International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

ENHANCING FARM TO TABLE SUPPLY CHAIN MANAGEMENT USING BLOCK CHAIN TECHNOLOGY

Mr. G.Rajesh[1], Naruboina Williams[2], Mallam Bhupathi Charan[3], Veeradasari Vamsi[4]

[1]Assistant Professor In Department Of Cse, Pbr Visvodaya Institute Of Technology And Science, Kavali.

[2,3,4]B. Tech With Computer Science & Engineering, Pbr Visvodaya Institute Of Technology And Science, Kavali.

Abstract: The underlying Distributed Ledger Technology (DLT) of several cryptocurrencies might have a significant effect on the world economy. The DLT is now being utilised in a number of fields, including supply chain management (SCM). Blockchain technology has the ability to significantly improve various supply chains by enabling quicker and more economical product delivery through the use of distributed ledger technology. The primary advantages of integrating blockchain technology into supply chain management are that it enhances product traceability and facilitates better coordination between producers, manufacturers, distributors, retailers, and consumers. Additionally, facilities make funds simpler to get. The Food Supply Chain (FSC) has been leveraging the blockchain in recent years to take advantage of SCM's advantages and improve the Food Supply Chain's performance. This article proposes the FARMSUPPLY concept, which leverages blockchain technology in a food supply chain to improve the visibility of farmers, goods, and merchants. This model presents a smart contract and Ethereum blockchain technique for validating and verifying different qualities at every point in the food supply chain.

Index terms - Blockchain Technology, Food Supply Chain, Supply Chain Management, Distributed Ledger Technology, FARMSUPPLY, Smart Contracts, Ethereum, Traceability, Transparency, Farmers Visibility, Product Verification

1. INTRODUCTION

Our initiative aims to use the Ethereum blockchain to modernise the Food Supply Chain (FSC), with a particular emphasis on improving security, efficiency, and transparency. We hope to improve supply chain reliability by streamlining FSC processes, giving stakeholders clear information, and strengthening transactional security by utilising Ethereum's capabilities. Inefficiencies, a lack of transparency, and fraud vulnerability are some of the issues with traditional FSC techniques. Verification of compliance and traceability

are hampered by manual procedures. These problems are addressed by our initiative, which acknowledges the need for a safer and more efficient method. We combine smart contracts and the Ethereum blockchain to address the issues that have been discovered. Blockchain tracks transactions in a transparent and safe manner, much like a digital ledger. We utilise it to record data on product sources, authenticity checks, and verification procedures. Blockchain keeps records as blocks of data, each with a distinct code known as a hash, rather than storing all the data in one location. Because these blocks are dispersed over several computers, or nodes, it is far more difficult for someone to alter the data or attack the system as a whole. Blockchain has a number of benefits. The data isn't kept in a single, susceptible location since it's decentralised, to start. Because the data is kept in an encrypted manner that is extremely difficult to change or hack, it also improves security. Thirdly, because all transactions are documented and accessible to authorised persons, it fosters transparency. Fourth, it guarantees that data is immutable, which means that once it is entered into the blockchain, it cannot be readily altered. Finally, even if some nodes fail, the data is still maintained by the remaining nodes, making it robust to failures. This project makes use of Ethereum's blockchain, which is well-known for its smart contract functionality. In addition to being safe, these Ethereum network contracts closely monitor important product information, which improves supply chain transparency and dependability even further.

2. LITERATURE SURVEY

2.1 Block-chain Technology for Food supply chains:

https://ieeexplore.ieee.org/document/9388478

ABSTRACT: Blockchain technology is the most recent and extensively utilised in practically every application, including supply chain management systems, banking, healthcare, business, IT, government agencies, and agricultural, among others. Food goods are more delicate, and the current centralised technique makes it extremely difficult to track down the buyers, suppliers, and farmers. In addition to the characteristics of decentralisation, enhanced security, immutability, and tamper proof for supply chains, the use of blockchain technology is suggested and tested in this study. The suggested work eliminates data falsification, database corruption, and external threats by utilising Ethereum smart contracts for food supply chain management systems. The findings of the experiment demonstrate the examination of food supply networks.

