

Secure and Reliable Land Registry System using QR Code and Blockchain Technology

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ABSTRACT

The land registry system serves as one concerning the most significant departments in any government structure since it preserves real estate ownership data. Effective lands administration is crucial for revenue generation and government. The traditional property registration mechanism fails to have the necessary guidelines and is prone to fraud and security threats.

A key component of social structure, economic development, and individual welfare across all cultures and civilizations has always been the transfer and ownership of land. characterized by failure and corruption. Recent technological advances have offered promising possibilities for addressing these problems. Our approach aims to provide a comprehensive guide on how to build a Land Registry system with the help of QR codes that integrates Blockchain Technology. By combining the flexibility and accessibility of QR codes with the immutability of blockchain, this solution improves efficiency, transparency, and security.

KEYWORDS

Land Registry, QR Codes, Blockchain, Smart Contracts, Security, Transparency, Integration, Efficiency, Property Transaction, Fraud Mitigation.

INTRODUCTION

Human society has relied on reliable land registration systems and the concept of property ownership since the beginning of civilization. Blockchain Technology with a mixture of Quick Response (QR) code offer a fresh perspective on creating a trustworthy land registry system. An integral part of the system's architecture are smart contracts and blockchain, which facilitate the automation of property transactions and offer immutable data storage. In order to make information collection and verification easier, each property is given a unique QR code that is linked to its blockchain record. Encryption, access restrictions, and tamper-proof QR codes are some of the mechanisms used to

safeguard data. Interoperability and requirement compliance are guaranteed by integration with existing systems. Thorough testing, user training, and continual monitoring are conducted before the system is implemented to assure its successful operation. A more open system with less room for deception is the goal of this novel scheme to improve property transfers. It is essential to construct a trustworthy land registration system in order to record property transactions and ownership. The inefficiency, secrecy, and fraud-prone nature of conventional procedures are well-known. Using a novel approach, this study develops a reliable land registration system by integrating blockchain technology with QR codes.

Quick response (QR) codes, which act as distinct identifiers for every property, form the basis of the system's architecture. Stakeholders can instantly access property information by scanning these QR codes with their mobile devices, thanks to the integration with the relevant blockchain data. Anyone may instantly confirm the legitimacy of property records, and the increased transparency is a result of this accessibility. Ensuring the security of any land register system is of the utmost importance when handling sensitive property data. The proposed solution employs multiple strong security mechanisms to counter this. Some notable inventions that could significantly change the management and protection of property rights are QR codes and blockchain [1]. To ensure that no unauthorised parties may read or change the data stored on the blockchain, access control techniques encrypt the data. This aids in thwarting unauthorised entry. Additionally, in order to ensure that QR codes cannot be altered or counterfeited, tamper-proof processes are employed during their manufacturing.

The proposed land registration system cannot be adopted or implemented without first integrating it with current systems and legal frameworks. When it comes to property registration, for example, the system follows all rules and laws to make sure everything is compatible and above board. Thorough testing is performed on the system before it is put into action in order to find and fix any problems or vulnerabilities. Stakeholders become acclimated to the new system and progress towards full proficiency through user training sessions. The efficiency, dependability, and security of the land registry system depend on regular monitoring and maintenance. It is possible to set up a trustworthy and safe land registration system by following the suggested method. Using blockchain and QR codes, the system simplifies real estate transactions, makes them more transparent, and reduces the likelihood of fraud. As a result, the market's efficiency and safety are enhanced.

CHALLENGES WITH LAND REGISTRY SYSTEM

First, we must understand the issues with current land registry systems, and only then can we look into the proposed solution. Land registry systems are relied on paper records, manual processes, and centralized databases, which ultimately leads to error, inefficiency, and risk. Because these institutions are not transparent and are not responsible, problems over property rights, fraud, and disputes over disputes have often arisen [2]. There are numerous parts of the world where social and economic progress are slowed down by antiquated land registration procedures. Due to the uncertainty surrounding property rights, investors are hesitant to fund infrastructure projects, threatening the livelihoods of millions of people. To tackle these issues directly, we must reevaluate how we administer and safeguard intellectual rights in view of the game-changing potential of emerging technologies. To facilitate the retrieval and validation of property records, land registry systems can include quick response (QR) codes as identifiers [3].

Types of Records	Physical (paper, files)	Becomes difficult to manage large volumes of data efficiently	Electronic with Blockchain
Data Entry and Retrieval	Manual processes	Leads to slower data entry and retrieval. Also, human errors are common leading to inaccuracies and delay.	Automated with blockchain security
Accessibility	Limited to physical location	Limiting access to authorized personnel only.	Remote access with blockchain
Data Security	Vulnerable to physical loss	Data breaches and unauthorized access are made more likely due to a shortage of adequate safety precautions.	Highly secure
Scalability	Limited	Scaling in order to efficiently handle expanding data quantities is challenging.	Scalable
Record Immunity	Susceptible to tampering	Susceptible to tampering, fraud, or change.	Immutable
Transparency	Limited	Records are not easily accessible which further leads to concerns	High due to blockchain
Decentralization	No	The centralization might result in a single point of failure, increasing the likelihood of	Yes

Aspect	Traditional Registry System	Limitations of Traditional Registry System	QR-Based Blockchain Registry System
		alteration or suppression.	
Trust	Moderate	Moderate trust because dependence depends on the integrity of those administering the records, which may lead to suspicion about data accuracy.	High due to blockchain
Adoption	Common	Traditional registration systems sometimes depend upon older systems and existing processes, which makes it difficult to embrace emerging technologies or deploy creative solutions.	Emerging

Table 1. Comparison between traditional System and proposed system.

