# A Novel Framework for Implementation of Land Registration and Ownership Management via Blockchain in Bangladesh

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***Abstract*—Registration process regarding ownership, possession or other rights for properties like land is a tedious method in progressing countries like Bangladesh. This paper highlights issues related to manual land registrations processes such as transparency, centralization, authenticity, reliability, etc and proposes a better method to overcome these problems using Blockchain Technology. The comparison between Blockchain-based digital land record systems in different countries is also explored in this paper. Finally, we have developed a novel framework that uses Blockchain method for executing the process of Land Registration and providing authentic and indisputable rights on ownership for the people in Bangladesh.**

***Index Terms*—Blockchain, Land Registration, Ethereum, Smart Contarct, Cryptocurrency, Decentralized Architecture**

## I. Introduction

Land registration is a system that provides recorded information on ownership and land associated rights preventing fraudulent activities. Reliable land ownership records are one of the key factors in promoting economic development and Sustainable Development Goals (SDGs). Without a proper digitized land registry system, people often suffer to verify their proper ownership of land and often led to land misappropriation [1]. Only 30 percent of the world's population owns a "legally registered" title to their land according to World Bank [2]. In developing countries, land records are still kept on paper-based centralized systems or digital central databases. This method is assailable to natural or man-made disasters. The centralized database can be altered by Govt. officials or by the hackers from outside. This system lacks transparency, authenticity, and reliability. 20 percent of land owners have to pay bribes to register their property as stated by Transparency International [3]. Lastly, the current manual system is time-consuming, takes weeks to months for completing the whole process of land ownership verification and registration.

In this paper, we explore the digitization process of land registration using Blockchain Technology. The immutable nature of Blockchain can stop forgery of land titles enabling real-time verification of land ownership. Some of the countries like the Republic of Georgia, Ukraine, Brazil, the United Arab Emirates, among others have already introduced Blockchain based approach to enhance their land registration system [4]. In this paper, we explore the current land registration system in Bangladesh and suggest a new framework using Blockchain Technology to bring transparency and reliability in the current system.

## II. Literature Review

Nowadays cities are getting digitized with the help of modern technology. This digitization runs on data and the processed information from this data creates the fundamental need for trust. Blockchain Technology can bring trust between different stakeholders in the business ensuring better economic growth for smart cities [5]. For the process of land registration, many of the countries have started using Blockchain to bring transparency in the system. In the Republic of Georgia, a Blockchain-based land titling system has been developed on top of the NAPR's(National Agency of Public Registry) existing digital land registry system [6]. Certificates were timestamped and hashed in the public Bitcoin Blockchain to provide an immutable and authentic database for the land buyers and owners. The same kind of approach has been taken by Honduras. But because of the proper IT infrastructure, lack of authentic land records and political resistance to changing the status, the second case was less successful than the first one. The Cook County Recorder of Deeds in Chicago, USA has started a project to test how digital property abstracts can be illustrated using the Blockchain. The government at Andhra Pradesh in India is collaborating with a Tech company to build a Blockchain-based land deals [7]. As there still exists infrastructural deficits, the proper implementation of a Blockchain-based registry system is still in their rudimentary stage.

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## III. Process of Land Registration in Bangladesh

The land Registration process in Bangladesh often creates disputes among the property owners. All the process is executed under the registration Act 1908 and the related documents that must be registered for verification are in sections 17A and 17B [8]. The current process of land registration in Bangladesh is outlined below [9]:

- While buying a property, buyers first need to check the proper information relating to ownership of the land like khatian/porcha, mutation khatian, tax records, history of transactions, authenticity of the title deed, etc manually by visiting the local Sub Registry Office.
- The buyer and the seller then finalize the deal and get it notarized. Then the buyer needs to obtain the inspection for RS mutation and the non-encumbrance certificate from the relevant sub-registry office.
- The buyers then pay the stamp duty to the Accounts Department of the sub-registry office. The final transaction is drafted on stamp paper by paying capital gains tax, VAT and registration fees in a bank.
- Finally, Sub Registry Office registers the deed. After mutation is granted, the buyer needs to register the change in ownership at the Land Revenue Office.

