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Empowering Agriculture: The Promise of Direct Farmer-Buyer Relationships

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***Abstract*: The farming management system proposed in this research aims to revolutionize the agricultural industry by empowering farmers to sell their products directly to buyers through an e-commerce platform, eliminating the need for intermediaries. This platform facilitates a direct connection between farmers and buyers, offering a user-friendly interface for secure and efficient transactions. Farmers can upload product details, set prices and shipping options, while buyers can browse products based on location, category, and keywords, and place orders securely. Once confirmed, orders are fulfilled by the farmers, ensuring a seamless process from purchase to delivery. The Farming Management System (FMS) integrates advanced technologies to streamline agricultural practices, optimize productivity, and promote sustainability. By leveraging data analysis and automation, the FMS enables farmers to make informed decisions, reduce waste, and meet the increasing demand for direct-to-consumer sales. This research highlights the transformative impact of technology in modernizing agriculture, creating a more equitable and sustainable food system, and empowering farmers to thrive in a competitive market.**

***Keywords*: farm-to-table, farming management system, agriculture e-commerce, sustainability, community engagement.**

1. Introduction

In an era marked by technological advancements and the imperative shift towards sustainable agricultural practices, the Farming Management System E-commerce Project emerges as a pioneering solution poised to revolutionize the agricultural landscape. This innovative endeavor integrates digital tools, e-commerce platforms, and precision agriculture techniques to transform how farmers manage their operations and interact with markets, thereby fostering efficiency, profitability, and environmental sustainability.

This project embodies a holistic approach to modernizing agriculture, seamlessly integrating farming management tools with a robust online marketplace. By doing so, it aims to provide farmers with a comprehensive suite of resources that empower them to optimize operations, make informed decisions, and establish direct connections with buyers and suppliers.

A Multilingual SMS and Multilingual Call System has been designed specifically for the 47% of illiterate farmers, revolutionizing their ability to sell produce directly to buyers. This system not only increases farmer profits by offering better rates but also benefits buyers with access to quality products at affordable prices. Furthermore, transport systems gain from a wider client base, enhancing their profitability.

Buyers are no longer limited to purchasing from their own cities, expanding market opportunities. Remote farmers can now engage directly with buyers through a user-friendly chat or call system, facilitating fair negotiations. The system is accessible via basic phones with legal documentation and Android devices running Jellybean or higher. An online portal complements the mobile system, compatible with major web browsers like IE v9 or higher, Google Chrome, Mozilla Firefox, ensuring seamless access for all users.

A. The Key Elements of the Proposed Model

1. Streamlined Farm Management: Through a user-friendly digital interface encompassing crop planning, livestock management, resource allocation, and financial tracking, farmers can enhance operational efficiency and decision-making processes.
2. Precision Agriculture: Leveraging data analytics and Internet of Things (IoT) technologies, the project enables real-time monitoring of essential parameters such as weather conditions, soil health, and pest presence, aligning with the principles of precision agriculture.
3. E-commerce Integration: The project integrates an e-commerce platform where farmers can showcase their products while providing buyers and suppliers with direct access to high-quality produce and resources, thus eliminating intermediaries and enhancing market transparency.
4. Market Access and Sustainability: By bridging the gap between farmers and consumers, the project expands market access for agricultural products, as discussed by Johnson & Thompson (2020). Additionally, it promotes sustainability by encouraging optimal resource utilization, waste reduction, and the adoption of eco-friendly farming practices.
5. Community Engagement: Interactive features such as discussion forums and knowledge-sharing platforms foster collaboration among stakeholders, allowing them to learn from one another and collectively address challenges.
6. User-Centric Design: Recognizing diverse user

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backgrounds, the project prioritizes an intuitive and user-friendly interface, ensuring accessibility and maximizing benefits for farmers across various technological proficiency.

In true essence, the objective is to provide a direct-to-consumer sales platform for farmers to sell their products without the help of any mediator or a middleman and enable them to receive a fair price for their products and increase in income. This also helps the farmers to grow crops that are in demand and to promote stable agricultural practices. This reduces food waste and minimizes the negative environmental impact of long-distance transportation. This provides the buyer with a wide variety and different range of fresh and high quality products, promotes economic growth in rural areas by providing a platform for small-scale farmers to sell their products and creating jobs and economic development in those areas.