LITERATURE REVIEW

(Deininger & Feder, 2009) "The Impact of Land Registration on Property Rights" Property rights, government, and development are the foci of this groundbreaking research into the effects of land registration. Assessing the efficacy of land registration in fostering tenure security, investment, and economic growth, Deininger and Feder examine empirical evidence from several nations. In order to promote sustainable development, the study stresses the significance of open and effective land register systems [4].

According to a 2010 study by Holden and Tefera, "Land Tenure Insecurity and Investment in Rural Ethiopia" Holden and Tefera look into the connection between unsteady land ownership and investments in rural Ethiopian farms [4]. Their survey results show that uncertainties about future land ownership have a detrimental impact on investment choices, output, and conservation initiatives. In order to encourage investment and boost agricultural development, the report stresses the significance of protecting property rights.

"Blockchain Technology for Land Governance Opportunities, Challenges, and Outlook" As stated by Kemper and Lynch (2018) Blockchain technology has the ability to revolutionize land governance systems, which Kemper and Lynch investigate [5]. Using case studies and interviews with experts, they examine the pros and cons of using blockchain technology for land registries. This research sheds light on the institutional, legal, and technical factors that should be considered before implementing blockchain technology inland administration. "QR Code Technology in Land Administration A Review" "Abdullahi et al., 2017" argues When it comes to land administration, Abdullahi et al [6]. give a thorough analysis of QR code technology. They talk about how cadastral mapping, property registration, and QR codes can be used in such fields. The research looks at possible ways to improve the efficiency of QR code-based systems in land management and assesses their advantages and disadvantages. The article "Smart Contracts for Land Administration A Review of Use Cases" was published in 2018 by Zevenbergen et al [7]. The article by Zevenbergen et al. discusses smart contracts and their applications in real estate transactions and land administration. Land registration, property transfers, and dispute resolution are just a few of the procedures that they examine as potential applications of smart contracts. This research looks at how smart contracts could improve land governance in terms of efficiency, openness, and safety.

"Blockchain-Based Land Registry A Case Study in Ghana" A study conducted by Salisu et al. in 2020 demonstrated A case study of a pilot project in Ghana's land register that used blockchain technology is presented by Salisu et al. They look at the steps taken, problems solved, and takeaways from using blockchain technology in a real-world setting for land administration [8]. The study sheds light on the real-world consequences of using blockchain technology for land administration.

"Assessment of Land Registration Systems in Sub-Saharan Africa" Per Toulmin and Quan (2000) Toulmin and Quan evaluate Sub-Saharan African land registration systems,

paying special attention to how well they safeguard land rights and advance sustainable development. Problems with land registration procedures, including inaccessibility, corruption, and gender inequality, are highlighted via case studies and comparative analysis [9]. In order to strengthen land governance in the region and tackle these difficulties, the report recommends reforms.

BACKGROUND

The background section's goal is to set the stage for the current study or project by providing relevant historical information. Background information, relevant theories and concepts, and specifics about the subject or problem are typical components. In this part, you will get a sample backdrop for a study that examines the use of QR and blockchain technologies to create a secure land register system. Modern societies rely heavily on land registration systems to document, manage, and transfer ownership of property. In contrast, the conventional methods of recording land titles are infamously cumbersome, difficult to understand, and open to fraud and corruption. Problems like these can lead to a decrease in economic growth, social stability, and property ownership disputes. Answers to the issues plaguing land registry systems have been offered by recent technological breakthroughs, which is positive.

Blockchain and QR codes are two technologies that have gained a lot of interest recently because of their potential to make property data more trustworthy and secure. Despite being first developed for tracking automobile parts in manufacturing, quick response (QR) codes have found widespread use across other industries due to their ease of use and versatility [16]. In addition to numerical data, text, and online links, these two-dimensional barcodes can store vast amounts of information. Property information can be quickly and readily verified with the use of quick response (QR) codes, which can be utilized as identifiers in land register systems. Blockchain technology, the foundation of cryptocurrencies like Bitcoin, creates decentralized and immutable ledgers of monetary transactions.

