

جامعة الشارقة
UNIVERSITY OF SHARJAH

Phase 1
Syntax Solutions

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Software Engineering - Phase 1

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Section : 12

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1 Introduction:

Our mobile application is designed to transform property transactions by using blockchain technology to enhance transparency, security, and trust. It tackles common issues and skepticism in real estate by securely recording every transaction detail such as ownership records, legal approvals, and transaction histories on an immutable blockchain ledger.

The app integrates all key stakeholders buyers, sellers, landlords, government authorities, and legal entities into a unified platform. This integration allows users to access verified property information, automate processes through smart contracts, and track the entire transaction history. By using blockchain, the app helps prevent fraud and tampering, providing a reliable and efficient environment for property transactions.

In addition to its core functionalities, the app aims to simplify and expedite the real estate process by reducing paperwork and manual checks. By automating routine tasks and ensuring all data is easily accessible and verifiable, the app not only improves the efficiency of property transactions but also enhances user confidence. This streamlined approach helps to minimize delays and errors, making the overall experience more seamless and user-friendly.

Our aim is to make the process of buying and selling property straightforward and reliable, thereby addressing the common challenges faced in real estate transactions and fostering a more trustworthy market environment.

1.1 Goals & Objectives:

The primary goal of our application is to build trust in property transactions through enhanced transparency at every step. By providing verified property information—including ownership records, legal status, and government approvals—all stored securely on the blockchain, the app ensures that all data is accurate and reliable.

The app also aims to simplify the buying process using smart contracts that automate key tasks such as payment transfers, ownership changes, and legal clearances. This automation reduces the need for intermediaries, minimizes delays, and lowers the risk of errors.

Reducing fraud and scams is another key objective. The immutable nature of blockchain guarantees that once property records and transaction data are recorded, they cannot be altered or tampered with, enhancing security and protecting users from fraud.

Moreover, the app promotes transparency by allowing users to track the entire transaction history, ensuring that all steps of the process are verifiable. By integrating all relevant parties including landlords, government authorities, and legal entities into a single platform, the app aims to create a secure and efficient property transaction ecosystem.

In summary, our app is designed to make property transactions more transparent, secure, and efficient, addressing common challenges and improving the overall buying and selling experience.

1.2 Statement of Scope

The project's scope is to create a mobile app that improves property transactions using blockchain technology. The app will ensure transparency, security, and trust by recording and verifying property details, ownership, legal approvals, and transaction histories on a secure blockchain ledger.

Accessible on Android, the app will require users, buyers, sellers, landlords, government authorities, and legal entities, to create accounts for streamlined communication. A real-time database will store property and user data, updated with each transaction. Users must provide accurate property details, legal documentation, and contact information.

Our property transaction app is designed to tackle the common challenges in real estate dealings, such as lack of transparency and security. The major functionalities of the app include:

Essential Requirements:		
Feature	Description	
Contracts	Automates property transactions by handling payment transfers, legal approvals, and ownership transfers. <ul style="list-style-type: none">Auto-execution: Executes contract terms automatically when conditions are met.Dispute Resolution: Provides mechanisms for resolving contract disputes.	
Record History of Lands	Maintains an immutable, transparent record of land ownership and transaction history using blockchain. <ul style="list-style-type: none">Searchable Database: Allows users to search transaction history by property or owner.Document Upload: Supports uploading and linking relevant documents to the transaction history.Audit Trails: Provides detailed audit trails for all changes and updates.	
Easier Way to Meet Government Regulations	Streamlines compliance by integrating government regulations into the transaction process.	
Secure Transactions	Ensures secure payment processing and transaction management via blockchain's cryptographic protocols. <ul style="list-style-type: none">Encryption: Uses advanced encryption for transaction data. (hashing maybe?)Two-Factor Authentication: Requires additional verification for transaction approval.Fraud Detection: Implements mechanisms to detect and prevent fraudulent activities.	
Tenant Screening	Verifies tenants' identity and financial background for landlords using blockchain-based data. (ID, Credit Score, Financial History)	
Proof of Income for Buyers	Requires buyers to provide verifiable proof of income before proceeding with property transactions.	
Investment Opportunities	Offers users the chance to invest in real estate through secure, blockchain-backed contracts.	
Ownership Validation	Verifies property ownership through blockchain, ensuring clear and tamper-proof validation.	
Loan Management	Provides tools to manage loans and financing within the app, integrated with blockchain for transparency. <ul style="list-style-type: none">Loan Application Integration: Create a user-friendly application form with document upload capabilities.Loan Approval Workflow: Implement both automated and manual loan approval processes.	
User-Friendly Property Verification (QR Codes)	Enables easy property verification through QR codes linked to blockchain data.	

Desirable Requirements:

Feature	Description
Past User Feedback of Landlords	Allows buyers and tenants to view feedback and reviews of landlords from previous users.
Predefined Regulations	Provides users with predefined legal and financial regulations to simplify compliance in property deals.
Buying Shares	Enables users to invest in fractional property ownership by buying shares in real estate.
Data Export	Allows users to export property transaction data for external analysis or legal documentation.
Easier Negotiations	Facilitates communication between buyers and sellers with features that help streamline negotiations.
Web Page Access	Offers access to property transactions and information via a dedicated web interface.

Future Requirements:

Feature	Description
Credit Score and Financial History from Banks	Integrates with banks to pull users' financial history and credit scores for better transaction assessment.
Integration with Government Entities	Expands the app's functionality to further integrate government services for enhanced compliance checks.
Advanced AI-based Property Recommendations	Uses AI to recommend properties based on user preferences, financial status, and market trends.
Software Worldwide Deployment	Plans to expand the software's reach worldwide, ensuring it can operate across different legal frameworks.
iOS Version	Develops a dedicated iOS version of the app to cater to Apple device users.
Multilingual Assistance	Adds support for multiple languages to cater to a global user base.
Multi-currency Support	Enables transactions in various currencies, facilitating global real estate investments.
User-Friendly Enhancements	Focuses on improving the overall user interface and user experience to make the app more accessible.

1.3 Software Context:

The property transaction app operates within the real estate sector, aiming to enhance the process of buying and selling property through blockchain technology. It serves as a platform for all stakeholders involved in property transactions, including buyers, sellers, landlords, government authorities, and legal entities. The app provides a secure, transparent, and efficient environment by utilizing blockchain for immutable record-keeping, smart contracts for automating transactions, and a comprehensive system for tracking and verifying property information.

1.4 Major constraints:

The app faces several constraints, including the need for a robust blockchain infrastructure and seamless integration with existing systems. It must also ensure data privacy and comply with legal standards across different jurisdictions. Widespread user adoption is crucial for effectiveness, and the app must maintain technical reliability and scalability to handle a high volume of transactions smoothly.

- **Blockchain Integration:** Requires reliable infrastructure and integration with current systems.
- **User Adoption:** Needs acceptance from various stakeholders for optimal use.

2 Usage Scenario

This section describes use-case scenarios that illustrate how data is collected and processed, detailing the main features and functions of our software.

2.1 User Profiles

Buyer:

The buyer is an individual who uses the app to explore and acquire properties. They are able to register and manage their account, search for available properties, and view detailed information about each listing. Buyers can initiate transactions and track the progress of their property deals through the app.

Landlord:

The landlord utilizes the app to manage rental properties. They can list available rental units, interact with prospective tenants, and keep their property information up-to-date. Landlords also use the app to track rental transactions and maintain their properties efficiently.

Legal Entity:

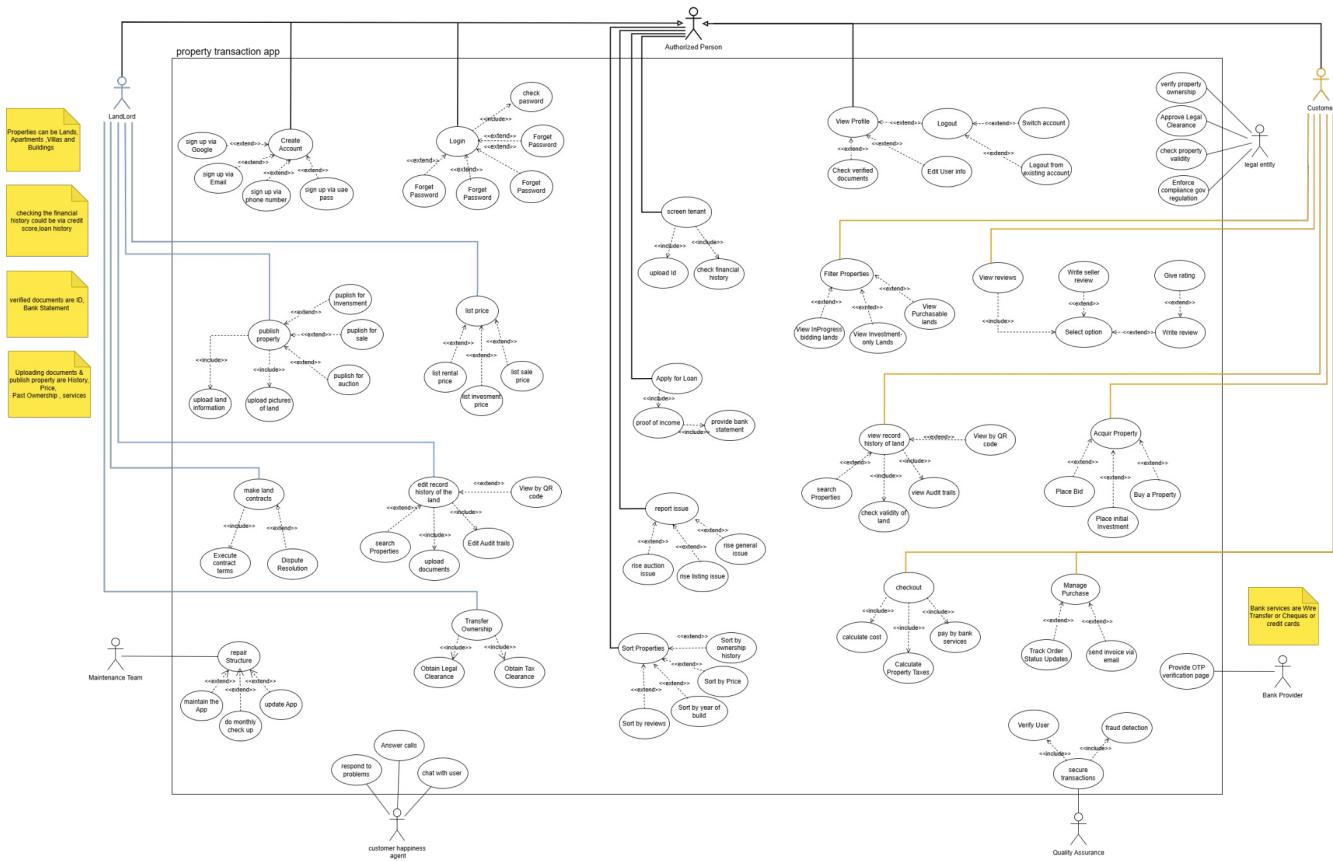
The legal entity is involved in validating and handling the legal documentation required for property transactions. They ensure that all legal aspects are addressed, including verifying documents and facilitating the legal clearance processes for transactions conducted through the app.

App Administrator:

The app administrator oversees the overall functionality and performance of the application. They manage user accounts, monitor system performance, address support requests, and handle updates to app features and data. Their role ensures that the app operates smoothly and efficiently for all users

2.2.1 Use-Case Diagram

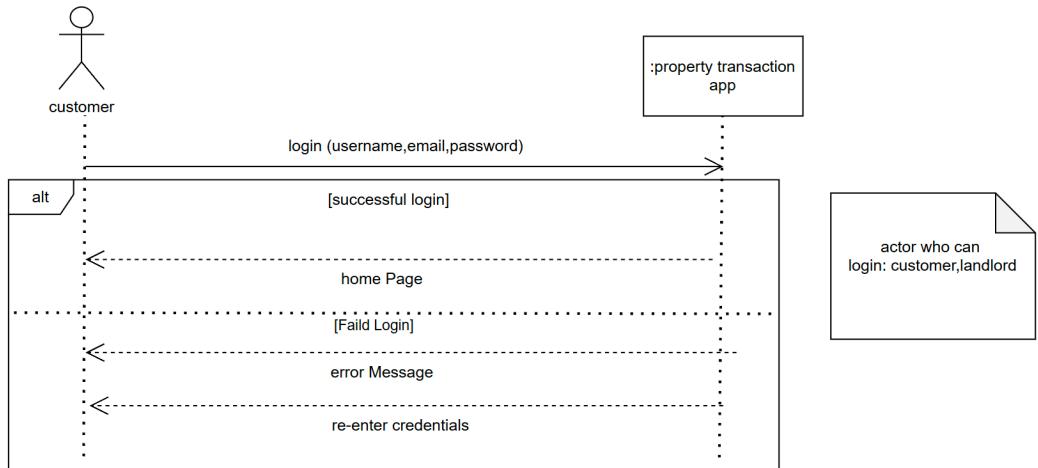
This is the Use-Case Model for our Property transaction app:



This use case diagram outlines the process flow for a property management and acquisition system, involving various user roles and actions. It covers essential functions like account creation, login, and password management, followed by steps for filtering, viewing, and selecting properties based on user preferences. The diagram also highlights processes related to tenant screening, financial history verification, document uploads, and ownership transfers. Additional functionalities include applying for loans, sorting properties by reviews, price, or year built, and managing purchases. The system ensures secure transactions through features like bank verification and OTP (One-Time Password) validation, making it suitable for both buyers and landlords managing real estate.

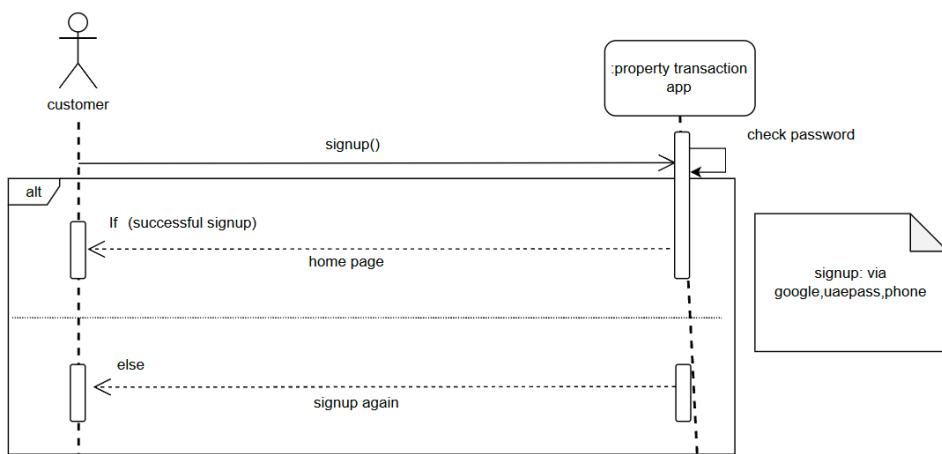
2.2.2 Sequence Diagrams

1) Login



for the login process, the customer submits their login credentials to the property transaction app. The system then checks the validity of the credentials .If the login is successful, the system displays the home page. If the login fails, an error message is shown, and the customer is prompted to re-enter their credentials.

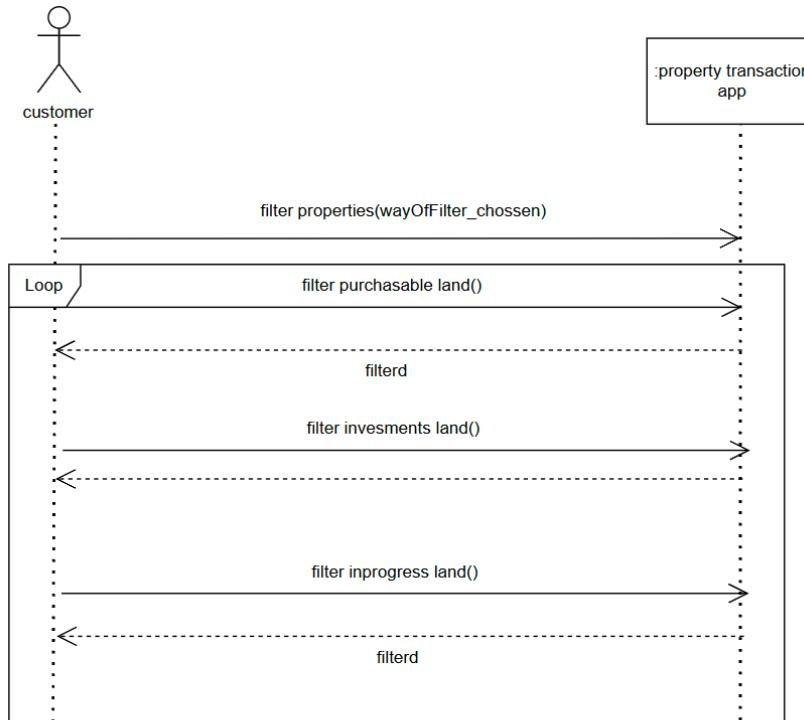
2) Signup



for the signup process, the customer submits their signup details to the property transaction app. The system checks the password and other required information .If the signup is successful, the system displays the home page. If the signup fails, an error message is shown, and the signup form is presented again for re-entry

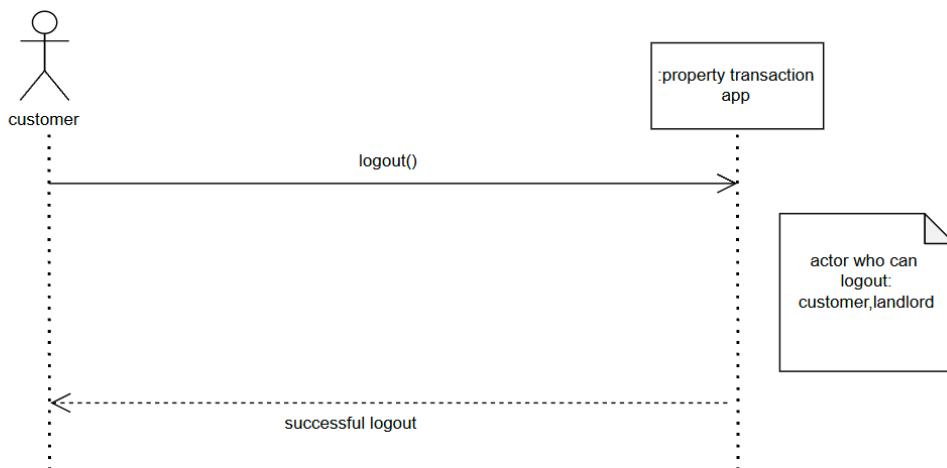
2.2.2 Sequence Diagram's

3) Filtering



customer needs to login with verified account and secured one to be able to filter the published properties in the app by choosing the way of filtration either by purchasable land or investments land or inprogress land

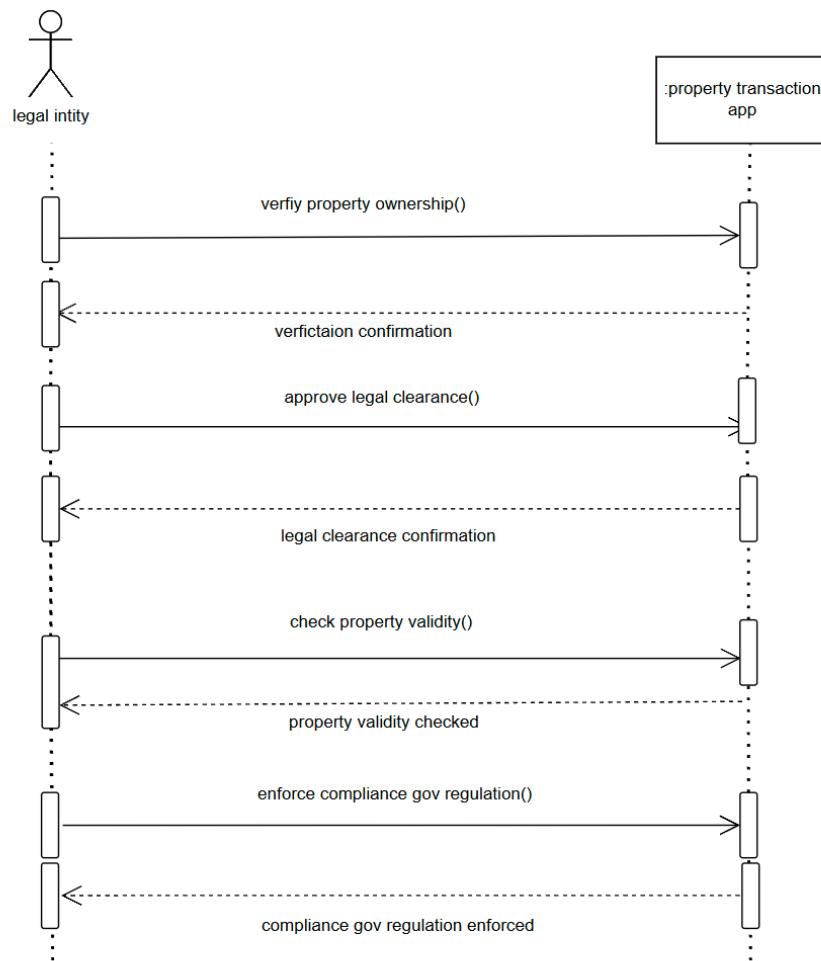
4) Logout



for logout, the **Customer** sends a logout request to the property transaction app. The system processes the request and returns a successful logout confirmation. Once the confirmation is received, the system redirects the customer to the login page

2.2.2 Sequence Diagrams

5) Verify Ownership



for verifying property ownership, the process begins when the legal entity sends a request to verify property ownership, and the verification confirmation is returned.

