A Study on Intelligence Agriculture using Blockchain with IoT

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Abstract **- Agriculture is becoming an important growing sector throughout the world due to massive population growth. The existing agriculture industry very traditional, structured, paper based, historical kind of model. The purpose of this paper is to propose an Intelligence agriculture sector using Blockchain with IoT. Different kinds of sensors capture the information in real time and talk to the Blockchain and update the relevant data that they have captured. This is the main scenario for to form the Industry 4.0 application. Using the innovative technologies it helps the farmers to increase their agricultural production with minimum environmental footprint. In this paper we provide a survey to study both IoT technology and Blockchain techniques used in the Intelligence agriculture sector. First the IoT technology elements for different types of sensors implementation usages in the smart agriculture. Second the Blockchain concepts are blocks, creation of blocks, data storages about the blocks and execution of Blockchain in agriculture sector. In addition this paper discuss the process of smart agriculture using the environment of Internet of Things with the Blockchain concepts.**

Keywords : Blocks, IoT, sensors.

1. INTRODUCTION

Intelligence agriculture system is the new environment of the agricultural sector. The world population will be 8.5 billion by 2040. To meet global food demand, the agricultural sector should be revolutionized. Adoption of IoT with Blockchain will be optimum solution for food production and food safety. The farmers can adopt new framework to enhance the fundamental work on the traditional farm cultivation. Adoption of Blockchain technology will revolutionize the food security in traditional agriculture. Blockchain provides a decentralized data structure to store and retrieve data that are shared with farmers and consumer. To take that specific business scenario of an agricultural supply chain where there are multiple people involved starting from the farmer who produces crop to the inspector to the insurer and the logistics provider who takes this crop up to the exporter and from the exporter it goes to importer and further on various parts of supply chain. who needs to come into this transaction who may or may not know each other but really understand the provenance of the crop in this kind of a scenario we bring in a Blockchain network. when all the participants can have a real time view of the movement of the crop as well as the authenticity of the crop and complete entire transaction in much shorter time without a lot of paper work that is the kind of transaction that we are looking at when we get go to Blockchain instead of having a decentralized place to keep all the data of this particular transaction.

The blokchain will help reduce there by adding transparency and trust to the food safety by tracking the journey of our food from farm to factory and factory to table with checkpoints of accountability along the way for this to make a new concept of Intelligence agriculture system.

In Blockchain technology,many advanced computational and cryptographic techniques are integrated into distributed data structure to achive a digital trust system in an untrusted environment[1]. The intelligence agriculture system formation using a hash function to create a blocks for famer's data storages in the environment.

Blokchcian is a database. In this database differ from existing database(Oracle,SAP). Blokchain is special kind of database , you can add the crop formation data

information. But we cannot delelte the information. i.e a unique differentiate factor for Blockchain database with other traditional database. For example traditional database the root access the administrator falls easy change the informtion on the database.i.e possibility of fraud it can be occcur. Hacker can change or delete the information. This is not possible occurred in Blockchain environment. so it is trusted and transparency of smart agriculture system.

The Blockchain technology involves the highly secured and transparent network where each users having its own block of data which contain hash code, consensus algorithm,cryptographic signature that is used in the agricultural data inputs in the intelligence agriculture sector. In this paper we present a comprehensive study on the Blockchain with IoT based agricultural applications and highly innovations to create a promote of Inelligence agriculture system using Blockchain techniques. Digital technologies like IoT, Blockchain, Machine learning, cloud computing are helping agriculture sector to create an Intelligent agriculture sector in the country.

2. RELATED WORK

Intelligent agriculture is the application of technologies such as Blockchain, Internet of Things,Artificial Intelligence,Cloud computing,Global positioning system(GPS) into traditional agriculture. The IoT technology supported by the smart farming agriculture area. While the current technologies make the concept of IoT facing many challenges in deployments of data storages in centralized network. In recent years, the Blockchain concept has supported to researchers and industralists for security data storages in the peer to peer to network application.smart agriculture is an innovative way of carrying out farming activities by reducing human efforts and by making maximum utilization of the avilable resources.