B. The Modules in the Proposed Module

- Farmer module
- Buyer module
- Registration Module
- Login Module

These 3 modules help to easily navigate the different users to their designated interface, which provides them the ease to utilize the platform with efficiency.

1) Farmer Module

The farmer module allows the farmers to login and enter the product details. This module contains my product, transaction and contact details. It helps the farmer to enter the new products and modify the products.

2) Buyer Module

The buyer module allows the buyer to login and view the details about the products. This module contains details of fruits, vegetables and crops. The buyer can view the farmer details and select the farmer which is convenient

3) Registration Module

The Registration Module allows the farmer and the buyer to register. This module contains the contact number and password of both the farmer and the buyer. It helps to maintain the details of both the parties.

C. Login Module

The Login Module helps the farmer and the buyer to login into the application and use accordingly.

2. Scope

The main objective of this model is to exclude intermediaries (including wholesalers, agents and intermediaries) from the process of buying and selling agricultural products. By doing so, we aim to reduce the additional charges and investments these intermediaries impose on each farmer and consumer. The edition facilitates direct negotiation between farmers and shoppers.

Farmers can digitally label their products, and consumers can buy from them instantly. this direct link provides accurate and transparent pricing. the device provides real-time information on the market prices of many crops and commodities. Consumers can browse the rates at exclusive stores and make the right choices. Farmers can set competitive prices based on market trends. Consumers can have the opportunity to obtain the facts about production, farming practices and the actual cost of the product directly from the farmers.

Quality assurance builds confidence and justifies accurate pricing.it can also enable smallholder farmers to actively participate and benefit from direct sales. transport-related emissions can also be reduced by farmers and by direct customer connectivity. Efficient logistics and direct transportation from the farm to the customer will reduce costs and electricity consumption.

In short, the goal of this definition is to create a transparent, green and straightforward market for agricultural products, and ultimately reduce costs by eliminating unnecessary intermediaries empowering farmers and consumers we are able to create excellent agricultural conditions that are extremely and easily accessible.

3. Proposed System

Traditional agricultural markets rely closely on intermediaries—wholesalers, consumers, and processors who offer beneficial however fragile merchandise to farmers and customers to extra costs, product inefficiencies, and price clarity. The proposed response disrupts this reputation quo via exploiting the dynamics of direct relationships between the farmers and direct buyers.

1) Digital Marketplace

The platform offers specific virtual connectivity at people's fingertips through internet cellular gadgets. Individual farmers create profiles, identifying their products with precise descriptions. Buyers can view agricultural tasks without hesitation in locating a place to locate.

2) Real-time pricing records

The collection of marketplace statistics enables real-time visibility of crop tariff guidelines. Consumers make appropriate alternatives primarily based on fairly correct pricing forecasts. Farmers actively regulate their costs in reaction to marketplace needs.

3) Quality assurance and transparency

Farmers offer comprehensive statistics on farming practices, real charges, and assets. Consumers get information about where every item comes from and the methods used. Trust is built through easy communication.

4) Effective logistics

Direct exchange reduces emissions from device. Power consumption is decreased with the assistance of subject-to-patron timelines.

5) Carbon footprints excluded

By getting rid of the center phase, the mechanism without a doubt reduces the car's emissions. In addition, inexperienced exporters help lessen the strength consumption. Soil compaction via tillage cut value and recycling of residues is right.

6) Soil carbon storage

Practices promoted by the proposed platform, such as cover

crops and organic amendments, increase soil carbon storage. Soil is a storehouse of carbon and benefits both agriculture and the environment.

7) Empowerment of small farmers

The platform levels the playing field, allowing small farmers to actively participate. Direct sales increase their financial returns and flexibility.

8) Reasonable prices and food safety

Consumers pay full prices without intermediaries. Food security is strengthened when farmers receive adequate wages.

4. System Design and Development

The system design and development of the proposed farming management system model embodies a concise yet technically advance approach towards integrating cutting-edge technologies and user-centric features. This endeavor encompasses a comprehensive system architecture that integrates farming management tools with a responsive e-commerce platform. The design phase focuses on creating a user-friendly interface for farmers and buyers, ensuring accessibility across various devices and technical proficiencies. Development efforts prioritize scalability, security, and data integrity, leveraging technologies such as cloud computing, data analytics, and IoT integration. Through iterative testing and feedback mechanisms, the system will evolve to meet the demands of agricultural stakeholders while adhering to industry standards and best practices.

