Group 12

Project ID 2

Smart Farming using Blockchain Technology

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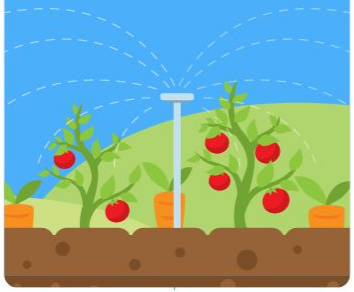
Introduction

E-Agriculture, or Smart Farming, refers to the design, development, and application of innovative methods to use modern information and communication technologies (ICTs), such as the Internet of Things (IoT) and machine learning, to move towards more sustainable agricultural and farming practices.

Blockchain In Agriculture

Stages of data generation

Crop and soil monitoring



Warehousing and distribution

Retail and marketing

Benefits of Implementing the Blockchain in Agriculture:

1. Improved Quality Control and Food Safety
2. Increased Traceability in the supply Chain
3. Increased Efficiency for Farmers
4. Fairer payments for Farmers

Blockchain and smart contract for IoT enabled smart agriculture

Authors: Tahmid Hasan Pranto, Abdulla All Noman, Atik Mahmud and AKM Bahalul Haque

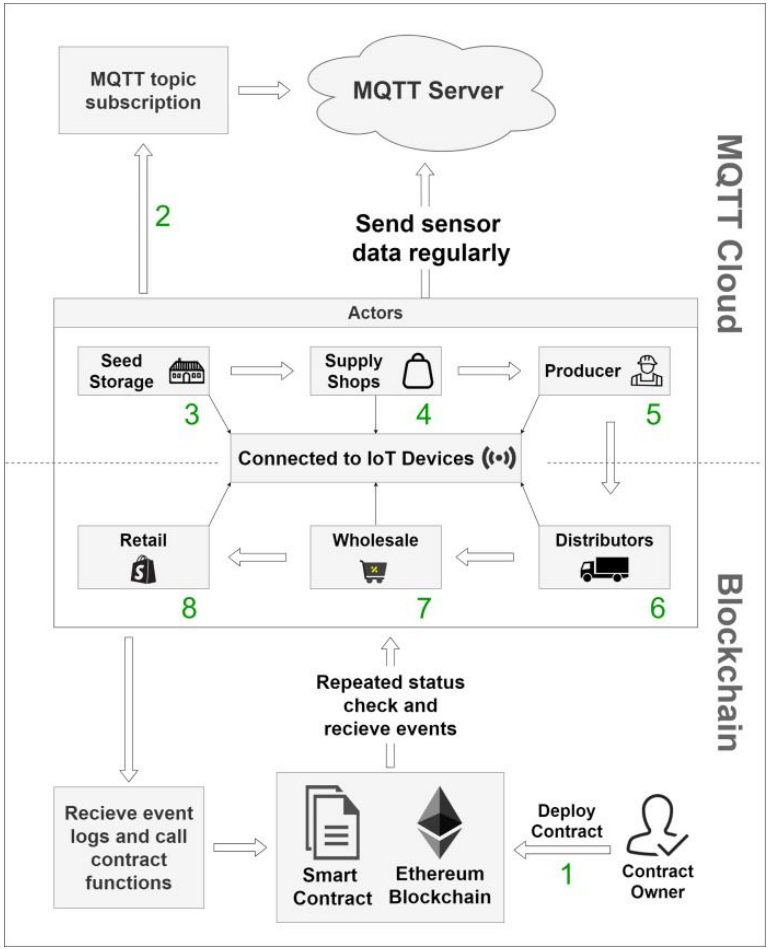
Journal: PeerJ Computer Science, 2021

Abstract:

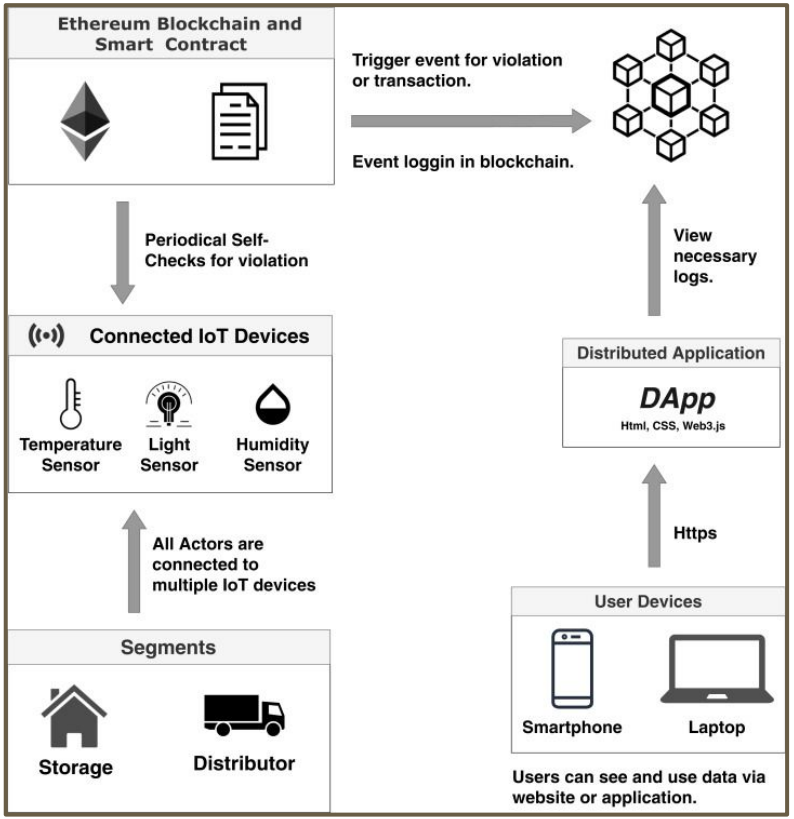
- The agricultural sector is still lagging behind from all other sectors in terms of using the newest technologies.
- In this research, we explored the different aspects of using blockchain and smart contracts with the integration of IoT devices in pre-harvesting and post-harvesting segments of agriculture.

Proposed Blockchain Model:

Blockchain is used to safely store this monitored data while a Smart Contract will be used to automate the process, trigger events, and set the necessary implementation of terms and conditions for all the parties.



System Design



Pre Harvest and Post Harvest:

1. In the pre-harvest period, the system monitors the storage condition that directly impacts the quality of seed, that is, temperature, humidity, and light exposure.
2. In the post-harvest, the system tracks all the necessary information and logs events in the blockchain. Information includes departure dates, prices along the way, and quantity in every layer that the product crosses till it gets to the retail.

Advantages:

- Authorization is never compromised. Only the person allowed by the smart contract can execute or invoke a task.
- Monitored data has been secured and solidified in two ways. IoT devices automatically push data to the MQTT server and the blockchain periodically self-checks these data via smart contract and logs every event and violation.
- Data security within the blockchain is robust. Several types of data from pre-harvest and post-harvest segments are stored in the blockchain so that they remain unchanged as any data saved into the blockchain can hardly be changed or tampered.
- Authenticity has been made sure by the smart contracts. The smart contract automatically checks values in different segments and saves the result within the blockchain.

Innovative blockchain-based farming marketplace and smart contract performance evaluation

