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Blockchain-based E-commerce Site for Direct Subsidy Disbursement

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***Abstract*— India's prominence in the global agricultural sector cannot be overstated, with agriculture accounting for the main source of income for over 55% of the country's population. Karnataka, with its majority rural population, is no exception. Millions of workers depend on agriculture for their livelihoods, and the Indian government has been actively involved in efforts to improve the delivery of subsidies to those who deserve them. While the direct benefit transfer program has been helpful, it still faces certain drawbacks or challenges, such as a lack of auditability and control over the use of funds. However, the solution to this issue lies in the disruptive technology blockchain. With its immense potential to transform data processing, transmission, storage, and security, a blockchain-based system presents the ideal solution for automating subsidy disbursements, bypassing the necessity for banks in rural regions, and establishing an auditable and transparent ecosystem that effectively combats corruption and financial mismanagement. This smart blockchain system will undoubtedly transform the agricultural sector in India and ensure that deserving beneficiariesreceive the subsidies they need.**

***Index Terms*— Block Chain, Bitcoin and Direct Beneficiary Transfer.**

I. INTRODUCTION

In the fiscal policy statements, it was highlighted that the Indian agriculture area is projectedto develop by 3.5 percent in FY 2022-23. In recent years In recent years, India has also become a net exporter of agricultural merchandise. To support farmers, the government provides subsidies as incentives to supplement their income, procure agricultural inputs, pursue new initiatives, and promote growth in the agriculture and allied sectors. The Direct Benefit Transfer (DBT) scheme aims to directly transfer subsidies to individuals through their bank accounts. According to government data, there are 53 schemes under 53 ministriesin India (2023-24), and total direct benefit transfers are 5,706 Cr. Aadhar registrations have presently covered around 91% of the country's population. The challenge is increasing the Aadhar linkage to 100% to ensure no one is left out. Banking services in rural areas need to be enhanced to reach the beneficiaries. Blockchain technology, which is the underlying technology of Bitcoin, has the potential to transform the delivery of welfare payments in thetwenty-first century. Programmable money allows for payments to be made only if certain conditions are met, creating tokens that can only be used for a specific transaction. This generates a transparent and real-time audit trail, making it difficult for tokens to be copied. By using blockchain technology, the need for a bank account at the beneficiary level is

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obviated, and the beneficiary only needs a phone and an Aadhaar number. This could simplifybenefit distribution in rural areas. Blockchain-based smart contracts technology can link theexisting farmer's database to a blockchain database for supplying automation subsidies among the government and farmers. It makes the system more transparent, efficient, and fair without charging transaction costs and eliminates intermediaries who might misuse/divert subsidies.

II. Literature Survey

This section reviews and highlights the related work to know how the Blockchain can be usedfor solving the above-stated problems. In recent research [1] author explained that Blockchain Technology is a distributed peer-to-peer linked structure that can solve the problem of maintaining and recording transactions in a banking system. Blockchain providesproperties like transparency, robustness, auditability, and security. This paper aims to give these functionalities in a distributed banking system using blockchain, which will be at par with the current methodologies. It will also focus on the limitations while implementing blockchain and future scope. In [2] author discussed the open cyber security challenges of smart farming, security, and privacy issues, use cases w.r.t cloud and edge computing, and relevant research work in the cyber security domain. The authors [3] discussed blockchain applications, problems, and solutions related to agricultural and food sectors like agriculturalinsurance, smart farming, the food supply chain, and farm products.

III. Problem Statement

The Direct Benefit Transfer system schemes have various loopholes such as the involvement of intermediaries, security & and privacy issues as well commissions charged by the various banks. However, the largest implementation hassle for DBT in fertilizer is accurately identifying beneficiaries. Due to the substantial loss of right identity and verification, any huge farmer can visit a fertilizer store and get a bag of subsidized fertilizer irrespective of need. The key problems highlighted were:

1. Lack of readability on whether or not the Aadhar is mandatory.
2. The problem of targeting and identification of the right beneficiaries for the rightsubsidies.
3. Lack of privacy.
4. Unawareness about the scheme and how to access it due to huge adult illiteracy.
5. Incorrect amounts of subsidy transferred.

