



International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Authentication and Authorization for Land While Registration Using Deep Learning Model and Block Chain Technology

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ABSTRACT

Land Registration system is official process for storing land transactions and for authorizing ownership rights according to governance regulations. Historically the land registration is totally offline, the seller and buyer will prepare a sale deed and then they register at sub-register office for ownership transfer and mutation of details at local municipal authorities. Presently in our country, every state has its own implementation with their own comprehensive land revenue laws and reforms with online registration system. In some states, land registration system involves preparing documents, paying stamp duty and registration fees online and booking a slot at the Sub-Registrar's Office (SRO). Even the problem arising with land registration system like same owner will sell same property to multiple buyers. To eliminate this fraudulent issue, there must be proper authentication and authorizing the parties. In this paper, the objective is to implement proper online system using Artificial Intelligence sub technologies deep learning models like arcface Blockchain for decentralized system with proper alignment with governance rules, insight face framework for image recognition for registering the users, GIS system for land location recognition using boundaries. Even there is online registration system but no proper authorization. The deep learning method like Convolution neural network is likely to be implemented for proper face detection; it will use filters for feature maps and max pooling for identifying face with more accuracy. IPFS system is used for data storage.

Keywords: Land Registration system, deep learning algorithms, fraudulent system, CNN Algorithm, GIS, IPFS system

Introduction

Land is main resource for human life to survive. The chief things land provides for human survival are food, shelter, natural resources etc.,. Now-a-days it plays as a resource for economic development. It also supports country's biodiversity and ecosystem. Every family holds land as resource for their survival. So, to get owner rights, people must register a land according to land regulations which were implemented by our country. In this paper, the main thing is to implement land registration using AI Technologies. Presently in India, there exists land registration system according to governance regulations, every state has its own land rules and reforms. Some states have implemented online system for land registration but there is no proper authorization access which leads to a problem. The present online system is not delivering proper authorization and integrity. The problem is like owner will sell land to multiple buyers. The aim is to eliminate present issues by aligning certain constraints i.e. face biometric using deep learning algorithm CNN, Land area details should store with boundaries details using GIS technology and Block chain technology combined with IPFS for storing records with decentralized system. The research idea is to overcome concerns which were existed in present online land registration system. The research proposes deep learning algorithm like Insight Face heavily relies on Convolutional Neural Networks (CNNs) for its face recognition and analysis capabilities. GIS system is used for land boundaries recording and retrieval. In this proposed system, the owner authorization rights will be updated when land is sold. The idea in this paper will perform the land registration system with responsibilities which will provide integrity which serves the developing nation.

Objectives of study

- Land registration system using advanced convolution neural network will be used for face recognition for well accuracy.
- The owner details will be updated with authorization rights (Present system there is system like owner will sell same land to multiple buyers).
- There is decentralized system, blockchain system will provide copy of data to multiple nodes in network.
- The whole system must follow governance land regulations using smart contracts.

Literature Review

Mostly land registration system in developing countries, including India, has been paper-based or semi-digital. According to the World Bank, manual systems may lead to malpractices, inconsistent records, and unauthorized access with ownership rights. Even digital systems often rely on centralized databases, which is not with proper security, integrity, there is redundancy problem the whole system violating the governance policies. During British era in our country Land registration system was not unified but there were system like Zamindari system, Mahalwari system and Ryotwari system. These systems were implemented to grant authorization to land owners and collect revenue from land owners. Zamindars were authorized as land owners and they collected revenue from farmers. In Mahalwari system Land was divided into 'mahals' (villages), and the land revenue was collected from the village community as a whole. In Ryotwari system the land ownership was granted to cultivator and they will pay revenue to government. In India, The Registration Act of 1908 is a central law that provides the legal methodology for registering documents related to immovable property to ensure their authenticity, provide public notice of ownership, and store land records. The land was registered multiple times there were no proper constraint to verify the details of land whether it is sold or not, mostly these problems were arising related to ventures. Even in some states land registration system is through online but there is no redundancy and reliability. The database is centralized without proper normalization, the details of owner were not properly updating.

In some states the land registration system was online, the particular portal was used, in that stamp duty and registration fees paid online after completing uploads slot booking we must choose our preferable sub-registrar office after that all parties must visit sub-registrar for biometric and signing the documents. After that registration, the certified copies of the registered document and Encumbrance Certificate (EC) are issued within an hour. The gap is the system will not ensure the ownership authorization, same land was sold to multiple buyers there was no proper solution the issues were arising presently without solution.

Secure and Reliable Land Registry System Using QR Code and Blockchain

This model introduces a hybrid land registry solution by using QR codes and blockchain. It provides ownership accessibility by granting users retrieve property details via scanned QR codes.

Gap Identified: Limited to front-end, it does not address legal rules, or security challenges.

Systematic Review of Blockchain-Based Land Governance Systems

This comprehensive study analyses global assess (e.g., in Ghana, Georgia, and Sweden) and evaluates governance models, scalability issues, and stakeholder trust. It emphasizes that legal rules and political will are as important as technical innovation.

