Section: Research Paper

DIGITIZATION OF LAND PROPERTY MANAGEMENT SYSTEM USING BLOCKCHAIN TECHNOLOGY

[1]Mrs.D.Mohanapriya, [2]Pavithra M, [3]Monisha K, [4]Akshitha S.

[1]Assistant Professor, Manakula Vinayagar Institute Of Technology,Pondicherry University,Puducherry

[2,3,4]UG Scholar, Manakula Vinayagar Institute Of Technology,Pondicherry University,Puducherry

[1]mohanapriyacse@mvit.edu.in, [2]pavimurugaiyan7@gmail.com, [3]monishaa30501@gmail.com, [4]akshithags2002@gmail.com

ABSTRACT: A intermediary (broker), for instance, helps the buyer and seller connect when using India's traditional land registration procedure. A broker should be contacted if someone wants to buy or sell a home. Brokers will prepare and compile any physical documents needed to fulfil contracts as proof of ownership. Brokers will check to see if the land or property is registered with the appropriate government agency and meets all requirements. Every block in a blockchain data structure is connected to every other block this distributed data ledger records digital transactions for public consumption permanently and the data in a block is immutable due to the use of hashing algorithms, cryptographic techniques, and consensus protocols before a block is added to the blockchain.

Index Terms – Blockchain, Land Registration, Ethereum, Smart Contract, Decentralized Architecture, Consensus Algorithm, Proof of Stack

I. INTRODUCTION

Many people are involved in bookkeeping, a decentralized list of bookings that is constantly expanding is possible, and the respective proper state must be documented. This idea is known as Distributed Ledger Technology (decentralized booking technology). What should be booked and documented is unimportant. Importantly, subsequent transactions build on previous transactions and validate them as correct by demonstrating knowledge of previous transactions. Bookings do not have to be property transfers; they can also be a formal confirmation by the notary of the existence of all required documents for the execution of a notarized land purchase agreement. Individual processing steps of the transfer of ownership process could thus be speed up and made more transparent, allowing the parties involved to have an overview of the status of proceedings at any time.

A blockchain is a continuously growing list (chain) of records (blocks) linked by encrypted data exchange. A reference to the previous block, a timestamp, and transaction data are typically included in each block. The cryptocurrency Bitcoin is one of the most popular blockchain applications. Because the transaction data on all applications (clients) is visible to all and traceable, this system is considered tamper-proof and transparent.

The following are some of the most common security threats to blockchain networks:

When a single entity or group controls the majority of computing power on a network, they can manipulate transactions and block confirmation.

In order to gain network control, an attacker will create multiple fake identities or nodes.

Smart contracts have flaws in that the contents of the agreement between the buyer and seller are directly encoded into lines of code, making them self-executing contracts. Malicious code: Blockchain networks are vulnerable to malware, such as viruses or trojans, which can exploit system vulnerabilities.

To mitigate these risks, blockchain networks use cryptographic algorithms for authentication and encryption, consensus mechanisms to prevent manipulation, and public and private key encryption to ensure secure

network access.
Furthermore, regular audits and codebase updates are critical to the security of a blockchain network. To protect their own accounts and assets, users should also follow best practises such as using strong passwords and not sharing private keys.

II. MOTIVATION

In the modern world, the development of new technologies and the rise of the digital age are the most potent forces propelling societal change. If a user lost the original physical contracts that served as the true proof of ownership or if the documents were altered or damaged, it was extremely difficult to navigate all the information pertaining to the assetswith the previous system. Legal business transactions are typically slowed down because personally verifying ownership and land records typically takes a lot of time. Another serious concern is fraudulent conditioning, which includes impeding, bribery, misleading information, or revision carried out by intermediary agents in the process and leading to a lack of security. Our suggested approach was a solution built on a blockchain-based land enrollment system that overcame the limitations of the status quo by taking significant considerations into account. The proposed method will expedite the verification of ownership and land deeds, as well as speed up data recovery in the event of a disaster, cache all blockchain updates, and guarantee that no current transactions are tampered with. Transactions will be safer as a result. To avoid data change, information on the landowner and proprietor is translated. We encourage the use of a peer-to-peer or decentralized system, where all transactions are conducted directly between the buyer and the seller using digitally generated and verified agreements. This streamlined technique can avoid fraudulent conditioning because blockchain uses disguised transactions and records every change. All changes are documented in the next block, and all transactions are preserved in a blockchain with the proper timestamps attached for rigorous auditability to guarantee that no stoner is oblivious of the current condition of any asset.

