

Blockchain-Enabled Secured Land Transaction Framework using Smart Contract

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Abstract—In the past, checking who owns land and handling all the paperwork involved in land transaction took a long time due to involvement of lawyers and two witnesses. To solve this problem, we propose using a blockchain along with smart contract for creating tokens for each plot of land. The proposed technology will shorten the steps required in transferring land ownership from seller to buyer. This research used Abuja, Nigeria as a case study and we investigated the process involved in land ownership transfer from seller to buyer. Our proposed algorithm removed the need for lawyers and witnesses that exist in the current system in Abuja, Nigeria.

Index Terms—Blockchain, Land, Smart Contract

I. INTRODUCTION

The acceleration of digitization and technological advancements stands as a paramount force reshaping our society. Traditional methods of verifying ownership and land deeds often proved cumbersome and vulnerable to fraud and tampering. This paper advocates for a blockchain-based land registration system to mitigate these challenges. By decentralizing transactions and employing encryption techniques, the proposed system ensures security and transparency while expediting processes. Through recording all changes in immutable blocks, it provides a reliable and efficient means of managing land records, enhancing overall trust and efficiency in property transactions.

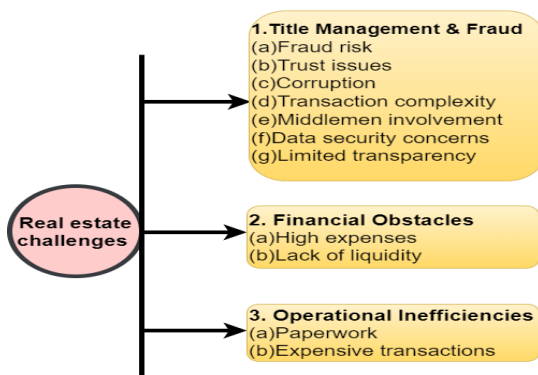


Fig. 1. Summary of Real Estate Challenges in Developing Countries

This study is divided into subsequent sections. Section II discusses the literature review. The proposed system model was presented in section III. The experimental setup and results are described in Section IV, while the conclusion and future work are presented in Section V.

II. LITERATURE REVIEW

Alam and etal in 2022 highlighted that real estate faces challenges with cumbersome title management, fraud, and illiquidity, which can lead to delays and errors in transactions, undermine trust, and limit financial flexibility for property owners. It was pointed out that the high expenses associated with land acquisition and transactions deter potential buyers or investors, as these costs make property transactions costly. The challenges in the real estate sector, including fraud risk, complex transaction procedures, and involvement of multiple intermediaries, which can complicate transactions and increase costs were also highlighted [1] [2] [3] [4] [5].

To close the research gap of the previous studies, this paper proposes a blockchain-based system that digitalizes land ownership and sales by implementing smart contract in Fig. 4.

III. PROPOSED SYSTEM MODEL

A. Proposed Algorithm for Nigeria

The proposed system architecture is shown in Fig. 3. It shows how land information is being stored in the blockchain network. The algorithm 1 facilitates the transfer of ownership for registered land. First, the buyer expresses interest in purchasing a specific plot from the seller. Once an agreement is reached, the seller transfers the land's unique tokenId to the buyer's address. The buyer then confirms ownership of the tokenId. Finally, the buyer pays the agreed-upon amount to the seller, completing the transaction and receiving confirmation of land ownership transfer. Fig. 4 depicts the smart contract backend functions including *transferTokenId* for transferring *tokenId* and *getlandInfoById* for fetching land details from Purechain network.

Algorithm 1 Proposed Algorithm for Abuja, Nigeria

Require: *buyer_address, tokenId*

Ensure: Confirmation of land ownership transferred to buyer

- 1: Buyer requests to purchase plot of land from seller
 - 2: Agreement reached between the two parties
 - 3: Seller transfers land tokenId from seller's address to buyer's *address*
 - 4: Buyer confirms ownership of the tokenId
 - 5: Buyer pays the seller amount agreed upon
 - 6: **return** Confirmation of land ownership transferred to buyer
-

