International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Blockchain based Banking System Using Ethereum

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Abstract: This paper proposes a novel blockchain-based advanced banking system that leverages the distributed ledger technology of Ethereum to create a secure, transparent, and efficient financial system. The system utilizes a permission blockchain network, where participants are pre-authorized to join and contribute to the network. This ensures the security and integrity of the system, while still allowing for a wider range of participants than a fully public blockchain network. The system works by first having a user initiate a transaction request. The system then verifies the user's identity and ensures the authenticity of the request. The transaction is entered into the blockchain ledger after it has been validated. This ensures that the transaction is immutable and transparent, as all participants in the network can view the transaction details. The system also includes a fraud detection mechanism that can detect any changes made to the transaction after it has been recorded on the blockchain. This helps to ensure the security of the system and protect users from fraudulent activity. The proposed system has the potential to revolutionize the banking industry by providing a more secure, transparent, and efficient way to conduct financial transactions.

Keywords: blockchain, online banking, ethereum, ganache, hash, smart contract, blocks

I. Introduction

1.1 Overview

Blockchain is one of the new technological revolutions that will have a huge impact on business and commerce. Every transaction has a digital signature that proves the authenticity of the blockchain. Data storage on the blockchain is tamper-proof and cannot be changed due to the use of an Ethereum address. To change a list on the blockchain, a lot of information needs to be changed, and the list needs to be changed. Therefore, it is not possible to change the information entered into the blockchain. Each "block" contains a batch of transactions, linked in chronological order, creating a chain. It prevents tampering and fraud by requiring network agreement before data is added or altered. This innovation has the potential to revolutionize various industries by enhancing security, reducing intermediaries, and increasing efficiency. Every block contains a cryptographic hash of the previous block, creating an interlinked structure that resists alteration. If someone tries to change an earlier block, it requires changing later blocks across the network, which is computationally impossible. This immutability makes blockchain ideal for applications requiring trust, like supply chain management, voting systems, and digital identity verification. Blockchain can solve all kinds of problems in the banking sector. This technology gained fame after the launch of the first cryptocurrency, Bitcoin. There are big problems in the financial sector right now that blockchain can solve.

1.2 Background

The concept of a central server is still a core part of many banking systems, the architecture is evolving to be more resilient and geographically distributed. Many banks still rely on a central database to store critical information. A complete failure of the central server could still cause significant disruption. Customers might experience issues with accessing accounts, making transactions, or using online banking services. However, the severity and duration of the outage would depend on the bank's specific disaster recovery plan and the level of redundancy built into the system.

1.2.1 Ethereum

Ethereum is a decentralized open source blockchain platform that allows developers to create and deploy smart contracts and distributed applications (DApps). Ethereum operates on a blockchain-based architecture, similar to Bitcoin. However, Ethereum's architecture is more versatile and programmable, allowing developers to create custom applications and smart contracts. The Ethereum blockchain consists of a network of nodes that validate and record transactions. These nodes communicate with each other to maintain a distributed ledger of transactions. Ethereum's architecture includes the Ethereum Virtual Machine (EVM), which executes smart contracts. The EVM is a Turing-complete runtime environment that enables the execution of arbitrary code on the blockchain.

1.2.1.1 Core functionalities of Ethereum

Smart Contracts: These are programmable agreements that automate transactions and eliminate the need for intermediaries. They operate under predefined conditions, ensuring trust and transparency.
Turing Completeness: The Ethereum Virtual Machine (EVM) allows writing complex programs, enabling a diverse range of dApps (decentralized applications) to be built on the platform.
Ether (ETH): The native cryptocurrency of Ethereum, used for:

- Paying transaction fees on the network
- Rewarding miners/validators for securing the network
- Facilitating smart contract execution