Table 2. List of different authors and their proposed method

Agrawal, Aniket, Kamalakanta Sethi [1].	Ballot paper data	Blockchain, QR Codes	Proceedings of the International Conference on Cybersecurity	100% accuracy in voting results
Prasad, G. B., Shreya, P., & Shailaja [12]	Product data	Blockchain, QR Codes	Turkish Journal of Computer and Mathematics Education, 2023	90% accuracy in product data
Pal, K. and Kumar, C.R.S. [13]	Document Data	Blockchain, QR Codes	Data Management, Analytics and Innovation: Proceedings of ICDMAI 2020,	95% accuracy in document data
Soner, Swapnil, Ratnesh Litoriya [14]	Land Registry data	Smart Contracts, Blockchain Technology	Wireless Personal Communications, 2021	99.7% accuracy in land record registration and retrieval
Muhammad Sajjad, et al [7].	Land Registry data	Smart Contracts, Blockchain Technology	Hindawi Publishing Corporation, 2022	95% accuracy in land record registration
Shuaib, Mohammed Daud, Salwani [15]	Land Registry data	Smart Contracts and Blockchain Technology	TELKOMNIKA (Telecommunication Computing Electronics and Control)	90% accuracy in land record registration and retrieval
Maaithah, Sarah, Mohammad Qatawneh, [2]	Ballot paper data	Blockchain, QR Codes	International Conference on Information Technology (ICIT). IEEE	100% accuracy in voting results

Author	Dataset Used	Methods Applied	Conference/Year	Performance
Muhammad Ali, et al [10].	Document data	Blockchain, QR Codes, two-factor authentication	IEEE Access, 2020	98% accuracy in document data
Muhammad Ali, et al [11].	Medical Record data	Blockchain, QR Codes	IEEE Transactions on Biomedical Engineering, 2022	99.9% accuracy in medical record access and sharing

By cryptographically connecting each recorded transaction to the one before it, blockchain technology ensures transparency and eliminates tampering. Blockchain technology has the potential to enhance and secure land register systems by cutting out intermediaries and rendering property data immutable. While both blockchain and QR codes show potential for enhancing land registry systems, a combination of the two could address many issues plaguing present approaches [17]. A more dependable, efficient, and trustworthy land registry system can be built with the aid of stakeholders by combining the immutability and security capabilities of the blockchain with the portability and flexibility of QR codes.

Blockchain and QR codes have been studied for their possible applications in many different fields, including healthcare, supply chain management, and finance. Researchers interested in land registry systems have paid surprisingly little attention to the integration of various systems. By investigating the pros and cons of combining QR and blockchain technology into a safe land registration system, this study aims to fill that information gap. Through an analysis of the system's technological, legal, and institutional aspects, this research seeks to provide light on the potential advantages, disadvantages, and consequences of land governance. Ultimately, our goal is to contribute to the discovery of innovative approaches to improving the security, transparency, and efficiency of land registry systems with the aim of advancing social justice and achieving sustainable development.

evidence such as digital signatures. Before executing a transfer of ownership, the smart contract checks the ownership rights of the parties involved to ensure that only legitimate transactions are carried out.

Smart Contracts can hold assets or payments until specific criteria are met. With the help of escrow smart contracts, buyers can keep their money or other assets secure until they formally acquire title to the property. When all conditions are satisfied, the vendor receives payment from the smart contract.

Conflict Resolution By incorporating dispute resolution mechanisms into smart contracts, parties can have their conflicts automatically addressed. To avoid wasting time and money on court proceedings, a smart contract can initiate arbitration or mediation to resolve a dispute over the terms of a real estate deal.

SMART CONTRACTS FOR LAND TRANSACTIONS

Smart contracts integrated into a land registration system streamline land transactions, do away with superfluous administrative work, and make property transactions more transparent and secure. Legal and regulatory concerns, technological issues with scalability and interoperability, and other such issues are among the many challenges that arise when implementing smart contracts for land transactions [18]. Smart contracts are one way that land registration systems could automate and secure land transactions. These contracts, when deployed on blockchain networks, eliminate intermediaries by executing themselves to enforce predefined standards and conditions.

One possible use case for smart contracts in real estate deals is this: -

Efficient Handling of Financial Transactions Use of smart contracts allows for the automation of real estate transactions such as registrations, modifications, and deed transfers. Once certain requirements are met, including payment completion or ownership verification, the transaction is automatically executed and the blockchain is updated with the applicable property data [19].

Verification of Property Ownership Smart contracts can verify ownership of property by comparing cryptographic

Transactions Are Conditional Smart contracts allow you to make conditional transactions by triggering certain actions based on predefined circumstances. Smart contracts allow for the conditional transfer of property upon the occurrence of specific events, such as the approval of zoning permits or the results of a building inspection. As a result, you can be assured that all transactions will be carried out efficiently and in compliance with all laws.

Enduring Evidence Smart contracts ensure that the blockchain keeps an unchangeable and transparent record of all transaction details. By keeping an immutable record of all land transactions, this removes the chance of fraud, disagreements, or corruption. When stakeholders have faith in the land registry system, they can check the legitimacy of property records whenever they choose.

Establishing Linkages to Existing Facilities Smart contracts are easy to integrate with government databases, land registration systems, and current legal frameworks. Smart contracts ensure that transactions based on smart contracts comply with all relevant requirements and allow for data interchange and reporting through integration with third-party systems.

PROPOSED METHODOLOGY

Our approach towards this traditional registry system is to make it digital so that the data can be easily seen and will be accessible for all. To make it easy and secure, we have combined Blockchain and QR Code.

In blockchain, we have used Smart Contract, Ethereum, Ganache and MetaMask.

