iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VII **Month of publication:** July 2021

DOI: https://doi.org/10.22214/ijraset.2021.36765

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VII July 2021- Available at www.ijraset.com

Overview of IoT and Blockchain Technology in Smart Agriculture

Anshika Kaushal[1], Dr. Krishna Raj[2]
[1, 2]*Student, Professor and Head of the department of Electronics Engineering, Harcourt Butler Technical University, Kanpur*

Abstract: The digital breach between applications of IoT and agriculture decaying from the last few years. As we know nowadays the latest technologies such as Blockchain technology etc. are blooming. And the combination of IoT and these blooming technologies will allow in improvisation of productivity through the sustainable cultivation of food, efficient use of water, food security, food chain supply, transactions efficiency, transparency of food safety, e.t.c. Thus, in this paper, applications of " IoT" in agriculture have been analyzed and studied, also this paper concisely introduced the technology IoT, agriculture sector, benefits of IoT in agriculture, and presents a review of some literature. The purpose of this paper is to elaborate the ongoing studies and research on smart agriculture using the recent combination of IoT, Blockchain Technologies to fix a variety of agriculture's problems.
Keywords: IoT, Blockchain , Smart Agriculture.

I. INTRODUCTION

One of the most important sectors of primary industry is 'Agriculture'. Techniques and practices of agriculture play a very important role in large countries like INDIA , CHINA etc. As we know that most of the economy of India is based on agriculture,[1],[2].

Then , there is a requirement of looking at all the aspects of agriculture such as food security, food cultivation, etc. The emerging technologies like IoT, Blockchain will help to face all the challenges whatever occurs in the field of agriculture. According to this paper we can understand the concept and research status of Blockchain and IoT in Smart Agriculture,[3],[4].

The organizational structure, of this paper is as follows- Section (1), this will describe the definition of IoT and its application in smart agriculture. Section (2), here we will look at the concept related to blockchain technology and its application in smart agriculture.

Section (3), how blockchain technology will help in smart agriculture. Section (4), finally conclusion.

A. Introduction of IoT[Internet of Things]

ITU'(International Telecommunication Union)'s according the definition of IoT as given below-

"The Internet of things is a technology that mainly resolves the interconnection; between 'human to a thing', 'thing to thing', and 'human to human'." In 1999, the concept of IoT was proposed , after that increment of this increases immensely in various fields such as agriculture , smart home, smart city, smart energy, health care, logistics etc. Now in the modern era agriculture is getting a lot of attention from the world,[10],[11].

B. How the internet of things emerged?

Well, there are few basic reasons for this question is that the robust growth currently has been observed in IoT's applications; is attributable to several major underlying trends, that are just now coming in fruition,[6],[8];

1) Computing's cost decrease(including sensor),
2) [Wi-Fi]'s growth helped lot in growth in IoT's applications,
3) Software development's growth
4) Increment of standardized low-power wireless technologies{as per suggested by ABI Research} etc.

©IJRASET: All Rights are Reserved

Table 1: IoT technologies's Functions with examples[12]-

Functions	Examples
Mobility and Location,	Mobile location or fixed { ex. GPS, GPRS) OR monitoring engine's status in automobile vehicles or on a flying drone.
Identification and addressing	Ex. IP addresses, IMEI, Chips, Smart cards, SIMs, etc.
Topology , architecture and node density and dispersion	In dense environments such as hospitals, smart cities etc. And if we will discuss topology then this will take into account the architecture and how nodes are constructed for reporting purposes lets say zone architecture etc.
Purpose	There are a wide variety of sensors present nowadays ex:(thermal, moisture, optical, radiation, acoustic, kinetic, acoustic, chemical, position, instrumentation, motion, level, GPS coordinates) for observing the range of variables associated with tracking positions;{ex: weather, climate, water, light, salinity, soils, vegetation, etc.}
Transmission	Here, we can break down data communications in different other variables too such as- Range; Routing;(Data bandwidth and data volume)'s requirement is high or low; transmission capabilities for one-way and two way ; There is a chance to not to transmit data through public Internet; Latency and QoS of transmission;
Alert or Warning system	Whenever natural disasters came then we commonly saw an alert system. This is not necessary that this will be only in binary; even this can be in methods like detection of motion or in threshold manner.
Automation	Whether human initiation , monitoring or if we will talk about intervention then there is need of automation or we can say independent function.
Frequency of replacement/visit	In the field of maintenance or obsolescence or replacement or etc.

