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Real Estate Website

Bachelor of Science in Computer Science

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Certificate

We accept the work contained in the report titled "Real Estate Website", written by Mr. Junaid Ali AND Mr. Syed Haider Ali as a confirmation to the required standard for the partial fulfillment of the degree of Bachelor of Science in Computer Science.

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Abstract

This project aims to overcome the problems that causes reduction in sale of a real estate agency. Waking clients are reduced by the factor of 40% due to the online real estate portal mainly Zameen.com. People now a days used to search for desired property on these portals and make purchases. This factor clearly states that every real estate agency should has its own web application. Where they can post their properties for sale and rent.

And often clients used to know the updated prices of their properties, sometimes agent response them immediately but sometimes they take time. To overcome this problem we will implement price prediction functionality, where client will enter some core details of plot/house/shop/apartment and the system will estimate the price at real time.

This project will enhance the sales as clients across all over the world can see their desired property on agency's website and can communicate with agent online with live chat facility. If clients want to save or add some properties to favorite then they will have to login into the website, if they do not have account then they can Register to the website by entering all required credentials or by signing up by Google.

As a Data Scientist website needs robustness that's why we will develop this in Django and will deploy it on HEROKU cloud.

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Chapter 1

Introduction

1.1 Overview

This Project is a Real Estate web application. It is a Business-to-Consumer E-business web application. It is for a Real Estate agency[1]. It will let agents of agency to post their properties on Website so, that their overseas clients and clients from other cities can find their required properties on agency's website. Each employee will have a separate account/dashboard from where they will manage their posted properties. Users can estimate price of their properties through price mediator functionality.

- In case of plot they will insert details like plot size, street width, sun face or not (optional), Distance from Masjid, Distance from Market and park, park face (yes or no), corner or not, how much side open, block, sector, area/town, plot no. (this will not use for prediction but to store plot details in Prediction database),

- In case of house in extend to plot details no. of floors, washrooms, bedrooms, TV lounge, Water Tanks, ceiling and floor details and little description (optional).

- In case of apartment building size, front road width, floor number, apartment size, no. of bedrooms, washrooms, ceiling and flooring details, corridor width , block, sector, area/town and apartment number (this will not use for prediction but to store apartment's details in Prediction database).

- In case of shop building size, front road width, floor (basement or other), shop size, ceiling and flooring details, block, sector, area/town and apartment no. (this will not use for prediction but to store shop details in Prediction database).

1.2 Problem Description

As this is the era of Information Technology and Information Technology is the future of every industry. Zameen.com accepted this phenomenon and started Real Estate E-business. Due to their E-business 40Where many agencies have their profiles on Zameen.com but Zameen.com offers many packages among which a starter package includes total 25 ads at a time with 20 listing and 5 video (hot) ads in 160,000rs. When sometimes an agency has more than 100 properties available for sale and rent. In such case, they had to buy package

of at least 5 to 6 lac. Where this package does not, guaranteed the sales.

Clients used to know updated price of their properties contact agents but sometimes agents immediately tell them the updated price and sometimes they take time to answer them where many times they forget or answers after hour(s). So this problem states that their, should be feature in a website where clients can easily get to know about updated prices of their properties.

1.3   Objectives

- To provide E-business facility to a Real Estate agency.

- To reduce communication gap between clients and agents by providing a web platform where every available property is listed.

- To introduce Artificial Intelligence in Real Estate industry.

1.4   Project Scope

The real of World Wide Web have spread across millions of household, so naturally, Internet has become by far the best platform for real estate marketing today. There is a lot of real estate companies who advertise their property online on Zameen.com and social media. So, idea behind developing this application is that their properties can also sell or buy using their own websites and clients can get updated price of their properties at Real Time. In future system like this, will be demand of every Real Estate Agency.

Chapter 2

Literature Review

2.1 Literature Review

In Pakistan there is a lot of work done on Real Estate Management websites[1].

- In which agents post their properties available for sale and rent, same as they update details of existing properties.[1][2]

- Agents can chat with clients. [1]

- Website shows recent searches of clients.[2]

- Clients can request admin to sale their property by filling a form.[1]

- Clients can get a quote.[1]

2.2 Paid B2C Web Applications for agencies

There are numerous websites globally

There are two portals www.zameen.com and www.graana.com, they connect buyers and sellers. Agencies all across the Pakistan can purchase packages and post their property ads. In this way these portals covers all societies of Pakistan. Where people can easily search their required properties. Both have mobile apps as well.
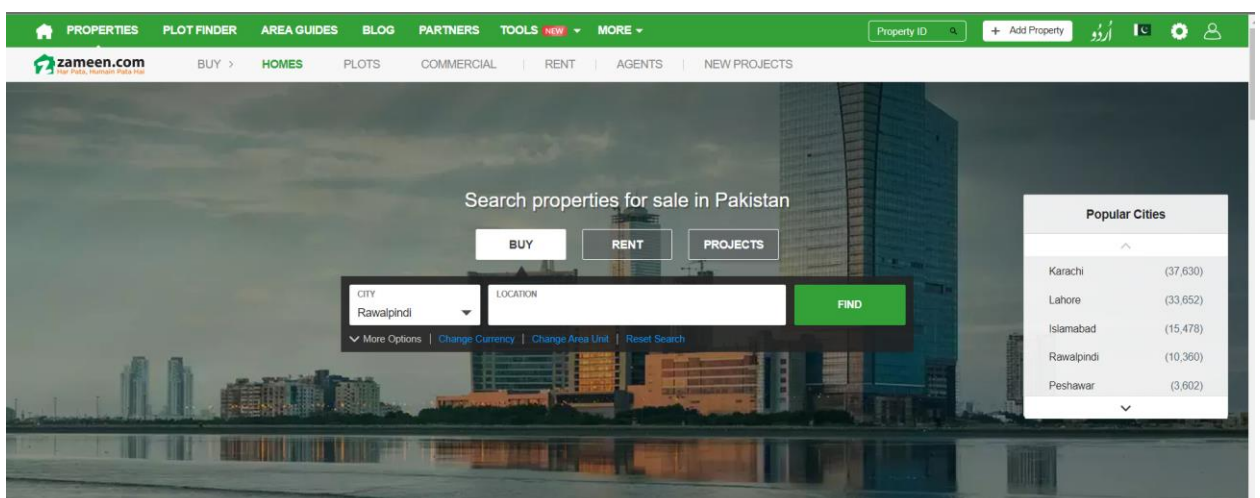
Figure 2.1: Zameen.com – Pakistan's real estate website
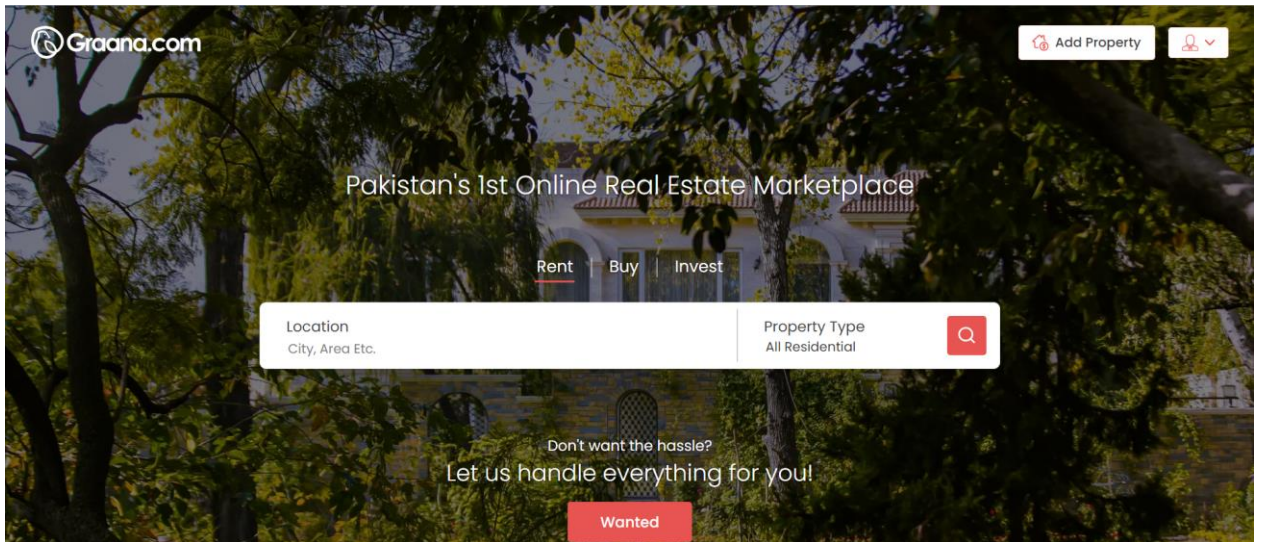
Figure 2.2: Graana.com – Pakistan's real estate website

Same alike Pakistani sites www.rightmove.co.uk and www.zoopla.co.uk are the portals of United Kingdom, www.zillow.com and www.homefinder.com are the portals for USA and same as every country have numerous Property finder portals.

All these portals have same functionalities. Customers can search for properties and can just get contact details of agents.
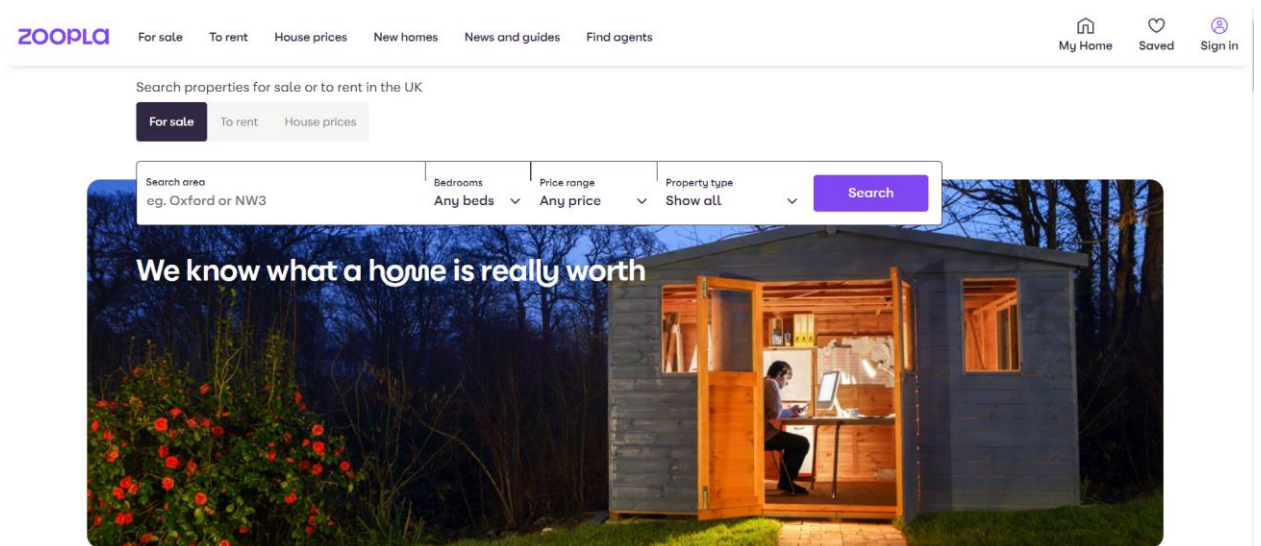
Figure 2.3: Zoopla.uk.co – UK's real estate website
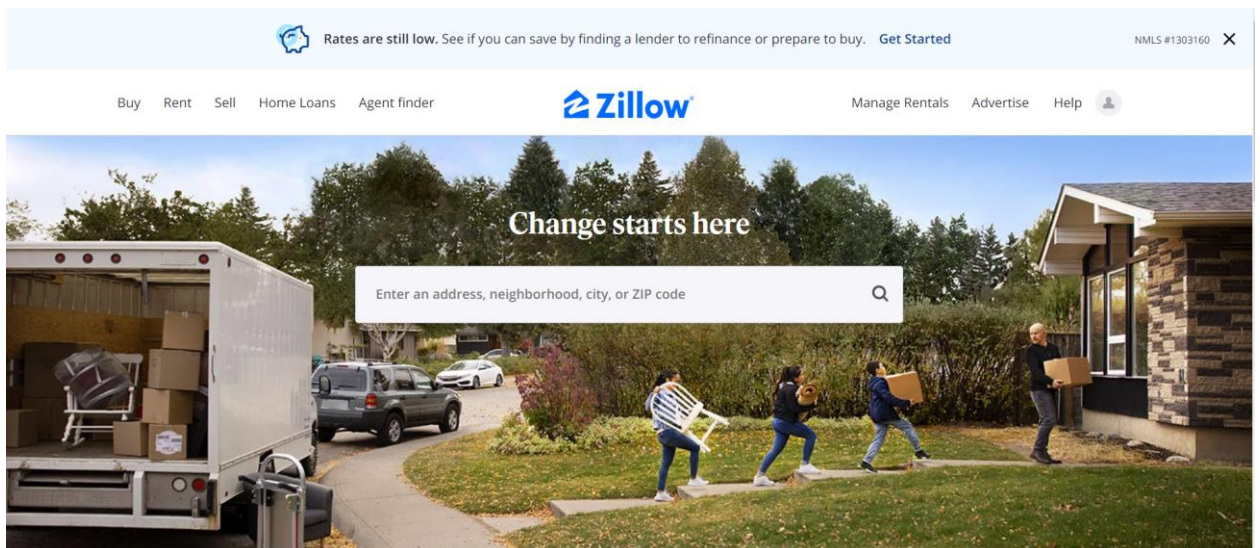
Figure 2.4: Zillow.com – US real estate website
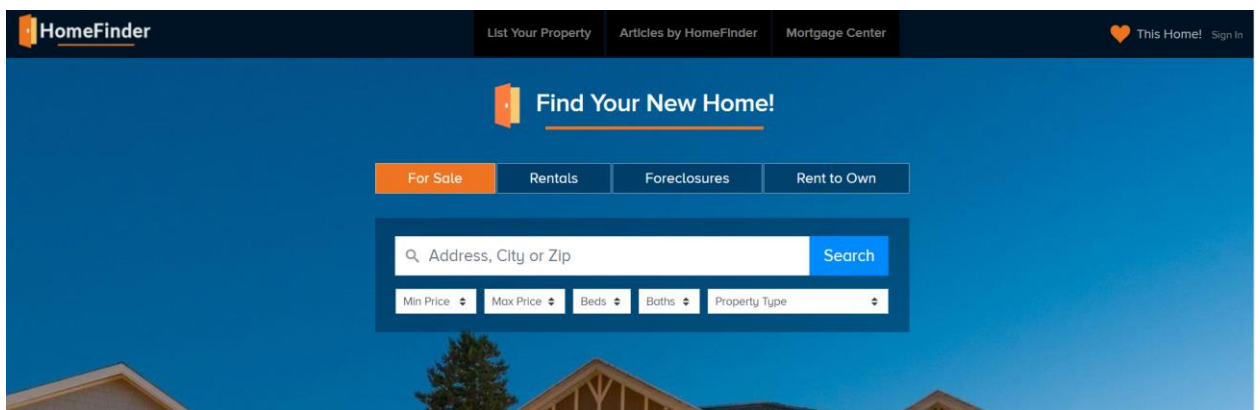
Figure 2.5: Homefinder.com – US real estate website