III. LITERATURE REVIEW

Cities are being digitised as a result of technological advancements. This digitization is data-driven, and the information derived from this data necessitates a fundamental need for trust. Blockchain technology can increase trust among various business stakeholders, resulting in increased economic growth for smart cities. Many countries have begun to employ Blockchain technology to improve transparency in the land registration process. In the Republic of Georgia, a Blockchain-based land titling system has been built on top of the NAPR's (National Agency of Public Registry) existing digital land registry system. To provide land buyers and owners with an immutable and authentic database, certificates were timestamped and hashed in the public Bitcoin Blockchain.Honduras has taken a similar approach. However, the second case was less successful than the first due to a lack of proper IT infrastructure, a lack of authentic land records, and political opposition to changing the status. The Cook County Recorder of Deeds in Chicago, USA, has begun a project to test how digital property abstracts can be illustrated using Blockchain technology. The government of Andhra Pradesh, India, is collaborating with a tech company to develop a Blockchain-based land transaction system. Because of ongoing infrastructure deficiencies, proper implementationof a Blockchain-based registry system is still in its early stages.

This study identifies problems with manual land registration procedures, including concerns with transparency, centralization, legitimacy, and dependability, and suggests a more effective solution utilizing blockchain technology. This paper also examines the comparison of Blockchain-based digital land record systems in various countries. Finally, we have created a novel framework that employs the Blockchain method for carrying out the process of Land Registration and providing authentic and irrefutable ownership rights to the people of Bangladesh.

Shloka and Chandresh sought to improve the efficiency of the current property system through block-changing technology in their paper. Problems that arise when manually transacting data can be eliminated using block-changing technology. The block chaining-based land registry method assumes that identifying land or belongings is

dependent on the community. Sekhar et al. described the use of Blockchain in various types of use cases, such as land registration, which we must gradually implement in the system. It is transforming the current system. To secure the facts of land, some chain will be twisted. They have most effectively considered registration documents and khasra in this model.According to the paper, they are hoping that the alternative documents can be related in comparable ways, resulting in the development of a network that may be more secure.Blockchain with smart contracts was touted by Sahai and Pandey as a potent tool for any application requiring trust and integrity. According to the paper, land record maintenance and registration are required for the process. The use of Blockchain in the land registry system will benefit both the users and the governments. It prevents fraud and saves time during the registry process. Blockchain's use of smart contracts will aid in the automation of the entire process via the application, providing an immutable registry and preventing land fraud.Rouhani and Deters' article focuses on the security of Blockchain applications. The author thoroughly examines and proposes the smart contract concept with a decentralised system, security methods, various tools, and performance improvement approaches. Security with a smart contract will yield better results in a distributed blockchain environment, as will work on a light-weighted consensus mechanism to improve blockchain application uses.

In 2000, the Haryana state government approved a project called Digitizing Land Records. Another venture, "Nemmadi," launched with the assistance of the Karnataka government in 2004, has a "Bhoomi" application that expedites the digitization of land information and digitises approximately 20 million records of land ownership of the state's 6. 7 million farmers. The Board of Revenue (Uttar Pradesh) modifies land reform guidelines and implements the "bhulekh" project, whichautomates all national land data in 312 tehsils across 71 districts. Chhattisgarh launched "Chhattisgarh online statistics for citizen empowerment (desire)" challenges for land records in order to provide citizens with a level playing field. Similar initiatives to digitise land records are being replicated in other states.

