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State Government Fund Allocation & Tracking System using Blockchain

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Abstract: The state government's working involves a large number transactions activities towards various operations throughout the state. This includes new actions, initiatives, projects, granting contracts, farmer schemes, and so on. One of the most challenging factors that top governments face is low-level corruption which at times is hard to follow and denies the state progress. State governments are exploring innovative technologies to enhance their fund allocation and tracking systems. This paper proposes the development and implementation of a State Government Fund Allocation, Tracking System using Blockchain technology. As a result of the current system, tracking is very problematic and provides needy people with a service that is sometimes difficult to track, deprivings them. In this case, we use blockchain which enables cryptography and transaction security at every stage while maintaining transparency so that every transaction is backed up with proof of its authenticity. Hence, we present a framework that uses blockchain innovation and a full-proof fund transfer system. This blockchain contains a growing list of records called blocks. Cryptographically hashed data, a timestamp, and recent transactions are included in each bloc k. or benefits of blockchain-based applications.

Keywords: Blockchain, Authority, Fund Tracking, transparency, and Blockchain application.

1. Introduction

Government fund allocation plays a critical role in the functioning of a state, affecting various sectors such as healthcare, education, infrastructure, and social services. However, traditional methods of managing and distributing these funds often suffer from inefficiencies, lack of transparency, and potential for misappropriation. A blockchain-based system can address these challenges and provide a more accountable and efficient solution.

Blockchain is one of the technologies that have created a disruptive change in several industries. Currently, Blockchain is getting used in numerous places and there are more applications of

Blockchain yet to be discovered and implemented. Blockchain is characterized by its decentralized nature, the integrity of the information stored within the chain, and its openness. Due to these characteristics, another area in which Blockchain can be used is to release funds for government projects. Governments have to cater to an enormous number of responsibilities of a state. This includes new projects, repair, and maintenance work, awarding contracts, paying off government employees, farmer schemes, and so on.

A serious hurdle that the highest government faces is the low-level corruption that's sometimes impossible to trace, which deprives the state of progress. Tracking it's a really difficult task because of the present system. Blockchain is touted for its capability to reinforce the trust and ease of information-based exchanges among people and associations. The innovation offers a guarantee when deliberately applied within the proper settings. Customarily and provoking establishment. Blockchain innovation tends to those difficulties by giving a specialized establishment that underpins the execution of shared business forms., such that no single substance controls the complete framework. Government incorporates a characteristic need to assemble, support, and ensure open trust in data and frameworks. In such kinds of situations, blockchain may help to boost this trust.

2. Challenges

2.1. Scalability:

- Challenge: As the system grows, blockchain networks may face scalability issues in handling a high volume of transactions and data.
- Solution: Implement scaling solutions like sidechains, sharding, or layer 2 solutions to ensure the system can accommodate increased demand.

2.2. Security:

- Challenge: Ensuring the security of the blockchain network and the stored data is paramount, as it may contain sensitive financial and government information.
- Solution: Regular security audits, robust encryption, and the use of consensus mechanisms like Proof of Stake or Proof of Authority can enhance security. Stay updated with the latest security practices.

2.3. Regulatory Compliance:

- Challenge: Adhering to state and federal regulations while using blockchain, which often operates in a decentralized and borderless manner, can be complex.
- Solution: Engage with legal experts who are well-versed in blockchain and government regulations to ensure compliance. Implement features that allow government agencies to maintain control and oversight while still leveraging the benefits of blockchain.

2.4. Privacy:

- Challenge: Protecting the privacy of sensitive data while maintaining transparency can be tricky.
- Solution: Utilize privacy-enhancing technologies like zero-knowledge proofs, private transactions, or confidential contracts to protect sensitive data while still providing transparency where necessary.

2.5. Interoperability:

- Challenge: Ensuring that the system can work with other blockchain networks or legacy systems is essential for seamless operations.

- Solution: Design the system with interoperability in mind, making it compatible with relevant standards and protocols. Engage in collaborations with other government agencies to facilitate data sharing.