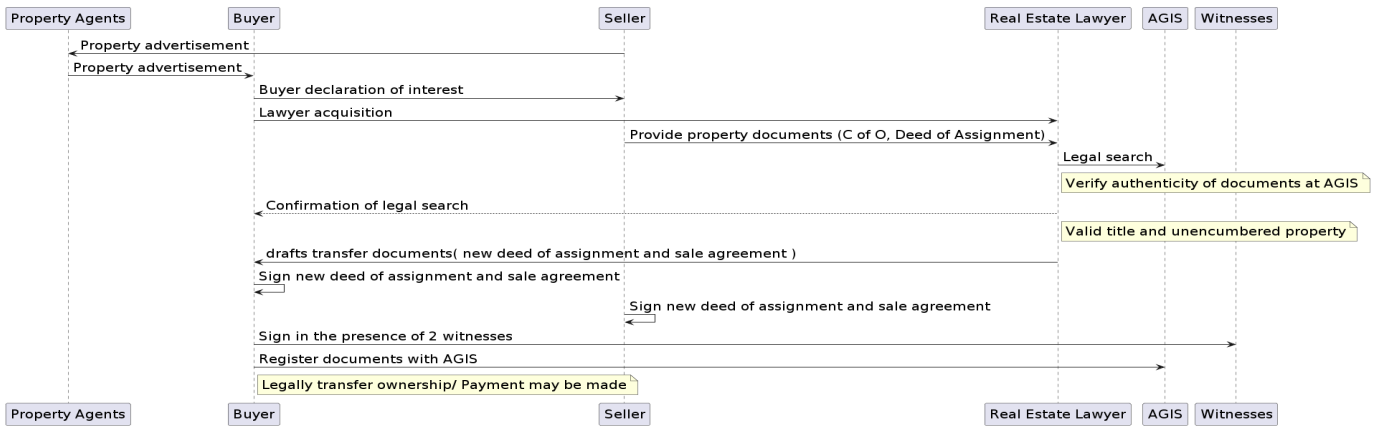


Fig. 2. Real estate transaction process in Abuja, Nigeria, AGIS : Abuja Geographic Information System

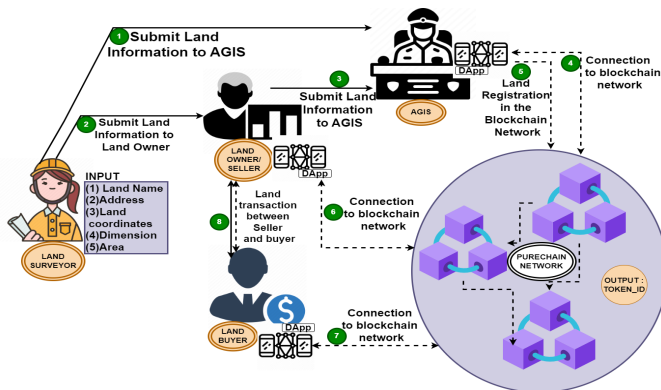


Fig. 3. Proposed System Architecture



Fig. 4. Smart Contract Functions

IV. EXPERIMENTAL SETUP AND RESULT

Purechain network was adopted as the host blockchain network because it uses proof of Authority (POA) consensus algorithm. Also, Purechain has a robust auto-mining feature as well which makes it unique when compared to other networks. The smart contract was compiled, deployed and tested on the Purechain using Remix.

```

"from": "0x0fc5025c764cE34df352757e82f7B5c4Df39A836",
"topic": "0xddf25ad1be2c89b69c2b068fc378daa952ba7f163c4a11628f55a4df523b3ef",
"event": "Transfer",
"args": {
  "from": "0x5B38Da6a701c56854dCfc803Fc8875F56beddC4",
  "to": "0xAb8483F64d9C6d1EcF9b849Aae677dD3315835cb2",
  "tokenId": "1"
}

```

Fig. 5. Smart Contract output showing the transfer of land ownership from seller to buyer via tokenId

V. CONCLUSION AND FUTURE WORK

In this research, we have been able to remove the need for lawyers and witnesses using algorithm 1, smart contract and Purechain network. Future research direction will include adding more functionality to the smart contract like renting and also creating a decentralized application for the solution.

ACKNOWLEDGEMENT

This work was partly supported by Innovative Human Resource Development for Local Intellectualization program through the Institute of IITP grant funded by the Korea government(MSIT) (IITP-2024-2020-0-01612, 33.3%) and by Priority Research Centers Program through the NRF funded by the MEST(2018R1A6A1A03024003, 33.3%) and this work was supported by (NRF-2022R1I1A3071844, 33.3%).

REFERENCES

- [1] K. M. Alam, J. Ashfiqur Rahman, A. Tasnim, and A. Akther, "A blockchain-based land title management system for bangladesh," *Journal of King Saud University - Computer and Information Sciences*, vol. 34, no. 6, Part A, pp. 3096–3110, 2022.
- [2] I. S. Igboanusi, K. P. Dirgantoro, J.-M. Lee, and D.-S. Kim, "Blockchain side implementation of pure wallet (pw): An offline transaction architecture," *ICT Express*, vol. 7, no. 3, pp. 327–334, 2021.
- [3] I. S. Igboanusi, A. Allwinnaldo, R. N. Alief, M. R. R. Ansori, J.-M. Lee, and D.-S. Kim, "Smart auto mining (sam) for industrial iot blockchain network," *IET Communications*, vol. 16, no. 18, pp. 2123–2132, 2022.
- [4] A. Zainudin, M. A. P. Putra, R. N. Alief, R. Akter, D.-S. Kim, and J.-M. Lee, "Blockchain-inspired collaborative cyber-attacks detection for securing metaverse," *IEEE Internet of Things Journal*, vol. 11, no. 10, pp. 18 221–18 236, 2024.
- [5] O. U. Nwankwo, D. S. Kim, and J.-M. Lee, "A novel deep learning-assisted truck driver drowsiness record using blockchain technology," in *2023 14th International Conference on Information and Communication Technology Convergence (ICTC)*, 2023, pp. 1082–1086.