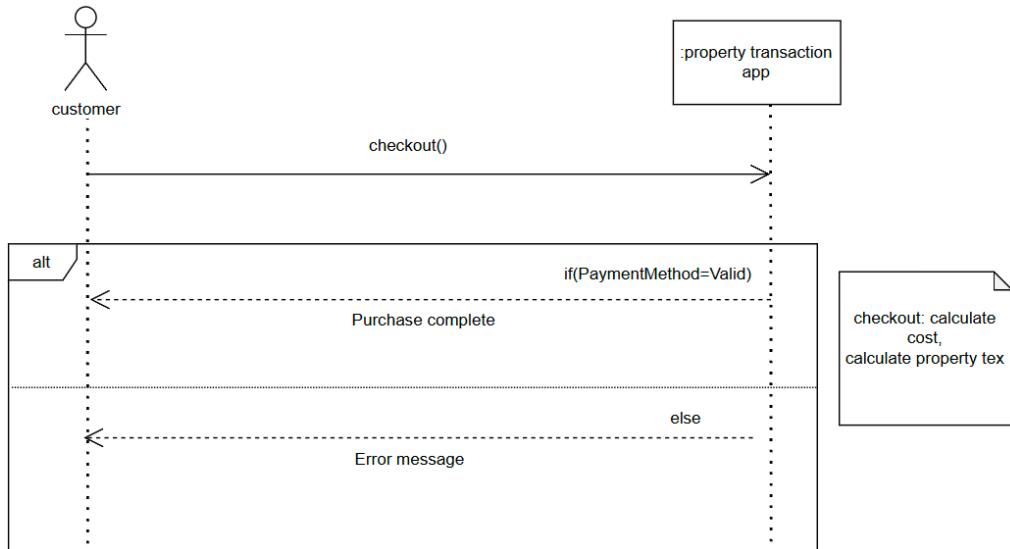
Next, the legal entity sends a request to approve legal clearance, and the legal clearance confirmation is received.

After that, the legal entity checks the property's validity, and once validated, a property validity confirmation is returned.

Finally, the legal entity sends a request to enforce compliance with government regulations, and the enforcement confirmation is returned, completing the process.

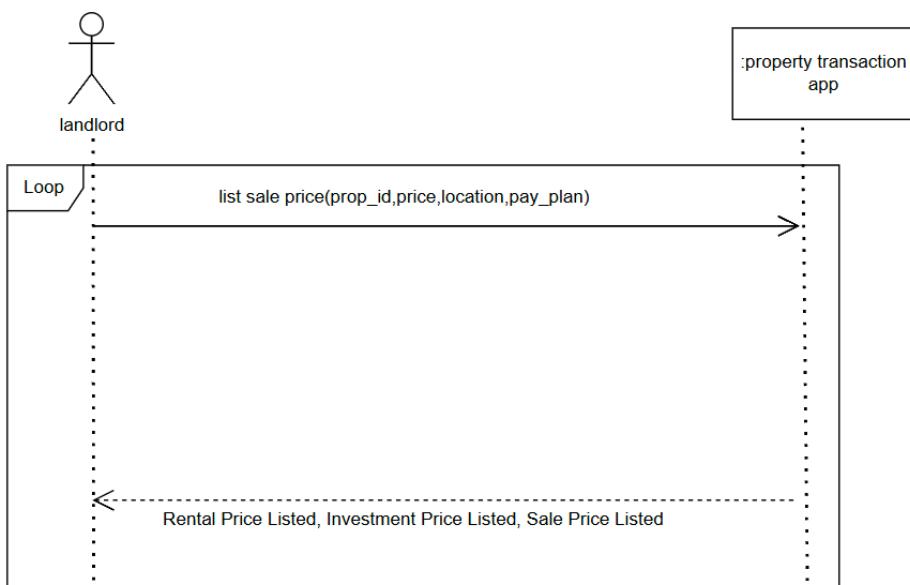
2.2.2 Sequence Diagram's

6) Checkout



for checkout, the **Customer** sends a checkout request to the property transaction app. The system verifies the payment method if the payment method is valid, the purchase is successfully completed and a confirmation is sent back. If the payment method is invalid, an error message is returned, and the customer is asked to correct the issue

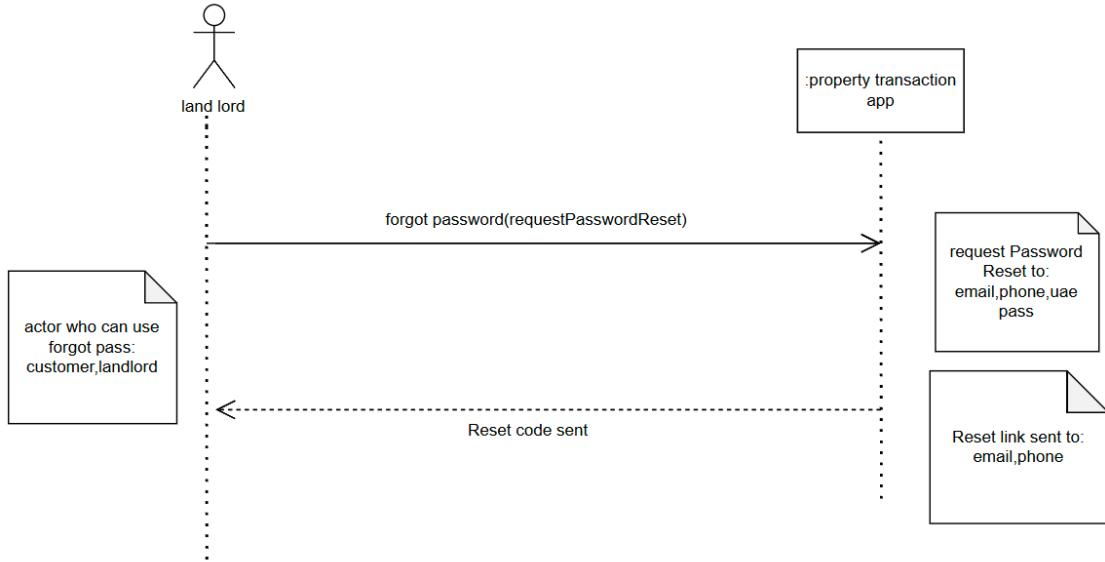
7) List Price property (editing)



for listing sale price, the **Landlord** sends the list of sale prices with parameters like property ID, price, location, and payment plan to the property transaction app. The app processes the information and returns the **rental price list**, **investment price listed**, and **sale price listed** as the response. loop work until all requested prices are listed

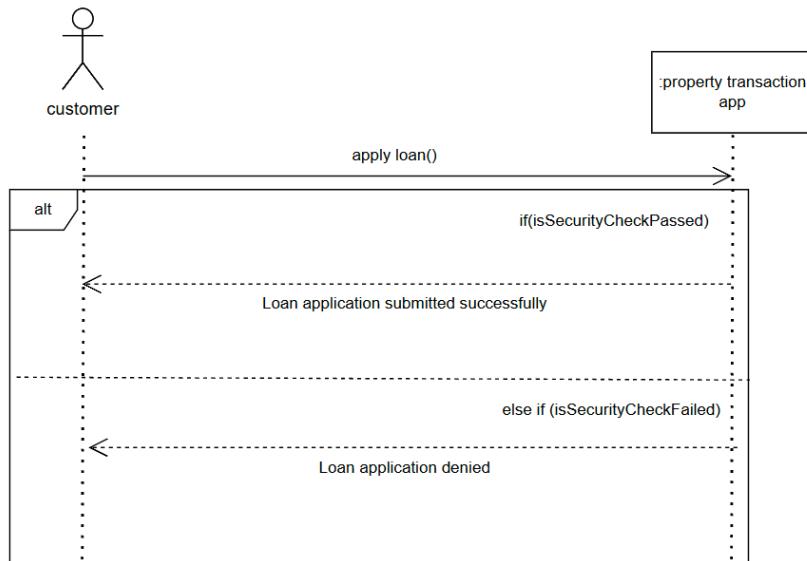
2.2.2 Sequence Diagram's

8) Forgot Password



for the "Forgot Password" process, the **Landlord** initiates a request by sending a "forgot password" notification to the property transaction app. The app processes the request and returns a reset code, which is sent to the **Landlord** via email or phone. This allows the **Landlord** to securely reset their password and regain access to their account.

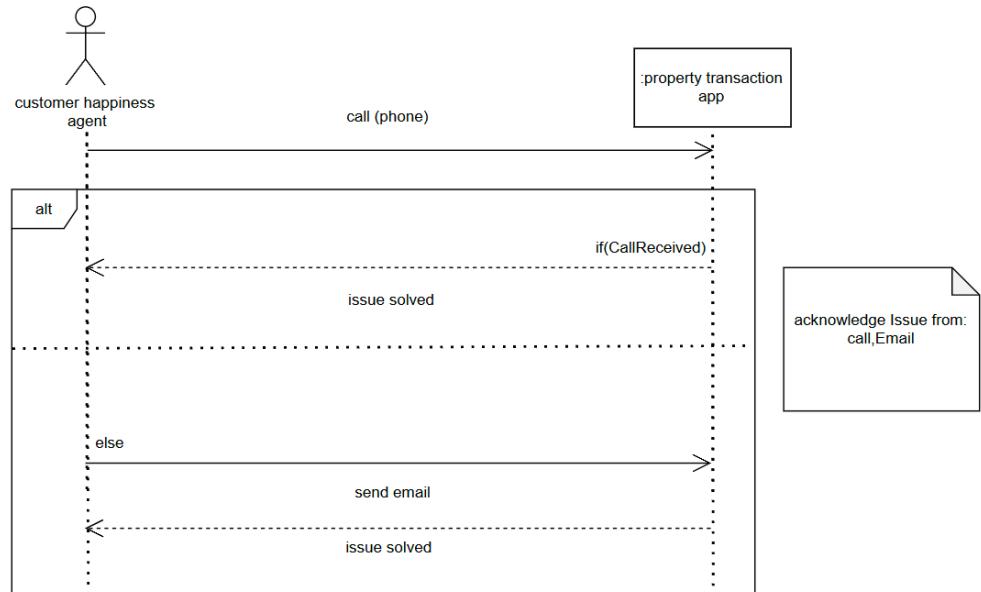
9) Applying for loan



for the "Apply Loan" process, the **Customer** submits a loan application to the property transaction app. The app performs a security check to ensure eligibility. If the security check is passed, it confirms that the loan application has been submitted successfully. Conversely, if the security check fails, the app notifies the **Customer** that the loan application has been denied.

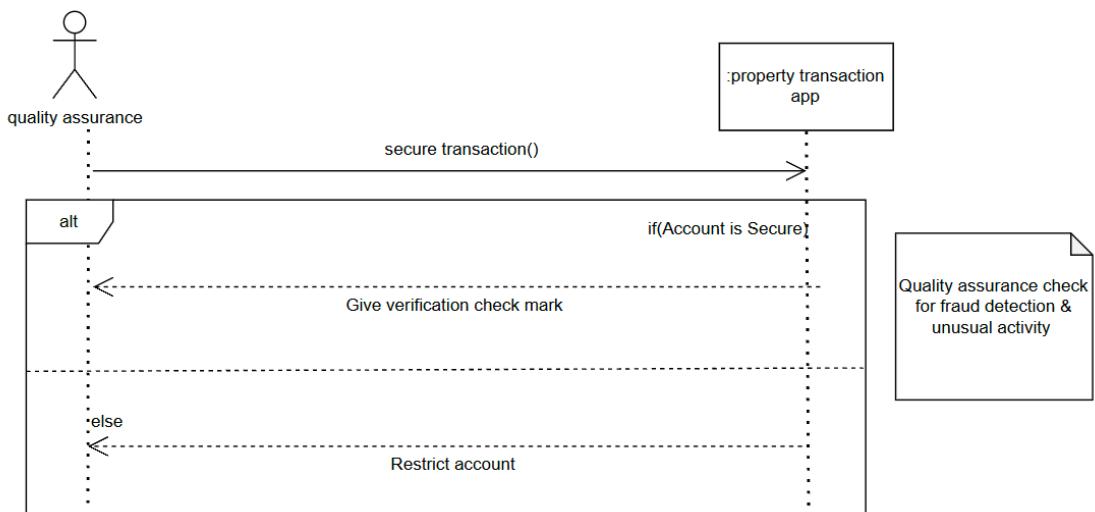
2.2.2 Sequence Diagram's

10) Customer Happiness Agent



for the "Call" process, the **Customer Happiness Agent** initiates a phone call to the customer to address their issue. If the call is received and answered, the agent confirms that the issue has been resolved. If the call is not picked up by the agent, the user is then prompted to send an email, after which the issue will also be marked as resolved

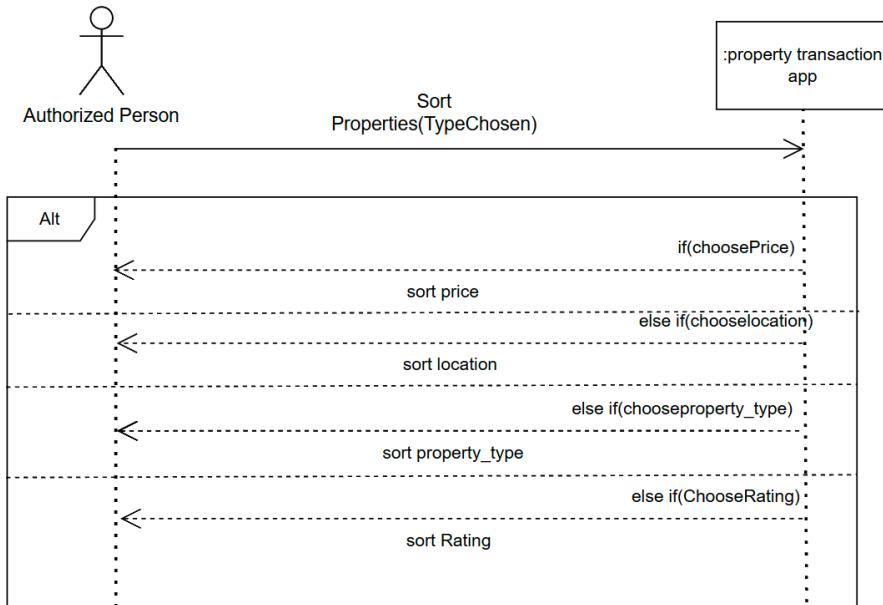
11) Secure transactions



the **quality assurance** team will make sure to secure the transactions of the user and then verify that its already got secured elae the account will be restricted

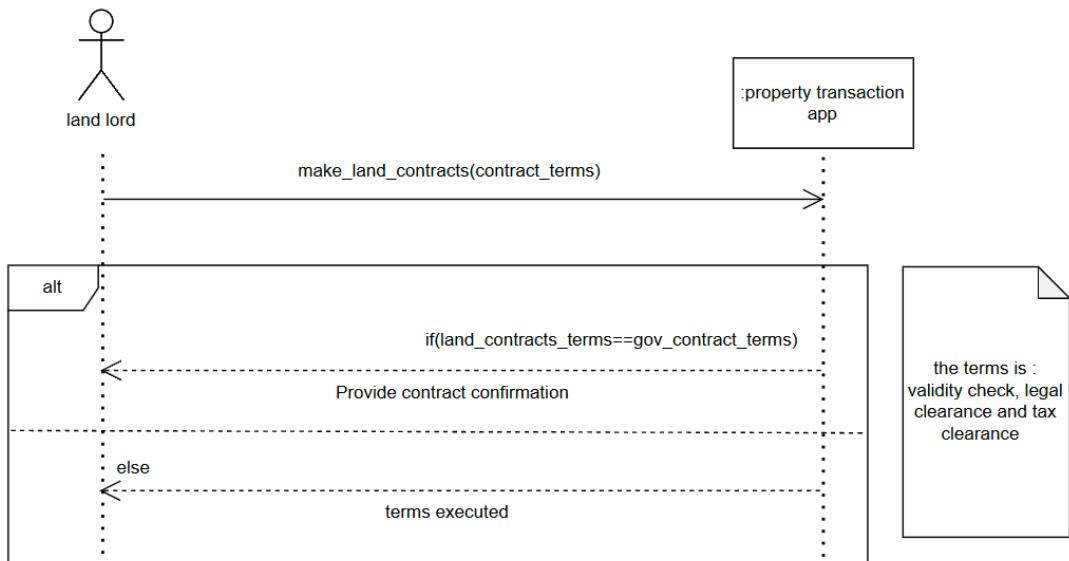
2.2.2 Sequence Diagram's

12) Sorting Properties



Authorized Person can sort properties by many ways depends in his choice after he login and screen the tenant then he can sort by price or location or property type or rating

