**COMSATS University Islamabad**

**Abbottabad, Pakistan**

**Land record Management system using blockchain**

***By***

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***Bachelor of Science in software engineering***

***(2018-2022)***

**The candidate confirms that the work submitted is their own and appropriate  
 credit has been given where reference has been made to the work of others**.

**Land record Management system using Blockchain**

**A project presented to**

**COMSATS Institute of Information Technology, Islamabad**

**In partial fulfillment**

**of the requirement for the degree of**

***Bachelor of Science in Software Engineering***

***(2018-2022)***

**By**

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We hereby declare that this software, neither whole nor as a part has been copied out from any source. It is further declared that we have developed this software and accompanied report entirely on the basis of our personal efforts. If any part of this project is proved to be copied out from any source or found to be reproduction of some other. We will stand by the consequences. No Portion of the work presented has been submitted of any application for any other degree or qualification of this or any other university or institute of learning.

Ammar Khalid Danial Karim

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Momin Tariq

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**CERTIFICATE OF APPROVAL**

It is to certify that the final year project of BS (SE) “Land record Management system using blockchain” was developed by   
**Ammar Khalid (CIIT/FA18-BSE-124/ATD)**, **Danial Karim (CIIT/FA18-BSE-088/ATD)**and **Momin Tariq (CIIT/FA18-BSE-080/ATD)** under the supervision of “Sir Fuzail Jameel” and co supervisor “Sir Kashif Bilal” and that in (his) opinion; it is fully adequate, in scope and quality for the degree of Bachelors of Science in Software Engineering.

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**Supervisor**

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**External Examiner**

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**Head of Department**

**(Department of Computer Science)**

**Executive summary:**

Land is an immovable and momentous asset which also helps the government to gather taxes and improved livelihood. Pakistan has been using traditional file processing or centralized system to store data which is highly exposed to the single point failure, performance bottleneck and lack of efficiency. Forgery and theft of documents are the main threats faced by current record management systems.

These vulnerabilities urgently required a system which could fix the current system’s shortcomings.

Blockchain Technology, providing decentralized system to the Land management users comes with the useful services. This technology removes the need for a third party, increases transaction integrity and traceability, and reduces the fault tolerance issue.

The Blockchain is immutable, which means that once a transaction is recorded, it cannot be

changed. Blockchain technology is prone to manipulations and will provide the transparency in transactions.

It is vital to determine the main requirements characteristics of Blockchain technology in order to effectively integrate the services of Blockchain technology within LRMS. As a result, the purpose of this study is to integrate or to provide an architecture that has potential to solve the issues of centralized systems in LRMS.

**ACKNOWLEDGEMENT**

All praise is to Almighty Allah who bestowed upon us a minute portion of His boundless knowledge by virtue of which we were able to accomplish this challenging task.

We are greatly indebted to our project supervisor “Sir Fuzail Jameel” and our Co-Supervisor “Sir Kashif Bilal”. Without their personal supervision, advice and valuable guidance, completion of this project would have been doubtful. We are deeply indebted to them for their encouragement and continual help during this work.

And we are also thankful to our parents and family who have been a constant source of encouragement for us and brought us the values of honesty & hard work.

Ammar Khalid Danial Karim

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Momin Tariq

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**Abbreviations:**

***Table 1.1: Abbreviation***

|  |  |
| --- | --- |
| **SRS** | Software Require Specification |
| DFD | Data Flow Diagram |
|  |  |
|  |  |
|  |  |

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1. **Introduction**
   1. **Brief**

In a world that is continuously innovating and evolving, Blockchain technology has immensely contributed to the transaction and storage methods which not only eliminates the manipulation of a trusted third party but also provides a distributed shared ledger.

Buying and selling of a land (Land Registration) consists or number of steps which are complicated. Registration, the transfer of property ownership, and the declaration certificates are all examples of LRMS processes.

information is stored and distributed across various government organizations that are not well-synchronized in existing systems, which means a third party can easily interrupt it.

By using decentralized system, it will be easy to provide transparency, and no one has unfair power.

It will be a system where seller can upload its property to sell through registrar who will upload the property, relevant information about the property, and buyer can send the buy request if he is willing to buy.

Before a ownership is transferred, the buyer will have to deposit the stamp duties and clear all the dues and fees which are necessary in a smart contract. After the mutation certificate is transferred, the property will be transferred to the new owner whose information will be updated by registrar and uploaded on ledger.

* 1. **Relevance to Course Modules**

We are creating our LRMS using Hyperledger Fabric. We are using blockchain technology and the course for it isn’t being teached in the campus yet.

For documentation and presentations, the courses of Software Project Management accommodated us well.

Performance, security, reliability is assured for the project which we studied in software quality Engineering.

Breaking down some of the courses we studied and how they assisted us on the journey of building this system are as follows:

**Software Engineering:**

This course helped us understand which software life cycle models and how we can apply that to out system to make things easier and efficient for both us and our clients.

**Software Engineering II:**

In software engineering II we studied UML which is integral part of software engineering. It helped us to better understand and evaluate the requirements and architecture.t.

**Human Computer Interaction:**

This course helped us to understand the importance of a friendly and easy interface for both users and admins. This guided us in the UX designing phase.

**Software Requirement Engineering:**

In SRE we studied about how the requirements are collected, gathered, and arranged, and how we can differentiate between functional and non-functional requirements.

**Software quality assurance:**

We studied how to improve the development phase, how to identify the problems so that the issues can be prevented in the early phase. This course assisted us in identifying the factors which helps us in improving the overall quality of our system.

**Software testing:**

Testing is a major step in software development life cycle. We studied manual and automated testing. Making test cases and how to perform different types of testing like black box and white box, unit, integration, system, and user testing.

Software project management:

in this course we studied how time, resource and risk management are vital part of the project Management. How to allocate and utilize resources effectively and efficiently. making schedule for the project was easier. We studied how to plan the development process. Understanding and using different software project management tools such as Visio.

**1.3 Project Background**

This project was proposed to minimize the limitations of existing Land record managing system. Existing system is based on centralized, so users have issues like:

* Vulnerable to manipulation
* Forgery of documents
* Data tampering
* Double spendings
* Involvement of intermediates and third party.

Keeping all these problems in mind we proposed a decentralized platform based on blockchain in which buying, and selling are secured through smart contract which will eliminate all the vulnerabilities and problems which cannot be fixed with centralized system.

**1.4 Literature Review**

Blockchain based Land Record Management System in Pakistan

See discussions, stats, and author profiles for this publication at: <https://ieeexplore.ieee.org/document/9073927>

**Published in:**[2020 3rd International Conference on Computing, Mathematics and Engineering Technologies (iCoMET)](https://ieeexplore.ieee.org/xpl/conhome/9055958/proceeding)

**1.5 Analysis from Literature Review**

In existing platforms there is a vulnerability in a system that it is highly exposed to the danger of data tampering, forgery, and theft.

This Decentralized blockchain system will provide these urgently required services to the system so that it can never be used or interrupted by any third party for any illegal usage.

The smart contracts in use will provide a whole new security to the system.

**1.6. Methodology and Software Life cycle for This Project**

* The approach we used for this project is structural approach.
* Software process model used in the project is Iterative model.

## **1.6.1. Rationale behind Selected Methodology**

**Methodology:**

we are using the structural approach because the smart contracts are written in go lang, and it also enables us to understand the requirements better in the early stage and evaluating after implementation which also increases the efficiency.

**Software life cycle:**

Iterative model is used for the better control and improved project. It welcomes the changing. As the committee will preview our projects then the changes will be made according to their remarks.

The flexibility is increased, and the risk is reduced with the continuous improvement as well.

# **Problem Definition**

Land Record Management System using blockchain will remove the threats and problems faced by currently working centralized storage systems such as forgery and tampering of data and documents.

Blockchain technology will provide the service which cannot be manipulated and changed.

4. 1. **Problem Statement:**

As discussed earlier that our application objective is to make it decentralized. There were many loopholes in the existing system, transactions data and documents holding sensitive and confidential information were exposed to number of threats such as involvement of intermediates.

There should be no third part involvement in the transaction mechanism which is achieved and secured through blockchain.

* 1. **Deliverables and Development Requirements**
* Feasibility report
* SRS
* Client module
* Admin (Registrar) module
* Smart contracts stored in blockchain module
* working application with all the integrated modules
  1. **Current System**

LRMS using blockchain will soon be functional, as of now it’s a project

1. **Requirement Analysis**

This section will give an overview of the whole system. The system will be explained in its context to show how the system interacts with other systems and introduce the basic functionality of it. It will also describe what type of users that will use the system and what functionality is available for each type. At last, the constraints and assumptions for the system will be presented.

