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Blockchain Technology -The Evolutionary Next Step for E-Agriculture

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SUMMARY

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.

INTRODUCTION

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 peer-to-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 decision-making protocol, meaning the majority of the parties involved should agree. Blockchain is a transformative ICT that has the potential to revolutionize how data is used for agriculture.

Detailed Process of How Blockchain Can Transform the Way Crops or Food Items are Produced

Step 1: IoT Devices Generating Data

The population across the globe is expected to touch 9.6 billion by 2050 and therefore, to feed the increasing population, the farming industry is adopting IoT devices and sensors. In IoT-enabled smart farming, a system is built for keeping an eye on the crop field using sensors (temperature, pH, soil moisture, humidity, light). IoT sensors and devices generate data which can help farmers make well-informed decisions related to the growth of the crops. The information gathered from the IoT devices first need to be structured before getting saved on the data storage.

Step 2: Cleaning and Enrichment of the Collected Data

Before saving the collected data on the blockchain, there is a need to ensure that it is structured and understandable. Data Enrichment is done to add more value to improve the quality of the captured information. The following two steps ensure that the data is cleaned before it gets stored on the distributed storage platform:

- **Adding Meta Information**
  Information related to timestamp, demography, and type should be added to the data for making it more structured.
- **Making data ready for compliance**
  Saving data on the blockchain does not mean that it should not be compliant. Instead, it makes compliance enforcement more seamless.
  Meeting compliance ensures that the personally identifiable information associated with the data collected from IoT devices is protected and follows security measures. Once the data is enriched, it is put into the machine learning-ready format.

Step 3: Making the Data More Insightful With Machine Learning Algorithms

Machine Learning is applied to the data generated from the sensors to provide useful insights. Predictive models can drive several high-value use-cases including:

- Crop Quality Recommendations

- Crop Identification
- Crop Yield Prediction
- GrowScore (Automated crop growth factor)
- Crop Demand Prediction

From the information captured through machine learning algorithms, farmers and other stakeholders will be able to make improvements in the irrigation system from time to time. The insightful data should be stored on the blockchain to enable agriculture market participants such as growers, innovators, producers, service providers and retailers to access it transparently.

Step 4: Data Gets Saved On the Blockchain

The high-value data gathered by applying machine learning gets stored in IPFS (Interplanetary File System), a distributed storage platform having addresses hashed and stored on the blockchain. Unlike the existing method to store essential information in the centralized server which has a risk of single point of failure, the data is distributed across every node in the network preventing a central authority to control the system. The information captured in the blockchain will trigger smart contracts to process rules defined within them. Smart contracts facilitate the exchange of data stored on the blockchain within the specific stakeholders in the system. Since information will be visible to every agriculture market participant, it will become seamless for them to bring efficiency in crop or food production.

Potential Blockchain Technology Benefits for Agriculture

The blockchain technology allows peer-to-peer transactions to take place transparently and without the need for an intermediary like a bank (such as for cryptocurrencies) or a middleman in the agriculture sector. By eliminating the need for a central authority, the technology changes the way that trust is granted – instead of trusting an authority, trust is placed in cryptography and peer-to-peer architecture. It thus helps restore the trust between producers and consumers, which can reduce the transaction costs in the agri-food market. The blockchain technology offers a reliable approach of tracing transactions between anonymous participants. Fraud and malfunctions can thus be detected quickly. Moreover, problems can be reported in real-time by incorporating smart contracts. This helps address the challenge of tracking products in the wide-reaching supply chain due to the complexity of the agri-food system. The technology thus provides solutions to issues of food quality and safety, which are highly concerned by consumers, government, etc. The blockchain technology provides transparency among all involved parties and facilitates the collection of reliable data. Blockchain can record every step in a product's value chain, ranging a product's creation to its death. The reliable data of the farming process are highly valuable for developing data-driven facilities and insurance solutions for making farming smarter and less vulnerable.

CONCLUSION

The blockchain is still a very recent technology, so there's a long way to go before its full set of applications can be developed and put into practice. However, it's becoming increasingly clear that there are opportunities in the agriculture industry. The global agriculture industry is now worth over 2.4 trillion dollars and has over one billion people involved worldwide. Now, more than ever, there is an opportunity for innovation.

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