Smart contract are programs that automatically gets executed or runs when a certain criterion is met or fulfilled. Smart contract can also be termed as digital agreement. We have used Solidity language to write code for smart contract.

Ethereum is a bitcoin which we have used in our project for the transaction purpose. Also, we have used Ganache here.

Ganache is a development tool which is used to run Blockchain on a local computer. It will create ten accounts in a blockchain or ten networks of a blockchain all of which will be having hundred Ethereum by default. If any transaction is done by any account, it automatically gets updated and is shown here.

Further, for using MetaMask, we have applied it in the chrome extension. MetaMask is a cryptocurrency wallet that is used to interact with Ethereum blockchain. It allows users to access their Ethereum wallet.

Above of all this, we also have combined blockchain with the QR Code. As soon as the payment is done and the OTP is verified, we have provided an option to generate QR Code which on scanning provides information about the user.

Below is a flowchart that describes our work:

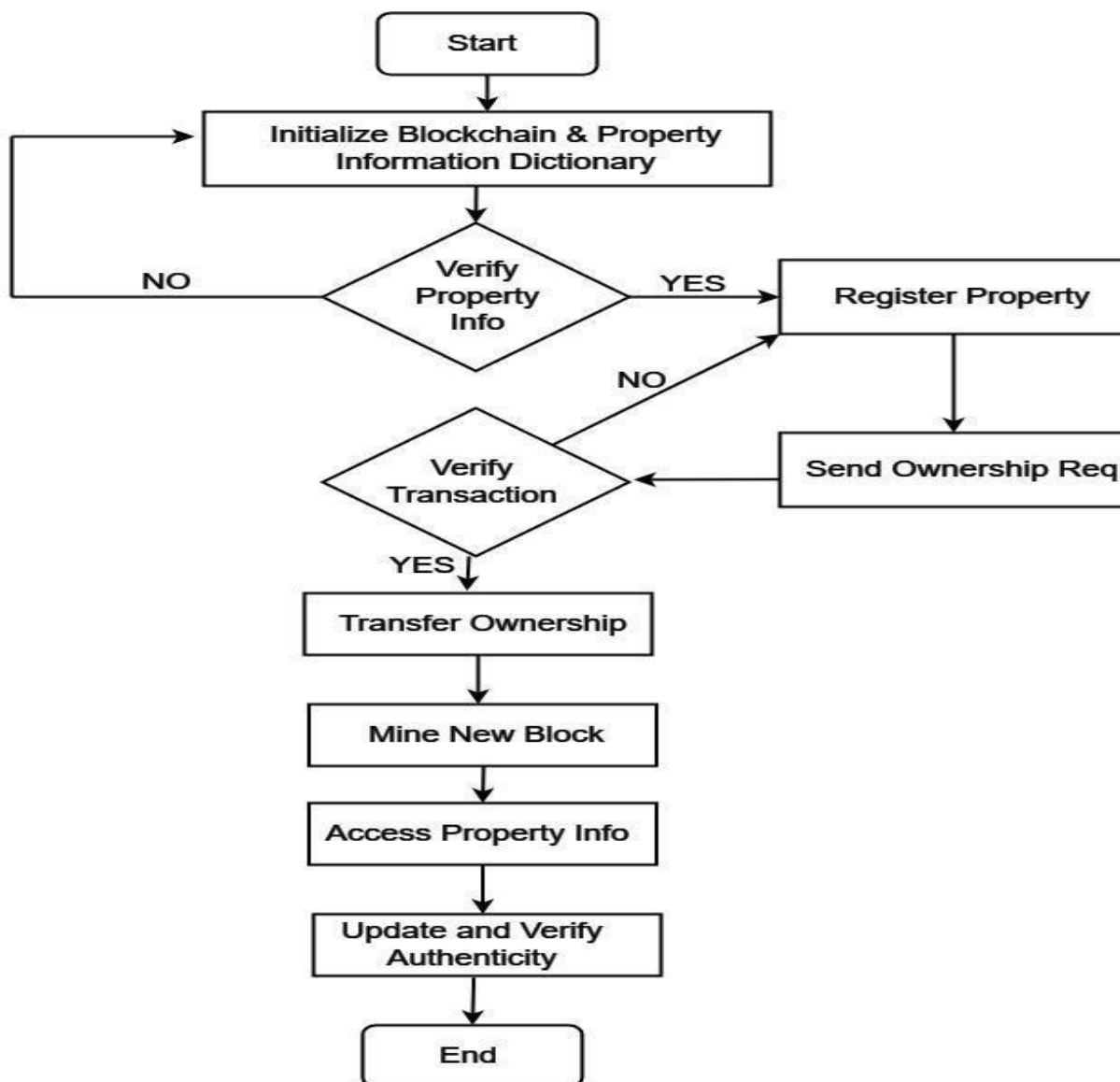


Fig1. Flowchart of Land Registry System

Further, below we are providing the algorithms that we have used in our project:

Algorithm for generation of OTP:

- a. Get the value of the email input field using it's ID ('email')
- b. Generate an OTP for authentication.
- c. Display an alert message indicating that the OTP has been sent to the user's email.