A. Data Frame Diagram

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modelling its process aspects [1]. A DFD is regularly used as a initial step to create a top level view of the system, that could later be elaborated. DFDs can also be used for the visualization of data processing (structured design). A DFD shows what kind of information will be input to and output from the system, where the data will come from and go too, and where the data will be stored. It does not show information about the timing of the process or information about whether processes will operate in sequence or in parallel (which is shown on a flowchart).

1) Level 0 DFD

A level-0 DFD is the most basic form of DFD. It aims to show how the entire system works at a glance. There is only one process in the system and all the data flows either into or out of this process [2]. Level-0 DFD's demonstrate the interactions between the process and external entities. They do not contain data stores [3].

Fig. 1. 0-Level DFD for FMS

The Data Flow Diagram (DFD) represents the FMS module, where the farmer inputs data or resources into the system. This system processes the inputs to generate outputs for the buyer. It's a digital platform that allows farmers to manage agricultural activities and buyers to access the produce or resources efficiently. Figure 1 shows the flow of information and goods between the farmer, the system, and the buyer, highlighting the system's role in facilitating transactions and management of farm operations. It's a streamlined approach to connect producers and consumers within the agricultural sector.

2) Level 1 DFD

The goal of Level 1 DFD is to provide a comprehensive system overview. They examine the system in greater depth. Sub-processes are the division of larger processes. The primary processes' data stores are likewise identified by Level 1 DFDs. The Context Level DFD must be examined before we can begin to design a Level 1 DFD. The single process needs to be divided into its component parts. Next, we need to select the data stores from the provided text and incorporate them into our DFD. Labeling of all entities, data storage, and processes is required, just like with the Context Level DFDs. Any conclusions we have drawn from the text must also be stated.

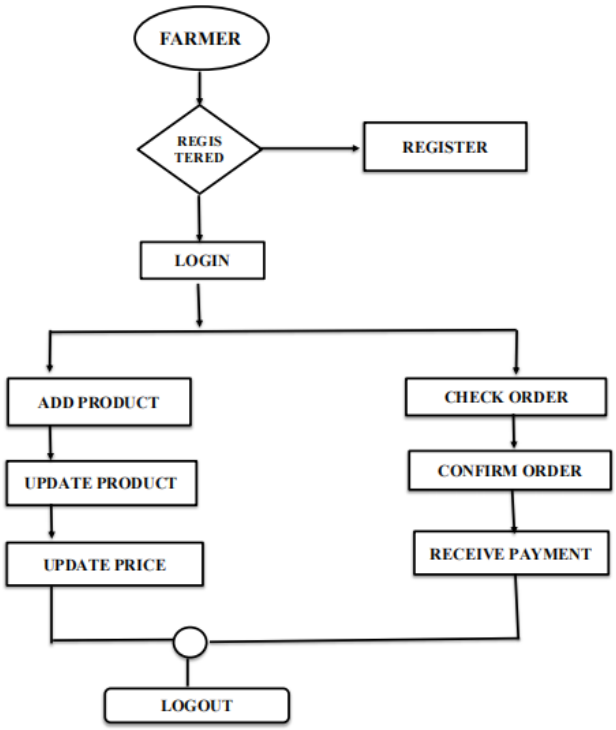

Fig. 2. Level 1 DFD: Farmer model

The flowchart illustrates the operational procedure for farmers within the proposed Farmer Management System. It commences with the farmer's registration, progressing to login. Subsequently, the farmer has the capability to add and update product listings, modify prices, review orders, confirm sales, and receive payments. The process is designed to be intuitive and efficient, concluding with a straightforward logout step. This flowchart encapsulates the system's functionality, providing a clear road map for the farmer's interactions from start to finish.

