Land Value Assessment and Blockchain Land Registry

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Abstract: The initiative focusing on land valuation and integrating blockchain technology into land registries aims to revolutionize land management practices by tackling inefficiencies, fraud, and a lack of transparency. The utilization of blockchain technology ensures the security and immutability of record-keeping. The project consists of four key modules: an administrative segment for registering landowners and generating QR codes, a buyer interface for accessing authenticated property details via QR codes, a landowner platform for verifying ownership using Aadhaar numbers, and a predictive module for estimating land prices employing the random forest algorithm to forecast prices based on user inputs. This integrated system streamlines land registration procedures, enhances transparency, reduces the risk of fraud, and fosters trust in transactions, offering benefits to administrators, buyers, and landowners.

Keywords: Blockchain, Random Forest, Price Prediction.

1. Introduction

Blockchain technology represents a groundbreaking advancement, providing a decentralized, secure, and transparent approach to recording transactions. Key features like immutability, cryptographic security, and transparency are crucial. Traditional land registration systems often depend on manual or centralized database management, leaving them vulnerable to fraud, tampering, and inefficiencies. Challenges such as delayed ownership updates and lengthy valuation and registration processes are prevalent in such systems. The integration of this technology into land management initiatives aims to address various challenges by ensuring indisputable and transparent record-keeping practices while streamlining transactions. Utilizing diverse modules to facilitate tasks like registering landowners, creating QR codes for property specifics, and granting buyers access to verified land data enhances the efficiency of the system. Landowners share QR codes with buyers for detailed land information retrieval. Additionally, a predictive analytics feature, leveraging the

random forest algorithm, provides accurate valuation insights based on key parameters. By combining blockchain technology, QR codes, and predictive analytics, this initiative introduces a secure, efficient, and modern approach to land registration and valuation. Its primary goal is to mitigate the inefficiencies of traditional methods while fostering trust and transparency among stakeholders. The utilization of blockchain technology in a land registry addresses issues related to data gathering and storage, ensuring data confidentiality, validating ownership details, and tracking fund origins. The system compiles data on financial resources from various entities involved in land transactions, including financial institutions, individuals, bankers, and insurance providers. It includes information on the land extent acquired by individuals or businesses, along with historical transaction details to boost transparency. Moreover, it emphasizes data security and fault tolerance to prevent data loss and demonstrates methods for representing historical attributes. Maintaining land registry records can be arduous, particularly in reconstructing all transactions from a land registry ledger, which can be time- consuming. Given the presence of illicit activities, safeguarding the integrity of data stored in the blockchain network is crucial, leading to innovation in land record management.

2. Proposing System

The system's goal is to establish a secure, transparent, and efficient platform for assessing and registering land values. It achieves this by utilizing blockchain technology and predictive analytics, addressing the limitations of conventional land registration systems. It integrates modern technologies like QR codes, blockchain, and the random forest algorithm for accurate price predictions.

3. Existing System

The current system of land registration and valuation is largely dependent on traditional methods that are outdated, prone to errors, and susceptible to fraud. Most land records are managed in physical registers or centralized databases, making them vulnerable to tampering, loss, and mismanagement.

4. Methodology

4.1 Use Case Model

When applying blockchain technology for land value assessment and land price prediction, the process entails establishing a transparent, secure, and decentralized platform to record property data and transactions. Blockchain facilitates precise tracking of property characteristics, ownership history, and market trends, supporting reliable land valuation. A use case diagram could visually represent stakeholders such as property assessors, buyers, and regulatory bodies engaging with the blockchain system to ensure dependable land value predictions.

