A Survey on Agri-Food Supply Chain Using Blockchain

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ABSTRACT

The globalization of agricultural production and distribution provides an innovative emphasis on the safety, quality, and validation of key important criteria in agriculture and food supply chains. The rising number of food safety and contamination risks has created a huge need for complete traceability solutions that act as a critical quality control tool, assuring appropriate product safety in the agricultural supply chain. Block-chain technology is a game-changing technology with the potential to revolutionize product traceability in agricultural and food supply chains. Our proposed solution enhances efficiency and safety while retaining the greatest levels of integrity, dependability, and security by eliminating middlemen, centralised authority, and transaction records. All transactions are documented and kept in the immutable block-chain ledger, which is linked to a decentralized file system and gives everyone access to a high level of traceability and transparency into the supply chain ecosystem in a safe, dependable, trustworthy, and effective way.

Keywords: Traceability, Blockchain, Supply chain management, e-Commerce, agriculture sector, Food Safety

INTRODUCTION

Incorporating blockchain technology in the agricultural industry has the potential to revolutionize traditional processes and bring about significant benefits. By leveraging blockchain, we can create a secure, transparent, and efficient platform for agricultural transactions. This introduction highlights the transformative power of blockchain technology in enhancing trust, transparency, and accessibility in the agricultural sector.

Traditional agricultural transactions often involve intermediaries, manual processes, and limited verifiability. The integration of blockchain technology addresses these challenges by providing a decentralized and immutable ledger. Transactions recorded on the blockchain are securely stored, ensuring the integrity of data and preventing unauthorized tampering. This creates a transparent and auditable history of activities, fostering trust among participants. Blockchain also enhances security by utilizing cryptographic algorithms. Each transaction is digitally signed, forming a chain of blocks that are cryptographically linked. This ensures the integrity and confidentiality of sensitive information, reducing the risks associated with data breaches or unauthorized access.

Furthermore, blockchain technology improves the efficiency and accessibility of agricultural transactions. By eliminating intermediaries, participants can engage directly with one another, reducing transaction costs and expanding market reach. The decentralized nature of the blockchain network allows for 24/7 access, overcoming geographical limitations and enabling global interactions.

In conclusion, the adoption of blockchain technology in the agricultural sector offers significant advantages. It establishes trust, transparency, and security in transactions, streamlines processes, and empowers participants by expanding market opportunities. By embracing blockchain, the agricultural industry can embrace digital transformation, paving the way for a more efficient, inclusive, and sustainable ecosystem.

RELATED WORK

Farmers, as well as agriculture, are the foundation of life. Numerous works has been done towards the enhancement of agriculture by developing technologies that support directly and indirectly to agriculture. A range of research shows that with the various enhancements in the field of ICT, the farmers are unable to take its advantage and fail to get the proper sale value for their crops.

Gosh et al. [1] has designed an interface that benefited the farmers by providing the information related to the advancement of

agriculture techniques; farmers can interact with the system by means of text and speech as an input. The approach was the first rate in terms of providing the interface to the farmers.

Manav et al. [2] proposed an android based mobile application that would take care of updating the farmers regarding agricultural products, weather forecasts, and agricultural news. However, the system was good in providing the instant update to the farmer but the version was only in the English language, which was the limitation of the system.

Jason [3] has discussed various technical approaches made in agriculture, mostly in the field of food and supply chain management. The incorporation of blockchain technology in agriculture has improved the efficiency of the agriculture supply chain by reducing the need for verification of data. However, the technology proposed benefited only the producers in terms of maintaining the accuracy of data for supply.

Jing Hua et al. [4] has used blockchain technology and proposed an agricultural tracing system that is decentralized, maintained collectively and provides trust and reliability in case of supply chain management. The system proposed is beneficial for producers in terms of safeguarding the data of production and supply that is immutable.

EXISTING SYSTEM

The existing agricultural system lacks efficient utilization of Information and Communication Technologies (ICT), resulting in farmers not receiving fair prices for their crops. The integration of blockchain technology in agriculture has shown potential in improving supply chain efficiency. However, current solutions primarily benefit producers in data verification. Our project aims to address these limitations by developing a comprehensive blockchain-based solution that benefits all stakeholders, providing farmers with valuable information and enabling fair pricing for their crops.