4. 1. **Use Cases Diagram(s)**

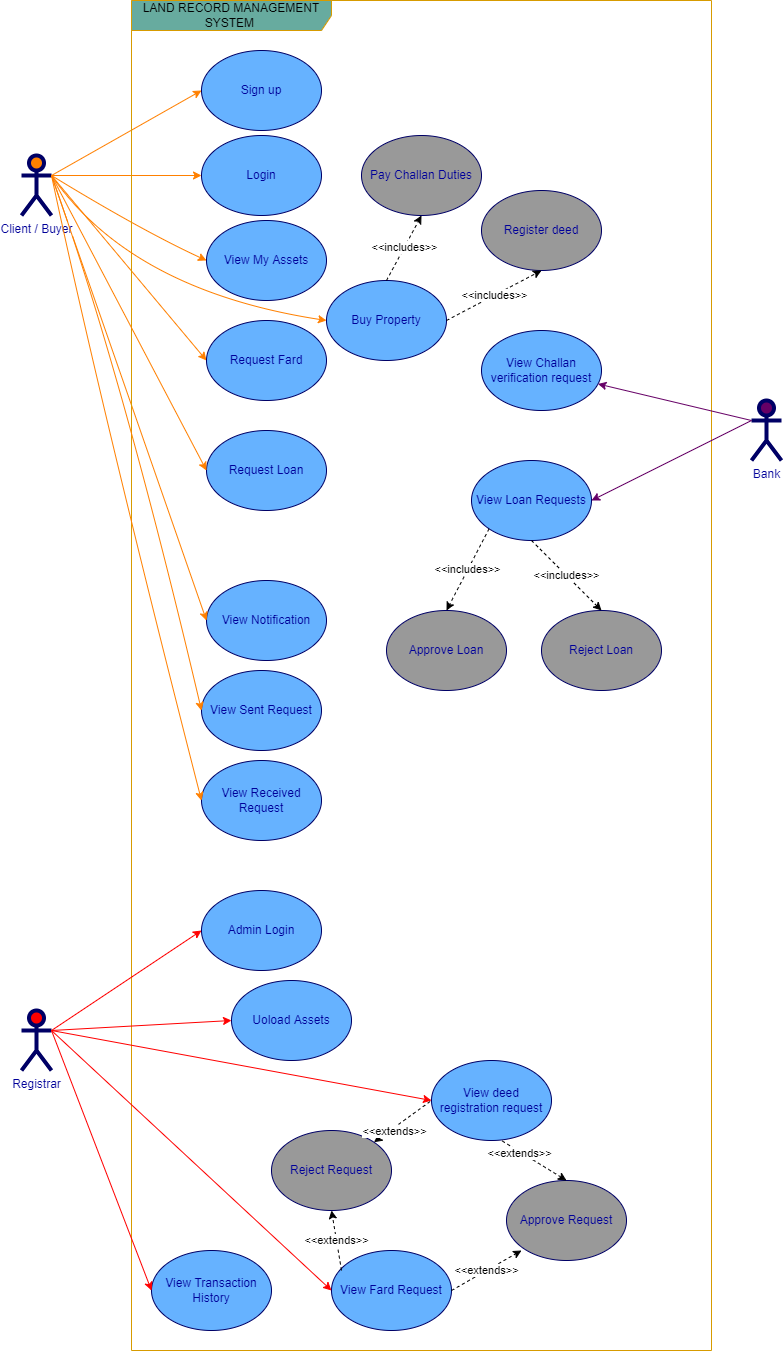


Figure 1 Use Case Diagram

* 1. **Detailed Use Case**

**Use case 1: Sign up**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | UC1: Sign up |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | Client |
| **Stakeholders and Interests** | * **User:**   Wants to create account successfully |
| **Preconditions** | * User does not have any previous account on his personal cnic |
| **Success Guarantee** | User will get successfully registered to the system |
| **Main success scenarios** | User will enter details to create account and then click sign up button. |
| **Exceptions** | 1. If user tries to get registered with email that is already been registered, then system shows message “email already exists 2. If password do not contain 8 characters, then system will show the message that password do not contain 8 characters 3. If wallet address is wrong, then system show “wallet address not found” message |
| **Special Requirements** | Confirmation of User signed up to be provided to the user within 5 seconds of submission. Names used for Buttons reflect what the buttons are for. |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 2% |
| **Miscellaneous** | - |

UseCase2: Login

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | UC1: Sign in |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | Client |
| **Stakeholders and Interests** | * **User:**   Wants to log in successfully |
| **Preconditions** | * User must have created an account |
| **Success Guarantee** | User will get logged in successfully |
| **Main success scenarios** | User will enter details and click on the log in button to get logged in |
| **Exceptions** | * If the user email is incorrect, the system will say “this email does not exist * If the password is incorrect the system will say” the password is incorrect” |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Miscellaneous** | - |
|  |  |

**Use Case 3: Buy Property**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | UC3 : Buy Property |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | Buyer |
| **Stakeholders and Interests** | **Buyer**, send buy property request |
| **Preconditions** | * Property must be advertised |
| **Success Guarantee** | * Asset is transferred * Ownership is transferred |
| **Main success scenarios** | **Buyer**:   * Buyer sends the buy property request against the certain advertised property * Buyer register deed * Ownership is transferred |
| **Exceptions** | * Buy request cannot be sent against the owned property |
| **Special Requirements** | * User is registered with LRMS |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 50% |
| **Miscellaneous** | - |

**Use Case 4: Request Loan**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | UC4: Request Loan |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | Buyer |
| **Stakeholders and Interests** | User: want to apply for loan for certain property. |
| **Preconditions** | * Users have the access to system and the internet connection. |
| **Success Guarantee** | * Loan is approved and granted |
| **Main success scenarios** | **Buyer**:   * User wants to apply for loan * User enters the details. * User submits the detail * Loan is granted |
| **Exceptions** | * Property is already on leased/mortgaged |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 5% |
| **Miscellaneous** | - |

**Use Case 5 : Get Fard**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | UC5: Get Fard |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | Buyer |
| **Stakeholders and Interests** | **Users**: want to confirm the sale of property form the property owner |
| **Preconditions** | * The ownership verified |
| **Success Guarantee** | * The user get the Fard against the requested property |
| **Main success scenarios** | **Buyer**:   * User is applying to get Fard * system will provide the Fard document. |
| **Exceptions** | - |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 30% |
| **Miscellaneous** | - |

**Use Case 6: View notifications**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | UC6: Get Fard |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | Client (Buyer/Seller) |
| **Stakeholders and Interests** | **User**: Want to view notification. |
| **Preconditions** | User must be logged in to the system. |
| **Success Guarantee** | Users get to view the notifications |
| **Main success scenarios** | Client:   * Client will click on view notification option and the list of requests are displayed. |
| **Exceptions** | When there are no notifications, ‘no notifications’ will be displayed |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 10% |
| **Miscellaneous** | - |

**Use Case 7 : View sent requests**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | UC7: View sent requests |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | Client (Buyer/Seller) |
| **Stakeholders and Interests** | Client/Buyer: Want to view his/her sent requests |
| **Preconditions** | User should be logged in to the system |
| **Success Guarantee** | List of sent requests are displayed to the user. |
| **Main success scenarios** | User:   * Users click on view notifications and after that the user selects the sent request tab and the list of sent requests are displayed |
| **Exceptions** | When there are no sent requests, ‘no requests’ will be displayed |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 10% |
| **Miscellaneous** | - |

**Use Case 8 :** **View received requests**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | UC8: **View received requests** |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | Client (Buyer/Seller) |
| **Stakeholders and Interests** | Client/Buyer: Want to view his/her received requests |
| **Preconditions** | User should be logged in to the system |
| **Success Guarantee** | List of received requests are displayed to the user. |
| **Main success scenarios** | User:   * Users click on view notifications and after that the user selects the received request tab and the list of received requests are displayed |
| **Exceptions** | When there is no received request then the system will show no results found message |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 10% |
| **Miscellaneous** | - |

**Use Case 9:** **Upload Assets**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | UC9: **Upload Assets** |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | User (Registrar) |
| **Stakeholders and Interest** | Registrar: Want to upload the asset after the verification of the documents |
| **Preconditions** | * User should be logged in to the system |
| **Success Guarantee** | after verification of documents the asset is uploaded  . |
| **Main success scenarios** | User:   * after the verification of ownership and the documents the register upload the assets |
| **Exceptions** | if the documents are not legal then asset is not uploaded**.** |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 50% |
| **Miscellaneous** | - |

**Use Case 10:** **View Fard requests**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | **UC10:** **View Fard requests** |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | User (Registrar) |
| **Stakeholders and Interest** | Registrar: Want to view Fard requests that he received |
| **Preconditions** | * User should be logged in to the system |
| **Success Guarantee** | registrar can view the received Fard request. |
| **Main success scenarios** | User:   * registrar can view the received Fard request and can perform further proceedings |
| **Exceptions** |  |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 20% |
| **Miscellaneous** | - |

**Use Case 11:** **View asset traceback**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | **UC11:** **View asset traceback** |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | User (Registrar, Client) |
| **Stakeholders and Interest** | Registrar: Want to view the asset traceback regarding the specific property. |
| **Preconditions** | * User should be logged in to the system |
| **Success Guarantee** | Registrar will be able to view the transection history regarding the specific property |
| **Main success scenarios** | User:   * Registrar view the traceback by clicking the check traceback |
| **Exceptions** |  |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 20% |
| **Miscellaneous** | - |

**Use Case 12 View ownership request**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | **UC12:** **View ownership request** |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | User (Registrar) |
| **Stakeholders and Interest** | Registrar: Want to view ownership |
| **Preconditions** | User should be logged in to the system |
| **Success Guarantee** | registrar can view ownership |
| **Main success scenarios** | User:   * registrar can view the ostensible owner of property |
| **Exceptions** |  |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 20% |
| **Miscellaneous** | - |

**Use Case 13 View loan request:**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | **UC13 View loan request:** |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | User (Bank) |
| **Stakeholders and Interest** | Bank: Want to view lease/loan request |
| **Preconditions** | User should be logged in to the system |
| **Success Guarantee** | Bank can be able to see the Lease/Loan request that he received |
| **Main success scenarios** | User:   * Bank can view the lease loan request which it can approve or reject after checking |
| **Exceptions** |  |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 20% |
| **Miscellaneous** | - |

**Use Case 14 View Challan Verification request:**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | **UC14 View Challan Verification request:** |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | User (Bank) |
| **Stakeholders and Interest** | Bank: Want to view challan verification request |
| **Preconditions** | User should be logged in to the system |
| **Success Guarantee** | Bank can be able to see the challan verification request that he received |
| **Main success scenarios** | User:   * Bank can view the challan verification which it can approve or reject after checking |
| **Exceptions** |  |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 20% |
| **Miscellaneous** | - |

**Use Case 15 View Deed registration request:**

|  |  |
| --- | --- |
| **Use Case Section** | **Comments** |
| **Use Case Name** | **UC15: View Deed registration request:** |
| **Scope** | LRMS |
| **Level** | Primary Goal |
| **Primary Goal Actor** | User (Registrar) |
| **Stakeholders and Interest** | Registrar: Want to view deed registration request |
| **Preconditions** | User should be logged in to the system |
| **Success Guarantee** | registrar can view deed registration requests. |
| **Main success scenarios** | User:   * registrar can either verify or reject the request. |
| **Exceptions** |  |
| **Special Requirements** | - |
| **Technology and Data variations List** | - |
| **Frequency of Occurrences** | 20% |
| **Miscellaneous** | - |

* 1. **Functional Requirements**

|  |  |
| --- | --- |
| **ENTITIES** | **WLL BE ABLE TO** |
| Buyer / Seller | Add/Buy property  Check property Details  Request Fard  Verifies for loan against asset from bank |
| Registrar | Set Property info(Khasra no, Khata no,khewat no)  Add area info(longitude , latitude)  Verify if the seller is legally allowed to make the transaction or not.  Update property record.  Display Traceback |
| Bank | Check for previous loan​  Grant loans in case of one apply for loan.​ |

* 1. **Non-Functional Requirements**

**Performance:**

Response time will be in few seconds. User’s request will be served within 3 to 5 seconds. Interface load time will not be more than 1 seconds for user.

**Usability:**

Interface will be friendly and easy to use. Every icon and buttons have proper labeling that will allow user to easily understand what functionality it provides; user can easily remember its interface.

**Responsiveness:**

Our system will support multiple screen sizes for different devices.

**Reliability:**

The system is much more reliable than the centralized one because in centralized system when one node or server is down then the whole is inaccessible and this thing is overcome here

**Transparency:**

It is entirely traceable and much easier to maintain,

**Availability:**

This decentralized system will be available even when 1 peer or server is down.

**Data Integrated:**

Every module is blockchain integrated.

**Accessibility:**

Everyone has their own id to have access to the system.

**Access Security:**

Data cannot be manipulated by any third party or intermediate.