©IJRASET: All Rights are Reserved

C. Internet of Things's Applications in Smart Agriculture

Agriculture is the heart of the world. Earlier there were different ways for horticulture but now there are a lot of new things that arise in this modern era which will help the farmers in various ways,[5],[8]. So,the Internet of things for agriculture supports not only monitoring of soil and plants but also in observing crop growth and their selection, precision agriculture, irrigation assessment support, monitoring in control systems, food supply chain, greenhouse environment.

1) Let's discuss some applications of IoT which are given below

Table 2: Sensors used in Agriculture-

Sensors	Characteristics
Optical	Soil's properties are measured using the light.
Mechanical	[Soil compaction or mechanical resistance]'s measurement by using probes.
Electrochemical	Detection of ions in soil by using electrodes.
Dielectric Soil Moisture	To check moisture level, after understanding the dielectric constant in soil.
Airflow	Soil air permeability's measurement.
Location	Examination of latitude/longitude/ altitude by using a GPS system.

1) *Monitoring:* In agriculture there are a wide variety of factors that can be monitored, some of the factors such as; crop farming, aquaponics, forestry, Livestock farming,etc,[13],[14].
2) *Tracking and Tracing:* By this factor one can know all the history of the product, by which one can improve consumer's trust.While tracking is not only the ability to capture, collect, and store data related to the supply chain downstream from upstream , tracing also allows the product to be distinguished from downstream to upstream. Tracking and tracing allows several data to be collected along the supply chain such that the consumer and other stakeholders are guaranteed on the origin, location, and life history of a product,[7],[8],[9].
3) *About Agriculture Machinery in IoT Technology:* Crop productivity and grain losses can be improved by IoT-based agriculture machinery. Using GPS and global navigation satellite systems (GNSSs) in a proper manner there is a chance that the machinery can be operated in autopilot mode,[5],[6],[7]. Use of vehicles, unmanned aerial vehicles (UAVs) and robots in any kind of machine can be remotely controlled based on the available data collected via the IoT's system for more precise and efficient application of resources whatever is required for farm areas. The data can also be collected by machinery and this kind of data will help in mapping of fields for planning purposes to the farmers, like fertilizing, irrigation, nutrition. For example; CLAAS, implementation of IoT on their equipment could be done by an agriculture machinery, would help enabling in autopilot mode for operation,[11],[12],[13]. There are other ways such as information that can be provided to the farmers by using UAV sensors of Precisionhawk, for example; wind's speed, air's pressure, and other parameters.
4) *About precision agriculture:* We can define precision agriculture in a very simple manner as real-time data collection from farm variables and predictive analytics's use for modern decisions in order to enhance yields, decrease the environment's effect, and reduce costs. Precision agriculture depends on a lot of technologies, such as combination of sensor nodes, GPS , and big DA, by which the consumer can achieve improved crop yield,[2],[3],[4]. And this is really essential to provide such solutions that are easy to use by the farmers and this can definitely happen by using precision agriculture technology and as we know that most of the indian farmers are not educated so we need to provide some training so that they can take help from these new trending technologies.

©IJRASET: All Rights are Reserved

5) *About Greenhouse technology:* Greenhouse, we can use the term glasshouse technology for greenhouse is a technique, in an under controlled environment, plants can be grown. We can take advantage of such technology in this manner such that we can grow any kind of plants in whatever the place irrespective of time by providing efficient and all the environmental conditions. Several research projects have been carried out on WSNs's applications in the greenhouse to observe all the environmental conditions. Several research projects have been carried out on WSNs's applications in the greenhouse to observe all the environmental conditions,[5],[6],[7]. According to recent research, we can say that, why IoT's applications are important for greenhouse technology, because of this we reduce human intervention, not going to waste energy , no decrease of efficiency in monitoring of greenhouse-site, and reduce the gap of connection of greenhouse farmers to customers.

