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# Efficient Monitoring of Agricultural Food Supply Chain Using Block Chain Technology

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## ABSTRACT

Block chains are now firmly established as a digital technology that combines cryptographic, data management, networking, and incentive mechanisms to support the verification, execution, and recording of transactions between parties. While block chain technologies were originally intended to support new forms of digital currency for easier and secure payments, they now hold great promise as a new foundation for all forms of transactions. Agribusiness stands to become a key beneficiary of this technology as a platform to execute 'smart contracts' for transactions, particularly for high-value produce. First it is important to distinguish between private digital currencies and the distributed ledger and block chain technologies that underlie them. The distributed and cross-border nature of digital currencies like Bit coin means that regulation of the core protocols of these systems by central banks is unlikely to be effective. Monetary authorities are focused more on understanding 'on-ramps' and 'off-ramps' that constitute the links to the traditional payments system rather than being able to monitor and regulate the currency itself. In contrast to the digital currency feature of block chain, the distributed ledger feature has the potential for widespread use in agribusiness and trade financing, especially where workflows involve many different parties with no trusted central entity.

**Keywords :** Agriculture, supply chain, BCT, Cryptography, etc.

## I. INTRODUCTION

An increasing demand in society for greater information about food reflects the need for more transparency and the lack of trust. At the same time, more and more food products and beverages are branded and accompanied by a variety of certification schemes, with an increasing risk of fraud (selling unqualified product with high-quality labels or claims) and adulteration. In the current situation, much of the compliance data and information is audited by trusted third parties and stored either on paper or in a centralized database and these approaches are known to suffer from many informational problems such as the high cost and inefficiency of paper-based processes and fraud, corruption and error both on paper and in IT systems. These information problems, indicating that current transparency and trust systems have not been able to solve or at times even have exacerbated the problems of low transparency and trust in agricultural food chains, pose a severe threat to food safety, food quality, and sustainability. In particular, food integrity has become a major concern. Food integrity refers to the fairness and authenticity of food in food value chains both at the physical layer and the digital layer, where the digital layer should provide reliable and trustworthy information on the origin and provenance of food products in the physical layer. Block chain technology provides a means to ensure permanence of records and potentially to facilitate the sharing of data between disparate actors in a food value chain. This potential may lead to an exciting paradigm shift facilitating transparency and trust in food chains that ensures food integrity.

## II. METHODOLOGY

### A. Literature Survey:

Blockchain- Based Soybean Traceability in Agricultural Supply Chain Khaled Salah; Nishara Nizamuddin; Raja Jayaraman; Mohammad Omar Published in: IEEE Access (Volume: 7) proposed solution eliminates the need for a trusted centralized authority, intermediaries and provides transactions records, enhancing efficiency and safety with high integrity, reliability, and security. The proposed solution focuses on the utilization of smart contracts to govern and control all interactions and transactions among all the participants involved within the supply chain ecosystem. All transactions are recorded and stored in the blockchain's immutable ledger with links to a decentralized file system (IPFS) and thus providing to all a high level of transparency and traceability into the supply chain ecosystem in a secure, trusted, reliable, and efficient manner.

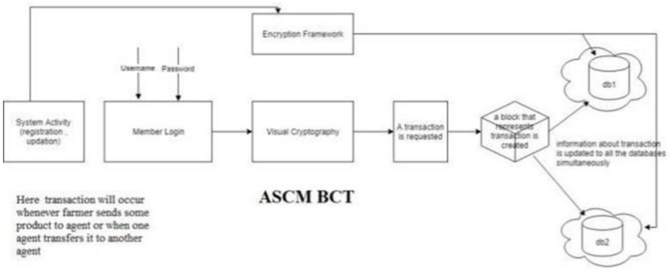
Blockchain-based traceability in Agri-Food supply chain management: A practical implementation Miguel Pincheira Caro; Muhammad Salek Ali; Massimo Vecchio ; Raffaele Giaffreda
Published in: 2018 IoT Vertical and Topical Summit on Agriculture - Tuscany (IOT Tuscany)
This paper presents Agricultural Block IoT, a fully decentralized, block chain-based traceability solution for Agricultural-Food supply chain management, able to seamless integrate IoT devices producing and consuming digital data along the chain. To effectively assess Agricultural Block IoT, first, we defined a classical use-case within the given vertical domain, namely from- farm-to-fork. Then, we developed and deployed such use-case, achieving traceability using two different blockchain implementations, namely Ethereum and Hyperledger Sawtooth. Finally, we evaluated and compared the performance of both the deployments, in terms of latency, CPU, and network usage, also highlighting their main pros and cons.