1. **Design and Architecture**






9. 1. **System Architecture**

Diagram

Description automatically generated

* 1. **Data representation**

**Data Flow Diagram:**

Graphical user interface, website

Description automatically generated

## **Process/Flow Representation:**

**Get Fard:**

Diagram

Description automatically generated

Figure 4 get Fard

**Buy Property:**

Diagram

Description automatically generated

Figure 5 Buy Property

**Apply for loan:**

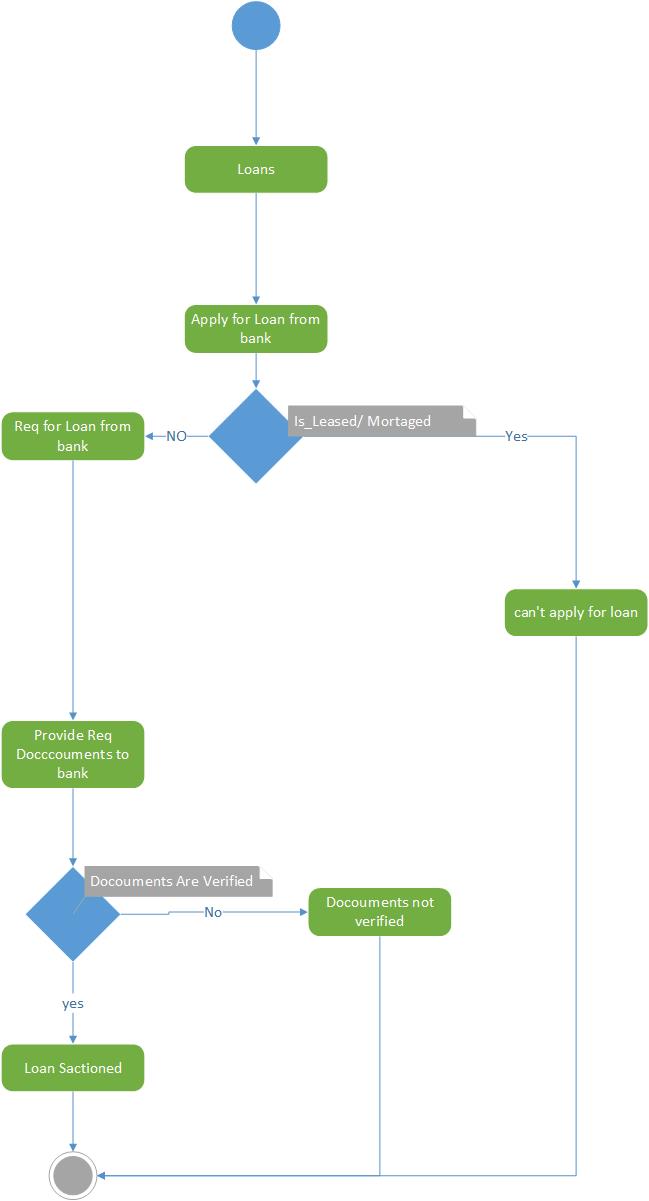
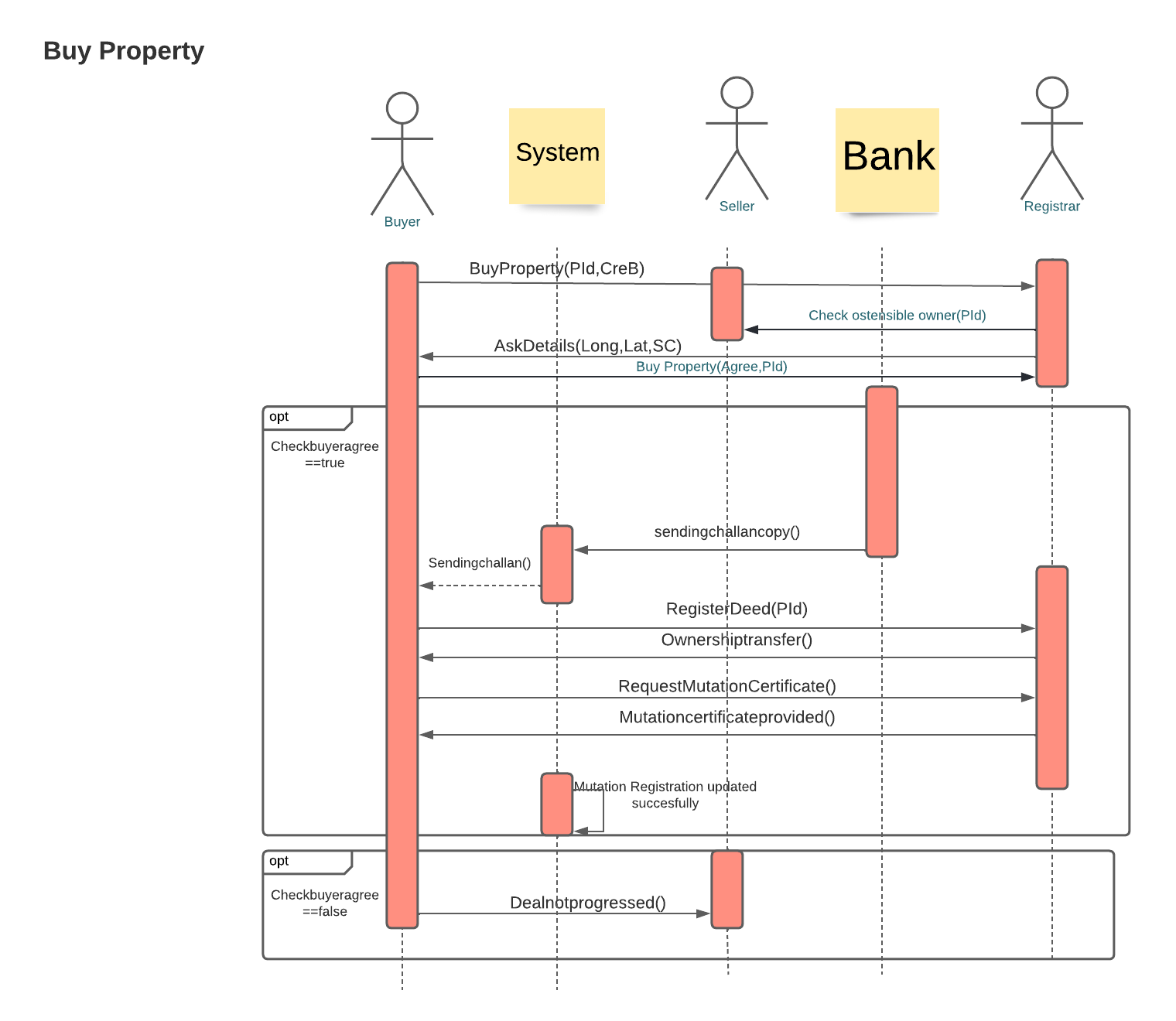


