A Real Estate Management System for Property Buying and Selling

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APPROVAL

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DECLARATION

We hereby declare that the work presented in this report is the outcome of the investigation performed by us under the supervision of **Bulbul Ahamed, Professor** and **Head,** Department of Computer Science and Engineering, Sonargaon University, Dhaka, Bangladesh. We reaffirm that no part of this project has been or is being submitted elsewhere for the award of any degree or diploma.

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ABSTRACT

Despite the presence of numerous platforms in the market, the lack of a truly comprehensive real estate solution remains evident, especially in areas like accurate price estimation and effective communication between buyers and sellers. To address these gaps, we developed a real estate management system equipped with a dynamic price prediction feature that helps buyers gain deeper insights into property values, enabling them to make more informed investment decisions. In addition, our platform emphasizes user experience through a highly intuitive interface and an integrated In-App Messaging Solution. This feature facilitates seamless and direct communication between parties, effectively bridging the existing communication gaps that often lead to misunderstandings and mistrust in property transactions. By offering a transparent and user-friendly environment, our platform enhances trust, clarity, and efficiency in the real estate buying and selling process. In essence, this project aims to deliver a complete web-based real estate application that empowers users with tools for better decision-making and improved interaction.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
API	Application Programming Interface
CI	Continuous Integration
CSS	Cascading Style Sheets (in Tailwind CSS)
DFD	Data Flow Diagram
ER	Entity Relationship
JS	JavaScript (implied in React.js, Node.js, Express.js)
NoSQL	Not Only SQL (database type)
NLP	Natural Language Processing
ORM	Object-Relational Mapping
QA	Quality Assurance
ROI	Return on Investment
UI	User Interface
UX	User Experience
UML	Unified Modeling Language
VS Code	Visual Studio Code

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The real estate industry is undergoing a digital transformation, influenced by the growing need for efficient, reliable, and accessible platforms that connect buyers and sellers. Traditional methods of property transactions are often time-consuming and prone to miscommunication. To address these challenges, the proposed Real Estate Management System aims to offer a streamlined, user-centric web platform that facilitates property buying, selling, and decision-making with ease. The platform incorporates features such as price estimation tools, in-depth property listings, and real-time communication between parties.

1.2 Problem Statement

Despite the rise of online property portals, many existing platforms fail to offer a comprehensive solution that supports informed decision-making and transparent communication. Common issues include:

- Lack of tools to estimate a property's fair market value.
- Inadequate communication channels between buyers and sellers.
- Cluttered or confusing user interfaces that reduce platform usability.
- Insufficient information about properties and neighborhoods.

These shortcomings often lead to misunderstandings, mispricing, and delayed transactions, which can ultimately reduce user trust and satisfaction.

1.3 Objectives

The primary objectives of the Real Estate Management System are as follows:

- To develop a web-based platform that enables users to buy and sell properties easily.
- To implement a property price estimation feature based on historical and market data.
- To provide detailed property listings including images, specifications, and location data.
- To integrate a secure and real-time in-app messaging feature for smooth communication.
- To offer a user-friendly interface that ensures effortless navigation and usage.
- To support property seekers and sellers in making better, faster, and more confident decisions.

1.4 Scope of The Project

This project focuses on the development of a single-platform solution for real estate transactions. The system will:

- Allow users to register, log in, and manage profiles.
- Enable sellers to list properties with multimedia content and relevant details.
- Provide buyers with filtering options to search and view available properties.
- Offer an integrated communication system for direct messaging between users.
- Display estimated price ranges and relevant analytics to support decision-making.

However, the system will **not** include:

- Legal documentation or transaction handling services.
- Integration with government property registries or tax systems.
- A mobile app version (unless expanded later).

1.5 Project Significance

This project holds significant value in improving the real estate experience for all stakeholders:

- **Buyers** will be able to assess properties more accurately and connect directly with sellers.
- **Sellers** can present their listings in a professional manner and reach more potential buyers.
- **Real estate agents** can use the system to enhance property exposure and client engagement.
- **Investors** gain insights into market trends and price movements, aiding in better investment decisions.

1.6 Methodology (Brief Overview)

The development of the platform will follow an agile methodology involving:

- Requirement gathering and analysis.
- UI/UX design using modern frontend frameworks
- Backend development with RESTful APIs and a secure database system [1].
- Integration of a custom price estimation model.
- User testing and deployment.

1.7 Organization of The Report

This report is organized as follows:

- **Chapter 1**: Introduction, including problem statement, objectives, and scope.
- **Chapter 2**: Literature Review – Existing systems and related studies.
- **Chapter 3**: System Analysis and Design – Data flow, architecture, and system requirements.
- **Chapter 4**: Implementation – Technologies used, UI snapshots, and feature explanation.
- **Chapter 5**: Testing and Evaluation – Test cases, results, and user feedback.
- **Chapter 6**: Conclusion and Future Work – Summary of findings and scope for improvement.

CHAPTER 2

LITERATURE AND EXISTING APPLICATION REVIEW

2.1 Literature Review

An academic paper that demonstrates knowledge and comprehension of existing scholarly work on a particular topic is called a literature review. It not only summarizes prior research but also provides a critical assessment of the content in context. Unlike a simple report on the literature, a literature review is both a method of academic writing and a systematic technique for evaluating relevant sources [2].

The key objectives of a literature review can be grouped into four categories:

- **Identifying and compiling sources:** Finding, organizing, and critically assessing relevant books, scholarly articles, and reliable internet sources related to the study topic.
- **Synthesizing knowledge:** Integrating the main arguments, key concepts, and findings into a coherent framework.
- **Identifying research gaps:** Highlighting areas where existing work is limited, thereby revealing opportunities for further investigation and new research questions.
- **Summarizing contributions:** Presenting a concise overview of the state of knowledge in the field.

In this study, we conducted a review of related works and similar applications before designing our system. Existing research demonstrates that machine learning techniques such as regression analysis, decision trees, and neural networks have been successfully applied for real estate price prediction [3], [4]. Studies also emphasize the importance of user-centered design for property platforms to enhance accessibility and adoption [5]. Building on these insights, our objective was to develop a real estate platform with enhanced AI-driven features, such as price prediction, while maintaining a user-friendly experience.

2.2 Existing Applications Review

Price prediction models that provide openness and data-driven accuracy in real estate transactions can help build consumer trust. Price prediction algorithms improve real estate transaction efficiency and assist individuals by lowering uncertainty and boosting transparency. Make wise decisions in the cutthroat real estate market.

We have investigated web and mobile applications like "BProperty" [6] and "Zillow" [7] that are used in Bangladesh and around the world. These applications aim to accomplish the same goal, but they also have some drawbacks that machine learning may help with. In the following, we have highlighted some of the primary characteristics and constraints of the current applications.

2.2.1 BProperty:

Key features:

1. Provides one of Bangladesh's biggest property databases.
2. To locate properties, use specific search and filter parameters.
3. Provides both mobile and web applications.

Limitations:

1. No means of contact with the vendor
2. comparatively new and does not yet have a sizable clientele

2.2.2 Zillow:

salient characteristics

1. Access to more than 135 million residences
2. may access Zillow-owned houses via the app and see the neighborhood's whole sale price history.
3. Comprehensive search and filtering parameters
4. Individual rental profiles

Limitations:

1. Price and rental estimates can occasionally be inaccurate.
2. Real estate agents and lenders may purchase your information.
3. Search parameters may not always be accurate.

CHAPTER 3

METHODOLOGY

The precise steps or methods used to find, pick, process, and evaluate data related to a subject are known as methodology. The methodology part of a research report allows the reader to assess the overall validity and reliability of the study critically [8]. It provides a clear framework that includes ordered phases, best-practice recommendations, and methodical procedures, guaranteeing that tasks or processes are carried out consistently. In addition to achieving the intended results, this methodological blueprint permits flexibility within the specified framework to accommodate various situations. It fosters a culture of constant improvement by enacting risk management techniques, recording important findings, and encouraging ongoing improvement. Different approaches, including Waterfall and Agile, are used in software development to guide the software lifecycle. Each approach has its own unique set of concepts and steps that lead to a successful software product.

3.1 Process Model

Similar processes that are grouped into a model are called process models. Accordingly, a process model is a type-level representation of a process [9]. It provides a visual framework to indicate resource requirements, emphasize decision points, and direct execution. Process models support efficient and well-organized workflows in a variety of fields, including software development, by helping to comprehend, analyze, and optimize processes.

3.2 Recent Trends in The Software Process Model

1. Waterfall Model
2. Incremental Model
3. Spiral Model
4. Iterative Development Model
5. Agile Model
6. Prototyping
    a. Throw away the prototyping process model.
    b. Evolutionary prototyping process model.

3.3 Choosing The Process Model

To create "INFINITE PROPERTY", we adhered to the Agile Model for development.

3.3.1 Agile Model in Software Development

The Agile Model is an iterative and incremental approach to software development that focuses on delivering small, functional increments of a product in short cycles (called sprints). It emphasizes customer collaboration, flexibility, and continuous improvement over rigid planning. [10]

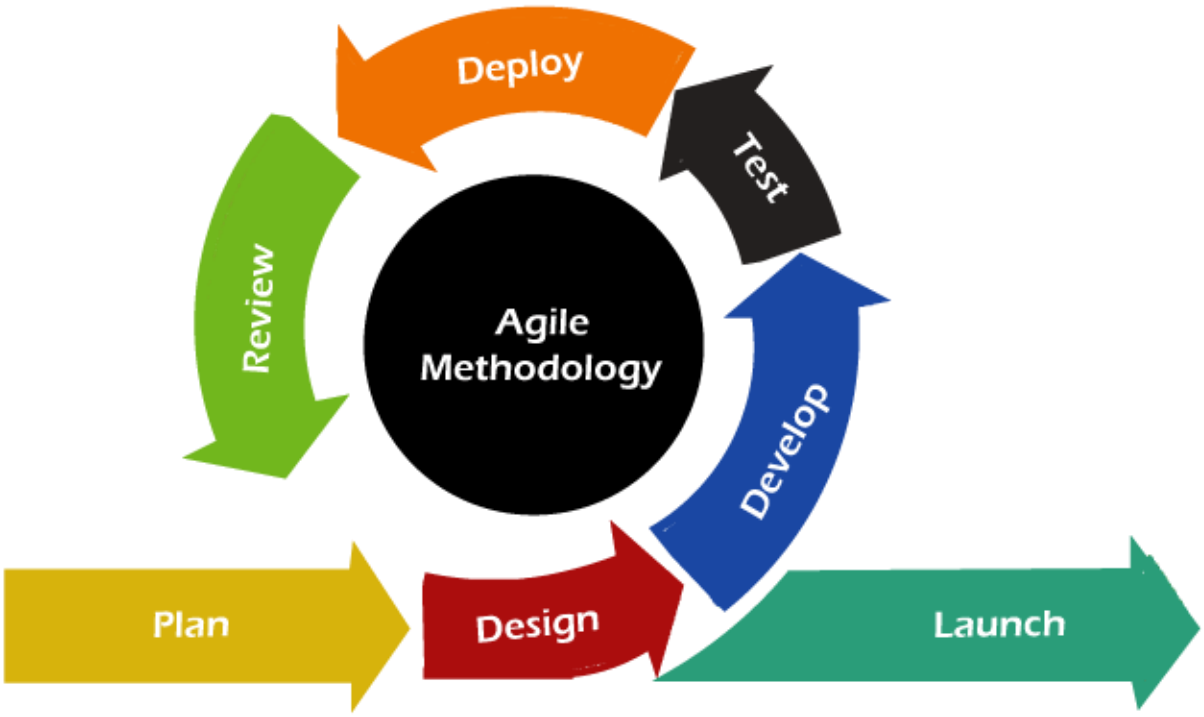


Figure 3.1: Agile model

3.3.2 Phases in Agile Model

Agile does not follow a strict sequential process like Waterfall but consists of repeating cycles (sprints). Here's a breakdown of key phases:

1. Requirement Gathering & Planning
2. Design
3. Development (Coding & Unit Testing)
4. Testing (QA & Bug Fixing)
5. Deployment & Review
6. Feedback & Next Iteration

Requirement Gathering & Planning

Objective: Define features (user stories) and prioritize them in a product backlog.

Activities:

- Stakeholders discuss requirements.
- The team estimates effort using techniques like Planning Poker.
- A Sprint Backlog (tasks for the next sprint) is created.

Design

Objective: Create a simple design for the current sprint's features.

Activities:

- UX/UI mockups (if needed).
- Database and system architecture planning.

Development (Coding & Unit Testing)

Objective: Build the product increment in short iterations (1-4 weeks).

Activities:

- Developers write code in pairs (Pair Programming).
- Continuous integration (CI) ensures code merges smoothly.
- Unit testing (e.g., using JUnit, pytest).

Testing (QA & Bug Fixing)

Objective: Ensure the increment is bug-free and meets requirements.

Activities:

- Automated testing (Selenium, JIRA).
- Regression testing.
- Customer feedback is incorporated.

Deployment & Review

Objective: Release the working increment and gather feedback.

Activities:

- Demo to stakeholders (Sprint Review Meeting).
- Reflect on improvements (Sprint Retrospective).

Feedback & Next Iteration

Objective: Adjust the product backlog based on feedback and repeat.

3.4 Advantages of The Agile Model

- **Flexibility:** Adapts to changing requirements easily.
- **Faster Delivery:** Releases working software in weeks, not years.
- **Customer Satisfaction:** Regular feedback ensures the product meets needs.
- **Reduced Risk:** Early bug detection lowers project failure chances.
- **Improved Team Morale:** Collaborative environment boosts productivity.

3.5 Disadvantages of The Agile Model

- **Not Ideal for Large Projects:** Complex systems may need more structure.
- **Requires High Customer Involvement:** If stakeholders are not available, delays occur.

- **Documentation is Light:** This can cause issues in long-term maintenance.
- **Less Predictable:** No fixed scope can lead to budget/time overruns.

3.6 Why We Followed The Agile Model

- **Fast-Paced Tech World:** Businesses need quick updates to stay competitive.
- **Changing Requirements:** Clients often refine needs as the project progresses.
- **Early ROI:** Functional parts are delivered early.
- **Better Quality:** Continuous testing reduces defects.

CHAPTER 4

REQUIREMENT SPECIFICATION & ANALYSIS

4.1 Overview

Analysis and formulation of requirements: Determine, examine, and simulate a potential software system's "what's" or functionality. The most crucial stage of software development is the requirements formulation and analysis phase of the project. Under no circumstances should it be left out. [11]

1. **User Roles and Authentication**:
    - Specify user roles, including admins, agents, buyers, and sellers.
    - Put in place safe procedures for user permission and authentication.
2. **Virtual Property Tours**:
    - Utilize technology to enable users to virtually tour properties.
    - Make sure virtual tours run well and are engaging.
3. **Market Analysis and Insights**:
    - Make use of AI to analyze and forecast the industry in real time.
    - Give users information about projections, real estate investment prospects, and market trends.
4. **Property Listings**:
    - Allow sellers/agents to create and manage property listings with details like location, size, amenities, price, etc.
    - Enable users to search, filter, and sort properties based on various criteria.
    - Implement AI-driven property matching to suggest relevant listings to users.

4.2 Why Requirement Specification Needed?

1. **Clear Understanding**: It facilitates the development of a clear grasp of the goals and features that the website must have. It establishes expectations for developers and stakeholders alike, as well as the project's scope.
2. **Stakeholder Alignment**: All stakeholders, including customers, developers, designers, and users, may align their expectations and aims for the website by using requirement specifications. It guarantees that everyone agrees with the project's goals.
3. **Feasibility Assessment**: The development team can determine whether implementing the AI capabilities and functions is feasible by outlining the requirements. They can spot any technical difficulties or restrictions early on. [12]
4. **Prioritization and Planning**: With a clear set of requirements, the development team can prioritize tasks and plan the project timeline effectively. This helps in avoiding delays and meeting deadlines.
5. **Quality Assurance**: It provides a basis for quality assurance and testing. Testers can verify whether the implemented features meet the specified requirements, ensuring a higher-quality end product.

6. **User Satisfaction**: Requirement specification ensures that the website meets the needs and expectations of the target users. This leads to higher user satisfaction and engagement.
7. **Risk Management**: It helps identify potential risks and challenges in advance, allowing the team to develop strategies to mitigate them.

Overall, the requirement specification is a critical step in the development of an AI real estate website as it lays the foundation for a successful project, aligns stakeholders, minimizes risks, and ensures the final product meets user needs and expectations.

4.3 Requirement Definition

The system includes several core features to enhance the user experience and functionality:

- **Secure Registration and Login**: Separate and secure login systems for buyers, sellers, and agents.
- **AI-Powered Property Search**: Intelligent search filters based on location, price range, and amenities.
- **Virtual Property Tours**: Immersive experiences powered by AI to explore properties virtually.
- **Real-Time Valuation and Recommendations**: Personalized suggestions and live property value estimates based on user preferences.

4.3.1 User Roles in AI-Based Real Estate Platforms

On an AI-driven real estate platform, three main user roles typically exist:

1. **User (Buyer/Renter)**: Individuals who browse properties, search listings, save preferences, and communicate with sellers or agents using AI-enhanced features like recommendations and alerts.
2. **Seller**: Users who list properties for sale by providing detailed descriptions, images, and pricing. AI tools assist with optimizing listings and recommending competitive prices.
3. **Administrator**: Website managers who oversee platform operations, manage listings, handle user accounts, resolve technical issues, and moderate content.

These roles together form a functional ecosystem that supports seamless property transactions and user interaction on the platform.

