



Addressing Accountability and Fair Practices in Labor Contracting for Sustainable Harvesting in the Sugar Industry

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Abstract

This study promotes the use of blockchain technology to solve issues with labor data management in the sugar business. Through decentralized blockchain storage, the proposed solution protects the security and openness of labor data, with an emphasis on preventing unethical activity by contractors holding numerous simultaneous contracts. Smart contracts make it easier for contractors to register and keep track of engagements, which helps the sugar industry enforce contractual compliance and confirm authenticity. In addition to reducing the possibility of abuse and false information, this blockchain-based approach lays the groundwork for a more responsible and effective labor management system, which will promote integrity and confidence in the sugar sector.

Keywords: Blockchain technology, efficient labor management, contractors, decentralized storage, security, transparency, smart contracts

INTRODUCTION

An essential part of the world's agricultural economy, the sugar business is crucial in supplying the world's need for this sugary good. Nevertheless, the industry continues to face a dilemma that has negatively impacted its operations and financial well-being, despite its economic significance. This challenge centers on dishonest behavior by some contractors that supply the sugar sector with labor services that are necessary, especially for transportation and cutting sugarcane. One of the most common problems facing the sugar business is the dishonest behavior of contractors who, in an effort to benefit themselves, participate in unethical activities that compromise the sustainability and integrity of sugar production. Taking up contracts from several sugar industry stakeholders at once is a standard

strategy used by some contractors. This is a serious threat to the efficient operation of the sugar producing processes, as well as a breach of fair business norms. Innovative solutions that can protect the interests of the sugar sector and guarantee the fair and ethical behavior of contractors are desperately needed in light of these difficulties. Seeing how technology may help with this problem, we are starting to design an application that makes use of blockchain technology.

With its intrinsic qualities of immutability, transparency, and decentralized consensus, blockchain proves to be a potent weapon against the

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unethical behavior found in contractor relationships in the sugar sector. This study investigates how to build a strong and safe framework using private blockchain while keeping a centralized structure. By offering an administrative login where vital contractor data is centrally stored, the proposed application seeks to expedite the contractor administration process. The key innovation lies in the application's ability to prevent contractors from undertaking multiple contracts simultaneously. The solution ensures that every contractor is bound by ethical and contractual duties through smart contract features incorporated in the private blockchain, hence reducing the possibility of contractors exploiting various stakeholders in the sugar sector at the same time. This article seeks to provide insight into the nuances of this blockchain-based solution as we dig deeper. on the difficulties the sugar sector faces, the possible applications of blockchain technology, and the special qualities of our application that we believe will improve the effectiveness and integrity of contractor interactions in the ecosystem supporting sugar production.

RELATED WORKS

Paper 1

- *Name:* Fraud Detection: A Review on Blockchain.
- *Author Name:* Anuska Rakshit, Shriya Kumar, Ramanathan I.
- *Description:* A blockchain serves as a decentralized ledger, commonly referred to as a public ledger, documenting all completed transactions or digital events shared among participants. Participants typically verify each activity manually within the community. Once data is entered, it remains immutable, enabling permanent, implicit, and irrevocable tracking of actions, thereby mitigating various forms of information fraud. Fraudulent transactions are deterred by the consensus mechanism, requiring validation by a group of miners. While hacking and breaches remain potential threats due to moderate data storage and administrative systems, the pervasive compliance mechanism of blockchain acts as a deterrent. Blockchain facilitates the exchange of assets, goods, or services, yet it contends with online fraud, identity theft, and other malicious activities prevalent on the internet. This study explores the application of blockchain technology in fraud detection, focusing on prevalent forms such as rating fraud, insurance fraud, employment history fraud, fraudulent acquisitions, and other scams across industries.

Paper 2

- *Name:* A Centralized Blockchain-based Data SecuritySystem for Electrical Energy against Attacks.
- *Author Name:* Shiela David, Dr. Aroul Canessane.
- *Description:* The main goal of this article is to use blockchain technology to strengthen system security against cyberattacks. The SCADA network, which gathers and organizes measurements of power units into meters, is the initial source of data. By acting as nodes in a network of meter-nodes, these meters help to create a cohesive link inside the system. Using a secure hash method that makes use of cryptographic hash functions, the data is encrypted and decrypted. Additionally, a consensus process is used to guarantee the integrity of the data. The Byzantine Fault Tolerance algorithm is employed to identify erroneous data within the system. This algorithm, integral to distributed networks, enables consensus even when multiple nodes fail to respond or provide incorrect information. Leveraging distributed consensus facilitates energy savings without necessitating complex mathematical computations.