2.2 Traceable, trustworthy and privacy preserving agri-food supply chains

https://ieeexplore.ieee.org/document/9750237

ABSTRACT: Globally intricate trading patterns have led to the digitisation of the supply chain for agricultural produce tracking and data storage. These traceability systems, however, have problems such

information being dispersed over several silos and being vulnerable to inaccurate or altered data, which might endanger food safety through fraud or counterfeiting. Another difficulty is making sure that information regarding a product is credible since the data that is currently accessible could not accurately reflect the actual physical events that occur over a product's lifespan. Transparency and traceability come at the price of providing data that is sensitive to business. It is challenging to protect trade secrets like shipments, prices, and trade frequency while still guaranteeing provenance and traceability to customers when product-related data is made public. The necessity of agri-food supply chain traceability is emphasised in this study, along with a general framework for the traceability model that includes blockchain as a crucial element. Building blocks from the data, storage, application, and blockchain levels are all included in the framework. Finally, using fresh fruit as an example use-case, we present our work on using blockchain technology for supply chain management. We also point out the difficulties and potential advantages of implementing blockchain technology for supply chain resiliency.

2.3 A Comprehensive Review of Blockchain based Solutions in Food Supply Chain Management:

https://ieeexplore.ieee.org/document/9418305

ABSTRACT: Food quality has gained significant attention in recent years as it may serve as a gauge of citizens' living conditions and any flaws in it can have a significant negative impact on people's health and well-being. Customers' lack of knowledge about food produce, including its origin, quality, shelf life, etc., has led to mistrust, which can also have an impact on producers' pricing and marketing strategies. All of this results from the centrally managed food distribution and procurement systems in place today, which rely on regulatory agencies to maintain quality. This has caused information regarding food produce to become opaque, and stakeholders may have doubts about the data that is currently accessible. A system that can transparently deliver information to its stakeholders, particularly its consumers, is urgently needed. Reliability in providing this information will increase customer trust, which will boost vendors' brand value. The Food Procurement and Distribution system is only one of several industries that have taken use of blockchain technology, which is a disruptive technology. Because of its immutability and transparency, which enable any component of the system to confirm the legitimacy of data contained therein, a blockchain facilitates the development of trust among stakeholders. if the block chain records every transaction that takes place in the food procurement and distribution system, from the point of production to the point of consumption. Customers may then more easily confirm whether the seller's statements on the quality of the food are accurate. In addition to outlining future research trends in the same sector, this article provides an overview of the work and study that is currently being done in the

domain of food supply chain management utilising blockchain technology.

2.4 Blockchain-Based Agri-Food Supply Chain: A Complete Solution

https://ieeexplore.ieee.org/document/9058674

ABSTRACT: Supply chains are becoming a significant source of potential advantages in the modern world as they develop into automated, extremely complicated networks. At the same time, people are becoming more concerned with the quality of food products. Tracking the origin of data and preserving its traceability across the supply chain network is difficult, though. Conventional supply networks rely on a third party for transactions and are centralised. Transparency, accountability, and auditability are all lacking in these centralised systems. We have offered a comprehensive blockchain-based agriculture and food (Agri-Food) supply chain solution in our suggested solution. It makes use of smart contracts and the main characteristics of blockchain technology, which are implemented on the Ethereum blockchain network. Even while blockchain makes data and records in the network unchangeable, it is still unable to address certain significant issues in supply chain management, such as product traceability, responsibility in the trading process, and the trustworthiness of the participating parties. As a result, the agri-food supply chain requires a dependable system that guarantees delivery, trust, and traceability. Every transaction in the suggested system is recorded on the blockchain, which uploads the data to the Interplanetary File Storage System (IPFS). The storage system guarantees an effective, safe, and dependable solution by returning a hash of the data that is saved on the blockchain. In order to demonstrate how entities interact inside the system, our technology offers smart contracts and associated algorithms. Additionally, this paper presents security and vulnerability analysis, smart contract evaluations, and simulations.