D. Let's Discuss the topic Known as Blockchain Technology-

After the success of the cryptocurrency which is known as Bitcoin, we came across the word such as 'Blockchain Technology' which is a very important technology nowadays. Blockchain technology is the key part and because of this we have seen the development of Bitcoin. We can say that this is ledger-based tamper proof technology which allows a lot of use cases in a border range of applications,[10]. Because of BC there is a possibility that we can maintain a continuous flow of factors related to a controlled database and sample sets of collected data. There are few key elements of BC such as participant-created transactions, and transactions' recorder blocks. Here,by the recorder block we can check the transaction's details whether this is in the correct sequence or not. No tampering of the data availability is allowed by recorder blocks. The need for a chain approach arises if there is a requirement for maintenance of data in correct sequential order. Participating nodes' network was shared with the maintained transaction. After identification of each and every node which is participating in the sharing process of a transaction by using the cryptography will eliminate the central server's concept. Secure authentication is allowed by this concept.

1) *In large scale IoT systems; Blockchain technology have the following pros such as-*

a) Tamper proof data.
b) Possibility of peer-to-peer messaging
c) Vigorous.
d) Highly authentic.
e) More nonpublic data.
f) Documentation of epoch-making actions .
g) Documentation of old transactions' data in a smart amenity.
h) Legitimate self-directed service.
i) Sharing of distributed files.
j) Single control authority's elimination, etc.

E. Blockchain Applications In Agriculture Sector

In recent years, attention to blockchain technology has been significantly increased in the agricultural sector. Major concerns in several valuable aspects is driven by blockchain technology trend, i.e. contamination of food and issues related to fraud, security of data and smart farming's safety and precision agriculture based on IoT, believe and issues efficacy in supply chain of financial transactions in the agricultural domain and data transparency and integrity of agriculture related information management systems,[10],[14],[15]. To achieve agriculture's efficiency and integrity, we can categorize ; blockchain's uses into a few different groups:

(i)Authentication of food; (ii) Management of data for smart farming; (iii) trade finance in the supply chain management; and (iv) other information management systems.

1) *Provenance traceability and food Authentication:* In product supply chain management there is use of blockchain technology for measuring traceability and provenance.This will be the most efficient way for enhancing food's safety, to decrease fraud and all kinds of food scandals since product origin's data and movement of all this can be stored with a very minimal tampering risk. After production of each product item, It is attached with a corresponding digital token in order to confirm that everything is tracked in a real-time manner,[9],[13]. All the information can be traced by procurement managers with the help of blockchain technology online in time, so that the individual tainted products can be easily pinpointed with the help of this technology with no requirement of recalling all the products. With the help of these systems can do quick safety traceability and will reduce the recall cost after allowing the tracking of the items rather than a bunch of batches. Based on the requirements of the applications we can design the collection procedure of data and transactions in blockchain traceability's system.

©IJRASET: All Rights are Reserved

2) *Smart farming data management:* Combination of IoT and blockchain technology will help in the better way to control the productivity and management in smart farming. All different types of sensors, all decisions related to farming and controlled management, whatever is based on the IoT technology are made based on the collection of the data from such sensors. Robotic swarm control which is proposed for future smart farming and precision agriculture[12],[15]. Distributed or collaborative decisions can be made based on data collection of the data from robotic swarms with the help of UAVs and land robots. Then , data related to privacy and integrity will be the most important feature in such systems. Existing trends of IoT and Blockchain technology are going to help in farming in a dexterous way for many applications. In these applications, farmers can make strong trust on the automated controllers as all decisions are accountable.
3) *The trade finance's efficiency improved in the supply chain:* We were supposed to improve financial efficiency and there should be no increment in transaction cost with the help of removing all intermediaries after proposing blockchain technology and audit cost via improved accountability in the trading business process,[10]. And many more.

F. Blockchain Technology Solution to IoT

Blockchain technology provides better solutions to the IoT systems. IoT expansion scenarios provide greater opportunities to interact with multiple objects or devices. More and more devices try to communicate with each other over the internet,[10],[11]. This is a bottleneck because most of the data collected by IoT systems is stored on a central server. In order for a device to access data, the device must communicate on the core network and data flow must pass through a central server. However, the growing demand for IoT and its applications has resulted in large-scale systems incorporating advanced technologies. A central server is not an efficient method for these large-scale IoT systems, sensors collect information about important things and make it possible to send data to a central server through wireless/wireless network information. Analyze user needs and comfort on a central server. From blockchain technology we can overcome all such kinds of issues whatever is present in the IoT system such as Security issues, Privacy concerns, interoperability issues, IoT standards issue, Legal, regulatory, rights issues, Emerging economy issues, Developmental issues[3],[10].