## IV. Problems in the Current Land Registry System

The current recorded information regarding land title, ownership, chain of history in the country is poorly managed manually and often does not reflect the real scenario. The government is also facing problems managing and updating the manual records of land registration. Some of the major problems in the current system are mentioned below:

- Lack of coordination among multiple stakeholders such as land records, survey, Registration Department and owner.
- Recorded information such as land title, history of transactions, tax-records is stored and updated by different departments at the remote level. The information is not synchronized regularly which creates inconsistency in the record and often leads to incompatibility with the real ground position.
- Lack of accessibility to the ownership history for an asset decreases trust during transactions with unknown parties.
- Paper-based land registration process is a lengthy process that may take more than a month for the handover of ownership for a property.
- Current unreliable digital records fail to prevent frauds and lead to illegal transactions. People often need to pay bribes to govt. officials for getting their registration process done in time.

## V. Application of Blockchain Technology in Land Management system

Blockchain is an immutable and decentralized digital ledger that is managed by a network of computers, not owned by a single entity. No third party is required to initiate the transaction. The records in the Blockchain database are transparent and the data is accessible to anyone on the internet. Every active peer on the internet keeps a copy of the original records in the Blockchain and no update is possible without agreement among them. The peers can verify transactions in the blockchain using encoded 'hash' that has to match with the Blockchain's history [10].

**Smart Contracts:** The decentralized architecture of Blockchain is made possible with the help of smart contracts. It is a program that can be encoded and run on any Blockchain. The related information that is needed to resolve conflicts is handled by smart contracts. Transactions happen only after fulfilling the pre-set conditions included by the smart contracts.

**Public blockchain and Ethereum:** Public blockchain is open-source and anyone can be a part of the consensus. To implement a large scale system such as land registration, a public and permissionless Blockchain like Ethereum will be the most suitable one [11]. Ethereum also provides unlimited processing facilities. As the history of land records, transactions and other important information are needed to be transparent and accessible to everyone, A public Blockchain-Ethereum is the best-suited environment for this application.

### A. Core Architecture of the Proposed System

The architecture of our system is a hybrid of a traditional Blockchain system with smart contracts providing the main basement of our implementation. All our land-related information and ownership transactions will be stored in a Blockchain. The **Township** class contains detailed information of a land like amount of area, Dag-no, mouja, khatian, tax records, owners' information, previous hash of the land record etc. Initially, all of this data will be collected and verified from currently stored databases or surveys and added in Ethereum's Genesis block. We can get any specific land information using the *getTownship(id)* method using unique information(id) of a township. Our front-end application provides a way of interaction for the administration and users with the system while back-end communicates with the Blockchain invoking corresponding methods of the smart contract. The whole process of land registration is described below according to the subsections mentioned in [Fig-1]-

1)
   1.1 While buying a property, buyers can go to the portal and request for land related information in an area of interest from our client system instead of manually visiting the local Sub Registry Office.
   1.2 When a buyer requests to get land related information, our system will communicate with Blockchain and invoke the *getTownship(id)* method of Smart Contract to fetch the block from the Blockchain[Fig-2]. This block will contain all the related information and transferred to the land administration system.