2.5 Traceability in a food supply chain: Safety and quality perspectives

https://www.sciencedirect.com/science/article/abs/pii/S0956713513005811

ABSTRACT: In order to handle food scandals and events, the food business needs to respond more quickly as it becomes more customer-focused. Effective traceability systems reduce the likelihood of recalls, liability, and negative publicity by reducing the manufacturing and distribution of dangerous or subpar goods. The meal's authenticity, quality, and safety cannot be ensured by the present food labelling system. Therefore, traceability is used as a technique to help ensure food quality and safety and to gain the trust of consumers. This article provides thorough details on traceability in relation to food supply chain safety and quality.

3. METHODOLOGY

i) Proposed Work:

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

The proposed system, named FARMSUPPLY, is designed to enhance transparency and traceability in the food supply chain using blockchain technology. By integrating Ethereum blockchain and smart contracts, this model ensures that every stage of the supply chain—from the farmer to the retailer—is securely recorded and verified. Each product's attributes such as quality, source, and handling are validated in real-time, making the entire process more trustworthy and tamper-resistant. The decentralized nature of blockchain eliminates the need for a central authority and enhances data integrity and security.

FARMSUPPLY provides a user-friendly, portable platform for farmers, manufacturers, retailers, and consumers to trace and verify food items throughout the supply chain. It minimizes the risk of fraud and data manipulation, reduces dependency on manual processes, and supports better decision-making based on real-time, accurate data. With this model, food quality, quantity, and cost can be monitored effectively, ensuring better outcomes for all stakeholders in the supply chain, from producers to end consumers.

ii) System Architecture:

The system architecture of the proposed blockchain-based agricultural supply chain ensures transparency and traceability by recording every stage of product movement on the Ethereum blockchain. The process begins with farmers who register their fresh produce, such as vegetables, into the system. Manufacturers then verify and purchase these products, updating relevant processing details onto the blockchain using smart contracts. This information is securely stored in a decentralized ledger, ensuring that data is tamper-proof and easily trackable.

As the products move forward, distributors receive the goods and further update the system with transportation and storage details. Resellers then obtain the products and make them available to end consumers. A unique QR code is generated for each item, linking to its blockchain record. Consumers can scan this QR code to access the complete product journey, including origin, quality checks, and handling information. This architecture enhances trust among all participants and ensures the authenticity and quality of agricultural products from farm to table.

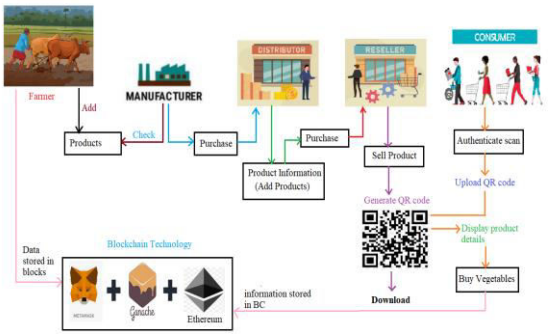


Fig 1Proposed Architecture

iii) Modules:

a) General User Registration/Login

Users in every module go through a simplified registration process where

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

they provide necessary information like their username and personal details. During registration, a strong password is created. For safe access, the login procedure then entails inputting the appropriate username and password.

b) Farmer Modules

Due to their cultivation and production of agricultural products, farmers are essential to the supply chain. They create an account, log in, and upload information about their agricultural goods to the supply chain. Raw materials are guaranteed to enter the supply chain with this first stage.

