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EMPLOYING BLOCKCHAIN IN AGRICULTURE

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ABSTRACT:

The blockchain is a ledger of accounts and transactions that are written and stored by all participants. It promises a reliable source of truth about the state of farms, inventories and contracts in agriculture, where the collection of such information is often incredibly costly. The blockchain technology can track the provenance of food and thus helps create trustworthy food supply chains and build trust between producers and consumers. As a trusted way of storing data, it facilitates the use of data-driven technologies to make farming smarter. In addition, jointly used with smart contracts, it allows timely payments between stakeholders that can be triggered by data changes appearing in the blockchain This article examines the applications of blockchain technology in food supply chains, agricultural insurance, smart farming, transactions of agricultural products for both theoretical and practical perspectives. We also discuss the challenges of recording transactions made by smallholder farmers and creating the ecosystem for utilizing the blockchain technology in the food and agriculture sector.

Keywords:Block chain, smart agriculture, data base, data driven .

1. INTRODUCTION:

Current agricultural development and reform are calling for new techniques and innovations to create a more transparent and accountable environment in the agriculture sector. One of the emerging tools is blockchain technology. Unlike conventional centralized and monopolistic agricultural management systems, blockchain provides a decentralized data structure to store and retrieve data that are shared with multiple untrusted parties. In this way, it could potentially resolve a number of serious problems in current systems caused by the following reasons: (i) hackers can easily attack the centralized system to

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tamper data integrity; (ii) insider manipulation of the centralized database could compromise data integrity; (iii) a supply chain management system is over-reliant on the centralized database (single point failure problem); and (iv) high costs when involving a third party to verify and monitor transactions. To solve these issues, distributed database enhanced by advanced cryptography is proposed in the past few decades. Among these, blockchain is one of the most predominant emerging methods to solve trust related issues generated by the invention of Bitcoin in 2008 [1].

In blockchain technology, many advanced computational and cryptographic techniques are integrated into distributed data structure to achieve a digital trust system in an untrusted environment [2]. In particular, hash function, as an algorithmic way to generate unique IDs, is used as the key element for data authentication. Hash values can be embedded into a format of stored chain to verify whether the stored data are tampered to ensure data integrity. Digital signature is used to verify real identities of data senders and receivers in stored transactions. In addition, consensus mechanism is designed to involve all computer nodes thus minimizing potential risks of data being manipulated by minority attackers.

Blockchain applications in agriculture enhance diverse aspects in agricultural systems, especially supply chain [3] and Internet of things (IoTs) based systems [4]. These applications include food safety [5], food security [6], food quality monitoring and control [7], traceability for waste reduction [8], reliable operational data analysis [9] and efficient contract exchanges and transactions to reduce economic costs [10], thus supporting small-scale farmers [11]. These applications can be developed by using existing blockchain platforms to facilitate easy and quick developments. Based on different deployment scenarios of these applications, different computational and cryptographic techniques can be plugged to provide flexibility to meet desperate user requirements.

In this paper, we present a comprehensive survey on the blockchain based agricultural applications and current innovations to promote blockchain techniques. We first explain basic concepts of blockchain technology, illustrate the current data storage ecosystem and analyze existing popular platforms by which the developed applications are implemented. Then we provide a comprehensive survey on diverse blockchain applications in agriculture related projects. After the survey, we further discuss the prospective of the emerging technology and how current challenges could be solved in deployment of the systems. Further, an illustration is presented to demonstrate how blockchain can be improved to build a more reliable and efficient food supply chain in future.

This research is based on existing literature. We have used a comprehensive literature search strategy. We first gather all relevant survey papers by complying with the systematic procedure via searching the relevant subjects in Google Scholar and many electronic databases, including Open Athens, IEEE Xplore and Science Direct. The search terms used to collect the relevant works are: blockchain for agricultural applications, blockchain for supply chain management, blockchain for IoT, data integrity, traceability, provenance, and IPFS with blockchain. All these terms are used in multiple search combinations to ensure the completion of data gathering. The comprehensive literature review is crucial for us to answer the following three main research questions: (1) What are the current standard blockchain applications in agriculture related projects? (2) What are the main challenges that these blockchain applications face in their deployments? And, how could these challenges be met? (3) How blockchain can be improved to build a more reliable and efficient food supply chain in the future? The contributions of our work can be highlighted as: (i) we make an insight investigation of the existing applications of blockchain in agriculture and highlight potential uses of the technology, (ii) we suggest suitable blockchain schemes in the agricultural sector by an illustration of the technical details of the key components in blockchain technology, (iii) we further identify the key challenges in many novel agricultural applications and discuss alternative solutions, and (iv) we present a post COVID-19 pandemic blockchain based supply chain system to improve the resource allocation when dealing with unexpected event emergency. Although there are many new blockchain survey papers published in recent years [12]–[21], our work provides a comprehensive study in the agricultural context. In the work, both technical details and applicative aspects are covered so that our insights could be used to suggest suitable techniques and platforms for individual applications in their own agricultural scenarios.