Drawbacks of the current system include:

- **Dependency on third parties**: The system relies on intermediaries or third-party entities to facilitate transactions. This can lead to delays, additional costs, and potential risks if the third party is not reliable or efficient.

- **Inadequate data security**: Data is stored on local servers, which may not provide sufficient levels of security. This poses a risk of unauthorized access, data breaches, or loss of valuable information

PROPOSED SYSTEM

The proposed portal is a single gateway through which agricultural e-commerce can be conducted. The portal experience can be tailored to the specific requirements of the users. Because it is a single access point, everything is in one place, and the only thing necessary is a single login for authorised users. The block chain's security is maintained by grouping transactions together to produce a block with a unique ID. By utilising a cryptographic hash function and putting a digital fingerprint in the block, the data contained within it is rendered tamper-proof.

Each block has its own hash value as well as the hash value of the previous block, producing a chain of blocks.

The blockchain makes use of hash functions. If someone tries to update the data on the blockchain, he must first recalculate all hash values, then execute the associated proof of work, and finally exercise influence over at least 51 percent of the network's nodes. And juggling all three of these responsibilities at the same time is practically impossible. The greater the network size, the higher the temper resistance.

The capability to recover a specific transaction of interest for future use from the storage is one of the most important features since it will allow the user to have a chronological record of all past activities. Our solution uses a simple, generic blockchain that only keeps track of transactions during active sessions because it is kept locally. However, if a deployable blockchain is utilised and cloud storage is an option, it will have access to all data from the earliest block added to the blockchain to the most current block. This final ledger of the transaction will be visible to every node in the network

ADVANTAGES OF PROPOSED SYSTEM

- The portal assists farmers in reaching the market without the need for further assistance from middlemen, increasing the level of participation and lowering the cost of intermediary services. Many farmers struggle to sell their goods at a fair price.

- The portal centralises all information in one place so those who require it may easily access it, simplifying the process and saving time and energy for everyone involved.

- From the farm to the grocery store, blockchain technology ensures improved efficiency, trust, accessibility, and openness. Users will gain by having more options and receiving competitive returns.

- Better workflow, wiser decision-making, and better productivity will result from improved customer engagement, customer, and business loyalty.
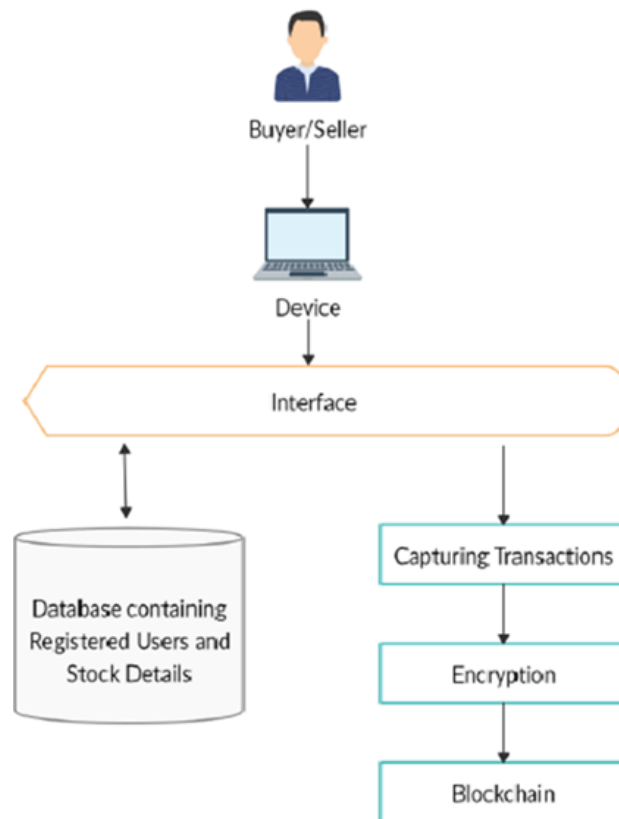
BLOCK DIAGRAM OF PROPOSED SYSTEM

Fig. 1 Block Diagram of Proposed System

DESCRIPTION:

- **User:** A user can be a buyer or a seller. The seller may be a farmer or are presentative or assistant of him.