4.4 Requirement Validation

To ensure that system requirements are accurate and aligned with project goals, the following validation steps are necessary:

- Stakeholder consultations for feedback and refinement.
- Technical assessments to confirm the feasibility of AI features.
- Consistency and traceability checks against project objectives.

- Use case validation for each feature.
- Legal and data privacy compliance verification.
- Evaluation of AI models to ensure accuracy in recommendations and valuations.
- Collaboration with developers and AI experts to test feasibility and effectiveness.

4.5 Requirement Validation in Software Development

Requirement validation within the software process involves:

- Confirming alignment with stakeholder expectations.
- Analyzing the technical feasibility of proposed AI components.
- Ensuring that requirements are complete, consistent, and unambiguous.
- Compliance checks for security, privacy, and legal standards.
- Testing AI functionalities for accurate performance.
- Mapping requirements to project goals and user cases.
- Ensuring all specifications are testable before proceeding to implementation.

4.6 Services and Data Inputs

AI Services:

- Smart property valuation
- Personalized recommendations

Natural language-based search

Data Inputs:

- Property information (location, size, price, photos, features)
- User preferences (budget, type, location, amenities)
- Market trends and real-time property data
- Chatbot interactions to provide user support and query handling

4.7 Tools and Technologies

- **Frontend**: JavaScript, React.js, Tailwind CSS
- **Backend**: Node.js, Express.js
- **Database**: MongoDB with Mongoose ORM
- **Development Environment**: Visual Studio Code (VS Code)

4.8 Feasibility Study

A feasibility study assesses whether the project is viable from various perspectives:

Technical:

- Availability and compatibility of required AI technologies
- Skill level of the team in implementing AI functionalities
- Identification of technical risks and barriers

Financial:

- Budget estimates for development, deployment, and ongoing operations
- Cost projections for maintenance, support, and promotion

Legal and Regulatory:

- Compliance with property and data laws in targeted regions
- Legal considerations surrounding AI predictions and valuations

Operational:

- Ability to manage listings, users, and content effectively
- Planning for system scalability and performance optimization

4.9 Functional Requirements

The system's fundamental functions, such as user registration, property listing, search, suggestions, and communication features, are outlined in the functional requirements.[13]

4.10 Non-Functional Requirements

Non-Functional Requirements (NFRs) describe how a system should perform rather than what it does. They cover quality attributes like performance, reliability, security, and usability, guiding design decisions and ensuring the system meets user expectations.[14]

These specify the system's quality attributes and constraints:

- **Usability**: Intuitive and easy-to-navigate interface
- **Reliability**: Stable and error-resistant operations
- **Security**: Strong data protection and access control
- **Performance**: Fast load times and response speed
- **Scalability**: The Capacity to handle a growing user base
- **Compliance**: Adherence to legal and ethical standards

4.11 Gantt Chart:

To complete this project, we have some roles and responsibilities. And if we want to complete this within due time, we should maintain the roles and responsibilities.

Process	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9
Initial idea	02/02/25								
Feasibility study		09/02/25							
Requirement Analysis			17/02/25						
Confirming feature				25/02/25					
Design					01/03/25				
Coding						08/03/25			
Testing							15/03/25		
Deployment								22/03/25	
Report Writing									30/03/25

Table 4.1: Gantt chart

CHAPTER 5

SYSTEM DESIGN

Software design [15] involves planning the structure and functionality of the system to address specific problems and conditions. The design approach depends on whether the system is completely automated or involves store commerce.

FINITE PROPERTY is a web-grounded operation with an emphasis on featherlight performance, minimum memory operation, and smooth usability.

5.1 Design Goal of The System

1. Performance
2. Rapid response time to stoner relations
3. Effective use of coffers
4. High outturn and vacancy
5. Scalable structure
6. Maintainability
7. Modular factors for easy updates
8. Logging and monitoring for quick issue resolution
9. Robotization of routine tasks
10. Interpretation control to manage changes
11. Security
12. Part-grounded access control
13. Data encryption and integrity checks
14. Authentication and authorization mechanisms
15. Routine security checkups
16. Stoner Experience
17. Clean and responsive interface
18. Availability for all druggies
19. Clear error dispatches and attestation

5.2 Database

Database design [16] is the process of structuring and organizing data to ensure efficiency, consistency, and scalability in storing and retrieving information. It involves identifying entities, their attributes, and relationships, followed by developing an Entity-Relationship (ER) diagram and transforming it into a normalized relational schema. A well-structured database design minimizes redundancy, enforces data integrity, and provides a reliable foundation for implementing application-specific functionalities.

MongoDB

- MongoDB is chosen for its flexible NoSQL structure, scalability, and performance benefits.

Indexing

- Speeds up quests through primary and secondary indicators

Scalability

- Supports vertical scaling using sharing

Replication

- Ensures data integrity through image clones

Aggregation

- Provides important data summarization tools

5.3 Flowchart

5.3.1 Flowchart for Buyer

- The buyer's trip follows this way
- Stoner identifies a property need
- Quest parcels using AI pollutants
- Reviews options and compares features
- Takes a virtual stint (if available)
- Shortlists or connections with dealers/agents
- Makes a final purchase decision

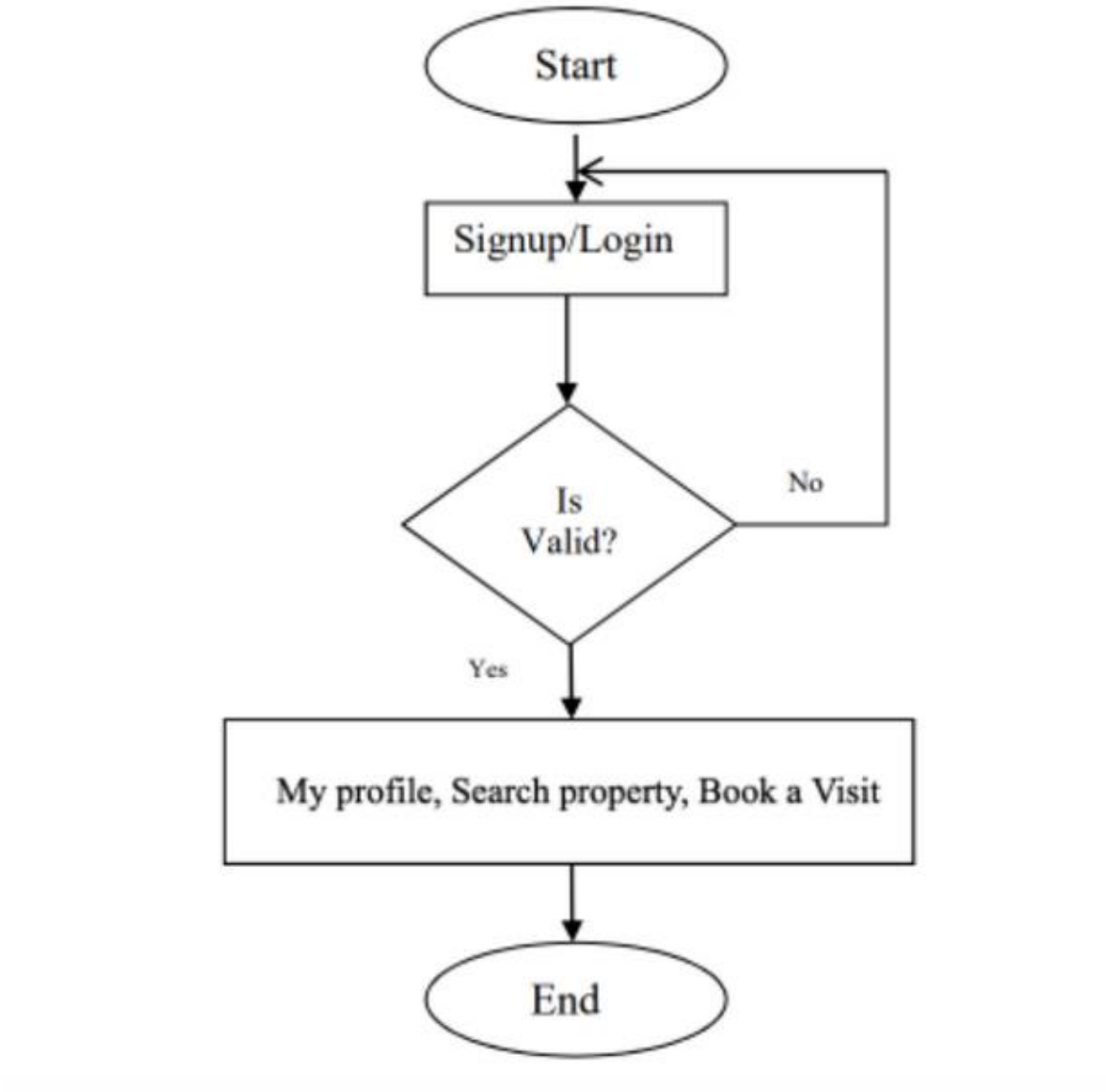


Figure 5.1: Flowchart for buyer process

5.3.2 Flowchart for the Seller

The flowchart for the seller outlines the sequence involved in dealing with a property. It begins with authentication, followed by listing property details adapted to the request demands. The dealer also promotes the property through colorful platforms, engages with prospective buyers, responds to inquiries, and aims to finalize successful deals.

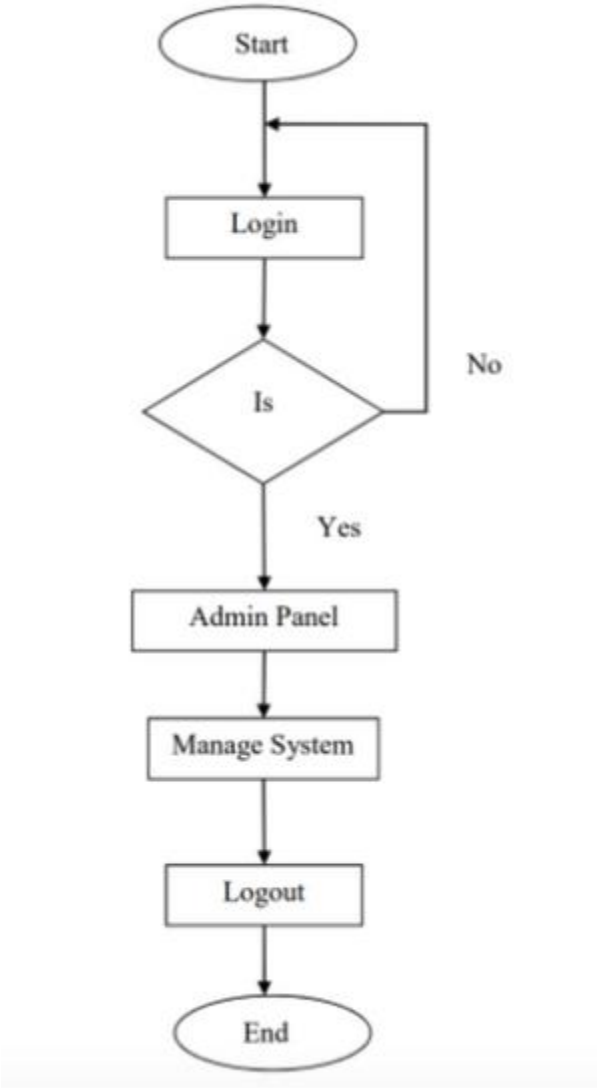


Figure 5.2: Flowchart for seller process

5.4 Entity Relationship Diagram

The Entity Relationship (ER) model results from a detailed analysis aimed at relating and defining the data needed by business operations. ER plates support the creation of a robust and well-structured database schema. They define connections between entities and outline primary and foreign keys, contributing to data integrity and consistency. Additionally, a clear ER diagram simplifies database maintenance and future updates.

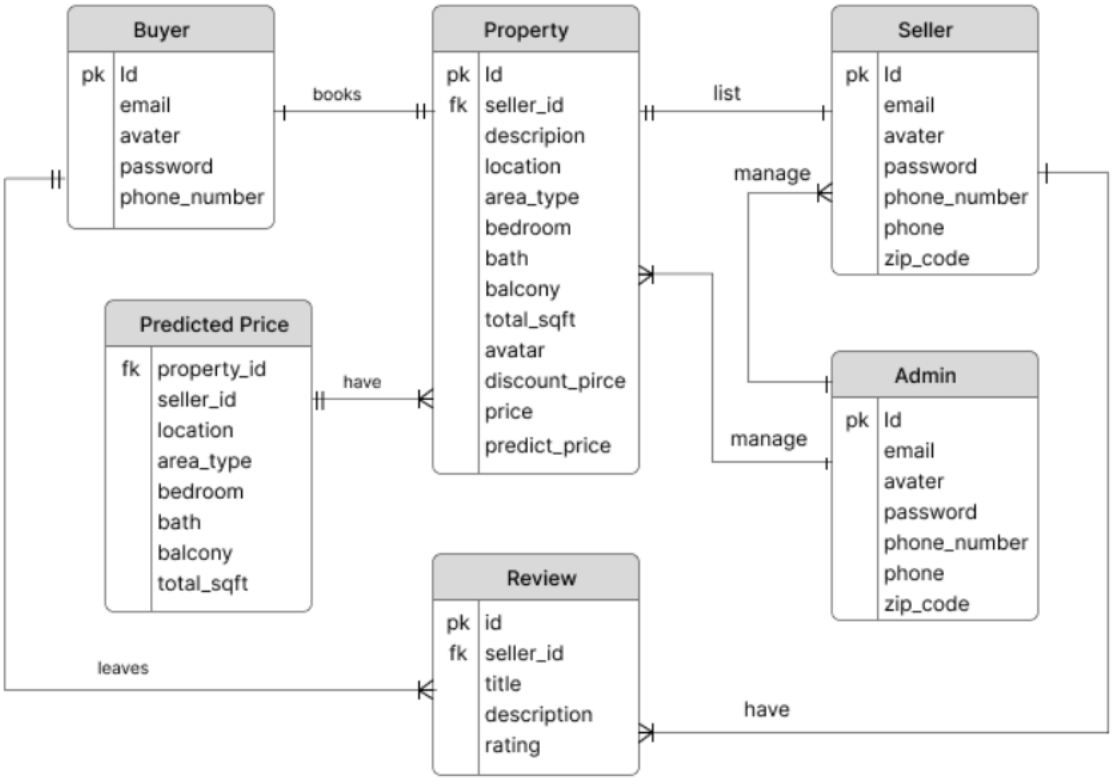


Figure 5.3:ER-Diagram

5.5 Data Flow Diagram

A Data Flow Diagram (DFD) [17] illustrates how data circulates through a system. It shows data inputs and labor, processes, and storehouse, but doesn't depict control inflow. DFDs help fantasize about how information moves through a system.

5.5.1 DFD Level 0

Position 0 DFD gives a high-position overview of the complete system. It captures the entire operation as a single process. Then, the Admin oversees all operations through the web gate, including adding, removing, and modifying dealer and stoner data.

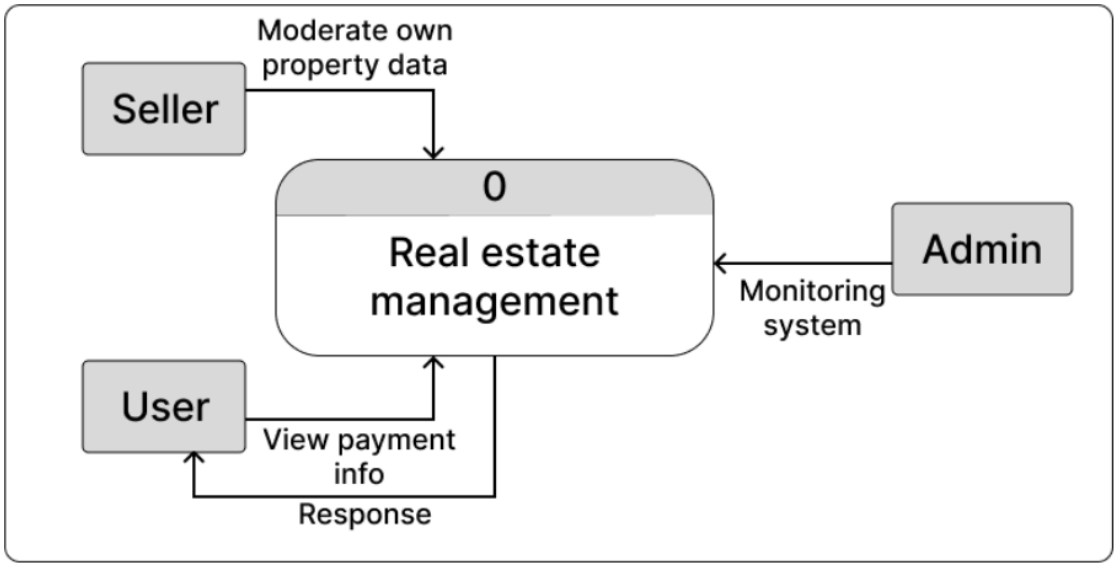


Figure 5.4: DFD Level 0

Then the 0-position DFD for the entire operation. The admin will have the master access to the administration system from the web, where he can add, remove, and edit the dealers' and stoners' words.

5.5.2 DFD Level 1

A position 1 DFD breaks down the high-position process into further specific subprocesses. This position highlights the detailed operations for property listing operations, such as inputting property data, uploading images, pricing, and status updates. It also illustrates stoner relations like handling customer queries, arranging visits, and managing dispatches.