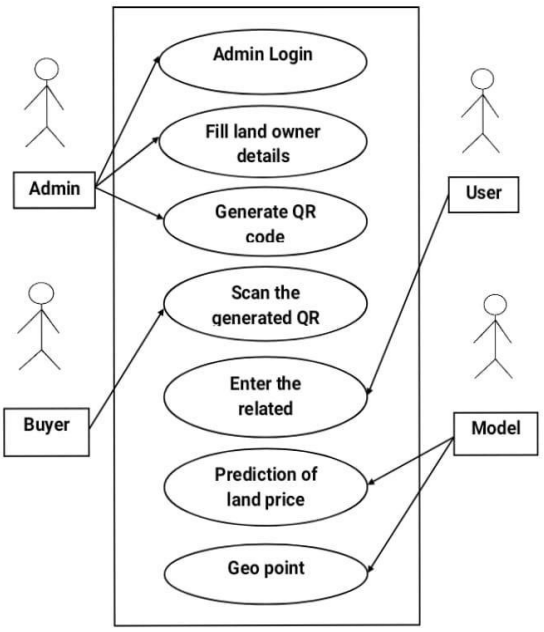

Fig 4.1: Use case diagram

The system for land price prediction begins with an admin logging in to gain access to the platform, allowing them to enter or update land-related data. After logging in, the admin fills in details about the landowner and specific property information, this will be crucial for further identification. Based on this input, the system generates a QR code as a unique identifier for the property, enabling quick access to the associated data. This QR code lets users scan and retrieve the landowner's information, granting access to supplementary features. Following this related parameters such as the land's size, location, and other relevant characteristics impacting its value are entered.

4.2 Flowchart

A flowchart illustrating the system depicted in the flowchart delineates the system's static framework by specifying classes, their attributes, methods, and interconnections. Critical classes within the system consist of Home Page, Land, Owner, Buyer, Admin, and QR Code. The Home Page class functions as the pivotal hub, facilitating access to various functionalities. The Owner and Buyer classes manage verification procedures, encompassing attributes like ID and contact information, alongside validation methods. The Admin class oversees land data oversight, involving functions for appending or validating land particulars and producing QR codes. The QR Code class incorporates QR code- specific information and functionalities for scanning and associating with land data. Inter-class relationships entail associations, such as the Admin overseeing the Land, and the Buyer engaging with the QR Code for accessing land specifics. The Land class embodies property specifics including location, dimensions, and ownership status, encompassing functions for modifying or retrieving these details. Furthermore, refining interactions could be achieved through clearly defined relationships such as the Owner linking land details with their profile and the Buyer authenticating land legitimacy through QR codes.

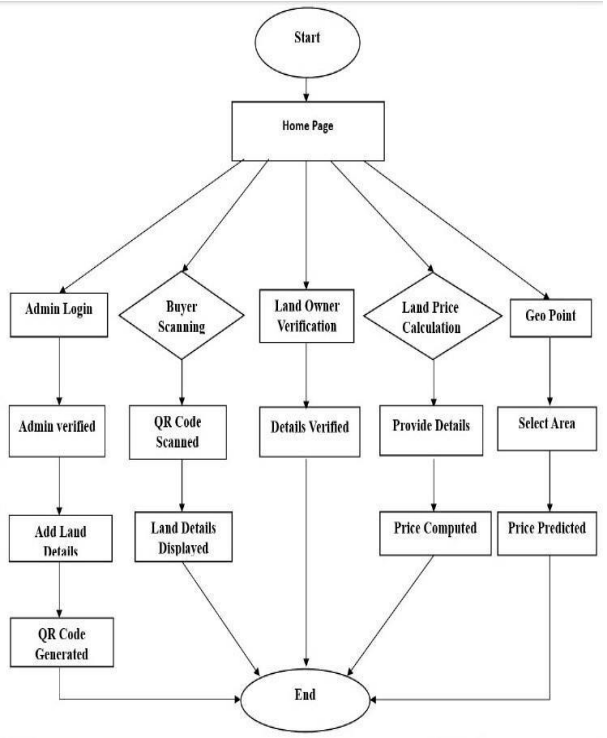

Fig 4.2: Flowchart

5. Algorithm

5.1 Random forest algorithm

This algorithm is widely utilized in land value assessment within the realm of machine learning. Its popularity stems from its capacity to effectively manage intricate, non-linear correlations among multiple variables. Land value assessment requires analyzing various factors that influence property values, such as location, property size, nearby amenities, neighborhood characteristics, and market conditions. Random Forest, being an ensemble method, builds multiple decision trees and combines their predictions to produce a more accurate and stable estimate of land value. Each tree in the forest makes a prediction, and the final output is based on the majority vote or the average prediction of all trees, making it robust against outliers and noise in data.

5.2 Algorithm Steps:

Step 1: Load the dataset.
Step 2: Create dynamic mappings for 'Location_Type' and 'Legal_Status'.
Step 3: Prepare the features and target variables.
Step 4: Split the dataset into training and testing sets (80% train, 20% test).
Step 5: Create and train the random forest model.
Step 6: Make predictions on the test set.
Step 7: Evaluate the model

- Mean Squared Error
- Root Mean Squared Error
- R Squared Error

Step 8: Save the trained model to disk.