Figure 6 Apply For Loan

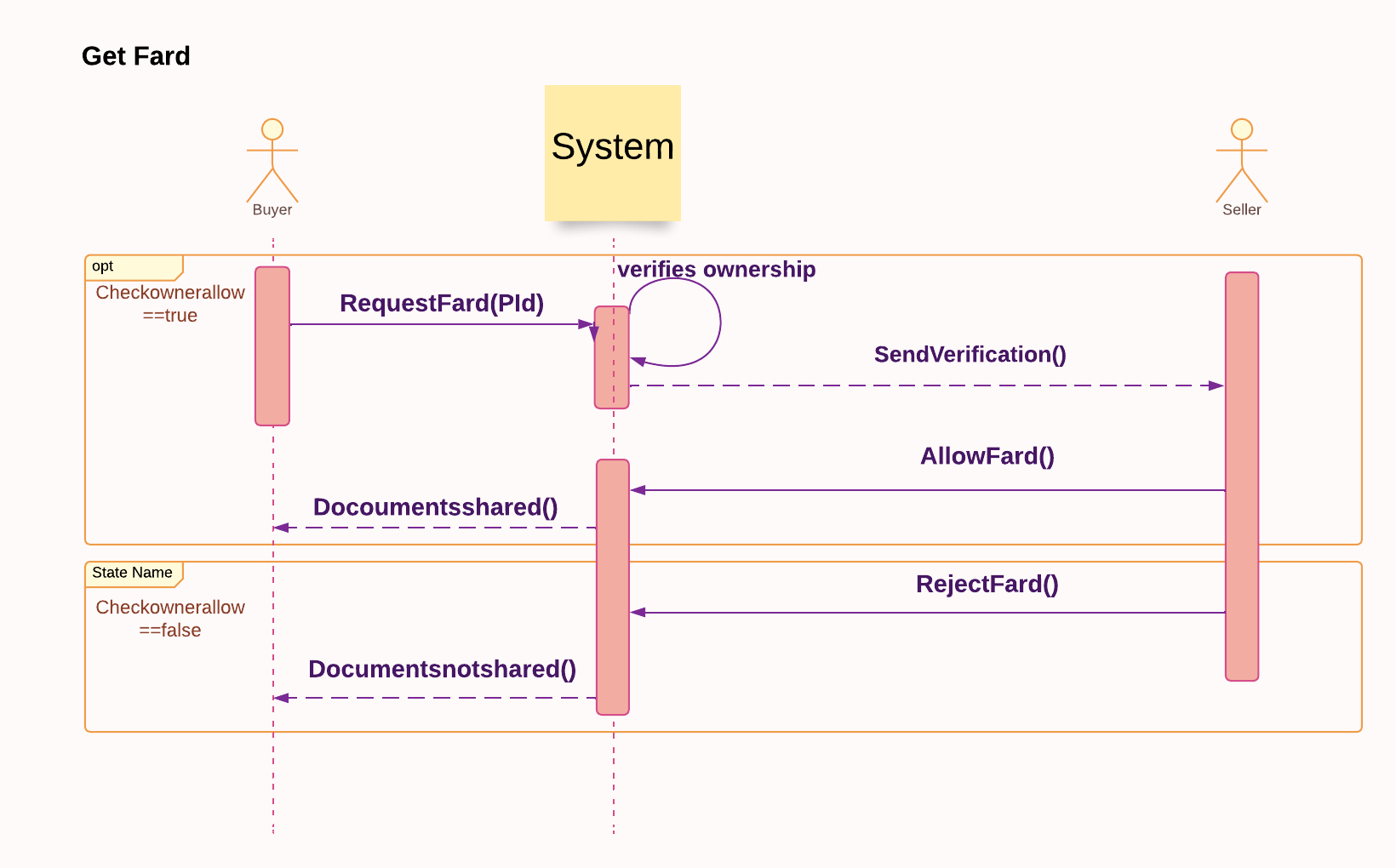
**4.4. Design Models [Class diagram]**

* + 1. **Sequence Diagrams**

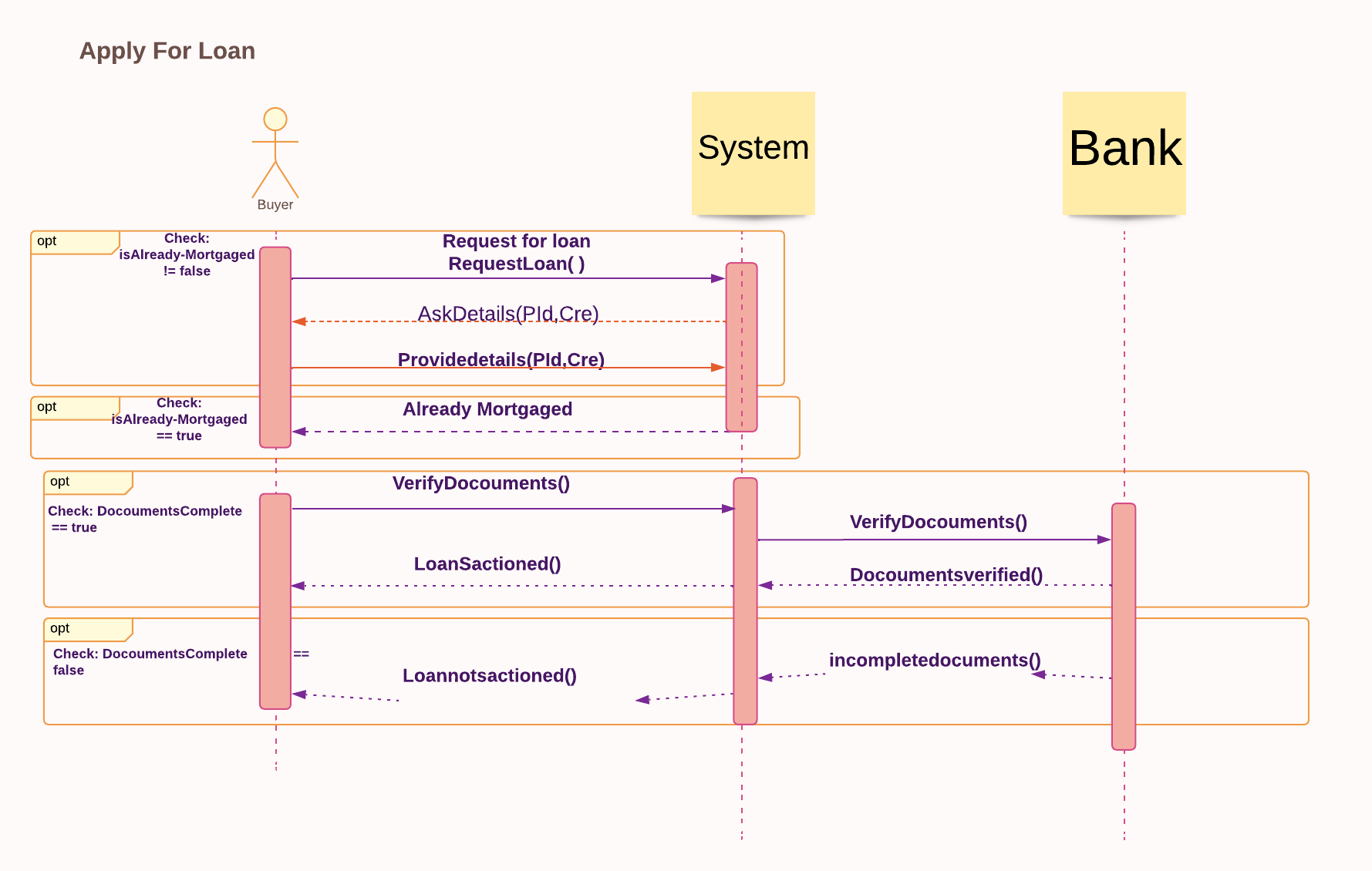
Sequence diagram 1:



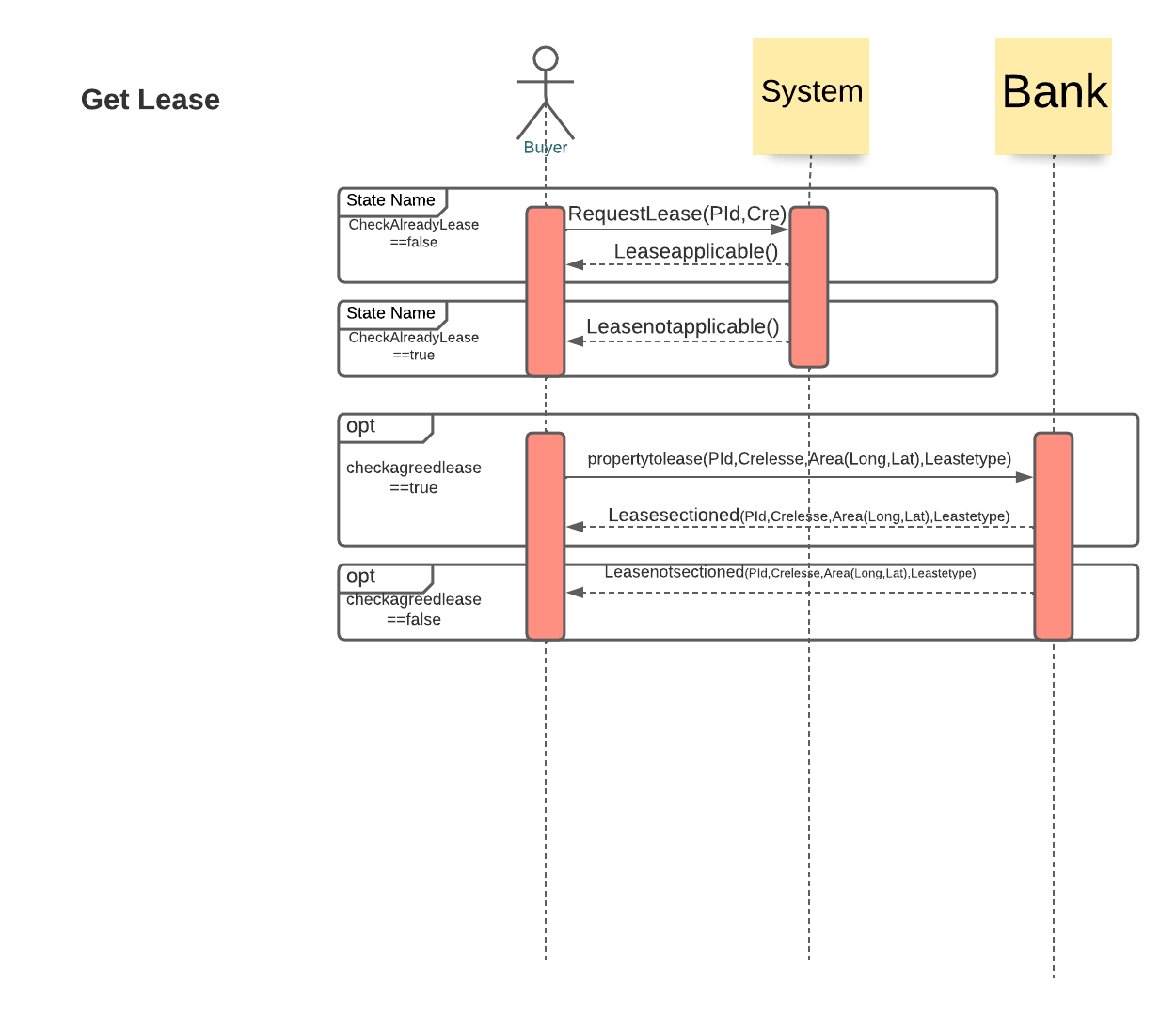
Sequence Diagram 2:



Sequence Diagram 3 :

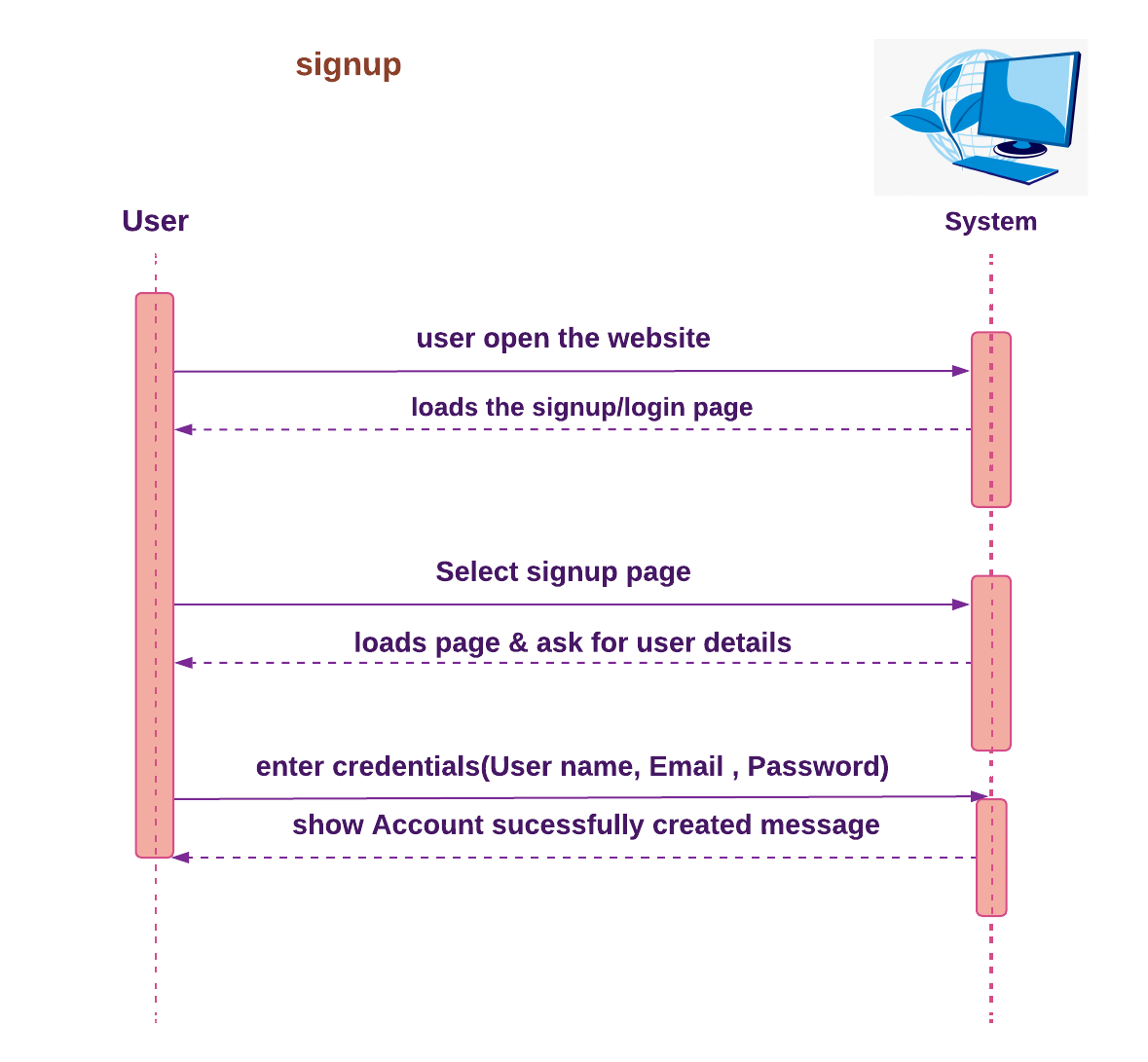


Sequence Diagram 4 :