II. CONCLUSION

This paper covers various possible security and privacy issues in the Internet of things. These are determined based on observations in the interaction of IoT components. Blockchain technology has been identified as one of solutions to the problems and challenges of the internet of things. The scope of the integration of blockchain and IoT is explained in this paper. In addition, various possible applications of internet of things and blockchain technology are also emphasized. Finally , the challenges faced by the internet of things using concepts to understand the need for blockchain in IoT. This technology can be applied to a wide range of services in the engineering field. But the exact meaning of each technology must be clearly studied. Blockchain provides greater flexibility for accessing data. The author will propose research related to the potential impact of various fields through appropriate demonstration models.

III. ACKNOWLEDGMENT

I would like to thank my supervisor Dr. Krishna Raj, Professor and Head of the department of Electronics Engineering, HBTU Kanpur for providing the required resources and funds in order to undertake this research project.

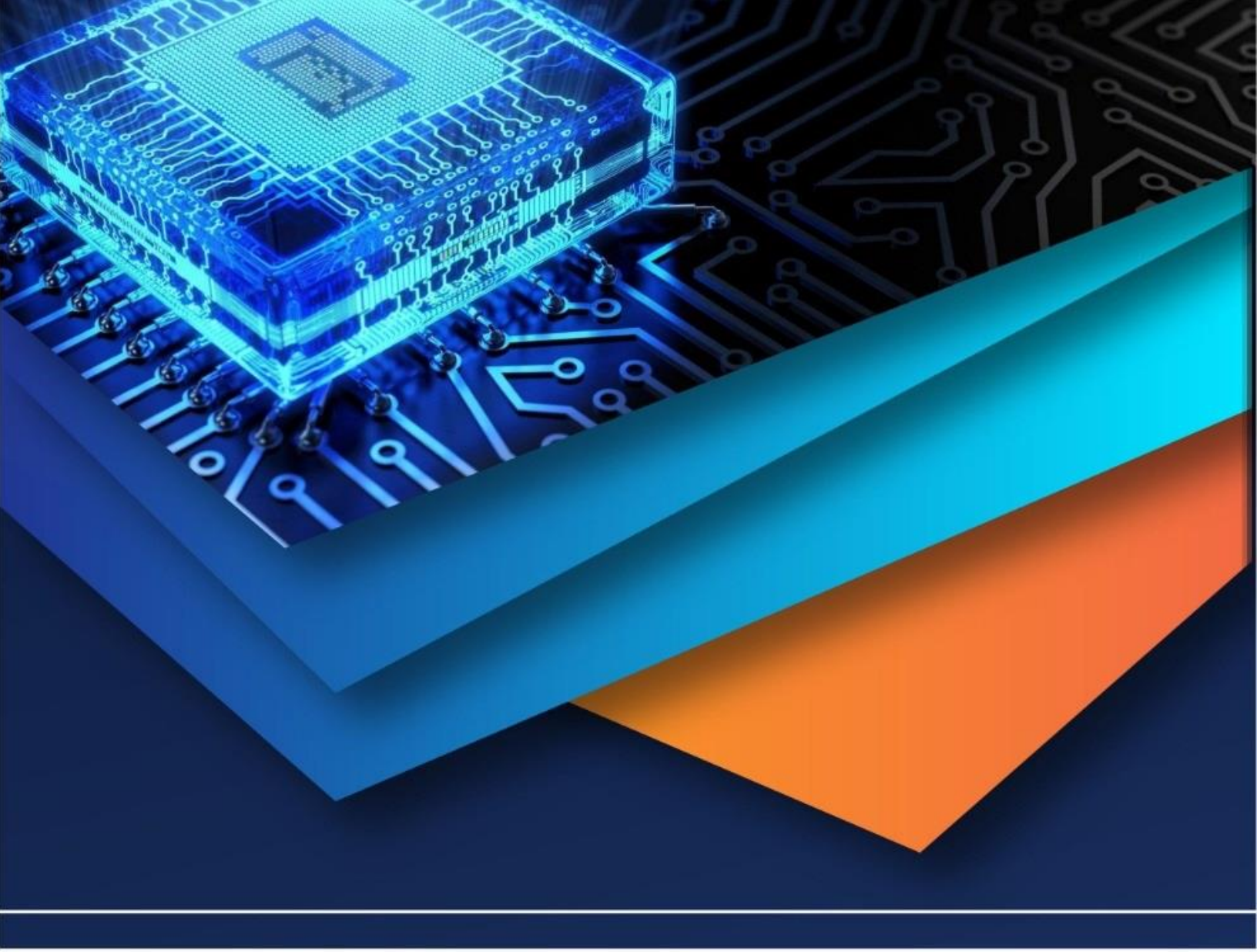
REFERENCES

[1] Zanella, N. Bui, A. Castellani, L. Vangelista, and M. Zorzi, "Internet of Things for smart cities," IEEE Internet Things J., vol. 1, no. 1, pp. 22–32, Feb. 2014.
[2] Olakunle Elijah, Igbafe Orikumhi, and MHD Nour Hindia, "An Overview of Internet of Things (IoT) and Data Analytics in Agriculture: Benefits and Challenges," IEEE INTERNET OF THINGS JOURNAL, VOL. 5, NO. 5, OCTOBER 2018.
[3] Kamlesh Lakhwani, Hemant Gianey, Niket Agarwal and Shashank Gupta,"Development of IoT for Smart Agriculture a Review,"Advances in Intelligent Systems and Computing 841,© Springer Nature Singapore Pte Ltd. 2019
[4] XIHAI ZHANG, ZHANYUAN CAO and WENBIN DONG, "Overview of Edge Computing in the Agricultural Internet of Things: Key Technologies, Applications, Challenges," IEEE OPEN ACCESS JOURNAL, VOLUME 8, 2020.
[5] Hassina Ait Issad, Rachida Aoudjit and Joel J.P.C. Rodrigues "A comprehensive review of Data Mining techniques in smart agriculture," Engineering in Agriculture, Environment and Food November 2019 https://doi.org/10.1016/j.eaef.2019.11.003 .