3. Key Components of the System

3.1. Blockchain Technology: The foundation of this system is blockchain, a decentralized and distributed ledger technology that records transactions in a transparent and secure manner. It offers several advantages for government fund allocation and tracking.

3.2. Transparency: All transactions are recorded on a public ledger, ensuring that every allocation decision is open and accessible to relevant stakeholders.

3.3. Immutability: Once recorded on the blockchain, data is nearly impossible to alter, providing a high level of security and trust in the system

3.4. Smart Contracts: Smart contracts are self-executing contracts with predefined rules and conditions. In the context of government fund allocation, they can automate the disbursement of funds based on specific criteria or milestones. Smart contracts eliminate the need for intermediaries and reduce the risk of fraud or misallocation.

3.5. Decentralization: The system operates on a decentralized network of nodes, meaning that there is no central authority or single point of control. This decentralization minimizes the risk of corruption and ensures that the system is tamper-proof.

4. Key Features and Benefits

4.1. Transparency: The blockchain ledger provides real-time, transparent tracking of all government allocation transactions. Citizens, government officials, and auditors can view and verify transactions, promoting trust and accountability.

4.2. Security: Blockchain's inherent security mechanisms make it highly resistant to fraud and unauthorized alterations of data. This enhances the integrity of government fund management.

4.3. Efficiency: Automated smart contracts can expedite the allocation process, reducing administrative overhead and the time required for fund disbursement.

4.4. Accountability: With transparent records and automated processes, it becomes easier to hold government officials and agencies accountable for their financial decisions

Use Cases:

- **Education Funding:** Smart contracts can ensure that education funds are allocated to schools based on student performance metrics and enrollment, leading to a fair distribution.
- **Healthcare Funding:** Healthcare facilities can receive funds automatically when they meet predetermined healthcare indicators, improving the quality of healthcare services.
- **Infrastructure Projects:** Funds for infrastructure development can be released as construction milestones are met, reducing delays and cost overruns.

5. Literature survey

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[2] Rishita Gawade, Aditi Kale, Snehal Mane (2022) " Government Fund Allocation a Tracking System using Blockchain." In this full-proof, secure government fund allocation and tracking system, the allotted funds are tracked at each level until they reach the beneficiaries. This proposed framework is added to assist the authorities to lessen corruption and offer transparency in all transactions because of the functions of blockchain-like immutability, proof of work, and security.

[3] Sahil siddharth jambhulkar, vishakha prashant ratna parkhi." Government fund distribution and "Tracking system using blockchain Technology." In this paper we propose a system to track funds allocated to the government as they travel through the government process at each stage using Key pair generation algorithm, Metadata file decryption and Data verification algorithms. This system uses block-chain technology to maintain the transparency & security at every stage as the funds move ahead. This system allows us to maintain the crystal-clear record with all users who are connected in the chain to transaction the data on a need-to-know basis.

4] Apoorva Mohite, Ajay Acharya. (2018)" Blockchain for government fund tracking using Hyperledger." This paper gives a description about a prototype which was developed using Hyperledger Composer. It then discusses the future development of this prototype and finally, concludes with the applicability of Blockchain.

[5] Abhishek Katore, Sanskar Choubey. (2021)" Government Scheme and Funds Tracker using Blockchain." It is also referred to as the Digital ledger, the same as the ledger maintained by financial institutions for keeping the track of records. In similar fashion
blockchain is essentially digital ledger which is maintained in a decentralized and
distributed environment.

[6] Smriti Ranjan Bhattacharya, Dr. Anupam De, (2014) Financial Planning Through Resource Allocation in Urban Local Self Government, this study shows a new way of financial planning for the ULSGs. The result shows a new dimension towards management of finance through resource allocation. "Infrastructure" clearly indicates that house tax, being the major source of income, should be allocated to the expenditure related with infrastructure. It is meaningful in the sense that the citizens have to bear the expenses for overall development of the city through development and maintenance of infrastructural facilities.