Authors: Guilain Leduc, Sylvain Kubler, Jean-Philippe Georges

Journal: Journal of Cleaner Production, Elsevier, 2021

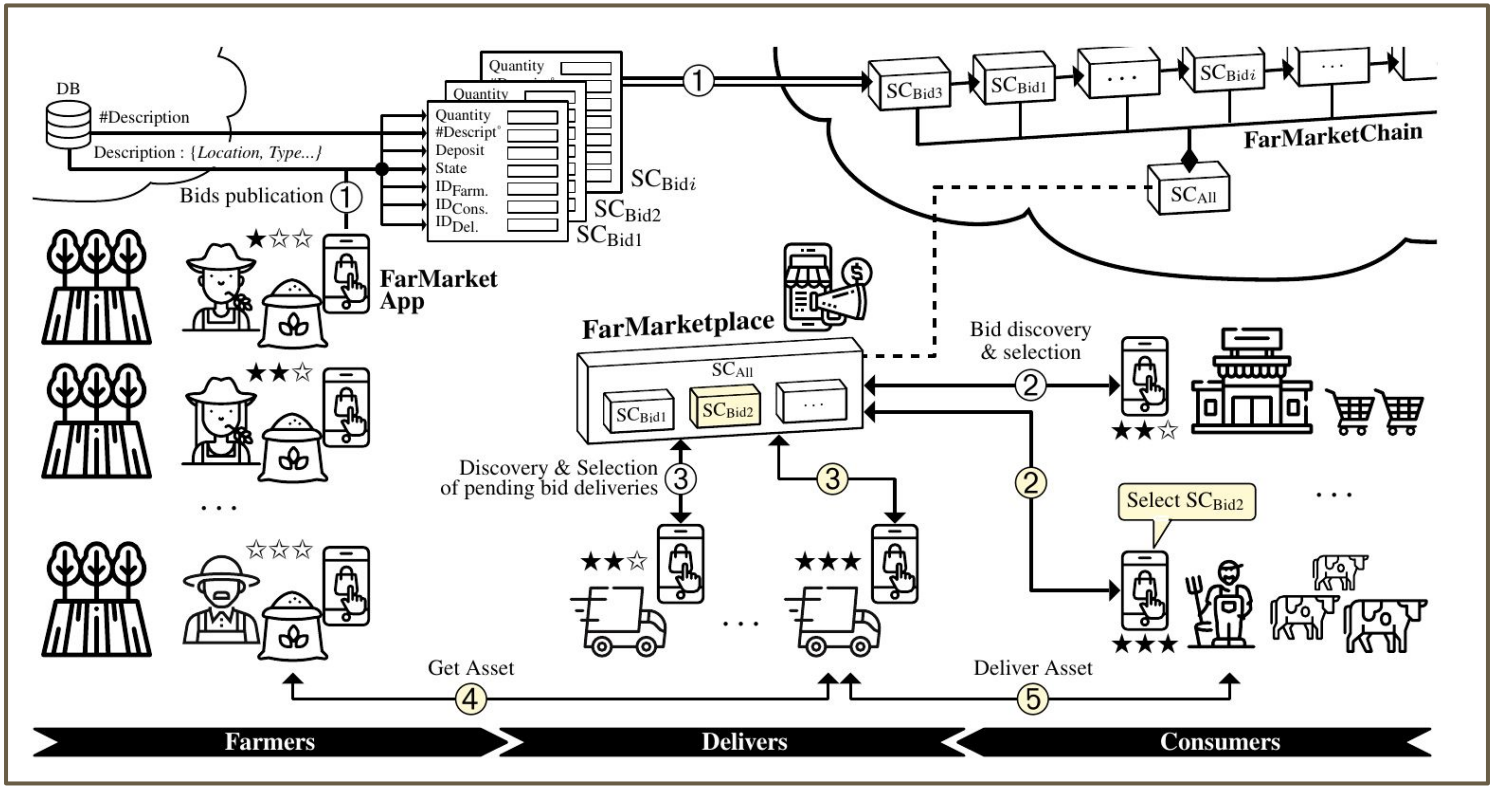
Abstract:

- Proposes a novel blockchain-based farming marketplace
- Proposes a comprehensive methodology using Blockchain, IoT, Cloud Computing etc to enhance the **overall quality of service performance** in the long run.

The Proposal: FarMarketPlace

- This paper proposes a blockchain-based solution called **FarMarketPlace** for **enhanced tracking** and **traceability** of agricultural goods.
- It also supports **trading of agricultural goods** between farmers and interested third party stakeholders by utilizing smart contracts.
- The aim of this proposal is to **reduce the monopoly of corporates** in the food industry and promote local agriculture markets by facilitating interactions between Farmers, Consumers and Deliverers.

FarMarket ecosystem



Interactions between stakeholders and supporting marketplace

Limitations

- Description of farmer’s crop can include more details
- Blockchain is a high-cost technology, so small and medium businesses can’t afford easily
- Because of blockchain’s recent emergence, there will not be a clear feedback.
- Performance depends on the platform on which it is deployed (like Ethereum or Hyperledger Fabric)

Blockchain and IoT based Food Traceability for Smart Agriculture

Authors: Lin, Jun; Shen, Zhiqi; Zhang, Anting; Chai, Yueting

Conference: Proceedings of the 3rd International Conference on Crowd Science and Engineering (ICCSE 2018)

Abstract:

- Proposes a trusted, self-organized, open and ecological food traceability system based on Blockchain and IoT.
- It involves all parties of a smart agriculture ecosystem, even if they may not trust each other.