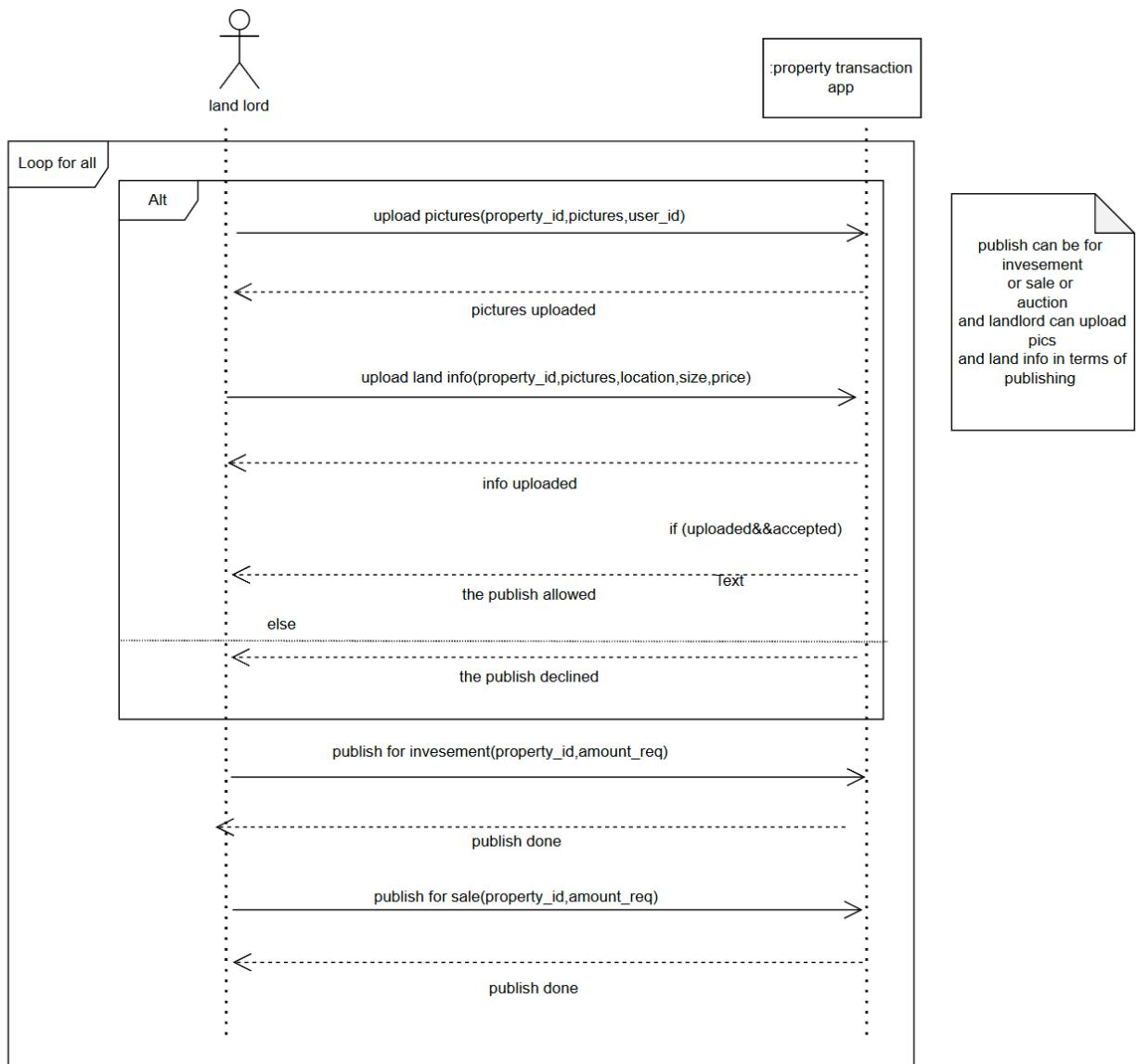
13) Making contracts



for "make land contracts" the **land lord** will be able to make contracts by sending the contract terms to the system and after checking it follows the gov terms he will get the approval else terms will be excuted and not accepted

2.2.2 Sequence Diagram's

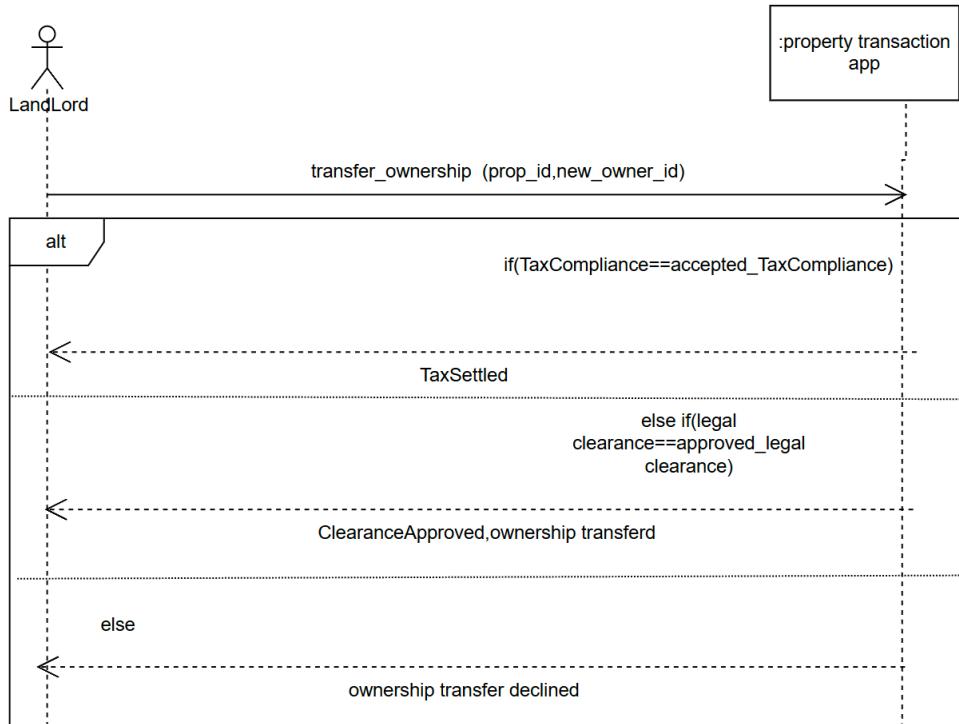
14) Publishing Property



land lord needs to login and screen tenant to be able to publish properties but first he need to upload land info and pictures of the land then choose type of publish either for sale or invesment

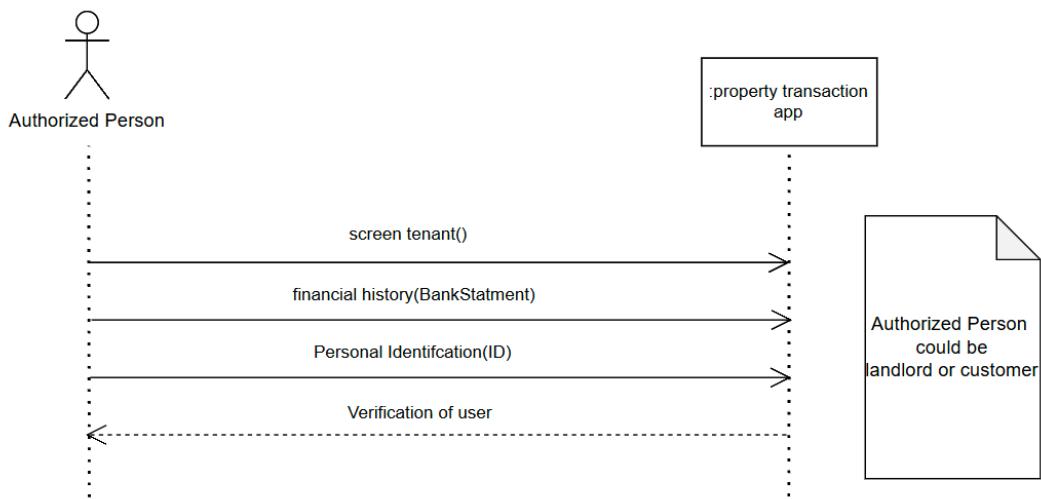
2.2.2 Sequence Diagram's

15) Transfer Ownership



for transfer ownership the landlord needs to upload the prop id and the new_owner_id inside the app then get confirmation regarding the tax Compliance then obtain legal clearance the either gets approved or rejected depends on the terms of our system and gov terms

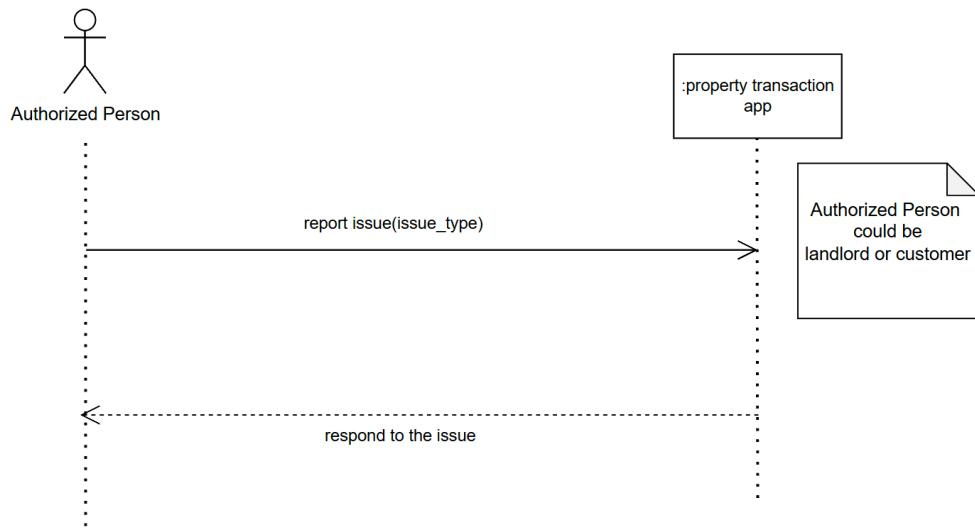
16) Screen Tenant



Authorized Person can screen tenant by providing the financial history with including the bank statement and personal id then it will get checked and either approved or rejected

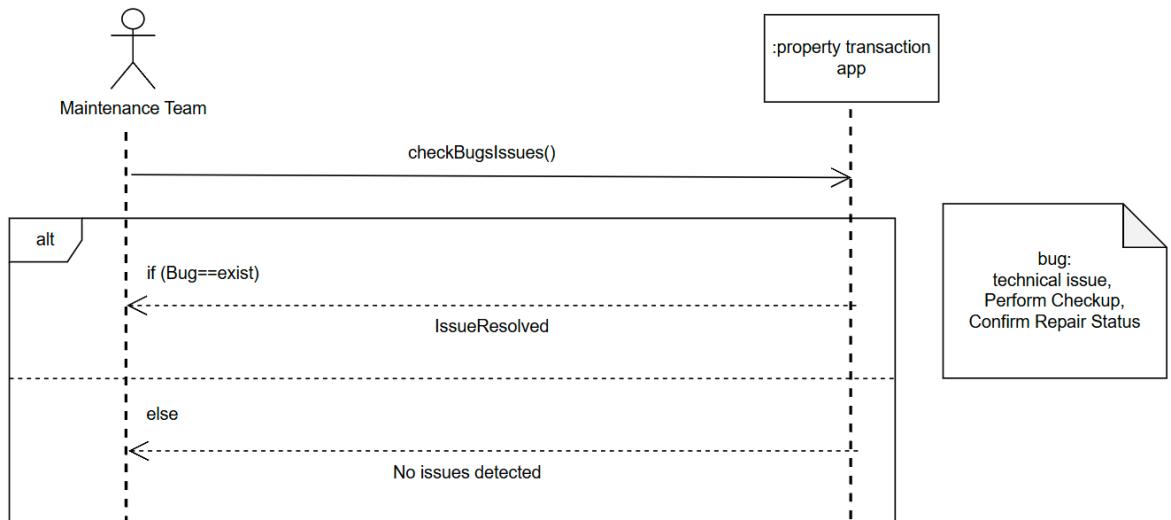
2.2.2 Sequence Diagram's

17) Report Issue



Authorized Person can report issues in the app by providing the issue description and the report could be Property Information, Difficulty in Navigation, Notification Delays then will get respond to the issue

18) Maintaining system (Bug fixes)



Maintenance Team are responsible about checking bugs and fixing it so bug could be technical issue, Perform Checkup,

Confirm Repair Status and if the bug exist then will be fixed else it will not

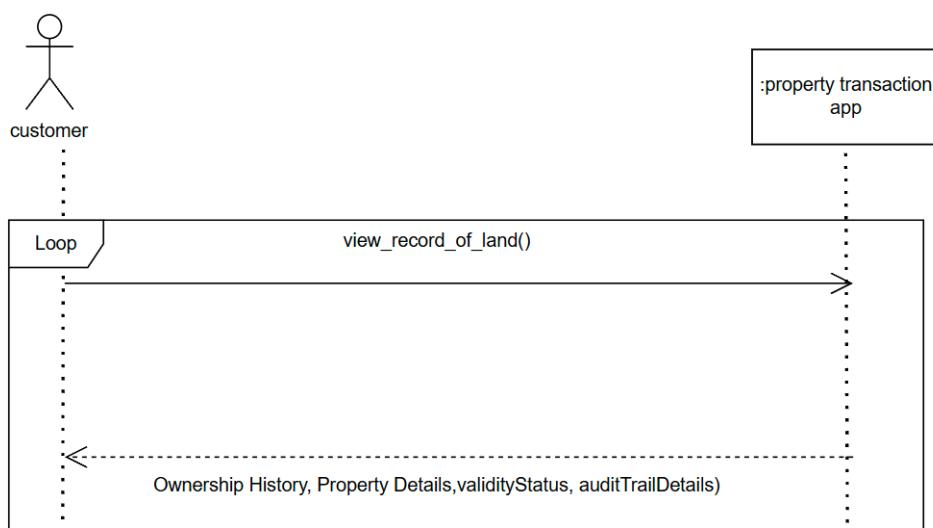
2.2.2 Sequence Diagram's

19) Approving Property documents



legal entity can completePropertyFile by getting propertyDetails,propertTex,legalDocuments, regulationRequirements the will approve the outcome which means verificationConfirmed, clearanceApproved, validityConfirmed, complianceEnforced

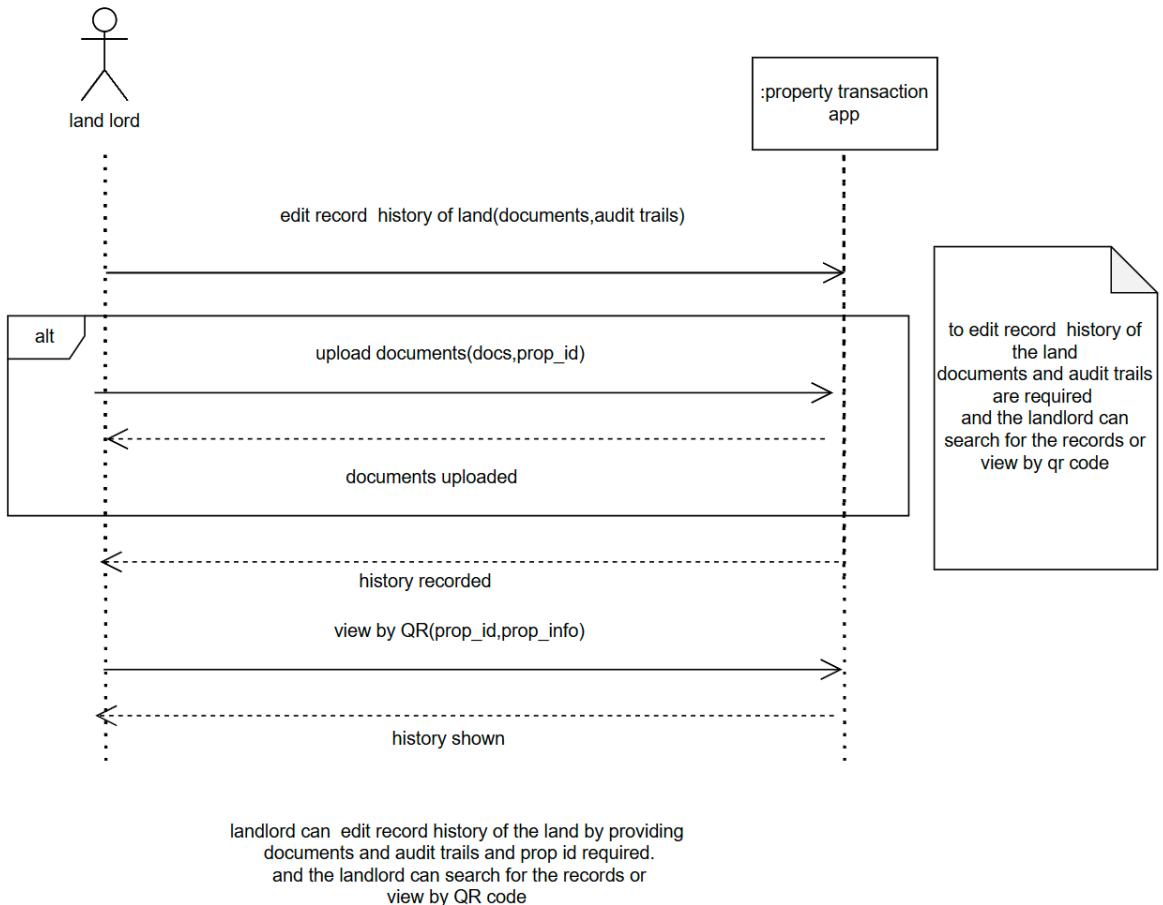
20) View record of land



customer can view the record of the any land in the app and the records could be Ownership History, Property Details,validityStatus, auditTrailDetails

2.2.2 Sequence Diagram's

21) Audit Trails



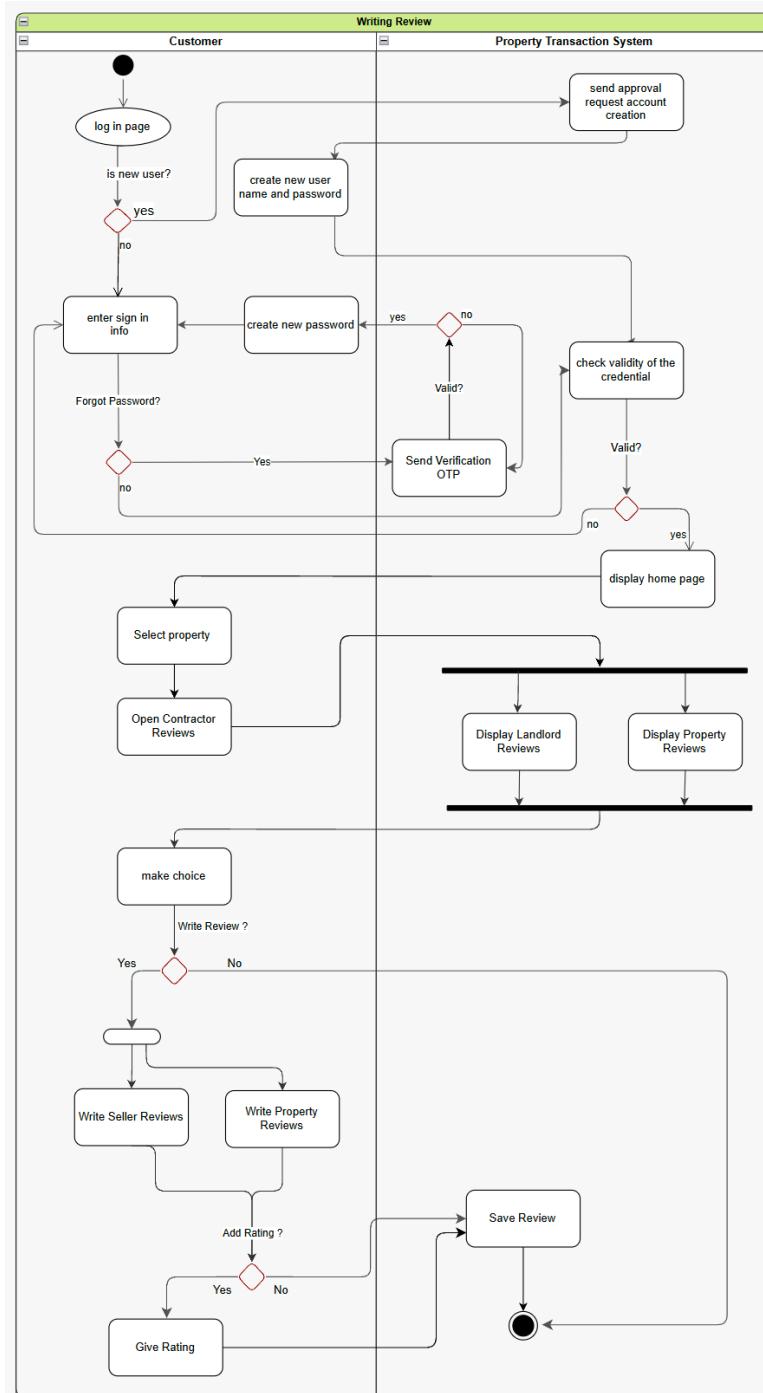
2.3 Use-Case Diagram

This is the Use-Case Model for our Property transaction app :

- Minimum Transaction Requirement: To list any property, the minimum transaction amount must be no less than 10,000 AED
- Listing Duration: Once a property is listed, it remains active for a maximum of 30 days unless manually extended by the landlord or removed by the system after the expiration period
- Transaction Confirmation: Payment via bank transfer will only be processed after both the buyer and seller confirm the successful completion of the transaction within the app.