6. Result

The Land Value Assessment and Land Registration project utilizing Blockchain Technology integrates a Random Forest algorithm to forecast land prices, resulting in remarkably precise outcomes. Here is a detailed examination of the project's findings.

6.1 Model Performance Metrics

The accuracy and effectiveness of the Random Forest model for land price prediction can be evaluated using various metrics. One key metric is the Mean Squared Error (MSE), which in this case is calculated to be 963,760.38847. The MSE represents the average of the squared variances between the predicted and actual land prices. A lower MSE suggests that the model's predictions closely align with the actual prices. Despite the seemingly high value of MSE, its interpretation should consider the scale of the price data, where a value of 963,760.38847 might be considered acceptable given the context.

Root Mean Squared Error (RMSE): 981.71289
RMSE is the square root of MSE, providing an interpretable error value in the same unit as the target variable (land price). An RMSE below 1,000 shows that the model makes only minor deviations from actual prices, ensuring reliable predictions.

R-squared (R^2): 0.99401
The R^2 value indicates that 99.4% of the variance in land prices is explained by the model's input features. This high R^2 score demonstrates the model's robustness and its ability to capture the complex relationships between land features and their prices.

6.2 Model Training and Deployment

After training the Random Forest model, it is saved as a reusable file. This enables the model to be integrated into the system for deployment without retraining.
The system successfully loads the saved model file for predictions, ensuring that it is ready for use in the land price prediction module. This persistence mechanism is essential for production environments where the model needs to be accessed frequently without the overhead of retraining.

6.3 User Input and Prediction

The system is designed to interact with users to collect land-related data for prediction. Examples of inputs include:

- Location Type (Urban, Semi-Urban, Rural)
- Proximity to City (in km)
- School and College Distance (in km)
- Land Area (in square feet)
- Public Transport Access
- Infrastructure Quality
- Legal Status of the property
- Crime Rate in the region

The Random Forest model effectively produces precise predictions for the market value of land by considering various parameters. This comprehensive approach ensures that the predictions align closely with real-world conditions, enhancing their accuracy and reliability.

6.4 Significance of Results

Accuracy: With an R^2 value of 0.99401, the model achieves near-perfect accuracy, making it highly reliable for stakeholders.

Efficiency: The deployment of the model ensures seamless integration into the land price prediction module, enabling instant predictions without re-training the model.

User-Friendly: The system prompts users for clear and relevant inputs, ensuring ease of use and accessibility for both technical and non-technical users.

7. Conclusion

The project on land value assessment and land registration incorporating blockchain technology aims to modernize land management practices. It ensures secure, transparent, and tamper-proof record- keeping through blockchain, simplifying access to verified property details via QR codes. Additionally, it leverages the random forest algorithm for accurate land price predictions. This system effectively reduces fraud, enhances trust, and streamlines transactions for all stakeholders by overcoming the inefficiencies of traditional systems. Ultimately, it presents a scalable and efficient solution for land registration and valuation processes.

8. References

[1] Christo, Mary Subaja and Sarathy, Partha and Priyanka, C and Kumari, Raj and others. (2019) "An Efficient Data Security in Medical Report using Block Chain Technology." 2019 International Conference on Communication and Signal Processing (ICCSP). IEEE, 2017. 0606-0610.

[2] Blockchain Application for Land Registry: Georgia and Sweden Leading"
A case study of early blockchain adoption in land registries in Georgia and Sweden

[3] Secured Data Storage Framework for Land Registration Using Blockchain Technology
Publisher: IEEE
Salman Humdullah; Siti Hajar Othman; Muhammad Najib Razali;
Hazinah Kutty Mammi

[4] A Secured Land Registration Framework on Blockchain"
Proposes a security-focused blockchain framework for land registration.
Published in the IEEE ISEA Conference on Security and Privacy.

[5] B. Venugopal and Greeshma Sarath, "A Novel Approach for Preserving Numerical Ordering in Encrypted Data", in 2016 International Conference on Information Technology (ICIT), Bhubaneswar,
India, 2016

[6] Blockchain-based Land Registration: Possibilities and Challenges Author(s): Maria Kaczorowska Subject(s): Law, Constitution,
Jurisprudence, Constitutional Law
Published by: Masarykova univerzita nakladatelství

[7] Land Registration: Global Practices and Lessons for India
July 2019
Publisher: Pentagon Press LLP, New Delhi – 110049

[8] Blockchain and Land Registration Systems
Nicolás Nogueroles Peiró EMAIL logo and Eduardo J. Martinez García From the journal European Property Law Journal 2017