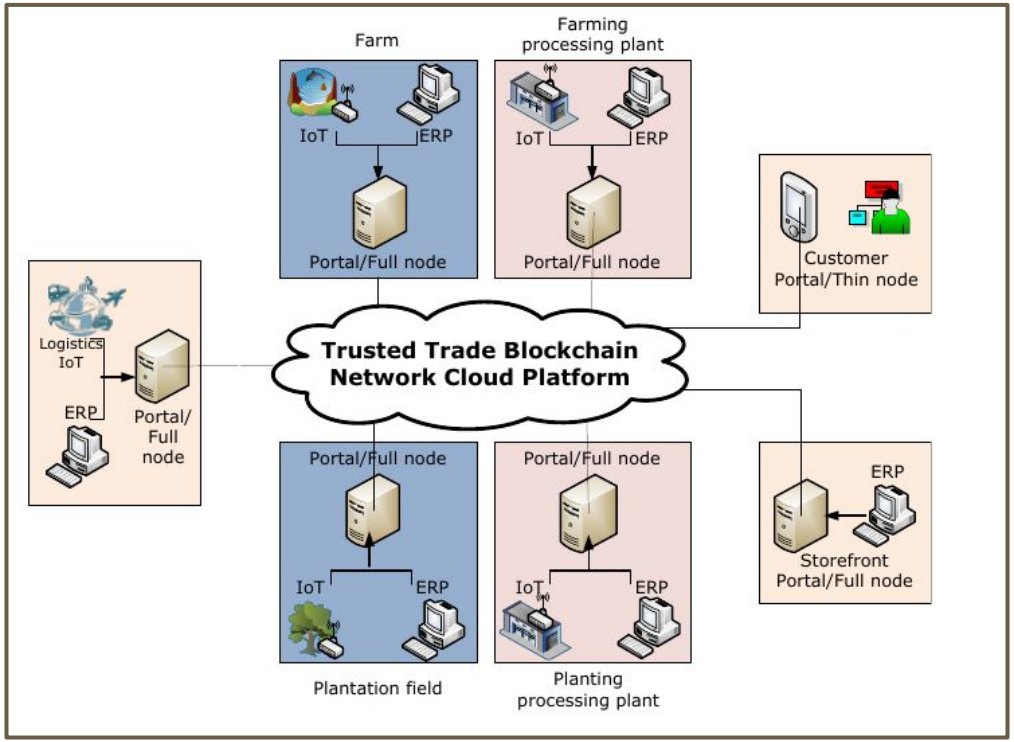
Related Work

- By combining IoT and Blockchain, we can have the best of both worlds.
- IoT devices possess state of the art communication architecture
- IoT frameworks can be used in agriculture for monitoring information like temperature, humidity, soil pH, soil nutrition levels, water level etc.
- Blockchain provides an open, trusted, decentralized and tamper-proof system with easy traceability of a specific transaction.
- The decentralized computation feature of Blockchain solves security issues in IoT.

Proposal

- For every product in the agro-food supply chain, if each player involved in each stage of it’s processing uploads relevant data into a blockchain network, traceability can be improved.
- The relevant data will be captured by IoT devices.
- This would guarantee the food safety, by gathering, transferring and sharing the authentic data of agro-food in production, processing, warehousing, distribution and selling links.

Blockchain and IoT based Smart Agriculture Ecosystem



Limitations

- The paper proposes solution for food safety tracking but does not provide any method for prosecution for untrustworthy parties.
- So, in future, smart contract technology in blockchain could be used to help law-executors to find problems and process them timely.

Thank You

Our Future Work

When the 3 papers are combined together, this could give rise to a comprehensive solution for food traceability which can:

- Regulating Value of the Food Supply Chain
- Trace the Quality of Food
- Trace the Quality of Service

Also, we will implement Loan facility for farmers