Web application to help farmers find and connect with buyers for their products.

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***Abstract*—The project aims to address a significant problem in Bangladesh's agriculture where we create a direct relationship between producers and customers eliminating the middle man.The primary issue is that people find it difficult to obtain fresh food because of these middlemen, and farmers are underpaid. Our plan is to develop an online marketplace that facilitates direct communication between buyers and producers. The establishment of an online marketplace with separate registration for producers and customers is an essential element of our strategy. This platform allows producers to showcase their products, providing consumers with an easy and direct option to purchase fresh fruit. Conversely, customers find it simple to select products, register for purchases, and have deliveries managed via a streamlined logistics network.The project has resulted in a significant decrease in the gap between farmer wages and consumer spending. In addition to providing fair pay for the agricultural labor force, this also ensures that consumers will have access to pure, premium produce.**

INTRODUCTION

With a population of 170 million, 16.5 million of them are farmers, making up 28% of the total population. A vital industry that employs 40% of the labor force and supplies commodities like rice, wheat, jute, and vegetables to people in all socioeconomic layers, agriculture is the backbone of the country. Unfortunately, our dedicated farmers' work is frequently in vain because of inadequate compensation and an absence of direct consumer input. The agricultural pioneers are falling behind, even in spite of advances in other fields. From the consumer's perspective, the complicated transactional processes involved in getting products to the consumer table give rise to concerns about food adulteration and make it difficult for consumers to afford the shifting prices set by intermediaries.In response to these complex problems, our initiative is born. Our goal is to do away with the disadvantages of middlemen by creating a direct line of communication between purchasers and farmers. This direct connection solves a long-standing problem in the agricultural sector by guaranteeing fair remuneration while also giving farmers more control over their produce based on real-time consumer feedback.We believe that this direct relationship has the potential to increase customer trust, give farmers vital information, and improve their economic well-being based on our thorough evaluation of nearly thirty research studies. Our method is dynamic, enabling continuous testing and improvement to eventually build a smooth and effective system.

In this paper, we go into the details of our initiative, examining its approach, expected results, and the revolutionary change it seeks to bring about for Bangladeshi farmers and consumers.

LITERATURE REVEIEW

The papers explore various applications of digital technologies like e-commerce, internet-of-things, blockchain, mobile phones, and web platforms to make agriculture and food supply chains more efficient, transparent, and profitable. Key focus areas include improving market access and income for small-scale farmers; enabling traceability in supply chains; facilitating direct farmer-to-consumer trade; overcoming information gaps; boosting rural development; and promoting sustainability. Factors driving technology adoption like ease of