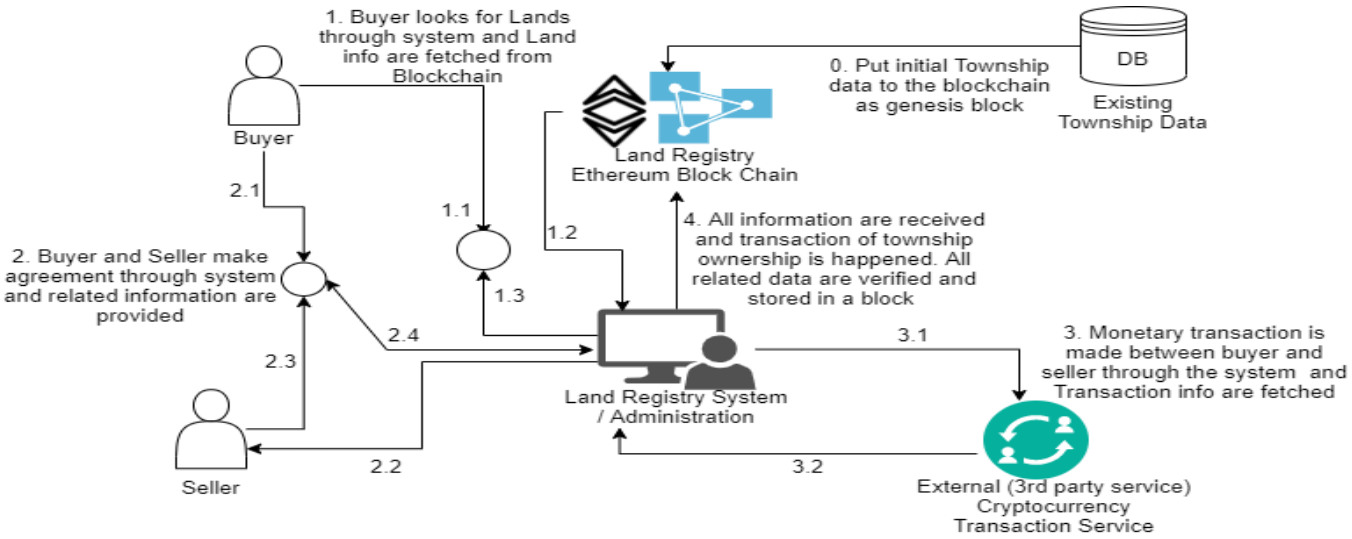


Fig. 1. Flow diagram of proposed system.

1.3 The land registration system will process these raw data related to land and a public view will be represented to the buyer abstracting the owners automatically.

2)

2.1 When the buyer decides to buy any land, he sends a purchase request to the registry system.

2.2 The registry system notifies the owners about the buyers information. There can be one to multiple interested buyers or buyer parties (group of buyers sharing land ownership) in the same period of time.

2.3 The buyer and seller come to an agreement and provide their payment wallet addresses, currency type and any related information if needed. A seller or seller party can communicate with multiple interested buyers but once reached an agreement, the smart contract ensures that there is only one buyer or buyer party for a land.

2.4 The Land registry system uses a **LandRegister** class containing our land registry or land ownership exchanged data. It's actually the virtual Deed. It includes seller information, buyer information, witnesses, township id, monetary transaction information (wallet addresses, currency type, transaction hash, etc. received from external payment service)[Fig-2]. So, when a land registration occurs through our system, this information is fetched and goes to the transaction phase.

3)

3.1 For secured monetary exchange between buyer and seller, we have proposed to use existing Blockchain-based payment service for secured transaction. Buyers will be authenticated before any fund is deducted from their wallet. Our system will record seller wallet addresses and using the system buyer can transfer Cryptocurrency to the seller. As Cryptocurrency is still not legalised in Bangladesh, for current development any other third party payment system can be introduced. For research purpose, we just used a dummy monetary transaction.

3.2 After the monetary transaction is made between buyer and seller through the payment system all related information is fetched and forwarded to the land registry system.

4) Upon receiving all necessary information and transaction confirmation, the Land administration system invokes the method *transferProperty(data)* from our smart contract to store the registration data. Triggering this method will make a transaction in our Blockchain and store relevant data into the block and also transfer the ownership of the land (update township) from seller to buyer. This block helps to track all the information related to land registration like getting land, new owner/buyer, monetary transaction and history of registration etc. Sometimes land registration takes some external witnesses and the information is managed by the **Witness** class. As our system keeps the records in Ethereum Blockchain, thus fee related to each transaction to the Blockchain will be beared by land registry administration. Land register authority can charge additional fees from the users due to this. In our system, we have options open to add more related information if necessary and owners can also update their proper verification.