2.3 Free C2C Web Applications

OLX is an online marketplace which is an easy way to buy, sell, or trade used goods and services. It is an international portal for sale purchase of all types of items but user can make purchases in its own country. Like other sellers, agents or general audience can post their properties ads for sale/rent. Alike other Property finder systems, client can search for required properties and can get contact details of seller. It is free for both seller and buyer but OLX charges fee for ad boosting.
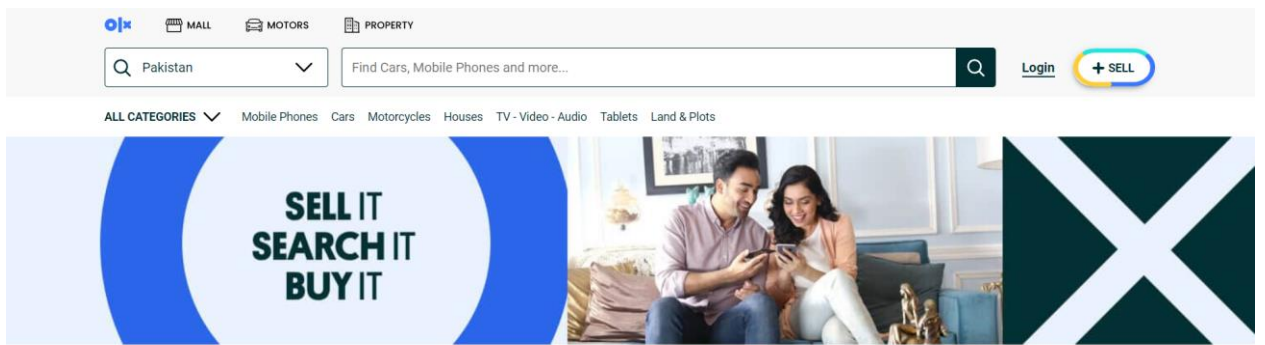
Figure 2.6: OLX.com international C2C web app

2.4 B2C personal Web Applications

www.advice.pk , www.prismestate.com , www.zembuilders.com are some agencies websites. They developed private portals for marketing. These agencies have numerous employees which uses these portals for E-business. These portals have live chat functionality, when user comes to website the agent active on backend starts to text user to guide him/her.

Proposed system is similar to these systems but have advance features of price predictor developed upon Artificial Intelligence.
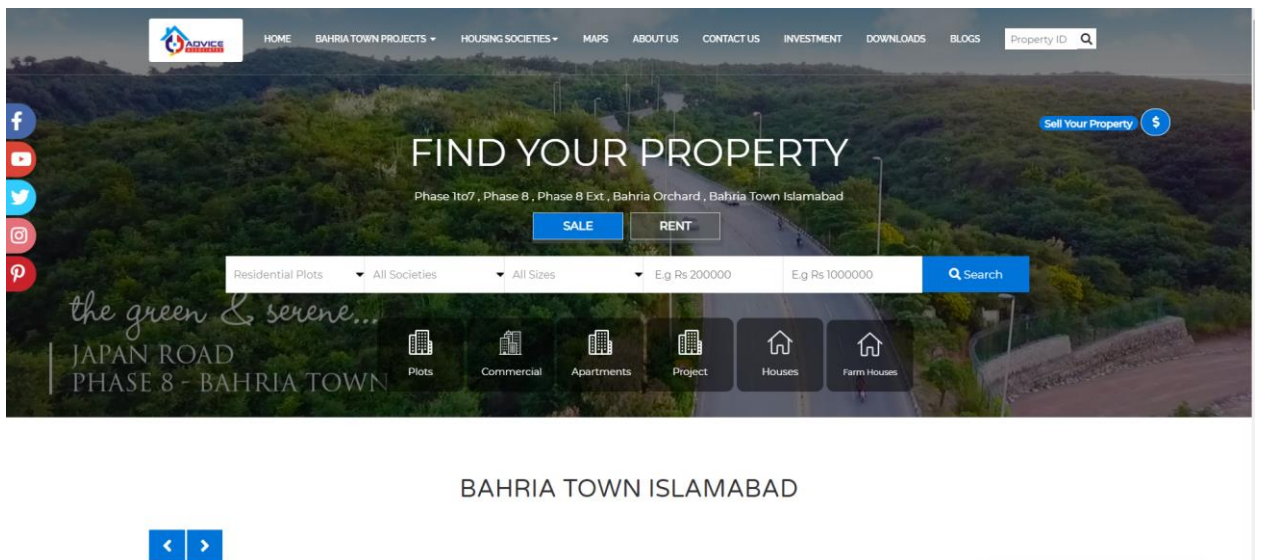
Figure 2.7: advice.pk Pakistan's B2C Real Estate web app
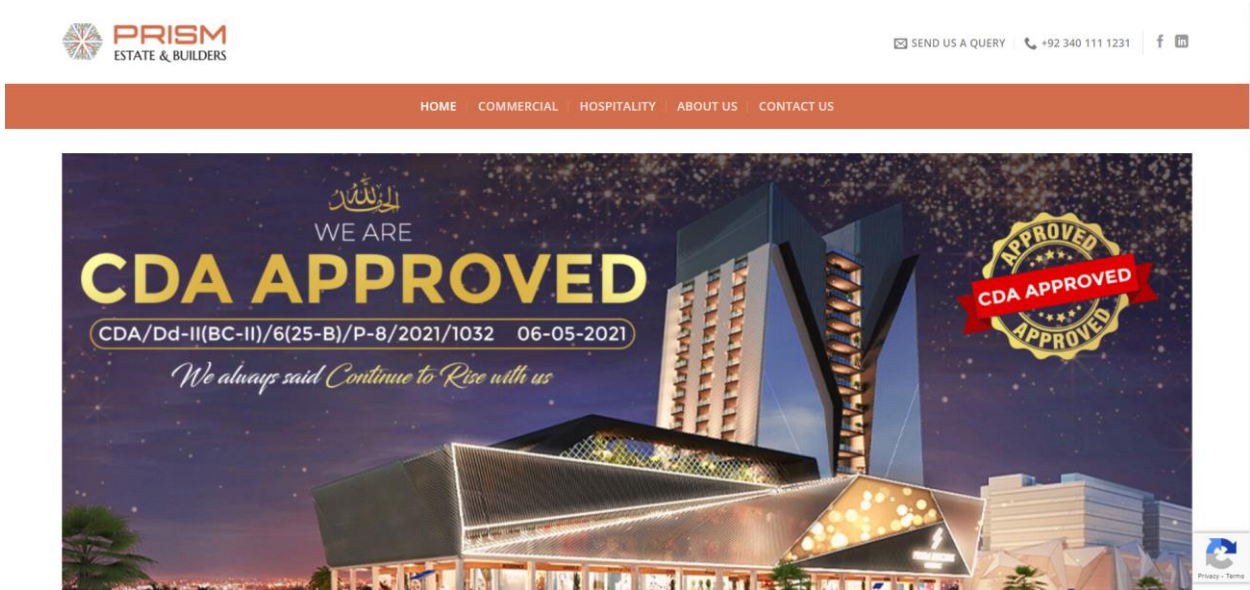
Figure 2.8: PrismEstate.com Pakistan's B2C real estate web app
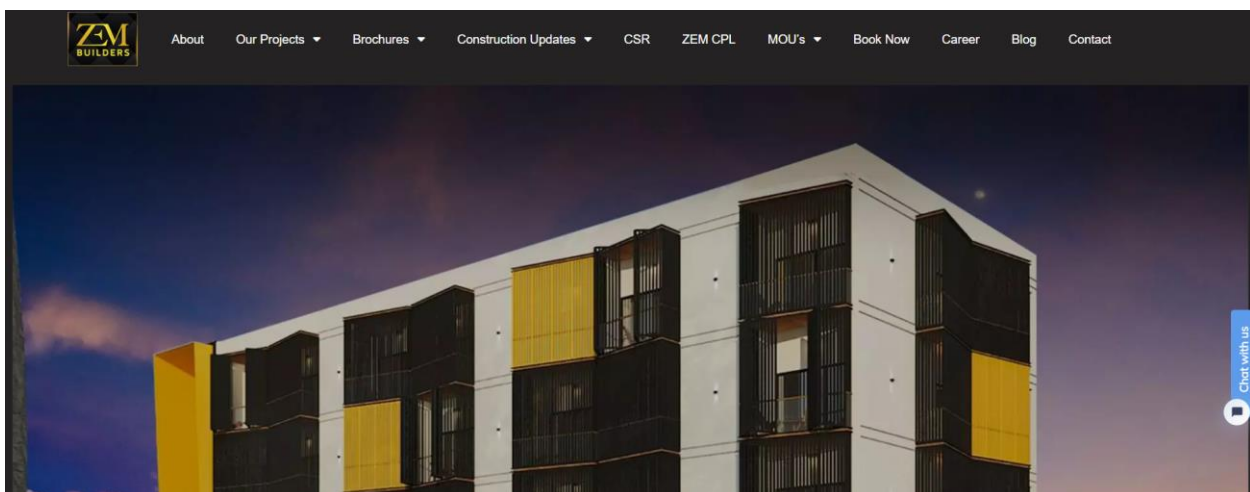
Figure 2.9: ZEMbuilers.com Pakistan's B2C website

Chapter 3

Requirement Specifications

3.1 Existing System

Real Estate Web Applications are working as E-business applications, which have ability to perform business activities online. Most of websites have live chat facility due to which Agents try to help each visitor to find required property.

Every agent has its own profile which contains core details name, position, DOB, phone, experience, Display picture, properties posted on website, address, properties sold through website. Among these name, phone, properties posted on website and display picture can be seen, by visitors.

There is another website related to our work which is Zameen.com. It is little different, there are no. of agencies registered and their numerous agents use their separate but child dashboard of parent agencies dashboard. It does not contain live chat facility.

3.2 Proposed System

Our System contains functionality to estimate price of property e.g. shop, apartment, plot, house along all traditional system's functionality.

To estimate price of a property, user will fill a form with required credentials and in response system will generate the price.

In instance each agent will have their separate profile, where they will manage their posted properties and can see no. of visits on their ads. Each client/user will also have their profiles, in which their required information will be stored along with saved or favorite ads. Newsletters of new added properties will be sent to subscribed users.

3.3 Requirement Engineering

3.3.1 Functional Requirements

- Admin should have all authorizations, it can manage agents, properties and client accounts.

- Admin should register agents by itself. There will not be signup page for agents.

- Agents can login to system to manage ads and their profiles. They can add, remove and update ads.

- Agents can manage their profiles but they will not allowed to edit their history that how much ads they posted.

- Clients can search for properties or search manually by scrolling and navigating.

- Clients can add ads to favorite which will be listing on their dashboard.

- Clients can be register to website and should be logged into the website to save properties.

- Client can estimate the price of property by entering required details. Machine Learning model on the backend can estimate the price.

- Clients can make a request to sale its property by filling up a form.

- Recent searches of client will be shown on Home page.