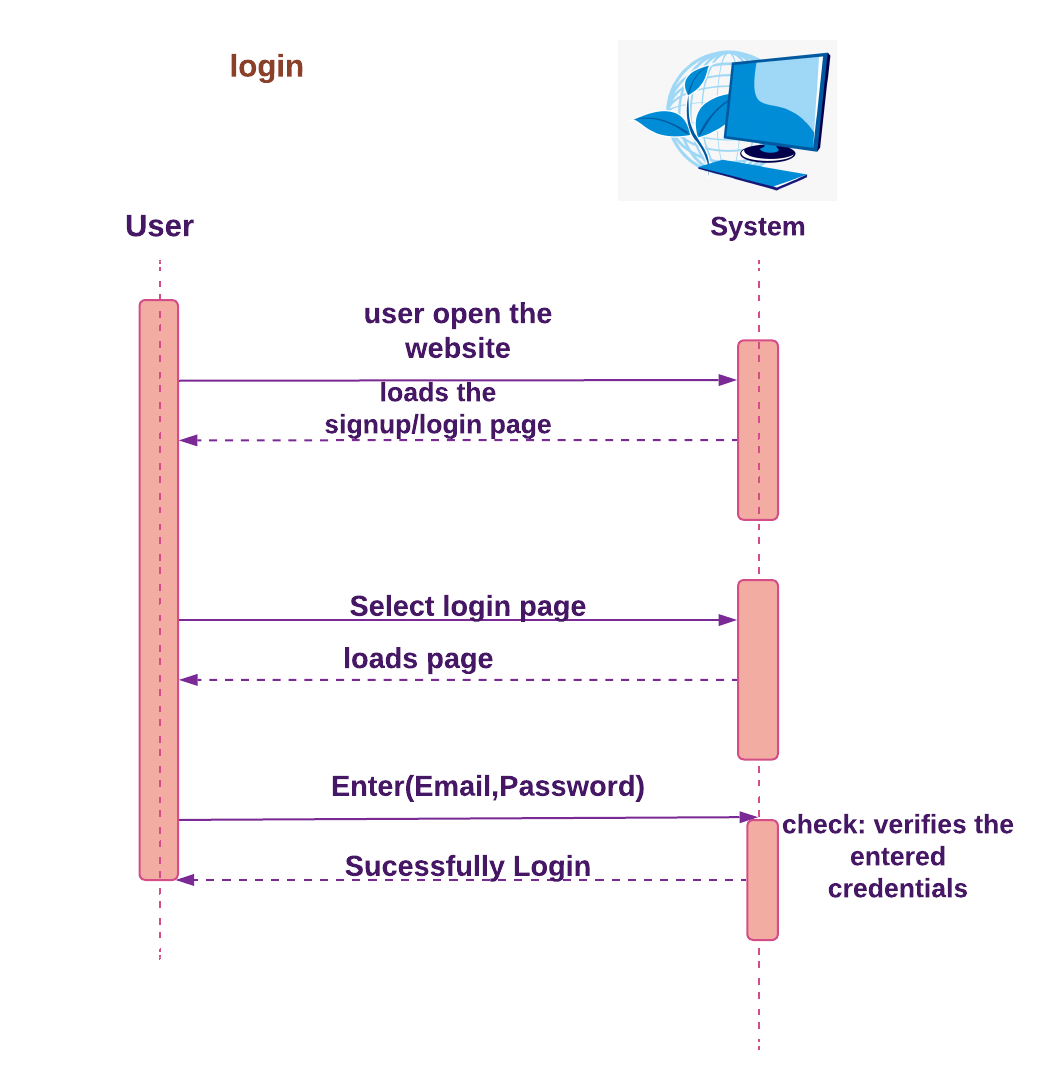


**System Sequence Diagrams :**

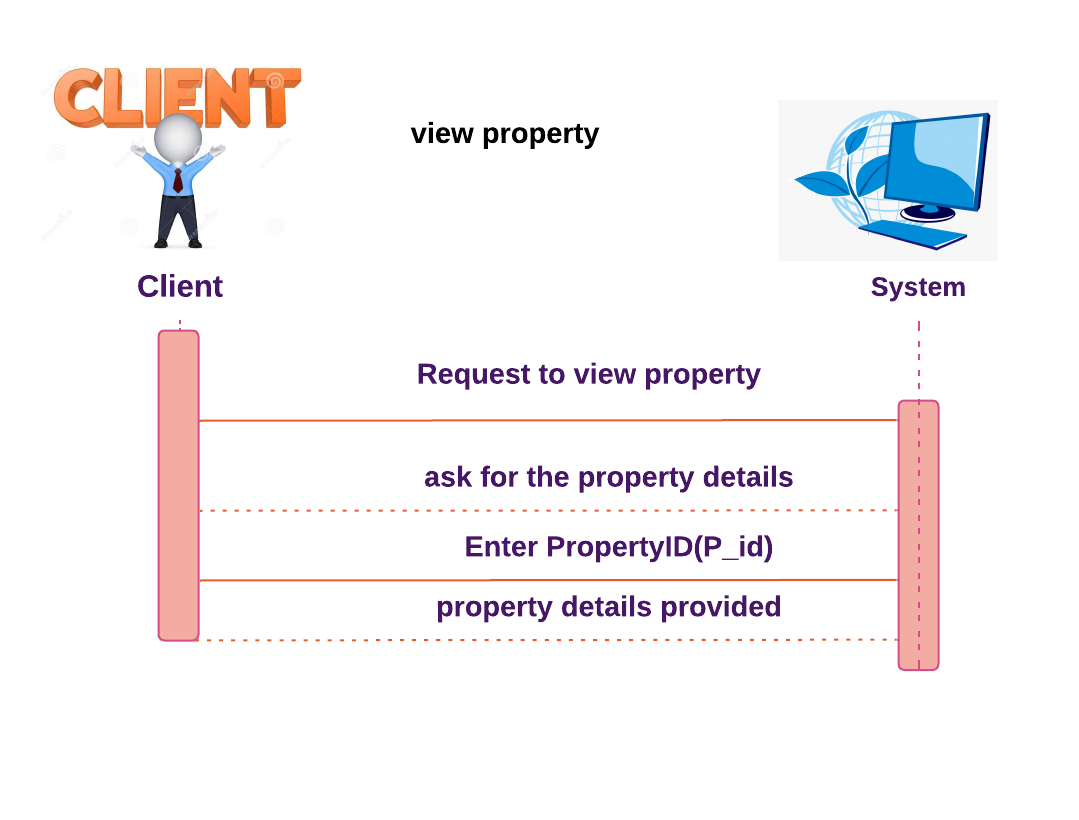
**1 .**

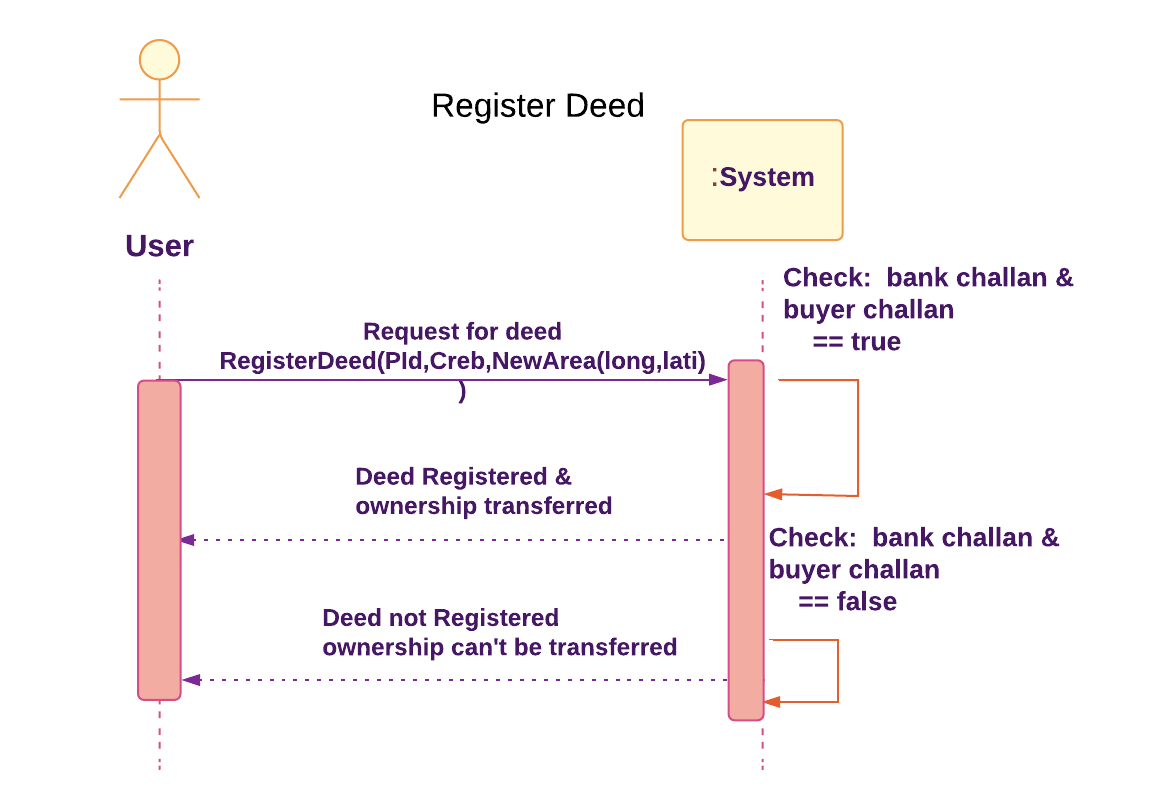


**2**

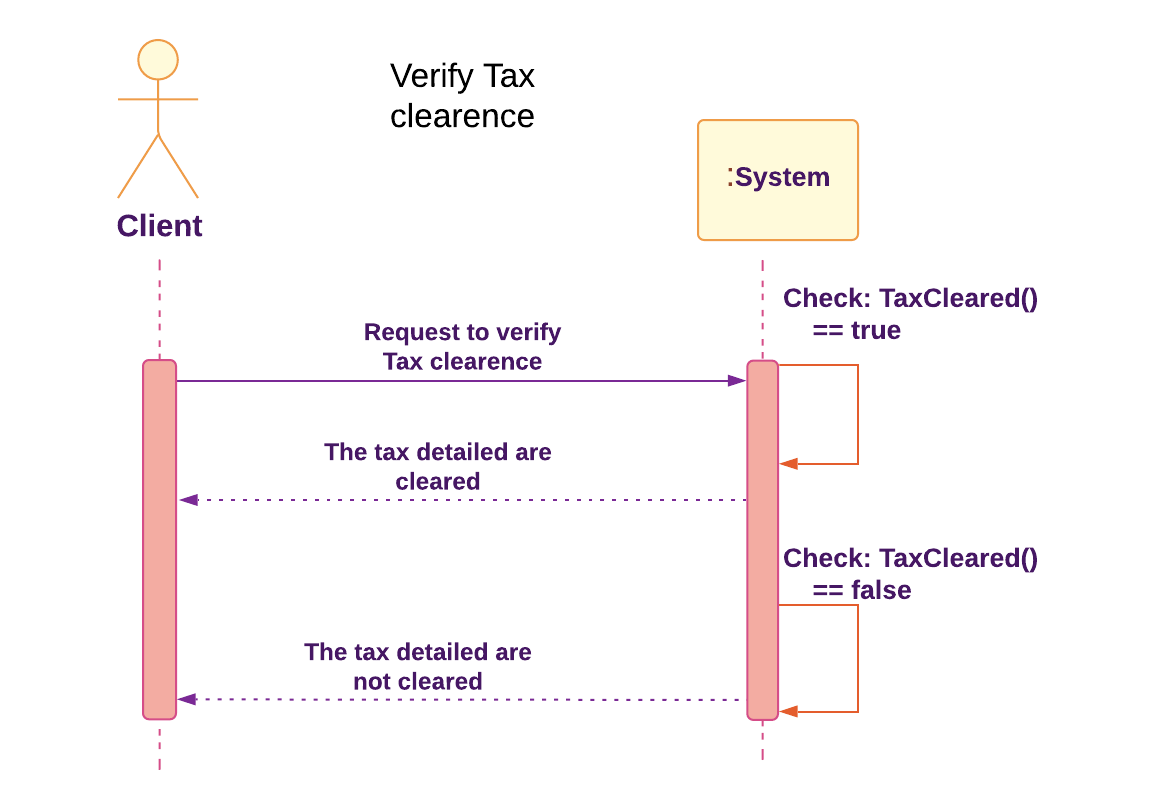


**3.**

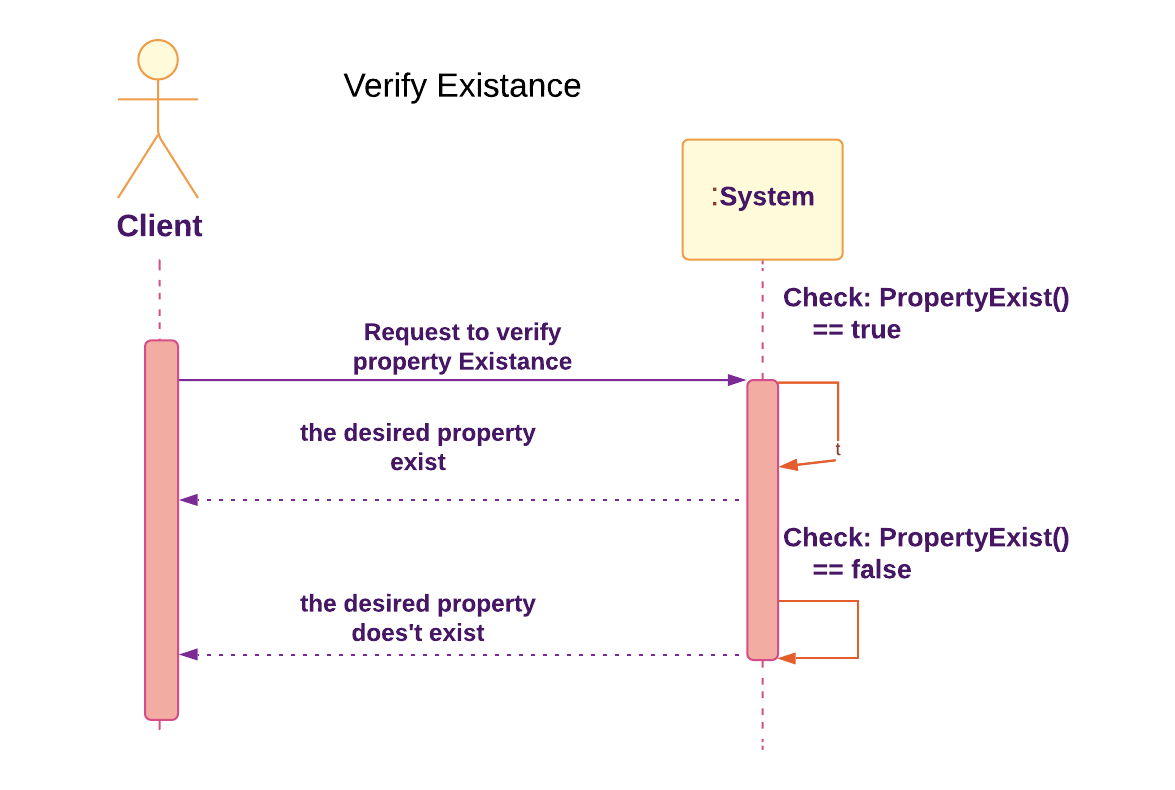


**4.** 

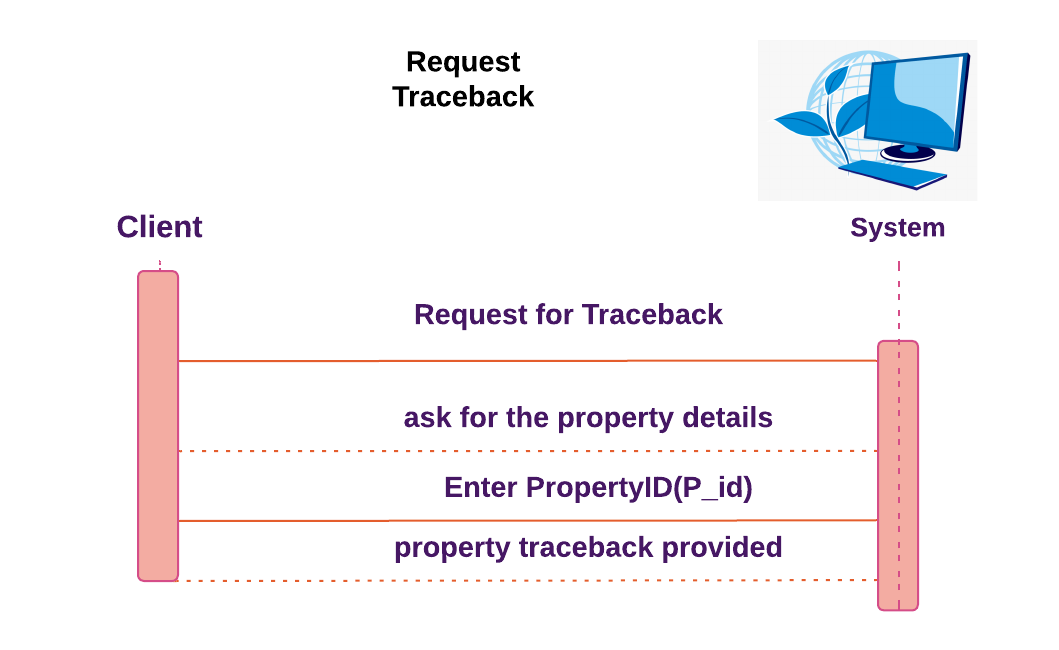