2.4 Activity Diagrams

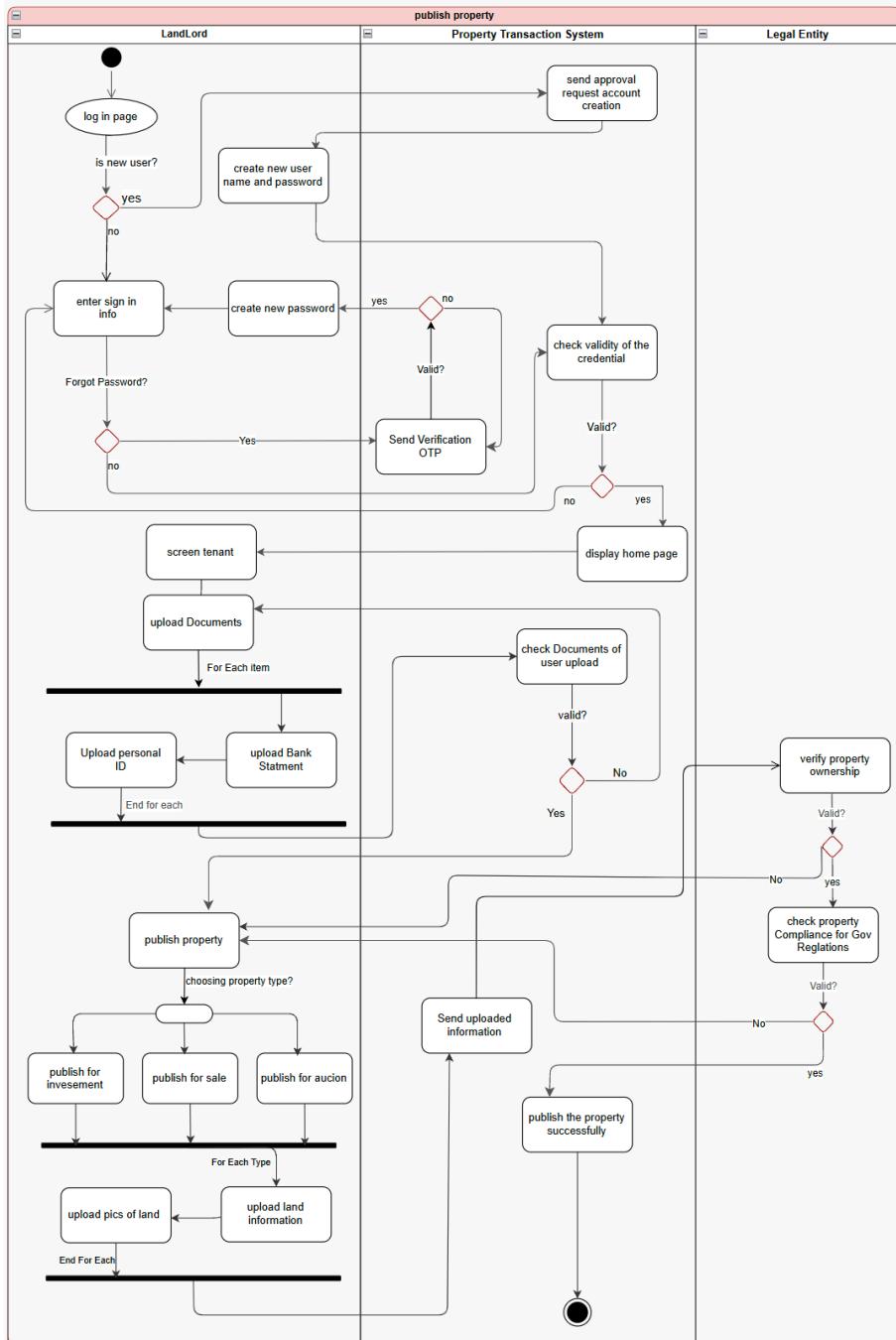
1) Writing Review



The activity diagram outlines the process for writing a review in the Property Transaction System. First, the customer logs in or creates an account if they are a new user. The system verifies their credentials and, once valid, displays the home page. The customer selects a property and can view contractor, landlord, or property reviews. If they choose to write a review, they decide whether to review the seller or the property, and optionally, add a rating. Finally, the review is saved, completing the process.

2.4 Activity Diagrams

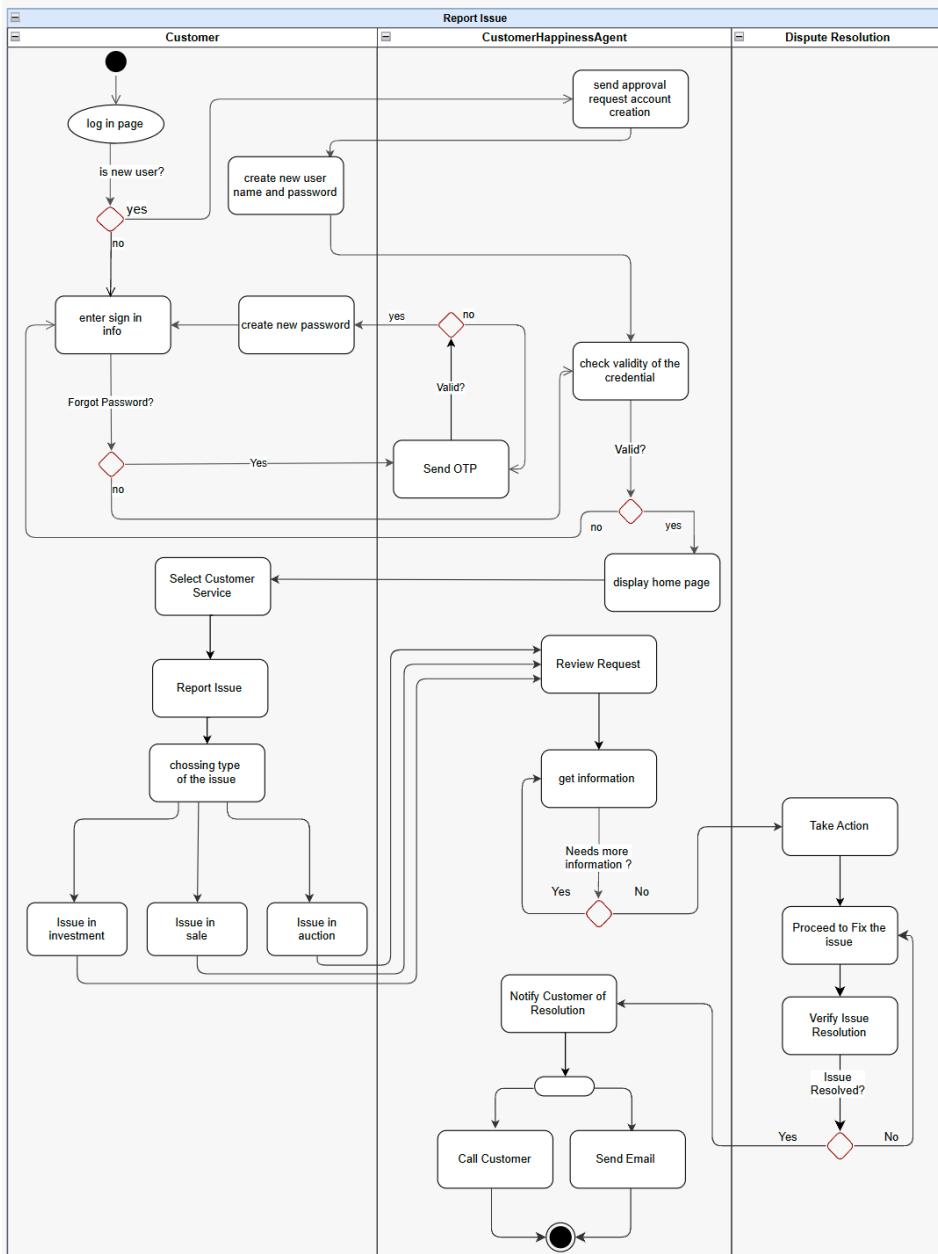
2) Publishing Property



The activity diagram describes the process for a landlord to publish a property in the Property Transaction System. The landlord begins by logging in or creating an account if they are a new user. After verifying credentials, the system displays the home page. The landlord then screens tenants and uploads required documents, such as a personal ID and bank statement. Once the documents are validated, the landlord selects the type of property listing: investment, sale, or auction. They upload land pictures and information based on the listing type. The system sends the information for verification, checking property ownership and compliance with government regulations. If everything is valid, the property is successfully published.

2.4 Activity Diagrams

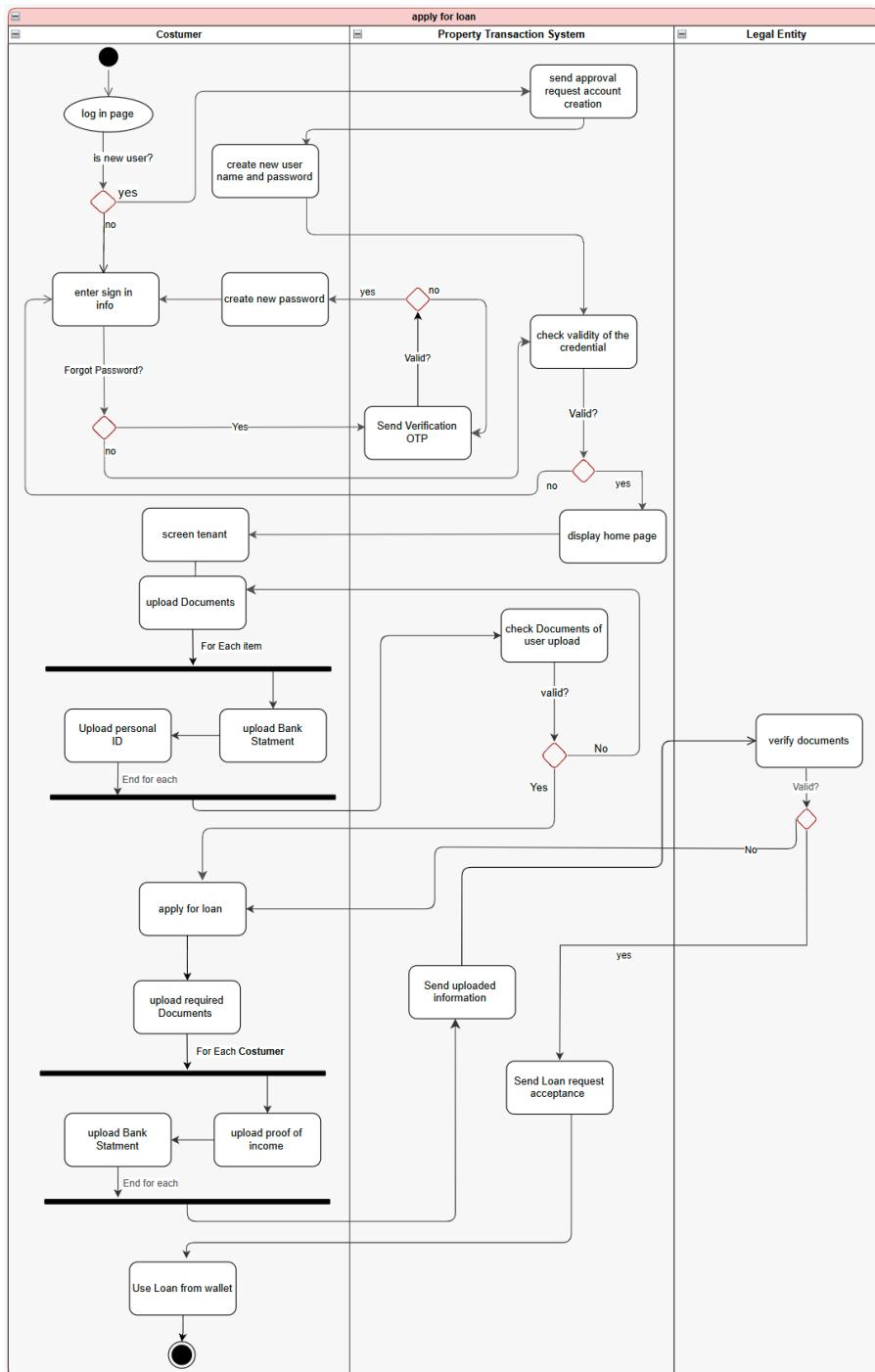
3) Report Issue



The customer starts by logging in or creating a new account if they are a first-time user. After logging in, they choose customer service and report their issue, selecting from options like investment, sale, or auction. The customer happiness agent reviews the request, gathers more information if needed, and works to resolve the issue. Once the problem is fixed, the agent verifies the resolution and notifies the customer through a call or email. The process ends after the customer is informed.

2.4 Activity Diagrams

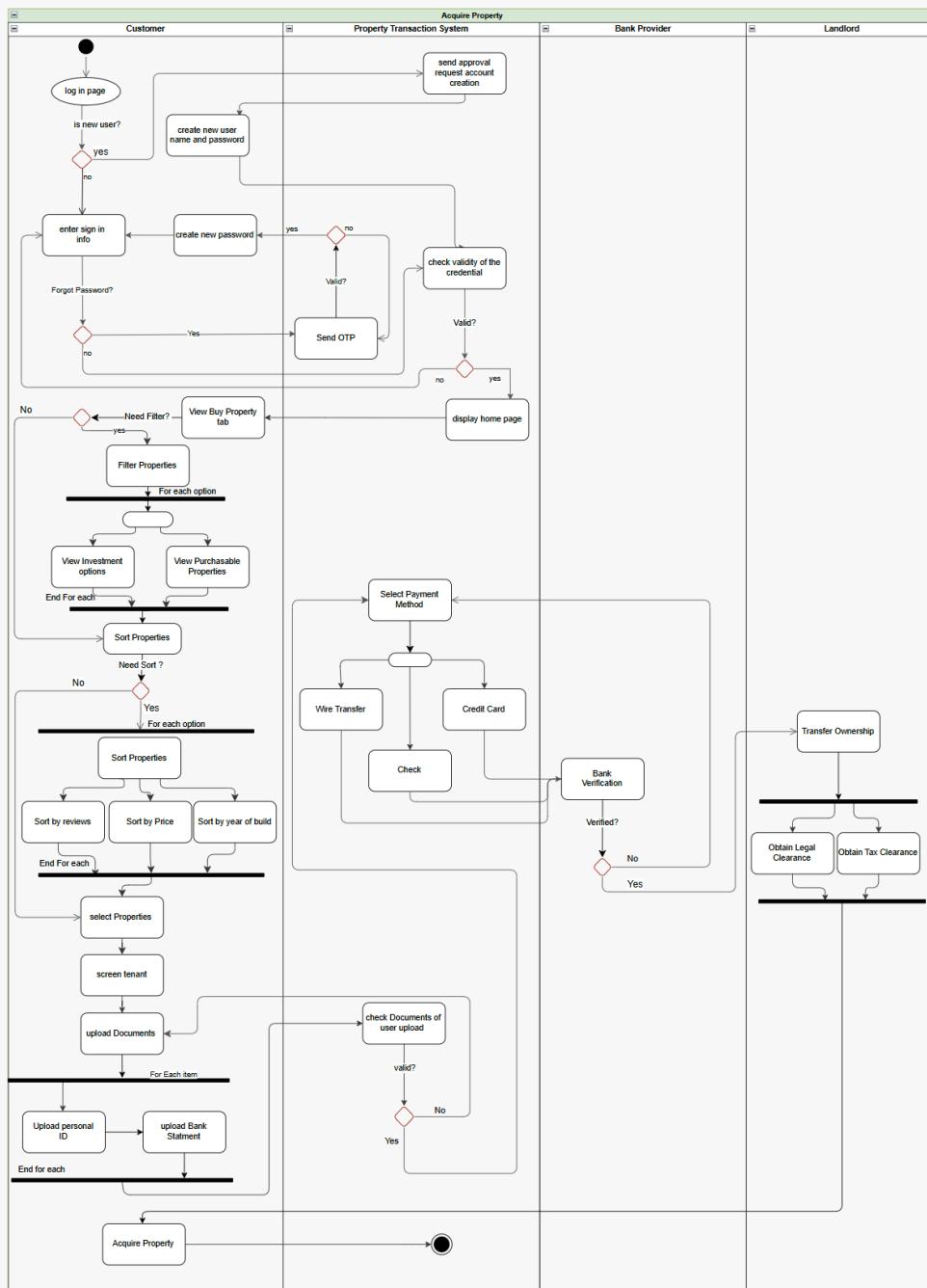
4) Apply for loan



The customer begins by logging in or creating a new account if they are a new user. If they forget their password, they can reset it using an OTP. After logging in, they upload the necessary documents, such as a personal ID and bank statement, which are reviewed for validity. Once verified, the customer can apply for the loan by submitting additional documents like proof of income and bank statements. The loan request is then processed, and if accepted, the loan is made available in the customer's wallet for use.

2.4 Activity Diagrams

5) Acquire Property



This diagram illustrates the process of acquiring a property, starting with the customer logging in or creating a new account. If the user is new, they create a username and password; if they forget their password, they can reset it. The system verifies credentials through an OTP (One-Time Password). Once logged in, the user can either filter or view properties for sale or investment. After sorting properties by reviews, price, or build year, the customer selects a property, screens the tenant, and uploads necessary documents (personal ID, bank statement). The property transaction system verifies the documents and processes the payment through various methods (wire transfer, credit card, or check). Once the bank verifies the payment, ownership is transferred after obtaining legal and tax clearances.

3.0 Data Model and Description

This section describes the information domain for the software.