3.3.2 Non Functional Requirements

(a) **Usability**

GUI of a system develops the user interest to use system happily or not. To create good user experience, professional color themes according to HCI principles.

(b) **High Availability**

When system will be busy in core calculations of Machine Learning Algorithms for user(s) then it should also be available for more users. To make sure the availability system requires more and good hardware capability on server. That is why it will be installed on HEROKU Cloud.

(c) **Scalability**

Most of the time website's traffic increases rapidly and system requires more storage and memory on server. To overcome this problem, it will be installed on HEROKU.

(d) **Security**

User's personal information and passwords are most important aspects of a system. To make the system secure TLS certificate will be used and Django's middleware "Django-cors-headers" is are used.

(e) **Maintainability**

Prices of properties fluctuate, therefor to add new instances in prediction databases is core responsibility of admins. New users get registered or new agents hired in agency, so they also should have account on System. To make regular backups and make sure of backups. That's why this requirement is required.

3.3.3 Software Requirements

(a) **Python for Machine Learning**

Price estimator model is developed on Supervised Machine Learning technique using Multi Linear Regression Model. This algorithm is best suitable for Property price estimation. Following libraries used to implement it.

- **Pandas**

  It is used for data analysis. Data cleaning and reshaping will be done using this.

- **Seaborn**

  It is used for better data visualization. More visualization will create more clarity.

- **Scikit-learn**

  It is used for data visualization, modelling, predictive analysis and Multi Linear Regression algorithm.

- **Numpy**

  It is used to perform scientific and mathematical operations on arrays.

- **Matplotlib**

  It is used for grid and ration axes box visualization.

(b) **React.js for frontend**

It is fastest technology for good user experience. It takes less execution time than native JavaScript. Its component based object oriented nature loads all frontend rapidly.

(c) **Django for Backend**

It is fastest web framework. In heavy traffic situation, server decides the quantity of threads. It has good compatibility with Machine Learning models. Required components for development are as follow

- **Django Rest Framework**

  It will be used for Get/Post/Put/Delete requests development.

- GET will be used for general requests,
- POST will be used for sensitive request e.g. Signup/Sign in credentials, sale property request and credentials for price prediction.
- PUT request for update details of any ad or agent's profile information.
- DELETE request for remove ads or agent.

- **Django Object Relational Mapper**
  It is Django's default relational model which interacts with relational databases, it gives feel like developer is directly using SQL. It will be used to interact with MySQL database.

(d) **MySQL database**

It is the fastest database for Web Applications. It will be used for data storage and fast retrieval by using Store Procedures, variables, various transaction categories. These queries reduce execution time on a huge factor.

(e) **Bootstrap and CSS**

Bootstrap is a free and open-source CSS framework coordinated at responsive, versatile first front-end web advancement. It contains CSS-and JavaScript-based plan formats for typography, forms, buttons, route, and other interface parts.

(f) **Asynchronous JavaScript and XML**

Ajax is a set of web development procedures that utilizes different web advances on the customer side to make offbeat web applications. With Ajax, web applications can send and recover information from a server asynchronously without meddling with the showcase and conduct of the current page. It is used to send and receive some requests asynchronously.

3.3.4 Hardware Requirements

- 4gb DDR3 Ram or higher

- 60gb storage

- Core i3 or higher

- 10 GB SSD storage and 1 GB ram on cloud server.

3.3.5 Required Tools

- Visual Studio Code

- Jupyter Notebook

3.4 Descriptive Use cases

3.4.1 Client Signup

UC Name	Sign Up
Initiating Actors	Client
Actor Goals	Register to website
Pre-Condition	Enter valid credentials
Post-Condition	Successfully registered to web site
Stimulus	Click the sign up button
Success Scenario	Successfully registered
Alternative Scenario	Enter correct credentials
Comment	New user will be successfully signed up to website by entering right credentials. Now it can login to use dashboard options.

Table 3.1: Use Case for Client Registration

3.4.2 Client Login

UC Name	Login
Initiating Actors	Client
Actor Goals	login to dashboard
Pre-Condition	Must be registered user and enter valid credentials
Post-Condition	Successfully logged into dashboard
Stimulus	Click the sign up button
Success Scenario	Successfully logged in
Alternative Scenario	Enter correct credentials
Comment	User will be signed into the website. Then user can add properties to favorite list.

Table 3.2: Use Case for Client login

3.4.3 Price Estimator

UC Name	Estimate Price
Initiating Actors	Client
Actor Goals	Estimate the price of property plot, house, shop or apartment.
Pre-Condition	Enter valid credentials against shop, plot, house or apartment.
Post-Condition	Successfully predicted the price.
Stimulus	Click estimate button
Success Scenario	Estimated correct price according to market.
Alternative Scenario	Enter correct credentials
Comment	User will get to know current market value of its property.

Table 3.3: Use Case for Price estimation of property

3.4.4 Agent Registration

UC Name	Agent Registration
Initiating Actors	Admin
Actor Goals	Register an agent profile
Pre-Condition	Enter Email and other credentials of agent
Post-Condition	Successfully created agent's profile
Stimulus	Click register button.
Success Scenario	Successfully create agents profile.
Alternative Scenario	Enter correct credentials according to field type.
Comment	Agent will get dashboard on system. Where it can manage its ads.

Table 3.4: Use Case for Agent registration

3.4.5 Agent Login

UC Name	Agent login
Initiating Actors	Agent
Actor Goals	login to Agent Panel
Pre-Condition	Must be registered by admin and enter valid credentials
Post-Condition	Successfully logged into dashboard
Stimulus	Click the login button
Success Scenario	Successfully logged in
Alternative Scenario	Enter correct credentials
Comment	Agent will be signed into the Agent panel of website. It can manage properties and update its profile.

Table 3.5: Use Case for Agent Login

3.4.6 Ads Management

UC Name	Ads Management
Initiating Actors	Agent
Actor Goals	login to Add, update or remove properties ads.
Pre-Condition	Agent must be signed into the Agent panel.
Description	Agent can add new property ads by entering valid details of plot, house, shop or apartment located in Islamabad. Each add will contain contact details of agent. In addition it can update or remove ads accordingly.
Post-Condition	Successfully added, removed or updated ads.
Stimulus	Click the add, update or delete button
Success Scenario	Successfully performed CRUD operations
Comment	Agent will be signed into the Agent panel of website. It can manage properties and update its profile.

Table 3.6: Use Case for Property Ads Management by agents and admin

3.4.7 Price Estimation Model Management

UC Name	Price Estimation Model Management
Participating Actors	Agent and Admin
Actor Goals	Add new rows in Models dataset to keep the model updated according to market.
Pre-Condition	Agent and Admin must be signed into their panel and enter valid details.
Description	Agent can add new property ads by entering valid details of plot, house, shop or apartment located in Islamabad. Each add will contain contact details of agent. In addition it can update or remove ads accordingly.
Post-Condition	Row added successfully and Regression model considered it.
Stimulus	Click the add button.
Success Scenario	Model updated successfully.
Comment	Model will be trained and it will estimate price for given property details according to market rate.

Table 3.7: Use Case for Price Estimation model Pupation

3.4.8 Property Sale Request

UC Name	Property Sale Request
Initiating Actor	Client
Actor Goals	To fill up the form requiring required details of property.
Pre-Condition	Client should enter correct information according to text fields.
Description	Client will fill the form with required details plot size, area, demand, its name, Contact details and the request will be transferred to admin then admin will contact the client.
Post-Condition	Form details will be sent to admin.
Stimulus	Click the send button.
Success Scenario	Request sent successfully.

Table 3.8: Use Case for property sale request

Chapter 4

Design

This chapter illustrates the overall system design. Design of Flow of data, database design and UI design. It contains couple of diagrams for clear illustration.

4.1 System Architecture

This diagram illustrates High level view of system.
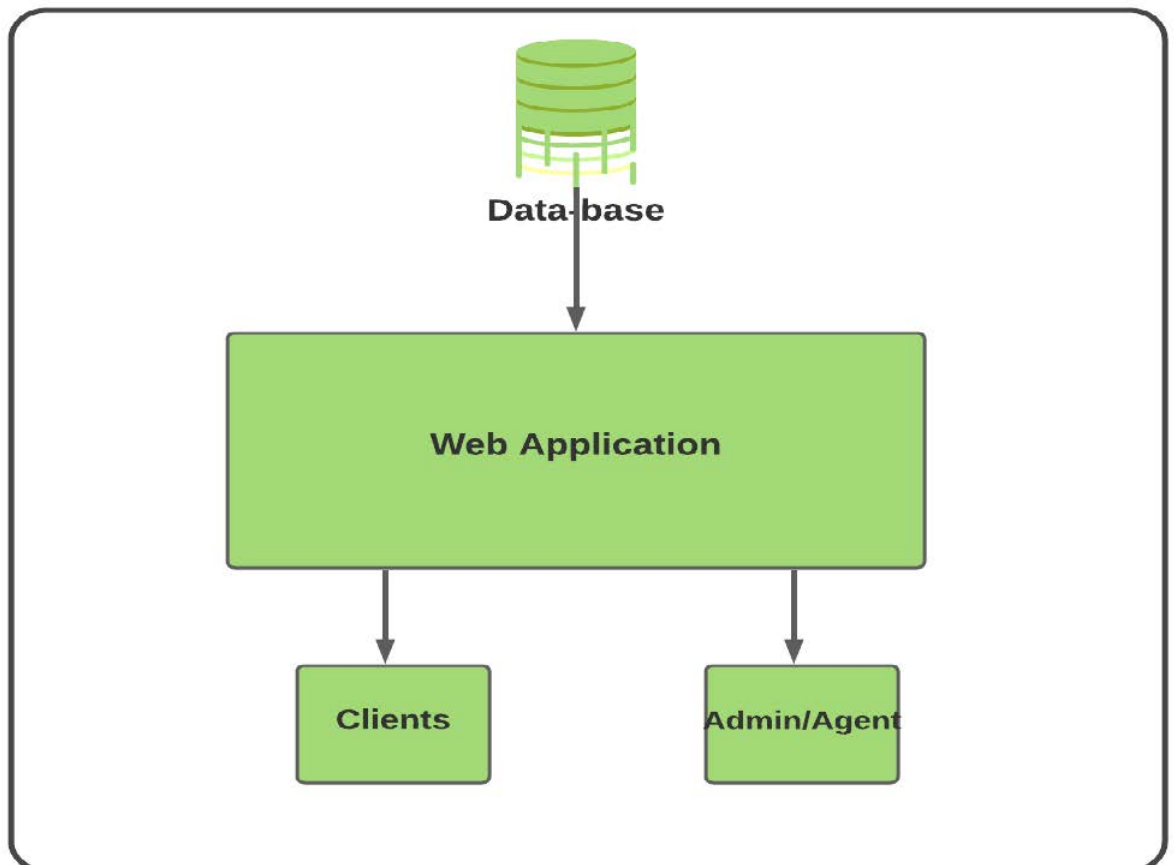
Figure 4.1: System architecture diagram

4.2 Database Design

System contains two databases.

1. **Properties_db:** It contains the all listed ads.

2. **Users_db:** It contains all information of users.

3. **CSV files:** Price Estimation model data will be stored in it.

4.2.1 Properties_db

It contains five tables. Its schema is as follow

Table: houses_tb

Columns:

h_id	int AI PK
h_no	varchar(10)
st_no	varchar(10)
st_width	int
is_corner	tinyint
sides_open	int
no_of_beds	int
no_of_baths	int
no_of_kitchens	int
no_of_floors	int
no_of_tanks	int
has_servent_quarter	tinyint
has_basement	tinyint
has_false_cieling	tinyint
floor_type	varchar(45)
sector	varchar(45)
phase/block	varchar(45)
city	varchar(45)
year_of_construction	int
price	varchar(45)
Agent	varchar(45)

Figure 4.2: Houses Table of properties database

Table: appartments_tb

Columns:

a_id	int AI PK
dimensions	varchar(20)
no_of_beds	int
no_of_baths	int
is_studio	tinyint
is_corner	tinyint
is_pent_house	tinyint
building_name	varchar(45)
building_dimensions	varchar(20)
road_front	int
sector	varchar(45)
phase/block	varchar(45)
city	varchar(45)
price	varchar(45)
Agent	varchar(45)

Figure 4.3: Apartments table of properties database

Table: plots_tb

Columns:

id_plot	int AI PK
dimensions	varchar(45)
p_no	varchar(10)
st_no	varchar(10)
is_solid	tinyint
st_width	int
is_corner	tinyint
sides_open	int
sector	varchar(10)
phase/block	varchar(25)
city	varchar(45)
price	varchar(45)
Agent	varchar(45)

Figure 4.4: Plots table of properties database

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Table: shops_tb

Columns:
s_id	int AI PK
dimensions	varchar(20)
floor_no	varchar(20)
is_corner	tinyint
is_washroom	tinyint
is_kitchen	tinyint
building_name	varchar(45)
building_dimensions	varchar(45)
sector	varchar(45)
block/phase	varchar(45)
city	varchar(45)
road_front	int
price	varchar(45)
Agent	varchar(45)

Figure 4.5: Shops table of properties database

Table: areas_tb

Columns:
a_id	int AI PK
a_name	varchar(45)

