Web Application to Store Data and Track Data on Global Food Supply Chain

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***Abstract*—N A web application arises to transform the global food supply chain into a world beset by food insecurity and safety issues. This platform provides stakeholders with unheard-of transparency by acting as a tracking system and data repository. While processors, distributors, and retailers easily register transportation and storage details, farmers can enter information about their crops. By gaining access to the food's journey, consumers might develop greater faith in the product's provenance and quality. Real-time analyt- ics spot possible contamination concerns, streamline logistics, and expose inefficiencies. This web application is more than simply a database; it's a cooperative instrument that opens the door to a food system that is more secure, sustainable, and fair for everybody. Through the integration of analytics tools, stakeholders can extract important insights from the stored data through the application. Decision-makers are thus better equipped to streamline procedures, make wise decisions, and spot opportunities for development. Navigating and using the system is made easy by the user-friendly interface, which sup- ports a wide range of users, from wholesalers and merchants to farmers and producers. The initiative aims to improve transparency, resilience, and sustainability in order to transform the way the world's food supply chain is managed. The web application makes a valuable contribution to the worldwide effort to guarantee food security, reduce waste, and improve the overall effectiveness of the food supply chain by encouraging effective data administration and tracking**

***Keywords*—component, formatting, style, styling, insert**

I. Introduction

The demand for a strong and effective management system is more than ever in the complex and interrelated global food supply chain. Constructed as a Database Management System (DBMS) project, the Global Food Supply Chain Management System is an all-encompassing online application with the goal of revolutionizing the way data is tracked and stored throughout the food supply chain. The intricate global food supply chain, which encompasses everything from agricultural production to distribution, logistics, and retail, necessitates the use of a sophisticated system that can guarantee data security and integrity, improve visibility, and streamline procedures. By offering a centralized platform where interested parties can easily save, retrieve, and track vital data pertaining to the production, transit, and consumption of food goods, the initiative seeks to address these issues. In this system of tracking and supplying of products a farmer can easily sell their product directly to the customer, it means they have a clear interaction with the consumer and other public. By centralizing data storage, the program breaks down information silos and makes real-time data accessible to all parties involved in the supply chain. The decision-making and teamwork are improved by this centralized method. The system's sophisticated tracking features enable real-time tracking of food products' journey from farm to fork. This guarantees openness and makes it easier to react quickly to any problems or supply chain interruptions. Data security and adherence to laws and industry standards are given top priority in this project. Strong permission and authentication procedures protect sensitive data, giving users peace of mind about the confidentiality and integrity of their information. The program uses analytical methods to extract valuable information from the data that has been stored. This gives stakeholders the ability to optimize operations, make data-driven decisions, and spot areas where efficiency may be increased. Considering the wide range of users in the food supply chain, the web application has an easy-to-use interface. This guarantees that the system is easily navigable and exploitable by stakeholders at different levels, ranging from farmers and producers to distributors and merchants. The goal of the Global Food Supply Chain Management System is to promote a more robust, transparent, and sustainable ecosystem as we set out to transform the way the world's food supply chain is managed. This project aims to support worldwide efforts to ensure food security, reduce waste, and improve the overall effectiveness of the food supply chain through integrated data management and tracking. In this we have a total of 7 users. Every user has their own interface page. They can easily contact other users and non-users through their page. We hope that this system will help our people to track their data easily also the farmers will get the proper price of their products. This programme aims to create a more transparent, safe, and effective food system for the future—it is not just about technology. It's about giving farmers more authority, educating customers, and making sure that everyone has access to wholesome food that is produced responsibly. Come along on this transformative adventure with us. One mouthful at a time, let's unlock the potential of the global food supply chain.