2. EXICITING SYSTEM:

Information and Communication Technology does not avoid bias in the collection and use of data. Individuals operating ICT always are motivated to use data in a way that favors their own interest. For example, stakeholders' preference in a multi-criteria decision is highly influenced by the organization they represent (Collier et al., 2014) and NGOs can have a disproportionate focus on the issues to address due to its interest (Ngo Monitor, 2015). An effective way of avoiding such bias is to make data manipulation difficult or even impossible by

distributing the power of data management to a very large number of individuals.

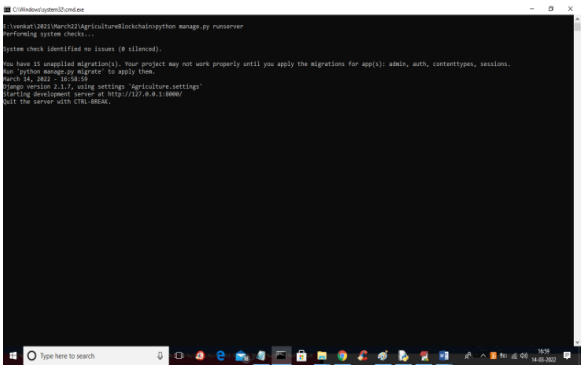
A blockchain is a ledger in which agents take turns recording information on the process of generating, transacting and consuming a product or service. The ledger is collectively managed by all participating parties typically through a peerto-peer network. A new record must be verified by the network before adding it to the blockchain. Any alteration to the recorded data should follow consensus decisionmaking protocol, meaning the majority of the parties involved should agree. In addition, an alteration to one record will lead to the alteration of all its subsequent records. It is, therefore, almost impossible to change in data recorded in a blockchain in practice. Blockchain is viewed as "an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way" (Iansiti and Lakhani, 2017). Blockchain is a transformative ICT that have the potential to revolutionized how data is used for agriculture.

PROPOSED SYSTEM:

Underlying the agri-food systems is the essential data and information on the natural resources that support all forms of farming. As shown in Figure 1, data and information flow while products flow from inputs to output through various value-adding stages as well as financial flow from output to inputs. Different actors and stakeholders generate and manage data and information as per their needs and capacities. Smart agriculture is featured by the utilization of ICT, internet of things (IoT), and various modern data collection and analysis technologies including unmanned aerial vehicles (UAV), sensors and machine learning. A key issue of establishing smart agriculture is developing a comprehensive security system that facilitates the use and management of data. Traditional ways manage data in a centralized fashion and are prone to inaccurate data, data distortion and misuse as well as cyber-attack. For example, environmental monitoring data is generally managed by centralized government entities that have their own interest. They can manipulate the decision-making related to data.

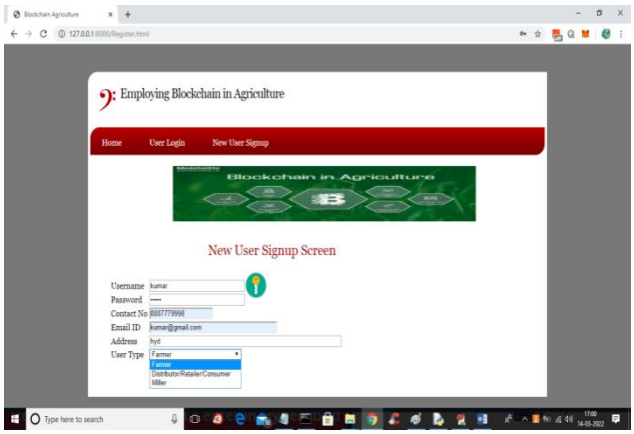
3. METHODOLOGY

To run project double click on 'run.bat' file to start DJango Server and to get below screen

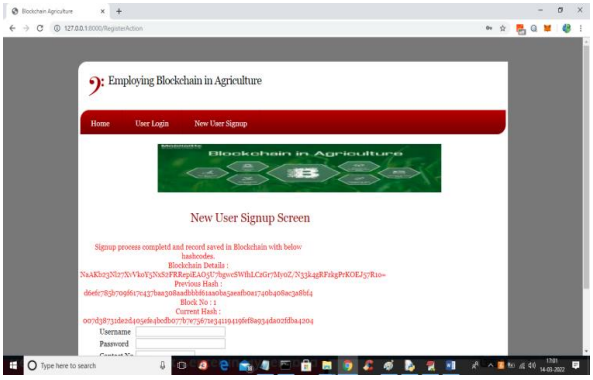


In above screen server started and now open browser and enter URL as 'http://127.0.0.1:8000/index.htm' and press enter key to get below screen