[7] Ajayvikram Chauhan, Gaurav Savner, Prajwal Venkatesh, Vishwanath Patil, and Wencen Wu, (2020), A Blockchain-based Tracking System, this paper presented a blockchain-based solution for a delivery tracking system. The system is generalized and can be incorporated into many business domains. The features of blockchain such as immutability and security have been leveraged by the system to provide a decentralized and trustworthy system. It trumps over the existing traditional approach by having a more credible tracking system which would eliminate the scope of wrongdoings or discrepancies. The wallet transactions are stored on a distributed blockchain ledger, providing complete trans

6. Existing System

Initially, we took notes manually about funds and government schemes. However, it was found that much data had been lost as well as a lot of corruption had occurred. To resolve this issue, we created a system of tracking and allocating government funds using blockchain technology. The current system, of tracking is very problematic and provides needy people with a service that is sometimes difficult to track, depriving them. In this case, we use blockchain cryptography and transaction security at every stage while maintaining transparency so that every transaction is backed up with proof of its authenticity.

The problems in the existing systems are:

I. Provision of access to the assets to all users without any priority.
II. Only using one security mechanism like hashing at a time.
III. Not granting the applicants the ability to track the status of their funds.
IV. Only allowing a singular application from a participant per scheme.
V. Giving the admin rights over the entire system that is a third-party user and might not be trusted completely.
VI. Added costs of cloud services that are required to store records.
VII. Extensive usage of the database for all transactions makes the storage less secure.
VIII. The rejection level for an application is not being made clear to the applicant.

There are three basic components of a blockchain: blocks, miners, and nodes.

Block – Each blockchain is made up of multiple blocks, and each block contains data that is a record of transactions. The key point is that the chain is not owned by a single person or organization. When a block is efficiently mined, the miner receives a monetary reward.

Nodes: A node connects each block to another block, forming the chain. Basically, a node keeps copies of the ledger keeps the network operational. How does blockchain provide security?? Most blockchains organize data into blocks, with each block containing a transaction or series of transactions. Each new block in a crypto chain is so connected to all previous blocks that it is very difficult to manipulate them. Consensus procedures ensure that every transaction within the block is truthful and accurate in validating and accepting all transactions within the block. Blockchain technology provides decentralization by allowing members of a distributed network to participate.

7. Proposed System

The proposed system tracks the funds granted to the state government as they go through the government process. It uses blockchain technology to safeguard transactions at each level while retaining transparency in every transaction and sealing every transaction with proof as the money goes forward. The system secures data using hashes to keep a block of transactions in a chain. It enables a complete proof, secure, and authentic financial distribution and tracking mechanism, which contributes to the formation of an incorruptible government. Our system has 2 modules, i.e., Admin (Government) and User. Admin (Government) Module: The government provides the requested funds to the user.

User Module: In this system, the user will request the funds according to their needs and also, and they can check their transaction history and wallet balance as well. The user requests the funds from the admin (Government) then the requests are sent to the Government for approval. After that, the government views the request and then can approve or reject the request. The transaction is validated by the network's nodes (people in real life). Following this confirmation, the block is put on the blockchain along with a timestamp. After that, the transaction could be enforced. All transactions submitted in this manner will be noted and made publicly available to everyone. the proposed work for a state government fund allocation and tracking system using blockchain involves a series of steps and tasks to design, develop, and implement such a system.

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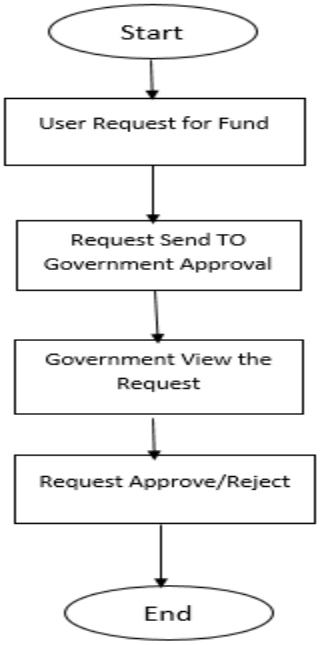

Figure 1: Block diagram

8. System Design

8.1. System Architecture

In Figure 1 there are various modules like government, users, and various types of departments. in our system, there are 2 main modules i.e., Admin (Government) and User.

Admin (Government) Module: The government provides the requested funds to the user.