Sufficient maintenance of transaction finality eliminates the requirement for repeated confirmations after settlement. Miners verify blocks and enter transactions on the distributed ledger after reaching consensus. They then work out mathematical puzzles to get the block's nonce, which is essential for block summing. Blocks are finally combined to create a coherent dataset of daily electricity use that has been thoroughly examined, pre-processed, and certified. The system watches out for and detects possible intrusions.

Paper 3

- *Name:* Automated User Authentication in Wireless Public Key Infrastructure for Mobile Devices Using Aadhar Card.
- *Author Name:* Krishna Prakasha, Balachandra Muniyal.
- *Description:* This paper shows how to scan an Aadhar card with a smartphone to enable user verification and identity, then issue a digital certificate. The Unique Identification Authority of India (UIDAI) is leading the Aadhar project, which combines biometrics and digitalization to create a comprehensive database with citizen demographics like name, sex, fingerprint, and iris scans. These particulars are stored on a smart card and are shown as a QR code in addition to the 12-digit Aadhar card number. Scanning QR codes makes it easier to retrieve and view encoded data. A distinct smart card is given to each person, granting them access to a range of government services. Global verification of entities linked with Aadhar numbers is made possible by the comprehensive digital online identity infrastructure that is provided by Aadhar authentication. When asking entities fulfill the proper verification criteria, the UIDAI offers Aadhar-based authentication services.

Paper 4

- *Name:* Blockchain and Machine Learning for Fraud Detection: A Privacy-Preserving and Adaptive Incentive-Based Approach.
- *Author:* Tahmid Hasan Pranto, Kazi Tamzid Akhter Md. Hasib, Tahsinur Rahman.
- *Description:* This study presents an approach for e-commerce entities to collaboratively develop robust machine learning algorithms while preserving corporate plans and attending to privacy issues. Using genuine data from real-world market conditions is crucial to improving the resilience of current systems. This work creates a framework for cooperatively training fraud detection machine learning algorithms step-by-step while protecting the anonymity of involved companies by utilizing cutting-edge blockchain technology. In order to automate system operations and guarantee their resilience and immutability, smart contracts are utilized. The fact that no entity can change the functionality of the system promotes confidence amongst companies.

A framework for adaptive incentives is developed to incentivize organizations in a just manner. Higher difficulty yields larger benefits when it comes to boosting model performance, which is the basis for calculating incentives. Because genuine data has a major impact on model performance, businesses that contribute it are rewarded accordingly.

Paper 5

- *Name:* Towards Blockchain-Based Secure Storage and Trusted Data Sharing Scheme for IoT Environment.
- *Author:* Zia Ullah, Basit Raza, Habib Shah
- *Description:* This article proposes a decentralized storage solution that leverages the InterPlanetary File System (IPFS) coupled with the Ethereum blockchain to address the issues with conventional cloud or third-party storage systems. An access control policy is put in place to prevent unwanted access in order to protect data security and privacy. IoT data streams are encrypted using AES-128 and attribute-based access control (A-BAC) techniques before being uploaded to IPFS. Ethereum smart contracts also hold hashes that are encrypted. Secure key distribution is achieved by using the elliptic curve Diffie-Hellman key exchange protocol, which does not require a reliable Private Key Generator (PKG). Transaction information from the Ethereum blockchain can be obtained to recover the private key in the event of its loss. IoTChain uses a reward-based strategy, giving digital currency to nodes that store data. IPFS-related digital

currency called Filecoin provides storage nodes with incentives. Furthermore, IPFS encrypted keyword searches are made possible by smart contracts that are implemented on the Ethereum blockchain.

ALGORITHM USED

SHA-256 Algorithm

Data Integrity Verification

To generate a distinct hash for every contract between the contractors and the sugar producers or transporters, we have employed SHA256. These hashes are then safely kept in a ledger system or centralized database.