Figure 4.6: Areas table of properties database
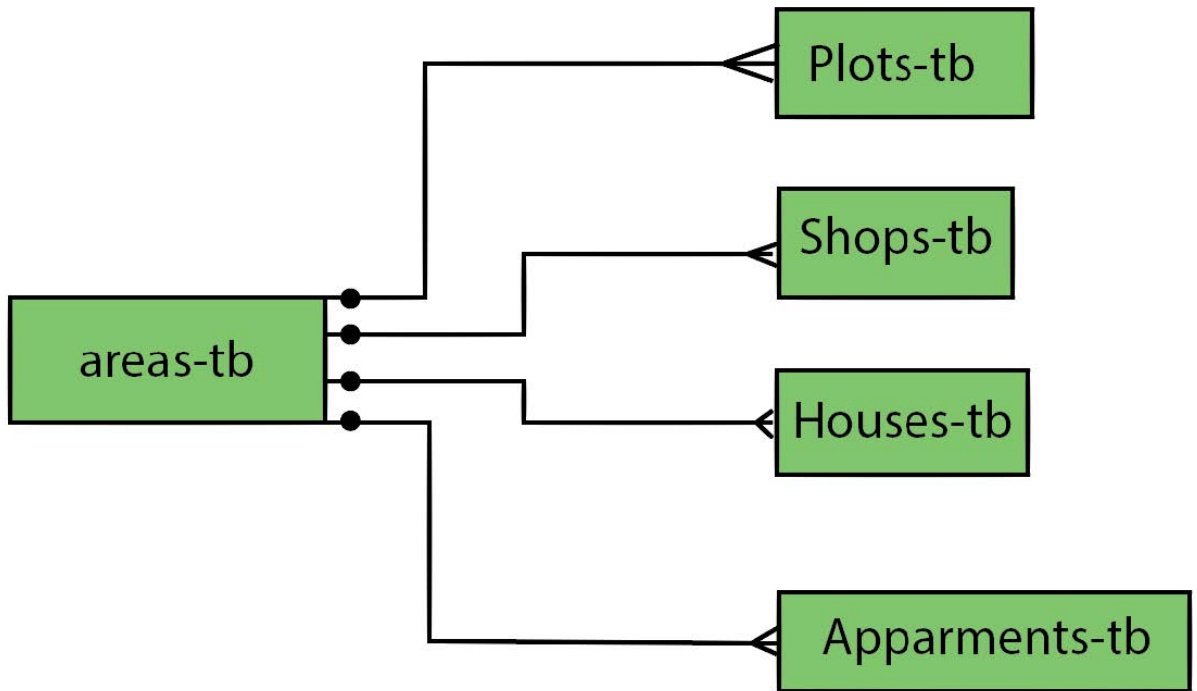
Figure 4.7: ERD of properties database

4.2.2 Users_db

Figure 4.8: Agents information table of properties database

Table: agents_login_tb

Columns:
agent_username varchar(50) PK
agent_password varchar(45)

Figure 4.9: Agents login information table of Users database

Table: client_info_tb

Columns:
client_id   int AI PK
client_name varchar(45)
client_email varchar(45)
client_phone varchar(45)
client_saved_ads varchar(100)
client_picture varchar(1000)

Figure 4.10: Clients information table of Users database

Table: client_login_tb

Columns:
client_email varchar(70) PK
client_password varchar(45)

Figure 4.11: Clients login information of Users database

agents-login-tb	●———●	agents-login-tb
clients-login-tb	●———●	clients-login-tb
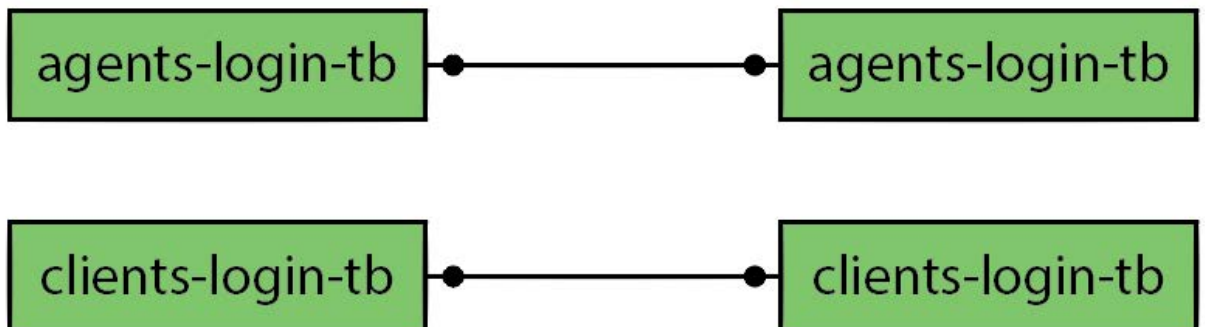
Figure 4.12: Simple ERD of Users database

4.3 Sequence Diagrams

These diagrams illustrates overall usage of components. These diagrams helps to show system design.

4.3.1 User Interaction to find Property

This diagram illustrates that how user will comes to website and search for required properties. It shows Presence and activities of Server and database during usage.
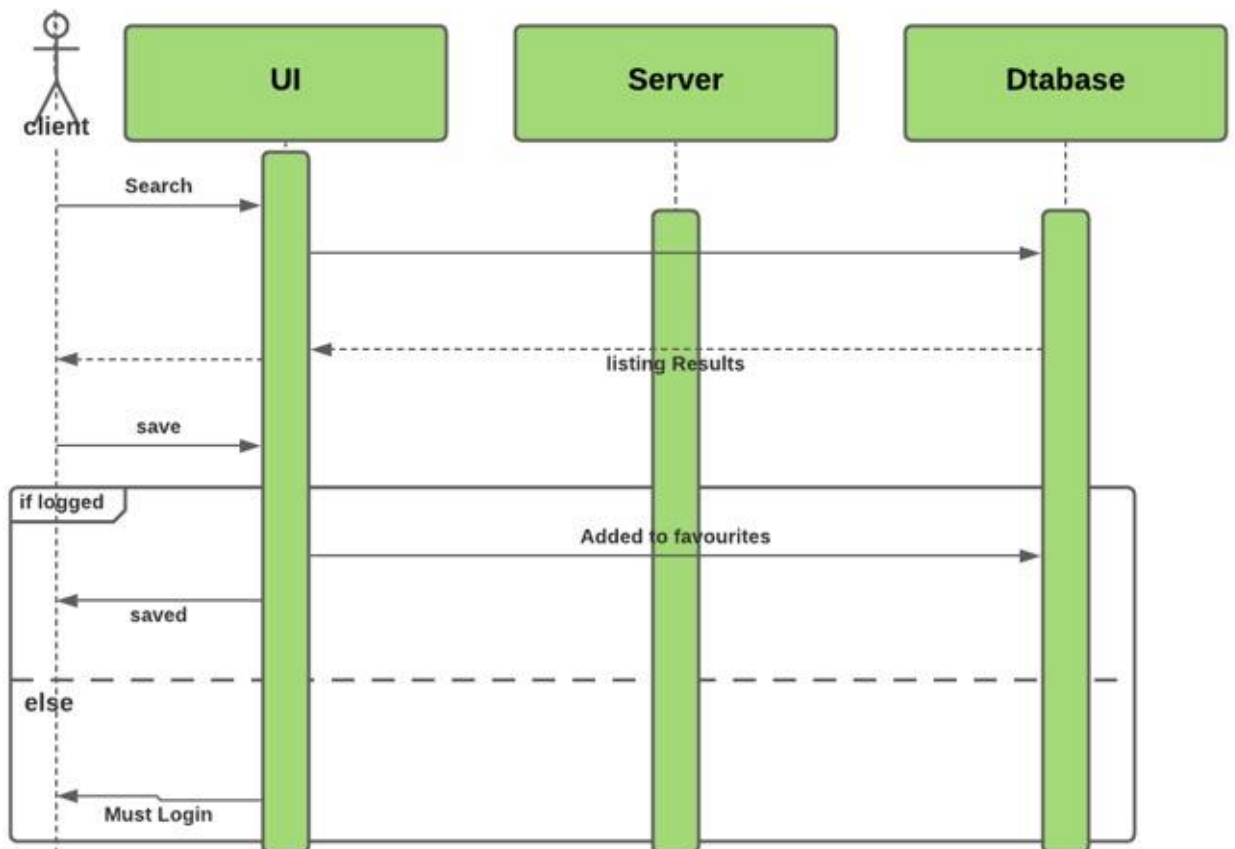
Figure 4.13: Sequence Diagram for User Interaction to find property

4.3.2 Client Registration

This diagram illustrates the Registration process of a client.
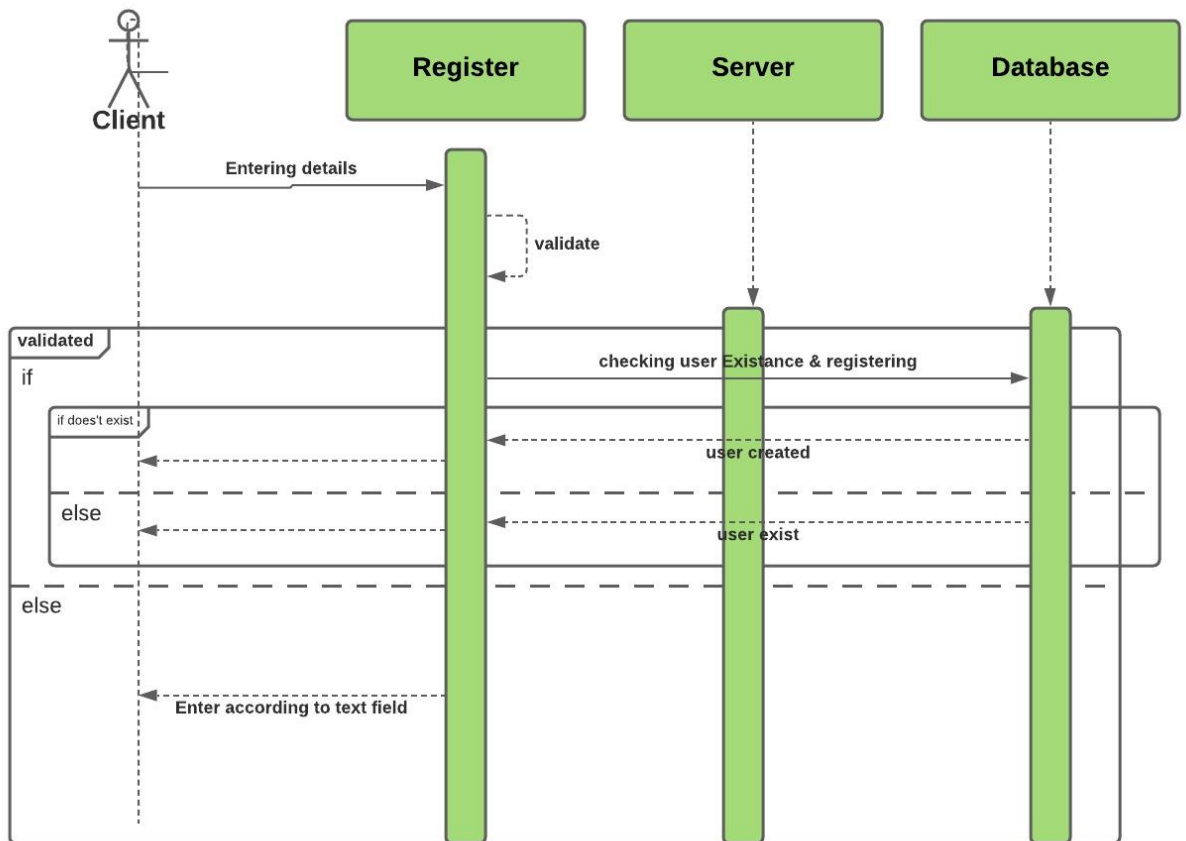
Figure 4.14: Sequence Diagram for Client Registration