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use, cost savings, reliability, and customization are analyzed across users like farmers, cooperatives, retailers, wholesalers and consumers. Challenges such as lack of infrastructure, skills, quality standards and trust also emerge. Solutions like food hubs, customized boxes, transparent ledgers, improved logistics, farm management systems, secured payment gateways and hyperlocal e-commerce models are suggested. Policy and spatial factors around clustering of rural e-commerce receive attention. Comparative studies evaluate maturity levels of websites, analyze supplier-buyer relationships and power imbalances. Models, frameworks and algorithms are employed for optimization of production, distribution and planning decisions. Surveys, interviews and data analysis feature prominently across empirical studies spanning multiple geographies. In summary, the papers provide rich insights on present adoption levels, determinant factors, impending challenges, and potential pathways for various digital interventions across agriculture and food supply chain networks globally. They highlight the transformative potential of technologies alongside nuanced ground realities that call for multi-pronged strategies by diverse stakeholders. Based on the analysis of the 35 research papers, some of the key problems faced in agriculture and food supply chains are: Lack of market information and coordination between farmers, retailers, and consumers resulting in supply-demand mismatches. High wastage and deteriorating quality of fresh produce due to gaps in production, distribution, and sales planning. Limited access to customers and fair prices for smallholder farmers leading to lower incomes. Lack of traceability and transparency in supply chains hampering food safety. Information gaps, trust issues, and resistance to adopting digital technologies like e-commerce and blockchain among stakeholders. Inadequate rural infrastructure posing barriers for seamless integration of internet-of-things, sensors, farm management systems etc. Some of the major actionable plans and learnings that can be implemented are: Developing hyperlocal e-commerce platforms, online dashboards and mobile apps to seamlessly connect farmers, retailers and customers. Deploying improved logistics including optimized route planning and blockchain-enabled traceability mechanisms for transparency. Promoting alternative food networks like cooperatives and food hubs to empower smallholder farmers. Incentivizing technology adoption via customized solutions, secure digital payments, and cost-benefit education initiatives among stakeholders. Formulating supportive policies and spatial strategies focused on infrastructure upgrades, skill development, and accessibility of solutions. Applying emerging innovations in farm management systems, precision agriculture, robotics, self-driving vehicles, sensors, and satellite farming. In summary, a multi-pronged approach addressing technical, economic, social, and policy-related aspects is needed to transform traditional agricultural value chains into efficient, inclusive and sustainable digitally-integrated ecosystems. The analysis of 35 research papers highlights several key proposals in the agri-food sector that have yet to achieve widespread implementation. Firstly, there is a push for the large-scale adoption of blockchain technology to establish transparent and decentralized traceability mechanisms in agri-food supply chains. While the potential benefits of blockchain are outlined in the papers, actual implementations remain limited. Additionally, the papers advocate for the robust integration of mobile and web-based farm management information systems with satellite farming, AI, and advanced analytics to provide real-time insights for farmers, with current progress limited to proofs-of-concept. Furthermore, the vision of food hubs and online B2B marketplaces connecting small-holder producers, distributors, and bulk customers on transparent e-commerce platforms is currently fragmented. Hyperlocal e-grocery models, delivering farm-fresh produce directly to consumers based on crop cycles and proximity, are primarily limited to urban areas. The network-wide adoption of digital financial services and fintech innovations tailored for the agriculture sector is mostly in pilot phases. Lastly, large-scale sensing mechanisms providing climate and disease forecasts, as well as analytics for better risk mitigation at individual smallholder farms, are not adequately available. In essence, the research papers present glimpses of a futuristic, tech-integrated agri-food system, but concerted efforts by stakeholders over the next decade are crucial to drive wider implementation, especially for the benefit of smallholder producers in developing countries.

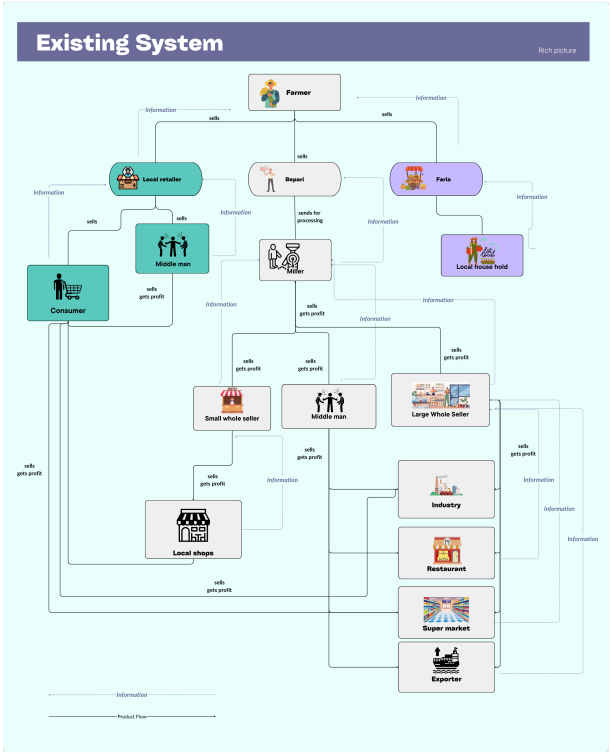
PROBLEM STATEMENT :