This essay discusses the possibility of duplicate spending, the lengthy process of recording transactions in a land administration system, and data manipulation. This might make a system of land administration less accurate. Our research is predicated on the hypothesis that distributed ledger technology, or more specifically, blockchain technology, has the potential to address these issues. The answer is a smart contract written in the Solidity programming language that can handle even more complex use cases in land administration systems, like merging or dividing real estate, sharing ownership, transferring ownership, and limiting real estate trading. The suggested smart contract includes a programming interface designed to meet the specific requirements of land administration systems and is based on both the ERC-20 and ERC-721 token standards. It is demonstrated how BCT could be used to address a few common LAS problems. A smart contract is offered to reduce the time needed for transaction registration, and BCT is also suggested to address issues with double spending and data manipulation. The suggested method may be able to manage some of the more unusual LAS scenarios that haven't been addressed before, like sharing ownership, transferring a piece of ownership, dividing up or combining real estate, and restricting real estate trading. By creating a programming interface based on two already-existing interfaces (ERC-20 and ERC-721), which lacked the essential capabilities to handle those more specialized This is done by LAS instances on their own.The lack of centralization, validity, and reliability of human land registration techniques is one of the problems this study identifies. In its stead, a better plan based on blockchain technology is recommended. This also examines the differences in the digital land record blockchain systems used by various nations. Due to the immutability of blockchain technology, which can prevent faked land titles, real-time land ownership verification is now possible.

In India's traditional land registration system, an intermediary known as a "broker" acts as a conduit for communication between the buyer and seller. For instance, if someone wishes to buy or sell a piece of real estate, the broker will acquire all the physical documentation required to confirm ownership of the property. Brokers make certain that the land or property is registered with an authorized government agency, where all of its details are

entered in a ledger, and that the full transaction and sale between the twoparties takes place after that. The risk that the papers will be lost or altered in this scenario puts at risk the physical proof of labor because anyone with the necessary access privileges can easily see or alter the papers. So, this kind of system is slower, less secure, and unsynchronized than our suggested approach, which uses a smart contract to handle assets and transactions among users. When the right method is followed, it also raises the potential that fraud and corruption will happen. We propose a blockchain-based land registration system built on Hyperledger that gives users a decentralized, open, and secure way to conduct transactions. This approach combines the examination and analysis of the prior approach with a study of the greater transparency, integrity preservation, and portability of Blockchain technology.

IV. PROBLEMS IN THE CURRENT LAND REGISTRY SYSTEM

The involvement of middlemen and brokers makes the process expensive and tedious. There are a lot of fraud cases due to fake ownership. There is a significant time delay – two to three months from registration to completion. Land registration is prone to error as human interaction increases the probability of errors. Current digitized method of property registration occurs on a centralized server which has the following disadvantages – can be misused, tamper able, lack of transparency, inefficient. Multiple Agencies such as - Land Records, Survey, Courts, Bank, and Registration Department) and the lack of coordination amongst them.

The data on land title, ownership, and chain of history that is now recorded in the nation is handled manually, often insufficiently, and frequently does not fully reflect the situation. The government is also presently addressing the management and updating of the manual land registration data. The following is a list of some of the main issues with the existing system:

There is a lack of coordination between the owner, registration department, survey, and land records as a result of the remote holding and updating of recorded information such as land title, transaction history, and tax records by many departments.

The lack of regular synchronization of the information causes discrepancies in the record that frequently make it incompatible with the actual ground position.

Lack of knowledge of an asset's past owners lowers trust when dealing with unknown persons.When employing a paper-based land registration process, the transferof ownership for a property can take more than a month.

Why Due to the shortcomings of digital records, it is now challenging to prevent fraud and promote illegal activity. People usually have to buy off government employees in order to speed up the registration process.

