of Home Metrics. Following test approaches will be used in test execution:

- **Unit test**: Developers are responsible for unit test as white-box testing. The implementation of each module and individual component will be verified separately.

- **Integration test**: After the unit test is passed above the defined quality threshold, testers will execute the integration test cases. After all the modules are integrated, it's crucial to test the product as a black-box. End-to-end scenarios will be tested to ensure the communication functionality.

- **White Box Testing:** In white box testing, the UI is bypassed. Inputs and outputs are tested directly at the code level in functions and the results are compared according to requirements. This form of testing ignores the function of the program under test and will focus only on its code and the structure of that code.

- **Black Box Testing:** Black box testing typically involves running through every possible input to verify that it results in the right outputs using the software as an end-user would.

- **Regression test**: After developers fix the bug in one feature, regression test will be executed by testers to ensure that the other functions are not affected.

- **Positive and negative testing design technique**: This approach will be combined with unit test and integration test. Test cases are designed in obvious scenarios, which ensure that all functional requirements are satisfied. What's more, different test cases will also be covered to show how the system reacts with invalid operations.

- **Performance testing:** This test will be conducted to evaluate the fulfillment of a system with specified performance requirements. It will be done using black-box testing method. And this will be performed by Checking out the response time of the system

5.5 Item Pass/Fail Criteria

Details of the test cases are specified in section Test Deliverables. Following the principles outlined below, a test item would be judged as pass or fail.

- Preconditions are met
- Inputs are carried out as specified
- The result works as what specified in output => Pass
- The system doesn't work or not the same as output specification => Fail

5.6 Suspension Criteria and Resumption Requirements

Any bugs found can be fixed by developers quickly and no need to start the testing process from the beginning. However, when major bugs will block the some test cases as they are interdependent and the testing has to be paused. The test will restart from the very beginning until the major error is solved.

5.7 Test Deliverables

Following are the test cases:

Test case Name	**Create Account**
Test case Number	1
Description	User can create his account with home metrics with valid ID
Testing Technique Used	Black Box Testing
Preconditions	• User should be connected to internet • User have access to Home Metrics, a web app • Main Menu is displayed
Input	Full Name, Email-id, Password
Steps	• Open Home Metrics • Main menu is displayed • Click on “Register” • Enter a name “Amna Shaur”, Valid Email-id “amnashaur@gmail.com” and password “123@4r5”
Expected Output	Successful registration
Actual Output	User’s Profile is displayed. i-e Successful account creation

Test case Name	**Login**
Test case Number	2
Description	User can Login his account with home metrics with registered ID and password
Testing Technique Used	Black Box Testing
Preconditions	• User should be connected to internet • User have access to Home Metrics, a web app

	• Main Menu is displayed
Input	Email-id, Password
Steps	• Open Home Metrics • Main menu is displayed • Click on “Sign in” • Enter Email-id “amnashaur@gmail.com” and password “123@4r5”
Expected Output	Login successful
Actual Output	User’s Profile is displayed. i-e Successfully logged in

Test case Name	**Add property details**
Test case Number	3
Description	User can Login his account and add his property details
Testing Technique Used	Black Box Testing
Preconditions	• User should be connected to internet • User have access to Home Metrics, a web app • User should be logged in
Input	Type Property area, location and purchasing Price
Steps	• Open Home Metrics • Main menu is displayed • Click on “Sign in” • Enter Email-id “amnashaur@gmail.com” and password “123@4r5” • Selects “Add property” • Enter “Property Type”, “Purchasing Price”, “Area”, “Location” as house, 1500000, 5 marlas, G-10.
Expected Output	Property should be added successfully

Actual Output	"Added successfully"
Test case Name	**Selection of Property Type**
Test case Number	4
Description	User can select among homes, buildings and shops
Testing Technique Used	Black Box Testing
Preconditions	• User should be connected to internet • User have access to Home Metrics, a web app • Main Menu is displayed
Input	Click on the type of property
Steps	• Open Home Metrics • Main menu is displayed • Click on "Let's get started" • Click on "Select Property Type" • Choose "House"
Expected Output	Different Locations should be displayed
Actual Output	Many sectors of Islamabad are displayed

Test case Name	**Location Selection**
Test case Number	5
Description	User can select location after selecting the type of property
Testing Technique Used	Black Box Testing
Preconditions	• User should be connected to internet • User have access to Home Metrics, a web app • User selects the property type
Input	Full Name, Email-id, Password
Steps	• Open Home Metrics

	• Main menu is displayed • Click on “Let’s get started” • Select property type “House” • Select location “I-9”
Expected Output	Choice among areas should be displayed
Actual Output	Options of different area sizes are displayed