In Bangladesh's agriculture, farmers face inadequate pay, lack direct customer feedback, and consumers worry about unpredictable prices due to intermediaries. To tackle this, our proposal involves creating a direct link between farmers and buyers, aiming to empower farmers, build consumer trust, and establish a fair and transparent agricultural system. We plan to use research and experimentation to understand and address these challenges effectively. The research aims to address the issues of farmers' restricted market access by developing a web application that facilitates smooth interactions between farmers and buyers, addressing the significant obstacles faced by farmers in selling their goods in inefficient markets. Traditional agricultural markets face challenges in identifying and engaging buyers, leading to prolonged processes, reduced profit margins, and suboptimal resource utilization. Innovative technology solutions are needed for efficient and transparent marketplaces.The application helps to remove the middleman or syndicate that are becoming a barrier in the process of delivering vegetables to the consumers The lack of appropriate platforms customized to the unique demands of the agricultural community exacerbates farmers' difficulties. Existing systems frequently fall short in terms of user-friendliness, real-time communication capabilities, and complete information sharing capabilities. This study aims to overcome these restrictions by designing and deploying a web application that not only links farmers with potential purchasers but also includes elements critical for overcoming the historical obstacles of market inefficiencies and restricted market reach.As we go more into the complexities of this issue, it becomes clear that a comprehensive and technologically driven solution is required for

reshaping the agricultural environment. The proposed online application aims to empower farmers by giving them a tool that increases their market awareness, allows direct connection with buyers, and simplifies the sharing of crucial information. This research intends to help farmers overcome market-related issues, thereby boosting economic sustainability and improving the overall development of agricultural communities.

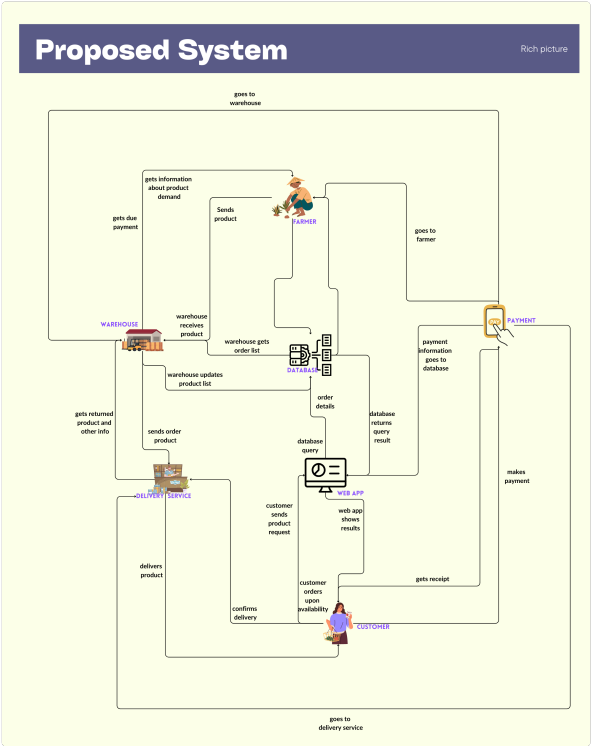
METHODOLOGY :

To develop an application to meet the needs of both farmers and customers, while filling the gaps in the current market, we came up with rich pictures of the current system and the new system we want to develop. Then we followed the rich picture with an ERD to map out how different entities interacted with each other within our system. Next we designed the relational schema and normalized it to create our database. Finally the software architecture was implemented for both frontend and backend development.



After navigating through numerous research papers we found that in the current system a farmer sells his harvested crops to many people like Beparis, Farias, Wholesalers and local sellers for very cheap prices. These middle men then sell it for higher prices to other wholesalers, who hike the price even more when selling to customers in cities and in restaurants and shops. This creates an exacerbated hike in prices while farmers get a very tiny fraction of sum. Also customers have to go to shops to buy their produce.