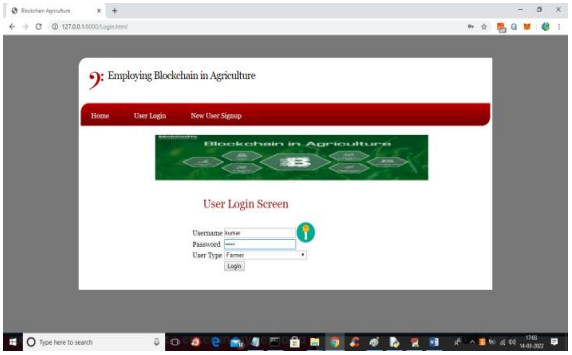
In above screen click on 'New User Signup' link to get below screen



In above screen user is signup and select desire user as Farmer or distributor or Miller and then press submit button to get below output



In above screen in red colour text we can see data is stored in Blockchain and we see hash code of previous and new blocks and similarly you can add distributor and miller user. Now click on 'User Login' link to get below screen



In above screen kumar farmer user is login and after login will get below screen

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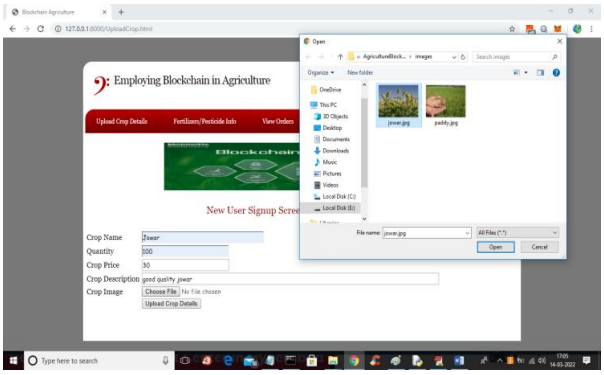
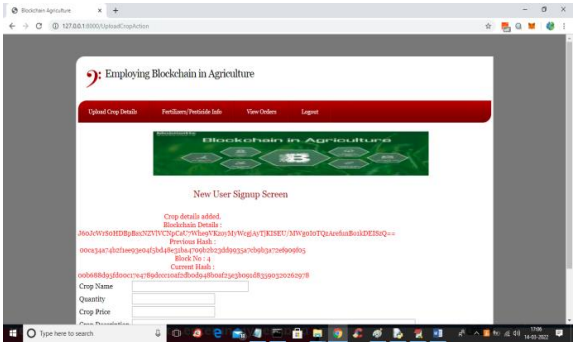
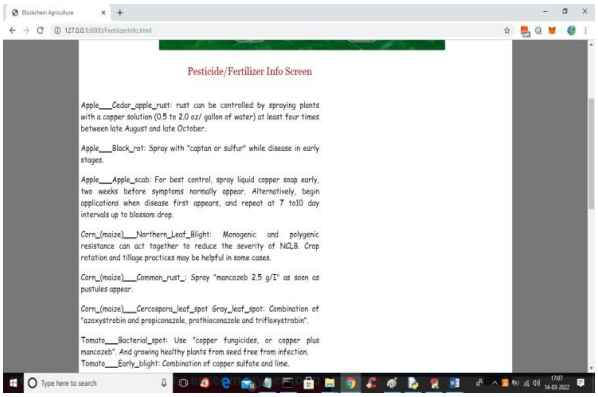
In above screen click on 'Upload Crop Details' link to upload crop details and get below screen



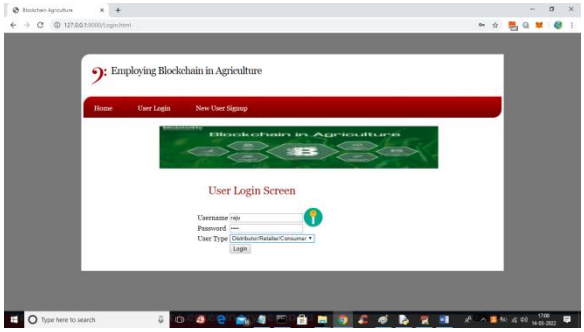
In above screen farmer is uploading crop details with images and then click on 'Upload Crop Details' button to get below output