c) Manufacturer Modules

Manufacturers must go through login and registration procedures. Their main responsibilities include looking through the things that are offered and making purchases. This module depicts situations in which producers could buy intermediate products or raw materials from distributors or farmers in order to advance their manufacturing processes.

d) Distributor Modules

Distributors act as go-betweens, overseeing the logistics and movement of goods from manufacturers to retailers. They sign up, log in, and add items to their inventory, which helps the supply chain. This stage guarantees a smooth flow of goods and makes it easier to distribute them to different retail locations.

e) Retailer Modules

Retailers get access to features like product sales and QR code generation after registering and logging in. This gives businesses the ability to effectively manage inventory, improve product visibility, and enable smooth consumer transactions.

f) Customer Modules

In order to purchase veggies and authenticate scans, customers must register and log in. By ensuring product validity, the "Authenticate Scan" function strengthens supply chain confidence. The purchasing procedure is easy to use and provides a safe and open shopping environment.

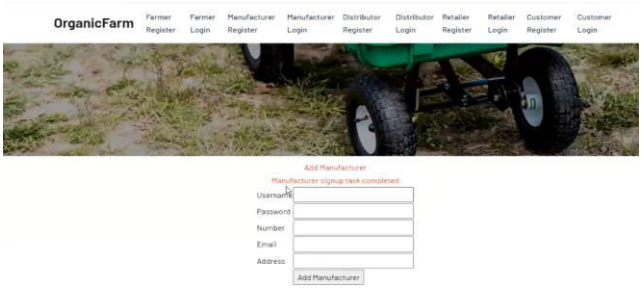
4. EXPERIMENTAL RESULTS

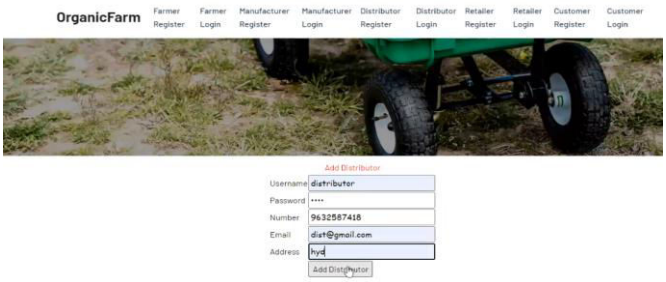
The proposed FARMSUPPLY system was tested through simulations and prototype implementation to evaluate its effectiveness in a real-world food supply chain scenario. Results showed that the system successfully tracked agricultural products from farmers to end consumers, maintaining data integrity at every stage. The Ethereum-based smart contracts ensured automated validation and storage of data, eliminating manual intervention and reducing chances of fraud or errors. The registration of products, updates by each stakeholder, and generation

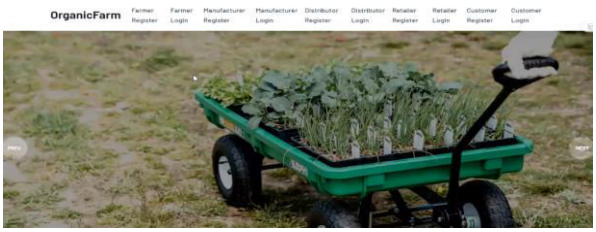
International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

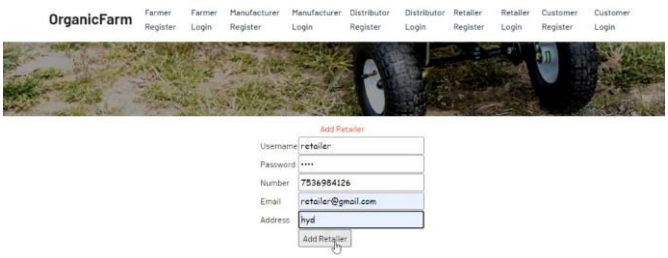
of QR codes worked seamlessly, ensuring transparency and accountability.