We need a medium to establish a direct connection between farmers and consumers, eliminating intermediaries. Farmers can showcase and sell their products directly to consumers, fostering transparency and trust. By cutting out middlemen, our app will reduce unnecessary costs in the supply chain. By integrating a direct delivery system, our app will streamline the connection between farmers and consumers, ensuring a seamless, intermediary-free process from farm to doorstep. Our app will provide a warehouse system that facilitates payments: the delivery system channels payments to the warehouse, which will then ensure that the rightful amount reaches the farmers, guaranteeing a secure and efficient transaction process. The warehouse acts as a central hub, managing product distribution and providing farmers with insights into consumer demand, creating a dynamic system where farmers receive information on product demand from the warehouse for efficient supply management.

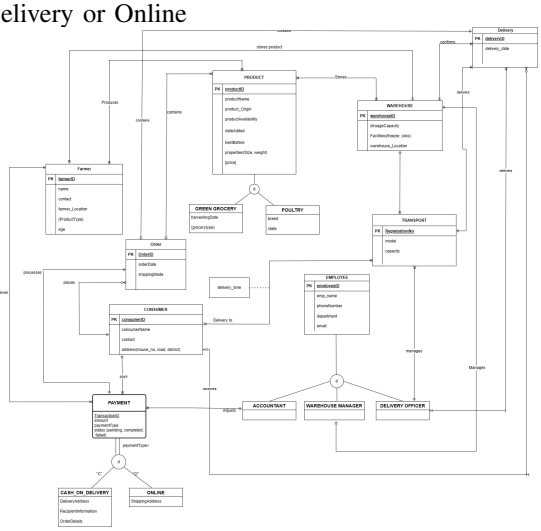


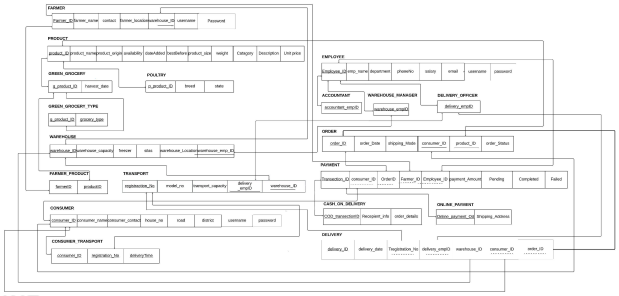
Entity Relationship Diagram

Based on our requirements in the planned rich picture, we came up with the following rules to make the entity relationship diagram to create our web application.

- Each farmer is required to produce at least one product, and they can produce multiple products. Simultaneously, each product must be associated with at least one farmer, and it can be associated with multiple farmers.
- Each order should have at least one product . A product can be sold in a single order only.
- A farmer can store products in the designated local warehouse only . A warehouse can store products from multiple farmers.
- Farmers can receive one or more payments. But A payment goes to each farmer separately.
- A payment is made to a single order at a time. Each order can take only one payment.
- Consumers can place multiple orders. But an order is placed by no more than one consumer.

- Consumers can pay multiple payments. But one payment must be done by only one consumer.
- Products can be stored in one or more warehouses. One warehouse can store multiple products.
- A warehouse can have multiple transports. A transport must belong to only one warehouse.
- Warehouses can confirm multiple orders. An order can be confirmed from only one warehouse.
- A consumer can receive payment from one or multiple vehicles. Again one transport vehicle can deliver to one or multiple consumers. Each delivery should have one relational attribute: the delivery time.
- A product can be green grocery, or poultry or something else.
- An employee can be one of the following , an accountant or a warehouse manager or a delivery officer or some other designation.
- One warehouse is managed by only one warehouse manager. A warehouse manager must manage only one warehouse.
- Delivery officers can manage multiple delivery vehicles, but one delivery vehicle must be managed by only one delivery officer.
- Accountant adjusts one or multiple payments with discounts. But one payment has to be adjusted by only one accountant.
- Payment must be either of these two types. Cash On Delivery or Online





1NF :