### *B. Implementation*

Initially, our Blockchain system is developed and tested in a local environment. First, we have created a smart contract using Solidity programming language. Truffle Framework is used to build and develop Ethereum smart contracts with Solidity. Then the smart contacts have been tested and deployed to the Blockchain. Ganache Personal Blockchain is used as a local development Blockchain network. A separate client-side application has been developed using NodeJS, PHP, and Javascript for general purpose users and administration

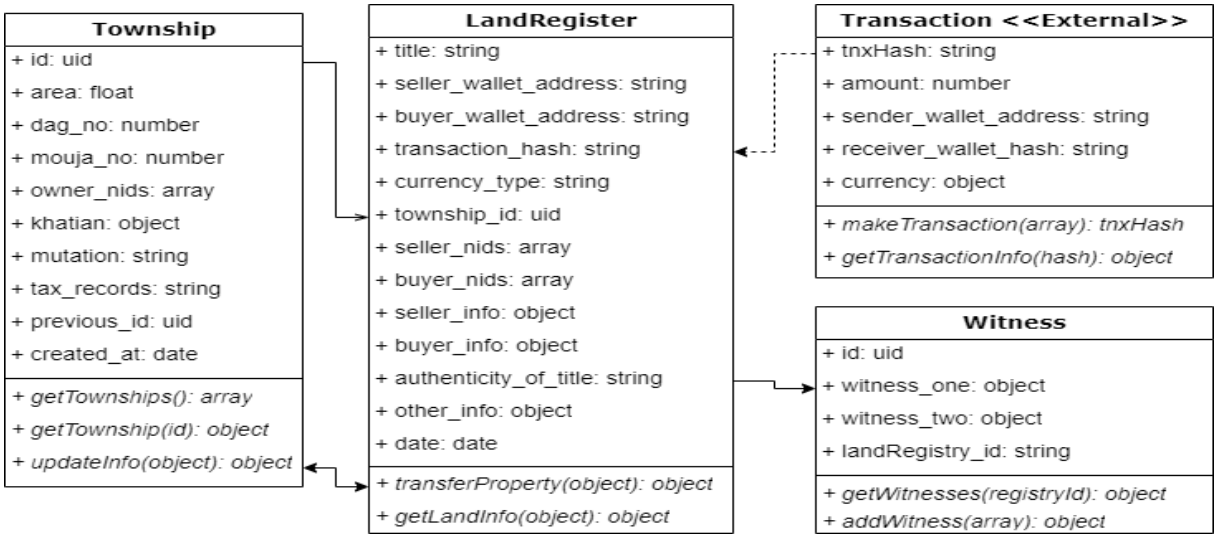


Fig. 2. Class diagram of land registration process (Smart Contract).

management. Also, some predefined data will be stored in traditional databases like MongoDB or can be fetched from Government Stored Data. Lastly, We have used Metamask Ethereum Wallet to connect our browser with the blockchain network. Source code of the smart contract will be found in the Git repository(http://bit.ly/blockchain-land-management).

## VI. Conclusion

The introduction of Blockchain to the current land registration system in Bangladesh will bring transparency in ownership evaluation and prevent illegal transactions. The proposed architecture in this paper inheriting the advantages of Blockchain will also help to accomplish Sustainable Development Goals(SDGs) and economic development in Bangladesh. Previously there was uncertainty and lack of trust between different stakeholders of the land management system. The distributed information of the virtual deed in the proposed system will reduce the disputes drastically.

### *A. Limitations and Future Research Directions*

This paper incorporates multiple key advantages such as security and transparency issues related to land registration system. Some of the privacy concerns of stakeholders of the system need further research. Also the mechanism of selling a portion of the land needs to be addressed with the proposed Blockchain system.

Collecting reliable land-related information for genesis blocks will be a big challenge. The load of the Blockchain system will gradually increase with the population growth. There may be a need for maintaining several Blockchains due to the increase in infrastructure requirements. Also, countries like Bangladesh that are prone to natural disasters, the boundary information for a land may need to be updated from time to time. So this update needs to be smooth to prevent any kind of dispute. The legal requirements may also need to be notified by the government. To accommodate all the dynamic updates in the Blockchain environment, new emerging technologies like Artificial Intelligence(AI) and Machine Learning can be integrated with the proposed system to make the land management system more efficient, secure and responsive.

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