Highlighting these key problem areas as part of our problem definition, we limit the scope ofthe project to address each of these critical problems. To do so, we decided to use a public- permissioned blockchain. The reason is a public-permissioned blockchain network, infuses the space by linking the public-permissionless networks i.e., Bitcoin/Ethereum with the private-consortium network to attain the prime quality of distributed models. Transparency is achieved in the system through access control and consensus mechanisms that maintain transaction sequences. This means that the blockchain infrastructure ensures that onlyauthorized participants can access the data, and the consensus mechanisms ensure that the transaction history remains consistent and transparent to all participants. [9]. By consideringthese issues we formulate the problem statements as:

1. Create a blockchain network that allows for the recording of subsidy disbursements foreach enrolled beneficiary. This can involve choosing a suitable blockchain platform (e.g., Ethereum, Hyperledger, etc.) and setting up the necessary smart contracts and datastructures. Ensure that the system is auditable and transparent, meaning that the subsidytransactions can be easily traced and verified.
2. Implement robust security measures to protect the integrity of the data on the blockchain. Additionally, consider privacy-enhancing techniques such as zero-knowledge proofs or selective disclosure to protect sensitive beneficiary information while still ensuring the required transparency for subsidy disbursements.
3. Design and implement a mechanism to verify the eligibility of beneficiaries to prevent fake beneficiaries from receiving subsidies. This can include using identity verificationmethods and cross-referencing data with relevant authorities.
4. Create a system that eliminates unnecessary commissions charged by banks or intermediaries by leveraging the automated nature of blockchain transactions and smartcontracts. And develop a robust algorithm to calculate a unique blockchain ID or addressfor each enrolled beneficiary. This unique identifier will help in distinguishing beneficiaries and associating their subsidy disbursements correctly.
5. Integrate an email verification process to ensure that the beneficiaries' identities are authenticated during the enrolment process. Thoroughly test the developed system to ensure its functionality, security, and privacy features. Once tested, deploy the system for real-world use.

6. After deployment, continuously monitor the system for any issues or security vulnerabilities. Regularly update and maintain the infrastructure to adapt to changing requirements and potential improvements. And provide training and support to users andadministrators to ensure they understand how to use the blockchain system effectively and address any potential issues that may arise.

IV. Research Methodology

A. Blockchain Technology

Blockchain is based on a distributed ledger concept that logs every transaction and maintainsthe timeline and veracity of that information on a secure, tamper-proof worldwide network [7,8]. Where a group of transactions are recorded and saved in a chain-like data structure. These transaction groups are known as blocks and are ordered at the chain with the aid of using transaction time Later blocks are appended to the end of the chain. While maintainingthe hash of the preceding block. Smart contracts are self-imposing and self-executing programs that actuate the phrases and conditions of a selected agreement or contract using software program codes and computational infrastructure. Using blockchain-based smart contracts makes the application more secure. However, distinct use instances require distinctkinds of blockchain. There are 4 kinds of blockchain networks: public blockchains, private blockchains (non-public), consortium blockchains, and hybrid blockchains Each one of thesestructures has its benefits, drawbacks, and best uses. We are using a public-permissioned blockchain network. A public-permissioned blockchain network is a new type of network that fills the gap between the public and private consortium networks to infuse the space witha distributed model.

B. Process Flow

After conducting a thorough literature survey, we found that the current welfare disbursement systems and subsidy schemes face several complexities such as duplication and tampering of farmland records, fraud cash transfers, and delays in the process. Farmers are required to register with multiple government departments, including the Land Records Department, theGovernment of India Treasury Department, and their bank, to claim cash benefits from the government fund delivery system. However, the use of blockchain-based smart contracts could potentially enhance the computational infrastructure of the application and mitigate some of these challenges. Department, the Government of India Treasury Department, and customer bank to claim the cash benefits provided by the government fund delivery system.

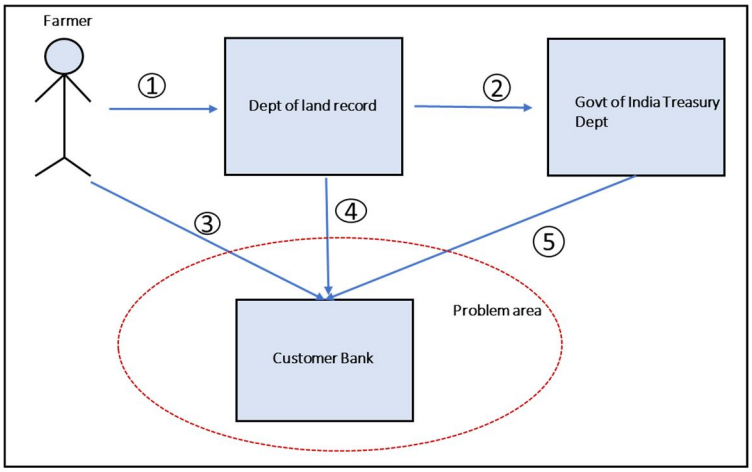

Figure 1. Current System

The existing process is summarized in five steps as follows: In the first step, the farmers needto register with the Land Records Department by providing farmland records. In the second step, the Land Records Department will submit the details of the farmer's farmland to the Government of India Treasury Department. The department verifies the details and allows cash benefits to the individual farmer. In the third step, the farmer has to open an account ina private or public bank validated by UIDAI, such as an Aadhar card. In the fourth step, the bank verifies both the farmer's details submitted at Land Record sources and facts presentedat the bank and then links the Aadhar card with the farmer's bank account. In the last step, The government of India's own Treasury Department verifies the details from banks and theLand Records office and initiates direct cash transfers to the farmer's bank account. As shownin Fig 1, Using a public-permissioned blockchain with smart contracts is a strategic choice to overcome