Farmer_ID	farmer_Name	farmer_contact,	farmer_location,	Warehouse_ID
Product_ID	product_name	product_Origin	availability	dateAdded
bestBefore	product_Size	weight	Order_ID	warehouse_Capacity
freezer	silos	warehouse_location	warehouse_emp_ID	Registration_ID
model_no	transport_capacity	delivery_Officer_emp_ID	order_Date	Consumer_ID
Consumer_name	consumer_contact	road	house_no	district
Registration_ID	delivery_Time	Employee_ID	emp_name	emp_contact
department	email	shipping_Mode	Transaction_ID	payment_amount
pending	completed	failed	farmer_password	emp_password
emp_username	farmer_username	customer_username	delivery_ID	delivery_date

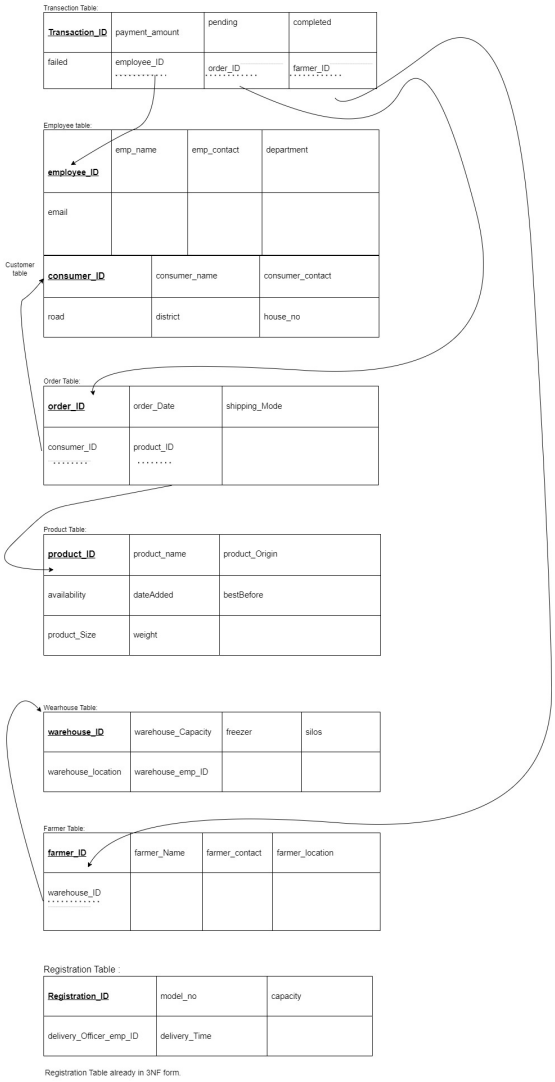
Schema and Normalization

From the entity relationship diagram, a schema was designed accordingly and normalized to reduce redundancy, converting it into a series of simpler records with the suitable relationships with no loss of information.

2NF

Transaction_ID	consumer_ID	consumer_name
consumer_contact	road	district
house_no	order_ID	order_Date
shipping_Mode	product_ID	warehouse_ID
product_name	product_Origin	availability
dateAdded	bestBefore	product_Size
weight	warehouse_Capacity	freezer
silas	warehouse_location	warehouse_emp_ID
farmer_ID	farmer_Name	farmer_contact
farmer_location	employee_ID	emp_name
emp_contact	department	pending
completed	failed	payment_amount

3NF



Registration Table :

Registration_ID	model_no	capacity
delivery_Officer_emp_ID	delivery_Time	

Registration Table already in 3NF form.

SOFTWARE ARCHITECTURE :

The primary objective of the software is to establish a direct and seamless connection between buyers and farmers within the agricultural domain. This platform is designed to empower farmers by providing them with a digital space to showcase and sell their products without the intervention of intermediaries. Simultaneously, it offers buyers, including individuals and institutions, a user-friendly interface to conveniently browse, select, and purchase a diverse range of agricultural products.

This software solution addresses the inherent challenges faced by farmers, such as inadequate compensation and a lack of direct market access. By cutting out middlemen, it aims to streamline the buying and selling process, fostering a more transparent and equitable agricultural marketplace. The software's purpose extends beyond mere transaction facilitation; it seeks to promote fair compensation for farmers, enhance market accessibility, and contribute to the overall development of the agricultural sector through the integration of modern technology

A responsive design will be incorporated to ensure an optimal user experience, catering to desktops, tablets, and smartphones.