V.APPLICATION OF BLOCKCHAIN TECHNOLOGY IN LAND MANAGEMENT SYSTEM

1.Smart Contract

This is the heart of the complete solution. The backend of this project is a smart contract written in a solidity programming language. This smart contract contains all the specifies rules and regulations regarding the property dealings. This technology can create Turing complete smart contracts and programme conditional transactions, enabling it to mimic human behaviour. Smart contract architecture consists of logic, properties, ledger. These smart contracts are executed with the help of Ethereumblockchain.

2.Decentralised Application or DAPP

Decentralized applications provides blockchain features and services to the outside world for interactions. Because the web frontend is not part of the blockchain protocol, it can only connect to the blockchain smart contract via artefacts generated by the smart contract compile process.One of the most crucial elements is a DApp, which incorporates user interfaces for buyers, sellers, notaries, and land registries but does not operate directly on the blockchain. 3.IPFSAs the project deals with storing of sensitive personal information of the users Interplanetary File storage system should be preferred. It is a decentralized file storage system and provides high throughput, data distribution and low latency.

4.metamask

A software cryptocurrency wallet which is used to interact with Ethereumblockchain. It allows user to access their Ethereum wallet through a browser extension which is used to interact with DAPP.

5. RopstanTestnet

Before launching the smart contract on the main net developer tests smart contracts in production like environment called as Testnet. RopstanTestnet is a proof of work testnet.This means its best like for like representation of Ethereum.

6.Truffle suite

To test the working of the smart contract, deployment of a contract and management of blockchaintransactions truffle suite is to be used. It comes with smart contract compilation and deployment environment and asset pipeline for Ethereum testing of contract becomeseasy. The built in blockchain explorer Ganache examines all the blocks and transactions to gain the insight of what's happening under the hood.

VI. PROPOSED SYSTEM ARCHITECTURE

The Ethereumblockchain is used to build the smart contracts. The technology creates an electronic register to store the transactions. Each block contains a hash function code that is used to provide an e-stamp certification for that particular project. Every buyer or seller would use the e-stamp documents made available by the e-registry element of the anticipated e-portal system to buy or sell real estate. The technology creates an electronic register to store the transactions. Any land registry offices that are prepared to accept the proposed system and adhere to a blockchain-based platform should employ the suggested e-register facility. The registry office confirms that the land is in possession and that the registration fee has been paid. Blocks are created by blockchain technology for use in smart contracts that fetch blocks from the blockchain for records of land ownership. All relevant data will be sent to the land administration system and contained in this block. To provide a certified document on the land property, the suggested system comprises a crucial module called the Validator or the registry office. Each owner of the property is listed in detail in that document. A user must obtain a certified document and the validator's permission before they may register their assets on the digitalized network.

Registration of user

To utilize the program, a user must register and then wait for validation. The validator thoroughly investigates the newly registered user's data and supporting documentation before approving it if the investigation is successful. If the validation process is unsuccessful, such as when a phone document or incorrectly registered information is sent, it is rejected. The respective user will be alerted through SMS, NEXMO API, or mail as to whether their user registration has been approved or rejected. The original land document, a government or citified document in the user's name, and other official documents are among the documents that the validator verifies. Therefore, the user must supply accurate and complete information and documentation when filling out the registration form.

Management of properties:

Following successful registration of the user with the agreement of the registry officer, the land must only be administered by the respected user. The user logs into the landregistration system using the private key from the meta mask, and data about him or her and their properties are uploaded there. with the approval of the validators, the proposed system comprises successfully secured property sales and purchases. The user established a starting price based on the size of the property when they offered their land for sale. After the land is added to the selling list, any user who registers with this program will be able to look at the land and its specifics. It is possible that a different person who saw the land and is interested in buying it will gamble more than the base rate. If the seller is eager to receive the money, the buyer can seal the agreement. If a transaction request is made by the buyer, the transaction will then start. A new block will be generated on that land record and updated with the buyer's name

after the payment has been successfully completed.