4.3.3 Login Process of Users

This diagram illustrates the Login process of client(s).
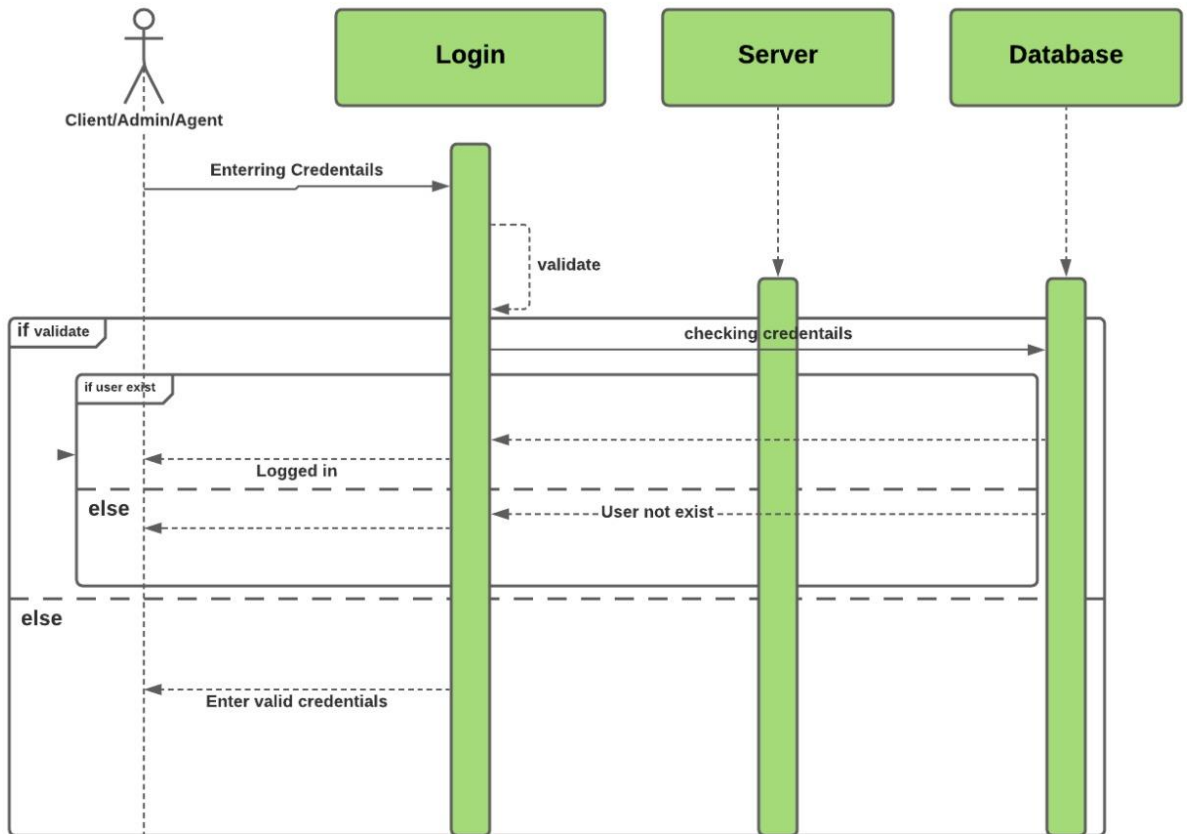
Figure 4.15: Sequence Diagram for Login Process of Users

4.3.4 Price Estimation

This diagram illustrates that how Client will fill up the form to estimate the price of its property assets.
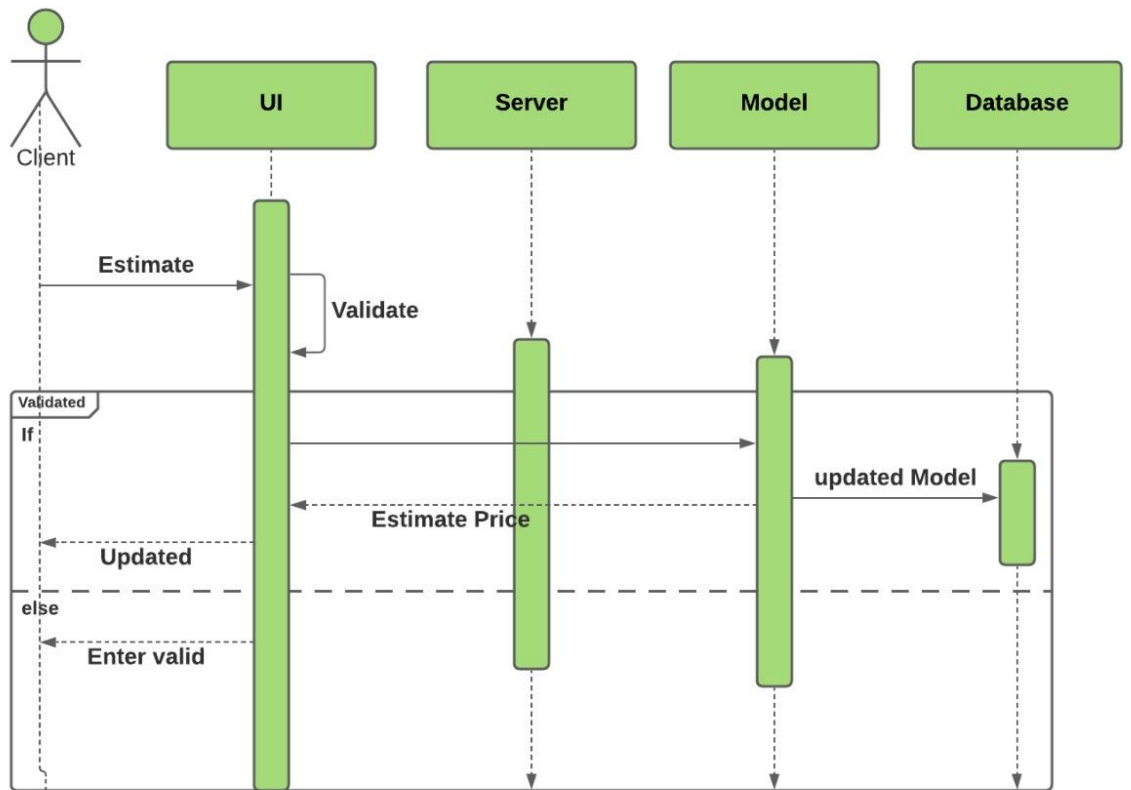
Figure 4.16: Sequence Diagram for Price Estimation of property

4.3.5 Property ads Management

This diagram illustrates the process of add, update or delete property ads. Ads are managed by Admin or Agent panel.
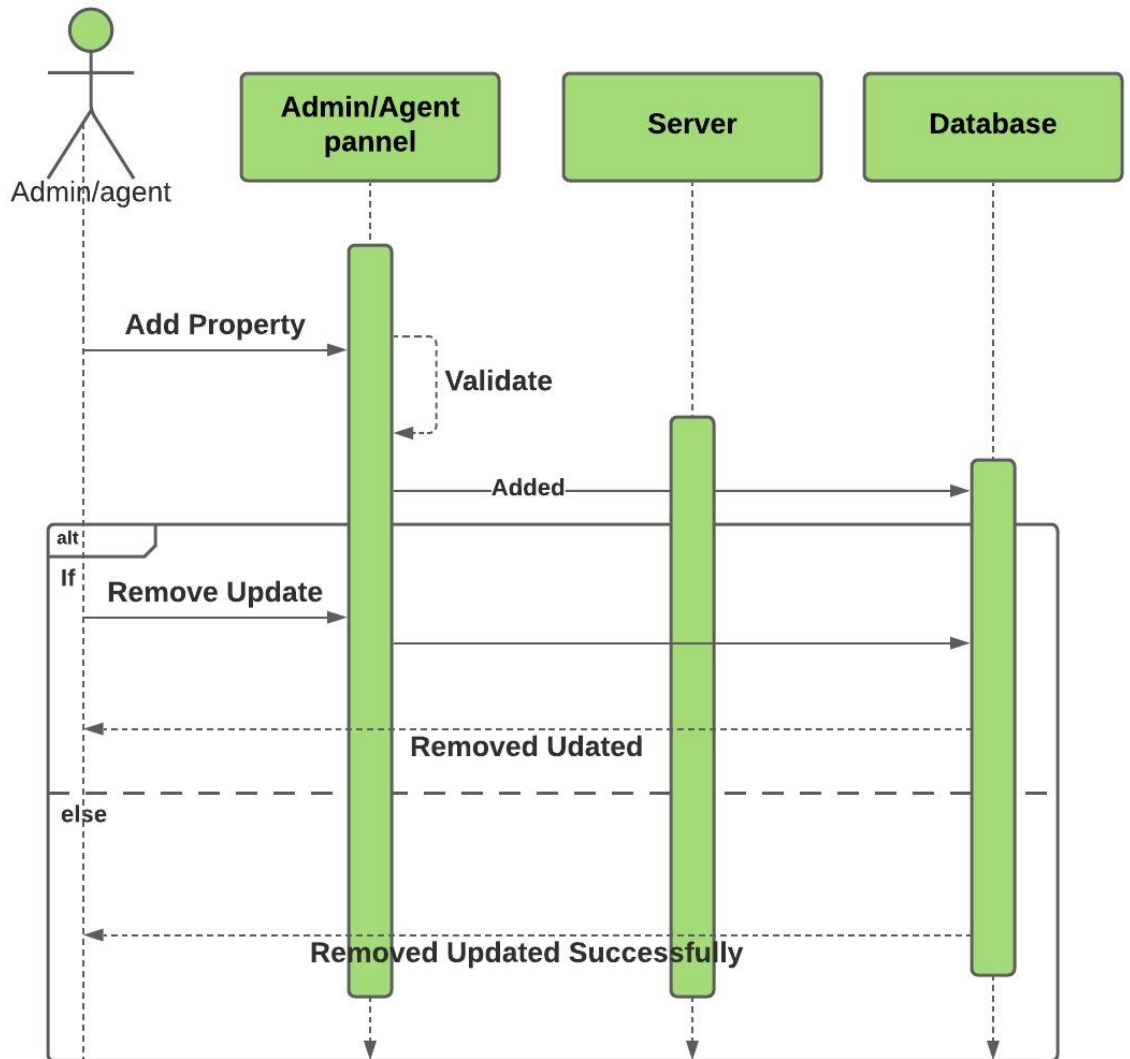
Figure 4.17: Sequence Diagram for Property ads management

4.3.6 Price Prediction Model pupation

This diagram illustrates the method and process of pupation of price prediction model. This process is managed by Admin or Agent panel.
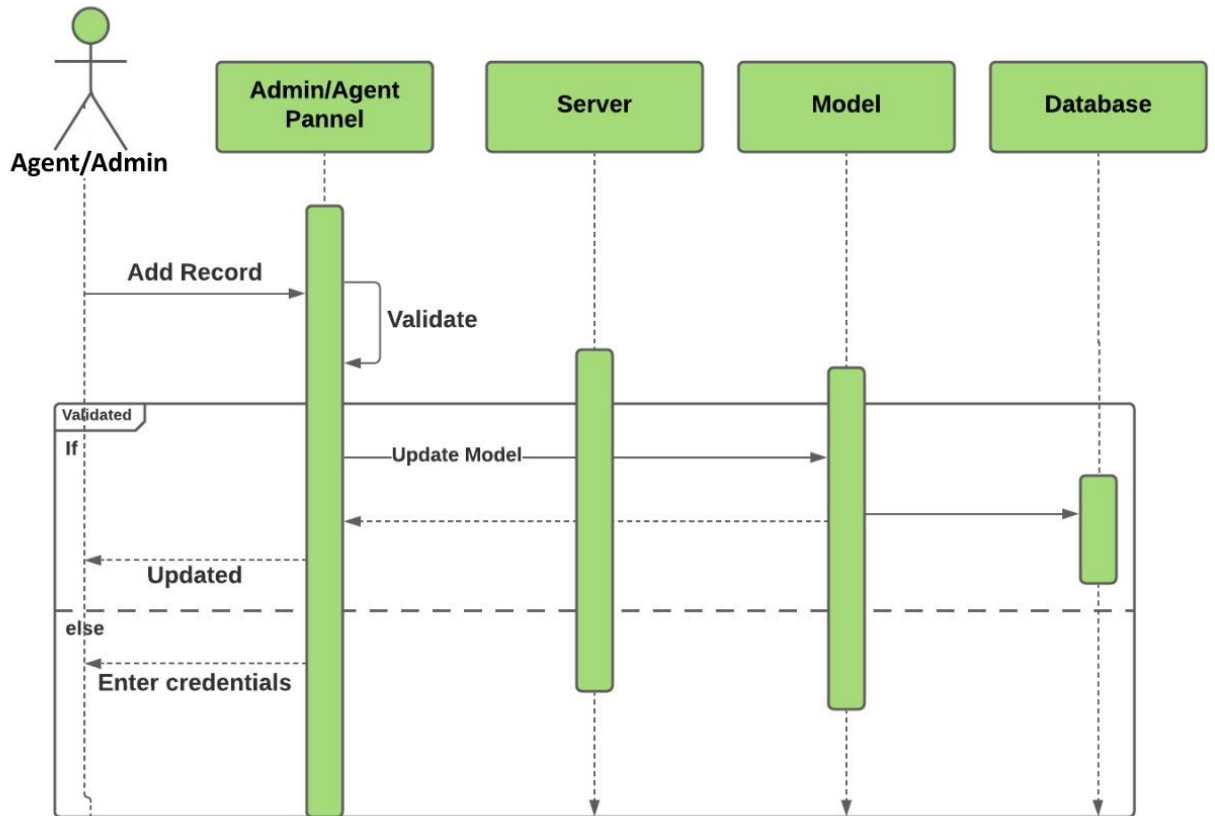
Figure 4.18: Sequence Diagram for Price Prediction model pupation.

4.4 Activity Diagrams

These diagrams illustrates the activities of users. Separate diagrams of clients, admin and agent are drawn.