Frontend:

- HTML: Utilized for structuring web pages, providing a solid foundation for content presentation.
- CSS: Employed for styling and visual enhancements, contributing to an intuitive and visually appealing user interface.
- Bootstrap: Integrated for responsive design, ensuring adaptability and consistency across different screen sizes.

Backend:

- PHP: Selected as the server-side scripting language to manage server logic, process user requests, and interact with the database.

Database:

- MySQL: Employed as the relational database management system for secure and efficient data storage and retrieval.

Authentication:

- Hashing algorithms will be implemented to fortify password security during user authentication, prioritizing the protection of user accounts.
- Security Measures:Robust measures will be put in place to prevent SQL injection, enhancing the platform's resilience against potential security threats.

These technical specifications are carefully chosen to create a reliable, secure, and user-friendly web platform. The technologies selected aim to ensure a responsive and visually pleasing interface while prioritizing the security and integrity of user data.

User Interface (UI):

- HTML, CSS, Bootstrap: The frontend is built using HTML for structure, CSS for styling, and Bootstrap for a responsive and visually appealing user interface. These components collectively ensure a clear and intuitive experience for users, providing visual cues for seamless interaction. Server-Side Logic:
- PHP Scripts: The server-side logic is handled by PHP scripts, managing user requests and processing business logic. These scripts facilitate communication between the frontend and the backend, ensuring a dyUser Requirements :

Buyer :

- User Registration: The software should provide a straightforward registration process for both individual buyers and institutional buyers.
- User Profile: Buyers should have the ability to create and manage their profiles, including contact information and preferences.
- Browsing Interface: A user-friendly interface allowing buyers to easily browse through a diverse range of agricultural products listed by farmers.
- Product Information: Detailed product descriptions, pricing, and availability information to aid buyers in making informed purchasing decisions.
- Shopping Cart: An intuitive shopping cart feature enabling buyers to add, review, and manage selected products before making a purchase.
- Order Tracking: Buyers should have access to a tracking system to monitor the status of their orders from purchase to delivery.
- Feedback Mechanism: A feedback and rating system to allow buyers to share their experiences and provide constructive feedback to farmers.

Farmer :

- User Registration: An easy and efficient registration process for farmers to create accounts on the platform.
- Product Listing: The ability to showcase and list agricultural products with detailed descriptions, images, and pricing.
- Order Management: Access to an order management system, allowing farmers to view and fulfill incoming orders.
- Communication: A messaging system to facilitate communication between farmers and buyers regarding product inquiries, orders, and delivery details.
- Feedback Analysis: Access to feedback and ratings provided by buyers, enabling farmers to assess the market response and improve their offerings.

Administrative User :

- User Management: Administrative users should have the capability to monitor and manage user accounts, including the ability to edit, activate, deactivate, or delete farmer and consumer accounts.
- Product Oversight: Admins should have control over the products displayed in the system, with the authority to edit, activate, deactivate, or remove listings as needed.
- Order Management: Access to an order list, containing details of consumer orders, allowing admins to track and manage order fulfillment.
- Consumer and Farmer Details: Admins should have access to consumer and farmer details for communication and administrative purposes.
- SSLCommerz Payment Gateway: Secure Payment Processing: Integration of the SSLCommerz payment gateway to ensure secure and reliable financial transactions for both farmers and consumers.

Technical Requirements:

- Platform: The platform will be web-based, designed to work seamlessly on various devices for broad accessibility. namic and responsive user experience. Database Management:

- MySQL: Employed as the database management system, MySQL ensures secure and reliable data storage. It facilitates efficient retrieval and storage of user, product, and transaction data, forming the backbone of the system's information architecture.

Security Layer:

- Hashing Algorithms: Implemented for password security during user authentication, adding an extra layer of protection to user accounts.
- SQL Injection Prevention Measures: Robust security measures are in place to prevent SQL injection, fortifying the system against potential threats and ensuring the integrity of the database.