It can solve the problem of shortage of agricultural workers, improve the ability of agricultural production to resist and help small, weak farmers to produce large scale network and intelligent transformation. The use of sensors, gateways, cloud servers, to control agricultural production through mobile platforms will make traditional agriculture more wisdom[2]. Hence the Blockchain platform used in combination with IoT sensors to collect data feeds and use them for enrichment, processing & storage using Blockchain is quite to popular use cases.

The below sessions are review the related work on different techniques and concepts for Intelligence agriculture sector.

2.1 IoT concept for Intelligent agriculture

In paper[3], authors surveyed some complex a operation of Agriculture IoT Sensor Monitoring Network technologies using cloud computing as the backbone. Authors point of view the precision agriculture sensor monitoring network is used greatly to measure agro related information like temperature, humidity,soil PH, soil nutrition levels, water level etc. so, IoT farmers can remotely monitor their crop and equipment by smart phones and computer.

In paper[4] authors study on the sensors at various depths,rain fall, leaf wetness and humidity are recored periodically. Smart agriculture helps the famers to determine the time for plantation, irrigation and harvesting.The paper intends to brief the reader about the IoT technology and its operational requirements in agricultural practices.some basic content about the working of agriculture IoT are discussed.

2.2 Blockchain with IoT for smart agriculture

In paper[5] authors viewd by Internet of Things,Blockchain is the blooming technology in which each node involved in the Blockchain contains the distributed ledger which enhances the security and data transparency. The authors proposed proof of concept is implemented with Ethereum private Blockchain network under a genesis block. In each node involved in the Blockchain receives the information from the sensors that are connected to the things involves in the smart agriculture process.

In paper[6] authors discussed the integration of the Blockchain with the IoT with highlighting the integration benefits and challenges. They think that moving the IoT system into the decentralized path may be the right decision. The Blockchain is a powerful technology that is able to decentralize computation and management processes that can solve many of IoT issues, especially security.

3. PROPOSED METHOD

3.1 Blockchain with IoT based Intelligent agriculture system

The above research work show that the application of Blockchain and IoT technologies can bring smart agriculture many benefits, but most of them are used solutions for one function or some specific aspects. In this paper we propose and design a general Intellignence agriculture system using Blockchain with IoT.

3.1.1Blockchain

Block+chain. Chain is made up of multiple blocks. Blocks contains data. Blockchain is collection of blocks. Each block contain some information they are connected with each other. Once the data is added to block, it cannot be deleted.once goes in it just remains there. we cannnot be delelted. As more and more information is added to the blocks, the new blocks are created. Every block have a capacity(1 mb,2 mb) we can define the size. Once the block capacity is fill another new blocks is (created) generated. The first block is connected to second block. The second block is conneted to third block and so on. That feature is ability that connection different blocks gives provides transparency and visibility. Any time throughout the life go back to check the content of particular block. We can validate,verify,the certain piece of information existed on particular date and particular time.

Blockchain technology is built using peer to peer networking. Any one can join the network and there is no central authority to manage it. It is operated by people, called miners.who lend their computing power to the network in order to solve complex algorithms. In a Blockchain each block stores the data of the transaction, its hash code and previous blocks hash code. So whenever a new block is created it is validated by a majority of the peers or miners on that network. If anyone tries to change the data in one block, the entire Blockchain will be invalidated, so it's nearly impossible for an individual to change all other attached blocks. The data is encrypted for security purposes. The first block is called the Genesis block.

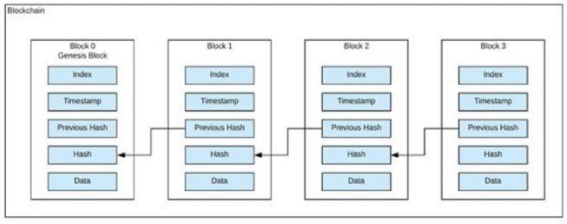

Figure 1: Base level architecture diagram of Blockchain.