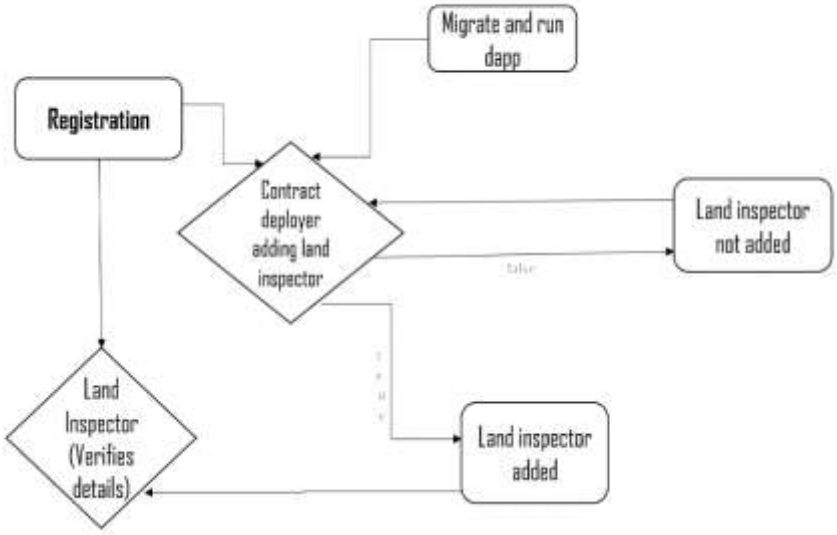

Figure1: proposed architecture

PROJECT FLOW

- The user may link their Metamask wallet or enter their private key to log in.
- If a person logs in for the first time, they must enter all of their information and upload a copy of their identification.
- FileCoin-based IPFS was utilized to store documents.
- After logging in successfully, the user may now access his dashboard.
- The user has not yet been validated, and only the land inspector may do so at this time.
- The contract owner will first include the land inspector in this.
- The land inspector can access his account afterbeing added.
- The registered users are viewable by the land inspector. He has access to the papers and can confirm the users.
- The users have now been validated.
- Currently, users can add their lands. Users may also design their own land on a map, as seen in the figure below, and they can include all the relevant land information and documents. mapping out the terrain.
- Only the land inspector has the authority to check land additions.
- The user, or owner of the land, may put it up for sale after the land inspector has confirmed it.
- Once it goes on sale, everyone else may view all the lands in the choice for the land Gallery. Here, customers may make a request to purchase the land and view all of the land's features and location on a map.
- The landowner has access to all requests that have been submitted and may approve or reject them.
- Finally, the land inspector may view all the payments made and will verify the payment before transferring the ownership once the land owner approves the request and the user who submitted it makes payment from his account to purchase the property. Land must be transferred in the presence of the buyer, the seller, and one witness. The land inspector will take their picture, get the witness's details, and then transfer the land.
- The program will generate a digitally signed document after a land transfer, and it will be instantly posted to the database.

- Seller can then access the purchased land using his "my land" option.

VII. METHODOLOGY

Open source and intended for commercial use, the Hyperledger fabric is a distributed ledger system. The work has been separated into two modules: module 1 provides a comprehensive description of how the administrator functions with regard to registration and launching smart contracts, and module 2 provides a thorough analysis of the procedures involved in changing ownership and concluding the acquisition of land. by utilizing the transparent, decentralized, and unchangeable Ethereumblockchain technology. We are creating a blockchain-based land registration platform where all information about properties that have already been registered will be stored on a decentralized, transparent database so anyone looking to buy a property may cross-verify all of the information about the property. Each piece of land's details will be preserved as a block with a digital title attached to aid with searches.

Everything is kept in one place, including sales, purchases,information about the land, and information on the current and prior owners. The strategy was expected to greatly lower the incidence of land disputes because fake documents are difficult to produce and have little use in legal processes.

VIII.IMPLEMENTATION

The main goal of the project was to build a solution which consist of a decentralized application. The complete setup should serve the following purpose:Provide a interface for the user to buy/sell their properties, Provide a interface for the land inspector to verify the transactions involved in property dealing and transfer the land ownership, User should be able to carry out the deals easily and in transparent manner, Solution should be able to handle multiple users, Generate a digitally verified ownership transfer document.