- **Device**: The user can communicate through the portal using a computer or a laptop

- **Interface**: Permission to enter the portal, the user needs to register using a sign-up. The registered user's logins using the correct credentials. Once the user signs in successfully. The user will have access to the portal/interface. A user can see available items that are crops and seeds with their price.

- **Buyer**: The buyer can buy a product and can search for any product according to the requirement. They can add the product in cart and update the cart. After finalizing the product to buy and verifying the cart user can check out.

- **Seller**: The seller can add a new item, update the existing items, allot and update the price of the item.

It will increase the market reach and will also eliminate the middleman.

- **Database**: The record of the registered user is stored. The added and updated items are stored in it.

- **Capturing Transaction, Encryption and Blockchain**: Every activity related to introducing a new item and purchasing an item is considered as a transaction and is added to the blockchain accordingly with the correct unique digital signature and timestamp so that any user cannot deny the activity done by them.

PERFORMANCE EVALUATION

Performance evaluation of the project can be assessed based on several key factors:

- **Transaction Throughput:** The number of transactions processed by the blockchain system within a given time period, indicating the system's ability to handle a high volume of transactions.

- **Transaction Confirmation Time:** The time taken for a transaction to be confirmed and added to the blockchain, indicating the

speed of transaction processing.

- **Block Generation Time:** The amount of time required to construct and add a new block to the blockchain, which affects overall system performance and transaction throughput.

- **Scalability**: The blockchain system's capacity to accommodate a rising number of farms and transactions without significantly degrading performance.

- **Consensus Mechanism Efficiency**: Evaluating the efficiency of the consensus mechanism used in the farmer's portal blockchain, such as Proof of Work (PoW) or Proof of Stake (PoS), in terms of transaction processing speed and resource utilization.

- **Data Storage Efficiency:** Assessing the efficiency of storing farmer-related data on the blockchain, including the size of stored data and its impact on the system's performance.

- **Network Latency**: Measuring the time delay or latency in transmitting data and communication between different nodes in the blockchain network, as it can affect the overall system performance.

- **System Downtime:** Evaluating the availability and uptime of the farmer's portal blockchain system, indicating its reliability and resilience to failures or disruptions.

- **Security and Privacy**: Assessing the level of security and privacy provided by the blockchain system, including the immutability of stored data, encryption techniques, and protection against unauthorized access.