3.1.2 Internet of Things

The Internet of Things is the intelligent connectivity of physical devices driving massive gains in efficiency, business growth, and quality of life. IoT is a network of 'things' within built intelligence to sense, store and exchange information with mobile phones, machines, smart homes, vehicles, electronic devices, smart agriculture etc. It is fourth industrial revolution.

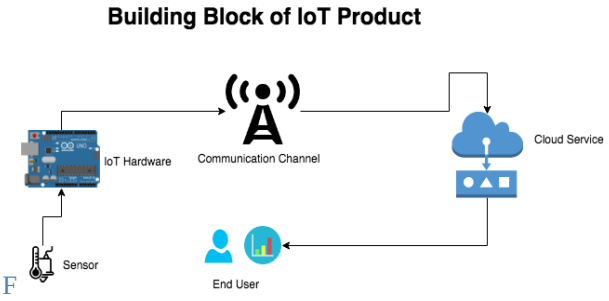

Figure 2 Base level of Stages of IoT
src:8bitwork.com

The above diagrams represent the sensors help to collect the data from any location and then share it to IoT gateway. Once the information is collected from the sensors, it passed on the gateway. The gateway is a mediator between sensor nodes and the World Wide Web. It processes the data that is collected from sensor nodes and then transmits this to internet infrastructure. Once the data is transmitted through the gateway it is stored and processes in the cloud server. The end user can view and access the data processed in the cloud server.

3.2Blockchain with IoT application in agriculture sector

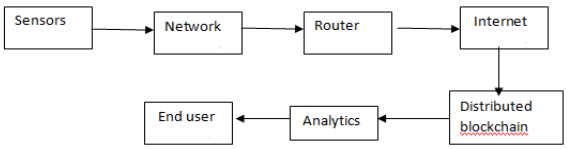

Fig 3 Data flow in IoT with Blockchain Technology

Most of IoT system that are implemented as of now are relaying on centralized server concept. In IoT systems, the sensor devices collect the information from the focused things and allow the data transmission to the central server by wired/wireless network refereeing as internet. One best way to solve this is to have decentralized or

distributed networks where 'peer to peer' networking, distributed file sharing, and autonomous device coordination functions could be capable[7]. Blockchain allows a peer to peer messaging in faster way with the help of distributed ledger as shown in fig 3. The data flow process in IoT with Blockchain technology is different from only IoT system. In IoT with Blockchain the data flow is from sensors-network-router-internet-distributed Blockchain-analytics-user. Here the distributed ledger is tamper proof which does not allow in misinterpretation, wrong authentications in data.

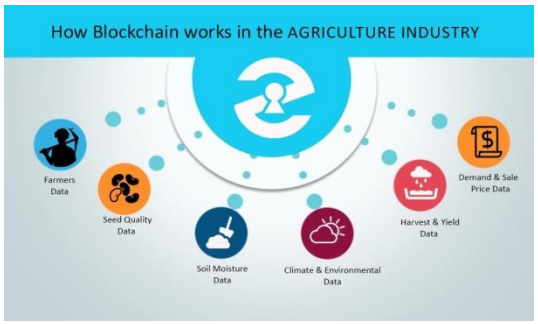

Figure 4: Data storages in different sensors

Figure 4 represents the conceptual scenario of the IoT blockchain platform, data regarding for farmers data(farmers details) directly stored in the block. Another data's are stored in the Blockchain using different types of sensors used in the field of agriculture sector.

Traditional agriculture should be digitized by adopting ICT in agriculture. Intelligent agriculture monitoring system must use the digital technology to stay connected with farmers, consumers and the land. This paper seeks to explore the use of Blockchain technology in intelligent agriculture products. Blockchain technology can be used to verify the authenticity of agricultural inputs. This technology uses peer to peer network that allows joining a new block in chain without affecting other blocks. The benefit of block chain is that is removing the function of middleman between two parties.