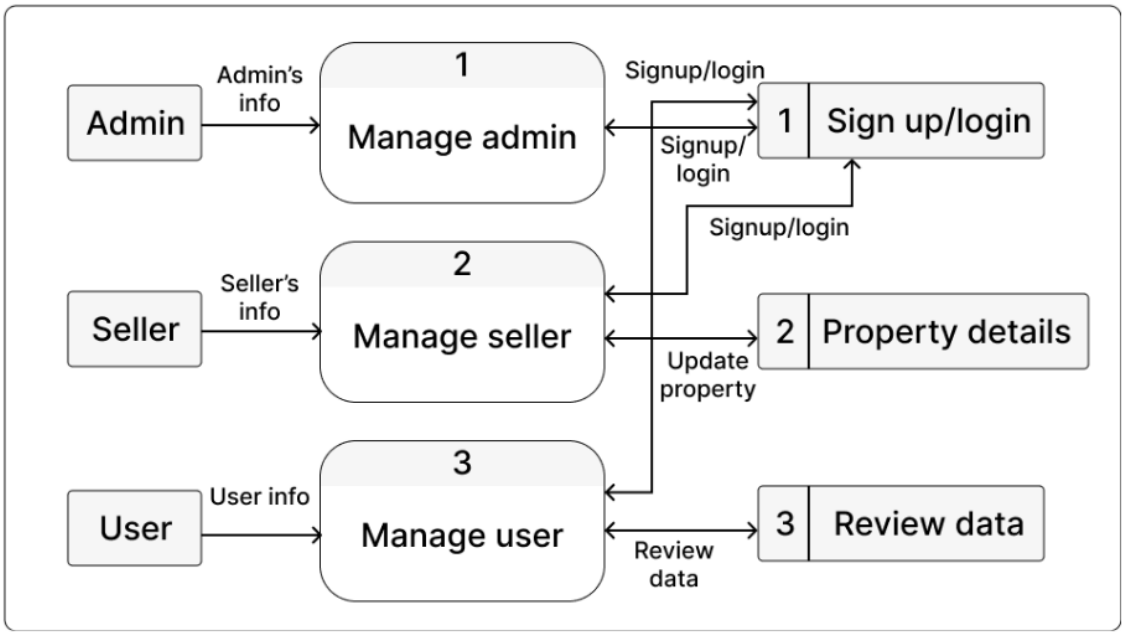


Figure 5.5: DFD Level 1

5.5.3 DFD Level 2 (Process 1.1 - 1.4)

Position 2 DFD provides an even more grainy view.

Process 1.1 Dealer Authentication – Merchandisers log in by submitting their credentials, which the system verifies using the dealer database.

Process 1.2 View Seller Profile – Verified merchandisers can pierce their profile with listing information and contact details.

Process 1.3 Add Property – Merchandisers can add property details, which are validated before being saved.

Process 1.4 Manage Property Visits – merchandisers handle visit requests by attesting vacancy and scheduling viewings.

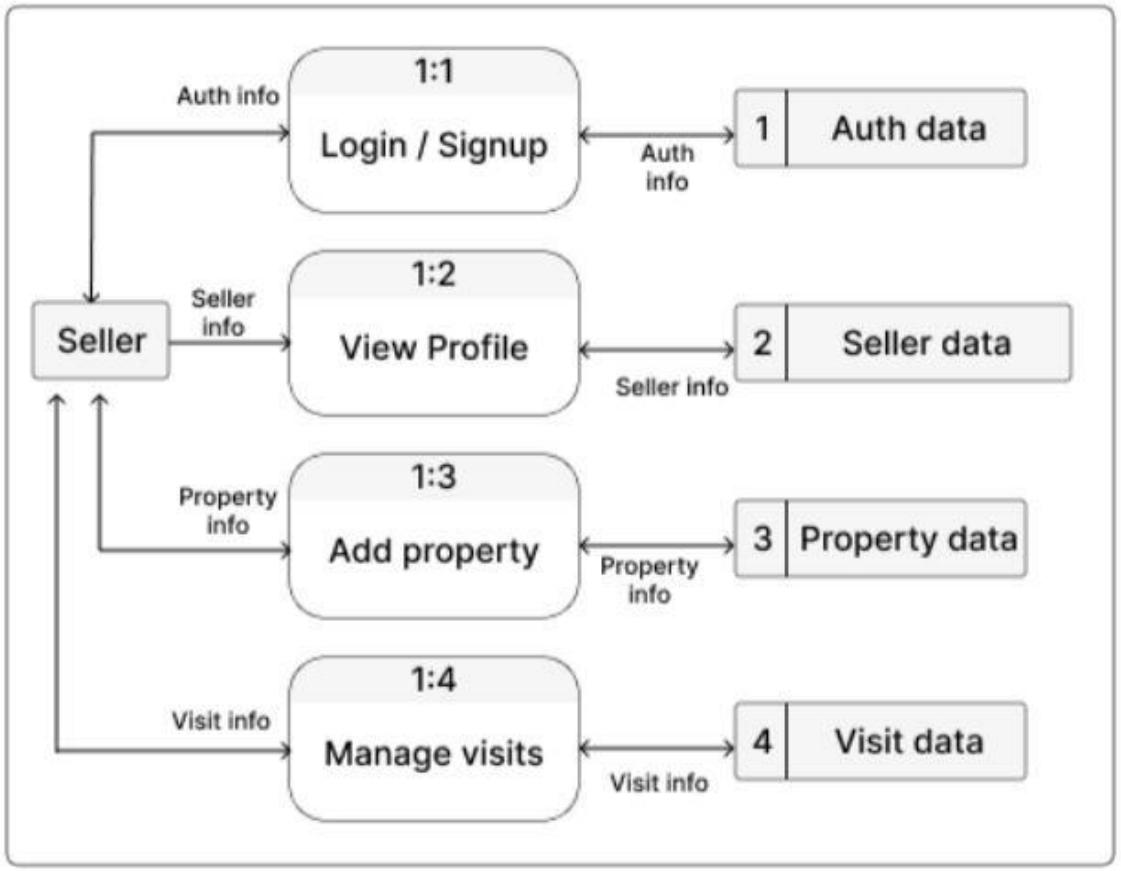


Figure 5.6: DFD Level 2 (Process 1.1 -1.4)

5.5.4 DFD Level 2 (Process 2.1 - 2.4):

This DFD dives deeper into the buyer's relations

Process 2.1 Buyer Authentication – Buyers sign in to Pierce their dashboards.

Process 2.2 View Buyer Profile – The system retrieves the stored word, including saved rosters.

Process 2.3 Schedule Property Visits – Buyers pick a time, and both parties get notified.

Process 2.4 Review operation – Buyers submit feedback and rate parcels they've visited.

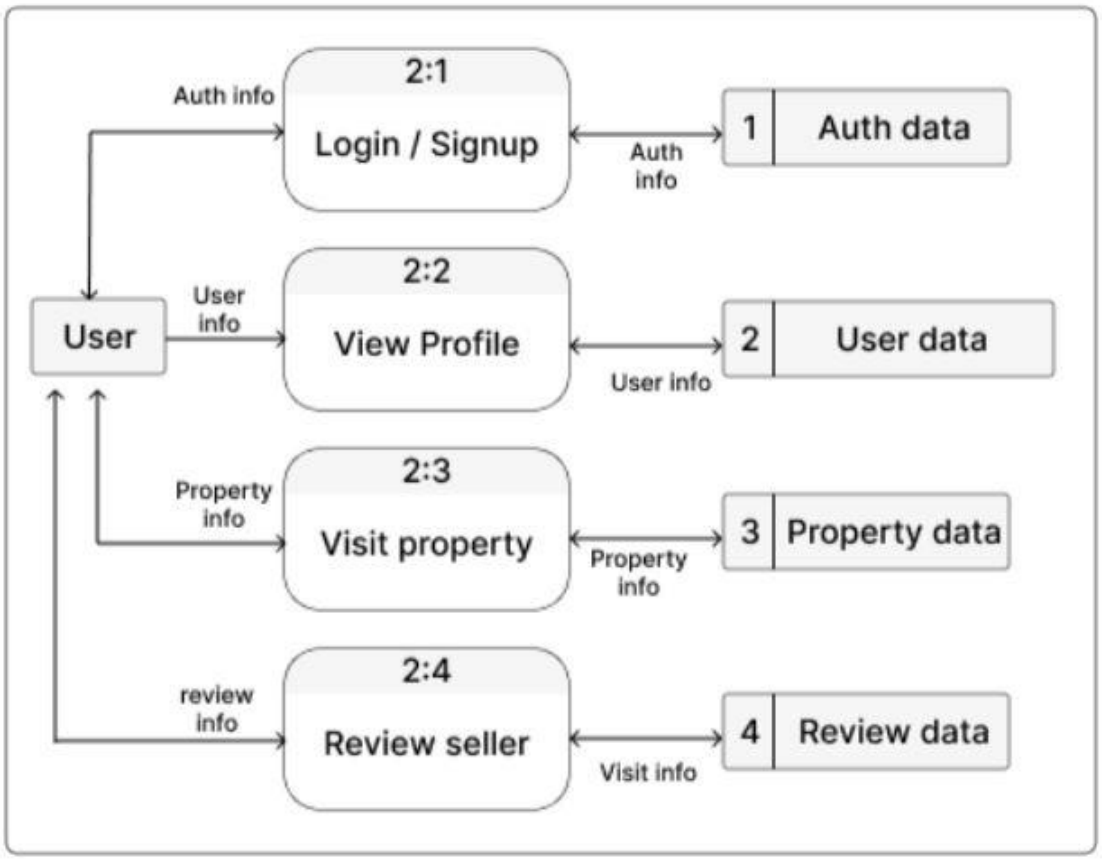


Figure 5.7: DFD Level 2 (Process 2.1-2.4)

5.6 UML diagram

UML (Unified Modeling Language) [18] diagrams visually represent a system's architecture and actions. These plates use standard symbols to help creators and inventors understand, communicate, and document system factors and workflows.

5.6.1 Sequence Diagram

Sequence diagrams show how system components interact over time. They represent the flow of messages between objects or actors in a step-by-step order, making it easier to understand the sequence of operations for a specific process or use case. [19]

5.6.2 Sequence Diagram for Buyer Registration

The buyer inputs their information into an enrollment form. The backend validates this data and creates a new buyer record in the system.

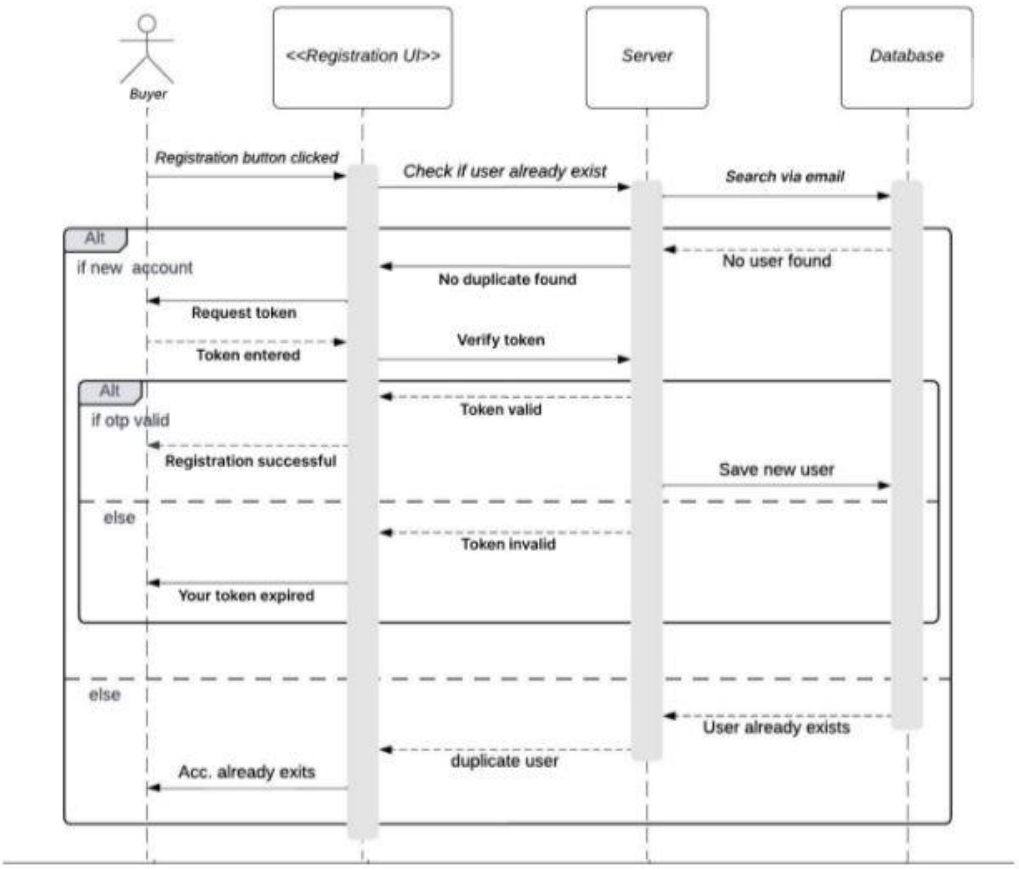


Figure 5.8: Sequence Diagram for Buyer Registration

5.6.3 Sequence Diagram for Buyer Login

The buyer enters their username and credentials. The system checks the data and subsidizes access if the credentials match.

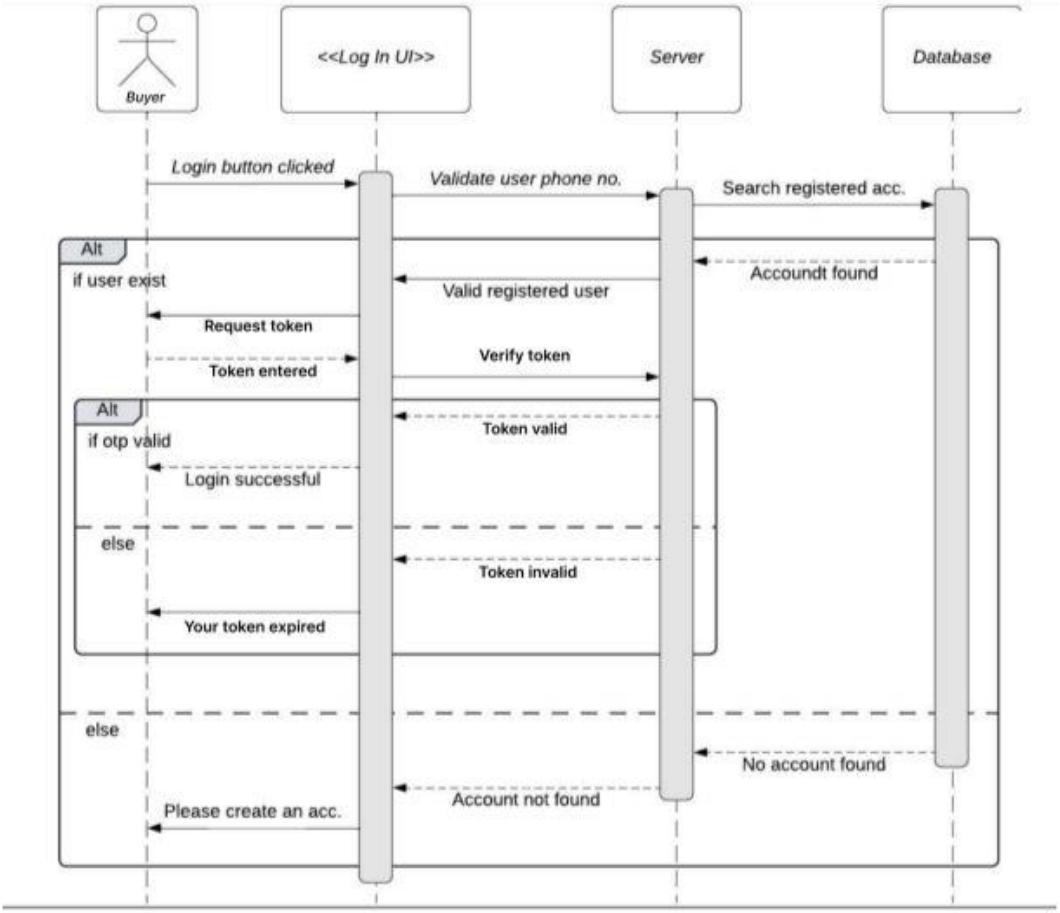


Figure 5.9: Sequence Diagram for Buyer Login

5.6.4 Sequence Diagram for Seller Registration

The dealer submits enrollment details through the interface. The system validates and stores the dealer's information in the database.