Verification of Agreements

Before contractors get advance payments, the written contract is hashed using SHA256. We now keep this hash along with relevant data such as the name of the contractor, manufacturing guidelines, and payment assurances. The output of a SHA256 hash computation is compared with the stored hash value when a contractor files a request for advance payment. This ensures the validity and integrity of the contract.

Tracking Payment Distribution

We use SHA256 to provide unique hashes for payment transactions and associated data, like the amount, date, and recipient information. The information on the contractor is linked to a ledger containing these hashes. Before disbursing funds, compute the hash of the payment data and compare it to the stored hash to confirm accuracy and prevent manipulation.

Ensuring Accountability

We are able to create a system that maintains an open file of all contractor advance payments. Each payment's amount, date, and purpose can be hashed using SHA256 and entered into an immutable ledger. Contractors can be identified in the system by their distinct hash or by an identifier linked to their identity.

Cross-verification for Multiple Advances

When a contractor requests an advance, search the recorded ledger for previous advances linked to their hashed data or unique ID. Use SHA256 to compare the contractor's details hashes against the stored data in order to identify any instances where the contractor is requesting advances again.

ARCHITECTURE

1. *Registration Process*: respective individual, indicating successful registration. If any information is incorrect or incomplete, the contractor
 - *Contractor's Role*: The individual acting as a is prompted to revise and resubmit. contractor initiates the process. They create an account in the system on behalf of the laborers.
2. *Document Collection*: The contractor gathers Contract Creation:
 - *Parties Involved*: A new contract is formed necessary documents from the laborers—Aadhar card, PAN card, and passport-sized photographs.
 - *Data Entry*: Using the collected documents, the contractor enters the required information into the system. This info could include personal details, document numbers, and other essential data.
 - *Validation*: The system checks the entered information for accuracy and validity. If the data meetsinvolving the registered individuals (laborers) and the factory. Factory Architecture is shown in Figure 2.
 - *Leader Selection*: Within the registered individuals, a leader is chosen to represent the laborers. This leader's name is included in the contract made with the sugar industry.
 - *Smart Contract Creation*: The system generates a smart contract that includes crucial details:
 - the system's criteria, a confirmation message is sent to the

- *Work Amount*: States the total work to be done, like the amount of sugarcane to be harvested (measured in tons).
 - *Financials*: Outlines the total amount of money involved in the contract.
3. Admin's Role
- *Verification and Validation*: The admin, as the main authority figure, reviews and authenticates the information entered by the contractors. Their approval is necessary before any significant decisions are executed.
 - *Period*: Specifies the duration of the contract. Contractor Architecture is shown in Figure 1.
 - *Record Maintenance*: The admin maintains records of all contracts completed by a particular industry. This involves organizing and storing contact details for future reference and transparency.
4. OTP Verification:
- *Validation System*: As part of the validation process, an OTP (One-Time Password) verification system is included. This serves as an additional layer of validation for the entered information, ensuring security and accuracy.

TEST CASES

Test Case ID: 001

Test Case Title: Login Process Verification Test Steps:

- Open the login page of the sugar industry administration system.
- Enter valid credentials (username and password).
- Click on the "Login" button.
- Verify that the system successfully authenticates the user and redirects to the dashboard.

Expected Results

- The system should authenticate the user based on the provided credentials.
- Upon successful authentication, the system should redirect the user to the dashboard interface.