Gap Identified: Very few assess demonstrate integration of identity systems or scalability in large, diverse populations like India

Designing Safe and Secure Land Registration with Mutual Authentication

This study proposes a triple-ledger blockchain model (citizen-land-transaction) with mutual authentication to reduce fraud and manipulation.

Gap Identified: The system is promising but lacks a legal compliance mechanism and has not been tested at a governmental level

Proposed System

Land Registration system using AI for authentication of land and authorization of owner by using facial recognition using some Tools like Megaface which stores large data sets.

- Blockchain Technology is used for storing the owner details like (name, facial capture, land survey no, khatano, pattadar passbook number, district, mandal, village, state GIS System will store and retrieve both image details and spatial information. A ledger-based land registration system uses blockchain technology to create a secure, decentralized, and immutable record of all land transactions, storing property details and ownership history in blocks linked in a chain. each transaction is then timestamped and added to the blockchain, making it tamper-proof and transparent to authorized parties. Smart contracts can automate processes like fund transfers and ownership verification, enhancing security and eliminating the need for many attackers
- After requesting above details the sub-registrar officer must give authentication to land and authorization for owner then only registration is successful if not the owner must recheck the details. if there is successful registration the owner should get the acknowledgement with id for selling the land.
- If the owner sell the land to buyer the owner details must be updated which is not there in existing system of land registration system
- The seller don't have ownership rights on sold land this will be updated.
- The document is generated digitally after selling the land with authorized details
- The generation of Encumbrance certificate also will takes place after all process completion

TOOLS:

Frontend : HTML, CSS, JS

Backend : Python

Face Recognition : InsightFace + ArcFace embeddings

Dataset: MegaFace

Blockchain: Python-based chain

Storage: IPFS

Methodologies

A methodology for land registration system using blockchain Technology ,Insight Face opensource framework , and IPFS storage system combines an immutable transaction ledger to prevent unauthorized access, secure identity verification, and decentralized data storage

Core components

- A. Blockchain:** it is decentralized system across the network.in this blocks were created which will cryptographic hashes, which was generated by IPFS off-chain storage system while storing large files, each file has unique address for accessing the files. The blocks were distributed over each blocks in network.
- B. Arcface Model:** it is an model that used for face recognition and verification and Arcface uses Additive Angular Margin Loss function .in this there is an additive angular margin (m) which is used for measuring distance between the different feature embedding classes,intra class compactness also increased so that this will make features of the same identity to be clustered closer together and inter class distance also increased this will make features of different identities to be clustered according to similarity into different classes. The formulae for calculating loss function by adding additive angular margin as penalty is

The mathematics formulae used for calculating loss function is

$$L = - (1/N) * \sum_{(i=1 \text{ to } N)} \log((e^{(s * \cos(\theta_{yi} + m))}) / (e^{(s * \cos(\theta_{yi} + m))} + \sum_{(j=1, j \neq yi \text{ to } n)} e^{(s * \cos(\theta_{j}))}))$$

- C. IPFS (Inter Planetary File System):**IPFS is a decentralized storage system where files are stored in multiple nodes in network. Whenever file is stored it will generate a hash (unique content identifier) which is and address of a file.it is used for retrieval of file from node ,the hash will be copied to multiple nodes so it is easy for accessing the file in network.it works in peer to peer network.

Methodology for a land registration system

1. System setup

- 1. Develop smart contracts:** it will Creates a series of smart contracts on a blockchain platform to define the rules and regulations for registering the land ,authorizing the parties (or) the ownership transfer, and verification. These will manage the core logic of the system.
- 2. Establish a network:** Set up a permissioned blockchain network that includes authorized entities, such as government land registrars, registered users . This ensures that only trusted parties can validate transactions.
- 3. Integrate IPFS:** Configure IPFS for document storage. Create a system for uploading land-related files (deeds, land maps, Aadhar identity etc.) and retrieving their unique hash id.
- 4. Integrate Insight Face:** Implement the Insight Face SDK into the user-facing application for biometric authentication during registration and authorizing the parties with their ownership rights.

1. Land Registration by parties :

- The owner will register on the land portal after that camera will scan the face biometric of the owner using arcface model.
- The owner will upload the necessary documents and GIS system is used for retrieving land details that all were stored in IPFS system.
- The buyer also need to register for updating the details, he to also must give face biometric for land purchase
- They must pay stamp duty and registration fees so that they can get approval

2. Sub-registrar Approval :

- A designated government official sub -registrar logs in (also using Insight Face verification) to review the user's uploaded identity documents.

- After verification of E-KYC and documents, official will approve and generate document with unique id
 - That Document should be downloaded and thumb impression of both parties should be given on that document and upload to sub-registrar
 - Block will be created for the transaction details which will be attached to previous block in a blockchain
3. **Updating the details :**
- The owner details of land were updated using backend functions,
4. **Digital Certificate Generation**
- After Verification of certificate Digital certificate was generated

Acknowledgements

I am gratitude towards god and I am deeply Thankful to my parents for their support towards my research work and pride of my country which gives me platform to work

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