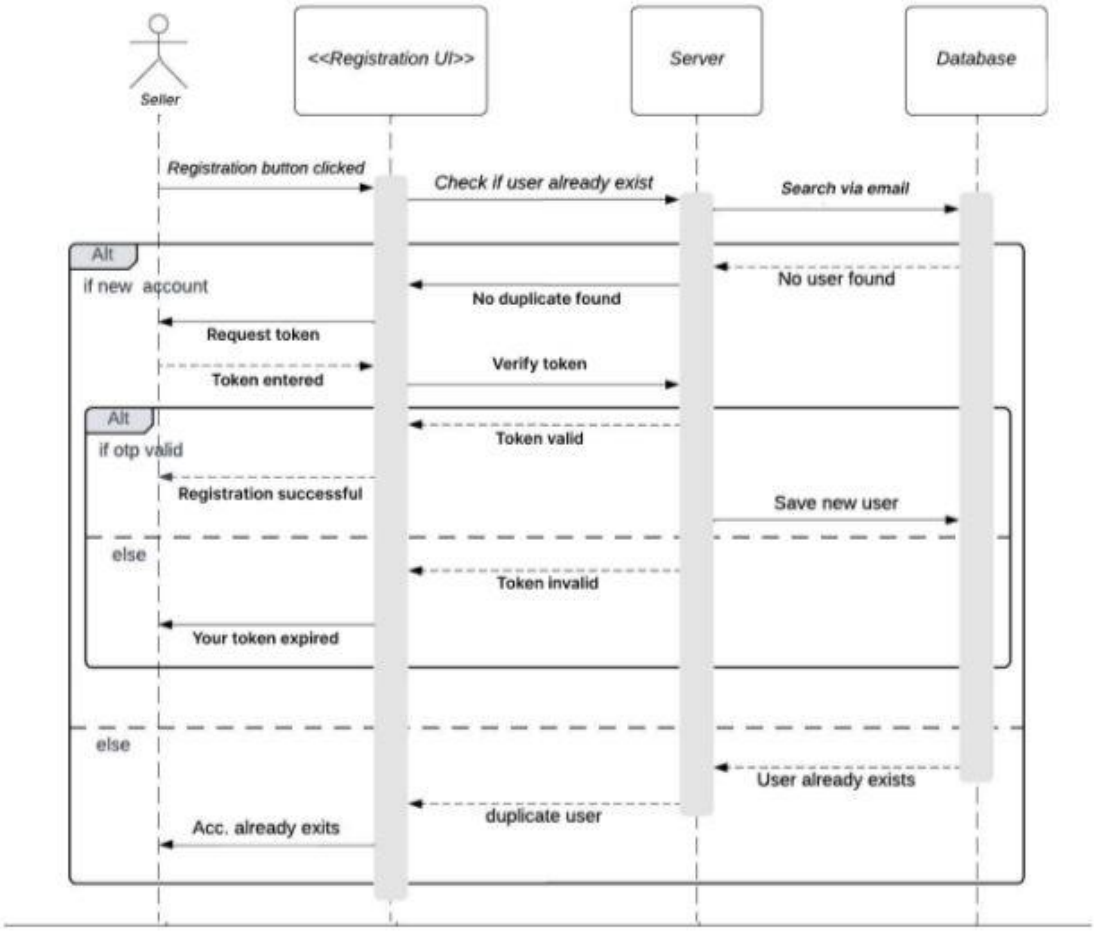


Figure 5.10: Sequence Diagram for Seller Registration

5.6.5 Sequence Diagram for Seller Login

A dealer logs in with their credentials. Upon confirmation, access is granted to their profile and tools.

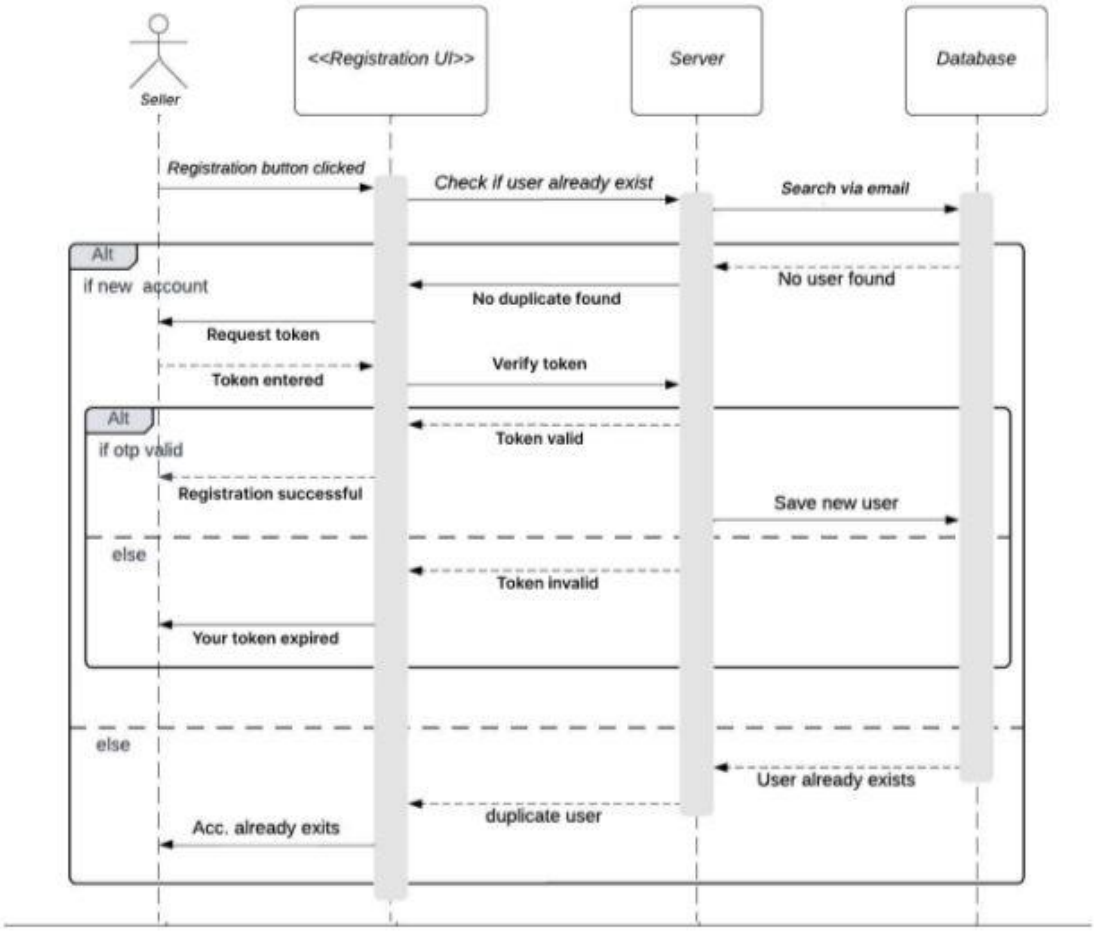


Figure 5.11: Sequence Diagram for Seller login

5.6.6 Use Case diagram

A Use Case diagram [20] depicts the interactions between actors, such as users or external systems, and the system, highlighting the different tasks and functionalities the system provides. Actors initiate specific use cases, illustrating how users engage with the system's features.

Buyer Use Cases:

- Hunt for Properties
- View Property Details
- Schedule Visits
- Submit Reviews

Seller Use Cases:

- Add Property rosters
- Manage rosters
- View Buyer dispatches

- Handle Visit Requests

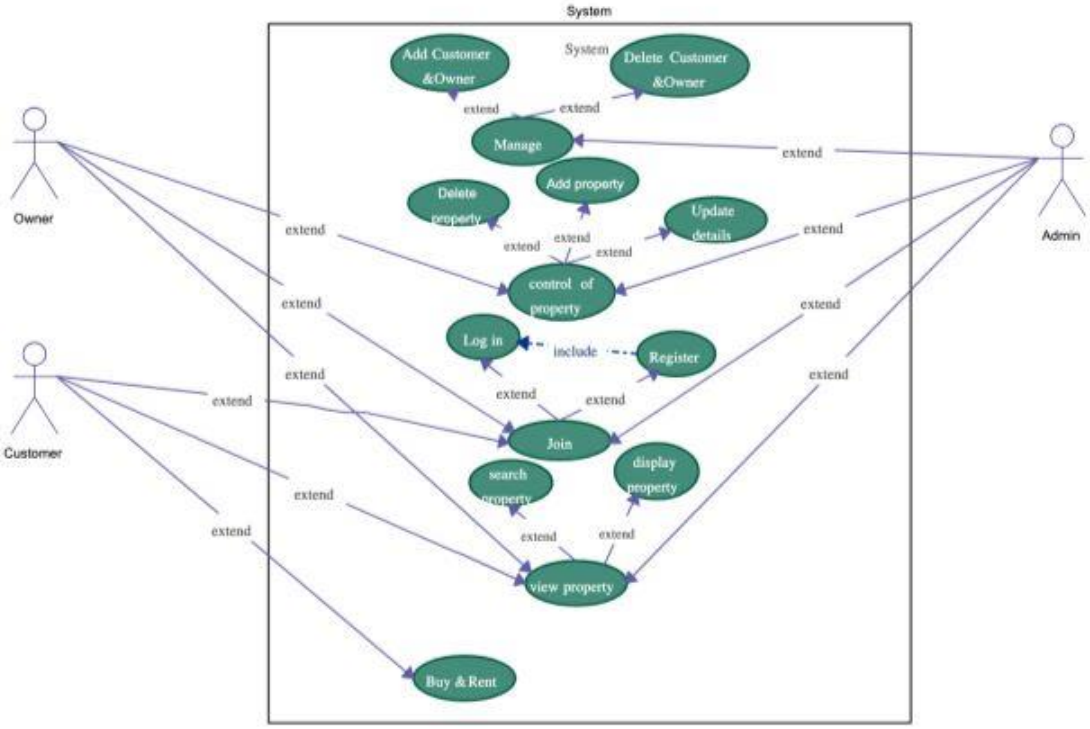


Figure 5.12: Use Case diagram

CHAPTER 6

SYSTEM DESIGN

6.1 Overview

This chapter provides a detailed breakdown of how the system functions, supported by snapshots of user interactions. It highlights the sequential processes involving both sellers and buyers on the platform.

6.2 Web Application Overview

6.2.1 Home Page (Before Login)

- Users can explore and search for properties.
- Featured and recent listings are displayed.
- Sign-up/sign-in options are available for further features.
- Properties can be browsed by location.

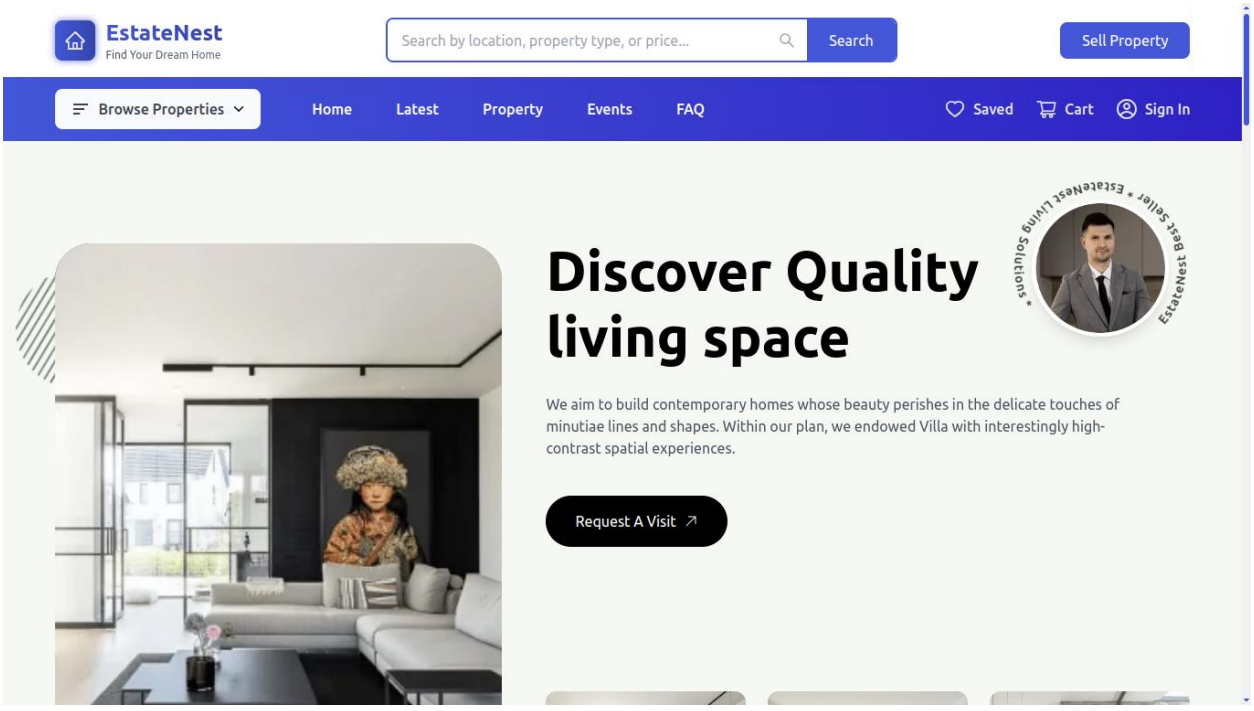


Figure 6.1: Home (User not logged in)

Scrolling down reveals additional listings and featured deals, along with a newsletter section.

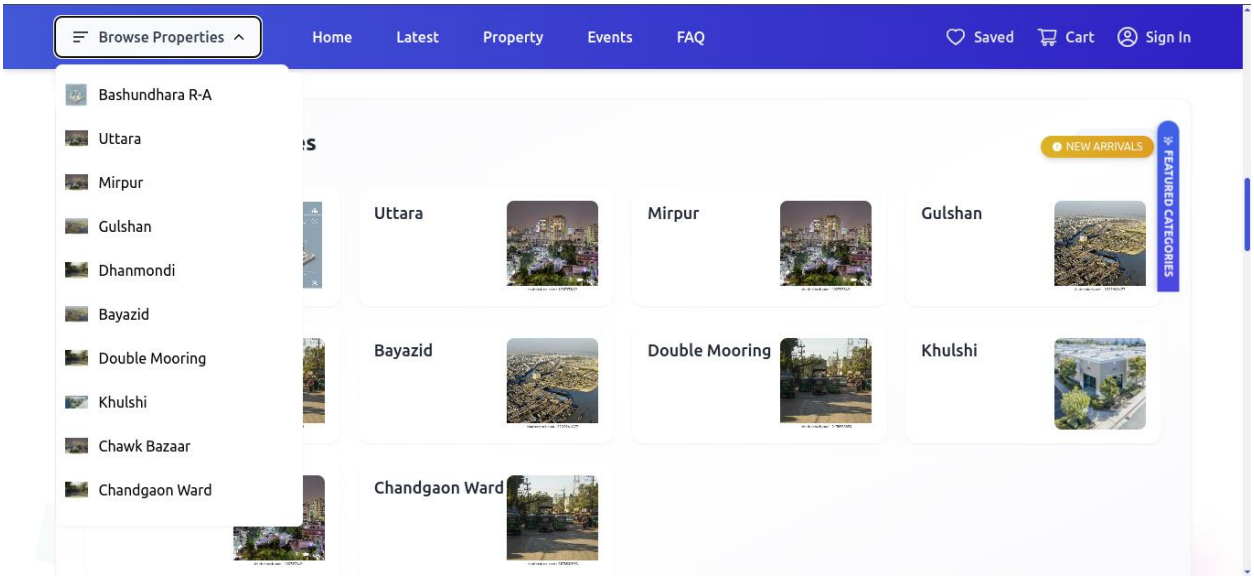


Figure 6.2: Home scrolled down (User not logged in)

6.2.2 Registration / Login

- **Register**: New users can create accounts with the required information.
- **Login**: Registered users access their accounts using valid credentials.

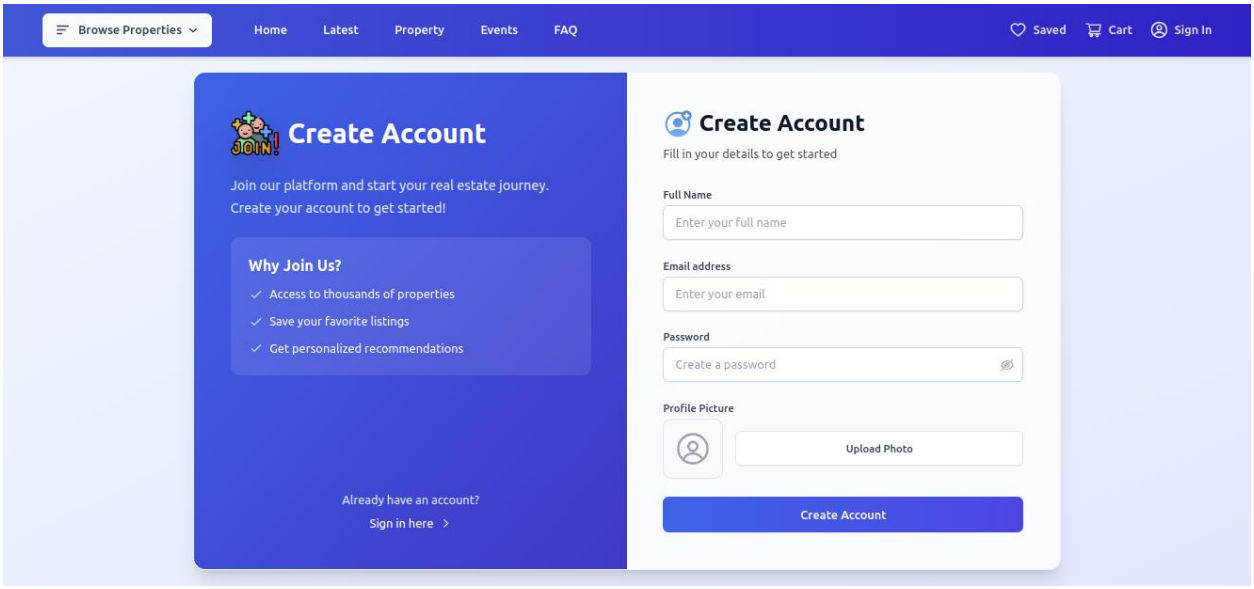


Figure 6.3: Register as a new customer

- This is the login page for the buyer.
- You can log in with only the correct username and password.