Algorithm for validation of OTP:

- a. Set the variable otp_val to a predetermined value (in this case, 123) representing the expected OTP.
- b. Get all input elements in the document and store them in the variable input.
- c. Get all elements with the class "form-control" and store them in the variable val.
- d. Check if the value of the first element with the class "form-control" (assuming there is at least one such element) is equal to otp_val:

If true:

- i. Display an alert message saying, "Email Address Verified".

If false:

- i. Display an alert message saying, "Invalid OTP".
- ii. Return false, indicating that the validation failed.

End Function

Algorithm for Payment process:

Initialize web3 and contract variables

Set Contract Address and ABI

Connect() {

 Try to enable MetaMask

 If successful, connect to MetaMask. If unsuccessful, connect to

local provider

}

Deposite() {

 Get input value from HTML input field

 Get users' account using web3.eth.getAccounts()

 Call contracts' deposit_money method with input value

 Redirect to new page after transaction

 Clear all input fields and update the balance displayed

 Handle any transaction errors

}

Show_balance () {

 Call contract's getBalance method

 Update the balance displayed on the webpage

}

SYSTEM ARCHITECTURE

The system architecture for a secure land registry system utilizing QR code and blockchain technology involves the integration of various components to ensure transparency, security, and efficiency in property transactions. Here's a high-level overview of the system architecture: -

transaction initiation can be accomplished by user interaction with the interface. The experiment starts with the making of the Registration page:

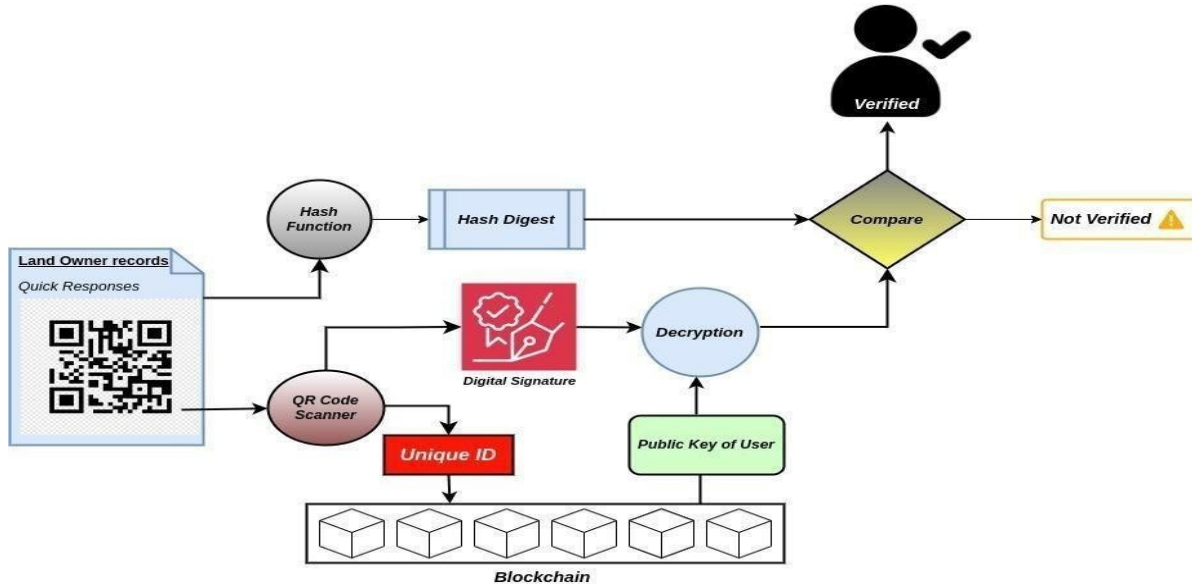


Fig2. Verification on land registry system

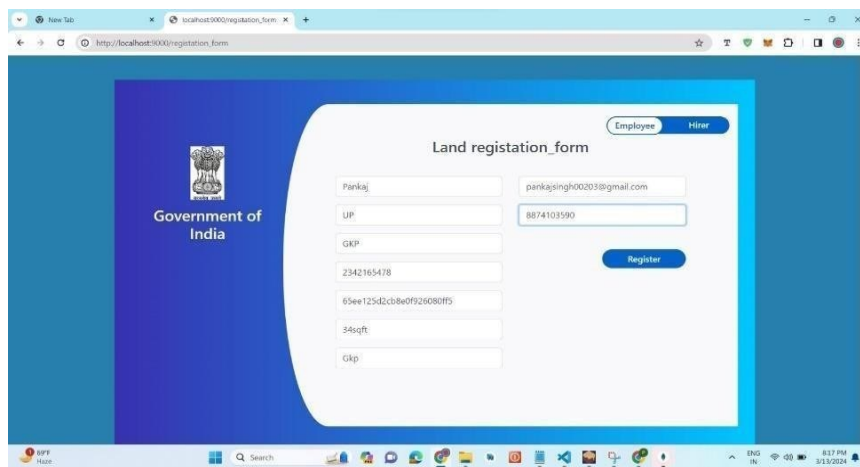


Fig3. Registration Page for Land Registry

a. Interface for the User

All parties involved—proprietors, stakeholders, and society at large—stand to gain from the secure land registry system's use of QR codes and blockchain technology, which work together as an integrated whole to improve the safety, efficiency, and openness of property transactions. Owners, purchasers, vendors, and public servants can all access the land registry through the system's user interface. Web and mobile apps that prioritize accessibility and user experience are part of it. Activities like property registration, verification, and