3.1 Data objects

Class Name: Account

Major Attributes:

- AccountID
 - accountStatus
 - registrationDate
 - lastLoginDate
- Major Methods:
- viewAccount()
 - newAccount()

- Class Name: LegalAgent

Major Attributes:

- AgentID
 - Name
 - PhoneNumber
- Major Methods:
- verifyDocuments()
 - signContract()

Class Name: Customer

Major Attributes:

- Username
- FirstName
- LastName
- Email
- Password

Major Methods:

- Login()
- Register()
- Purchase()
- RequestLoan()

- Class Name: Tenant

Major Attributes:

- TenantID
 - Name
 - ContactDetails
- Major Methods:
- rentProperty()
 - submitDocuments()

Class Name: Checkout

Major Attributes:

- CheckoutID
- TransactionID
- TotalAmount
- PaymentType

Major Methods:

- generateReceipt()
- applyDiscount()

- Class Name: Payment

Major Attributes:

- PaymentID
- PaymentType
- PaymentDetails
- TotalPrice

Major Methods:

- makePayment()
- calculateTotalPrice()

- Class Name: PropertyOwnership

Major Attributes:

- OwnershipID
 - OwnerName
 - PropertyID
- Major Methods:
- transferOwnership()

Class Name: Billing

Major Attributes:

- BillingID
- TransactionID
- Amount
- Date

Major Methods:

- viewBillingDetails()
- makePayment()

3.1 Data objects

- Class Name: Loan

Major Attributes:

- LoanID
- LoanType
- LoanStatus

Major Methods:

- applyLoan()
- checkLoanStatus()

- Class Name: Admin

Major Attributes:

- AdminID
- Username
- Role

Major Methods:

- manageInventory()
- manageAccounts()

- Class Name: Property

Major Attributes:

- PropertyID
- PropertyType
- PropertyValue

Major Methods:

- listProperty()
- viewPropertyDetails()

- Class Name: Invoice

Major Attributes:

- InvoiceID
- PurchaseID
- TotalAmount

Major Methods:

- generateInvoice()
- viewInvoiceDetails()

- Class Name: LegalContract

Major Attributes:

- ContractID
- ContractType
- SignatureDate

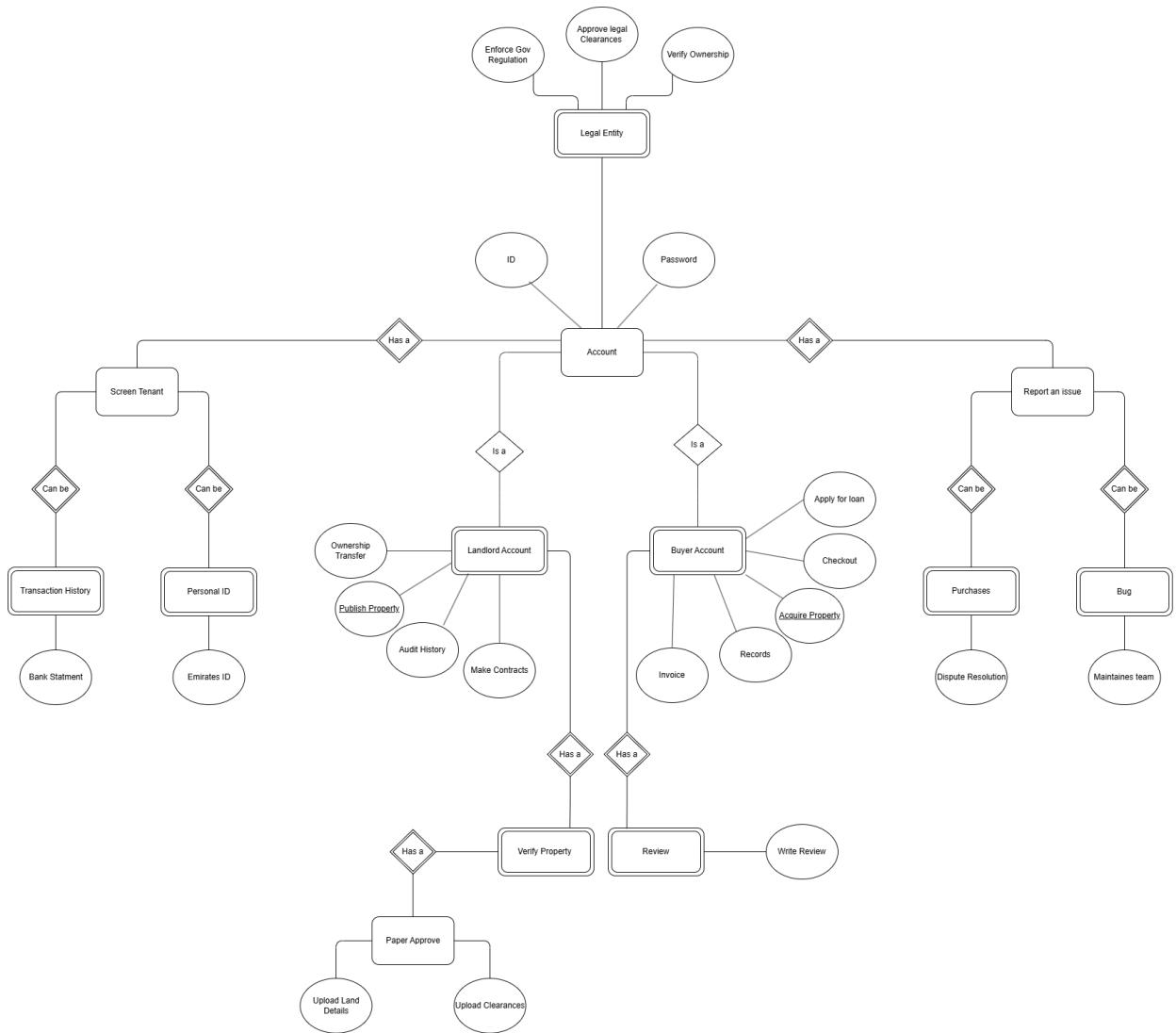
Major Methods:

- signContract()
- viewContractDetails()

3.2 Relationships

- **Customer** 'has a' **Account** (Association)
- **Account** 'is related to' **Loan** (Association)
- **Customer** 'can request' **Loan** (Association)
- **Property** 'is owned by' **Tenant** (Association)
- **LegalContract** 'is part of' **Property** (Aggregation)
- **Invoice** 'is related to' **Checkout** (Association)
- **Checkout** 'is linked to' **Billing** (Association)
- **Payment** 'is related to' **Checkout** (Association)
- **Admin** 'manages' **Customer** and **Tenant** (Aggregation)
- **LegalAgent** 'verifies' **Documents** and **sends Contracts** (Association)
- **Loan** 'is managed by' **Admin** (Inheritance)
- **PropertyOwnership** 'is transferred by' **LegalContract** (Composition)

3.3 Complete Data Model

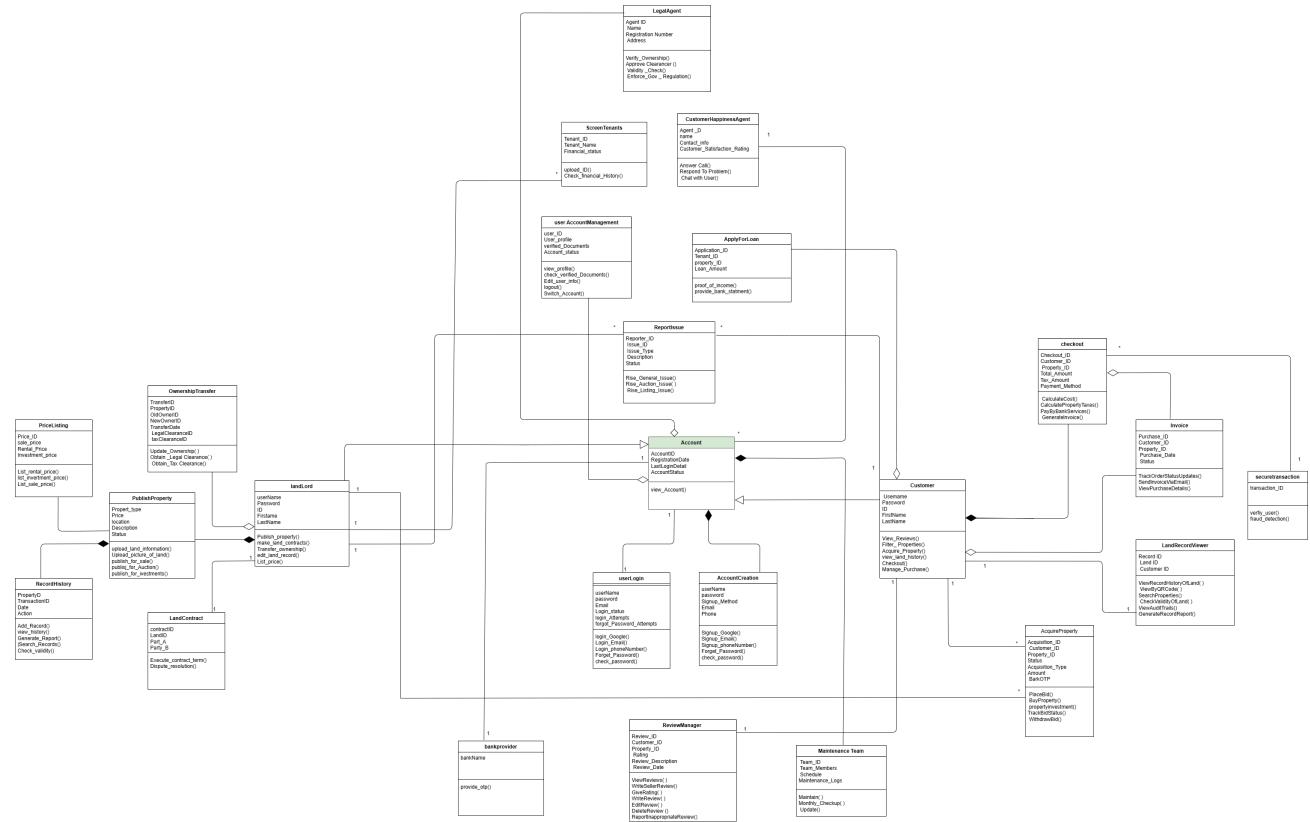


This diagram illustrates the structure and workflow of a property management system, detailing the roles of different account types and their interactions. It shows how Landlord Accounts and Buyer Accounts are connected to general Accounts, and the specific actions each account type can perform. Landlords manage properties by publishing listings, verifying ownership, and screening tenants, while buyers focus on purchasing properties, applying for loans, and leaving reviews. The system also highlights the role of legal entities in overseeing compliance, verifying ownership, and ensuring legal clearances are in place. Additionally, it includes processes for handling issues related to purchases or system bugs, making it a comprehensive view of property-related transactions and user interactions within the system.

4.0 Functional Model and Description

This section describes the static structure of the software

4.1 Class Diagram



4.2 Software Interface Description

The software interfaces to the outside world are described

4.2.1 External machine interfaces

- #### **• Printer for Document Printing:**

The system should interface with external printers to allow users to print reports, contracts, loan details, and receipts.

- Smart Devices:

The application will support integration with smart devices such as mobile phones, tablets, and other connected devices to facilitate notifications, updates, and real-time management of transactions and user activities.

4.2.2 External system interfaces

1. Data Analytics and Reporting:

Implement data analytics tools to provide insights on property transactions, loan applications, user behavior, and transaction history. This data will help optimize loan approvals, risk management, and customer satisfaction by enabling informed decision-making.

2. User Authentication and Authorization:

Integrate secure user authentication methods, such as two-factor authentication (2FA) and biometrics, to safeguard user credentials and sensitive transaction data during login and account management processes.

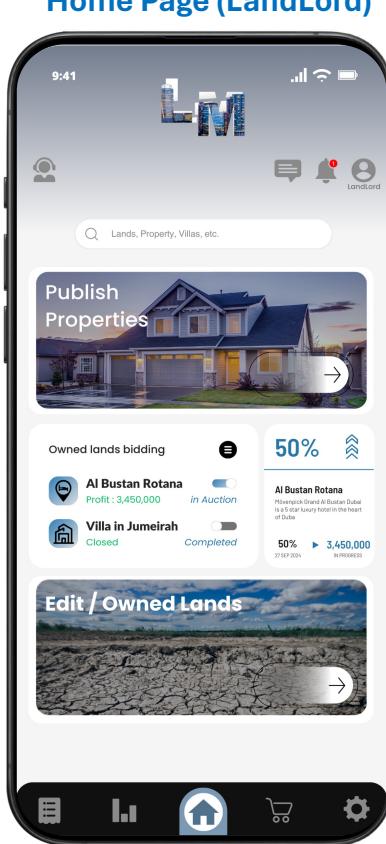
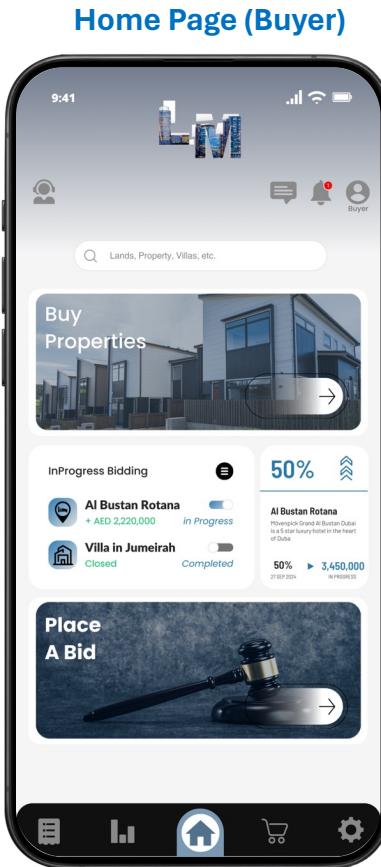
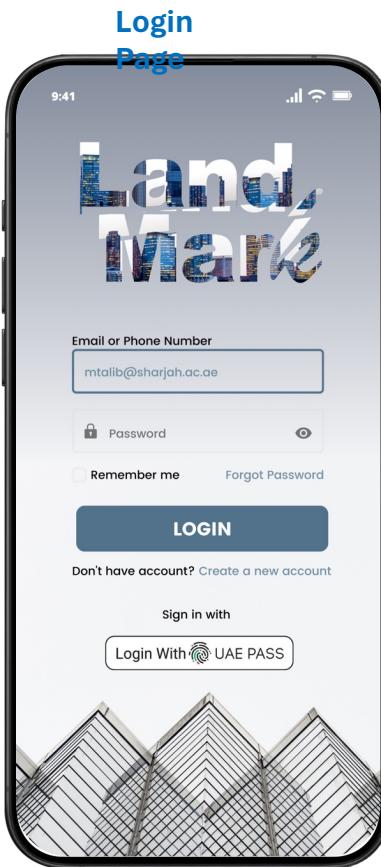
3. Feedback and Rating Systems:

Provide feedback and rating mechanisms for users to rate their loan experiences, customer service, and property-related transactions. These insights will help enhance service quality and improve the overall user experience.

4. Payment Gateways:

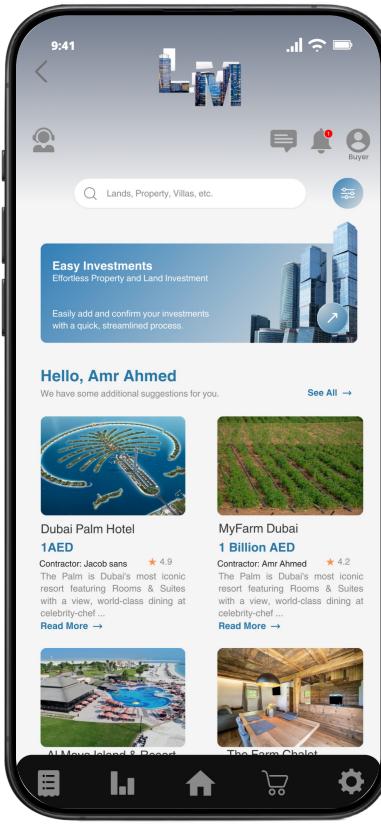
Implement payment gateway integration to handle various financial transactions, including loan payments, property-related fees, and transaction charges. This will allow for secure and seamless processing of payments via credit/debit cards, bank transfers, and digital wallets.

4.2.3 Human interface

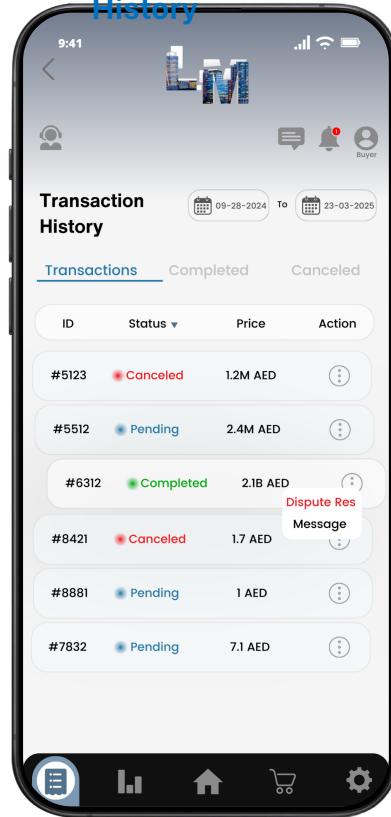


4.2.3 Human interface

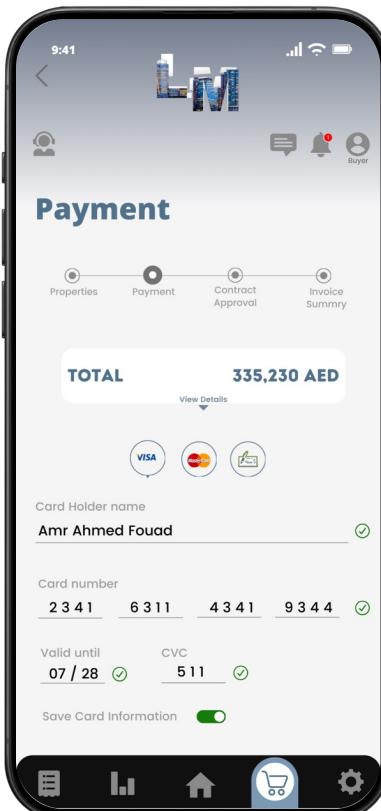
Buying property tab



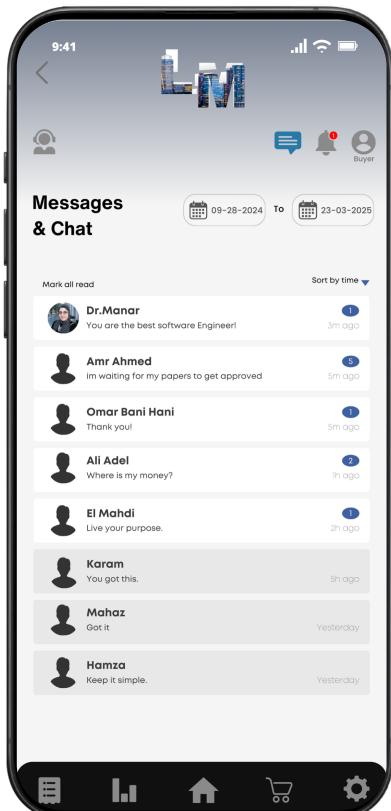
Transaction History



Checkout



Messages & Chat



5.0 Behavioral Model and Description

This section will discuss the behavior of the software.

5.1 Events

Events for Transfer ownership

- User opens the homepage to begin the transfer process.
- User selects the property for which ownership is to be transferred.
- System checks for legal clearance.
- Transition: If clearance is granted, move to the next step. If not, process halts.
- System checks for outstanding taxes on the property.
- Transition: If taxes are cleared, proceed. If not, process halts.
- System reviews compliance for legal and tax regulations.
- Transition: If compliant, proceed. If invalid, return for corrections.
- User enters the new owner's details.
- System verifies the new owner's information and compliance data.
- Transition: If valid, move forward. If invalid, return for corrections.
- The system updates ownership records with the new owner's information.
- System displays a confirmation message stating that ownership transfer was successful.
- The transfer request is completed and the process officially ends.

Events for Review system

- User opens the homepage.
- User clicks on 'view reviews.'
- User clicks on 'write review.'
- User finishes writing the review and adds a rating.
- User clicks on 'edit review.'
- User clicks on 'delete review.'
- User clicks on 'report review.'
- The system processes and completes the user's request (edit, delete, or report).
- The system processes and completes the user's request (edit, delete, or report).
- The system returns the user to the homepage after executing their request or submitting a review and rating.
- User clicks on 'exit app.'

5.0 Behavioral Model and Description

This section will discuss the behavior of the software.

Events for User account management

- The user logs into the system.
- The user opens the account management section.
- Three options are available: The user can display profile information, edit documents, or switch accounts.
- If displaying profile information: The user views their profile and can choose to edit their user information.
- If editing documents: The user checks verified documents and edits them. If editing is successful, the process completes, and the user returns to the account management section. If unsuccessful, the user is prompted to try again.
- If updating information: The user edits their profile information. If the update is successful, the process completes. If unsuccessful, they are prompted to re-edit.
- If switching accounts: The user switches to another account.
- The user logs out of the system when finished.

Events for Acquisition

- The user opens the application by clicking the app icon.
- Two options are presented: If the user has an account, they proceed to logging in. If the user does not have an account, they choose the sign-up option and proceed to create an account.
- The user enters their email and password: If the credentials are correct, the homepage opens. If the credentials are incorrect, they are prompted to re-enter them.
- If the user forgets their password, they select the 'forgot password' option: A code is sent to the user for verification.
- The user enters the verification code: If the code is valid, they are prompted to enter a new password. If the code is invalid, they are asked to re-enter the code, with a limit of 3 attempts.
- The user enters a new password: If the password is valid and matches, the password is changed, and the process returns to logging in. If the password does not match or is invalid, the user is prompted to re-enter the new password.
- Successful login takes the user to the homepage.

5.0 Behavioral Model and Description

This section will discuss the behavior of the software.

Events for Report issue

- User logs in.
- User selects issue type.
- User explains the issue.
- User selects a property.
- User submits issue explanation.
- System reviews issue.
- Issue approved.
- Issue rejected.
- System resolves the issue.
- User/system returns to homepage.