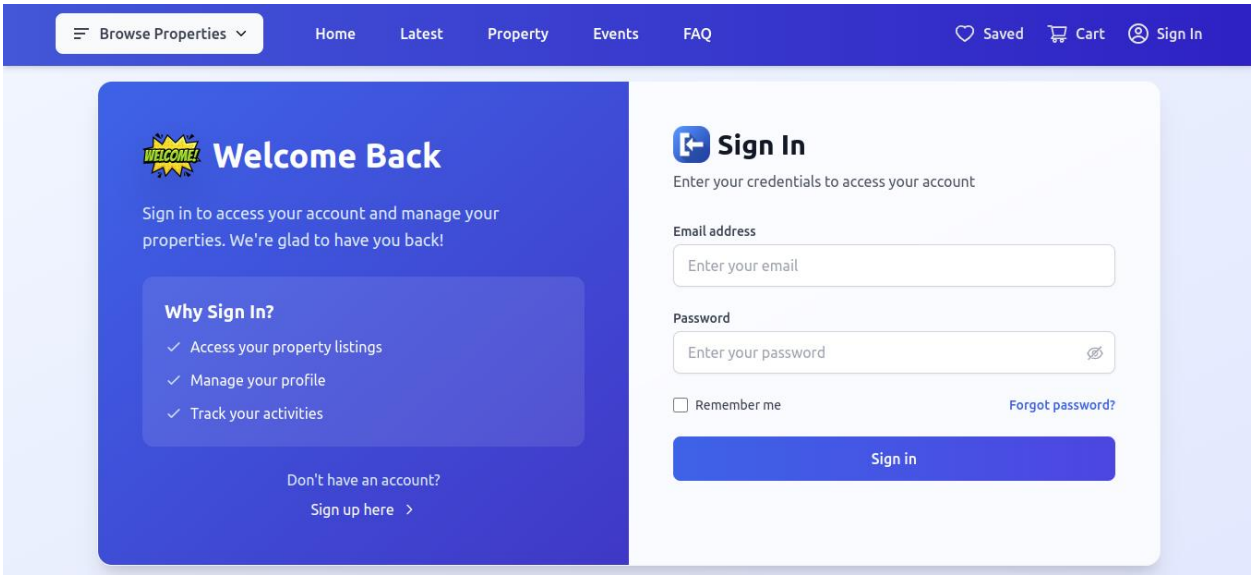


Figure 6.4: Login as a new customer

6.2.3 Latest Tab

- Displays newly added properties.

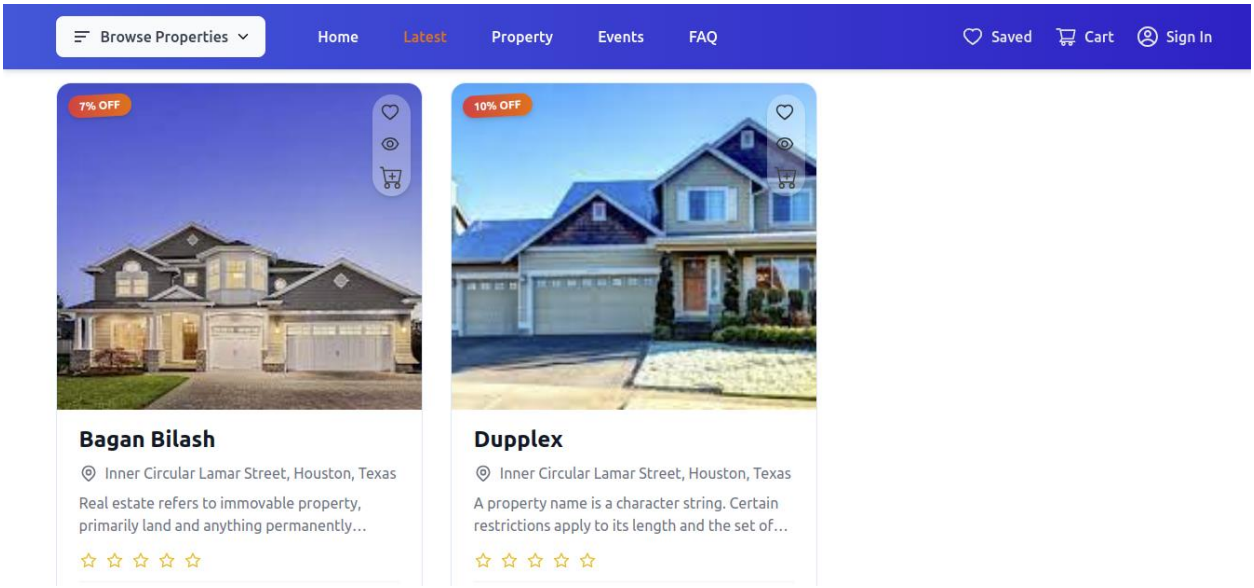


Figure 6.5: Latest tab

6.2.4 Property Tab

Lists all available properties and includes a newsletter subscription form.

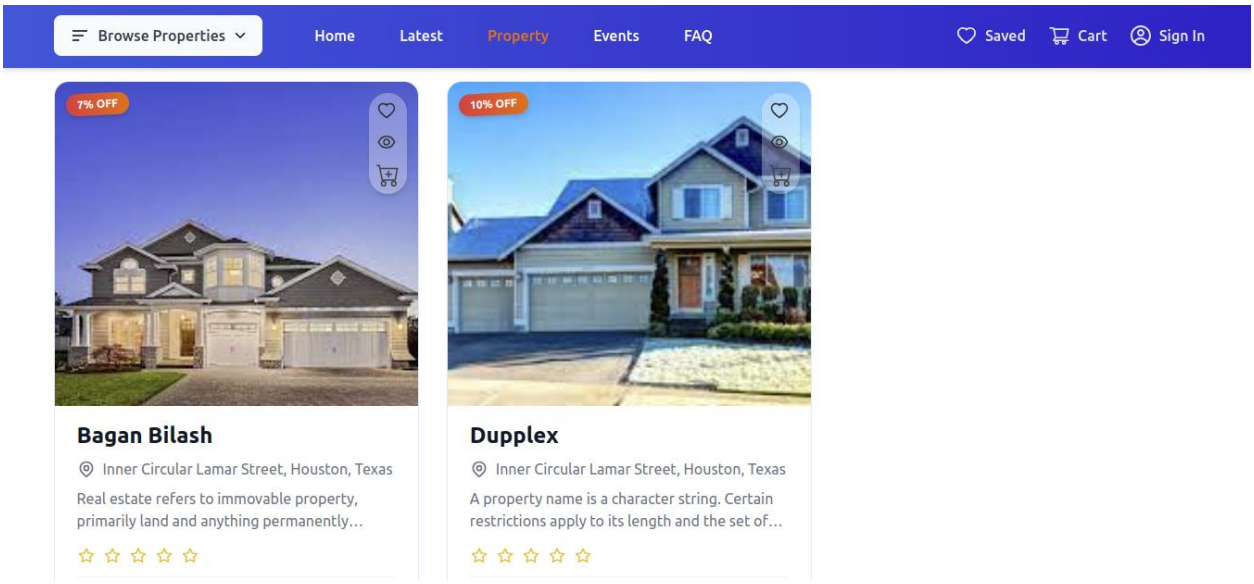


Figure 6.6: Property tab

6.2.5 Quick Preview

1. A brief overview of the attributes is provided by this model.
2. This is where the user can save the property.
3. From here, the user can message the owner.

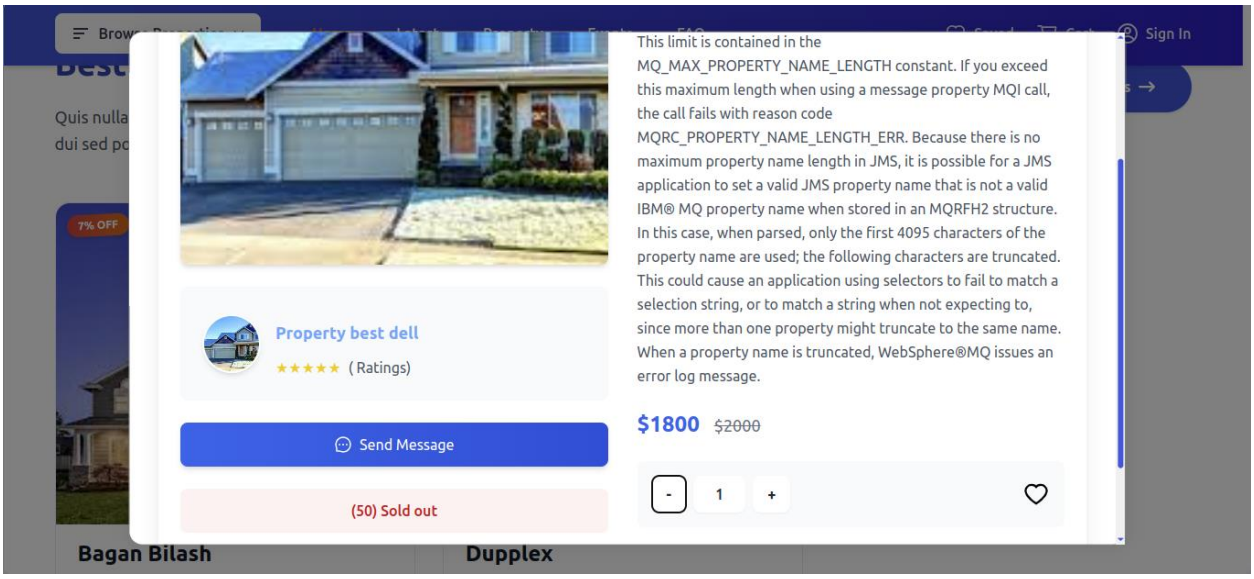


Figure 6.7: Quick preview

6.2.6 Included Are Property Details

1. A thorough overview of the homes, including the number of bedrooms, bathrooms, and square footage, is provided on this page.
2. This is where the user can save the property.

3. From here, the user can message the owner.

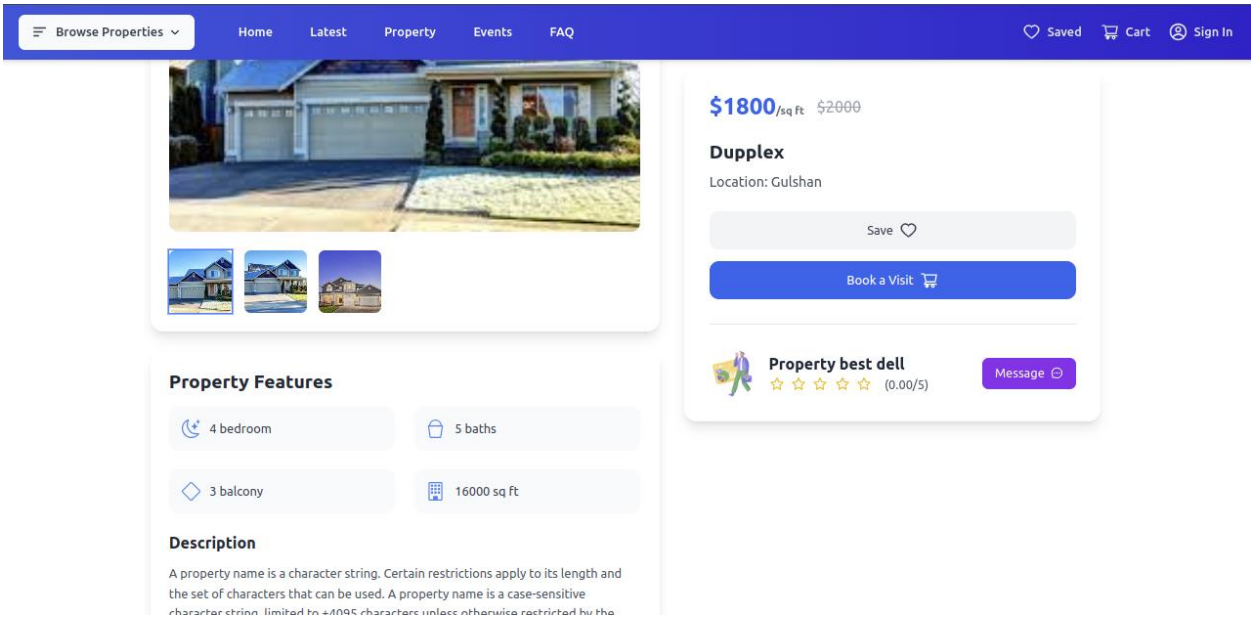


Figure 6.8: Property details

Predicted Price:

API Endpoint Triggering: When a request for product details is made to a specific API endpoint, the Flask server receives the request.

Data Retrieval: The Flask server processes the request and extracts the necessary input data related to the product details, such as product features or identifiers.

Linear Regression Model Interaction: The Flask server then passes the input data to the deployed linear regression model. The model applies the trained regression coefficients to the input data, performing calculations to predict relevant product details, such as pricing or demand estimation.

Response Generation: The model's prediction output is received by the Flask server. The server prepares a response containing the predicted product details, which may include pricing information or other relevant insights.

Response Dispatch: The prepared response is sent back to the requester who made the initial API call for product details. The requester receives the response, displaying or utilizing the predicted product details as needed.

```python
def predict(location,area,size,bath,balcony,total_sqft):
    output = np.zeros(151)
    output[0] = total_sqft
    output[1] = bath
    output[2] = balcony
    output[3] = size

    result_location = location
    if result_location not in location_cat:
        output[146] = 1
    else:
        output[index_dict[str(location)]] = 1

    return model.predict([output])[0]
```

Python

Figure 6.9: Linear Regression Model

1. Scrolling down, you can see product details and seller information
2. The user can view the related properties from here.

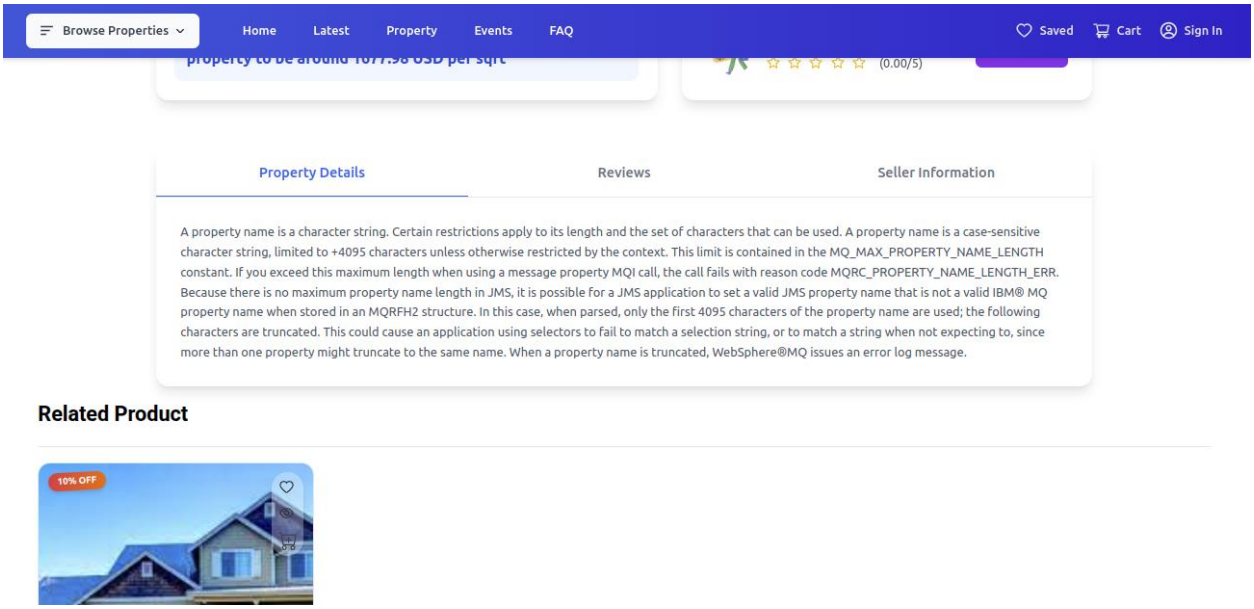


Figure 6.10: Property details scrolled

1. You can also message the seller from here

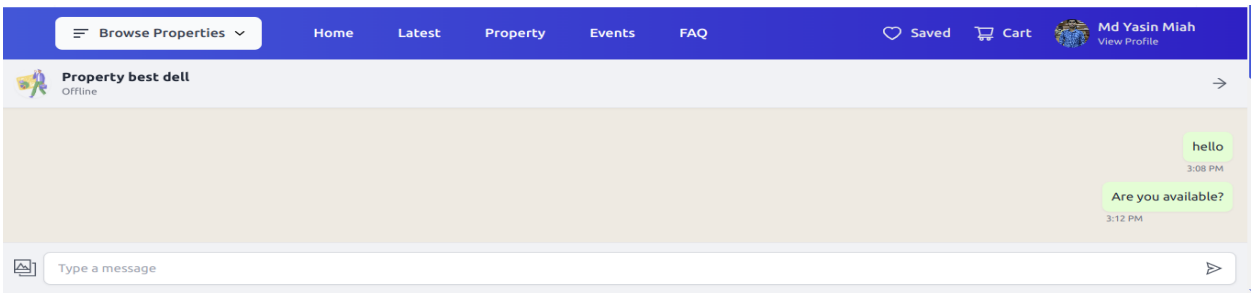


Figure 6.11: Chat

6.2.7 Saving Property

1. You can choose your favorite property from here

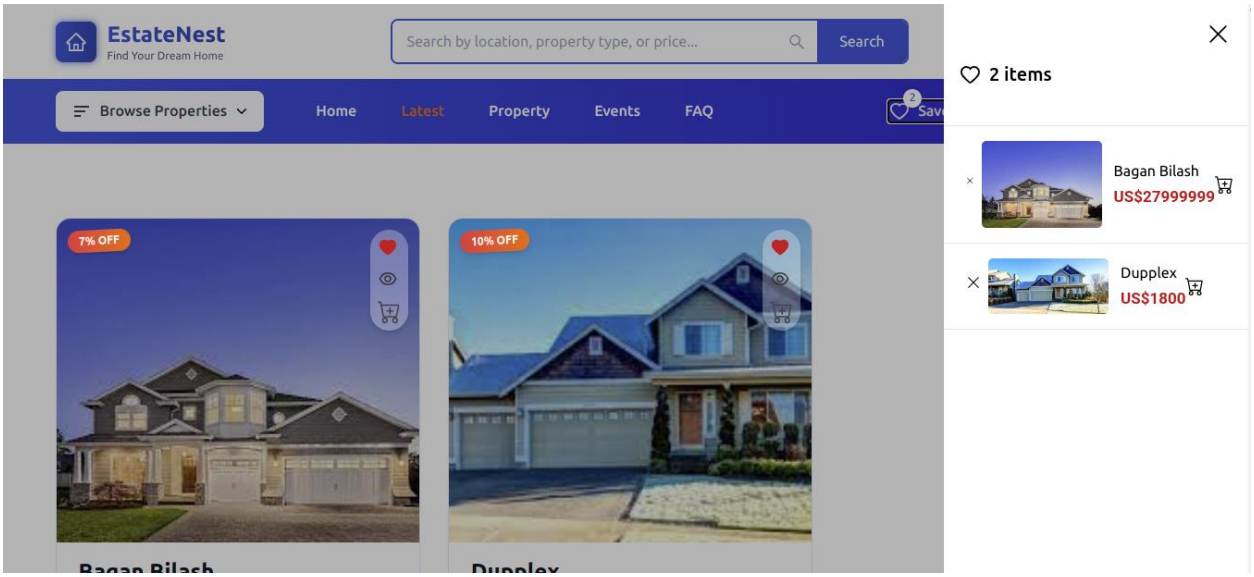


Figure 6.12: Saving Property

6.2.8 Booking a Visit

1. You can book a visit to your favorite property from here
2. This is the first step to booking a visit to see a property.