Then, we move for the Payment Gateway and for this we connect with the MetaMask

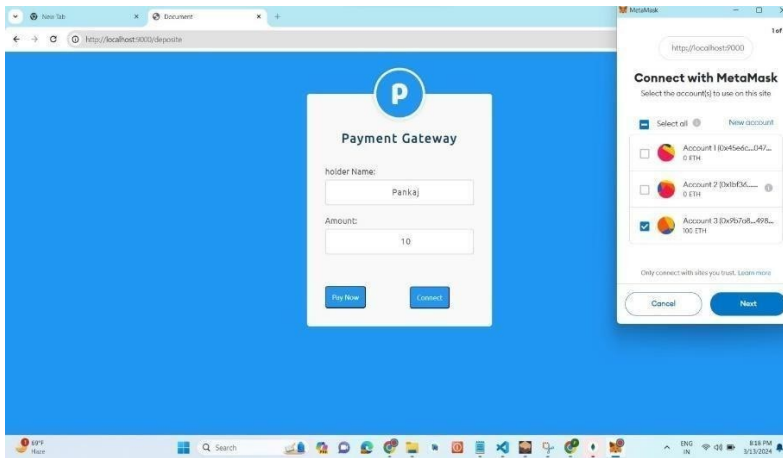


Fig4. Payment Gateway connecting with
MetaMask

For making payment successful, we have made One Time Password (OTP)

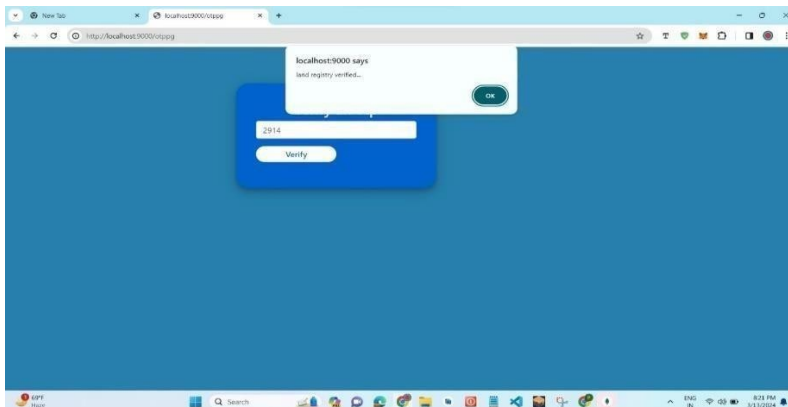


Fig5. OTP for successful payment

At last, we have generated the QR Code which carries all the information of the land



Fig6. Generation of QR Code

- b. **Making and Managing QR Codes**
 An individual QR code is allocated to each piece of property; this code acts as a digital identification and is connected to the relevant record in the blockchain.
 The system generates accurate and unique QR codes as part of the property registration or updating processes.
 Users can scan codes to access property information and check ownership rights using the QR code management functionalities.
- c. **Using Blockchain Technology**
 At its heart is a blockchain network that keeps track of properties and transactions. Blockchain technology records transactions in a distributed and unchangeable ledger, making property data secure, transparent, and unchangeable. Automating property-related procedures like registrations, changes, and transfers is the goal of smart contracts, which are pieces of code that execute themselves on the blockchain.
- d. **Services Used in the Background**
 Services at the backend are responsible for processing, storing, and retrieving data.
 To execute smart contracts, retrieve and update property information, and carry out other blockchain-related actions, these services communicate with the blockchain network.
 To further guarantee interoperability and compliance with regulations, backend services can enable integration with other systems like government databases and legal frameworks.
- e. **Prevention Steps**
 To safeguard private property information and forestall manipulation or unauthorized access, the system employs stringent security protocols.
 To ensure the safety of data while it is kept or sent on the blockchain, encryption techniques are utilized.
 To make sure that only authorized people can see or change certain data, access control systems limit user access according to preset roles and permissions.
 To avoid forgery and unauthorized changes, QR codes are created using tamper-proof methods.
- f. **Connectivity to Third-Party Platforms**
 To make sure it's compatible and follows all the rules, the system connects to preexisting government databases, legal frameworks, and property registration procedures. Information sharing and synchronization are made possible through data exchange methods, which allow the land registry system and external systems to communicate seamlessly.
- g. **Kept tabs on and reported on**
 The reporting and monitoring features keep tabs on transaction activity, security metrics, and system performance.
 Anomalies can be detected, property transactions and registry operations can be reported, and the administrator can keep tabs on the state of the blockchain network.
 These findings are useful for meeting audit, compliance, and decision-making criteria.
- h. **Redundancy and Scalability**
 To handle increasing amounts of property data and user interactions, the system architecture is built to be resilient and scalable.
 Data replication and backup procedures are examples of redundancy measures that guarantee data availability and integrity in case of system faults or disruptions.