- **User Experience:** Evaluating the user experience of farmers interacting with the blockchain-based portal, including factors such as responsiveness, ease of use, and overall satisfaction.
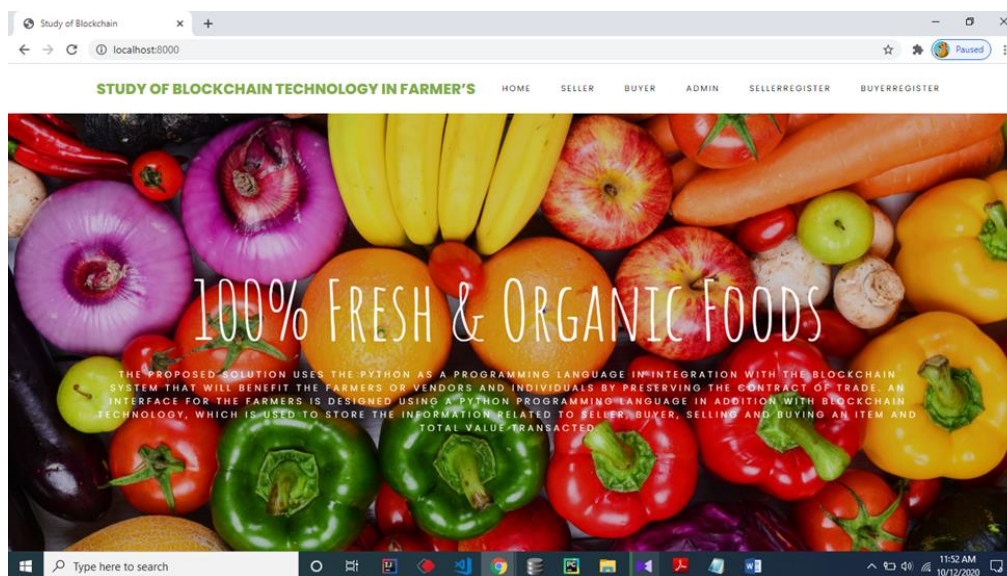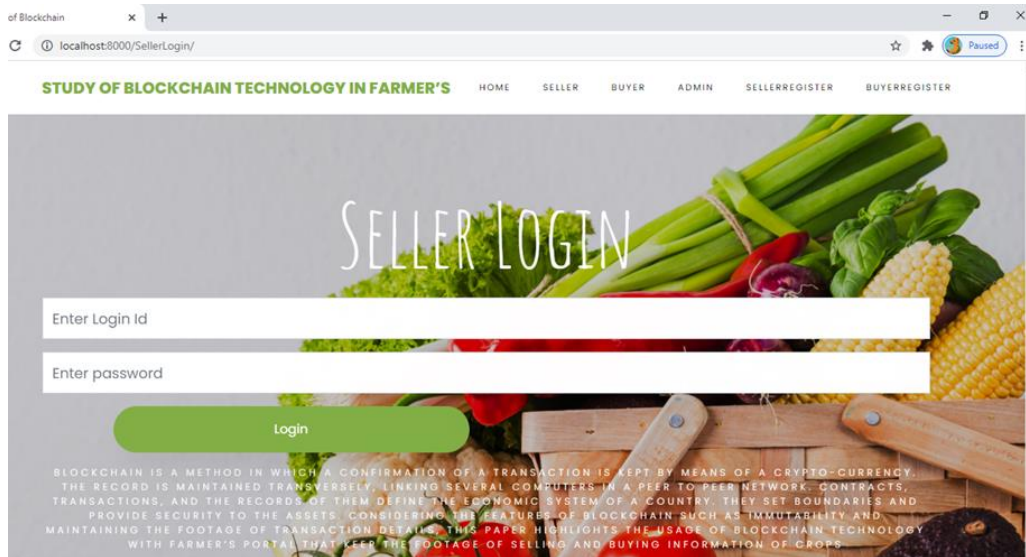
OUTPUT SCREENS:
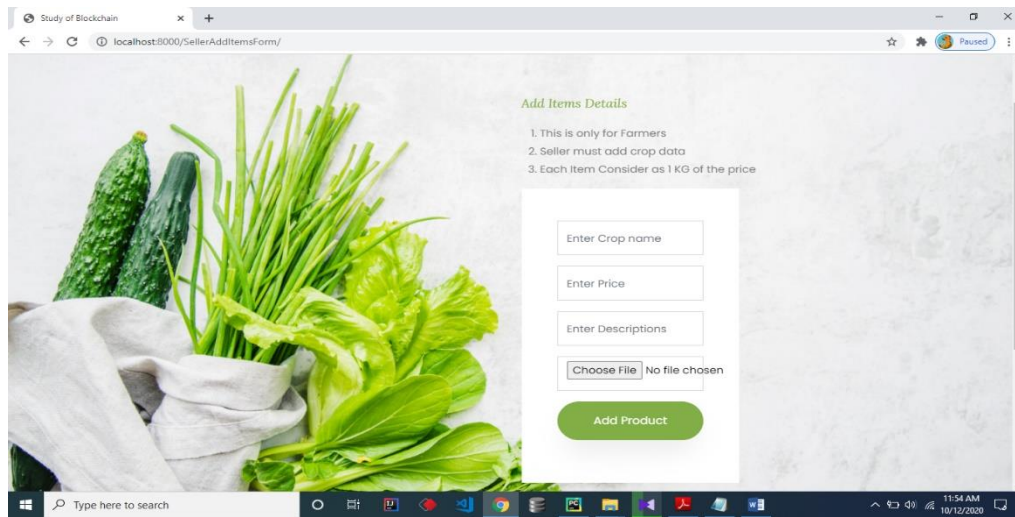