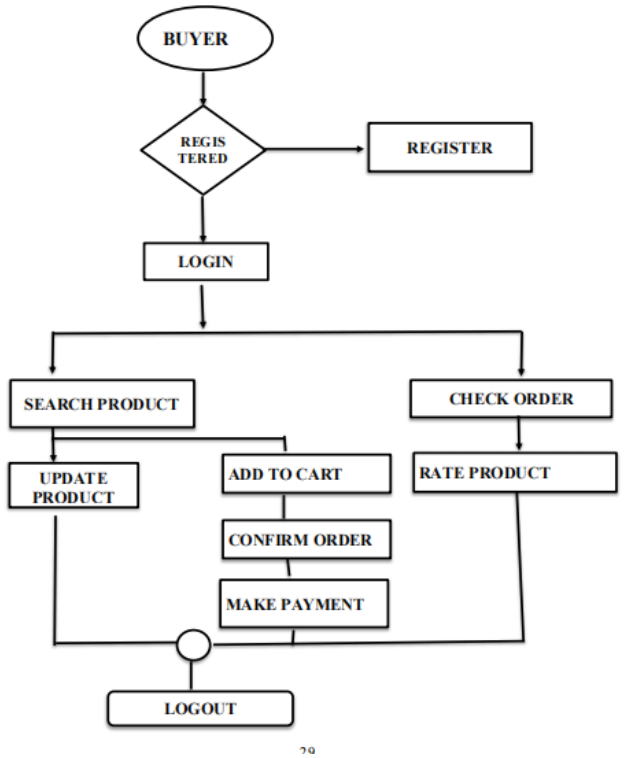

Fig. 3. Level 1 DFD: Buyer Model

The Data Flow Diagram (DFD) for the buyer in the proposed Farmer Management System model illustrates the buyer's journey from registration to logout. It begins with the "BUYER" registering and logging into the system. Once registered, the buyer can "SEARCH PRODUCT", "CHECK ORDER", "UPDATE PRODUCT", "ADD TO CART", and "RATE PRODUCT". These actions lead to the "CONFIRM ORDER" process, followed by "MAKE PAYMENT". The DFD culminates with the "LOGOUT" process, signifying the end of the transaction cycle. This DFD effectively communicates the sequential steps a buyer would take within the system, ensuring a user-friendly experience. The diagram is organized with clear, rectangular processes connected by directional arrows, showcasing the systematic flow of activities.

B. ER Diagram for the Proposed FMS

An Entity-Relationship (ER) diagram is a graphical representation that outlines the structure of a database by detailing the entities involved, their attributes, and the relationships between them. It serves as a blueprint for constructing a database, providing a clear and systematic visualization that aids in the communication of data requirements and structure to both technical and non-technical stakeholders [4]. In the system development process, an ER diagram plays a crucial role by facilitating the identification of data redundancies, ensuring data integrity, and simplifying the design process. It acts as a foundational tool that streamlines requirement gathering, supports effective decision-making, and provides a reference for future modifications and troubleshooting within the database architecture [5], [6].

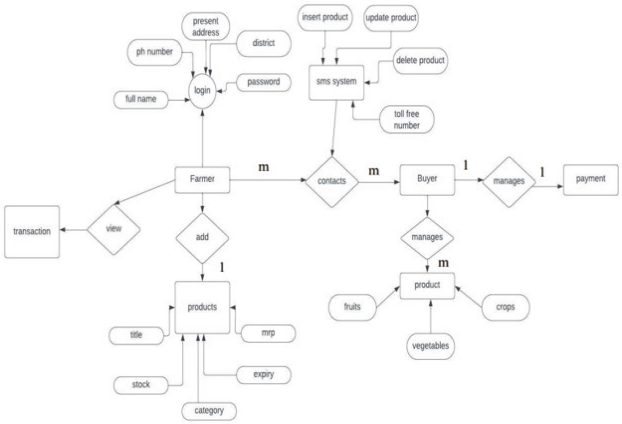

Fig. 4. ER diagram for FMS model

The ER diagram presents a structured overview of a product management system, centralized around the 'products' entity with attributes such as title, stock, category, MRP, and expiry. It depicts 'Farmers' as data contributors who can add or update product information, while 'Buyers' are shown to manage payments and interact with the system via a toll-free number [7]. The 'SMS system' entity is pivotal, enabling product information updates, thereby ensuring a dynamic and responsive system that adapts to the needs of both farmers and buyers in real-time [8]. This diagram is instrumental in visualizing the database design for the system, highlighting the inter-connectivity between its various components.