Before starting of deployment of the land registration smart contract we need to have ethers to deploy the contracts. So, in our project we use ganache as out blocks with ethers available. So, after starting the ganache server and connecting it without contract we can deploy the project.

Home Page:

The home page consists of all the details needed for an user about out land management system.

Login Page

One can log in as a user, land inspector, or contract owner on the home screen. A land inspector may be added, and the contract owner may view all additional land inspectors. Tools for user, property, and ownership transfer may all be found on the land inspector's dashboard. We can add lands, view land data, submit and receive land requests, and see all lands if we log in as the user.

User verification:

After the user register into the website by giving the public key,name,age,address,adharnumber,pan number and a verified certificate, he needs to be verified by the land inspector after a background check on his details. After successful verification the user will be marked as verified and now he/she can buy,see or sell lands.

Land Marking:

Land marking is an amazing feature which is used to mark out land shape or structure outline in the map by specifying the accurate location in the map.

Transfer verification with witness and picture:

When a transaction is going to be verified by the land inspector he/she becomes the witness and they will verify the transfer by taking the picture of the buyer , seller and themselves for security purpose.

Decreasing of ethers:

The value of the ethers will be decreasing after each transaction by the contract manager, land inspectors and users, For every approval of users, land and transaction the land inspector will be charged. And for every registration of land, buying , selling the users will be charged.