FIG 2: HOME PAGE

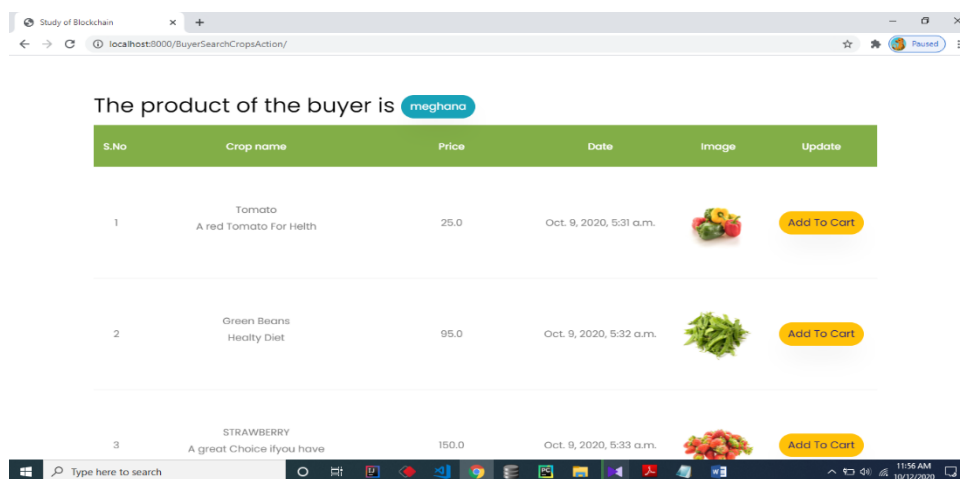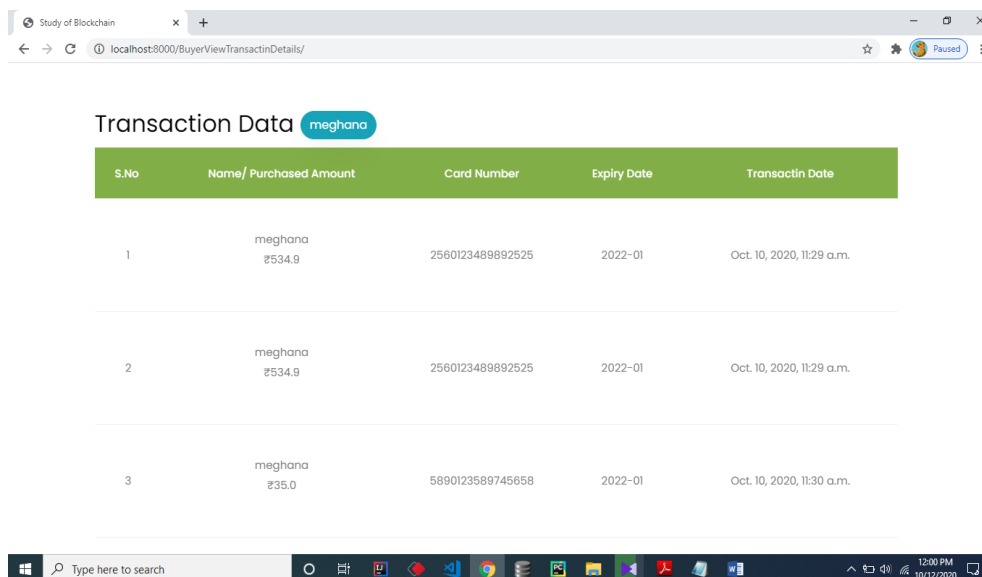**FIG 3: SELLER LOGIN PAGE**

FIG 4: SELLER ADDING CROP DETAILS

FIG 5: SEARCH RESULTS

FIG 6: BUYER VIEW TRANSACTIONS

CONCLUSION:

Blockchain technology has the potential to transform agriculture by securely storing farmers' data, verifying seed quality, monitoring soil moisture content, and tracking crop yield and demand. A blockchain-based portal is proposed in this project to address the issue of crop price and security for farmers. Farmers can use the site to register and sell their products, and when buyers commit to buying a farmer's crop, transactions are recorded on the blockchain. These agreements record critical crop information, committed prices, and volumes. This solution, which takes advantage of blockchain's immutability, enables farmers to earn fair pricing for their products while also lowering the operating costs associated with traditional methods of selling and buying goods. Blockchain technology integration improves trust, transparency, and efficiency in the agricultural marketplace, benefiting both farmers and buyers.

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