4.4.1 Client's activities

This diagram illustrates the all planned activities of client.
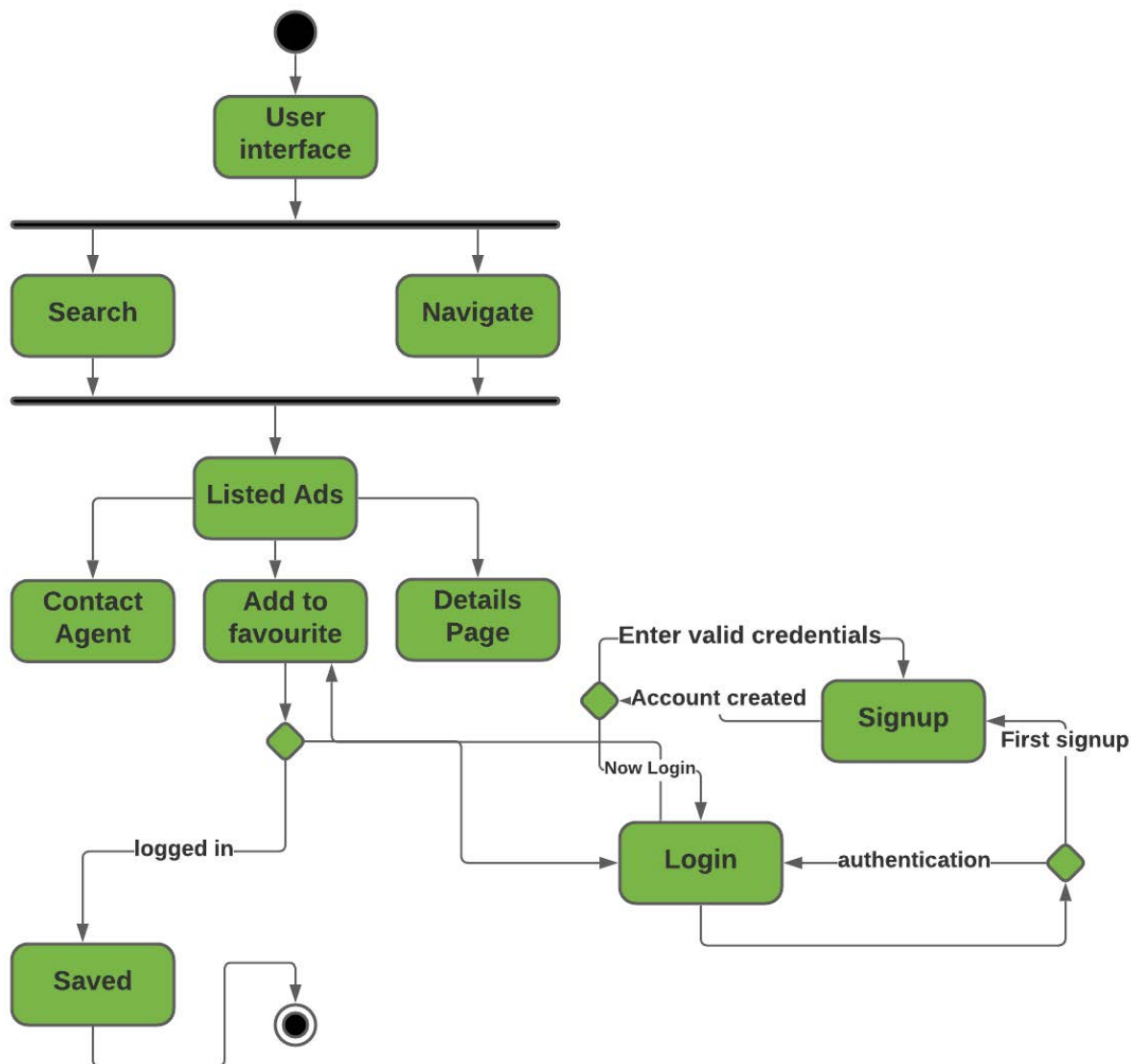
Figure 4.19: Activity diagram for Clients interaction

4.4.2 Admin's activities

This diagram illustrates all the activities of admin. Admin have full control of website.
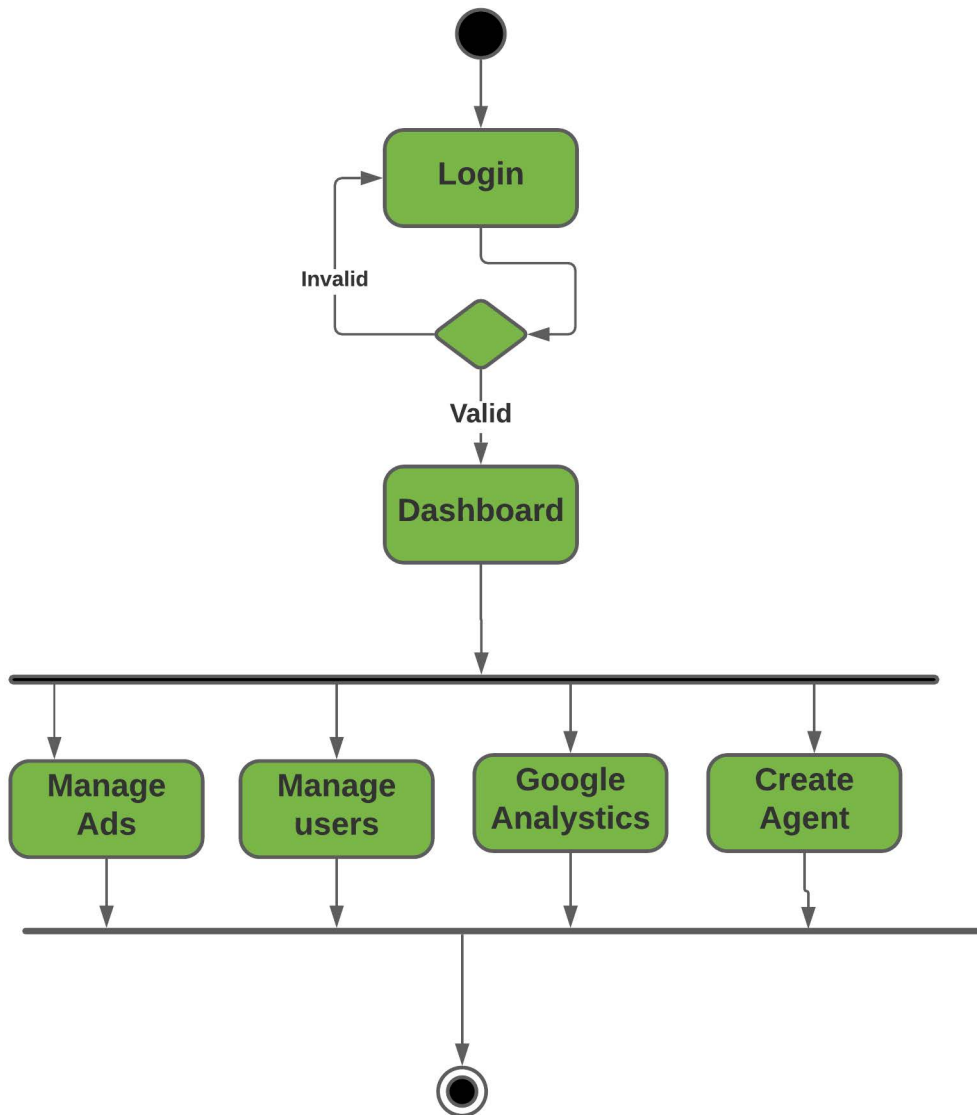
Figure 4.20: Activity diagram for Admin's interaction with system

4.4.3 Agent's activities

This diagram illustrates the all activities of agent. Agents performs its activities from agent panel.
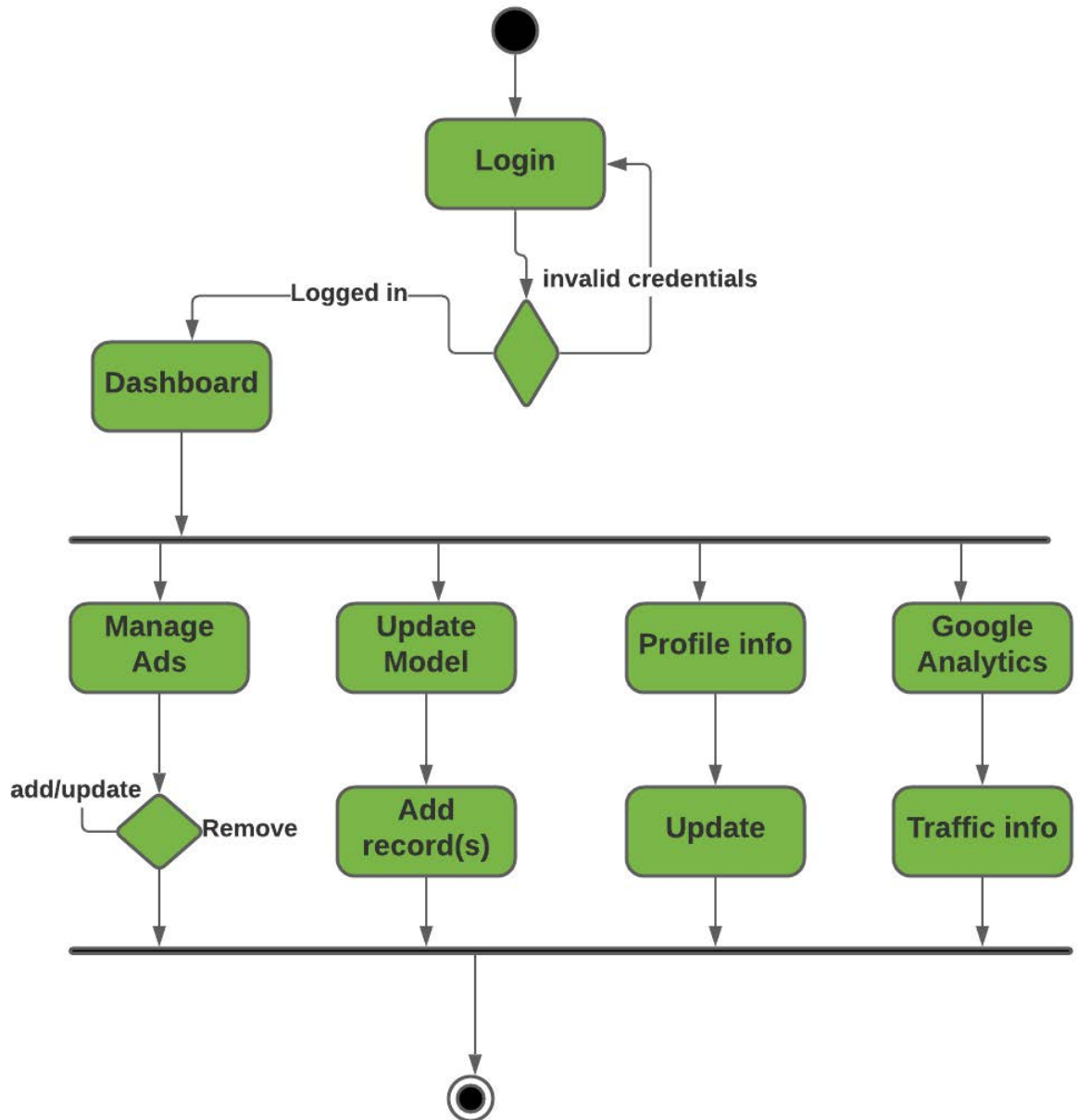
Figure 4.21: Activity diagram for Agent's interaction with system

4.5 State Diagrams

These diagrams illustrates the states transition of components when users perform different activities.