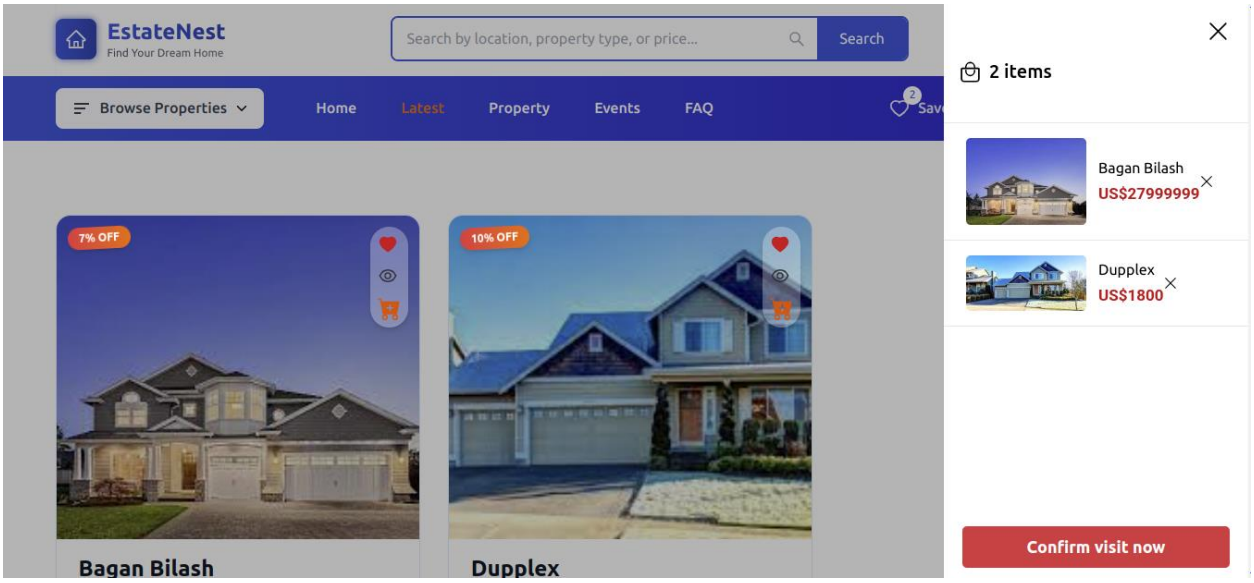


Figure 6.13: Booking a visit

6.2.9 Buyer Details

1. The second step is setting up a date with the seller

2. Other relevant details.

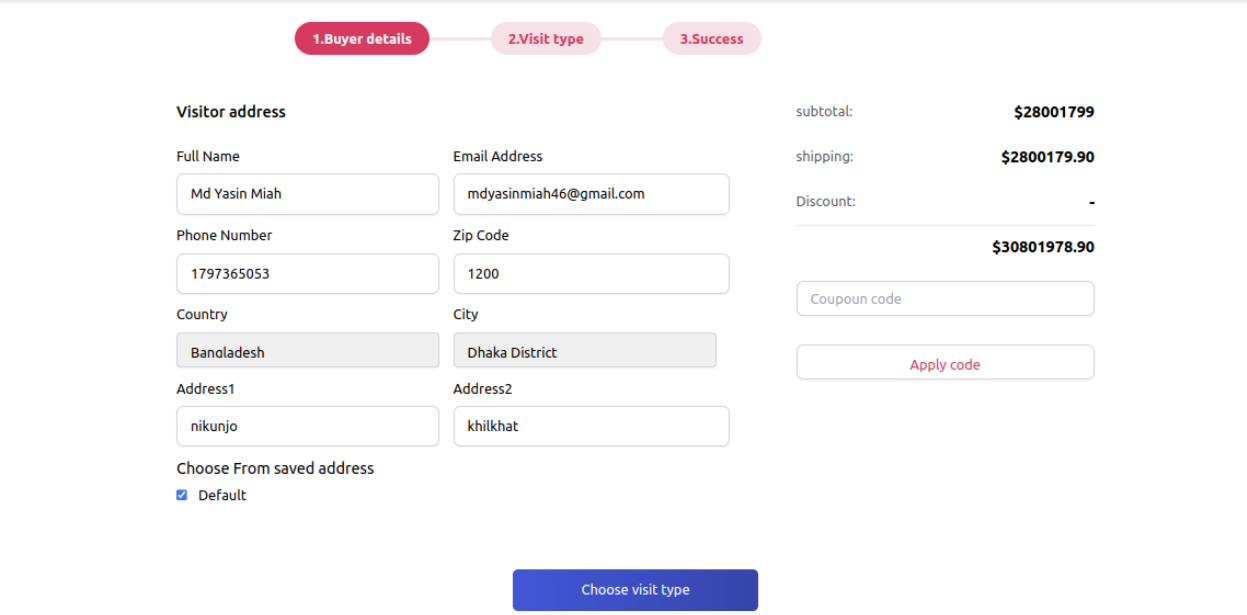


Figure 6.14: Buyer details

6.2.10 Choosing Visit Type

1. The next step is choosing the visit type.
2. Only a physical visit is available right now.

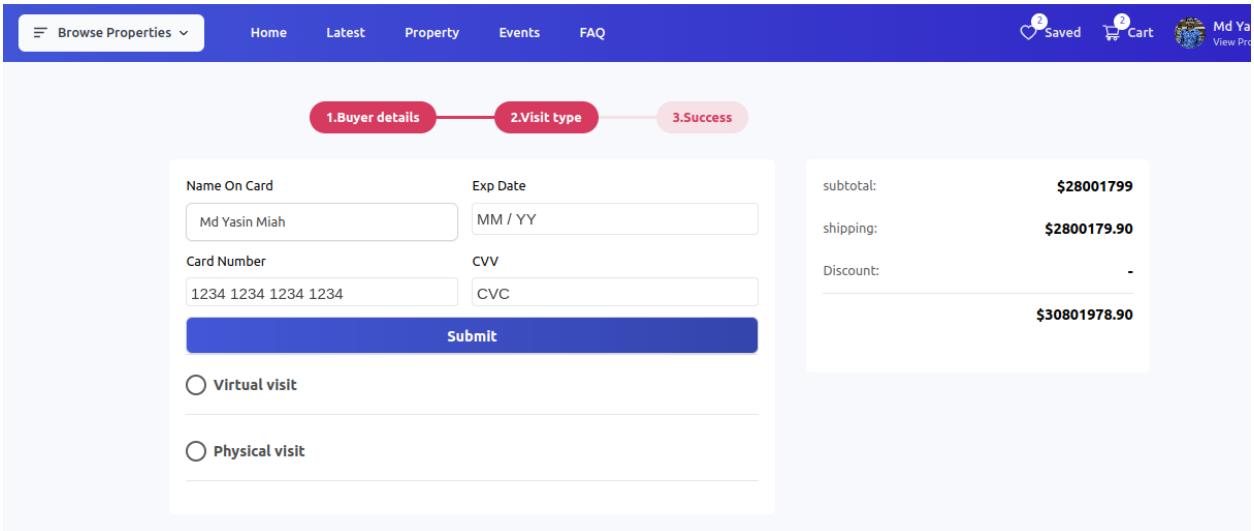


Figure 6.15: Choosing visit type

6.2.11 Finishing Visit

1. Confirmation screen of the visit.

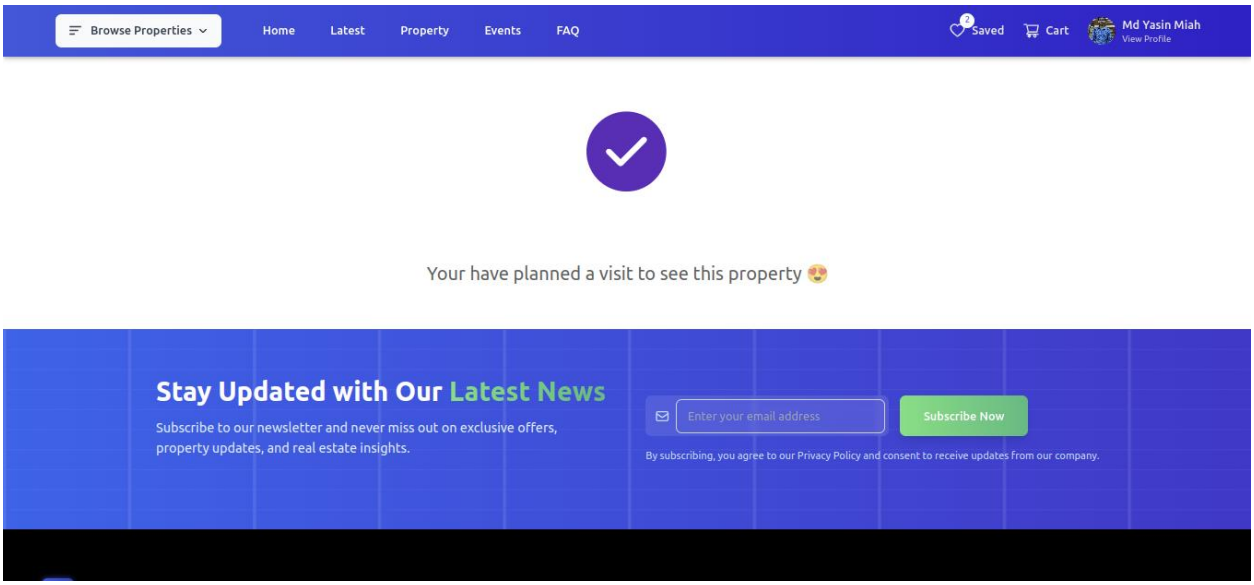


Figure 6.16: Finishing visit

6.2.12 Becoming a Seller

1. You can apply to be a seller from here.
2. This is the registration page for the seller.
3. You can register with the required credentials.

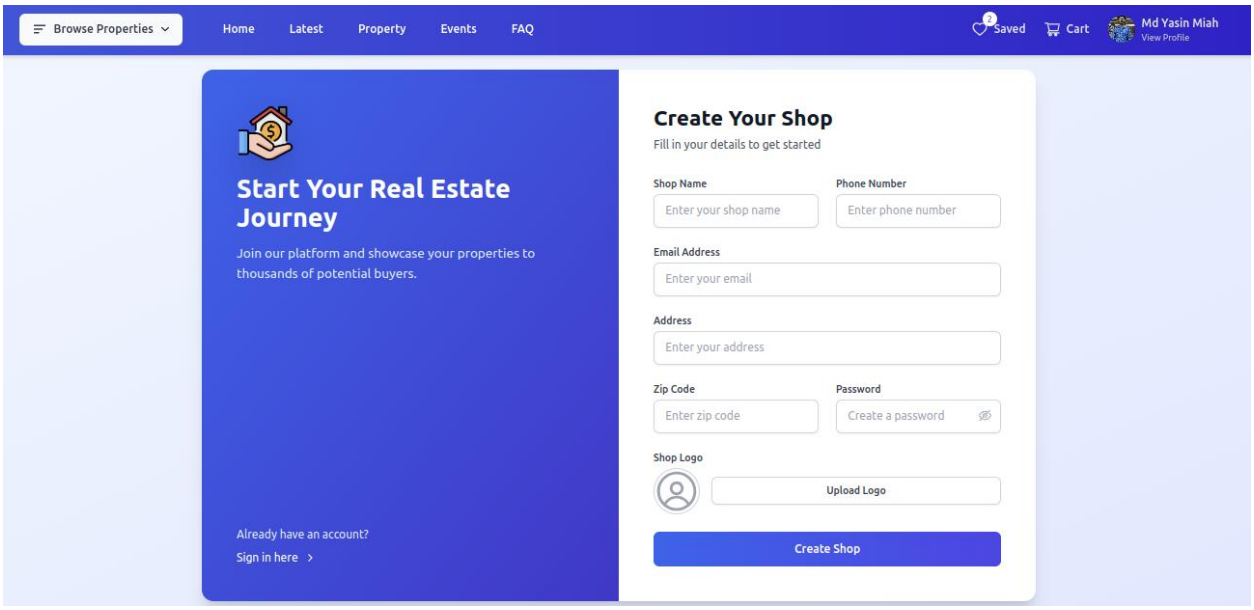


Figure 6.17: Becoming a seller

6.2.13 Register / Login (Seller)

1. This is the login page for the seller.
2. You can log in with only the correct username and password.

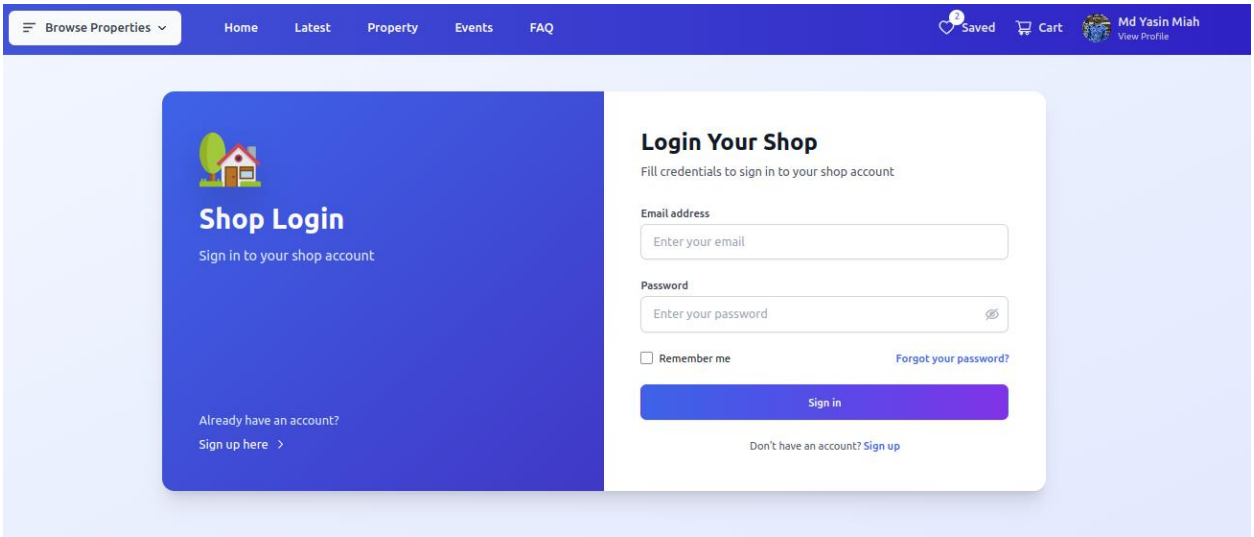


Figure 6.18: Seller login

6.2.14 All Property Listing

1. This is a view of all the listed properties for the seller.

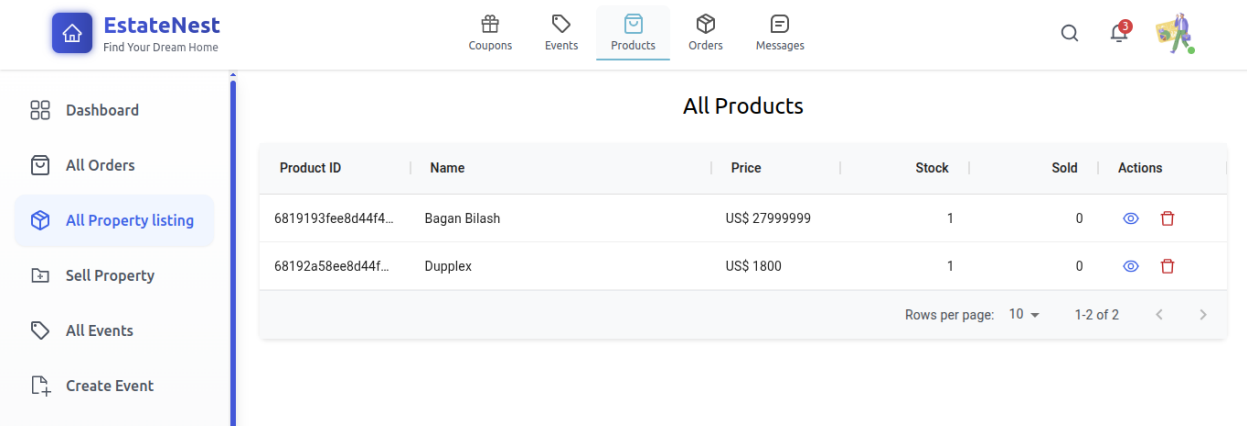


Figure 6.19: All Property listing

6.2.15 All Property Visits:

1. This is a view of all the visits for the properties for the seller.

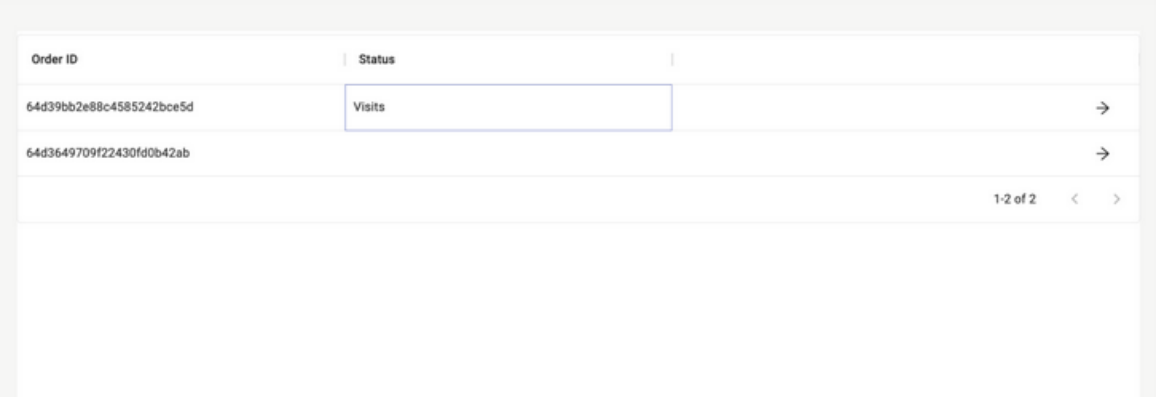


Figure 6.20: All property visits

6.2.16 Sell Property

1. The seller has to fill up the form to list any property.
2. All the (*) marks have been filled in to list the property.