In above screen crop details added in Blockchain and we can see hash code of old and new block. Similarly you can add any number of crops and now click on 'Fertilizers/Pesticide Info' link to view fertilizers details

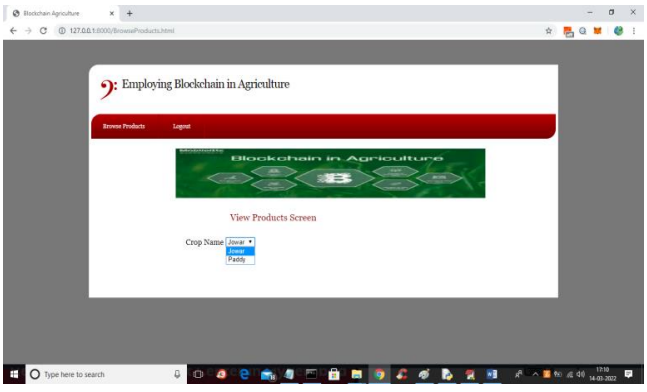


In above screen farmer can view crop names and the require fertilizers and now logout and login as other users to purchase crops



In above screen distributor user is login and after login will get below screen

In above screen click on 'Browse Products' link to get products details



In above screen distributor user can select desire crop and then click button to get below output

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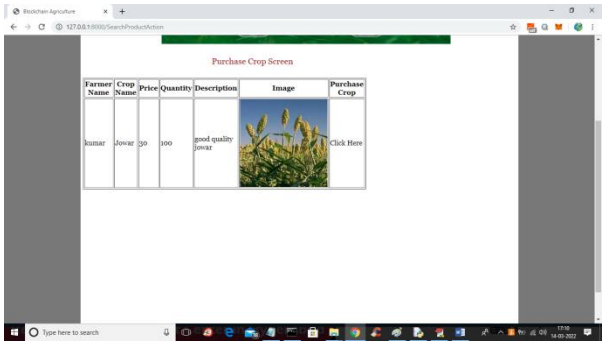
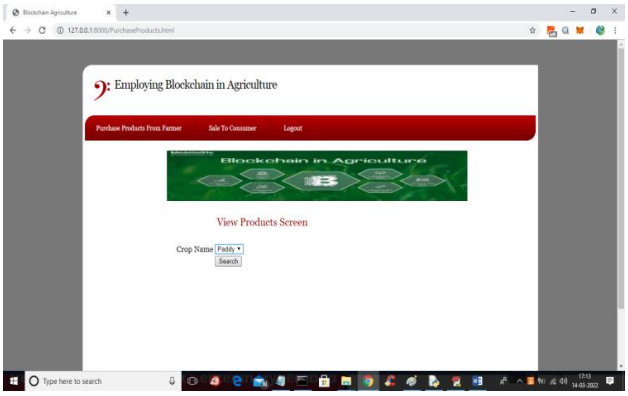


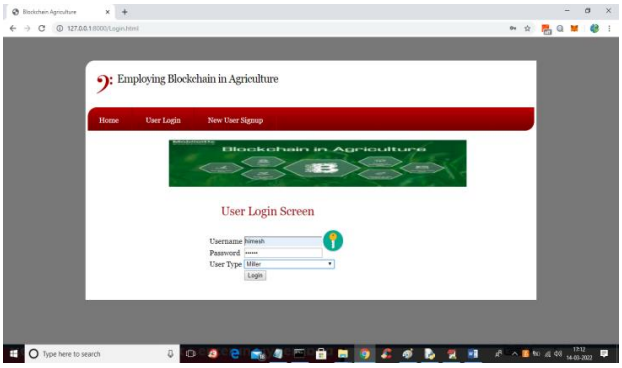
In above screen distributor can view all details and then click on 'Click Here' link to make purchase

In above screen click on 'Purchase Products from Farmer' link to get crop screen

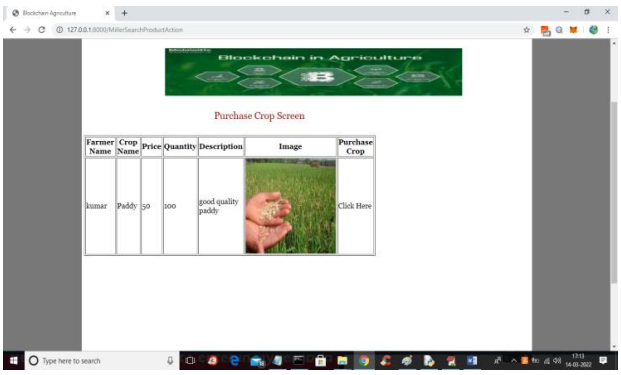
In above screen in red colour text we can see distributor order is confirmed and now logout and login as Miller