II. Literature Review

A. Maintaining the Integrity of the Specifications

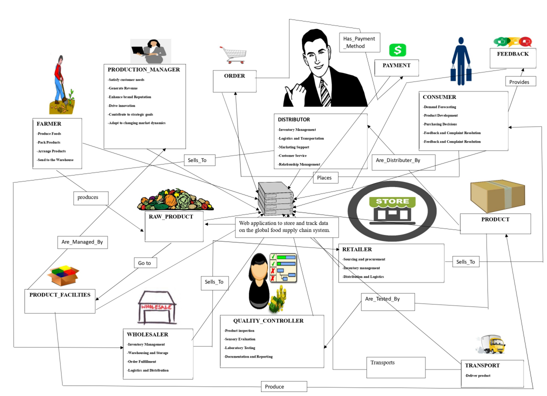
TFor this project our total 6 team members have read 30 papers. From this paper we have come to learn about the blockchain technology in these types of projects. Those papers have highlighted the shortcomings of centralized traceability systems and promoting blockchain technology as a means of enhancing security and transparency. Additionally, it examines the challenges associated with scaling blockchain technology and suggests a decentralized traceability system that combines blockchain with the Internet of Things (IoT) to handle data securely and transparently. In terms of lack we have found that most of the project developers always think about the large agribusiness and centralized markets. Our team members try to make user-friendly software for small-scale farmers and informal markets. From the literature review we come to know that every developer tries to online based software, but we think about both online and offline as some rural areas have no reliable connectivity of internet. Also, we have come to know that these types of software have no system of direct communication between consumers and farmers. The general consumer always depends on the wholesaler who gives them information about products, but our system will try to make direct communication between all users. Also, we are trying to make low-cost software which can be effort by all types of producers. The last thing is the security of the system. We are trying to make fully secured software which can help the users to protect their valuable information from hackers.

III. Problem Statement

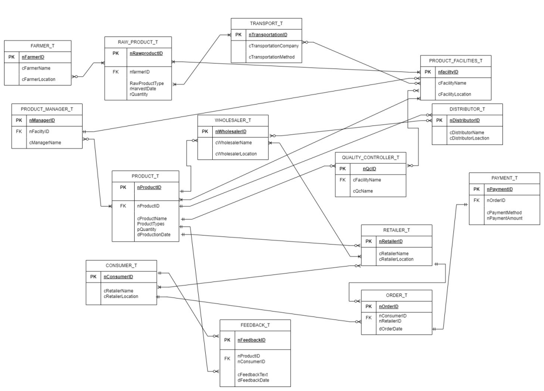
In this section we have thought about different types of problem which will be solved by our team. These problems are Data integrity and transparency, Technological challenges, Social and ethical issues, Sustainability, Lack of inclusivity. In this segment our team have tried to remove data integrity. There are many parties involved in the present global food supply chain, and each one has its own separate database. This results in inconsistent and fragmented data, which makes it challenging to get a complete and accurate picture of the whole supply chain. A decentralized structure makes it more difficult to trace food goods along the whole supply chain. The likelihood of fraud, foodborne infections, and inefficiency during recalls or emergencies is increased by this lack of openness. The danger of unauthorized access, data breaches, and cyber threats increases as supply chain data becomes more digitally connected. It's possible that the present systems don't have strong security safeguards to safeguard private data. The technical proficiency of the wide range of parties involved in the food supply chain may vary. The successful implementation of the suggested DBMS solution depends on making sure that all users have access to sufficient training and have user-friendly interfaces. It is a difficult undertaking to ensure conformity with international standards and regulatory requirements. Lack of a centralised structure frequently makes it impossible to follow different regulations, which can have negative legal and financial effects. The existing systems might not be able to handle the growth of the global food supply chain. The overall effectiveness and responsiveness of the system may be impacted by the incapacity to manage growing data volumes and user requests.

IV. Methodology

A. Rich Picture Proposed System



B. Entity Relationship Diagram



C. Normalization

Normalization:

Entity	Attributes
FARMER	nFarmerID(a), cFarmerName(b), cFarmLocation(c)
RAW_PRODUCT	nRawProductID(d), RawProductType(e), rQuantity(f), rHarvestDate(g), nFarmerID(a)
TRANSPORTATION	nTransportationID(h), cTransportationCompany(i), cTransportationMethod(j)
PRODUCT_FACILITIES	nFacilityID(k), cFacilityName(l), cFacilityLocation(m)
PRODUCTION_MANAGER	nManagerID(n), cManagerName(o), nFacilityID(k)
PRODUCT	nProductID(p), cProductName(q), productType(r), pQuantity(s), dProductionDate(t), nFacilityID(k)
QUALITY_CONTROLLER	nQcID(u), cQcName(v), nFacilityID(k)
DISTRIBUTOR	nDistributorID(w), cDistributorName(x), cDistributorLocation(y)
WHOLESALER	nWholesalerID(z), cWholesalerName(z1), cWholesalerLocation(z2)
RETAILER	nRetailerID(aa), cRetailerName(aa1), cRetailerLocation(aa2)
CONSUMER	nConsumerID(bb), cConsumerName(bb1), cConsumerAddress(bb2)
ORDER	nOrderID(cc), dOrderDate(cc1), nConsumerID(bb), nRetailerID(aa)
PAYMENT	nPaymentID(dd), cPaymentMethod(dd1), nPaymentAmount(dd2), nOrderID(cc)
FEEDBACK	nFeedbackID(ee), cFeedbackText(ee1), dFeedbackDate(ee2), nConsumerID(bb), nProductID(p)

Assuming As alphabets we can write:

a>b,c
d>e,f,g,a
h>i,j
k>l,m
n>o,k
p>qrst,k
u>v,k
w>x,y
z>z1,z2
aa>aa1,aa2
bb>bb1,bb2
cc>cc1,bb,aa
dd>dd1,dd2,cc
ee>ee1,ee2,bb,p

1NF:

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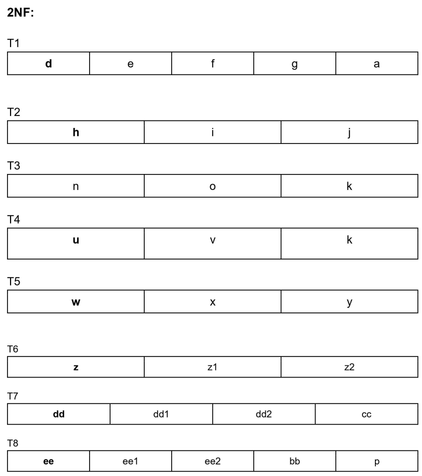
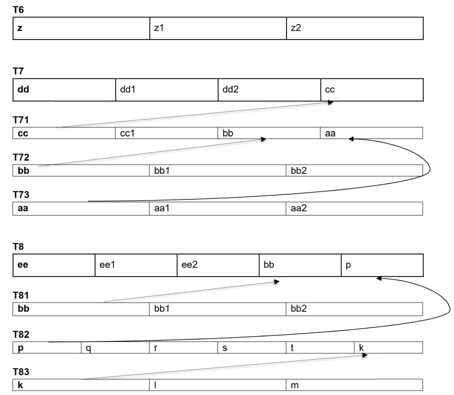
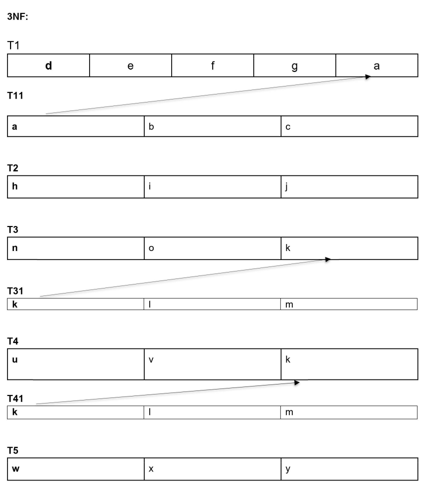
a	b	c	**d**	e	f	g	**h**	i	j	k	l	m	**n**
o	p	q	r	s	t	**u**	v	**w**	x	y	**z**	aa	aa1
aa2	bb	bb1	bb2	cc	cc1	cc2	**dd**	dd1	dd2	**ee**	ee1	ee2	







D. Software Architecture

E. DATA COLLECTION METHOD

1.Direct Input:

i.Farmer/Producer Registration: Forms allowing farmers and producers to register and enter information about their methods, livestock, crops, and output should be created.

ii.Supplier/Distributor Platforms: Provide interfaces that allow distributors and suppliers to upload information on the sourcing, processing, storage, and transportation of food goods.

iii.Retailer/Consumer Integration: Create specialised apps or integrate with already-existing merchant systems that allow users to enter information about their preferences, purchase histories, and feedback.