Block chain Based Provenance for Agricultural Products: A Distributed Platform with Duplicated and Shared Bookkeeping
Jing Hua ; Xiujuan Wang ; Mengzhen Kang ; Haoyu Wang ; Fei-Yue Wang
Published in: 2018 IEEE Intelligent Vehicles Symposium (IV)
In this paper, we propose an agricultural provenance system based on techniques of block chain, which is featured by decentralization, collective maintenance, consensus trust and reliable data, in order to solve the trust crisis in product supply chain. Recorded information includes the management operations (fertilizing, irrigation, etc.) with certain data structure. Applying block chain techniques to the provenance of agricultural product not only widens the application domain of block chain, but also supports building a reliable community among different stakeholders around agriculture production.

An agri-food supply chain traceability system for China based on RFID & block chain technology
Feng Tian
Published in: 2016 13th International Conference on Service Systems and Service Management (ICSSSM)
In this paper, we study the utilization and development situation of RFID (Radio-Frequency Identification) and block chain technology first, and then we analyze the advantages and disadvantages of using RFID and block chain technology in building the agri- food supply chain traceability system; finally, we demonstrate the building process of this system. It can realize the traceability with trusted information in the entire agri-food supply chain, which would effectively guarantee the food safety, by gathering, transferring and sharing the authentic data of agri-food in production, processing, warehousing, distribution and selling links. Blockchain application in food supply information security

Daniel Tse ; Bowen Zhang ; Yuchen Yang ; Chenli Cheng ; Haoran Mu
Published in: 2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)
This article introduces the concept of Blockchain technology, putting forward the application of Blockchain technology in information security of the food supply chain and comparing it with the traditional supply chain system.

## B. Proposed System:




Whenever any transaction will occur in the system , the record of that transaction is maintained in the form of hash value in a block. Each next block will get attached to the previous block and in this way a virtual block chain will occur. The hash value of a current block is generated using the data of a current block and the hash of the previous block. In this way if any of the block is tempered the subsequent all the block's hash must be changed . Such multiple copies are maintained at different servers , which will assure the data security and confidentiality. As everything is through application interface, it will maintain the transparency in the agricultural supply chain management.

## C. Mathematical Model:

Let S be Closed system defined as, S = Ip, Op, Ss, Su, Fi, A
To select the input from the system and perform various actions from the set of actions A so that Su state can be attained.
S=Ip,Op,Ss,Su,Fi,A
Where, IP1=Username, Password, image Set of actions=A=F1,F2,F3,F4 Where F1= Send Mail
F2= Merge Images F3= Encrypt Database F4= Generate Hash S=Set of users Ss=rest state, registration state, login state Su- success state is successful analysis
Fi- failure state Objects:
Input1: Ip1 = Username, Password
Input2 : Ip2= image from mail

1) Output1 : Op1 = Transaction Record

## D. Algorithm:

AES is used to encrypt the database.
The encryption process uses a set of specially derived keys called round keys.
These are applied, along with other operations, on an array of data that holds exactly one block of data, the data to be encrypted.
This array we call the state array.

**STEPS:**

- ➢ Derive the set of round keys from the cipher key.
- ➢ Initialize the state array with the block data (plaintext).
- ➢ Add the initial round key to the starting state array.
- ➢ Perform nine rounds of state manipulation.
- ➢ Perform the tenth and final round of state manipulation
- ➢ Copy the final state array out as the encrypted data (ciphertext).

**SHA 256:**

(secure hash algorithm, FIPS 182-2) is a cryptographic hash function with digest length of 256 bits. It is a keyless hash function; that is, an MDC (Manipulation Detection Code). A message is processed by blocks of 512 = 16 32 bits, each block requiring 64 rounds A cryptographic hash (sometimes called digest) is a kind of signature for a text or a data file. SHA-256 generates an almost-unique 256-bit (32-byte) signature for a text. A hash is not encryption it cannot be decrypted back to the original text (it is a one-way cryptographic function, and is a fixed size for any size of source text). This makes it suitable when it is appropriate to compare hashed versions of texts, as opposed to decrypting the text to obtain the original version.