Events for Legal Agent Process

- User enters agent details.
- User selects property.
- System displays property information.
- System verifies ownership.
- System exhibits legal status.
- Clearance approved.
- Clearance missing.
- Legal status updated.
- Owner notified.
- System receives feedback from owner.
- Government agent notified.
- System checks validity.
- Government regulation enforced.
- User returns to homepage.

Events for Loan Application Process

- User logs in or opens the loan page.
- User applies for a loan.
- User provides loan amount.
- User fills in application details.
- User submits proof of income.
- User submits bank statement.
- System reviews loan request.
- Loan request approved.
- Loan request rejected.
- Loan request executed.
- User returns to homepage.

5.0 Behavioral Model and Description

This section will discuss the behavior of the software.

Events for User log in

- The user opens the application by clicking the app icon.
- Two options are presented: If the user has an account, they proceed to logging in. If the user does not have an account, they choose the sign-up option and proceed to create an account.
- The user enters their email and password: If the credentials are correct, the homepage opens. If the credentials are incorrect, they are prompted to re-enter them.
- If the user forgets their password, they select the 'forgot password' option: A code is sent to the user for verification.
- The user enters the verification code: If the code is valid, they are prompted to enter a new password. If the code is invalid, they are asked to re-enter the code, with a limit of 3 attempts.
- The user enters a new password: If the password is valid and matches, the password is changed, and the process returns to logging in. If the password does not match or is invalid, the user is prompted to re-enter the new password.
- Successful login takes the user to the homepage.

Events for Checkout

- User opens the checkout page and enters customer details.
- Customer details are submitted for validation.
- If details are incorrect, prompt user to re-enter.
- If details are correct, proceed to calculate the total cost.
- Display the total cost.
- If applicable, calculate property tax.
- If no tax applies, show the cost without tax.
- User selects a payment method.
- User confirms the payment method to proceed.
- System validates the payment method.
- If payment is rejected, return to the payment method selection.
- If payment is accepted, send OTP to the user.
- System checks OTP for verification.
- If OTP is incorrect, display an error message.
- If OTP is correct, finalize the payment.
- After successful payment, generate an invoice.
- Send the generated invoice to the user.

5.0 Behavioral Model and Description

This section will discuss the behavior of the software.

Events for Publish property

- User provides valid login credentials.
- Successful login redirects user to the homepage.
- User clicks on 'Publish Property' option.
- User selects the type of property publishing (e.g., for sale, for investment).
- User uploads required information about the land (e.g., location, size, ownership).
- System validates the uploaded property details.
- System detects missing or incorrect information.
- User uploads a picture of the land/property for publication.
- User selects to publish the property for investment purposes.
- System displays expected returns or profits for potential investors.
- User selects to publish the property for sale.
- System shows a list of published properties for potential buyers.
- User opts to publish the property for auction instead of direct sale or investment.
- System starts collecting bids from interested buyers for auctioned property.
- System confirms that the property has been successfully published.
- User finishes the publishing process and clicks to return to the homepage.
- User returns to the properties list from the auction or sale page.

Events for land contracts

- User provides valid login credentials.
- Successful login redirects user to the homepage.
- User selects contract terms from the available options.
- User initiates the process of making a land contract.
- Contract terms are executed.
- Contract enters the verification stage to check if it is valid.
- If the contract is valid, it proceeds to the contract completion stage.
- If the contract is invalid, the system prompts the user to edit the contract terms.
- User modifies and completes the contract terms as required.
- System re-verifies the contract after modifications.
- Upon valid verification, the contract is completed.
- If a dispute arises during the contract process, the user enters the dispute resolution phase.

5.0 Behavioral Model and Description

This section will discuss the behavior of the software.

Events for customer

- User accesses the homepage.
- User performs a login to authenticate.
- User filters properties based on criteria.
- System displays filtered properties.
- User selects a property to acquire, initiating a request.
- System checks the request: if rejected, return to displaying filtered properties; if accepted, proceed to checkout.
- User is directed to the checkout page.
- User opens the cart page.
- User adds or removes properties from the cart.
- System processes the request: if incomplete, remain in the current step; if completed, proceed to checkout.
- User selects to view the land history of a property.
- System opens the land history page.
- System displays the property's land history.
- User returns to the homepage after viewing land history.
- User chooses to view reviews for properties.
- System displays reviews from other users.
- User writes a review.
- User submits the review.
- User returns to the homepage after submitting the review.

Events for maintenance

- Maintenance team enters the system.
- System transitions into maintenance mode.
- Monthly checkup triggers the inspection of the app.
- If bugs are detected during inspection, the system moves to fixing bugs.
- If no bugs are detected during inspection, the system proceeds to updating the app.
- Upon completing the updates, the system checks for further updates.
- If updates require testing, the app moves to testing mode.
- If bugs are detected during testing, the system returns to fixing bugs.
- If no bugs are detected during testing, the system exits maintenance mode.

5.0 Behavioral Model and Description

This section will discuss the behavior of the software.

Events for customer service

- A phone rings, triggering the system to **receive a call**.
- The call is **answered**, and the system transitions to **responding to the customer**.
- The customer and the service agent engage in a conversation to **talk about the issue**.
- Based on the issue, the agent **discusses the solution** with the customer.
- If a **solution is found**, the system returns to its initial state.
- If a **solution is not found**, the system escalates the issue by **sending it to a technician** for further assistance.

View land record

User logs in.

- User views record history.
- User searches properties.
- User chooses a property.
- System generates a record report.
- System checks land validity.
- System displays a record report.
- User returns to the homepage.
- User views land activities and audit trails.
- User views land record by QR code.
- User scans the QR code.
- System checks the QR code.
- User resubmits incorrect QR code.
- User returns to available properties.
- User returns to the history page.

5.1.2 States

States for publish property	Description
Opening Homepage:	The system opens the homepage, displaying the user interface after login.
Publishing Property:	The user begins the process of publishing a property, leading to further actions.
Verification of Information:	The system verifies the submitted property information. If invalid, the user may need to correct it.
Displaying Investment Returns	The system displays the expected investment returns to the user for the property.
Viewing Properties List	The user is shown a list of available properties that are published for sale.
Receiving Bids	The system receives bids from interested parties for the property listed in an auction.
Displaying Confirmation Message	The system shows a confirmation message to inform the user that the publishing process is successful.
Returning to Home Page	The user returns to the homepage after completing the property publishing task.

States for land contract	Description
Opening Homepage	The user begins the process by opening the homepage to access the land contracts system.
Making Land Contract	The user selects and sets the terms to create a land contract.
Completing Resolution	If there is a dispute, the process moves to resolving it. Once resolved, the agreement is approved.
Verifying Contract	The contract is verified to check whether the terms are valid or need modification.
Editing Contract Terms	If the contract is invalid, the user edits the contract terms, and then it goes for re-verification.
Completing Contract	If the contract is valid after verification, the contract is finalized and completed.

5.1.2 States

States for maintenance	Description
Entering Maintenance Mode	The application enters maintenance mode for regular upkeep and monitoring.
Inspecting the App	The app is checked monthly to ensure it is functioning correctly and to identify any bugs.
Fixing Bugs	Bugs detected during inspection or testing are addressed and resolved.
Testing the App	The app is tested to ensure no bugs are present after bug fixes or updates.
Updating the App	Updates are applied to add new features without fixing bugs (if no bugs are detected).

State for transferring ownership	Description
Opening Homepage	The process begins when the user opens the homepage of the system to initiate ownership transfer.
Reviewing Compliance	The system reviews the entire case to ensure that all legal and tax regulations have been followed.
Transferring ownership	The central process of changing ownership from one party to another, involving multiple steps.
Verifying Ownership	The system verifies the new owner's details and compliance data for accuracy.
Updating Ownership	The system updates the ownership record to reflect the new owner after successful verification.
Displaying Confirmation Message	A confirmation message is shown, indicating that the ownership has been successfully transferred.
Completing Request	The ownership transfer request is officially completed, and the process ends.

5.1.2 States

States for customer service	Description
Receiving a Call	The system detects an incoming call, preparing to answer.
Responding to Customer	The agent engages with the customer, listening to the issue.
Talking About the Issue	The agent discusses the customer's problem and gathers information.
Discussing the Solution	If a solution is found, the agent explains it to the customer.
Sending to Technician	If no solution is found, the issue is escalated to a technician for further help.

States for review system	Description
Opening Homepage	The initial state where the user opens the homepage of the review system. From here, they can either view reviews or write a new review.
Opening Reviews	The user navigates to the reviews section. Here, they can view existing reviews with options to edit, delete, or report them.
Editing Review Description	The user decides to write a new review and is prompted to provide a review description.
Adding Rating	After writing the review description, the user adds a rating. Once done, the user is returned to the homepage.
Editing Reviews	The user opts to edit an existing review. The system allows modifying the review content. Once editing is complete, the process is executed.
Deleting Review	The user chooses to delete a review. The review is marked for deletion, and after confirmation, the action moves to execution.
Reporting Review	The user can report a review if it is inappropriate or offensive. After reporting, the action moves to execution.
Executing the Request	This state handles all requests like editing, deleting, or reporting a review. Once processed, the user is returned to the homepage.
Returning to Homepage	After executing a request or completing a review, the user is returned to the homepage to either perform another action or exit the system.

5.1.2 States

States for checkout	Description
Opening Checkout Page	The process starts when the user opens the checkout page and enters their customer details.
Checking Details	The system verifies the validity of the entered customer details.
Proceeding to Confirmation	After valid details are entered, the system calculates the total cost for the order.
Showing Total Cost	The total cost is displayed to the user after calculation.
Showing Cost Without Tax	If no property tax applies, the system shows the cost without tax.
Choosing Payment Method	The user selects their preferred payment method to proceed.
Checking Payment	The system verifies if the payment method is valid.
Sending OTP	An OTP is sent to the user for an additional layer of payment verification.
Displaying Error Message	An error message is shown if any input or process step is invalid (e.g., OTP or payment rejection).
Finalizing Payment	Once the OTP is verified, the payment is finalized.
Sending Invoice	The system sends the generated invoice to the customer, completing the transaction process.

5.1.2 States

States view land record	Description
Logging In	The user logs into the system to access land records.
Scanning QR Code	The user scans a QR code to view specific land information.
Checking QR Code	The system checks the QR code to verify if it is correct.
Opening Property History Page	The system opens the history page of the selected land after login or QR scan.
Displaying Available Properties	The system shows a list of available properties to the user.
Choosing Completed	The user completes the selection of a property.
Displaying Land Activities	The system displays all activities related to the land (e.g., ownership, transactions).
Checking Completed	The system confirms the completion of checks on selected land or property.
Checking Validity	The system verifies the validity of the selected property/land records.
Displaying Record Report	The system generates and displays a report for the selected property/land.
Displaying Invalidity Message	If the land record is invalid, an error or invalidity message is shown.

States for customer	Description
Opening Homepage	The customer logs into the application and lands on the homepage.
Displaying Filtered Properties	The app displays properties based on the filters applied by the customer.
Checking Request	The system checks the property acquisition request made by the customer.
Opening Cart Page	The customer manages their purchase by adding or removing properties in the cart.
Completing Request	The app processes the customer's request, determining if it's complete or not.
Going to Checkout Page	The customer is directed to the checkout page after completing the request.
Opening Land History Page	The customer views the history of a specific property.
Displaying Land History	The system shows the detailed history of the selected property.
Displaying Reviews	The app shows reviews left by other customers on specific properties.
Submitting Review	The customer submits their review after writing it.
Returning to Homepage	The customer navigates back to the homepage after viewing history or submitting a review

5.1.2 States

States for user login	Description
opening application	The application is being opened by the user.
creating account	User does not have an account and is directed to sign-up.
entering email and password	User is prompted to enter email and password to login.
logging in	User chooses the login option and enters the credentials.
opening homepage	If credentials are correct, user is directed to the homepage.
sending code	User forgets the password and requests a verification code.
typing code	User enters the verification code sent for password recovery.
entering new password	User enters a new password after a successful code entry.

States acquisition	description
checking the request	Review the acquisition request.
Acquiring a property	Start the process of acquiring a property.
entering bidding amount	Enter the amount for placing a bid on the property.
checking bid	Check the current status of the bid (whether higher or lower).
going to checkout	Proceed to checkout after a successful bid.
entering investment amount	Enter the initial investment amount for the acquisition.
reviewing the investment	Review the investment placed and check its status.
returning to homepage	Return to the homepage after completing or rejecting the process.

States acquisition	description
checking the request	Review the acquisition request.
Acquiring a property	Start the process of acquiring a property.
entering bidding amount	Enter the amount for placing a bid on the property.
checking bid	Check the current status of the bid (whether higher or lower).
going to checkout	Proceed to checkout after a successful bid.
entering investment amount	Enter the initial investment amount for the acquisition.
reviewing the investment	Review the investment placed and check its status.
returning to homepage	Return to the homepage after completing or rejecting the process.

5.1.2 States

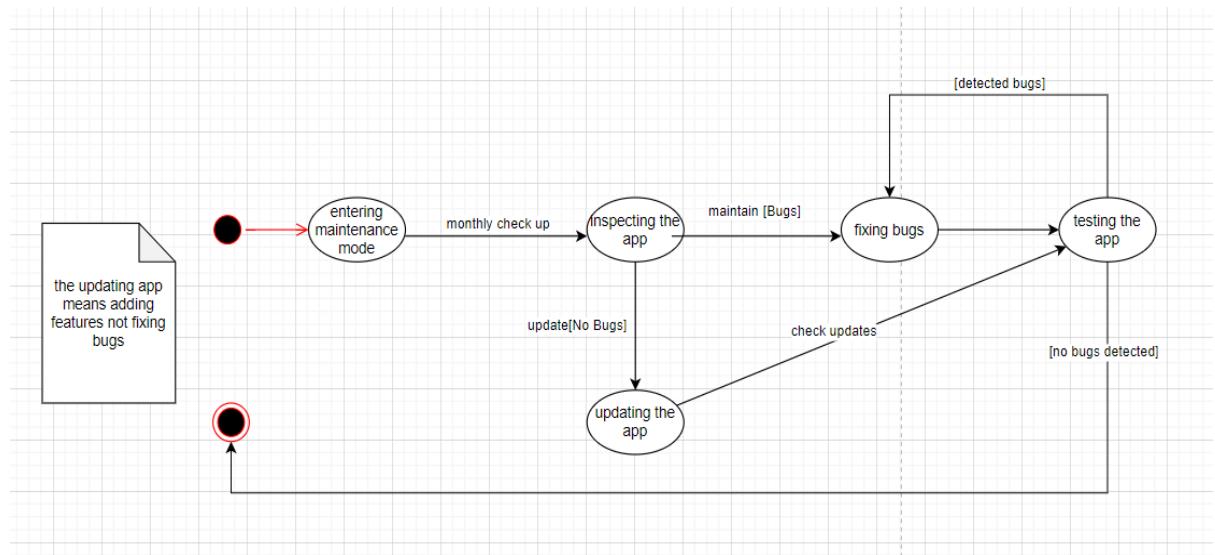
States acquisition	description
checking the request	Review the acquisition request.
Acquiring a property	Start the process of acquiring a property.
entering bidding amount	Enter the amount for placing a bid on the property.
checking bid	Check the current status of the bid (whether higher or lower).
going to checkout	Proceed to checkout after a successful bid.
entering investment amount	Enter the initial investment amount for the acquisition.
reviewing the investment	Review the investment placed and check its status.
returning to homepage	Return to the homepage after completing or rejecting the process.

States for applying for loan	Description
Applying for loan	The user initiates a loan application by providing the requested loan amount.
Filling Application Details	The user fills in the required application details, such as personal information.
Submitting Income Proof	The user provides proof of income to support the loan application.
Submitting Bank Statement	The user submits their bank statement as part of the loan validation process.
Validating the loan request	The system reviews and validates the loan request based on submitted details. The loan can be accepted or rejected at this stage.
Executing request	If the loan is accepted, the system processes and executes the loan request.
Returning to homepage	The system redirects the user to the homepage after completing the loan application process.

5.1.2 States

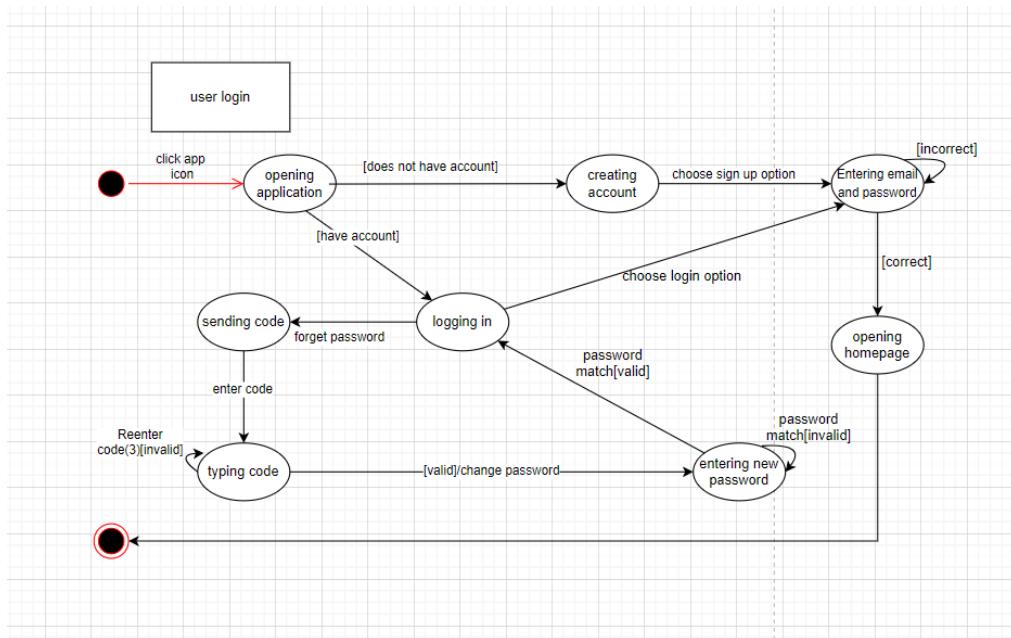
States for report issue	Description
Logging to homepage	The user logs into the homepage of the system.
Selecting issue type	The user selects the type of issue they want to report (general issue, auction issue, listing issue).
Explaining the issue	The user provides a detailed explanation of the issue based on the selected issue type.
Selecting the property	The user selects the property related to the issue and submits an explanation.
Reviewing the issue	The system reviews the submitted issue to determine if it is valid. It can either be approved or rejected at this stage.
Resolving the issue	If the issue is approved, the system resolves it by addressing the problem.
Returning to homepage	After the issue is either resolved or rejected, the system returns the user to the homepage.