4.5.1 Client

This diagram illustrates the state transition of different components during client's activities.
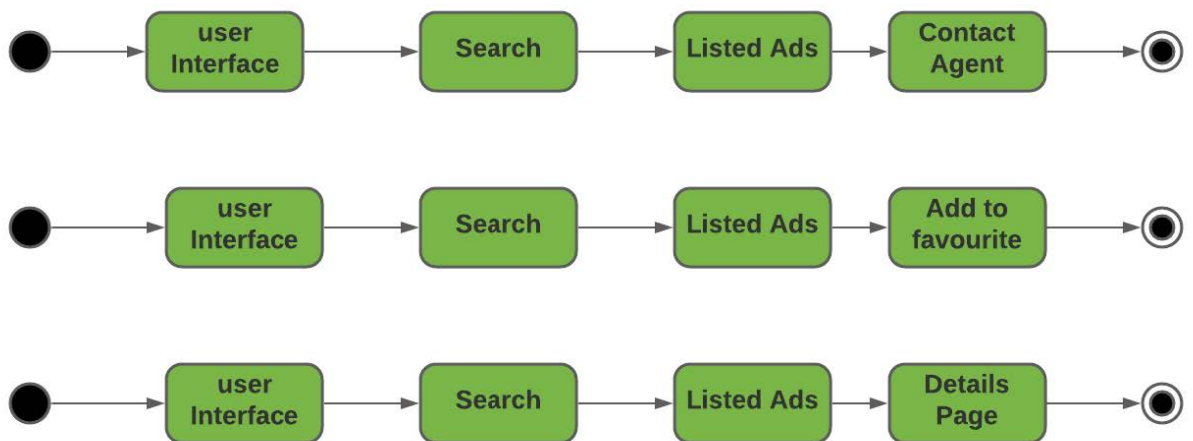
Figure 4.22: Client State Diagram for state transitions of system

4.5.2 Admin

This diagram illustrates the state transitions of components during Admin's activities.
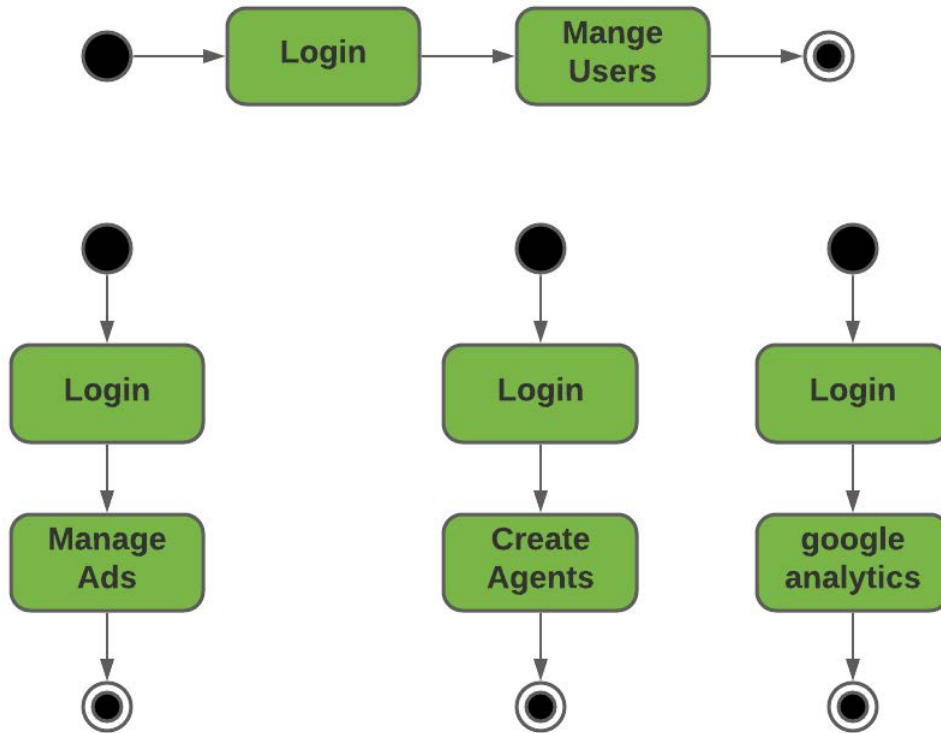
Figure 4.23: Admin State Diagram for state transitions of system

4.5.3 Agent's States

This diagram illustrates the state transitions of components during Agent's activities.
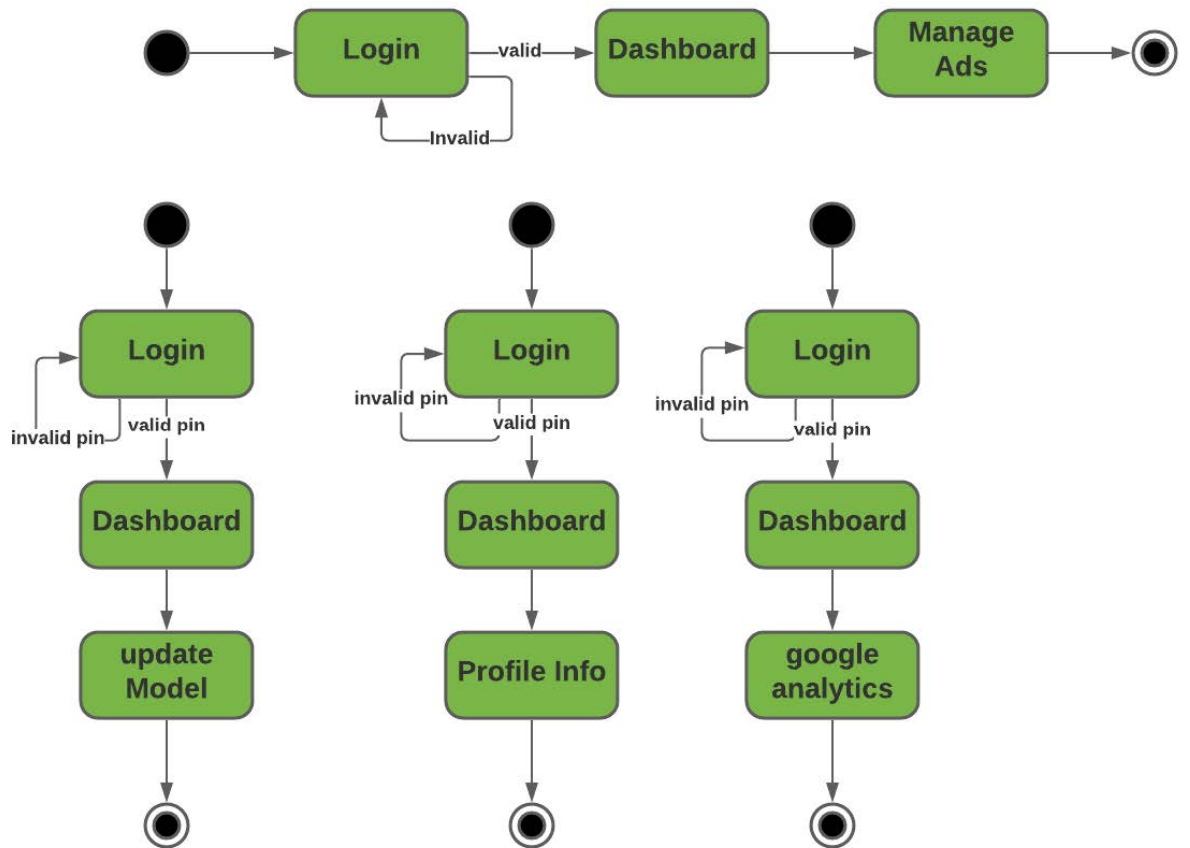
Figure 4.24: Agent State Diagram for state transitions of system

4.6   Process Model
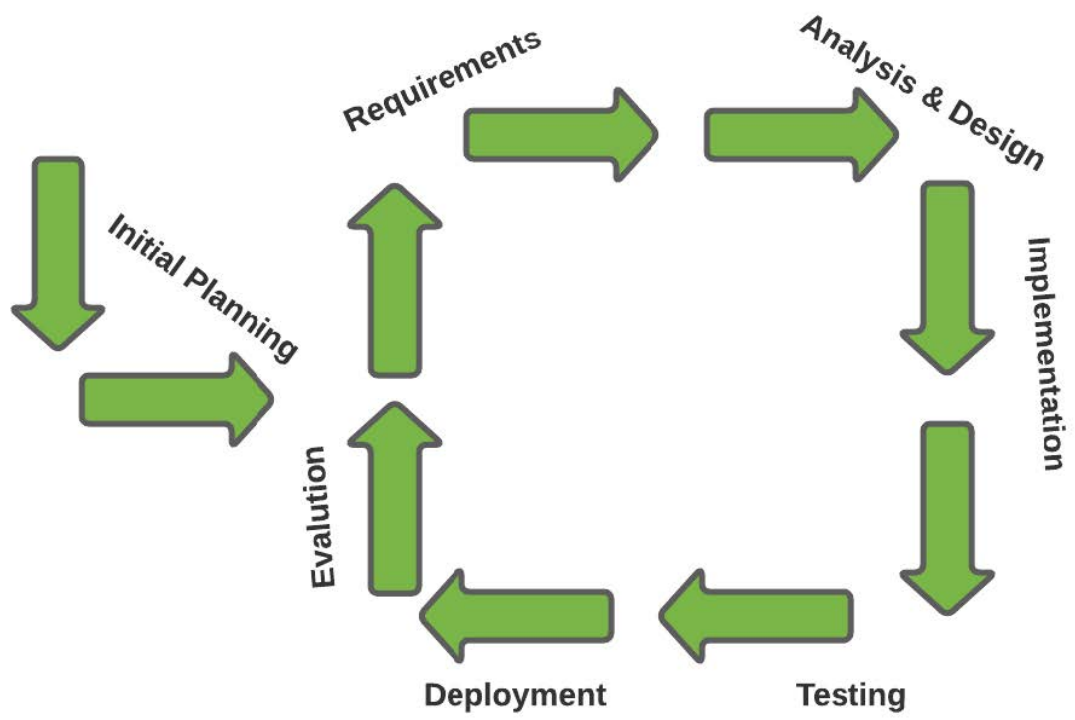
Figure 4.25: Process Model Diagram

Chapter 5

System Implementation

System implementation is an acknowledgment of a specialized specification as a program, software component, or another computer system by developing it, then deploying it. Introduction to the system of computes science process should determine how the system should be built, physically and systematically. In this chapter the implementation and execution of the systems concept algorithm strategy is done. It is a logical representation of a top-level project that shows, what components the application will have how the components are connected to each other moreover the user and the project collaboration with the components. It also gives information about the environment in which system is developed.

5.1 Integrated Development Environment

We have developed the Web Application based on React.js, Django, and Python for Machine Learning using Visual Studio Code and Jupyter Notebook. In this section we discussed the integration of our system in which the application is being developed and designed.

Visual Studio Code is a source-code IDE made by Microsoft for Windows, Linux and macOS. Highlights incorporate help for debugging, syntax featuring, smart code culmination, bits, code refactoring, and embedded git.
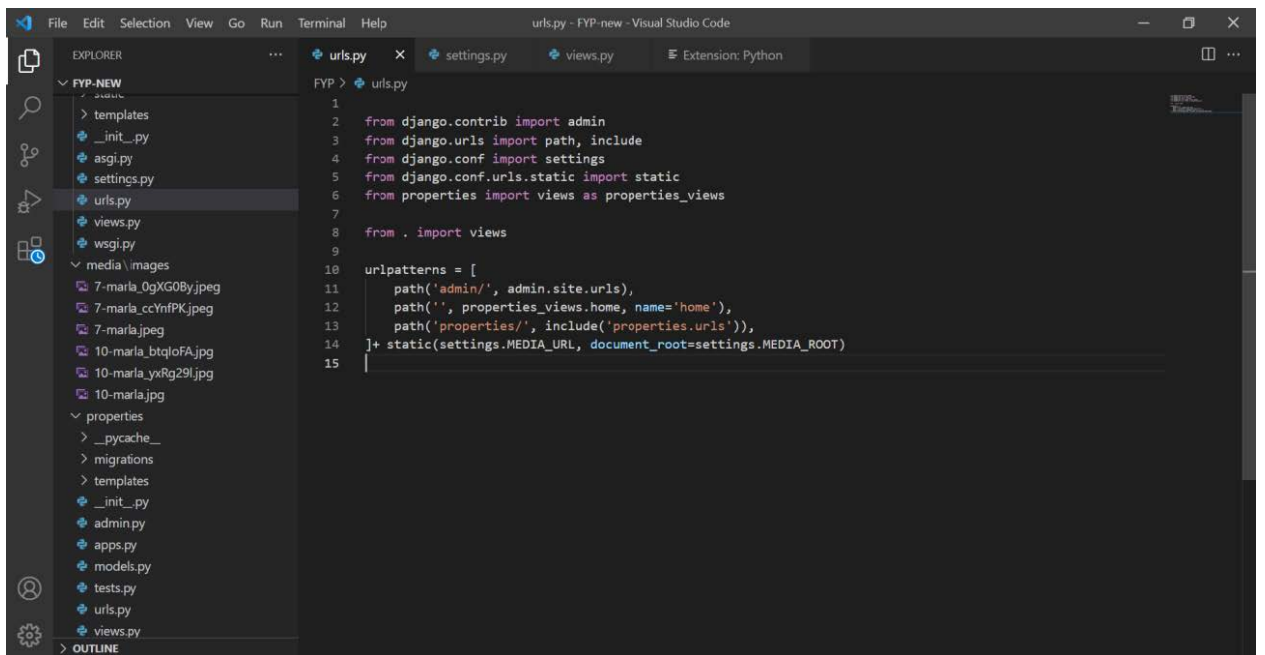
Figure 5.1: Django implementation on VS code