User Module: In this system, the user will request the funds according to

their needs and also, and they can check their transaction history and wallet balance as well.

I. Design the architecture of the blockchain based system, including the choice of blockchain platform (e.g., Ethereum, Hyperledger), data storage, and user interfaces.

II. Create the data schema for the blockchain ledger, specifying the types of transactions and data fields.

III. Develop the smart contracts that will automate fund disbursement based on predefined rules and conditions

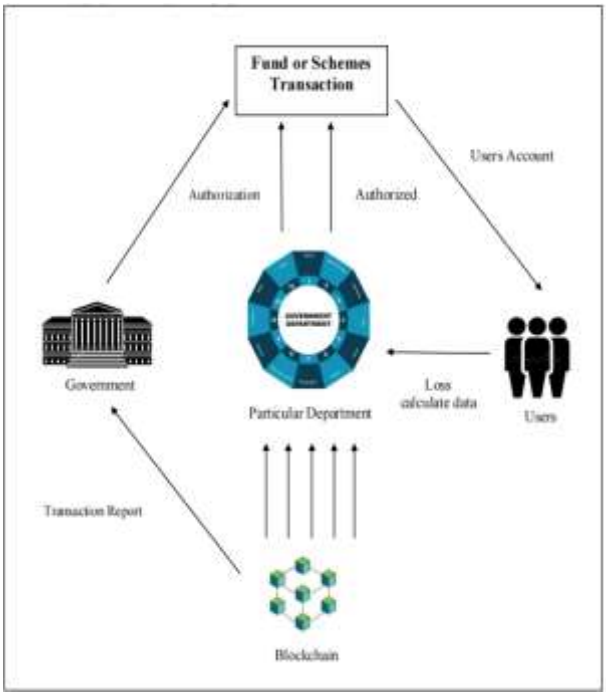

Figure 2: System Architecture

8.2. Usecase Diagram

In Figure 3 there are two modules user and admin.

User:

Users can Register
Users can log in
Users can Request for Fund/Scheme
Users can View Transaction on Funds

Admin:

Admin can log in
Admin can View Request
Admin can Add or Edit Different Categories of Fund/Scheme
Admin can Reject/Approved the Request
Admin can View Transaction on Funds

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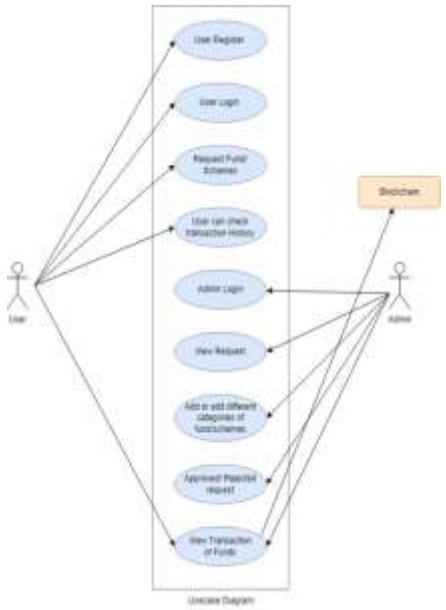

Figure 3: Start Diagram

8.3. Class Diagram

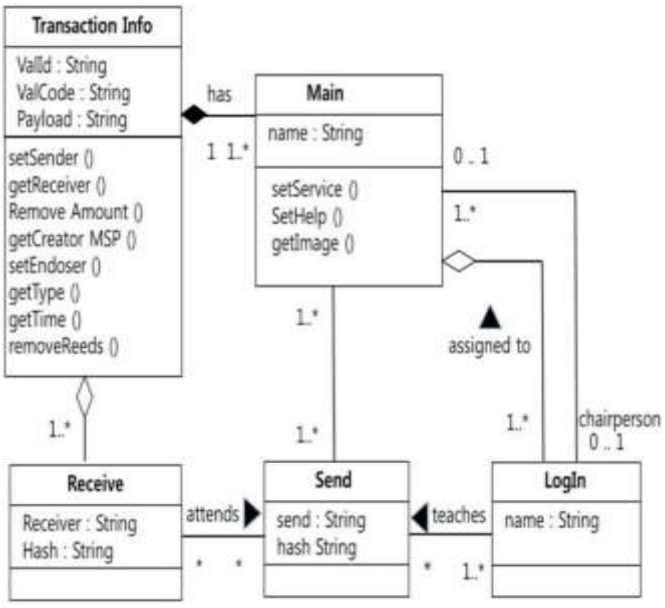

Figure 4: Class Diagram

8.4. Sequence Diagram

In Figure 5, there are all processes of the User and Admin which are done in the process of government fund allocation.