5.2 Statechart Diagram



Maintenance team

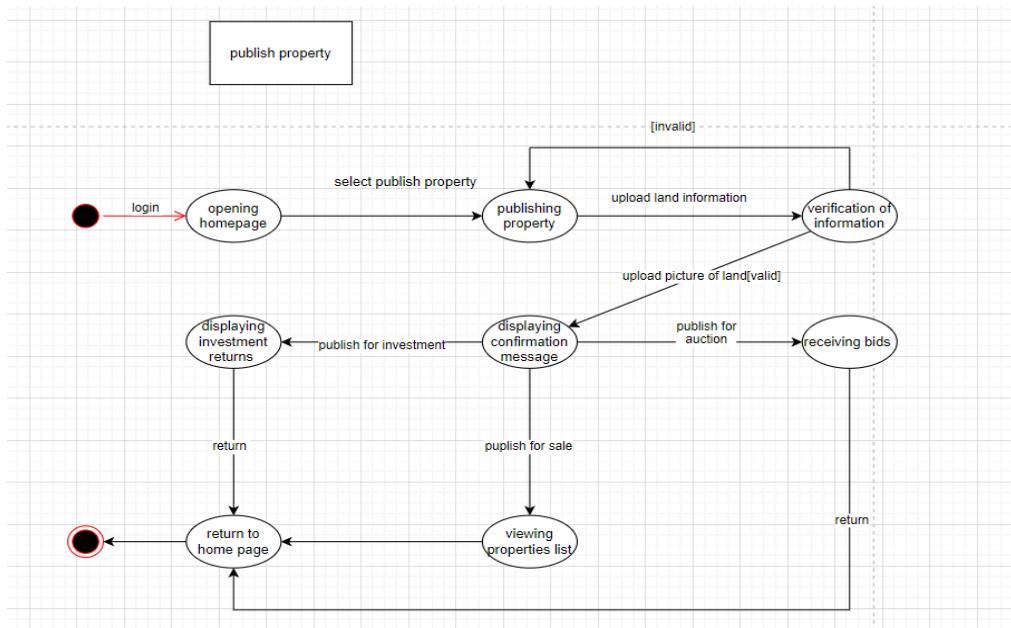
After the maintenance team enter the maintenance region, they will inspect the app looking for bugs, if bugs founded, they will get rid of it and test the system but if no bugs where detected they will just update and then test the system



User login

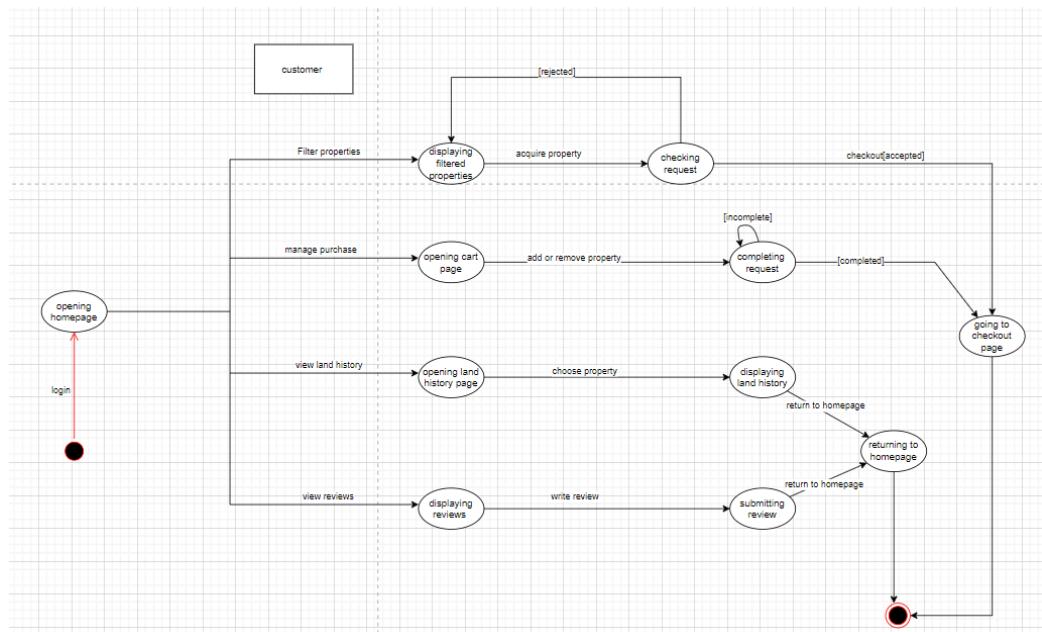
After the user open the application he will asked to create an account if he doesn't have one or he can log in if he do have one , in both cases he will enter his email and password and if they are correct he will enter the homepage .if the user choose to log in and click on forget password a verification code will be sent to his email if the entered code is correct he can change his password otherwise the code will be sent again

5.2 Statechart Diagram



Publish property

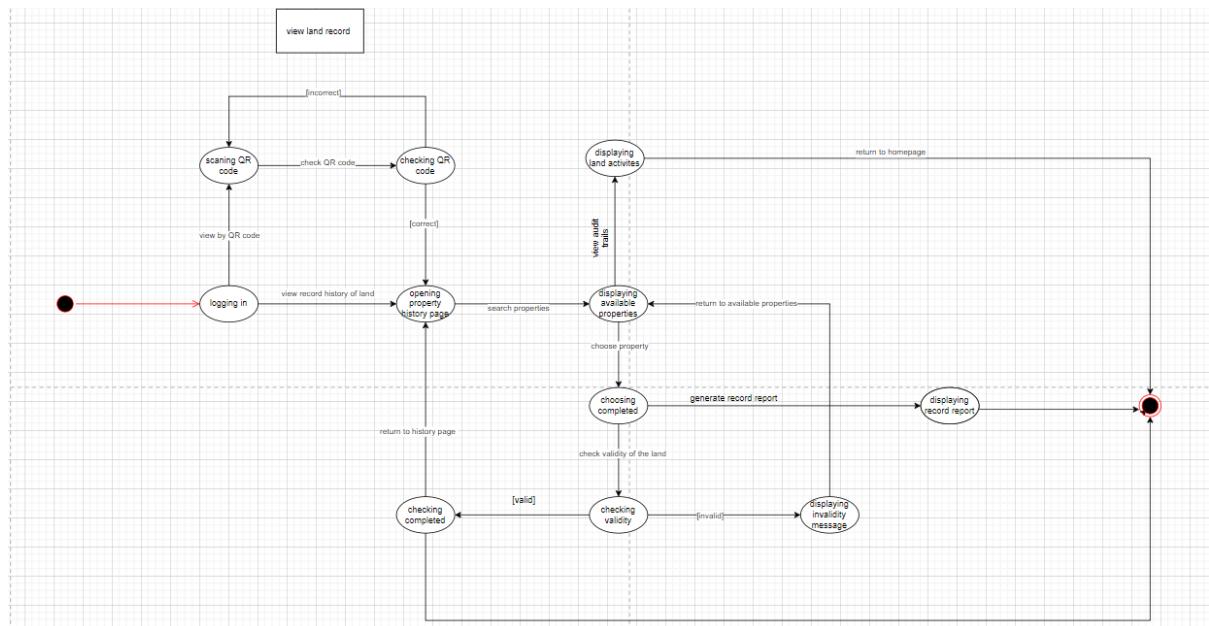
The state chart models the property publishing process in an application. The user logs in, uploads property details, and chooses to publish it for investment, sale, or auction, with verification and image upload steps. After completion, the system either displays a confirmation message or allows the user to return to the homepage or property listings.



Customer

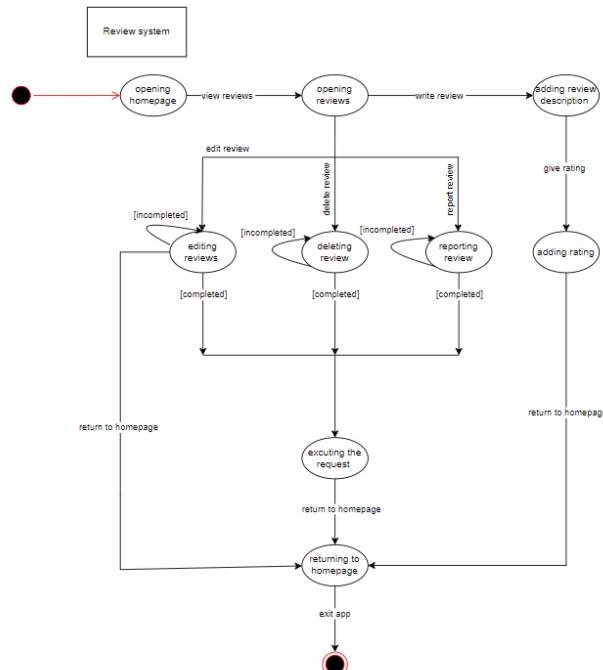
The state chart outlines a customer's journey through an app where they can filter, acquire, and purchase properties. After filtering, users can check requests for approval or manage properties in the cart before finalizing purchases. They can also view land history, write or view reviews, and return to the homepage. The process ends with checkout or returning to the main menu after completing actions.

5.2 Statechart Diagram



View land record

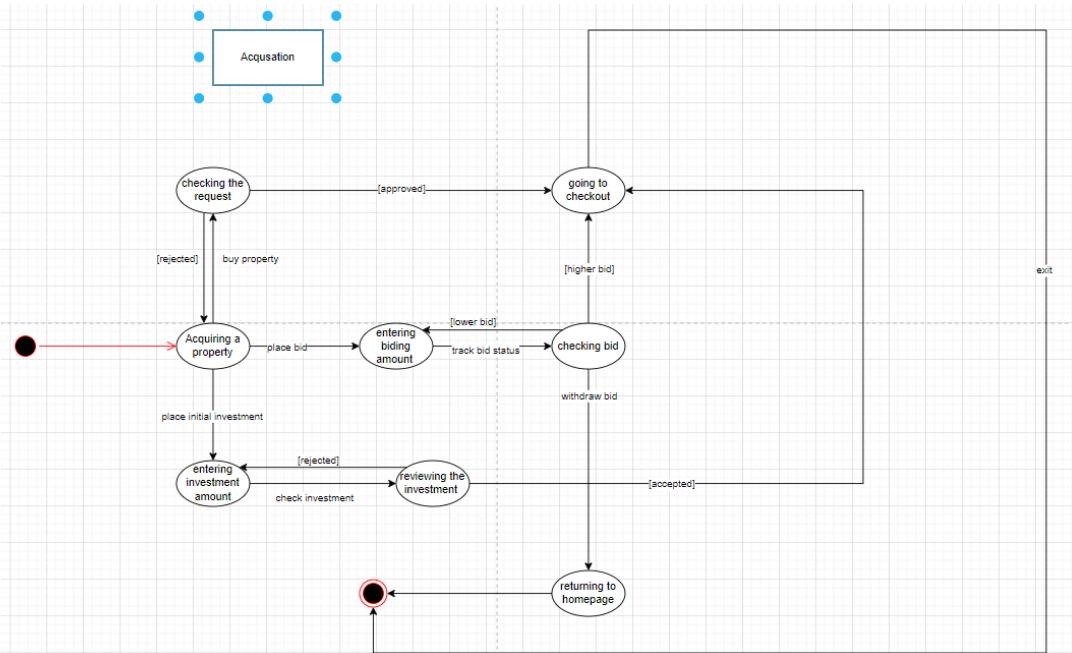
The state chart begins with a user logging in, scanning a QR code, or viewing available properties. The system checks the land's validity, generates a report, and displays either the land's records or an invalidity message if issues arise. The user can also view land activities and return to the homepage once actions are completed. The process ends after displaying the relevant information or completing the checks.



Review system

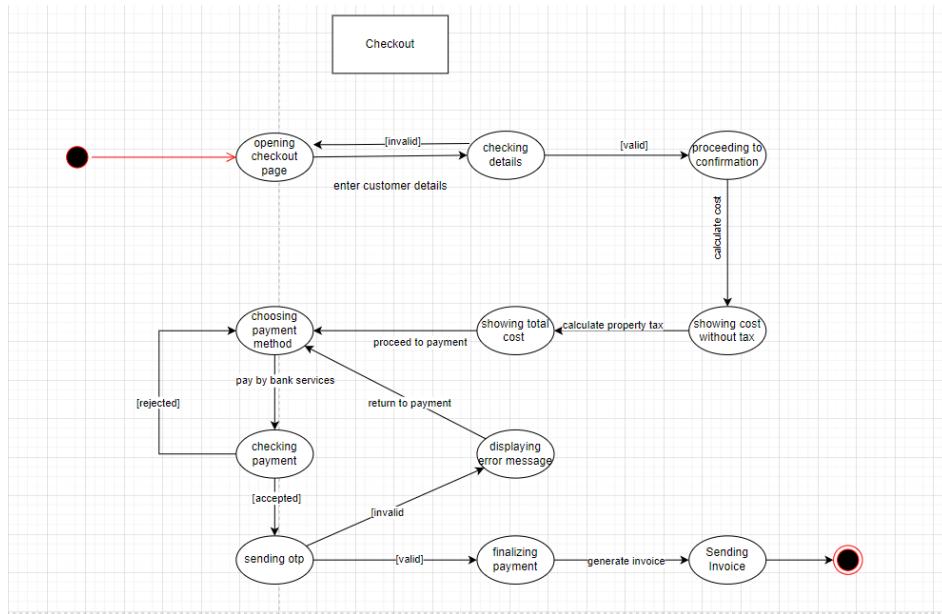
The state chart illustrates a review system where users can view, write, edit, delete, or report reviews. From the review page, they can either view existing reviews or create new ones by writing a description and adding a rating. Actions like editing, deleting, or reporting are processed and then return the user to the homepage. Finally, the user can either continue interacting with the system or exit the app.

5.2 Statechart Diagram



acquisition

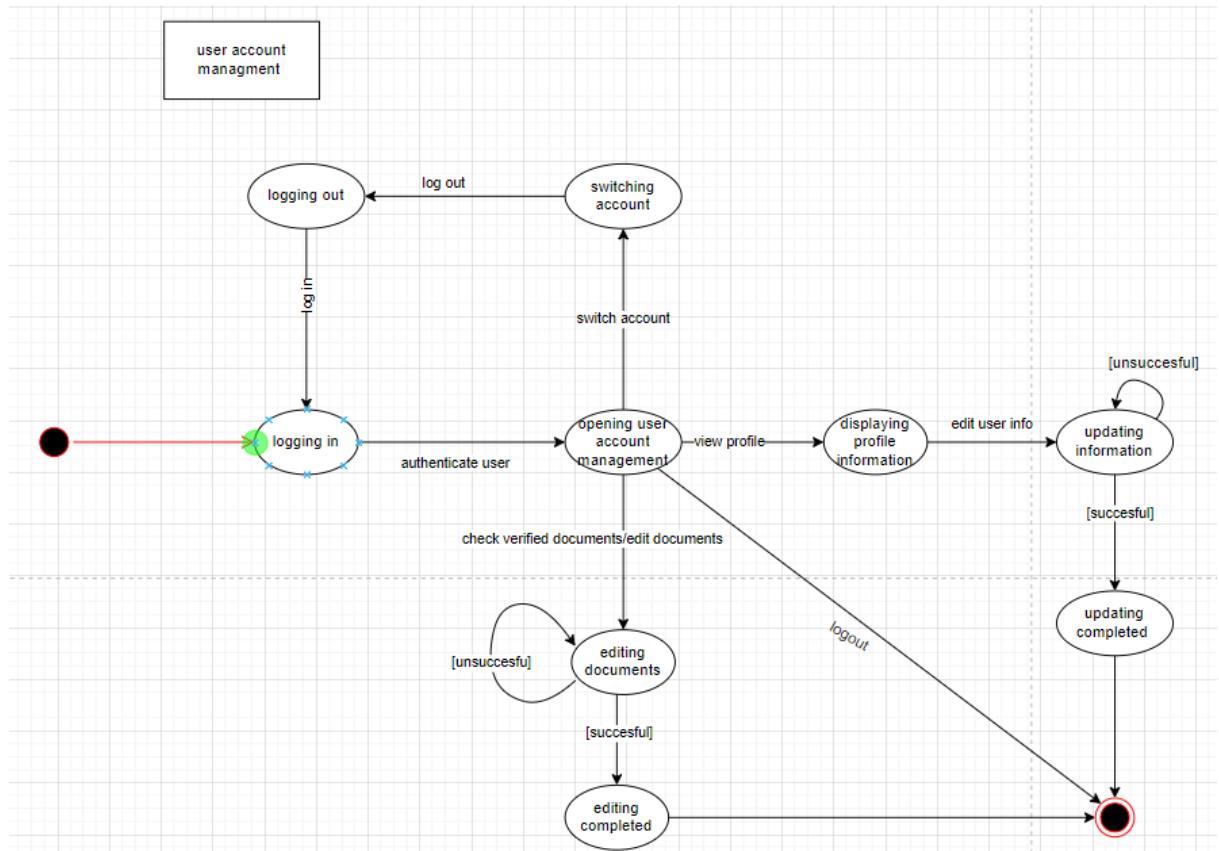
The state chart represents an acquisition process that starts with a user acquiring a property and entering a bid. The bid is either checked and accepted, leading to a transition to checkout, or rejected with an option to place another bid. If approved, the user proceeds to checkout. Alternatively, if the user chooses to invest instead, they can enter an investment amount, which is either accepted or rejected, followed by a review of the investment. The user can return to the homepage at the end of the process.



Checkout

The state chart outlines an online checkout process where a user enters details, which are validated before proceeding to confirm the total cost (with or without tax). The user then selects a payment method, which is checked for acceptance or rejection. Upon successful payment, an OTP is sent for verification, after which the payment is finalized, and an invoice is generated and sent to the user.

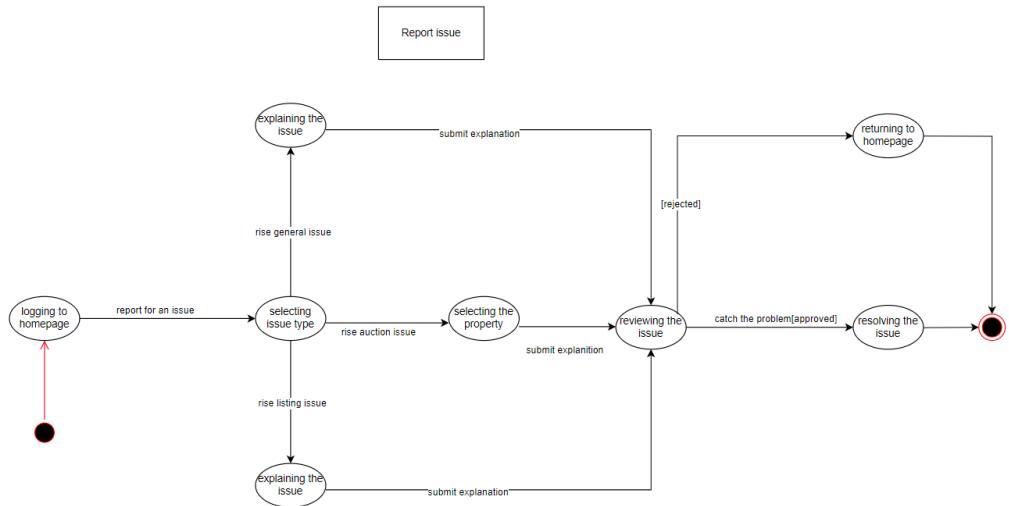
5.2 Statechart Diagram



User account management

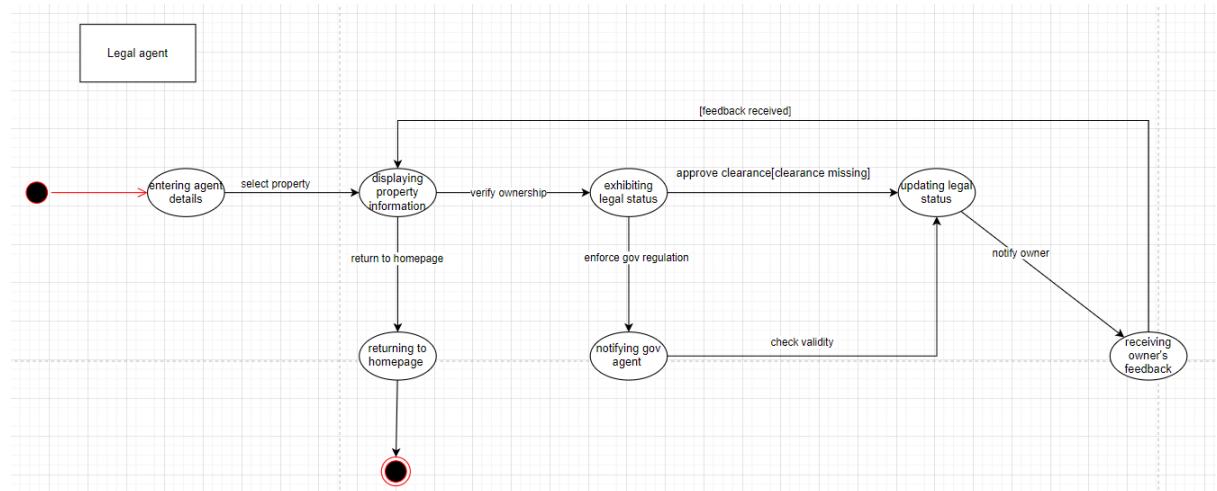
The state chart describes a user account management process starting with logging in. Once authenticated, the user can either log out, switch accounts, or open the account management page to view the profile. From there, the user can either update profile information or edit documents. If the update or editing is successful, it transitions to 'updating completed' or 'editing completed.' Unsuccessful attempts loop back for retry. Finally, the process ends when the user completes the update or document editing.

