

# Land Title Management

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>70%

OF THE  
POPULATION

lacks legally registered land

1/3

OF COUNTRIES  
WORLDWIDE

do NOT digitally track property  
ownership

2/3

OF PENDING COURT  
CASE IN INDIA

results from land disputes between buyers and sellers

**Source:**

<https://www.worldbank.org/en/events/2016/08/22/land-and-poverty-conference-2017-responsible-land-governance-towards-an-evidence-based-approach>

<https://www.youtube.com/watch?v=upvK4qnIULg>

# Challenges in Land Title Management

## 1. Centralisation and Trust

The concentration of power in the hands of government bodies allows people in power to manipulate land registry data for personal gain. This undermines the public's trust in their government.

## 2. Forgery

A paper document serving as the proof of ownership of a land can be replicated, manipulated or forged

## 3. Document Damage/Loss

Printed documents are also subjected to damage if not well preserved and can be lost by the owner.

## 4. Complexity

The current procedure of sale/purchase of land involves complex interactions with multiple government departments that could take months to process. This is both time and cost ineffective.

## 5. Traceability

In many non-developed countries it is only possible to know the current owner of the land through paper documents

# Suitability of Blockchain for Land Title Management

## 1. **Centralisation and Trust**

The decentralised nature of blockchain allows everyone in the network can view the shared ledger, resulting in no lone organisation monopolising the data and no single point of failure. Blockchain also replace trust with cryptography.

## 2. **Forgery**

The transparent nature of blockchain allows for real-time verification of land ownership by anyone in the network.

## 3. **Document Damage/Loss**

Since transactions are digitised and each participant maintain their own copy of the ledger, it is difficult to corrupt or lose documented data.

## 4. **Complexity**

Interactions predetermined by smart contracts significantly simplifies the transaction process, saving both time and costs.

## 5. **Traceability**

Having a widely accessible record of past ownership would increase trust when exchanging land titles.

# Functional Requirements

- **Users can access information about lands in the system.**
- **Land owners can register their property on the system.**
- **Land owners can transfer the ownership of their lands.**
- When there are multiple land owners for a land title, an owner can sell only their partition or portion of the land.
- Both buyers and land owners must confirm a transaction for it to proceed.
- Legal documentations are stored off-chained and are referenced by the relevant transaction block.
- Public and private key-pair cryptography is use to sign each block on the chain.

# Non-Functional Requirements

1. **Availability:**

- a. All transaction records are publicly accessible on the blockchain.
- b. All user interfaces are web-based and can be accessed with a standard browser from PCs and mobile devices.

2. **Data**

**Integrity:**

Once made, transactions cannot be modified (immutability).

3. **Latency:**

- a. Confirmation of the transfer of land ownership is within a relatively short time frame (20 minutes)
- b. Users may need to make multiple queries while browsing the website and hence a low read latency is required.
- c. Allows a relatively high number of transactions to occur simultaneously (e.g. 50 per second)

4. **Scalability:**

Maintain performance with increasing demands regardless of the blockchain size.