UI/UX Design Summary:

The UI/UX design utilizes HTML, CSS, and Bootstrap to create a simple and intuitive interface. With a focus on clean layout and straightforward navigation, the design prioritizes user-friendliness. It ensures optimal user experience through visually pleasing and accessible elements, enhanced by Bootstrap for responsiveness across devices. Visual cues and intuitive design elements facilitate seamless navigation, fostering a user-focused interaction. The overall emphasis is on clarity, ease of use, and a positive user experience.

User Interaction :

Farmers engage by creating profiles, uploading product details, and managing inventory through an intuitive UI. Buyers easily navigate the platform, browse products, place orders, and make secure payments. This ensures a seamless and user-friendly interaction for both farmers and buyers, facilitating efficient product management and secure transactions.

- Purpose The software aims to connect buyers directly with farmers, enabling farmers to showcase and sell their products without intermediaries. Buyers, whether individuals or institutions, can easily purchase agricultural products through a user-friendly platform.
- User Requirements Buyers: Individuals and institutions seeking to purchase agricultural products directly from farmers. Farmers: Users showcasing and selling their products through the platform.

Technical Requirements

- Platform: Web-based with a responsive design for compatibility on various devices.
- Frontend: HTML, CSS, Bootstrap for a visually appealing and intuitive user interface.
- Backend: PHP for server-side logic.
- Database: MySQL for secure data storage.
- Authentication: Hashing algorithms employed for password security.
- Security Measures: Implementation of measures to prevent SQL injection.

User Interface (UI):

HTML, CSS, Bootstrap-based frontend providing clear indications for user interactions. Server-Side Logic: PHP scripts handling user requests, processing business logic, and interacting with the MySQL database.

- Database Management: MySQL for secure and reliable data storage.
- Security Layer: Implementation of hashing algorithms and measures to prevent SQL injection.
- Data Management Farmers upload product information, including images, descriptions, and pricing through the frontend. Buyer information is securely stored in the MySQL database. Hashing algorithms ensure password security, protecting sensitive user data.
- Security Considerations Authentication: Hashing algorithms ensure password security, protecting user accounts. Data Encryption: Secure data transmission through encryption protocols. Authorization: Role-based access control to safeguard user privacy and maintain data integrity. SQL Injection Prevention: Measures in place to prevent SQL injection attacks, ensuring database security.
- UI/UX Design Simple and intuitive UI designed with HTML, CSS, and Bootstrap for optimal user experience. Clear indications for user actions, making navigation and interaction seamless.
- User Interaction Farmers create profiles, upload product details, and manage inventory through the straightforward UI. Buyers easily browse products, place orders, and make secure payments.

Result Analysis

Economic Sustainability:

The major economic benefit is on improving farmers' market access and revenue creation. By bridging the gap between farmers and customers, the online application has the potential to establish a more competitive and accessible marketplace. According to the theoretical grounding, more market involvement can help to the economic viability of individual farmers as well as the agricultural industry as a whole.

The application's improved communication is expected to minimize transactional inefficiencies, lowering costs associated with lengthy negotiations and delayed transactions. According to the theoretical framework, such efficiency increases might boost economic sustainability by optimizing resource consumption and increasing farmer returns.

Environmental Sustainability:

The application is projected to help to reduce food waste by boosting the efficiency of farmer-buyer interactions. According to theoretical grounding, direct and open communication may assist in aligning output with market demand, avoiding overproduction, and thereby reducing instances of surplus agricultural goods going to waste. The theoretical framework evaluates the application's potential to contribute to

environmental sustainability by assisting farmers in resource allocation optimization. Farmers may alter their farming operations as a result of improved market intelligence and demand predictions, resulting in lower environmental impact, such as reduced water usage and energy consumption.

Social Sustainability:

The capacity of the online application to empower small-scale farmers is a critical part of social sustainability. The application has the theoretical ability to elevate underprivileged farmers by offering a platform that increases their exposure and market access, hence fostering social fairness within the agricultural community.