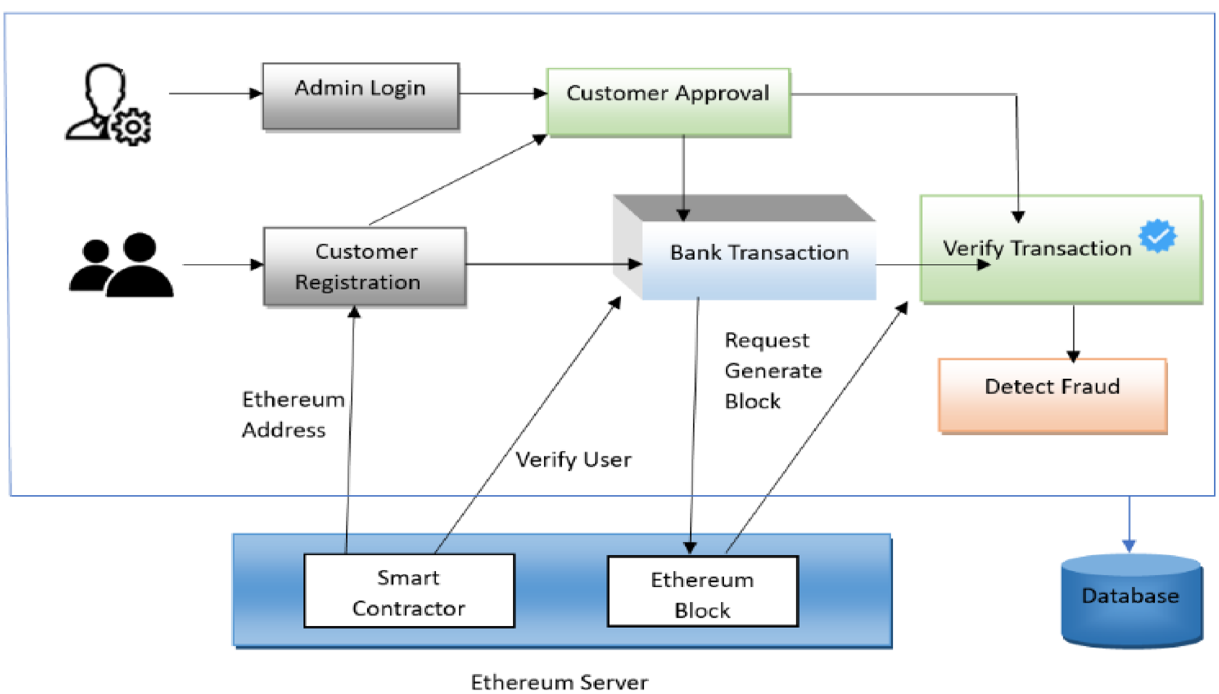
1.2.1.2 Ethereum Gas

Gas represents the cost of executing a transaction or smart contract on the Ethereum network. Each operation or computational step in a transaction consumes a specific amount of gas. The gas limit, specified by the sender of a transaction, defines the maximum amount of gas that can be consumed. If the execution of a transaction exceeds the gas limit, it will fail, and any consumed gas will be refunded. Gas is used to prevent abuse of the Ethereum network by requiring users to pay for the computational resources they consume. It ensures that miners and validators are compensated for the computational work required to execute transactions and smart contracts.

II. Objectives

1. To investigate the problems associated with the current banking security.
2. To analyze how block chain can be implemented in banking and its security applications within the banking sector.
3. To develop a system that will use blockchain technology to secure data storage in banking database and detect fraud.

III. Proposed System Architecture



As shown in Figure 1, first, when the customer does the registration, It is sent for the approval of the admin, and an Ethereum address is provided to the customer from the Ethereum Server (Smart Contract). At the time of the bank transaction, the verification is done by smart contracts on the Ethereum server, and the admin gives approval. At the time of the transaction, it requests to generate the transaction blocks, and the blocks are generated on the Ethereum server. At the time of fraud detection, the transaction blocks generated on the Ethereum server are used to detect fraud. If any changes are made by a third party, then they are detected as fraud; otherwise, no fraud is detected.

IV. Implementation

1. **Creating Bank Website**- This module likely focuses on the initial setup and configuration of the website, potentially including user interface design and backend functionalities.

2. **Admin Login-** This module is used by the administrator of the bank to log in to the system. It requires the following information:
    a. The username of the administrator
    b. The password of the administrator

Fig 1. System Architecture Diagram

3. **Customer Registration-** This module is used to register a new customer with the bank. It requires the following information:
    a. The name of the customer.
    b. Email of customer.
    c. The address of the customer .
    d. Adhar and pan card of customer.
    e. The contact information for the customer.
    f. Customer has to set password.

4. **Allocate Ethereum Address-** This module is used to allocate an Ethereum address to a new customer.

5. **Customer Approval-** This module is used to approve a new customer for opening an account with the bank. The administrator of the bank must approve the customer after registration and before they can login to an account.

6. **Bank Transaction**
    a. **User verification using Smart Contract-** This module is used to verify the identity of a user using a smart contract.

b. **Transaction Block** - This module is used to create a block of transactions. A block of transactions is a group of transactions that are linked together .

c. **Server**- This module is used to store the details of each transaction on a server. The details of the transaction include the sender, the recipient, the amount, and the time stamp.

7. Verify Transaction to detect Fraud- This module is used to verify each transaction to detect fraud. The model will look for patterns of fraudulent activity, If any changes are made by a third party, then fraud is detected. otherwise, no fraud is detected.

V. Comparative Analysis:

5.1 Architecture:

Traditional Banking Systems: Centralized architecture with a hierarchical structure of banks and financial institutions.

Blockchain-Based Banking Systems: Decentralized architecture with a distributed network of nodes, interconnected through consensus mechanisms.

5.2 Functionality:

Traditional Banking Systems: Relies on intermediaries for transaction processing, identity verification, and record-keeping.

Blockchain-Based Banking Systems: Employs cryptographic techniques and consensus mechanisms to automate transaction processing, verify identities, and maintain immutable records.

5.3 Advantages:

Traditional Banking Systems: Established infrastructure, regulatory compliance, and familiarity for customers.

Blockchain-Based Banking Systems: Enhanced security, transparency, efficiency, and innovation, with lower transaction costs and global accessibility.

5.4 Challenges:

Traditional Banking Systems: Vulnerable to cybersecurity threats, operational inefficiencies, and regulatory constraints.

Blockchain-Based Banking Systems: Scalability limitations, interoperability challenges, regulatory uncertainty, and adoption barriers.

5.5 Case Studies:

Traditional Banking: Case study of a traditional bank and its operations, challenges, and strategies for innovation.

Blockchain-Based Banking: Case study of a blockchain-based banking platform, highlighting its architecture, functionalities, and real-world applications.

5.6. Future Outlook:

The future of banking is likely to be shaped by a convergence of traditional banking systems and blockchain-based banking systems, as financial institutions embrace technological advancements to enhance efficiency, security, and customer experience. Continued research, collaboration, and innovation will drive the evolution of banking services and the broader financial ecosystem.

VI. Conclusion

Our project aims to develop advanced banking system software powered by blockchain technology, with a primary focus on secure transactions and fraud detection. Utilizing the benefits of the Ethereum blockchain. Our system is capable of identifying fraudulent transactions, safeguarding the bank and its clients from financial losses. We have implemented risk assessment mechanisms that analyze Ethereum addresses and transaction patterns to proactively identify potential risks, allowing banks to take preventative actions.

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