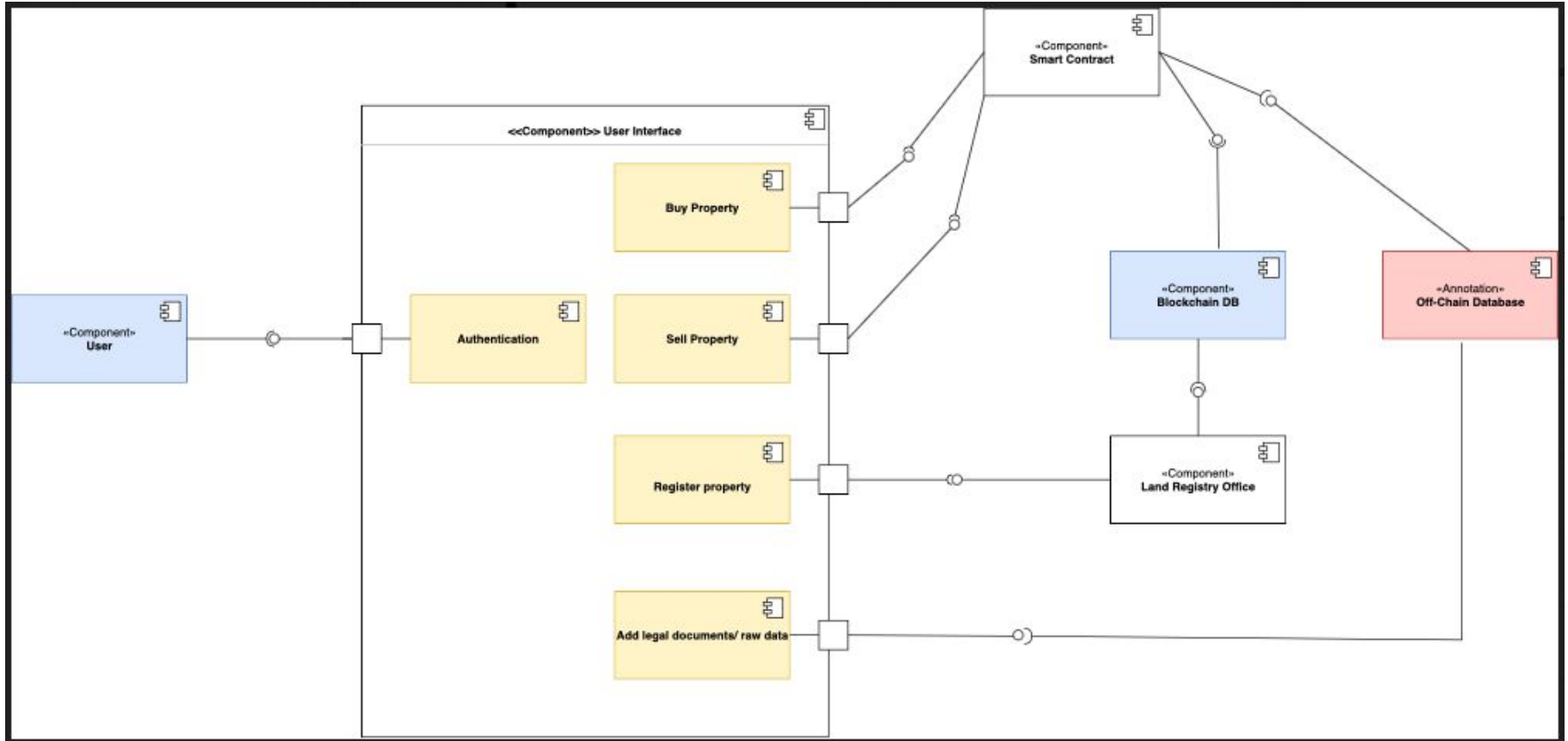
5. **Security:**

Identity of all relevant parties (e.g. clients and sellers) should be protected.

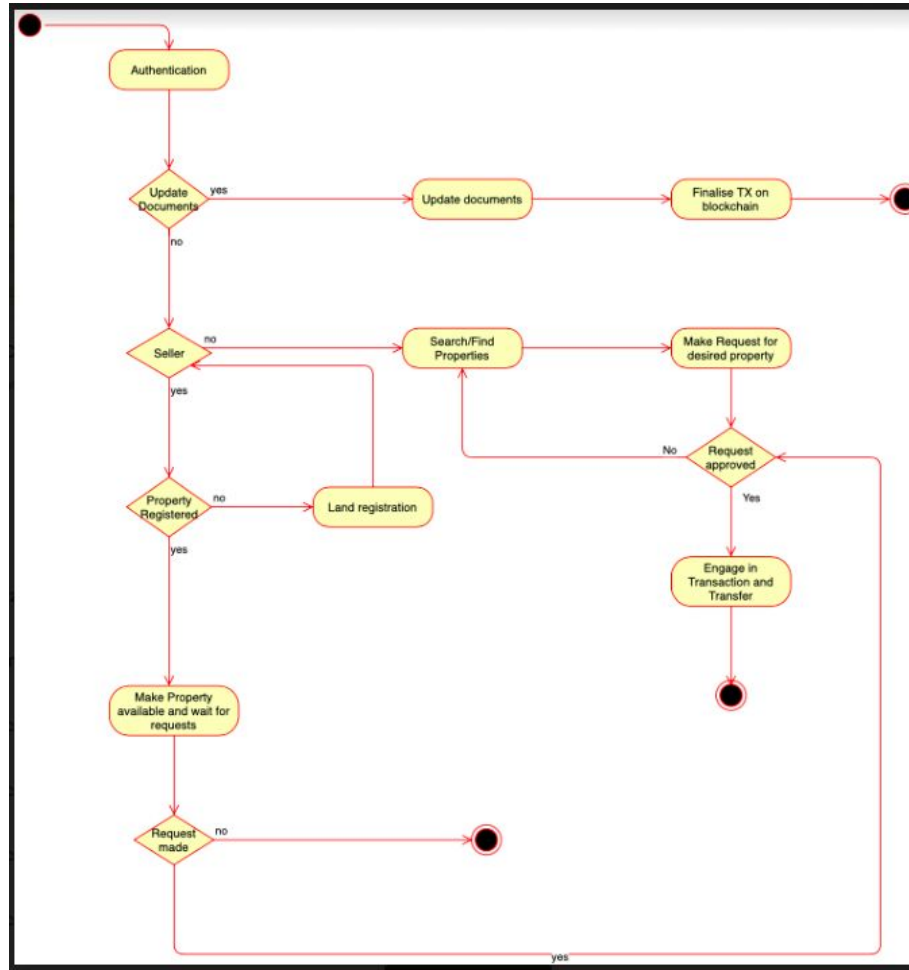
6. **Traceability**

The ownership history of a registered land is recorded and can be traced.