Although Machine Learning Models can execute on VS Code but Jupyter Notebook makes it easier by allowing to execute chunks of code and good visualizations. Its goal is to enable interactive computing across dozens of programming languages by developing open-source software, open-standards, and services.
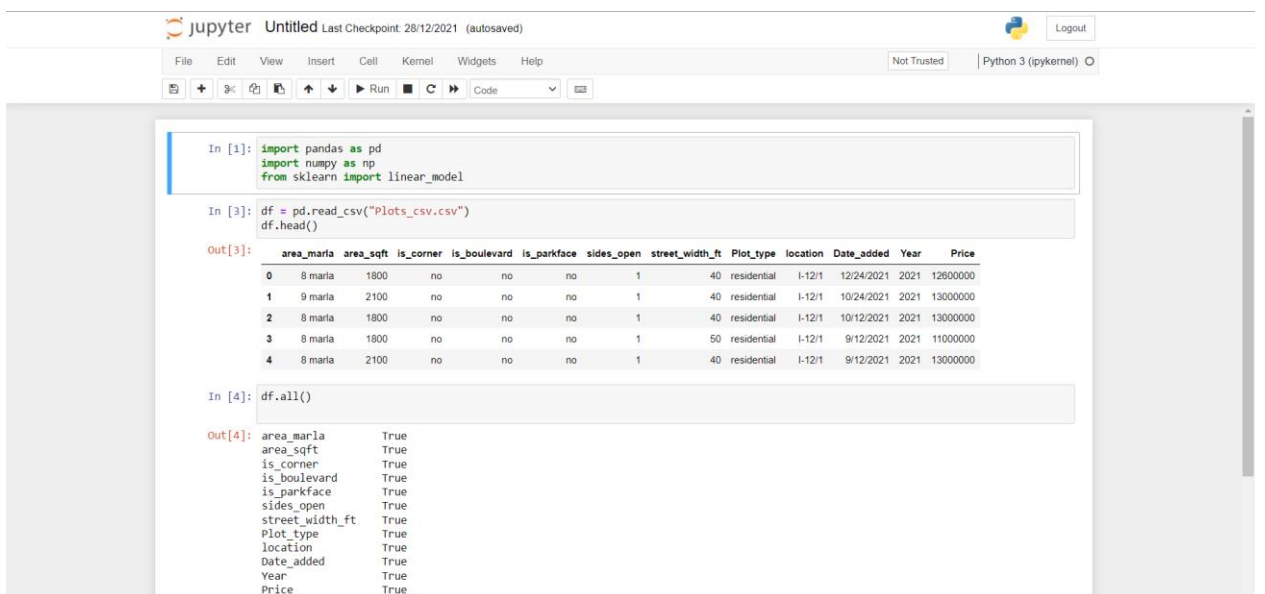
Figure 5.2: ML work on Jupyter Notebook

5.2 Architecture and Component Integration

5.2.1 Front end Components

User Interface is designed using bootstrap and native CSS where needed. Behavior of UI is developed on React.js. As in React.js there is not .html files in React instead html file is embedded in .JS file. Several files are named below

- Home.js

- Buy.js

- Rent.js

- Sell.js

- Estimate Price.js

- About.js

- Contact.js

- Client Signup.js

- Client Login.js

- Client dashboard.js

- Details.js

- Admin login.js

- Agent login.js

- Admin Panel.js

- Agent Panel.js

5.2.2 Backend components

Backend of Website is developed on Django. In Django Web App is developed using several apps. These apps makes the execution fast and are easily reusable. Each app contains its own templates, admin file, models, tests, views and URL files. When an app receives a requested link, it searches that link in its URLs.py file. Once found it picks the function name of the link and sees that function in its views.py, once found then it responses to requested link. Project contains several apps

1. Properties

2. Clients

3. Agents

4. Admin

All of development process is around these apps.

(a) **Properties App**

Requests of static pages, listing of ads comes to this app. URL.PY file of this app
ensures the link by searching the file in Views.py and in response sends that file
or extract the data from database and list data on specified page. Each estimated
property's information adds in Prediction Model's dataset.

- **Response to Static Requests:**
  When it receives the request.

  – It looks for the requested in its URLs.py file.

  – It takes function name from link and goes into its VIEWs.py file.

  – It goes into templates folder and returns the requested static page to UI.

(b) **Clients App**

This app contains the login, signup and dashboard functionalities of client. Once a
client tends to login/signup to the system. Request forwards to this app.

- **Response to Static GET requests:**

  – It searches that link in its URLs.py

  – It takes the function name and search that function in its VIEWs.py.

  – It takes database and table information from function and fetch the records
    (e.g. list of saved ads, profile information of client) and in response returns
    the requested records.

- **Response to Dynamic GET requests:**

  – It searches that link in its URLs.py

  – It takes the function name and search that function in its VIEWs.py.

  – It takes database and table information from function and fetch the records
    (e.g. list of saved ads, profile information of client) and in response returns
    the requested records.

- **Response to POST requests:**

  – It searches that link in its URLs.py

    – It takes the function name and search that function in its VIEWs.py.

    – It takes database and table information from function and fetch the records (e.g. list of saved ads, profile information of client) and in response returns the requested records.

(c) **Admin App**

This app contains the functionalities of admin. Admin is created by default statically. There is not any signup option for admin, although admin reserve rights to create another admin which can manage system as it manages. Admin can manage ads, google analytics, and agents.

Admin creates the agents profiles. There is not also signup page for agents.

- **Agents Registration:**

  Admin creates the agent from his dashboard. He enter the required credentials

      – Name

      – Email

      – Mobile

      – Password

  Of agent and then agent can change his password from his dashboard. Admin reserve rights to delete an agent's profile.

- **Price Prediction Model Pupation:**

  Admin can update the ML model. It will fill up the form to add a new row in dataset.

      – App will fetch the specified link in URLs.py

      – Then it will takes the function from VIEWs.py and executes the queries to updated model.

  Admin can also add a valid file to retrain the model.

- **Google Analytics:**

  Admin and agents both reserve rights to manage google analytics. Google analytics is used because it is very simple and easy to use to analyze traffic.

- **Users Management:**

  Admin reserve rights to delete profiles of clients as well as agents.

(d) **Agents App**

This app contains the functionalities of Agents activities login, dashboard, Model pupation and ads management.

5.2.3 Model components

Price Estimation model is developed using python for Machine Learning and Multiple Linear Regression. The dataset contains two thousand and 17 records which is further divided in four datasets containing data of shops, apartments, plots and houses. Different libraries are used for accomplishment.

(a) **Pandas:**
It is used for data analysis. Data cleaning and reshaping will be done using this.

(b) **Seaborn:**
It is used for better data visualization. More visualization will create more clarity.

(c) **Scikit-learn:**
It is used for data visualization, modelling, predictive analysis and Multi Linear Regression algorithm.

(d) **Numpy:**
It is used to perform scientific and mathematical operations on arrays.

(e) **Matplotlib:**
It is used for grid and ration axes box visualization.

5.3 Tools and Technique

5.3.1 Python for Machine Learning

Price estimator model is developed on Supervised Machine Learning technique using Multi Linear Regression Model. This algorithm is best suitable for price prediction. Its linearity nature makes easy to find value for independent variable .Following libraries are used to implement this.

5.3.2 Django Framework

It is fastest web framework. In heavy traffic situation, server decides the quantity of threads. It has good compatibility with Machine Learning models. Required components for development are as follow

(a) **Django Rest Framework:**
It used for Get/Post/Put/Delete requests development.

- GET will be used for general requests.
- POST will be used for sensitive request e.g. Signup/Sign in credentials, sale property request and credentials for price prediction.

- PUT request for update details of any ad or agent's profile information.
- DELETE request for remove ads or agent.

(b) **Django Object Relational Mapper:** It is Django's default relational model which interacts with relational databases, it gives feel like developer is directly using SQL. It will be used to interact with MySQL database.

5.3.3   React.js

It is used for frontend development because it is fastest technology for good user experience. It takes less execution time than native JavaScript. Its component based object oriented nature loads all frontend rapidly.

5.3.4   Asynchronous JavaScript and XML

It is used for runtime form validations as it is a set of web development procedures that utilizes different web advances on the customer side to make offbeat web applications. With Ajax, web applications can send and recover information from a server asynchronously without meddling with the showcase and conduct of the current page. It is used to send and receive some requests asynchronously.

5.3.5   MySQL database

It is used for storage of information as it is the fastest database for Web Applications. It makes fast execution of data because of Store Procedures, variables, various transaction categories. These queries reduce execution time on a huge factor.

5.3.6   MS Visual Studio Code

It is the best IDE for software development. In addition to highlighting syntax, auto-indenting, box selection, snippets, auto-syntax highlighting, and more, Visual Studio Code provides support for hundreds of languages.

5.3.7   Jupyter Notebook

Price Estimation model is developed on it. It is an open-source web application that permits data scientists to make and share reports that coordinate live code, conditions, computational result, visualizations, and other multimedia resources, alongside logical text in a solitary archive.

5.4 Methodology

As this project is a real-time application, it is best-suited to use incremental methodology. Incremental model would minimize risk (such as bugs, cost overruns, and changing requirements) when adding new functionality. In all incremental methods, teams develop the software in iterations that contain mini-increments of the new functionality. Iterative releases improve efficiency by allowing teams to find and fix defects and align expectations early on

Chapter 6

System Testing and Evaluation

6.1 Graphical User Interface Testing

- The size of the viewport was adjusted after trying out multiple dimensions during Design testing. The best actual view on large screen was considered.

- All the buttons which were added for certain activities are verified and tested for definite response area size and by determining the actual location to place the button on a certain generic Page.

6.2 Usability Testing

The website and system upon which it is being carried out, requires no technical experience to use. The website through which the user can access his account, this only requires physical implementation by which the user provides his credentials on the website and can hence log into the account to setup and access all the functionalities of his account.

Moreover system is developed on HCI rules. Color schemes and fonts are used by considering that older than 18 years anyone can use this system.

6.3 Software Performance Testing

This System requires no exceptional capabilities or resources, it has minimal response time, less system hardware utilization due to best technologies used which accounts for great overall performance. It is easy to use and in case if system stops to respond then it will be connection problem of user, user just have to reload the page.

6.4 Test Cases

6.4.1 Search for property

Test case ID	TC-1
Title	Finding Property
Pre Conditions	Users must open the home page.
Input	Select the Required property details and price range.
Test steps	- Select Buy or rent. - Select residential/commercial, other information and price range. - Press the Search button.
Expected Result	Listed searched ads.
Status	Pass

Table 6.1: Test Case Search for property

6.4.2 Agent Registration

Test case ID	TC-2
Title	Agent Registration
Pre Conditions	Admin must be logged in to Admin dashboard
Input	Admin must be logged in to Admin dashboard
Test steps	- Enter Name - Enter Email - Enter Phone - Enter password - Press the Create button
Expected Result	User is registered to use the Agents dashboard of application.
Status	Pass

Table 6.2: Test Case for Agent Registration

6.4.3   Login of Users

Test case ID	TC-3
Title	Login
Pre Conditions	Users must be registered.
Input	Enter correct Email/username and password.
Test steps	- Enter Email - Enter password - Press the Sign in button
Expected Result	User logs into dashboard.
Status	Pass

Table 6.3: Test Cases of login process, Pass scenario

Test case ID	TC-4
Title	Login
Pre Conditions	Users must be registered.
Input	Enter incorrect email or password
Test steps	- Enter Email - Enter password - Press the Sign in button
Expected Result	Error message occurred "Invalid email or password"
Status	Fail

Table 6.4: Test Cases of login process, Fail scenario

6.4.4 Price Estimation Process

Test case ID	TC-5
Title	Price Estimation process.
Pre Conditions	Users must select Plot or house.
Input	Enter correct Information for accurate result.
Test steps	- Fill the form correctly. - Press the Estimate button. - Wait for the result.
Expected Result	Predicted Correct price.
Status	Pass

Table 6.5: Test Case for Price Estimation Process

6.4.5 Property Ads management

Test case ID	TC-6
Title	Adding a property ad.
Pre Conditions	Agents or Admin must be logged in.
Input	Enter correct Information.
Test steps	- Select House, Plot, Shop or Apartment. - Enter information of property. - Press the Add button.
Expected Result	Add listed to relevant page.
Status	Pass

Table 6.6: Test Case for adding ads

Test case ID	TC-7
Title	Update an existing property ad.
Pre Conditions	Agents or Admin must be logged in.
Input	Enter correct Information.
Test steps	• Find the ad from list of posted ads which is sorted ascendingly. • Click on the Update button and the edited menu gets open. • Edit the details and Press Update button.
Expected Result	Add updated and listed to relevant page.
Status	Pass

Table 6.7: Test Case for updating ads

Test case ID	TC-8
Title	Update an existing property ad.
Pre Conditions	Agents or Admin must be logged in.
Input	Enter correct Information.
Test steps	• Find the ad from list of posted ads which is sorted ascendingly. • Click on the Update button and the edited menu gets open. • Edit the details and Press Update button.
Expected Result	Ad deleted.
Status	Pass

Table 6.8: Test Case for deleting ads

Chapter 7

Conclusions

System is developed for users who have issues with the pricing of the day-to-day purchase of real estate properties of Pakistan. While performing on the project, we learnt the practicality and aspects of land fare prediction has been a serious concern in real estate market. To stay track of all the knowledge and collection of dataset, it can cause solutions of major issues as discussed in several sections, the thought of using machine learning and data science to introduce land market to machine learning was a serious aspect of this project. Better results were obtained, appealing accuracy of the models resulted in better predictions and importance of live graphs was appreciated.

Using a dataset of Islamabad's properties by collecting through survey forms, realtors etc. This paper address, the foremost important attributes of this system can affect sold price, these models proposed during this paper outperform or get near to actual prices of Islamabad houses, as this concept of using models would be ready to predict accurate prices and has the credibility to be employed by the realtors and real estate agencies After inquiring the preprocessing steps and observing visuals and trends of various attributes with reference to price and rent, the attributes were ranked as per requirement, this system are often really useful when applied to a dataset with greater number of attributes, the foremost important attributes of Islamabad housing data that affect the sale price are location, area, bedrooms, garage and lawn. The models proposed during this project are considered one among the simplest algorithms for prediction consistent with previous work done on house price prediction in several countries. The idea are often implemented in land which may be really useful for realtors to stay track of all the knowledge and price trends and also by investors and customers. System may be appended with new functionalities in future.

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