2.Automated Data Capture:

i.IoT Sensor Integration: Employ sensors to monitor temperature, humidity, location, and other pertinent parameters on farms, warehouses, transit vehicles, and retail establishments.

ii.Satellite Imagery and Weather Data Monitor crop health, land usage, and environmental conditions with satellite photography; combine meteorological data for predictive analysis.

3.Public Data Sources:

i.Government Open Data: To improve your data, make use of official databases on trade, agriculture, and food safety.

ii.Industry Reports and Research: Make use of data and research papers from research institutes and industry associations.

iii.Crowdsourcing Platforms: To gather information on regional food systems and practices, think about utilising citizen science projects or platforms such as Open Street Map.

4. Data Aggregation and Standardization:

i.Data Harmonization: Provide techniques for integrating data with differing granularities and formats from various

sources.
ii.Data Quality Control: Put procedures in place to guarantee the consistency, correctness, and completeness of data.
iii.Data Enrichment: To glean insights and provide new data points, such food waste estimates or sustainability indicators, employ data analytics and artificial intelligence.
Additional Considerations:
i.Data Privacy and Security: To earn users' trust, make sure your security protocols are strong and your data privacy policies are clear.
ii.Stakeholder Engagement: Work together with all parties involved in the food supply chain to comprehend their requirements and guarantee that the data is relevant.
iii.Scalability and Sustainability: Provide data gathering strategies that can grow with the application and guarantee ongoing data upkeep and availability.

F. DATA ANALYSIS METHOD

i.A Buffet of Analytical Tools: Our toolkit for data analysis will consist of a variety of approaches, each customised to address certain queries. Descriptive statistics will provide a clear image of production volumes, transit durations, and spoiling rates, which can be used to identify inefficiencies. Seasonal patterns and long-term changes in consumption will be shown using trend analysis.

Forecasting using AI will be able to anticipate demand and avoid shortages or gluts. By separating out the intricate web of connections between farmers, processors, distributors, and retailers, network analysis will be able to pinpoint important nodes as well as any bottlenecks.

The cherry on top will be visualisations, which turn abstract data into colourful maps, charts, and dashboards that help people understand the food chain. Consider following a mango as it travels from a Kenyan orchard to your neighbourhood supermarket or calculating the environmental impact of your weekly shopping purchases.
ii.Drilling Deeper: However, the examination doesn't end there. The environmental background of our food choices will become clear when maps of soil quality, water availability, and climatic trends are superimposed over data on food production. The relationships between farmers, cooperatives, and NGOs will be mapped through social network analysis, revealing chances for cooperation and information exchange.

Text analysis will explore social media data and customer reviews to find patterns in preferences and issues. In addition to streamlining supply chains, this data-driven strategy will enable customers to make knowledgeable decisions about the food they eat and how it is produced.
iii.The Future on our Plates: Through the utilisation of data analysis, this web application has the potential to significantly alter the global food system. It can boost sustainable practices, empower customers, increase productivity, and cut waste. Essentially, it can assist us in creating a food system that sustains both our planet and our bodies.

Now let's get started and enjoy the revelations that are yet to be discovered. The data is available and ready to be used. It's time to examine, comprehend, and eventually change the manner that we feed the planet.