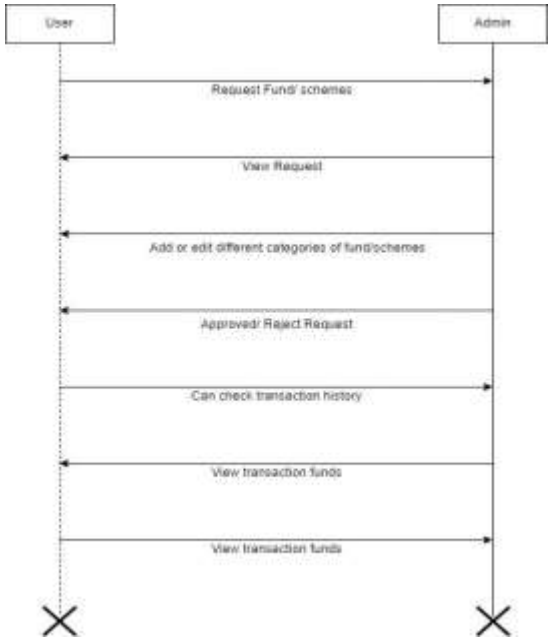

Figure 5: Sequence Diagram

9. Proposed Algorithm

Algorithm 1: Protocol for Peer Verification

Explanation: In peer-to-peer verification algorithms we can communicate with one or more then system. In this project, we use this peer-to-peer verification algorithm to communicate between the Admin and User.

Peer-to-peer (P2P) algorithms and hash generation algorithms are two distinct concepts, but they can be used together in P2P networks to achieve various functionalities, such as distributed data storage, decentralized lookup, and data integrity verification. the connection between P2P algorithms and hash generation algorithms lies in the use of hash functions to create unique identifiers, verify data integrity, and support efficient distributed data storage and retrieval in P2P networks.

Algorithm 1
Input: User gets IP address, User Transaction TID,
Output: Enable IP address or current query if any connection is valid
Step 1: User generates any transaction DDL, DML, or DCL query
Step 2: Get the current IP address
If (connection (IP) equals(true))
Flag true
Else
Flag false
End for
Step 4: if (Flag == true) Peer to Peer Verification valid
Else
Peer-to-Peer Verification Invalid
End if
End for

Algorithm 2: Hash Generation

Hash generation algorithms play a crucial role in blockchain technology for several reasons:

Hash functions are used to create a unique digital fingerprint (hash) for each block of data in a blockchain. This property ensures data security because the original content is not exposed in the blockchain. Hashes are used to link blocks in a chain. Each block contains the hash of the previous block, creating a chronological and secure linkage between blocks. Miners or validators use hashes to compete for the right to add a new block to the blockchain. In PoW, miners must find a nonce that, when hashed, results in a hash that meets certain criteria (proof of work)

Mining algorithms and hash generation algorithms are closely related in the context of cryptocurrencies like Bitcoin. In cryptocurrency mining, miners use a hash generation algorithm as part of the mining process to validate transactions and secure the blockchain. The connection between the hash generation algorithm and the mining algorithm lies in the process of finding a valid hash (satisfying PoW criteria) by adjusting the nonce value in the block header and repeatedly hashing it using the SHA-256 algorithm. This hash, when accepted by the network, contributes to the creation of new blocks in the blockchain.