the complexities and problems faced by farmers in the existing welfare disbursement system. This approach combines the advantages of both public and private blockchains, providing a flexible and secure solution to address the specific needs of the agricultural sector.

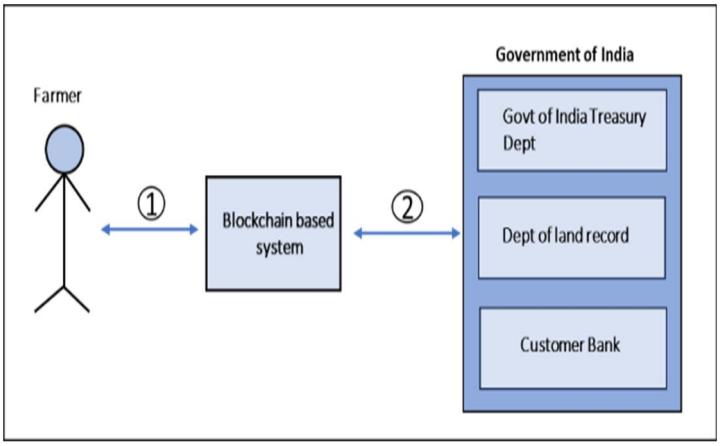

Figure 2. Proposed System

The amended process flow is reflected in Fig. 2. The Farmer is a user who can access different subsidy schemes that are uploaded by the Government. Farmers can register through the website using his/she personal details, and log in once their details are verified by Government. After the verification Farmer receives a mail and he/she can log in to the website and add the bank and land details. Details of land and bank will be verified after thisfarmer can apply to the subsidy schemes that are provided on the website. If the farmer is eligible for the scheme, then the admin(Government) transfers the preferred money to the farmer's account. The government will approve when the farmer registers to the system, validate all data has been posted to the website via a farmer, and give final approval for a submitted proof and details. This portal contains 2 step validation process making it a secureand accurate verification system. Admin will upload content related to subsidy schemes andallow farmers to apply for a subsidy.

C. System Architecture

We have put forward a comprehensive full-stack web application. The user interface is developed using PHP and JavaScript, while the backend data is managed through the MySQL server. To leverage the benefits of blockchain technology, we have implemented the blockchain using Distributed Ledger Technology. The system involves two primary participants, as shown in Fig 2. Beneficiaries and Government Authorities. The GovernmentAuthority encompasses the Treasury Department and Land Record Department, both of which have access to relevant data. In our proposed design, we have identified various assets,such as Aadhar card numbers, E-mail addresses, and subsidy amounts. These assets are securely recorded on the blockchain, ensuring transparency and immutability. Moreover, we have utilized Smart Contracts to facilitate several fund transactions [5]. Smart Contracts automatically execute predefined rules, streamlining the subsidy disbursement process and reducing the need for manual intervention.

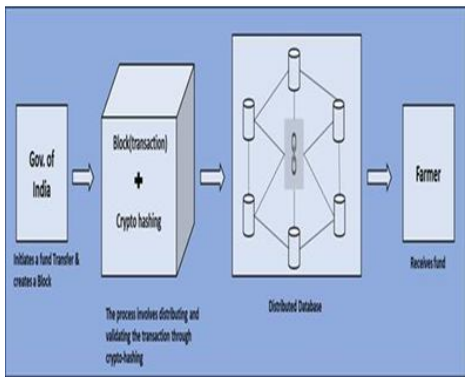

Figure 3. System Architecture

As shown in system architecture, a blockchain is a chain of blocks. Once a block is filled with data it is chained to the previous blocks. Each block stores the previous block hash datafor cryptographic security, and after that, crypto hashing is done using some built-in algorithms such as MD5 (message digest 5) Advanced Encryption Standard(AES) 256. Theoutput of MD5 is a 128-bit digest and AES 256 is a completely random set of characters. A cryptographic hash function is a particular class of hash functions sometimes called ‘digest’.It is a kind of 'signature' for a text or a data file with various properties, making it ideal for cryptography.