This paper focuses on the impact of intelligent agriculture that builds trust between farmers & consumers for improving brand reputation and operational efficiencies and open a new market opportunities. Advanced message queuing protocol(AMPQ) is a peer to peer protocol where one peer plays the role of the client application and other peer plays the role of delivery service or broker. This paper helps to design architecture for IoT based block chain for implementation the intelligence agriculture. It describes the nodes involved in the block chain receives the information from the sensors that are connected to the data involves in the intelligence agriculture monitoring process. The nodes involved in the IoT Block chain based intelligence agriculture are as follows and is shown above (fig 4).

- Temperature sensor node
- Mechanical sensor node
- PH control node
- Climate & environment node
- Soil moisture control node
- Moisture watercontrolnode

3.3 Soil moisture sensor node

Each node in the network acts as a miner. Each node maintains the local copy of the block chain with all the approved transactions. The transactions that are involved in each node are accessing, storing and monitoring the sensor data. In the example of single node namely soil moisture sensor node as follows the process of the content.

1. soil moisture sensor transaction

2. store the soil moisture details transaction

3.access the soil moisture details transaction

4.monitor the soil moisture status transaction.

The above four steps are involved in the all sensor nodes in the intelligence agriculture system. The remaining sensor process and stored the information to the blocks in the chain of networks. Artificial intelligence & smart algorithms can analyse massive amounts of data on weather, environment and historical information to make increasingly accurate predictions on what, where, when and how to plant crops for optimal performance and yields'. Block chain coupled with other technologies such as the internet of things would help maximize crop production. For example sensors on IoT devices could gather data on the water level, soil temperature, fertilizer use and send it to the blockchain.

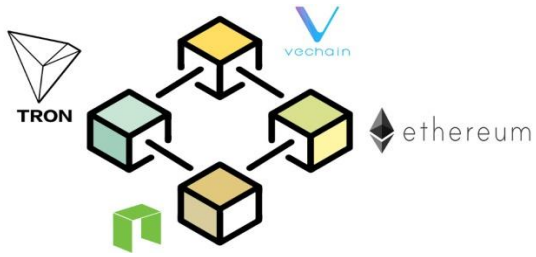

Fig 5 Blockchain platforms

The above Figure represents those different types of Blockchain platforms used in different types of use cases. Vechain focused on real world use cases such as supply chain, medicine and health care, automobiles. Vet uses a combination of Blockchain technology and IoT for tracking and tracing items throughout their life cycle. This platform mainly used for combination of IoT with their use cases. Each item is assigned unique identifiers (RFID) tag using IoT. Thus, each item is logged onto the Vechain Blockchain, enabling each stakeholder to track the item.

3.4 Highlights the difference between different Blockchain platforms

	Tron Blockchain	VET Blockchain	NEO Blockchain	EthereumBlockchain
Consensus mechanism	Delegated proof of stake	Proof of authority	Delegated Byzantine Fault tolerant(dbFT)	Proof of work
Transaction per sec(TPS)	20000	10,000	10,000	20
Quantum computer proof	No	No	Yes	No
Controversies	Plagiarism	Not known	Network crash	DAO attack
Written in	Javascript	C++,solidity	C#	Go,C++,solidity, Rust

Src: OpenSource ForU.com

4. CONCLUSION

In summary Blockchain and IoT technologies can help us to build the new environment of intelligence agriculture system. The proposed method describes the IoT devices are used in the data transfer in the block chain network. In this paper mention about the core details of block chain architecture with IoT application. Blockchain technology is identified as one of the solutions for the success within the agriculture sector .Blockchain and IoT technologies can help us to build a trusted, open and ecological smart agriculture system. The aim of this work will to evaluate the practical limitations and identify areas for further research.

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