V. RESULT ANALYSIS

i.Economic Sustainability: Enhanced Efficiency: Data tracking lowers costs for all parties involved by identifying inefficiencies, streamlining logistics, and cutting waste. Increased Market Transparency: Fairer pricing and improved market access for small-scale producers result from data availability, which also empowers farmers and consumers.
Improved Risk Management: Businesses and farmers may reduce risks related to weather, pests, and price swings with the use of predictive analytics.
Growth Potential: Investing in innovative technology and sustainable practices may be guided by data-driven insights, which will help the food industry thrive economically.
ii.Environmental Sustainability: Decreased Food Waste: By monitoring data, supply chain hotspots related to food waste can be found and addressed, reducing its negative effects on the environment.
Optimal Resource Management: Analysing data can help determine the most effective ways to use energy and water for transportation, processing, and farming.
Sustainable Sourcing: Monitoring environmental data can assist in identifying and advancing ethical raw material procurement as well as sustainable farming methods.
Reducing Carbon Footprint: Transportation routes and logistics can be optimised through data-driven decision making, which lowers greenhouse gas emissions.
iii.Social Sustainability: Empowering Farmers: Farmers may enhance their practices, boost yields, and obtain greater access to markets by using data and education.
Encouraging Fair Trade: Openness in the supply chain can contribute to equitable treatment and remuneration for workers across the board.
Creating Food Security: Data analysis can help guide programmes and policies that increase disadvantaged communities' access to and affordability of food.
Improving Food Quality and Safety: Data tracking aids in the identification and mitigation of food safety hazards, hence enhancing consumer health and welfare.
All things considered, the online application has the capacity to greatly support each of the three sustainability pillars by: encouraging waste reduction and resource efficiency. encouraging fair trade policies and economic growth. promoting communal empowerment and guaranteeing food security. Still, there are obstacles to overcome: Ensuring the accuracy and completeness of data is crucial. All parties must have access to and be able to use the data. It is necessary to address the ethical issues of data privacy and ownership. Through the resolution of these issues and the optimisation of data analytic capabilities, the web application can be transformed into an effective instrument for constructing a more just and sustainable global food system.

VI. Challenges Faced

Although there is much potential for a web application to track data in the global food supply chain, it is important to take into account probable challenges and limitations in its research design:

i.Data Collection: Reaching Diverse Stakeholders: It can be difficult to guarantee that all participants in the intricate food system, from huge corporations to small-scale farmers, would participate.

Data Accuracy and Consistency: It can be challenging to standardise data formats and guarantee dependability across a range of technologies and user input techniques.

Data Privacy and Security: It's critical to establish trust and make sure that strong data security procedures are in place to safeguard sensitive information.

ii.Data Analysis and Interpretation: Data harmonisation and integration: It can be difficult to integrate data with different granularities and formats from different sources.

Complexity of Supply Chains: Advanced analytical skills and instruments are needed to sort through the complex network of connections and exchanges that make up the world food system.

Attribution and Causality: It can be challenging to determine the actual causes of trends and effects that are seen inside a complex system.

iii.Implementation and Adoption: Technological Accessibility and Affordability: It can be difficult to guarantee that a variety of stakeholders worldwide have access to the web application and its features.

Language and Cultural Barriers: Effective communication and broad acceptance depend on localization and cultural sensitivity.

Encouraging Participation: It is crucial to offer stakeholders incentives and benefits that are obvious in order to encourage them to actively contribute and make good use of the data.

Additional Limitations: Restricted Scope: The software may at first concentrate on particular supply chain elements while maybe ignoring other crucial elements.

Unintended Consequences: Data-driven actions may impact various system players in an unanticipated way.

Ethical Considerations: Careful ethical thought is needed regarding data ownership, privacy, and possible information misuse.

Addressing these barriers will require: Including a range of stakeholders in the planning and development of the research is known as collaborative research.

Investing in data infrastructure means developing scalable and reliable systems for gathering and analysing data.

Creating User-Friendly Tools: Creating easily navigable and accessible data entry and analysis interfaces.

Encouraging data literacy involves teaching stakeholders how to analyse data and utilise it responsibly.

Handling Ethical Issues: Putting in place clear frameworks for data governance and ethics.

VII. Conclusion

To sum up, the creation of the Web Application to Store and Track Data on the Global Food Supply Chain is a big step in the right direction for improving sustainability, efficiency, and transparency in the intricate web of food production and distribution. Through the use of an extensive array of data gathering techniques, such as sensor networks, blockchain technology, API interfaces, and government databases, the programme provides stakeholders with a comprehensive solution for tracking, evaluating, and streamlining the supply chain. It is possible to take a proactive approach to problems like quality control, logistical optimisation, and regulatory compliance by integrating real-time data from many sources. Additionally, by facilitating information sharing and crowdsourcing among industry participants, the programme promotes a more robust and linked global food supply chain. This Web Application is a powerful instrument that helps us manage the complex dynamics of the contemporary food industry, empower decision-makers, reduce risks, and work towards the main objective of guaranteeing a safe and sustainable global food supply.

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