The projected favorable influence on farmers' economic well-being can contribute to overall community development. According to the theoretical framework, an economically empowered agricultural community may stimulate local economic activity, resulting in enhanced social infrastructure, healthcare, and education facilities.

The Challenges and areas of improvement: While the online application had a favorable overall impact, the research also found particular issues and opportunities for development. Notable problems, technical failures, connectivity concerns in specific places, and a learning curve for people unfamiliar with digital platforms surfaced. Addressing these concerns will be critical to the application's long-term viability and scalability.

Finally, the empirical research on the web application's influence on farmer-buyer connectivity confirms its usefulness in alleviating agricultural communities' issues. The good achievements and highlighted areas for improvement lay the groundwork for future study and development, underlining technology's revolutionary potential in enabling a more efficient, transparent, and inclusive agricultural economy.

Problem Analysis

Traditional agricultural marketplaces have substantial hurdles that prevent producers from reaching a larger consumer base. Geographical constraints, intermediate layers, and knowledge gaps all work to keep farmers confined to local markets. The consequences emerge as economic inequities and limited growth possibilities for farmers, perpetuating the issue of limited market reach. In agricultural transactions, inefficiencies such as delayed communication, prolonged discussions, and the participation of middlemen are common. These inefficiencies result in lengthy durations between product listing and transaction completion. As a result, farmers face increased operating expenses and lower overall profitability. Prolonged transactions increase the deterioration of perishable items, exacerbating economic losses.

An empirical study of a web application aiming to connect farmers directly with buyers revealed promising results in alleviating some of these issues. While the online platform had an overall positive impact, the research also surfaced particular areas needing improvement - namely, technical failures, connectivity issues in remote areas, and a learning curve for users without prior digital experience. Addressing such concerns will be critical for long-term viability and scalability.

Overall, the research confirms the web application's usefulness in connecting farmers and buyers, addressing critical problems faced by agricultural communities. The achievements, together with highlighted areas for improvement, provide a foundation for future development - affirming technology's potential to enable a more efficient, transparent and inclusive agricultural economy when thoughtfully implemented.

Plans for further exploration include qualitative interviews to comprehend obstacles and inform communication strategies, emphasizing impacts of market inefficiencies on small-scale farmers and reducing opportunity gaps in rural areas. Customizing features informed by usability studies and user feedback sessions aims to provide equitable access through simple digital solutions.

Conclusion

To sum up, a big step has been taken in the direction of resolving the issues that agricultural communities confront with the creation and deployment of with the creation and deployment of the online application that helps farmers locate and communicate with customers. This creative idea aims to close the gap between farmers and potential purchasers by utilizing contemporary technology, promoting a more effective and transparent marketplace. The study project's results highlight the potential benefits of using online applications in agriculture, including improved market access for farmers, rural development, and economic sustainability. The programme presents a workable answer to the persistent problems of market inefficiencies and restricted marker reach by offering a user-friendly interface and integrating features like real-time communication and information exchange. The online program has the potential to disrupt traditional agricultural processes and enable farmers to make educated decisions regarding their output, as indicated by the favorable response from farmers who participated in the trial phase. Furthermore, the platform's capacity to permit direct contact between farmers and buyers encourages trust, transparency, and fair trading practices, helping to enhance the agricultural value chain as a whole.

While the development of the online application is a significant step forward, it is critical to recognize that continual efforts are necessary to ensure its long-term viability. Regular updates, user input, and engagement with key stakeholders will be critical in improving and growing the application's capabilities to suit the agricultural community's increasing demands.

Finally, the online application is a potential instrument for promoting a more inclusive and efficient agricultural trade. Its beneficial influence on farmers' lives, economic growth, and community development demonstrates technology's revolutionary potential in tackling the agricultural sector's complex difficulties. Continued research and development in this sector will be critical in reaching the full potential of digital solutions

to change agriculture and contribute to the welfare of farming communities worldwide as we move forward.