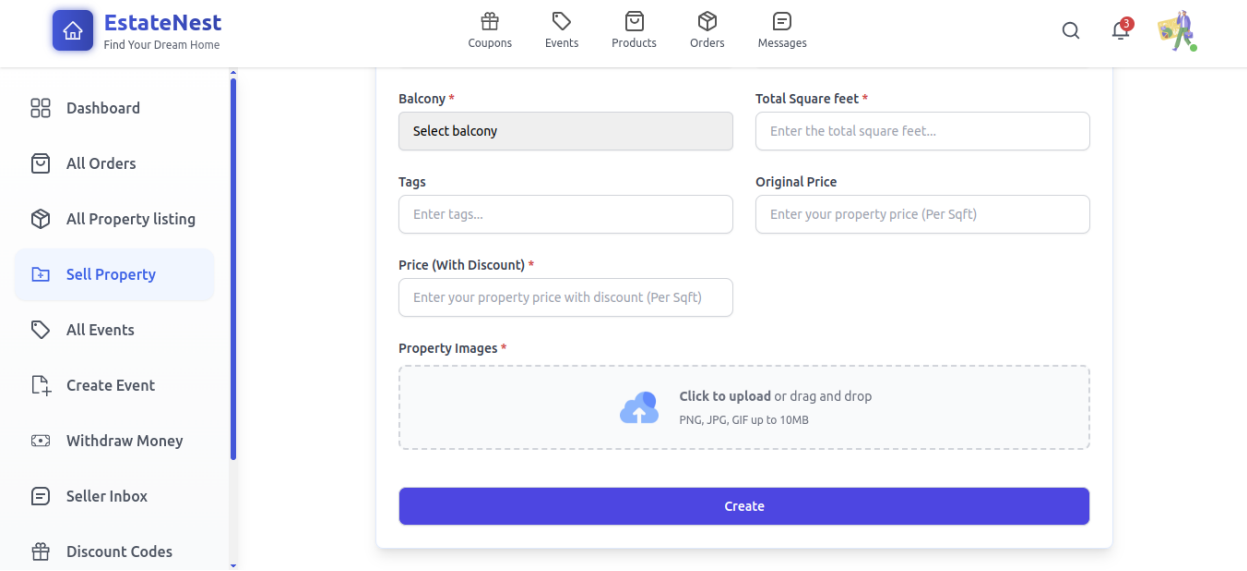


Figure 6.21: Sell property

CHAPTER 7

TESTING

7.1 Overview

Software testing is a systematic process used to evaluate the functionality and quality of a software product. It serves to inform stakeholders about the effectiveness and reliability of the application being tested. Moreover, it provides an objective analysis of the system, helping organizations understand potential risks involved in deploying the software [21].

7.2 Testing Objectives

Software testing aims to ensure that the developed solution is dependable, functional, and meets expected quality standards. The key objectives include:

- **Bug Identification**: The primary aim of testing is to uncover errors or defects in the software. Detecting these issues early during development can significantly enhance the overall product quality.
- **Validation and Verification**: Testing ensures that the system meets its technical requirements (verification) and fulfills the intended user needs and business objectives (validation).
- **Ensuring Quality**: By checking various aspects such as performance, reliability, and security, testing ensures that the application maintains high-quality standards.
- **Functional Accuracy**: Confirms that each feature of the software behaves as defined by the specifications.
- **Performance Assessment**: Evaluates system performance aspects like speed, load capacity, responsiveness, and scalability under different conditions.
- **Security Evaluation**: Focuses on identifying security flaws or weaknesses, ensuring that user data and system access remain protected from threats.
- **Cost Efficiency**: Identifying and resolving issues in the early stages of development is considerably more economical than fixing bugs after deployment.

7.3 Types of Testing

Different testing methodologies are employed to estimate software functionality. Common approaches include

- **Unit Testing**
- **Black Box Testing**
- **White Box Testing**

7.3.1 Unit Testing

Unit testing involves testing individual components of the software, such as styles, functions, or classes, to ensure that each one operates as anticipated. These units are tested for insulation to confirm the correct gesture. [22]

- Focus insulated testing of software factors or modules.
- Purpose ensures that each independent unit performs rightly designed according to the design specifications.
- Approach: Developers prepare specific test cases to estimate the anticipated effect against factual results. [23]
- Prosecution Inputs are passed to the unit, and laborers are matched with anticipated values. This process is generally automated and conducted during development.

7.3.2 Black Box Testing

This system evaluates the software's functionality without focusing on how it operates internally. It assists with attesting that the program satisfies the necessary specifications and operates as the user would anticipate.

- Focus: Examining the program without taking into account its internal sense or law.
- Things assess the software's performance in light of its conditions, specifications, and other factors.
- Using the input and output specifications handed by the software, testers construct test cases. The internal perpetration isn't necessary for them to understand.
- Method Without being apprehensive of the internal workings of the program, testers concentrate on inputs, labor, and overall software tests.

7.3.3 White Box Testing

This type of testing concentrates on the software's core sense and structure. Inventors can find possible excrescences, sins, and optimizations by examining law pathways and sense.

- Focus: Examining the software's internal sense and law.
- Things estimate the software's internal structures, pathways, branches, and code quality.
- Method: Test cases are created using knowledge of the internal law and the specific details of the product.
- System Testers dissect the law content, look at the law's prosecution pathways, and determine whether the underlying sense is sound.

White- box and black- box testing work in tandem to give a comprehensive system of software quality control. While black box and white box testing make sure the intertwined system works well and is duly enforced internally, unit testing provides the framework for ensuring that individual law units perform as anticipated.

7.4 Validation Check

The process of attesting that data or information satisfies designated criteria or norms and aiding in the identification of crimes or inconsistencies is known as a confirmation check.

7.4.1 Registration (Buyer)

Enforcing strong word conditions, vindicating the delicacy of particular information, and validating full name dispatch formats are all part of the buyer enrollment confirmation procedures.

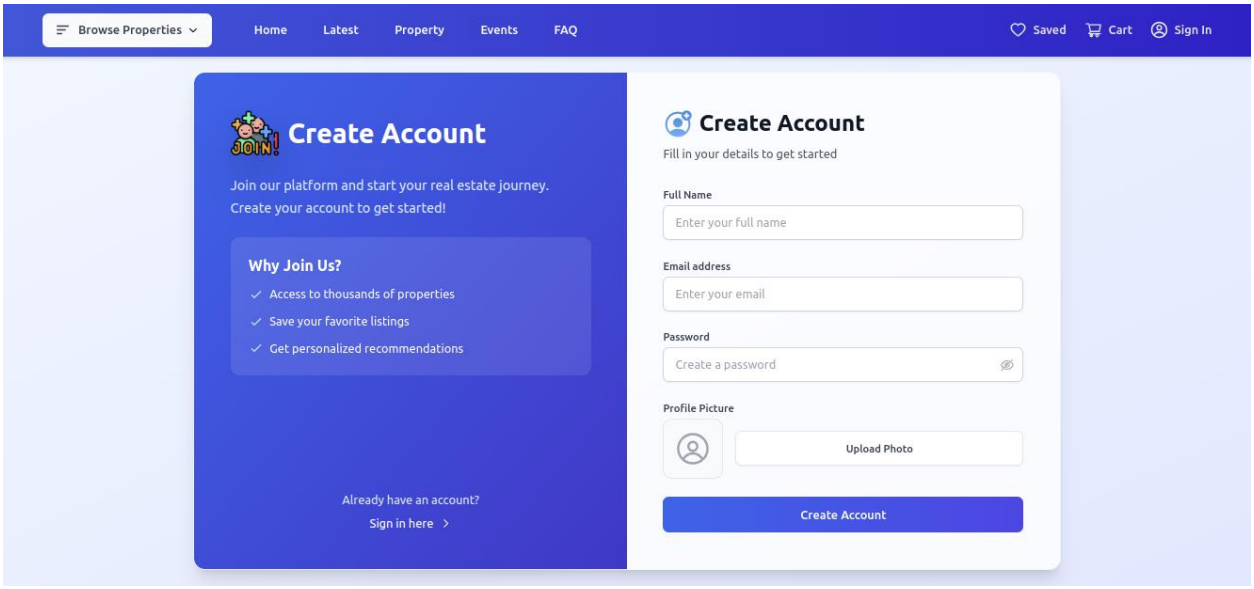


Figure 7.1: Buyer Registration

7.4.2 Registration Validation Check Table

The particular fields that require validation and the associated requirements are listed in the buyer registration table that follows.

Table 7.1: Registration validation check table for Buyer

Test step	Data field	Test data	Expected Result	Actual output	Verdict
1	Name, Email address, Password, Avatar	No input	Message: "Fill out all The field" is shown	Message: "Fill out all The field" is shown	Passed
2	Name, Email address, Password, Avatar	nahid24@gmail.com, 1111, Image	Message: "Fill out all The field" is shown	Message: "Fill out all The field" is shown	Passed
3	Name, Email address, Password, Avatar	Md Yasin Miah, ,1111, Image	Message: "Fill out all The field" is shown	Message: "Fill out all The field" is shown	Passed
4	Name, Email address, Password, Avatar	mdyasinmiah46@gmail.com, ,Image	Message: "Fill out all The field" is shown	Message: "Fill out all The field" is shown	Passed
5	Name, Email address, Password, Avatar	mdyasinmiah46@gmail.com, 1111, No image	Message: "Fill out all The field" is shown	Message: "Fill out all The field" is shown	Passed
6	Name, Email address, Password, Avatar	mdyasinmiah46@gmail.com, 1111, Image	Redirected to the homepage	Redirected to the homepage	Passed

7.4.3 Login (Buyer)

To ensure secure access, validation procedures for buyer login entail confirming the legitimacy of user-provided credentials. This involves validating the associated passwords and verifying that the usernames or emails entered are correct.

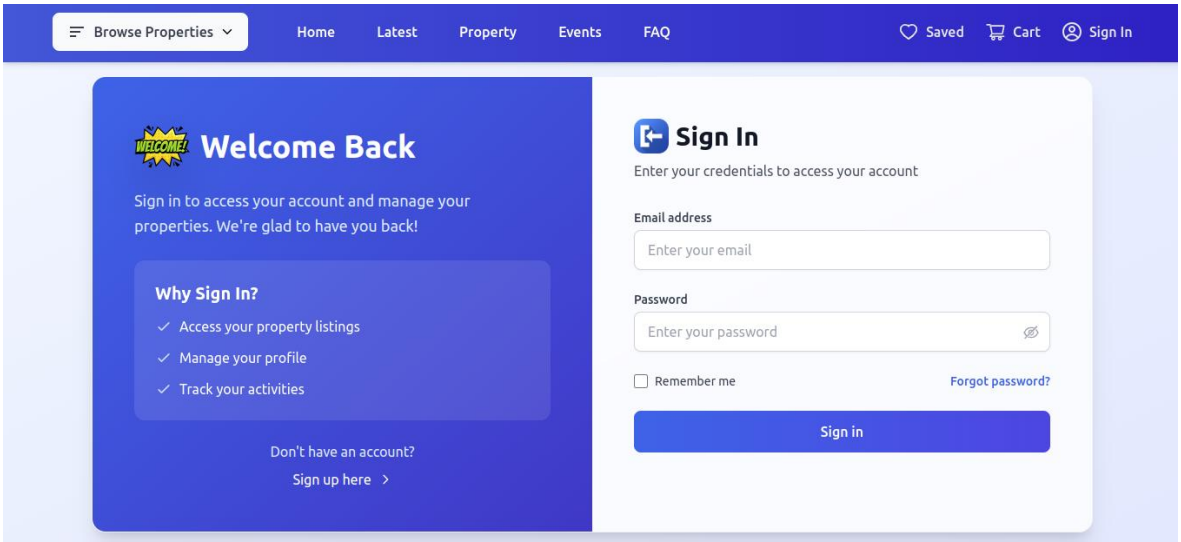


Figure 7.2: Buyer Login

7.4.4 Login Validation Check Table

This validation check table for the buyer login outlines the fields that require validation and the associated criteria.

Table 7.2: Login validation check table

Test step	Data field	Test data	Expected Result	Actual output	Verdict
1	Email address, Password,	No input	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed
2	Email address, Password,	,1111,	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed
3	Email address, Password,	nahid24@gmail.com,	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed
4	Email address, Password,	nahid24@gmail.com,1111,	Redirected to the homepage	Redirected to the homepage	Passed

7.4.5 Registration (Seller)

Validation checks during seller registration involve ensuring the accuracy and consistency of the provided information to maintain data quality. This includes validating email formats, enforcing strong password requirements, verifying phone number formats, Zip code, address and validating the accuracy of business details.

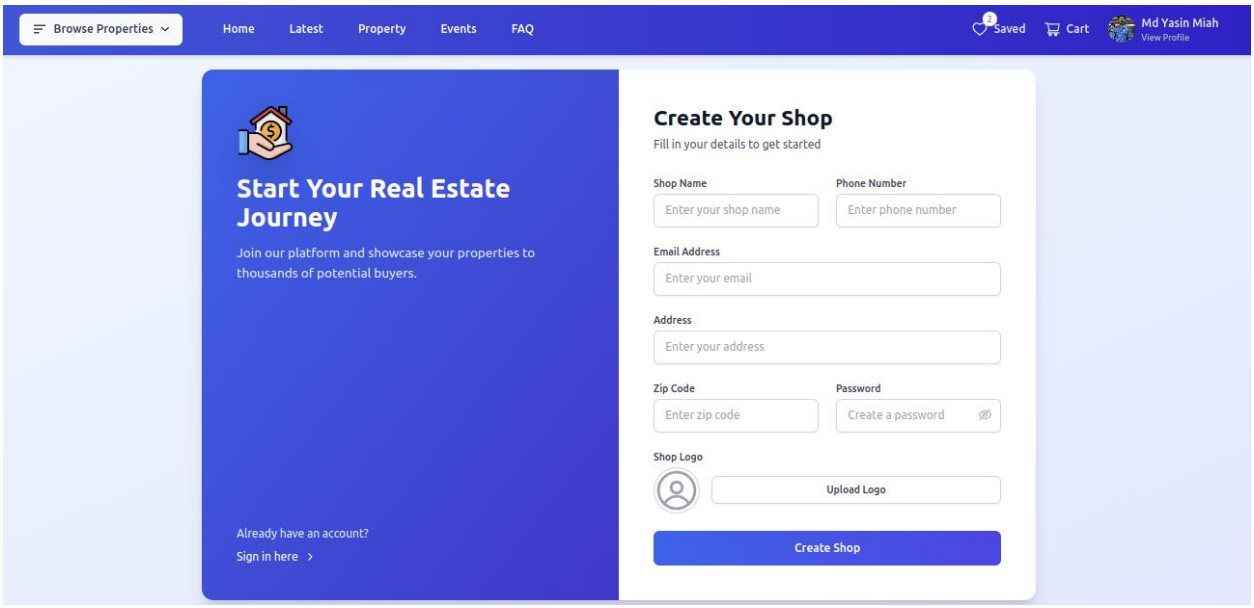


Figure 7.3: Seller Registration

7.4.6 Registration Validation Check Table

This table guides the implementation of validation checks during the seller registration process, contributing to accurate data and reliable accounts. A reference table for validation checks during seller registration is as follows:

Table 7.3: Registration validation check table for Seller

Test step	Data field	Test data	Expected Result	Actual output	Verdict

1	Shop Name, Email address, Address, Zip Code Password, Avatar	No input	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed
2	Shop Name, Email address, Address, Zip Code Password, Avatar	, nahid24@gmai l.com, 2nd street 433 1111, Image	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed
3	Shop Name, Email address, Address, Zip Code Password, Avatar	Village Shop, , 2nd street 433 1111, Image	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed
4	Shop Name, Email address, Address, Zip Code Password, Avatar	Village Shop, nahid24@gmai l.com, ,433, 1111, Image	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed
5	Shop Name, Email address, Address, Zip Code Password, Avatar	Village Shop, nahid24@gmai l.com, 2nd street, ,1111, Image	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
6	Shop Name, Email address, Address, Zip Code Password, Avatar	Village Shop, nahid24@gmai l.com, 2nd street, 433, , Image	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
7	Shop Name, Email address, Address, Zip Code	Village Shop, nahid24@gmai l.com, 2nd street,	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed

	Password, Avatar	433, 1111,			
8	Shop Name, Email address, Address, Zip Code Password, Avatar	Village Shop, nahid24@gmail.com, 2nd street 433 1111, Image	Redirected to the seller dashboard	Redirected to the seller dashboard	Passed

7.4.7 Login (Seller)

The validation checks for seller login involve verifying the legitimacy of provided credentials to ensure secure access. This includes confirming the accuracy of entered usernames or emails and validating the associated passwords.