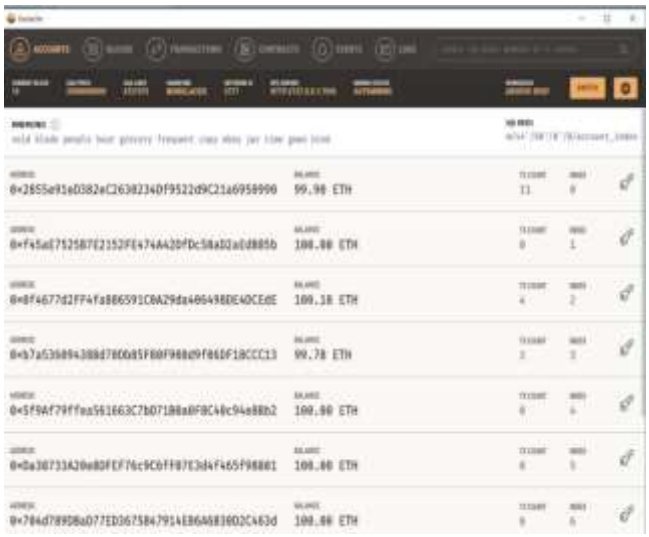

Figure2: Ganache Running

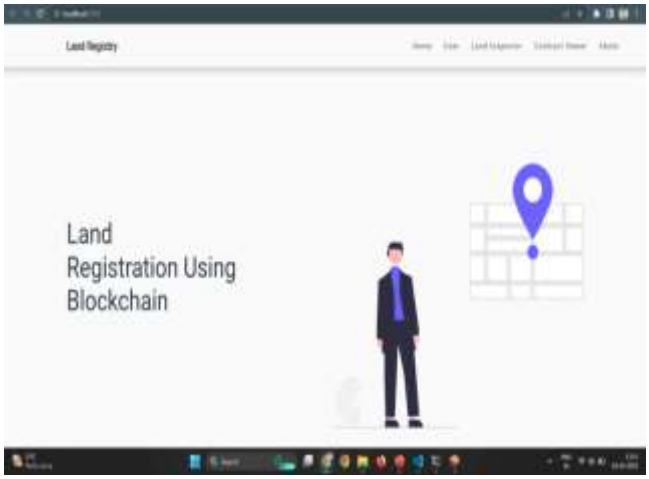

Figure3: Home page

Figure4: Login page

Figure5: User verification

Figure6: Land marking

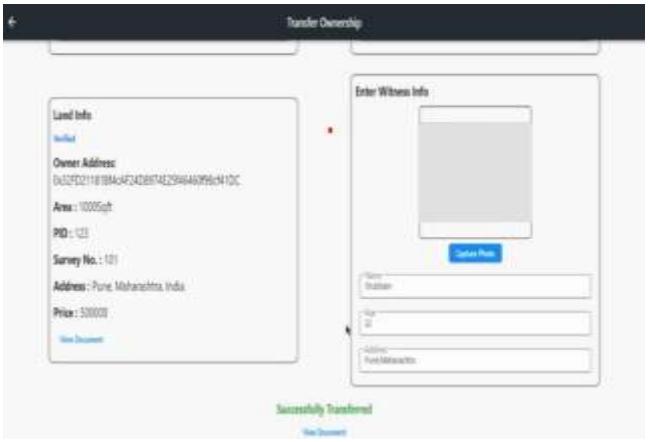

Figure7: Transfer verification with witness and picture

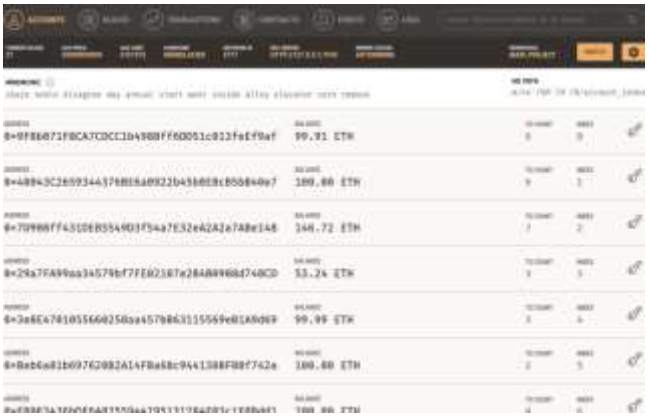

Figure8: Decreasing of ethers

The first user enters his land information, which the land inspector verifies. User must file a request to the land inspector in order to acquire or sell land. Users can complete transactions once the land inspector has approved their request. The land inspector confirms the sale. The ownership is transferred upon the transaction's verification.

During the ownership transferring process the land inspector will be the witness and miner to initiate and approve the transaction and take a picture of the buyer and seller for future references.

IX.MODULE DESCRIPTION

In this project we used Flutter (Decentralised App) as Frontend, Smart Contract Using Solidity Programming Language as Backend and Testing with Ganache, Integrating with Truffle and IPFS.There are five main components used in this project. The components are Flutter, Smart Contract, Truffle, MetaMask and web3.js.

Flutter

We used Flutter to create the project's front end. Google developed Flutter, which is open source. The SDK is cross-platform. We can develop applications for Android, iOS, and the web using a single codebase. Currently, we can develop apps for Windows, Linux, and Mac OS using a newer version of Flutter. One can log in as a user, land inspector, or contract owner on the home screen. A land inspector may be added, and the contract owner may view all additional land inspectors. The dashboard for the land inspector includes tools for user verification, property verification, and ownership transfer. We can add lands, view land data, submit and receive land requests, and see all lands if we log in as the user. We have used truffle IDE to set up the DAPP.

Smart Contract

Blockchain is to bitcoin what email is to the internet. A large electronic system on top of which applications can bebuilt. Currency is only one example. Bitcoin has an optional and unique feature called scripts that allows for the conditional transfer of values. The Ethereumblockchain developed the scripting feature into a full-fledged code execution framework known as a smart contract. A smart contract provided the extremely powerful code execution capability for embedding business logic on the blockchain. With addition of code execution comes serious consideration about public access to the blockchain hence, the classification of public, private and permissioned blockchain based on access limits. In this project we have implemented a smart contract as the backend which consists of all the terms and conditions for a smooth and secure transfer of property registration.