SECURITY ADVANTAGES OF BLOCKCHAIN

Because of these advantages, blockchain technology offers a viable substitute for the unreliable and risky conventional methods of land registration. By utilizing the inherent security features of blockchain technology, stakeholders can enhance the reliability of the land register system, reduce fraud, and mitigate dangers. Due to its various security advantages, blockchain technology is perfect for applications such as land registration systems.

The following are only a few of the numerous security advantages of blockchain technology: -

Immutability Following its addition to the blockchain, information is almost immortalized. Data deletion or alteration in the past is quite unlikely because of the cryptographically linked and timestamped nature of all transactions [20]. Because it makes property data unchangeable, this immutability is particularly useful for land registry systems, which aim to avoid fraudulent activities and unlawful changes to ownership records.

Decentralization The distributed ledger technology known as blockchain eliminates the need for a central authority to validate financial transactions. The blockchain is decentralized and each node maintains its own full copy of it. For transactions to be valid, all the nodes involved must reach an agreement. Due to its decentralized design, blockchain is less vulnerable to malicious attacks and single points of failure, making it more secure and durable overall.

Effective Expression Transparency is enhanced since all nodes in the network can view and verify each other's transaction records. Since the entire network is linked to the same public ledger, all participants may view the history of ownership. Stakeholders can easily track ownership and transactions because of this. The land registry system is made more accountable and less vulnerable to fraudulent or illicit acts because of this transparency.

Secure Data Transmission Blockchain uses strong cryptography techniques to guarantee the safety of data and transactions. Cryptographic hashing algorithms ensure that data stored in blocks remains intact, while public-key cryptography restricts access to authorized individuals only. Digital signatures add another layer of security to transaction authentication, guaranteeing that only authorized parties can send money and that all transactions are legitimate [21].

Methods for Reaching Consensus Blockchain uses two consensus mechanisms, Proof of Work (PoW) and Proof of Stake (PoS), to verify and authenticate transactions. In these types of systems, the addition of a transaction to the blockchain is contingent upon the consensus of all network nodes regarding the transaction's legitimacy. Since most nodes must agree before any transaction data can be altered or fabricated, blockchain technology further enhances security.

Protecting Data Many blockchain implementations use data encryption techniques to protect sensitive information. Cryptographic algorithms may encrypt data stored on the blockchain so that only authorized users with the correct decryption keys can access it. Because of this encryption,

the property records stored on the blockchain are more secure and less likely to be accessed by unauthorized parties [22]

Consistency and Amount Blockchain technology allows all parties to track the whereabouts of assets and any changes in ownership by recording transactions in an immutable ledger. Full audits and forensic investigations can be conducted on blockchain transactions because of their immutable record and timestamp. This audibility and traceability promote accountability while also enhancing transparency in property ownership and transaction history

RESULTS

Below are the results that have been generated while working on Blockchain. The tables and the graph shown below shows the Gas Used with different Contract Address and with the same Contract Address.

Table 3. Transaction based on different Contract Address with same gas used

Bloc k No	Transaction Hash	Contract Address	From	Gas Used
1	0xdb4742d547e1e872018823cc6777d96172e1b60017ab16adf50c6ebda29e914c	0xf813df96815e12048cece7e44891f8718c99f c14	0xc87bc417722f54b93f2cb675088b326cba65ccb7	156039 gas
2	0xdc51bb44f1150a8b2e7494ddb54ab211f9cbd384de73b9da83e054f4d4e9 e69	0x550fe50b05ca64947c076472abdbbb6ca89946eb	0xc87bc417722f54b93f2cb675088b326cba65ccb7	156039 gases
3	0xfd0b6cb28327198edcd530d7a55d12a9006b1b947252fd726e80421842a14053	0x585d1912a4a3e1bafbdea9219f223487a78d8485	0xc87bc417722f54b93f2cb675088b326cba65ccb7	156039 gases
4	0xc257b521c7fedb0e190ca7603c45844dcff43af69acfb44186b4582a0b14199f	0x92785071e522bf1ebdbdfbeb8d3b40655754613d	0xc87bc417722f54b93f2cb675088b326cba65ccb7	156039 gases
5	0x3c29763f0dd68928d3107cca3dc62a073319d938dc402d0e7013d93e96cf47df	0xf93ccaa9e74ca67f32946d90a60a74cf0e6513d2	0xc87bc417722f54b93f2cb675088b326cba65ccb7	156039 gases