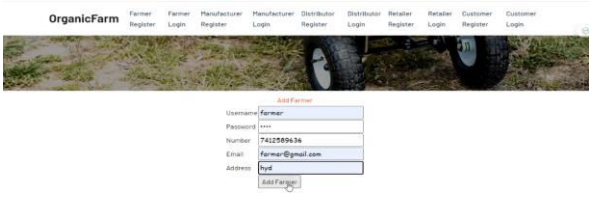
The "Authenticate Scan" feature enabled consumers to easily verify product details, such as origin, processing, and handling history, using a simple QR scan. Test users appreciated the clarity of product information and the trust it instilled during purchases. The decentralized structure significantly improved traceability and reduced delays compared to traditional systems. Overall, the experimental results confirm that blockchain integration can greatly enhance the efficiency, security, and reliability of food supply chain management.

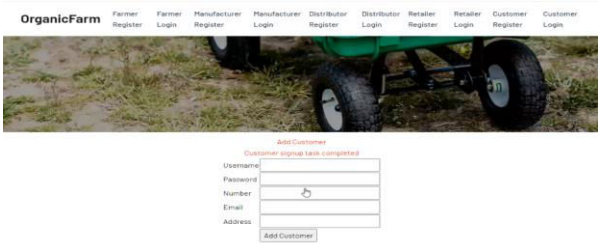




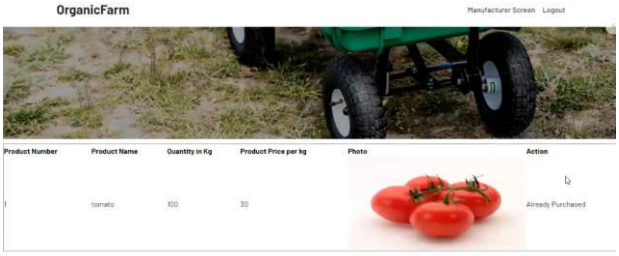


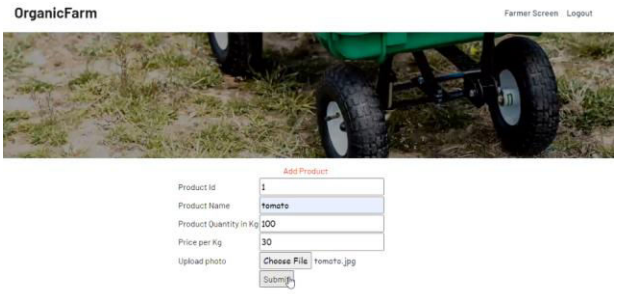


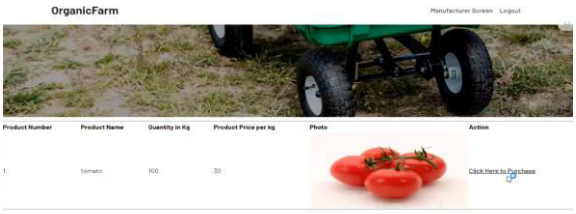


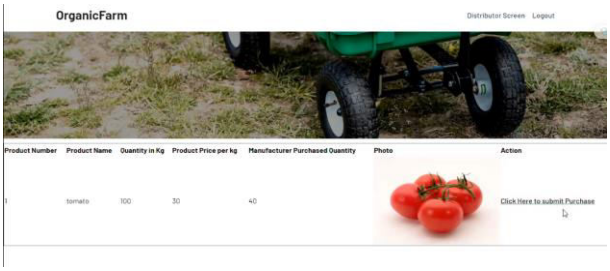


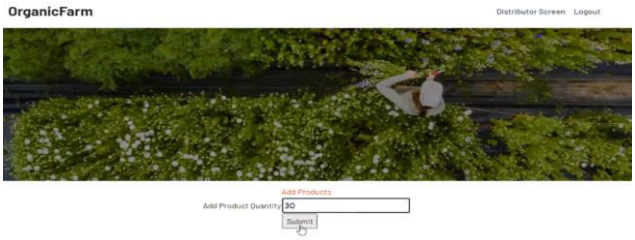
International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