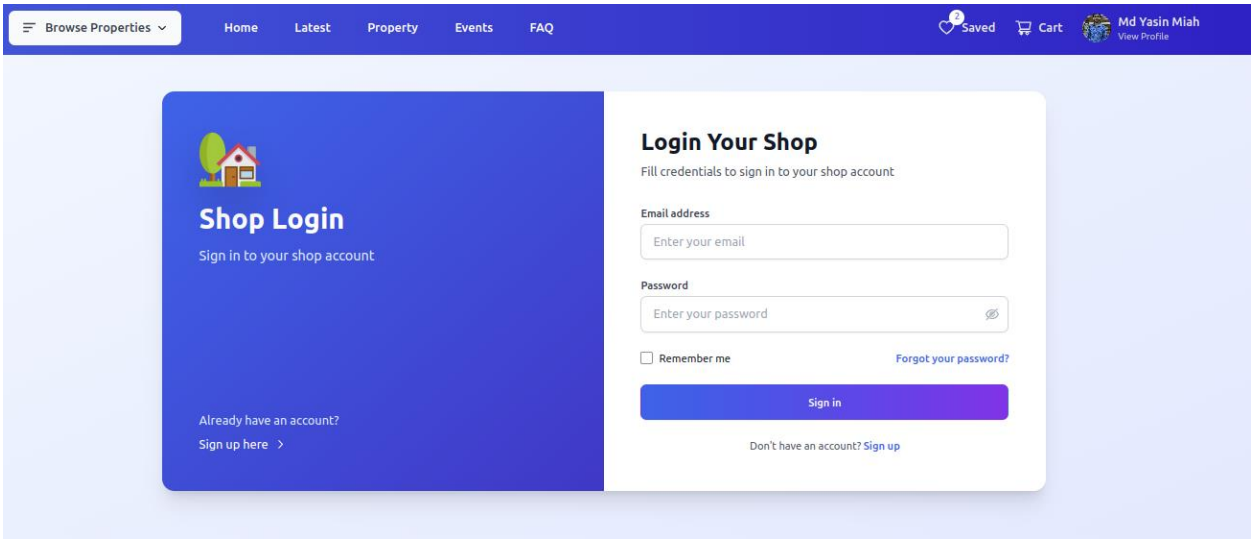


Figure 7.4: Seller Login

7.4.8 Login Validation Check Table

This table serves as a guide for executing validation checks during the seller login process, contributing to secure and authorized access to seller accounts.

Table 7.4: Login validation check table

Test step	Data field	Test data	Expected Result	Actual output	Verdict
1	Email address, Password,	No input	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
2	Email address, Password,	, 1111,	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
3	Email address, Password,	fahimchy24@gmail.com, ,	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
4	Email address, Password,	fahimchy24@gmail.com,1111,	Redirected to the homepage	Redirected to the	Passed

7.4.9 Booking a Visit

Booking property visits involves acquiring accurate information and proper scheduling to ensure a smooth visit. This includes validating the chosen date and time, attesting contact details, and ensuring any fresh notes are neatly handed.

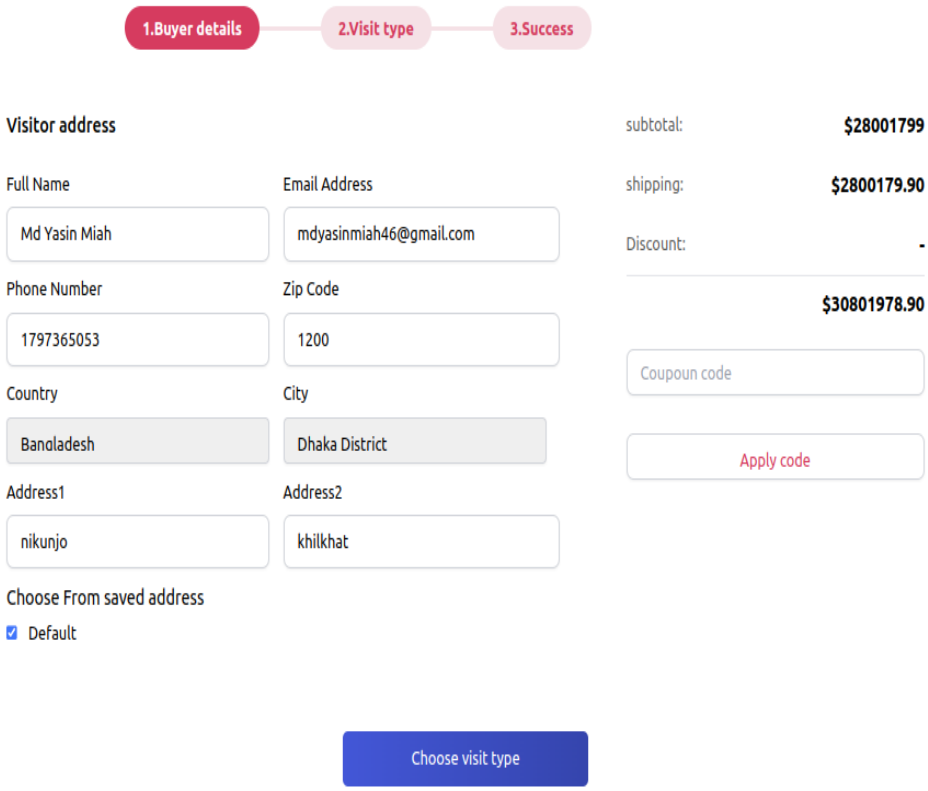


Figure 7.5: Booking a visit

7.4.10 Buyer Details Confirmation Check Table

This table acts as a reference for enforcing confirmation checks during the property visit booking process, promoting accurate scheduling and effective communication.

Table 7.5: Buyer details validation check table for the Seller

Test step	Data field	Test data	Expected Result	Actual output	Verdict
1	Name, Email address, Number, Address, Country, City, Zip Code Date	Joynal Abedin, csenahid24@gmail.com , , , , ,	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
2	Name, Email address, Number, Address, Country, City, Zip Code Date	Joynal Abedin, csenahid24@gmail.com , 2nd street, Bangladesh, Ctg, 433, 12/23/23,	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
3	Name, Email address, Number, Address, Country, City, Zip Code Date	Joynal Abedin, csenahid24@gmail.com 1212121, , Bangladesh, Ctg, 433, 12/23/23,	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
4	Name, Email address, Number, Address, Country,	Joynal Abedin, csenahid24@gmail.com 1223433, 2nd street,	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed

	City, Zip Code Date	, , 433, 12/23/23,			
5	Name, Email address, Number, Address, Country, City, Zip Code Date	Joynal Abedin, csenahid24@gmail.com 2112121, 2nd street, Bangladesh, Ctg, , 12/23/23,	Message: "Fill out all the field" is shown	Message: "Fill out all the field" is shown	Passed
6	Name, Email address, Number, Address, Country, City, Zip Code Date	Joynal Abedin, csenahid24@gmail.com, 334343232, 2nd street, Bangladesh, Ctg, 433, 12/23/23,	Redirected to the seller dashboard	Redirected to the seller dashboard	Passed

7.4.11 Selling Property

Listing a property involves ensuring accurate and reliable information is provided to present the property effectively.

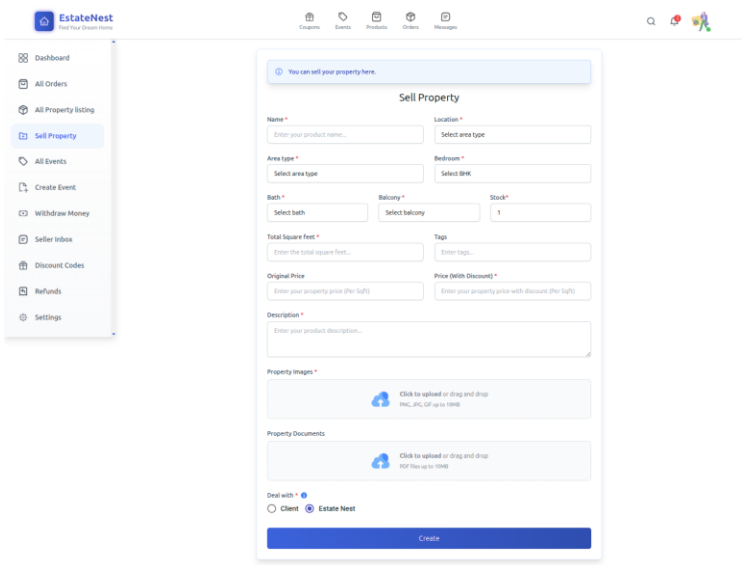


Figure 7.6: Selling Property

7.4.12 Selling Property Validation Check Table

This table serves as a guide for executing validation checks during the property listing process, contributing to accurate property representation and information. An organized overview of validation checks for listing a property can be expressed as:

Table 7.6: Selling Property validation check table

Test step	Data field	Test data	Expected Result	Actual output	Verdict
1	Name, Description, Location, Area type, Bedroom, Bath, Balcony, Total Square feet	No input	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed
2	Name, Description, Location, Area type, Bedroom, Bath, Balcony, Total Square	, Very nice house, Baized, Build up, 3, 4, 2,	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed

	feet	1200			
3	Name, Description, Location, Area type, Bedroom, Bath, Balcony, Total Square feet	1800 sqft house, , Baized, Build up, 3, 4, 2, 1200	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed
4	Name, Description, Location, Area type, Bedroom, Bath, Balcony, Total Square feet	1800 sqft house, Very nice house, , Build up, 3, 4, 2, 1200	Message: “Fill out all The field” is shown	Message: “Fill out all The field” is shown	Passed
5	Name, Description, Location, Area type, Bedroom, Bath, Balcony, Total Square feet	1800 sqft house, very nice house, Baized, Build up, , 4, 2, 1200	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
6	Name, Description, Location, Area type, Bedroom, Bath, Balcony, Total Square feet	1800 sqft house, Very nice house, Baized, Build up, 3, , 2, 1200	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
7	Name, Description, Location, Area type,	1800 sqft house, Very nice house, Baized,	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed

	Bedroom, Bath, Balcony, Total Square feet	Build up, 3, 4, , 1200			
8	Name, Description, Location, Area type, Bedroom, Bath, Balcony, Total Square feet	1800 sqft house, very nice house, Baized, Build up, 3, 3, 2, ,	Message: “Fill out all the field” is shown	Message: “Fill out all the field” is shown	Passed
9	Name, Description, Location, Area type, Bedroom, Bath, Balcony, Total Square feet	1800 sqft house, Very nice house, Baized, Build up, 3, 3, 2, 1200	Redirected to all listed property page	Redirected to all listed property page	Passed

7.5 Testing The Accuracy of The Model

7.5.1 Linear Regression

- Present the evaluation metrics used to assess the model's performance in the linear regression. [24]
- Discuss the coefficients of the independent variables

```
[ ] from sklearn.model_selection import train_test_split
    X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.2,random_state=10)

    from sklearn.linear_model import LinearRegression
    lr_clf = LinearRegression()
    lr_clf.fit(X_train,y_train)
    lr_clf.score(X_test,y_test)

    0.8629132245229443
```

Figure 7.7: Accuracy of linear regression

K-Fold Cross Validation:

We are using K-fold cross-validation to evaluate the robustness and generalization capability of our model. By repeatedly training and testing the model on different subsets of our data.

```
from sklearn.model_selection import ShuffleSplit
from sklearn.model_selection import cross_val_score

cv = ShuffleSplit(n_splits=5, test_size=0.2, random_state=0)

cross_val_score(LinearRegression(), X, y, cv=cv)
```

```
array([0.82702546, 0.86027005, 0.85322178, 0.8436466 , 0.85481502])
```

Figure 7.8: K-Fold Cross Validation

7.5.2 Random Forest

We are testing Random Forest, which combines multiple decision trees to improve predictive accuracy and control overfitting.

```
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=10)
rf_clf = RandomForestRegressor(random_state=10)
rf_clf.fit(X_train, y_train)
rf_score = rf_clf.score(X_test, y_test)
print("Random Forest Score:", rf_score)
```

```
Random Forest Score: 0.7785034768129033
```

Figure 7.9: Accuracy of Random Forest

7.5.3 KNN

We are also testing KNN which makes predictions by identifying the k nearest data points in the training set to a given input, and then classifying it.

```
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsRegressor
from sklearn.preprocessing import StandardScaler

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=10)
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)

knn_clf = KNeighborsRegressor()
knn_clf.fit(X_train_scaled, y_train)
knn_score = knn_clf.score(X_test_scaled, y_test)
print("KNN Score:", knn_score)
```

```
KNN Score: 0.7915112662167645
```

Figure 7.10: Accuracy of KNN

7.6 Validation Check for Linear Regression

1. Checking the distribution of residuals for normality.
2. Creating residual plots to identify non-linearity and patterns.

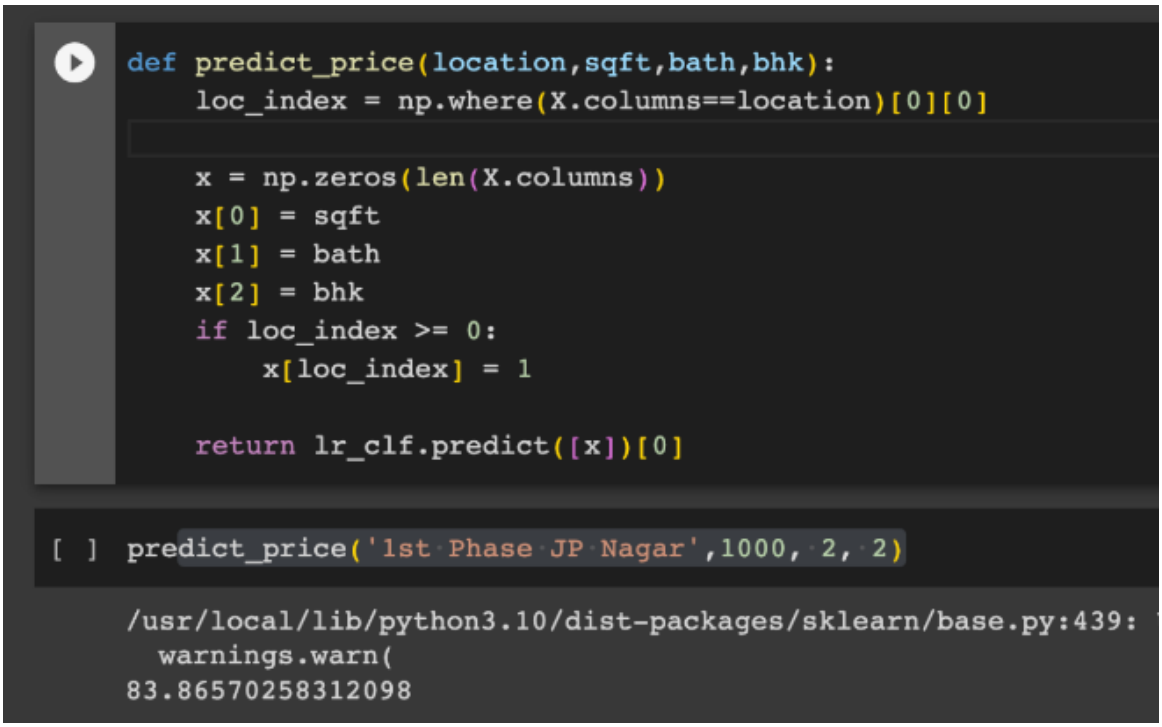


Figure 7.11: Validation check for linear regression

CHAPTER 8

CONCLUSION, LIMITATIONS & FUTURE WORK

8.1 Conclusion

We developed an intuitive real estate management system that makes it simple for users to look for, buy, and list properties. Improved AI functions, such as Price Prediction for Buyers and Sellers, give precise information.

Among the various features offered by the website are real estate listings, price forecasting, precise information, and an intuitive user experience. Anyone wishing to buy or sell real estate will find this real estate management system to be a worthwhile investment because it helps both buyers and sellers.

8.2 Limitations

1. The accuracy of the linear regression model is low. We can train the algorithm for even better outcomes if we can locate a better dataset.
2. The property cannot be purchased using the in-app purchase feature.
3. Renting properties is not an option.
4. The ability to identify fraudulent, duplicate, or phony listings is nonexistent.

8.3 Future work

1. We'll work to provide the ability to purchase the property within the app.
2. To find models with higher accuracy, we can test our dataset using several models.
3. We'll make the homepage's user interface better.
4. We plan to expand the admin panel's functionality.

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