V. Results And Discussion

In this section, Let's delve into the proposed blockchain-based fund transfer prototype model, its scope, and its functionalities. Before using this system, we need to make sure thatthe farmer has the necessary documents. It's important to note that this system assumes that the farmer has several crucial documents such as:

1. The farmer has an Aadhaar Card/ID,
2. Farmland records attested/verified by the Department of Land Records,
3. We believe that the farmer has an e-mail ID so that he/she can get a verification message
4. We additionally assume that farmers can use the designed portal/application.

B.Prototype

The proposed prototype is a web application leveraging blockchain technology to store records and execute smart contracts. This application caters to two user profiles: Government Authority (admin), represented by the Government Treasury Department, and Farmers (beneficiaries). From the Government Authority's perspective, they can access the system toperform various functions, including viewing registered farmers, releasing subsidy funds, and initiating audits using queries. The login information for accessing the blockchain-basedprototype model includes the Government Authority's authentication credentials.

For Farmers, the registration process involves providing essential details such as Aadhar cardnumber, phone number, and email ID. This information is securely stored in the blockchain database by creating blocks in the blockchain system. The Government Treasury Departmentholds the privilege to verify subsidy and fund transfers to the beneficiaries, facilitating securesubsidy delivery. Additionally, the department can generate reports via smart queries for monitoring and analysis purposes. The Government Treasury Department can efficiently manage subsidy disbursements, audits, and beneficiary records. Farmers' data remains secureand tamper-proof, enhancing trust and transparency in the subsidy distribution process.

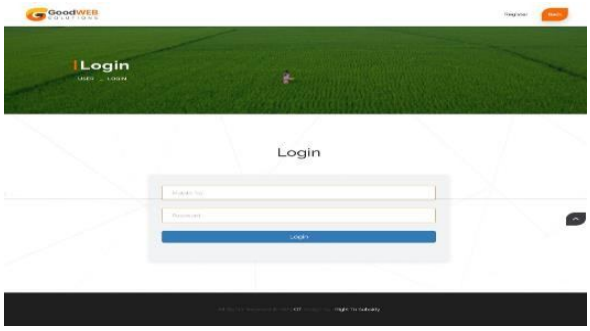

Figure 4. Farmer Login Screen

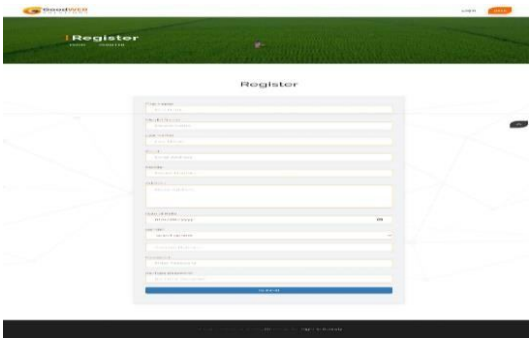

Figure 5. Farmer Registration Screen

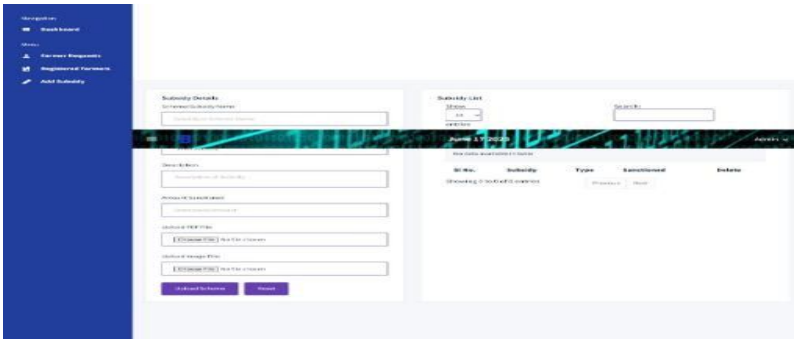

Figure 6. Farmland document upload

As shown in Figure 6 The farmer can upload the farmland documents in either of the formatssuch as JPEG or PDF. In turn, the land record department will verify the farmer's records/documents through the blockchain-based system using participants of a system like miners who will in turn submit a report to the government of India.

VI. Conclusion

As depicted in this paper, we have discovered a distinctive issue in India's DBT implementation. Our solution is to utilize blockchain-based smart contracts to elevate the government's fund delivery system. Our prototype model is intended to mitigate complexities and significant problems encountered by Indian farmers while ensuring security, privacy, audibility, transparency, and immutability. We have identified that the DBT system can be successfully adapted to a blockchain ecosystem, leading to several advantages. However, weacknowledge that our prototype model is limited as it relies on Aadhaar ID as a unique identifier, which could exclude those who don't possess it from availing benefits. Nonetheless, we are committed to finding a solution to address this limitation.

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