Test case Name	**Display Prices**
Test case Number	6
Description	User can see the price of his selected property at selected location
Testing Technique Used	Black Box Testing
Preconditions	• User should be connected to internet • User have access to Home Metrics, a web app • User has selected the property type, location and area
Input	Selects the area of property
Steps	• Open Home Metrics • Main menu is displayed • Click on “Let’s get started” • Select property type “House” • Select location “I-9” • Select area “5-marlas”
Expected Output	Price should be displayed in the form of graph
Actual Output	Graph of price and year is displayed

Test case Name	**Display property dealer information**
Test case Number	7

Description	User can see the information of property dealer of selected location
Testing Technique Used	Black Box Testing
Preconditions	• User should be connected to internet • User have access to Home Metrics, a web app • User has selected the property type, location and area
Input	Selects the location
Steps	• Open Home Metrics • Main menu is displayed • Click on "Let's get started" • Select property type "House" • Select location "I-9" • Select area "5-marlas"
Expected Output	Along with the price graph, property dealers info should be displayed
Actual Output	With the price graph, a column is displayed containing property dealers' names and contact numbers.

Test case Name	**Add investment Amount**
Test case Number	8
Description	User can search property according to the investment amount
Testing Technique Used	Black Box Testing
Preconditions	• User should be connected to internet • User have access to Home Metrics, a web app • Main Menu is displayed
Input	Add an investment amount
Steps	• Open Home Metrics • Main menu is displayed

	• Click on “Add investment amount” • Enter “1000000”
Expected Output	“Select location” option should be displayed
Actual Output	Options of different Areas of Islamabad are displayed

Test case Name	**Display Future price**
Test case Number	9
Description	Future trends of property prices are displayed in the form of a graph
Testing Technique Used	Black Box Testing
Preconditions	• User should be connected to internet • User have access to Home Metrics, a web app • Main Menu is displayed
Input	Property Type, Area and Location selection
Steps	• Open Home Metrics • Main menu is displayed • Select Property Type • Select Location • Select Area
Expected Output	A graph should be displayed
Actual Output	A graph is displayed to show the future prices

Test case Name	**Display ROI**
Test case Number	10
Description	ROI is displayed
Testing Technique Used	Black Box Testing

Preconditions	• User should be connected to internet • User have access to Home Metrics, a web app • Main Menu is displayed
Input	Property Type, Area and Location selection
Steps	• Open Home Metrics • Main menu is displayed • Select Property Type • Select Location • Select Area
Expected Output	ROI should be displayed below the future price graph
Actual Output	ROI is displayed below the graph on the same page

5.8 Test Environment

Hardware:

- Mobile or a computer connected with internet

5.9 Responsibilities, Staffing and Training Needs

Responsibilities: All developers of the project are responsible for the completion of all units testing and integration testing and white box testing.

Staffing and Training Needs: Basic knowledge of testing strategies and techniques is needed for the testing of project. Techniques such as Black Box testing, integration testing should be known to developers. All the developers will be testing each other's work and will be actively participating in the development and testing of the project simultaneously.

5.10 Risk and Contingencies

Efforts have been made to remove all and every chance of failure but there are certain unpredictable factors such as network issues, corrupt input data, or system failure that may lead to some issues. Error handling will be applied more deeply to cover all these issues but unforeseen circumstances may happen.

- **Schedule Risk**

The project might get behind schedule. So, in order to complete the project on time, we will need to increase the hours/day.

Chapter 6 Future Work

Anything dealing with Real Estate is highly unpredictable and tedious because there are infinite possibilities of the variations in prices of properties that are to be dealt with.

Home Metrics is confined to Islamabad only as data is available for Islamabad. Islamabad is a very systematic place and its reliable data is available on websites but this project will be extended to the other cities or to the whole country. If the reliable and enough data is available so that it can be used to train the algorithm for that cities. Further the algorithm also needs reforms. Many factors affect the efficiency of the algorithm and the most important one is the variation of prices. If researchers can evaluate the trend of variation of these prices then the algorithm having efficiency greater than 85% can be formed.

Researchers can use this Project as a guide to understand the property trends. They can use this as a base for upgrading the real estate industry. They can also use this for developing a new project by using this as reference material. The project developed could then be used as a basis for further work in the field of real estate.

It can be evolved into a bigger and more complex system with more features and functionality. The application can be enhanced to further include more features using which prices could be estimated in a more seamless and effective manner.

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Appendix A. Glossary

- ROI: Return On Investment
- Application: System
- Properties: Buildings