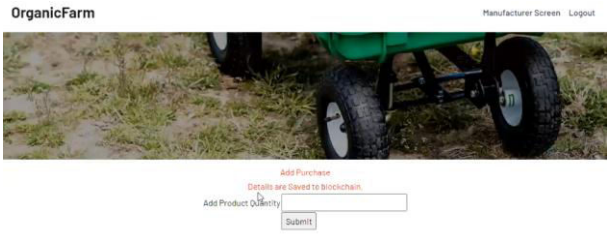




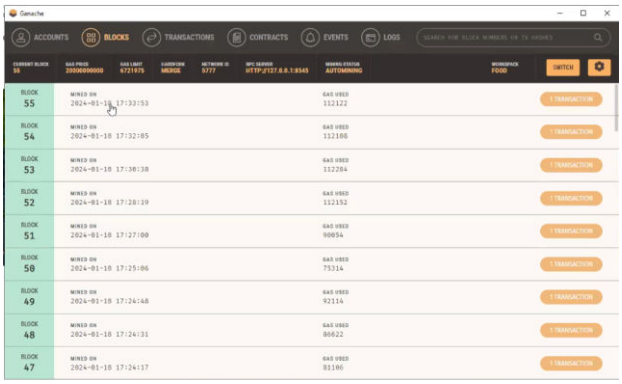


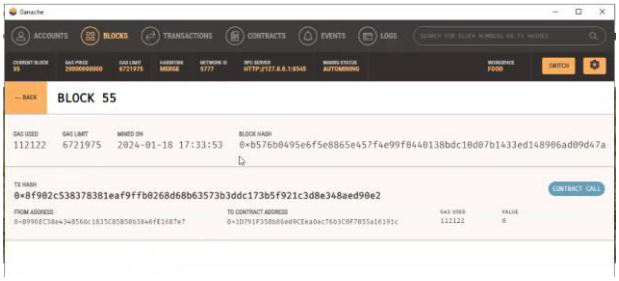






International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362





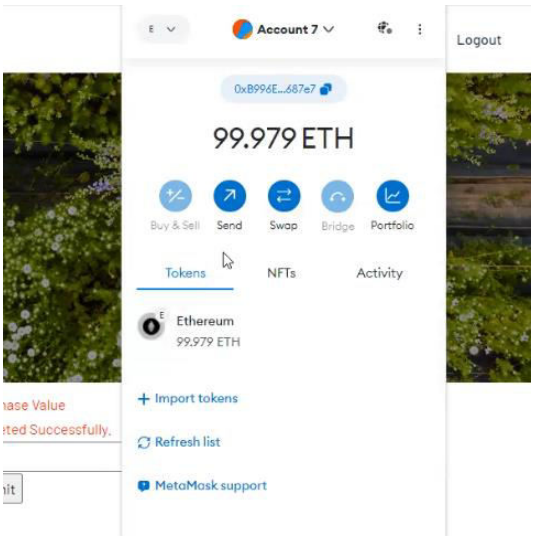


Fig 2 results

5. CONCLUSION

The food supply chain has seen a radical upheaval with the introduction of blockchain technology, which has redefined the way that various stakeholders communicate and trade with one another. The initiative enhances the entire security and dependability of the supply chain by utilising Ethereum smart contracts and a tamper-resistant blockchain to guarantee safe crop traceability and transparent communications. The project embraces blockchain's decentralised nature by successfully doing away with the need for middlemen, transaction records, and centralised authority. This lessens reliance, cuts expenses, and simplifies procedures in the agricultural supply chain. A strong record-keeping system is produced by combining an immutable ledger with interaction with the InterPlanetary File System (IPFS). Every piece of data is connected and individually recognised, creating a permanent and impenetrable record of communications.