5.2 Statechart Diagram



Report issue

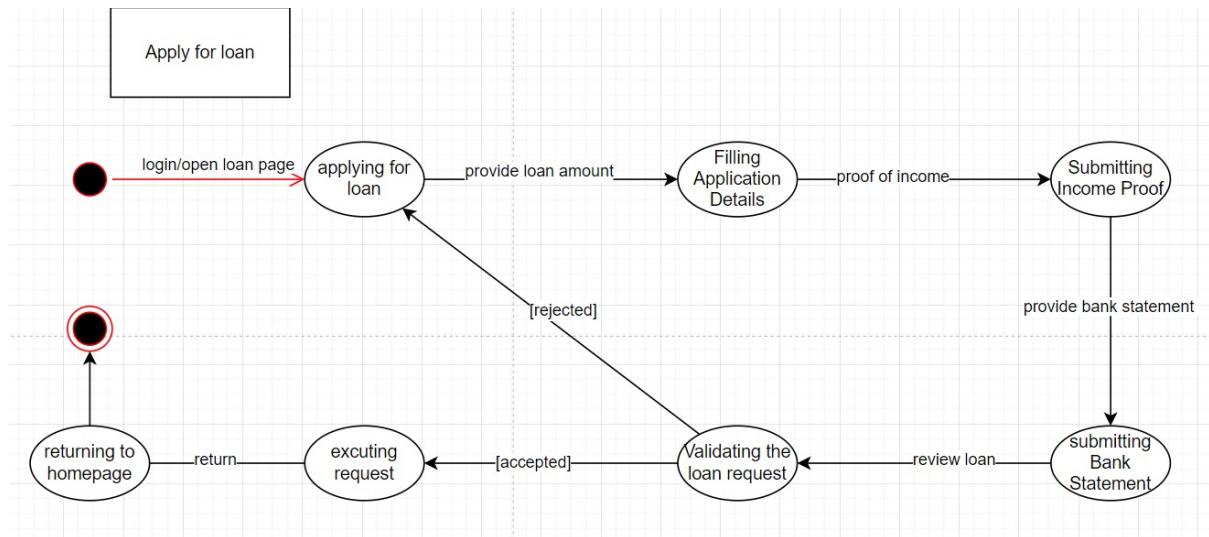
After logging in to homepage the user can report for an issue, the system will ask the user to choose the issue type he wants to rise, either a general issue or auction issue or listing issue.in general issue and listing issue you can submit your explanation directly but in auction issue you need to choose the property first then submit the explanation, the system will review the issue based in your description, if it didn't find the problem it will send you to home page else it will resolve the issue and terminate the order.



Legal agent

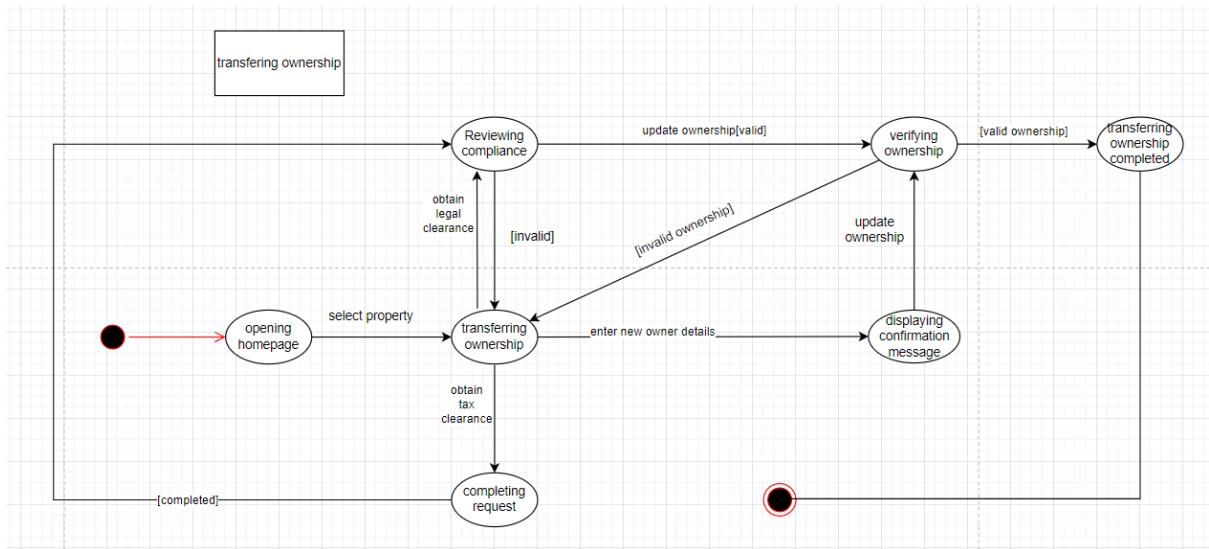
The state chart starts with the agent entering their details and selecting a property, after which the property information and ownership are verified. The legal status is then displayed, and if clearance is missing, the status is updated. The owner is notified, and feedback is received and validated. If necessary, a government agent is notified to enforce regulations, and the process concludes by returning to the homepage.

5.2 Statechart Diagram



Applying for loan

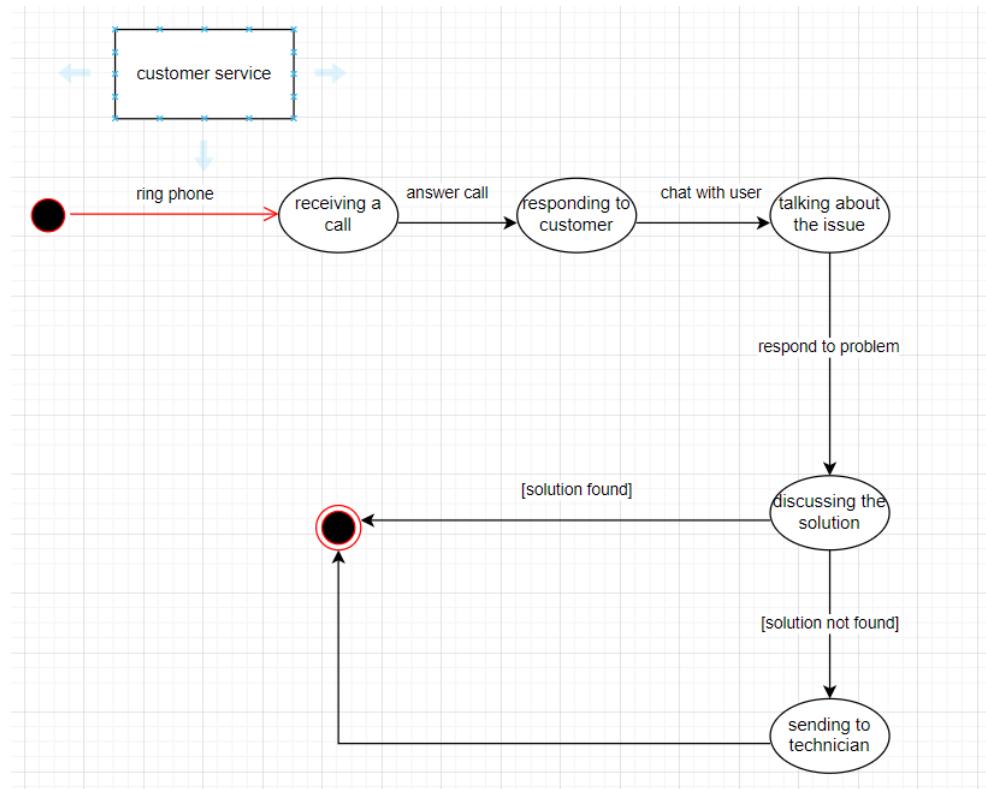
The state chart outlines a loan application process where the user logs in, applies for a loan, and provides the necessary details such as income proof and bank statements. The system then validates the loan request based on the provided information. If the loan is accepted, the request is executed; if rejected, the user is returned to the homepage. Finally, the process concludes by redirecting the user back to the homepage.



Transferring ownership

The state chart illustrates the process of transferring ownership, starting with the user opening the homepage and selecting the property. The system then verifies legal and tax clearances, followed by reviewing compliance. After compliance is confirmed, the new owner's details are entered, and the system verifies the ownership. Once verified, the ownership is updated, a confirmation message is displayed, and the request is completed, finalizing the transfer. Invalid states at any point lead to corrections before proceeding.

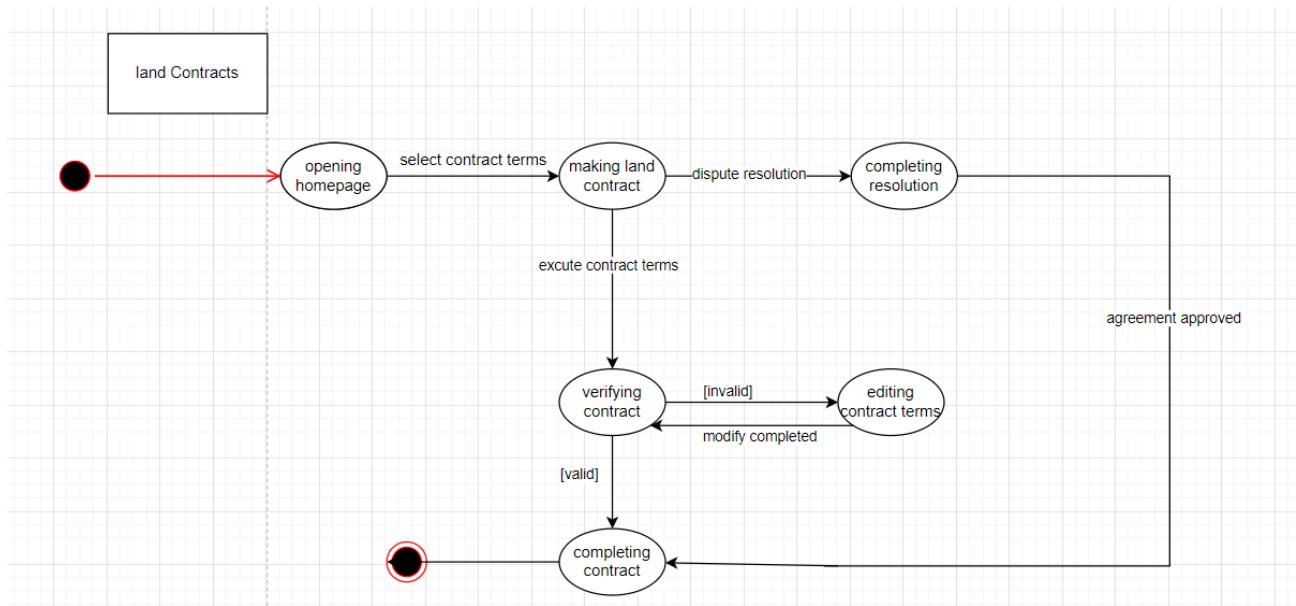
5.2 Statechart Diagram



Customer service

The state chart shows a customer service process starting with the phone ringing and the call being answered. The agent responds to the customer and discusses the issue. If a solution is found, it is discussed and resolved. If not, the issue is escalated and sent to a technician. The process ends either with a solution or escalation for further support

5.2 Statechart Diagram



Land contracts

The state chart for land contracts begins with the user opening the homepage and selecting contract terms. The land contract is created, and if there's a dispute, it's resolved before moving forward. The contract is then verified, and if valid, it's completed; if invalid, the contract terms are edited and re-verified. Once everything is valid, the contract is finalized, and the agreement is approved.

6.0 Restrictions, Limitations, and Constraints

This section identifies unique factors that have a notable impact on the specification, design, or implementation of the software. Several factors can impact the specification, design, or implementation of software. These may include 7 Validation Criteria.

Restrictions, Limitations, and Constraints

This section identifies the key factors that can significantly impact the specification, design, or implementation of a property application using blockchain technology.

Technological Accessibility and Compatibility

Ensuring the app's compatibility across various devices and operating systems can be challenging. Users with older or lower-end smartphones may struggle to access the app's full functionality, limiting its reach.

User Privacy and Data Security

Protecting users' personal data is critical in a blockchain environment. While blockchain provides transparency, ensuring off-chain data security and maintaining user confidentiality is essential to building trust.

Accuracy of Information

The effectiveness of the app relies on the accurate input of property listings and ownership data. Initial data entry can be prone to errors or fraud, necessitating robust identity verification and document authentication systems.

Legal and Regulatory Compliance

Navigating the complex legal landscape of property transactions is crucial. The app must comply with various regulations, including property laws, anti-money laundering (AML) regulations, and know-your-customer (KYC) requirements, which can vary by jurisdiction.

Blockchain Scalability and Performance

As the number of users and transactions grows, scalability becomes a challenge. Increased transaction volumes can lead to performance bottlenecks, affecting transaction speeds and costs.

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Dependence on Internet Connectivity

The app's functionality relies on stable internet access. In regions with poor connectivity, users may experience difficulties in engaging with the platform, limiting its effectiveness.

User Resistance to New Technology

Many potential users may be unfamiliar or uncomfortable with blockchain technology. Building trust and encouraging adoption requires effective education and user engagement strategies.

Cultural and Regional Variations

Property practices vary significantly across regions. Customizing the app to accommodate diverse regulations and cultural practices can be resource-intensive and complex.

Maintenance and Updates

Continuous app maintenance and updates are necessary to ensure compatibility with evolving blockchain technologies. This ongoing requirement can be resource-intensive and requires dedicated support.

Dependence on External Partnerships

The app's success relies on partnerships with government land registries and real estate agencies. Any disruption in these relationships can hinder the app's functionality and limit its use cases.

These key factors highlight the challenges that must be addressed to ensure the successful development and adoption of a blockchain-powered property application.

7.0 Validation Criteria

Validation ensures that the software meets its intended purpose, operates as expected, and delivers the necessary outcomes.

7.1 Classes of Tests

Testing the property transaction app involves various classes of tests that cover functionality, security, usability, performance, and integration with external services like blockchain networks, government authorities, and financial institutions. Each class addresses specific aspects of the software to ensure its reliability, accuracy, and performance.

Functional Testing

This class of tests ensures that all the features and functionalities defined in the software requirements specification (SRS) operate correctly. It involves:

- Verifying that users (buyers, sellers, landlords, government authorities, and legal entities) can register, log in, and access their respective dashboards.
- Ensuring that property listings are searchable and that property details (ownership, legal status, etc.) are displayed accurately.
- Testing the smooth execution of smart contracts for property transactions, including payment transfers, ownership transfers, and legal clearances.
- Ensuring that the history of land records is maintained and easily accessible.
- Verifying tenant screening features and buyer verification processes, such as proof of income submission.
- Testing integration with external APIs (e.g., financial institutions for loan management, government agencies for regulatory checks).
- Ensuring the proper operation of user-friendly features like property verification via QR codes.

7.0 Validation Criteria

Validation ensures that the software meets its intended purpose, operates as expected, and delivers the necessary outcomes.

7.1 Classes of Tests (cont.)

Security Testing

This class of tests focuses on identifying vulnerabilities within the app and ensuring that it meets industry-standard security protocols:

- Ensuring blockchain transactions are secure and encrypted.
- Testing user authentication (including two-factor authentication) to prevent unauthorized access.
- Verifying secure data transfer between the app and the blockchain, preventing data tampering.
- Performing tests to identify potential fraud detection mechanisms, ensuring transactions remain safe from manipulation.
- Testing encryption methods used for securing sensitive data such as financial information and personal details.
- Conducting penetration testing to simulate cyberattacks and ensure the app is resilient against threats.

Usability Testing

Usability testing focuses on evaluating the app's ease of use and overall user experience:

- Ensuring that all user interfaces are intuitive and simple to navigate, even for non-tech-savvy users.
- Testing how easily users can search for properties, complete transactions, and view legal approvals.
- Assessing the clarity of the app's instructions, forms, and error messages.
- Evaluating the time taken to complete key processes like property searches, tenant screenings, and loan applications.
- Ensuring the app's UI/UX is optimized for mobile devices, considering factors like screen size and touch interactions..

7.0 Validation Criteria

Validation ensures that the software meets its intended purpose, operates as expected, and delivers the necessary outcomes.

7.1 Classes of Tests

Performance Testing

This class of tests is critical for ensuring the app can handle real-world conditions, including high transaction loads and varying network conditions:

- Testing the app's responsiveness and speed during peak usage times, ensuring it can handle multiple concurrent transactions without lagging.
- Evaluating the app's performance on different devices, operating systems, and network conditions (Wi-Fi, 4G, etc.).
- Testing the speed of blockchain transactions and the app's ability to update transaction histories in real-time.
- Conducting stress tests to measure the app's ability to scale under heavy loads, ensuring it can support a growing user base.

Integration Testing

Since the app relies on multiple external services (e.g., government systems, financial institutions, blockchain networks), integration testing is essential to ensure smooth operation across different systems:

- Testing the interaction between the app and the blockchain to ensure that data is written to and retrieved from the blockchain accurately.
- Verifying that loan management features integrate correctly with external financial institutions' APIs.
- Testing the interaction with government systems to ensure that legal documentation, compliance checks, and approvals are handled seamlessly.
- Ensuring proper integration with QR code systems for property verification

7.2 Expected Software Response

The expected software response for each major functionality is outlined below. These expectations serve as benchmarks during validation testing to ensure the app operates correctly and efficiently.

1. Record History of Lands

- The app should present a comprehensive, immutable transaction history for every property, allowing users to view ownership records, legal approvals, and transaction dates.
- Users should be able to upload relevant documents, and these documents should be permanently linked to the property's record.

2. Secure Transactions

- Transactions involving payments and ownership transfers should be encrypted and processed within an acceptable time frame, ensuring both speed and security.
- Two-factor authentication (2FA) should prompt users for additional verification before finalizing transactions, ensuring that only authorized users complete transactions.

3. Tenant Screening and Buyer Verification

- The app should validate tenants' financial and identity information (credit score, proof of income, etc.) within a reasonable time, providing clear feedback to landlords and sellers.
- Buyers should receive confirmation of their verification status before initiating property purchases.

4. Property Verification (QR Codes)

- Users should be able to scan a QR code linked to a property, and the app should instantly retrieve and display the property's verified information from the blockchain.

5. Loan Management

- The app should integrate with financial institutions to allow users to apply for loans, upload necessary documents, and track the status of their loan applications in real-time.
- Loan approval workflows should function smoothly, allowing both automated and manual approvals depending on the financial institution's policies.

7.3 Performance Bounds

Performance bounds establish the acceptable limits for the app's operation under normal and extreme conditions. These metrics will be used to evaluate whether the app meets the required performance standards:

1. Transaction Speed

- Blockchain transactions (e.g., ownership transfers, payment confirmations) should be completed within a set time frame, ideally within 1-2 minutes for normal transactions. In peak periods, the app should still complete transactions within 5 minutes.

2. Response Time

- The app's response time for common actions (e.g., loading property details, initiating transactions, displaying verification data) should be less than 2 seconds under normal usage conditions.

3. Concurrency

- The app should handle at least 1,000 concurrent users without performance degradation, ensuring that property searches, transactions, and user interface interactions remain smooth.

4. Data Integrity

- At no point should the app allow corrupted or incomplete data to be written to the blockchain. Every transaction must be verified and immutable once recorded.

5. Scalability

- The app should be capable of scaling to support increasing numbers of users and transactions, ensuring it can grow without significant performance loss as the user base expands globally.

By adhering to these validation criteria, the property transaction app will ensure it meets its goals of transparency, security, and trust, delivering a reliable and efficient solution for real estate transactions.