**5.**



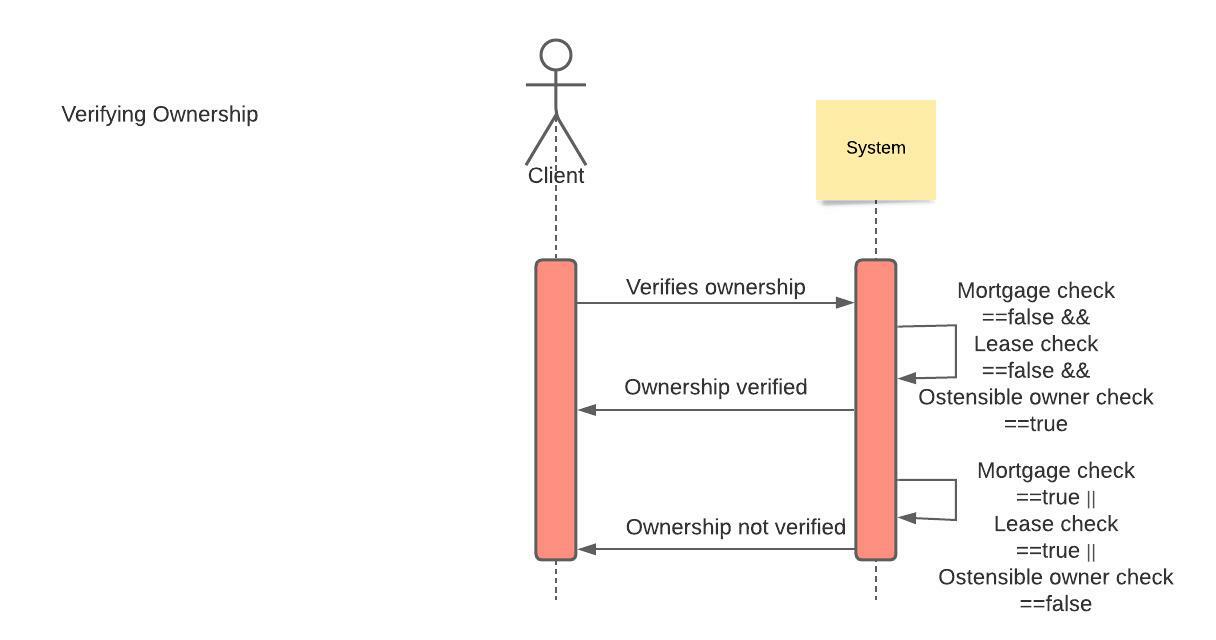
**6.**



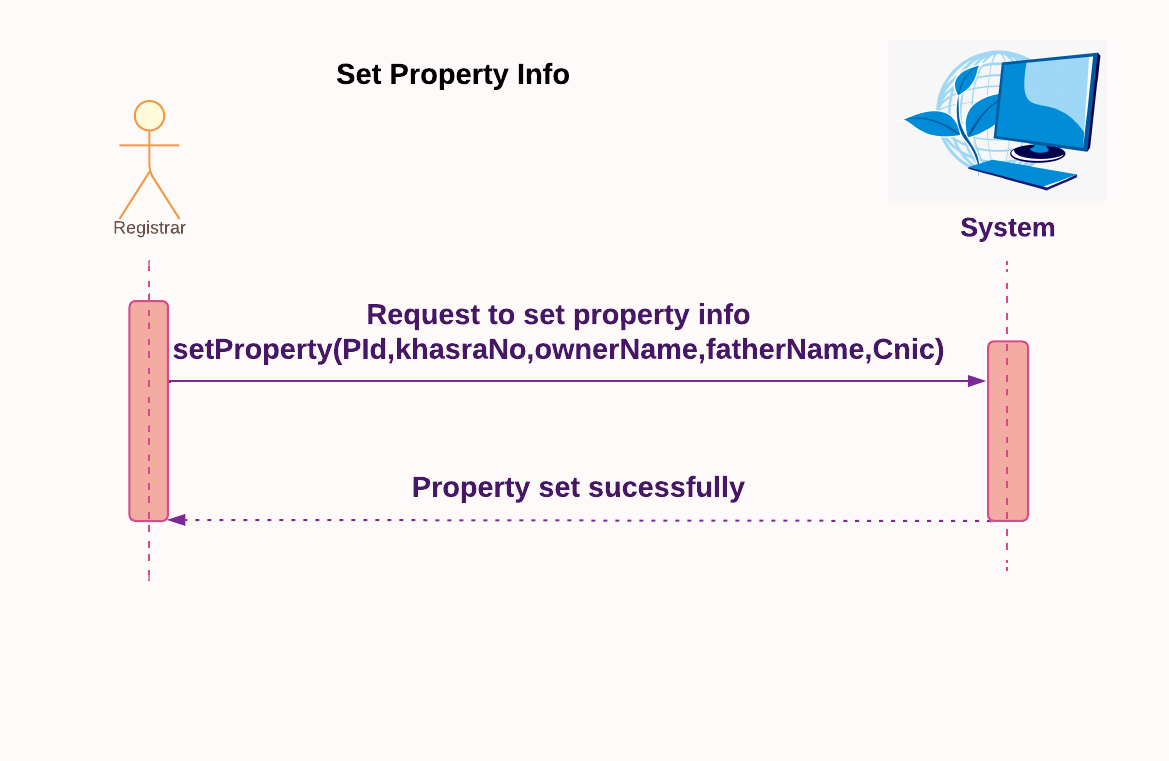
7



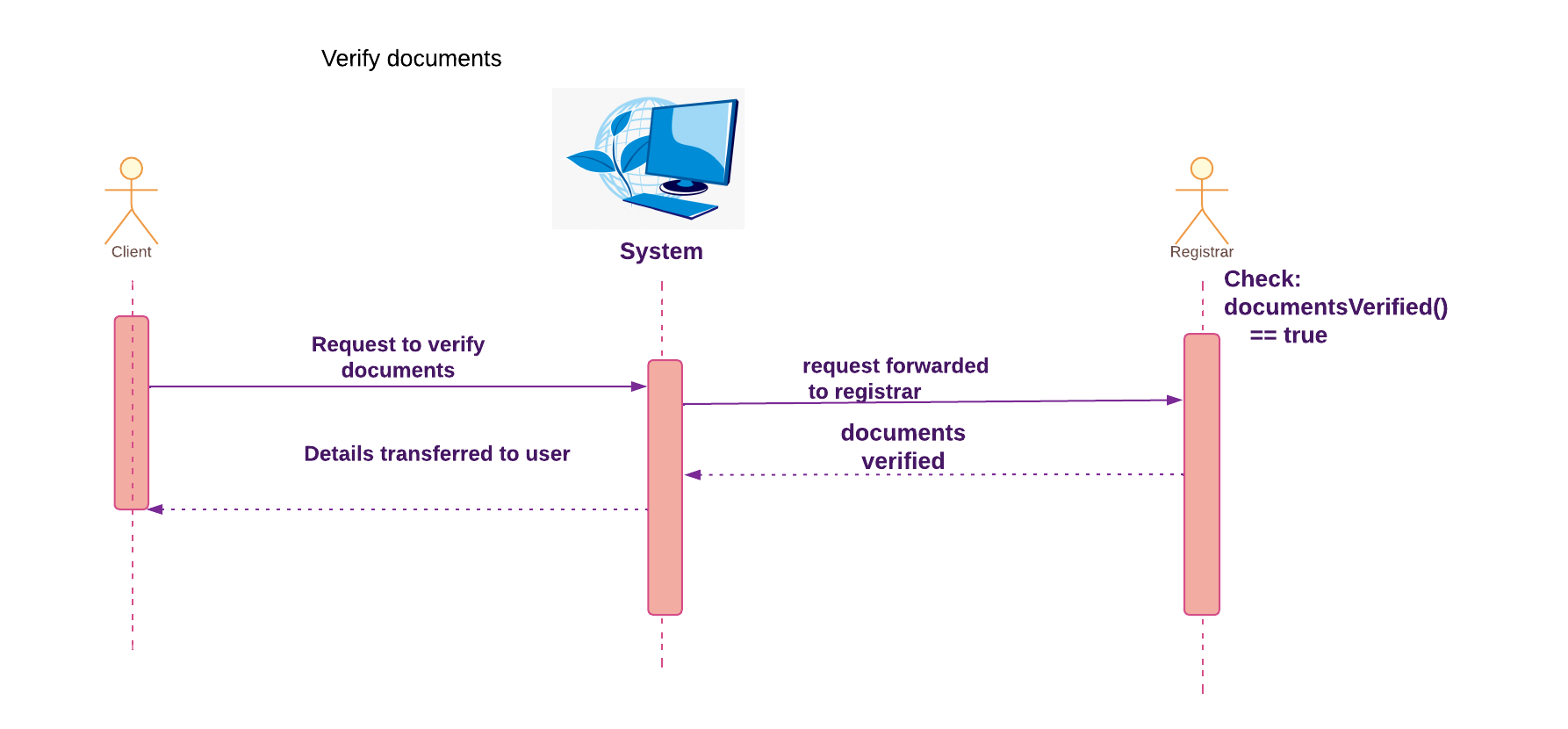
8.



9 .



**10 . verify documents**



**11 . view notification**

Text

Description automatically generated

**12. view my assets**

Text

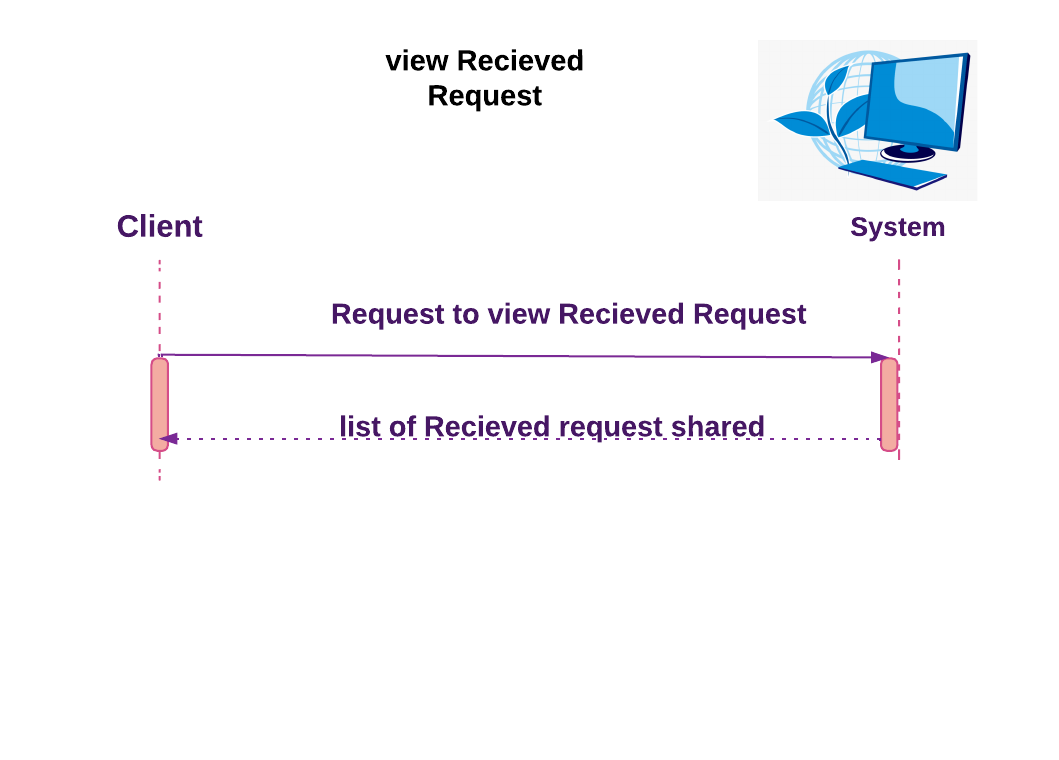