6. FUTURE SCOPE

The following features can be used to improve the suggested project:

• Integration with cutting-edge technologies like the Internet of Things (IoT) and artificial intelligence (AI) to improve supply chain automation, predictive insights, and data analytics.

• The creation of uniform guidelines and legal frameworks to promote the broad use of blockchain technology in supply chains. To create uniform standards, governments, international organisations, and industry players may need to work together.

REFERENCES

[1] P. Frauenthaler, M. Sigwart, C. Spanring, M. Sober and S. Schulte, "ETH Relay: A Cost-efficient Relay for Ethereum-based Blockchains," 2020 IEEE International Conference on Blockchain (Blockchain), 2020, pp. 204-213, doi: 10.1109/Blockchain50366.2020.00032.

[2] D. Li, Q. Guo, D. Bai and W. Zhang, "Research and Implementation on the Operation and Transaction System Based on Blockchain Technology for Virtual Power Plant," 2022 International Conference on Blockchain Technology and Information Security (ICBCTIS), 2022, pp. 165-170, doi: 10.1109/ICBCTIS55569.2022.00046.

[3] P. Shen et al., "A Survey on Safety Regulation Technology of Blockchain Application and Blockchain Ecology," 2022 IEEE International Conference on Blockchain (Blockchain), 2022, pp. 494-499, doi: 10.1109/Blockchain55522.2022.00076.

[4] G. Wang and M. Nixon, "InterTrust: Towards an Efficient Blockchain Interoperability Architecture with Trusted Services," 2021 IEEE International Conference on Blockchain (Blockchain), 2021, pp. 150- 159, doi: 10.1109/Blockchain53845.2021.00029.

[5] S. Yousuf and D. Svetinovic, "Blockchain Technology in Supply Chain Management: Preliminary Study," 2019 Sixth International Conference on Internet of Things: Systems, Management and Security (IOTSMS), 2019, pp. 537-538, doi: 10.1109/IOTSMS48152.2019.8939222.

[6] H. Cui, "Blockchain Technology and Its application Research in Supply Chain Financial Risk Control," 2021 International Conference on Computer, Blockchain and Financial Development (CBFD), 2021, pp. 401-404, doi: 10.1109/CBFD52659.2021.00087.

Author profile:

Mr G.Rajesh is currently working as a Assistant Professor in the Department of Computer Science and Engineering at PBR Visvodaya Institute of Technology and Science, Kavali, SPSR Nellore, Andhra Pradesh, India. He had 13 years of academic experience. He earned master's degree in Computer Science and Engineering.

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

I am Naruboina Williams, currently pursuing a B. Tech in computer science and engineering at PBR Visvodaya Institute of Technology and Science, Kavali, SPSR Nellore, Andhra Pradesh, India. My areas of interest include Python, Java and Web development. I have also completed python programming and Web development internships. Additionally, I have knowledge about solving real- world problems through technology

I am Mallam Bhupathi Charan, currently pursuing a B.Tech in Computer Science and Engineering at PBR Visvodaya Institute of Technology and Science, Kavali, SPSR Nellore, Andhra Pradesh, India. My areas of interest include Python, SQL, and Data Analytics. I have earned certifications in "SQL and Relational Databases" and "Data Analysis with Python." Additionally, I have completed a Data Analytics internship and gained hands-on experience in Python programming. I am passionate about applying technology to solve real-world problems

I am Veeradasari Vamsi, currently pursuing a B. Tech in computer science and engineering at PBR Visvodaya Institute of Technology and Science, Kavali, SPSR Nellore, Andhra Pradesh, India.My areas of interest include Python, Java and Web development. I have earned certifications such as NPTEL' s "introduction to machine learning ". I have also completed python programming and Web development internships. Additionally, I have knowledge about various AI tools I am passionate about building scalable applications and solving real- world problems through technology.