Truffle

Truffle is a world-class development environment, testing framework, and asset pipeline for blockchains based on the Ethereum Virtual Machine (EVM), with the goal of making life easier for developers. With over 1.5 million lifetime downloads, Truffle is widely regarded as the most popular tool for blockchain application development.

Metamask

MetaMask is a cryptocurrency wallet software that interacts with the Ethereumblockchain. It enables users to interact with decentralized applications by allowing them to access their Ethereum wallet via a browser extension or mobile app.

web3.js

Web3.js communicates with the EthereumBlockchain via the JSON RPC protocol, which stands for "Remote Procedure Call." Ethereum is a peer-to-peer network of nodes that copies all data and code on the blockchain. Web3.js enables us to send JSON RPC requests to individual Ethereum nodes in order to read and write data to the network. It's similar to using jQuery and a JSON API to read and write data to a web server.

X. CONCLUSION

Numerous issues with the traditional property registration system necessitated researchers concentrating on the same problems. Tampering with records, misusing property, and unethical behavior including bad financial management are a few of the problems that make conventional property systems a research topic. This paper offers a method for limiting transparency as well as a reliable Blockchain-based property registration system. The infrastructure provides several advantages to the parties involved in the purchase and sale of real estate. A tamper-proof ledger ensures the record's integrity, openness, and trustworthiness.

XI. REFERENCES

1. Xiaolong Liu, Riqing Chen, Yu-Wen Chen, Shyan-Ming Yuan "Off-chain Data Fetching Architecture for Ethereum Smart Contract", Digital Object Identifier 10.1109/ACCESS.2018.2874539 VOLUME 6, 2018
2. Joe AbouJaoudeAndRaafat George Saade, "Blockchain Applications - Usage in Different Domains", Digital Object Identifier 10.1109/ACCESS.2019.2902501 VOLUME 7, 2019
3. Meghali Nandi, RajatKantiBhattacharjee, AmritJha, Ferdous A. Barbhuiya “A secured land registration framework on Blockchain” , Third ISEA Conference on Security and Privacy (ISEA-ISAP) 978-1-7281-6708-4/20 ©2020
4. Elva Leka, BesnikSelimi, and Luis Lamani "Systematic Literature Review of Blockchain Applications: Smart Contracts", IEEE International Conference on Madhurya J A et al., International Journal of Emerging Trends in Engineering Research, 8(9), September 2020, 5209 – 52135213 Information Technologies, 978-1-7281-3274-7/19/ $31.00 ©2019 IEEE
5. WeilinZheng, ZibinZheng, Xiangping Chen, Kemian Dai, Peishan Li, AndRenfei Chen "NutBaaS: A Blockchain-as-a-Service Platform" IEEE Access, Digital Object Identifier 10.1109/ACCESS.2019.2941905

VOLUME 7, 2019

6. Jingjing Chen, TiefengCai, Wenxiu He, Lei Chen, Gang Zhao, WeiwenZou "A Blockchain-Driven Supply Chain Finance Application for Auto Retail Industry" Entropy 2020, 22, 95; DOI:10.3390/e22010095
7. Harry Halpin, Marta Piekarska "Introduction to Security and Privacy on the Blockchain", 2017 IEEE European Symposium on Security and Privacy Workshops (EuroS&PW)
8. AshwinSekhar, RishavChatterjee, RasDwivedi, RohitNegi, Sandeep K Shukla. Entangled Blockchains in Land Registry Management.
9. Yining Hu, MadhusankaLiyanage, AhsanManzoor, KanchanaThilakarathna, KanchanaThilakarathna, Aruna Seneviratne " Blockchain-based Smart Contracts -Applications and Challenges," arXiv:1810.04699v2 [cs.CY] 8 Jun 2019.
10. I.Jeena Jacob , DayanandLal.N , ParikshithNayaka S K , Beena G. Pillai , NidaKouser. Ensuring Network Security using Secured Privileged Accounts. International Journal of Emerging Trends in EngineeringResearch.https://doi.org/10.30534/ijeter/2020/80852020 Volume 8 No.5, 2020