Algorithm 2
Input: Genesis block, Previous hash, data d,
Output: Generated hash H according to given data
Step 1: Input data as d
Step 2: Apply SHA 256 from the SHA family
Step 3: Current Hash= SHA256(d)
Step 4: Return Current Hash

Algorithm 3: Mining Algorithm for valid hash creation:

Explanation: Mining algorithms are a crucial component of blockchain networks, particularly in proof-of-work (PoW) consensus systems. These algorithms are used to create valid hash values for new blocks. Mining algorithms make it computationally expensive and time-consuming to create new blocks. The mining algorithm is responsible for selecting which transactions to include in a new block

Miners perform Proof-of-Work (PoW) computations to find a nonce that, when hashed with a block header, produces a hash that meets specific difficulty criteria. Once a miner finds a valid hash, they create a new block that includes a set of transactions and the valid hash.

Algorithm 3

Input: Hash Validation Policy P [], Current Hash Values hash Val

Output: Valid hash

Step 1: System generates the hash Val for i th transaction using Algorithm 1

Step 2: if (hash Val. valid with P [])

Flag =1

Else

Flag=0

Step 3: Return valid hash when flag=1

Algorithm 4: Recover Block Chain Data

Explanation: Recovering blockchain data can be challenging, especially if data is lost, corrupted, or inaccessible. While there isn't a single "Recover Blockchain Data Algorithm," there are various techniques and methods that can be employed to address different data recovery scenarios in blockchain systems. Algorithms can be used to repair and reconstruct corrupted data in the blockchain. For instance, if a transaction or block has been partially damaged, algorithms can attempt to reconstruct the missing or corrupted portions.

Algorithm 4

Input: User Transaction query, Current Node Chain
C Node[chain], Old
Nodes Chain [Node id]
Output: Recover if any chain is invalid else execute current query
Step 1: User generate the any transaction DDL, DML or DCL query
Step 2: Get current server blockchain C chain ← C node [Chain]
Step 3: For each (read I into Node Chain)
If (! equals Node Chain [i] with (C chain))
Flag 1
Else Continue Commit query
Step 5: if (Flag == 1)
Count = Similarly Nodes Blockchain ()
Step6: Calculate the majority of server
Recover in valid block chain from specific node
Step7: End if End for End for

10. Mathematical Model

Mathematical module representation in a formal format, by using mathematical notation:

1. Input:
   - Recipients: List of recipients [Recipient1, Recipient2, ..., Recipient N]
   - Allocations: List of corresponding allocations [Allocation1, Allocation2, ..., AllocationN]

2. Output:
   - Updated balances for each recipient

3. Initialization:
   - TotalAllocation = 0

4. Calculate Total Allocation:
   - For i from 1 to N:
     - TotalAllocation += Allocations[i]

5. Check Sender's Balance:
   - If SenderBalance < TotalAllocation:
     - Return "Insufficient balance"

6. Allocate Funds:
   - For i from 1 to N:
     - Update Recipient[i] balance: Recipient[i]. Balance += Allocations[i]
     - Deduct Allocations[i] from Sender's balance: SenderBalance -= Allocations[i]

This provides a mathematical representation of the fund allocation algorithm.

11.Conclusion

In this full-proof, secure government fund allocation and tracking system, the allotted funds are tracked at each level until it reaches the beneficiaries. This proposed framework is added to assist the authorities toil lessening corruption and offer transparency in all transactions because of the functions of blockchain-like immutability, proof of work, and security. It offers the right governance and transparency. It will maintain track of all transactions made. As blockchain technology is used the transactions as soon as made cannot be changed and if there's any try of tempering, we can get to recognize approximately that easily. There might be no requirement for the outsider and the exchanges might be regulated all the extra sturdily and transparently. In addition to preventing human errors and delays, it will help eliminate human errors. This framework will make the general public authority framework activities appreciably extra stable and productive. We can nevertheless upload customary schemes from everywhere in the world for fundraising to take it to the subsequent stage for a big price range required by the humans in need.

12. Future Scope

I. The system can be made more scalable by using the Byzantine consensus mechanism.
II. The system can be further secured by adding another level of encryption to data.
III. The usage of multiple documents can be bundled together to use one unique identifier which will make tracking easier.
IV. Sub-contractors can be added so that funds for schemes can go directly to them whenever necessary instead of citizens having to find contractors and sub-contractors.

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