C. Database Design

A database is an organized collection of structured information, or data, typically stored electronically in a computer system [9]. A database is usually controlled by a database management system (DBMS). Together, the information and the DBMS, together with the packages which can be related to them, are known as a database system, frequently shortened to only a database. Data within the most common types of databases in operation today is typically modelled into rows and columns in a series of tables to make processing and data querying efficient. The data can then be easily accessed, managed, modified, updated, controlled, and organized. Most databases use structured query language (SQL) for writing and querying data [10].

Table 1
Buyer details

#	Field name		Datatype
1	Buyer_id	Int	
2	Buyer_Name	varchar	
3	Buyer_phone	bigint	
4	Buyer_add	text	
5	Buyer_comp	varchar	
6	Buyer_license	varchar	
7	Buyer_bank	int	
8	Buyer_pan	varchar	
9	Buyer_mail	varchar	
10	Buyer_username	varchar	
11	Buyer_password	varchar	

Table 2
Farmers details

#	Field Name	Datatype
1	Farmer_ID	Int
2	Farmer_Name	varchar
3	Farmer_phone	char
4	Famer_address	varchar
5	Farmer_state	varchar
6	Farmer_district	varchar
7	Farmer_pan	varchar
8	Famer_bank	varchar
9	Farmer_password	Mediumtext

Table 3
Cart details

#	Field name		Datatype
1	Product_id	Int	
2	phonenumber	bigit	
3	qty	int	
4	subtotal	int	

Table 4
Category details

#	Field name	Datatype
1	Cat_id	int
2	Cat_title	varchar

Table 5
Consumer details

#	Field name	Datatype
1	Id	int
2	Name	varchar
3	EmailId	varchar
4	Pincode	char
5	password	varchar
6	address	varchar
7	phone	varchar

Table 6
Order details

#	Field name	Datatype
1	Order_id	Int
2	Product_id	int
3	qty	int
4	address	varchar
5	delivery	varchar
6	phonenumber	bigint
7	total	Int
8	payment	varchar
9	Buyer_phonenumber	bigint

5. System Development

System Development is a methodical process that involves the meticulous design, construction, programming, and delivery of a comprehensive product. This process is integral to the development of computer systems, hardware devices, or software programs.

A. Feasibility Study

a) Problem Definition: Identify the limitations and define the scope of the current system.
b) System Objectives: Outline the envisioned system and establish its objectives.
c) Risk Assessment: Evaluate potential threats, constraints, and consider the integration and security of the system at this stage.

B. Analysis and Specification

a) Data Collection: Systematically gather, analyze, and validate the information.
b) Requirements Engineering: Define the precise requirements and develop prototypes for the new system.
c) Prioritization: Assess alternative solutions and prioritize the requirements based on strategic value.

C. System Design

a) Architectural Design: Develop the architecture for applications, networks, databases, user interfaces, and system interfaces.
b) Specification Elaboration: Translate the Software Requirements Specification (SRS) document into a detailed logical structure ready for coding.

D. Implementation

a) Code Development: Convert the system design into operational source code.
b) Integration Testing: Integrate and test all modules in a controlled environment to detect and resolve errors.
c) System Deployment: Introduce the information system into its intended environment and initiate the new system.

This approach ensures the creation of a robust platform that enables farmers to directly sell their produce to buyers, bypassing intermediaries, thus promoting a more direct and efficient agricultural marketplace [11], [12].

E. System Implementation

This involves the actual construction of the FMS model, turning design blueprints into a functional system. This phase is crucial as it brings the theoretical framework to life, preparing it for real-world application.

1) Code Development

Utilizing PHP and SQL, the back-end of the FMS is developed. PHP's server-side scripting provides a robust platform for creating dynamic web pages that interact with the SQL database efficiently.

Best practices in PHP and SQL development ensure that the system is secure, reliable, and scalable.

2) Integration

The integration process involves assembling the various modules of the FMS. This step ensures that the individual components function together harmoniously, providing a seamless experience for the end-user.

3) Deployment

The deployment phase sees the FMS being installed in the farming environment. This includes setting up the server, configuring the database, and ensuring that all components are communicating correctly.