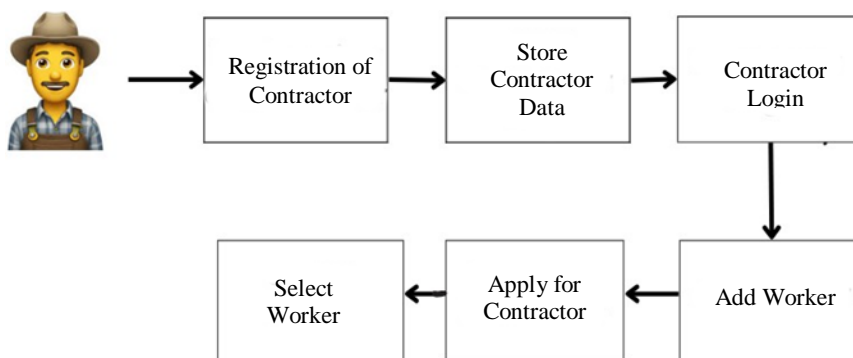


Figure 1. Contractor Architecture

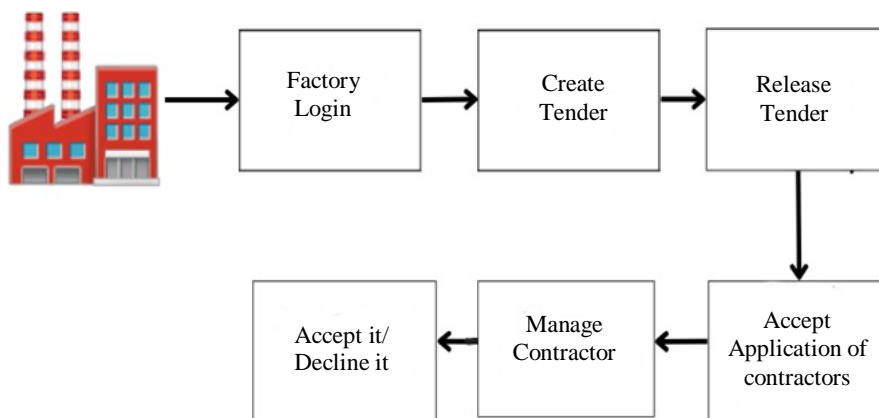


Figure 2. Factory Architecture

Test Case ID: 002

Test Case Title: Registration Process Verification Test Steps:

- Navigate to the registration page of the sugar industry administration system.
- Enter valid registration details, including personal information and credentials.
- Attach valid documents as required.
- Click on the "Register" button.
- Verify that the system processes the registration request without errors.

Expected Results

- The system should accept valid registration details without any errors.
- Upon successful registration, the system should provide a confirmation message and notify the admin.

Test Case ID: 003

Test Case Title: Data Accuracy Validation by Contractor

Test Steps

- Access the data entry section of the sugar industry administration system.
- Enter accurate and valid data as per the provided documents.
- Ensure all accompanying documents are valid and up-to-date.
- Verify the accuracy of the entered data before submission.

Expected Results

- The contractor should accurately input the data as per the provided documents.
- All accompanying documents should be valid and in compliance with system requirements.
- The contractor must ensure the accuracy of the entered data before submission to prevent errors in the system.

Test Case ID: 004

Test Case Title: Data Validation by Admin Test Steps

- Access the admin interface of the sugar industry administration system.
- Review the submitted data and accompanying documents.
- Verify the accuracy and validity of the provided information.
- Approve or reject the data based on validation results.

Expected Results

- The admin should meticulously review the submitted data and documents for accuracy and validity.
- Validated data should be approved, ensuring smooth registration processes without errors.

- Any discrepancies or inaccuracies should be addressed promptly, either by requesting corrections from the contractor or rejecting the submission.

CONCLUSION

In summary, this initiative tackles the complicated issues facing Maharashtra's sugar business, with a particular emphasis on labor contractor fraud, payment distribution, and harvesting complexity. The cooperative structure presents special problems that call for creative solutions, especially when combined with market volatility, drought conditions, and a reliance on manual labor. Issues that have been identified, particularly those involving contractors receiving advance payments without meeting obligations, highlight the necessity for an all-encompassing structure that guarantees responsibility and promotes equitable behavior. In order to prevent cheating, the suggested system integrates blockchain technology for improved transparency and monitoring. Driven by the sugar industry's economic survival in Maharashtra, the project seeks to create a strong foundation through open protocols, frequent audits, and a reporting system. A review of the literature, an analysis of the industry, surveys, data analysis, technological integration, pilot testing, and stakeholder involvement are all included in the holistic approach. Remaining adaptable is critical as the project moves through pilot testing, monitoring, and evaluation. Comprehensive documentation, continuous improvement, and regular feedback guarantee a full comprehension of the project's impact. While acknowledging limitations—especially with regard to image-based diagnosis—the emphasis is still on solving urgent problems in the sugar business. In summary, cooperation, flexibility, and a dedication to promoting accountability, fair procedures, and the sustainability of Maharashtra's sugar business are necessary for success. The suggested approach aims to have revolutionary effects, lower financial risks and legal conflicts, and support the sustainability of the industry and the welfare of workers.

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