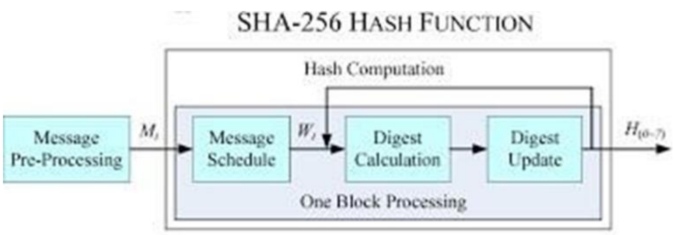



Figure 1. SHA-256 algorithm flow diagram

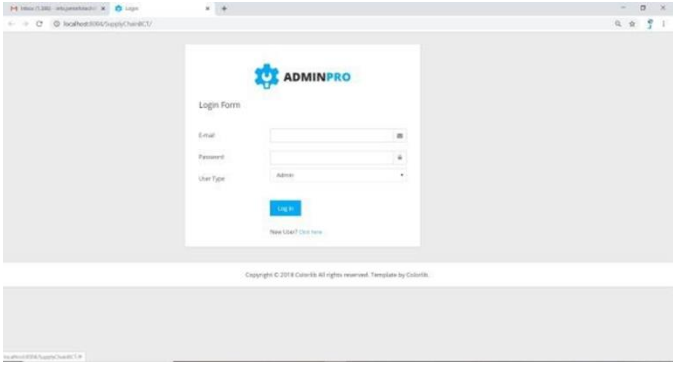



Fig: Login

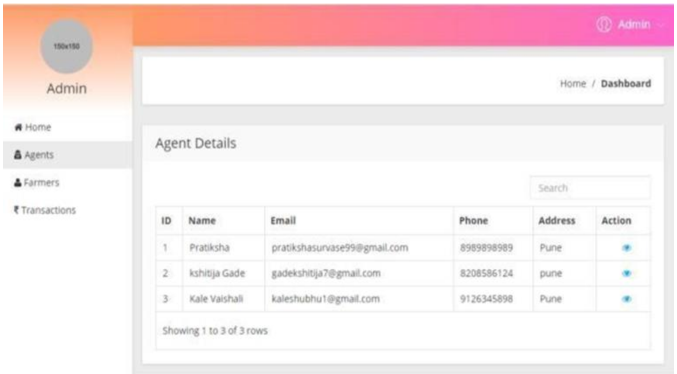



Fig:Agent Details

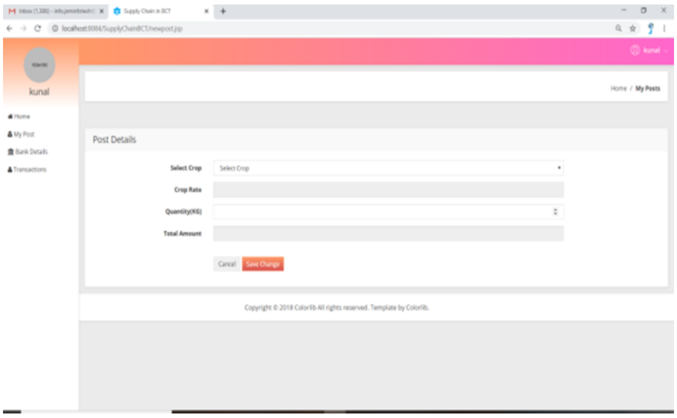


Fig: Farmer Add Post

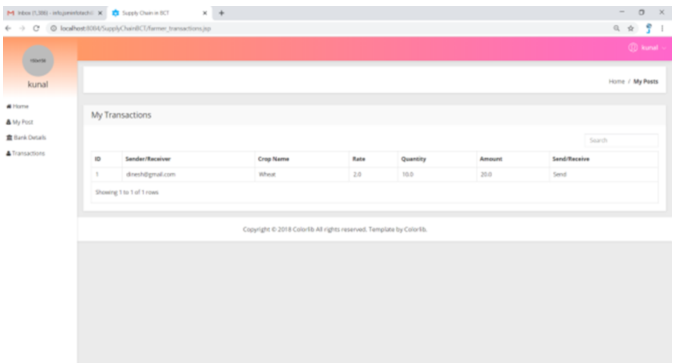


Fig: Farmer Transactions

**E. Experimental Results:**


Fig: Upload Image For Visual Cryptography


Fig: Combine and Share Password

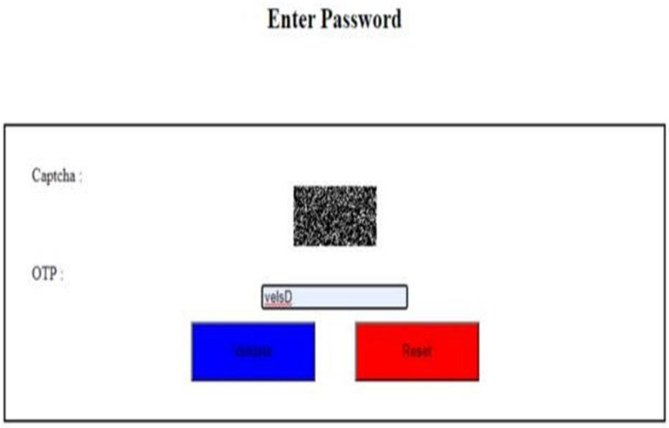



Fig: Get Password For Authentication

## III. CONCLUSION

Thus we are have implemented a prototype web based software application in Java for application of BCT in supply chain management. We have implemented block chain features such as: 1. Decentralization 2. Visual Cryptography 3. Hash Algorithm 4. Encrypted Database.

Thus it is possible to track agricultural supply chain and to give minimum price for agricultural products.

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