Description automatically generated with medium confidence

**13 view sent Request**

Text

Description automatically generated

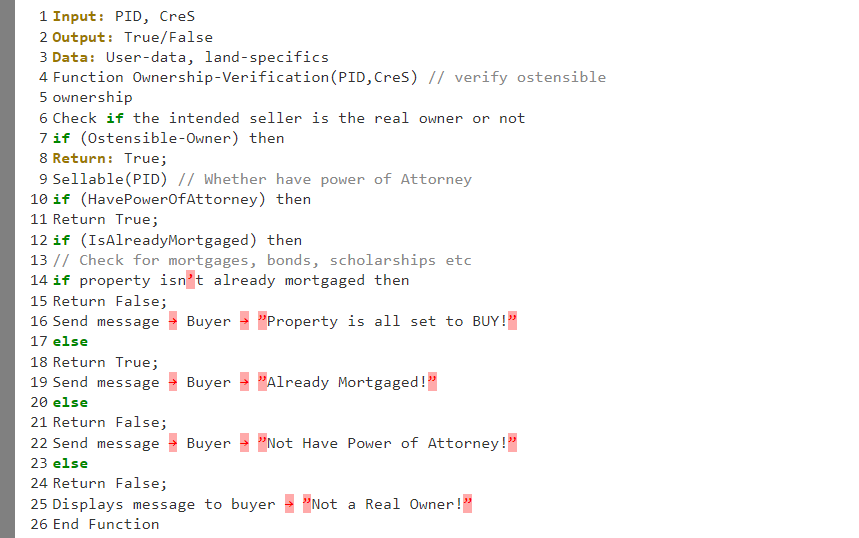
14 view Received Request



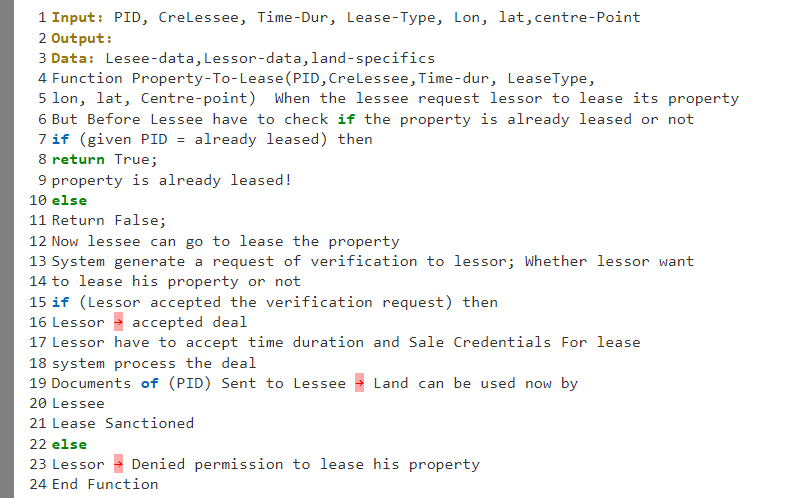
# **Implementation**

**5.1. Algorithm/Pseudo Code**

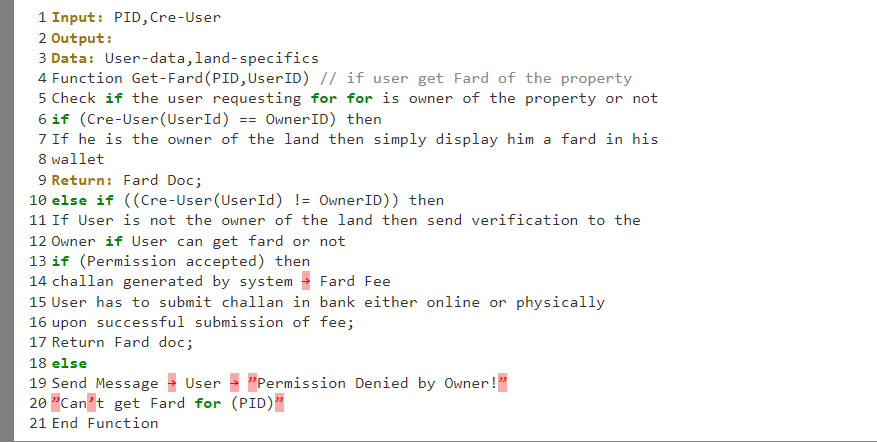
5.1.1. Owner Verification :