In above screen select the crop and press button to view crop details like below screen



In above screen miller user is login and after login will get below screen



In above screen all crop details can be view by Miller and then click on 'Click Here' link to get below purchase screen

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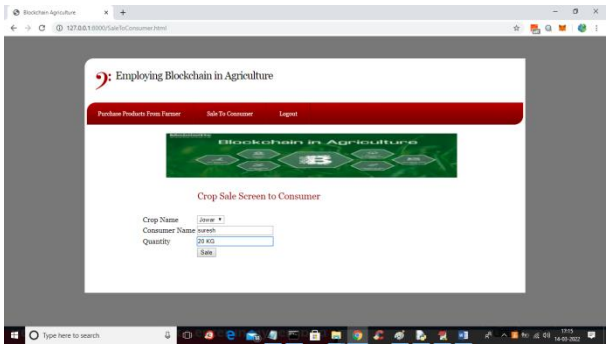
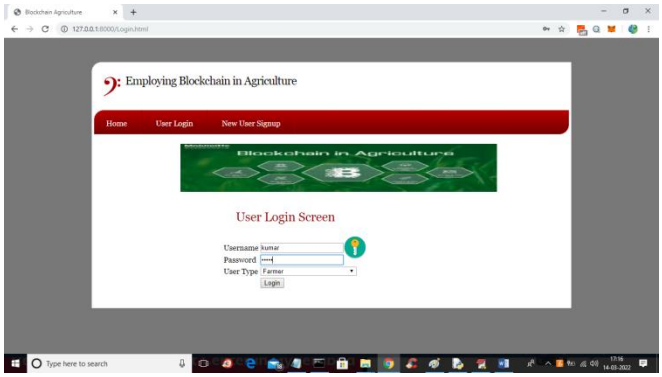
In above screen order details updated and this order will be view and fulfilled by farmer and now click on 'Sale To Consumer' link to get below screen



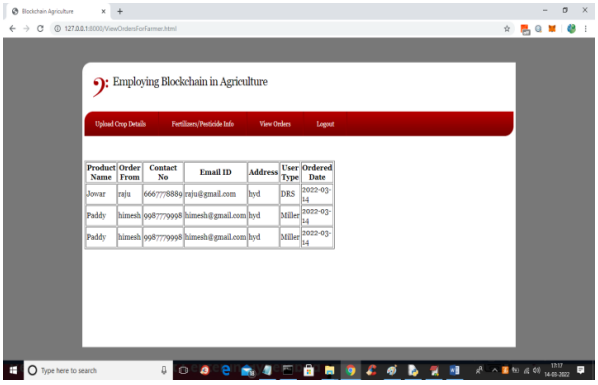
In above screen Miller will sale crop to consumer and press button to get below output

In above screen sale to consumer order is updated and now logout and login as farmer to view orders like below screen



In above screen farmer is login and after login will get below output

In above screen click on 'View Orders' link to get below orders details



In above screen farmer can view details of purchaser like crop name, quantity and their contact details with user type as DRS (distributor/ retailer/ consumer) or Miller and then complete the order.

CONCLUSION

Blockchain technology, as a part of the emerging agriculture system, is reshaping the whole sector to solve food crisis in new century. It plays key roles from the farm to the folk in many aspects: it ensures data privacy and integrity by combining smart farming and precision agriculture techniques to improve farm productivity; it creates a more efficient food supply chain by establishing trust among involving parties, thus simplifying the process; and the last not the least, it enables farmers to maximize their profit via a trusted platform. Overall, it adds great values to all stakeholders in the entire agricultural sector.

In this paper, to promote blockchain techniques, especially their various uses in the ecosystem of agricultural products, we have presented a comprehensive survey on current blockchain based agricultural applications and innovations. We have explained various concepts of blockchain technology, including its data storage ecosystem and its several popular application platforms. We have offered a detailed investigation of desperate blockchain applications in the agricultural sector. Then, we have considered several key challenges in the current use of blockchain related technologies in agricultural applications and provided some possible solutions. These challenges include: (1) scalability, (2) integration with existing legacy systems, and (3) security and privacy. Simply put, our suggested solutions can be viewed in a holistic fashion as a redesign of the system architecture. Further, we have indicated possible future developments and applications of blockchain in this sector via an illustration, i.e. the current COVID-19 global food crisis. In future, we wish to provide further discussions on various aspects of blockchain and explain in detail how current challenges as indicated in this paper can be resolved in future development of blockchain in agricultural systems. Potentially, our illustration could be further extended to be a much fuller case study, which could then be evaluated via a series of emperical tests.

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