Table 4. Transaction based on same Contract Address with different gas used

Block No	Transaction Hash	Contract Address	From	Gas Used
1	0x61907d4b578073c27ff39e9638a13bcb5c96bddbb5642b0667605c054afb60cd	0xd9145CCE52D386f254917e481eB44e9943F39138	0xc87bc41772f2f54b93f2cb675088b326cba65ccb7	179482 gases
2	0x8f249f1b9df3eb0269a2f5c75ea9ad98ec8f44ff1f0880d273ea98cde24d959d	0xd9145CCE52D386f254917e481eB44e9943F39138	0xc87bc41772f2f54b93f2cb675088b326cba65ccb7	156033 gases
3	0xf0ec312619b2bd1ee30967ea97adecbaad7cadd16bbefb217508c8db55797f49	0xd9145CCE52D386f254917e481eB44e9943F39138	0xc87bc417722f54b93f2cb675088b326cba65ccb7	30898 gases
4	0x21e9b9f2624f33932a2a85b0e848d73fd686d469cc446c765f6f0e149c469100	0xd9145CCE52D386f254917e481eB44e9943F39138	0xc87bc417722f54b93f2cb675088b326cba65ccb7	156039 gases
5	0x3c29763f0dd68928d3107cca3dc62a073319d938dc402d0e7013d93e96cf47df	0xd9145CCE52D386f254917e481eB44e9943F39138	0xc87bc417722f54b93f2cb675088b326cba65ccb7	30898 gases

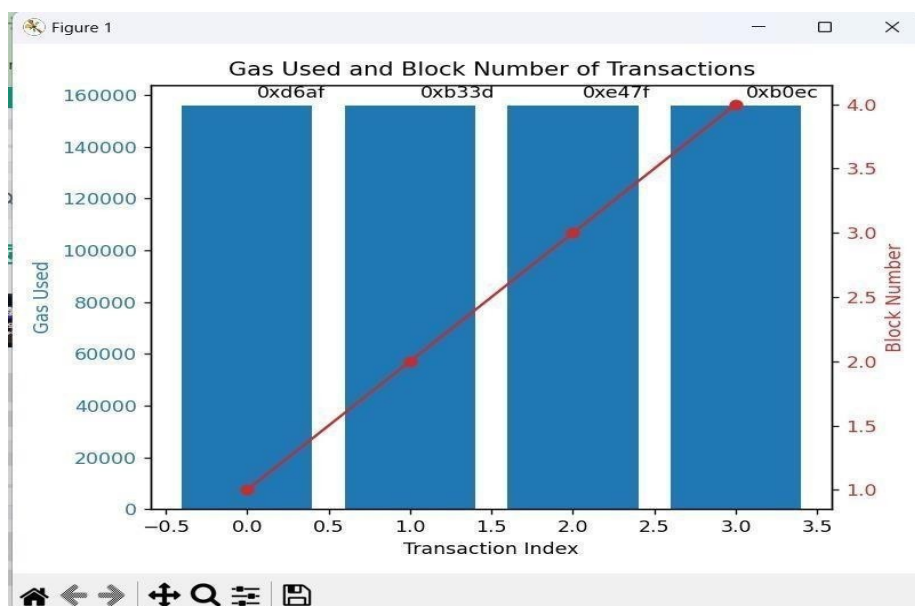


Fig7. Gas Used and Number of Transactions

Below is the table that shows comparison between Traditional Paper-based Land Registry System, the Existing System and our Proposed System. Table shows how our method have made the throughout system so easy and cost-effective by combing Blockchain and QR Code

Table 5. Comparative table between Traditional, Existing and Proposed System

Multiple bodies managing the current system	Multiple bodies managing the current system	Single body can manage this system.
Transaction done through cash	No such system exists	Less amount of gas fee is used during transaction through blockchain
Verification needs multiple witnesses	Verification needs at least 2 witnesses	Verification is done through OTP and Aadhaar No, no need of witness

Traditional Paper-based Land Records System	Existing System	Our Proposed System
Wastage of investment in resources for maintaining physical records	Lack of technical competency.	Hybrid Blockchain (Provide Privacy and Transparency).
Poor handling of records which leads to errors or missing records	Lack of physical infrastructure - downtime.	Distributed Ledger which provides 24/7 service, no downtime.
Not secured	Chances of data loss or hacking	QR Code generation of your land records
Lack of technology to keep track of records	Complex system with inaccurate information.	QR and Blockchain technology is used to keep track of records
Paper work was there	Multiple web portals with less synchronization.	Single-mode of access. (synchronized)

CONCLUSION

An attractive and potentially useful approach to building a trustworthy land register system is the suggested combination of QR code with blockchain technology. Analyzing the current literature makes it clear that conventional land register systems encounter major problems with inefficiency, secrecy, and fraud. But these problems can be solved by using QR codes and blockchain technology, which are transparent, immutable, and secure. An efficient, transparent, and secure land registration system that improves the quality of real estate transactions is detailed in the recommended system architecture. Stakeholders may access, verify, and amend property records in an auditable and tamper-proof manner by assigning unique QR codes to properties and utilizing blockchain technology for data storage and transaction

processing. By automating several steps in real estate transactions, smart contracts streamline procedures while decreasing room for fraud and human mistake. In addition, the suggested system's usability, security, scalability, and usefulness can be better understood by comparing it to current blockchain-based solutions.

To guarantee that the proposed system is up to par with industry standards and provides real advantages to stakeholders like government agencies and property owners, it is important to identify best practices and lessons gained from past implementations. An innovative approach to updating land registry systems that would improve the efficiency, security, and openness of property transactions is the suggested combination of QR code and blockchain technology. Stakeholders may fully use these technologies through thorough planning, implementation, and continuous review to build a land registration system that supports social equity and sustainable development by making it more inclusive, accessible.

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