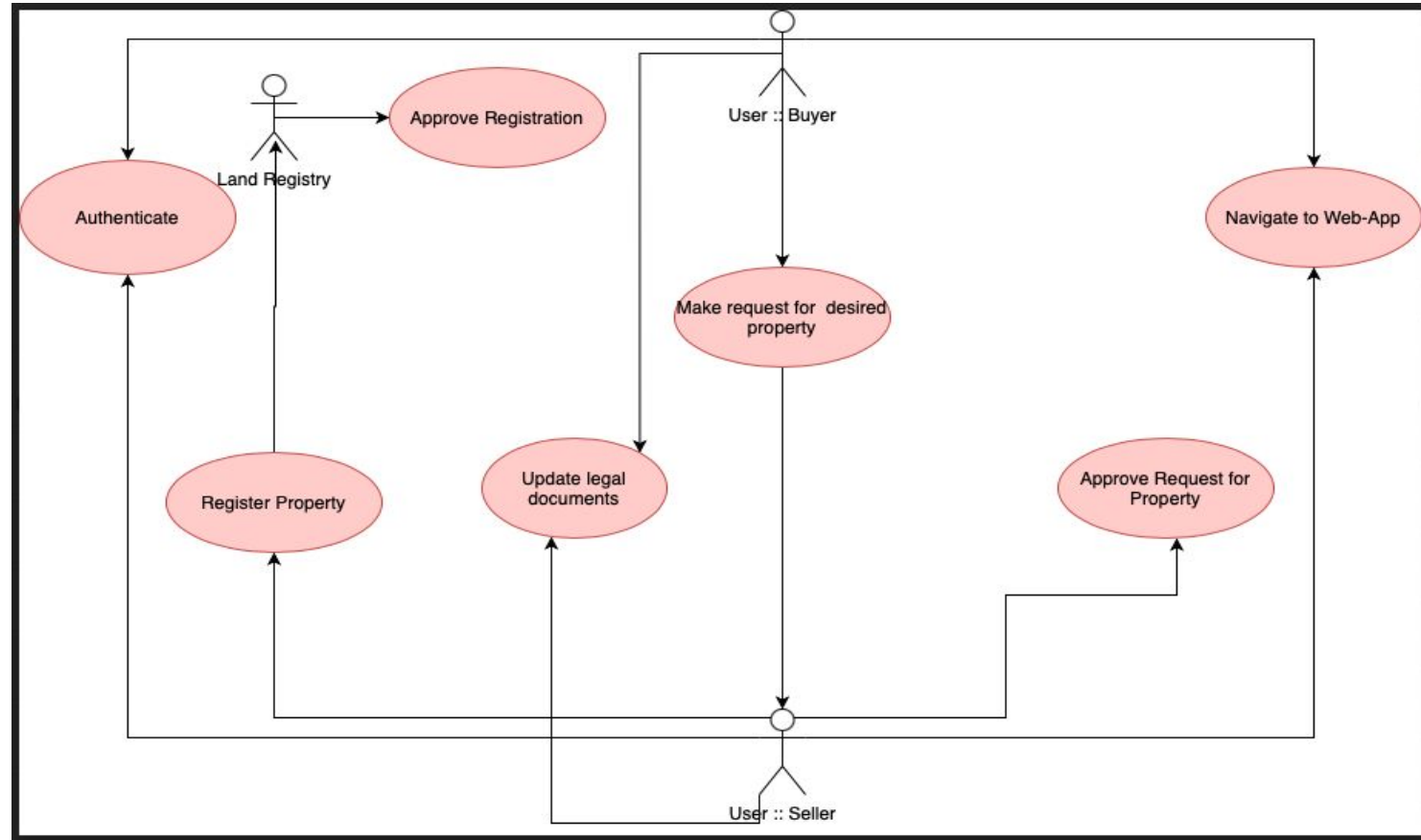
# Component UML Diagram - Viewpoint 1



# Activity Diagram - Behavioural Viewpoint 2

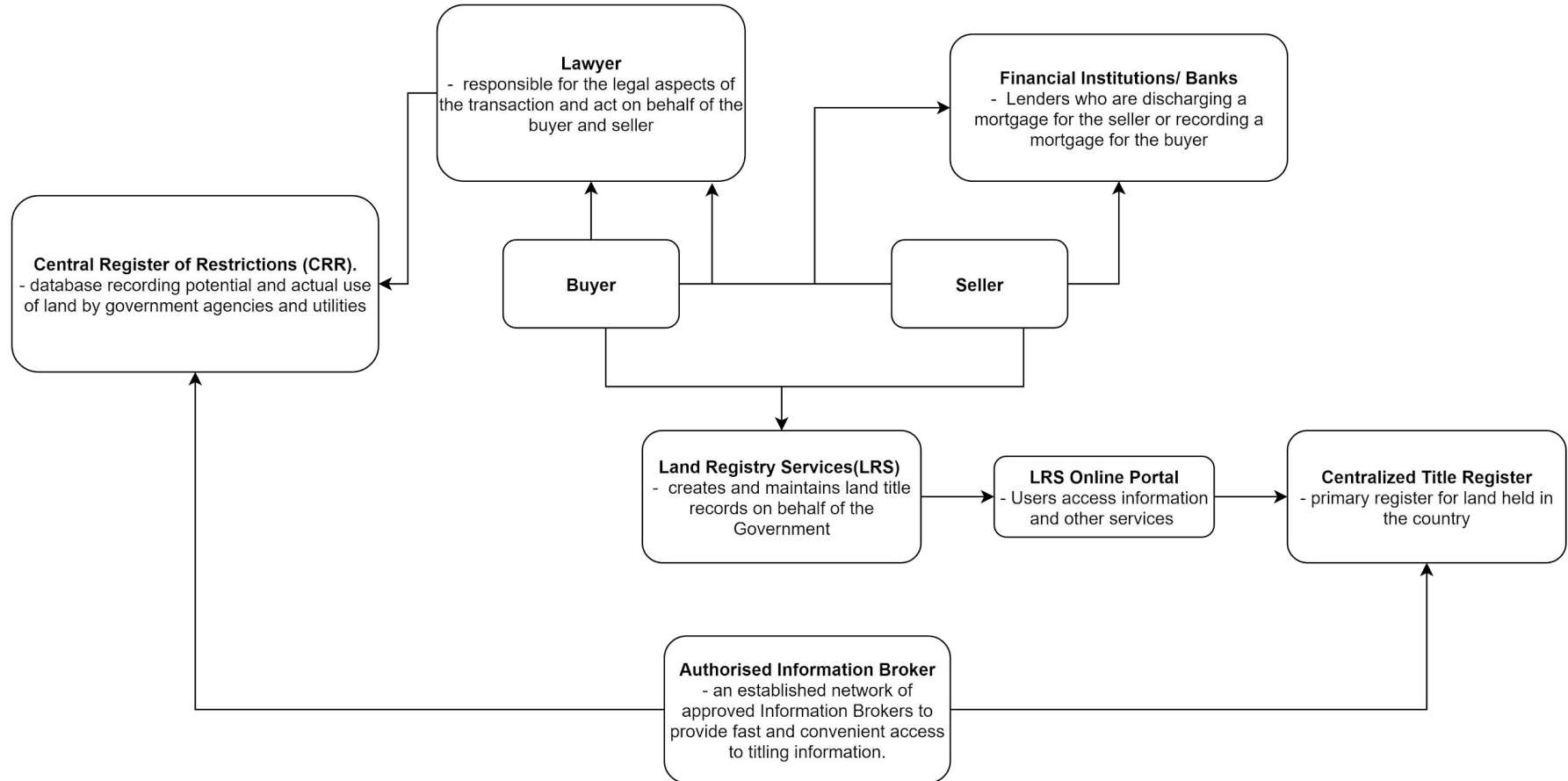


# Use Case Diagram





# Alternate Design: Current Land Registry Services



# Comparison

- Higher ***Availability***
- ***Integrity*** is increased drastically
- Improve data ***Security***.
- Better ***Read Latency***
- Transaction **history**
- **Operations**
- **Costs**

# Development Plan

- Selected Blockchain: Ethereum
- Off Chain Components:
  - Oracle: Chain Link -> Decentralized network of Oracles
  - Database: Cloud Database -> To store information related to the land such as pictures and documents.
- Division of Work:
  - Implementation and testing of Smart Contract 1: Tam and Ayaan
  - Implementation and testing of Smart Contract 2: Mison and Harshwardhan
  - Development of API and connecting to off-chain elements: Everyone

Week	Task
6	Acquire the necessary skills, including <ul style="list-style-type: none"><li>• Learning programming languages</li><li>• Further research on the state-of-practice for Land Title Management.</li></ul>
7	<ul style="list-style-type: none"><li>• Write the pseudocode for the smart contract,</li><li>• complete required tasks for the off-chain functionality,</li><li>• start working on the API</li></ul>
8	Implement and test code. Connect it to the API, complete Off-Chain elements and test.
9	Finalise all sections and make final adjustments to improve efficiency. Prepare for presentation.