[6] Mariana Mocanu, Valentin Cristea, Catalin Negru, Florin Pop, Vlad Ciobanu and Ciprian Dobre,"Cloud-Based Architecture for Farm Management,"2015 20th International Conference on Control Systems and Science.
[7] "State of blockchain q1 2016: Blockchain funding overtakes bitcoin," 2016. [Online]. Available: http://www.coindesk.com/ state-of-blockchain-q1-2016/
[8] S. Nakamoto, "Bitcoin: A peer-to-peer electronic cash system," 2008. [Online]. Available: https://bitcoin.org/bitcoin.pdf

©IJRASET: All Rights are Reserved

[9] G. W. Peters, E. Panayi, and A. Chapelle, "Trends in crypto-currencies and blockchain technologies: A monetary theory and regulation perspective," 2015. [Online]. Available: http://dx.doi.org/10.2139/ssrn. 2646618.
[10] I. Eyal and E. G. Sirer, "Majority is not enough: Bitcoin mining is vulnerable," in Proceedings of International Conference on Financial Cryptography and Data Security, Berlin, Heidelberg, 2014, pp. 436– 454.
[11] Karen Rose, Scott Eldridge, Lyman Chapin (2015) "The Internet of Things: An Overview Understanding the Issues and Challenges of a More Connected World."The Internet Society (ISOC), pp. 1-80. https://www.internetsociety.org/wp-content/uploads/2017/08/ISOC-IoTOverview-20151221-en.pd
[12] Celent, Interaction between the three components of internet of things.https://qph.ec.quoracdn.net/main-qimga1db8df2497ec1c595ca93deef7b25ca
[13] Nallapaneni Manoj Kumar, Pradeep Kumar Mallick (2018) "The Internet of Things: Insights into the building blocks, component interactions, and architecture layers" Procedia Computer Science.International Conference on Computational Intelligence and Data Science (ICCIDS 2018), Gurugram, India.
[14] Andreas Kamilaris, Agusti Fonts, and Francesc X. Prenafeta-Boldv´, "The rise of blockchain technology in agriculture and food supply chains," Trends in Food Science & Technology, vol. 91, pp. 640–652, 2019.
[15] Francesca Antonucci, Simone Figorilli, Corrado Costa, Federico Pallottino, Luciano Raso, and Paolo Menesatti, "A review on blockchain applications in the agri-food sector," Journal of the Science of Food and Agriculture, vol. 99, no. 14, pp. 6129–6138, 2019.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)