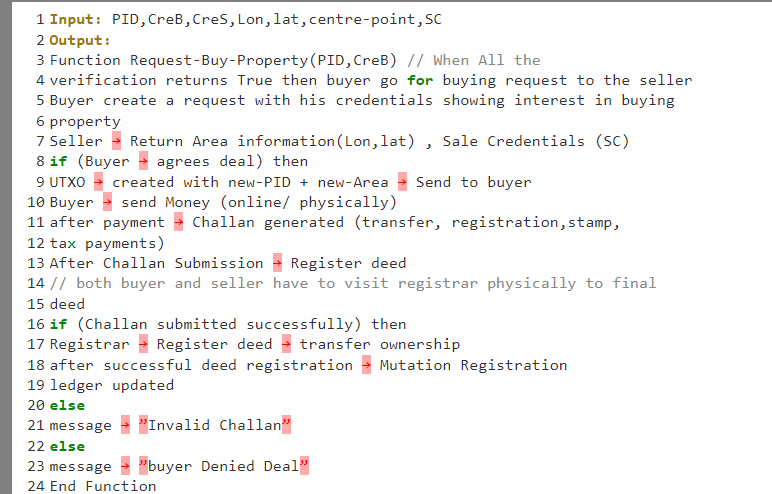
Lease Property :



5.1.3. Get Fard :



Buy Property :



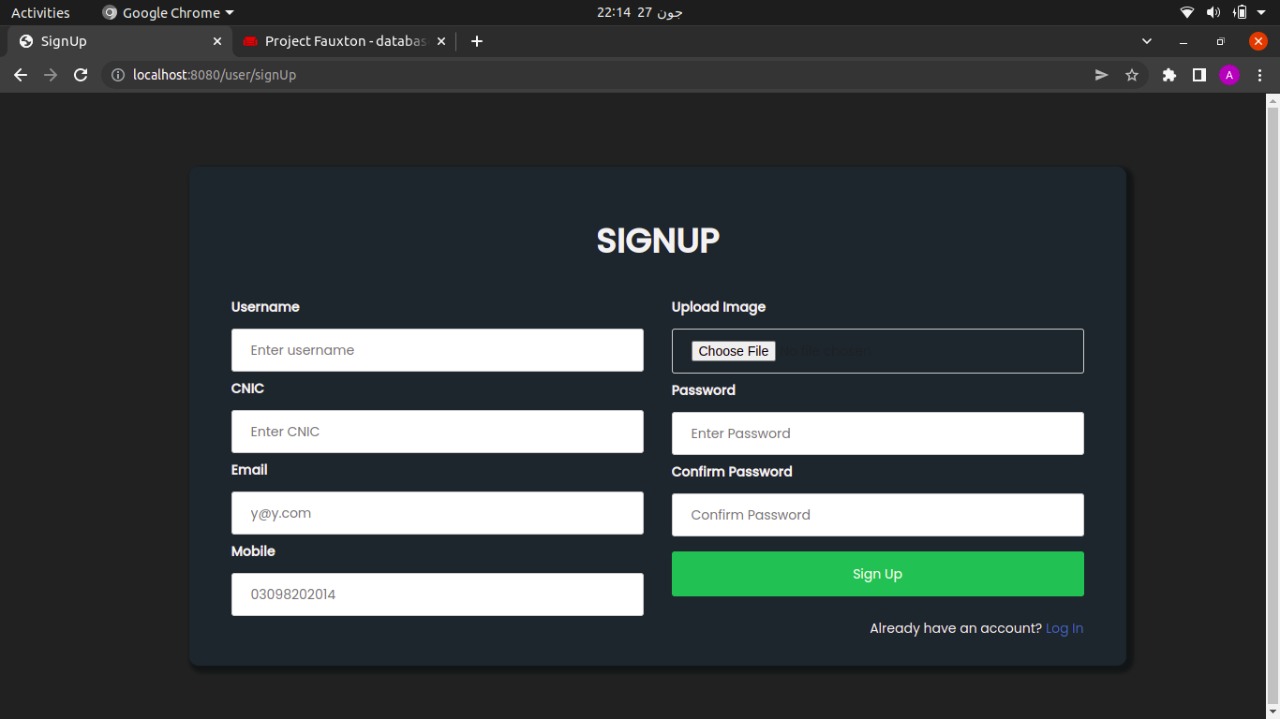
**5.2.External APIs**

*Table 5.2: Details of APIs used in the project*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of API** | **Description of API** | **Purpose of usage** | **List down the function/class name in which it is used** |
| Fabric shim api |  |  |  |
| Fabric contract api |  |  |  |
| Gateway client api |  |  |  |

**5.3. User Interface**

**5.3.1 Registration form**



**5.3.2. Client/buyer login**

**A screenshot of a computer

Description automatically generated with medium confidence**

**5.3.3. Registrar Login**

**Graphical user interface, application, website

Description automatically generated**

**5.3.4. Upload assets**

**A screenshot of a computer

Description automatically generated with medium confidence**

**5.3.5. Check traceback**

**Text

Description automatically generated**

**5.3.6. Advertised assets**

**Graphical user interface

Description automatically generated**

**5.3.7. Registrar dashboard**

**Graphical user interface, text

Description automatically generated**

**5.3.8. Client/buyer Dash board**

**Graphical user interface, application

Description automatically generated**

**5.3.9. Buyer/seller Profile**

**Graphical user interface, application

Description automatically generated**

**5.3.9. My assets**

**Graphical user interface, application, website

Description automatically generated**

**5.3.10. Apply for loan**

**Graphical user interface, website

Description automatically generated**

**5.3.11. Main Dashboard**

**A screenshot of a computer screen

Description automatically generated with medium confidence**

1. **Testing and Evaluation**

**6.1. Manual Testing**

* + 1. **System testing**

Extensive manual testing was performed on the system wit all the modules integrated with blockchain.

We have checked all the requirements. The result for every test is ‘PASS’.

* + 1. **Unit Testing**

Unit testing 1: Login test case

Testing objective: To ensure login form is working properly

: *Table 6.1: Login testcase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Test case/Test script** | **Attribute and value** | **Expected result** | **Result** |
| 1. | check user login after clicking on the ‘sign in’ button on login form | Email address  [Danialkarim@gmail.com](mailto:Danialkarim@gmail.com)  Password:  87654321 | After entering the credentials logged in successfully as client/buyer | Pass |
| 2. | Verify user login after clicking on the ‘sign in’ button on login form with correct email and wrong password. (Password should be 8 characters) | Email:  [Danialkarim@gmail.com](mailto:Danialkarim@gmail.com)  Password:  123ab | Invalid password | Fail |
| 3 | Verify user login after clicking on the ‘sign in’ button on login form with correct password and incorrect Email | Email  Danial3  Password:  87654321 | Invalid email provided | Fail |
| 4 | Verify user login after clicking on the ‘sign in’ button on login form with incorrect password and incorrect Email | Email:  Danial44  Password:  123aa | Invalid email format and invalid password | Fail |

* **Unit testing 2**: Add property

**Testing objective**: To ensure that the property is uploaded successfully by the registrar.

*Table 6.2: Add Property testcase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Test case/Test script** | **Attribute and value** | **Expected result** | **Result** |
| 1. | Verify registrar adding the property of seller after the registrar click on “add property” | Write the Cnic  Write the boundary values (latitude/ longitude)  Write khasra number | Property uploaded successfully | Pass |

* + 1. **Functional Testing**

**Functional Testing 1:** login with different roles

**Testing objective**: To ensure correct page is loaded.

*Table 6.3: Login testcase*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Test case/Test script** | **Attribute and**  **value** | **Expected result** | **Result** |
| 1. | Login as a buyer | Email address: [Danialkarim@gmail.com](mailto:Danialkarim@gmail.com)  Password: 87654321 | Login successful and the Dashboard of buyer is shown | Pass |
| 2 | Login as a Registrar | Email address: [Momin@gmail.com](mailto:Momin@gmail.com)  Password: 12345678 | Login successful and the Dashboard of Registrar is shown | Pass |

* + 1. **Integration Testing**

*Table 6.4: post project test case*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Test case/Test script** | **Attribute and value** | **Expected result** | **Result** |
| 1. | Login as a client | Email address:  [Danialkarim@gmail.com](mailto:Danialkarim@gmail.com)  Password:  12345678 | Login successful and the dashboard displayed | Pass |
| 2. | View Fard Sent Request | - | List of sent Fard request shown successfully | Pass |
| 3. | View notifications | - | List of received and sent request be shown to the client | Pass |

* 1. **Automated Testing:**
     1. **Tools used:**

*Table 6.5: Tools used*

|  |  |  |  |
| --- | --- | --- | --- |
| **Tool Name** | **Tool Description** | **Applied on [list of related tests cases / FR / NFR]** | **Results** |
| Selenium | Selenium is an open-source testing framework for web-based application  It is designed to support Automation Testing of functional aspects of different applications. | Sign in, Signup, view Fard Request, View Notifications, Buy Property | Pass |

1. **Conclusion and Future Work**
   1. **Conclusion**

The app is designed to overcome the loopholes and threats faced by the existing Land Management centralized systems which are always on the brick of bottleneck. Transactions are done through smart contracts which removes the fear of document theft and forgery.

Using decentralized system will reduce the double spending too.

Clients can easily Traceback any property and have clarity.

Our system provides the transparency and eliminates the involvement of any intermediate or third party.

* 1. **Future Work**

New emerging technologies such as Artificial Intelligence (AI) and Machine Learning can be incorporated with the suggested system to handle all the dynamic updates in the Blockchain environment, making the land management system more efficient, secure, and

responsive.

1. **References**

* <https://hyperledger-fabric.readthedocs.io/en/release-2.2/>
* <https://www.globalapptesting.com/manual-testing-best-practices>
* <https://fabrictestdocs.readthedocs.io/en/latest/glossary.html>