F. System Testing

This ensures that the FMS operates as intended, meeting all technical and business requirements.

1) Unit Testing

Each module, whether it's a PHP function or SQL query, is tested individually to verify its functionality.

2) Integration Testing

After unit testing, modules are combined and tested as a group to identify any issues that arise from their interaction.

3) System Testing

The complete, integrated system undergoes rigorous testing to confirm that it meets all specified requirements.

4) Acceptance Testing

Conducted with the stakeholders, this final testing phase confirms that the system fulfills its intended purpose and is ready for production use.

For the front-end, web development frameworks are employed to create an intuitive and user-friendly interface:

G. Web Technology:

HTML, CSS, JavaScript, AJAX, Bootstrap, Django, and Node.js:

1. HTML and CSS: Create user-friendly web interfaces for farmers to access the system from their browsers.
2. JavaScript and AJAX: Implement dynamic features, such as live updates, interactive forms, and asynchronous data retrieval.
3. Bootstrap: Ensure responsive design for various devices.
4. Django: Develop the back-end framework for handling requests, authentication, and data processing.
5. Node.js: Use Node.js for server-side scripting and real-time communication.

By integrating these technologies, the proposed FMS will empower farmers with data-driven insights, efficient management tools, and seamless interactions across web and mobile platforms.

6. Future Scope

If your present-day business agency attitude is definitely a web page primarily based on the internet in most instances to facilitate direct communication between farmers and customers, some upgrades you can keep in mind for future development are:

1. User rankings and evaluations: Use a device wherein farmers and clients can base the rate of their very own practices commonly and study one feature of every. This lets the discussion board assemble authenticity and self-information in the community and encourages honest and candid exchange.
2. Integration with charge gateways: Provide seamless online bills without delay on the platform through a hard and speedy rate gateway. This gives consolation to customers and assures farmers that they'll get a pleasing quote.
3. Multi-language assistance: Farmers and clients from precise areas can make the most of the platform by tapping into a multi-purpose marketplace with precise language assistance.
4. Geolocation Services: Integrate geolocation offerings simply so farmers can document their locations and clients can search for proximity to farms or techniques. This will increase participation from the nation on the platform and enhance community connectivity.
5. Product tips: Provide hints primarily based totally on seasonal availability to clients, helping them make knowledgeable purchase selections and helping in the close-to-term agricultural cycle.
6. Quality guarantee strategies: Use techniques in which farmers will emphasize the wonderfulness of their commodity through photos, films, or testimonials. This offers customers a self-guaranteed guarantee of the authenticity and innovation of the product.
7. Inventory management tools: Give farmers the tools to optimize their inventory, estimate inventory levels and equipment orders, and make unconventional calls to indicate whether an item may be retained too low or inconsistencies are reported.
8. Smart reports: Work with customized reports for each farmer and consumer, including logo aggregates for creating new product listings, order confirmations, or market cost trademarks.
9. Social Media Integration: Allow customers to send a percentage of their offer or product favorites to social media programs, maximizing the usability of the platform and creating a sense of community among the customers.
10. Sustainability requirements: A combination of requirements or certifications for the sustainability of raw garments, relating to agricultural practices that affects the environment, has contributed to the desires of discerning consumers.
11. Customizable Profiles: Allow clients to create customizable profiles consisting of information and farming practices, product selections, or dietary dreams. This creates a bespoke view for every farmer and purchaser.
12. Feedback Channel: Establish a review channel in which farmers and purchasers could give pointers on improving the platform or factor out problems they will come upon to ensure continued client delight.

7. Conclusion

The Farm Management System has been created to modernize the selling process of farmers' products by providing them with a direct-to-customer sales platform. The platform removes the need for middlemen such as wholesalers who take a big share of the sales. By eliminating these intermediaries, the farmers can sell their products at fair prices and keep more of the proceeds.

Furthermore, the system promotes sustainability by way of encouraging farmers to undertake environmentally pleasant practices. It gives resources and facts on sustainable farming techniques, including natural farming or water conservation methods. By selling those practices, the device pursuits to reduce the environmental effect of agriculture and make a contribution to a greater sustainable future.

One of the key capabilities of the Farming Management System is its transparent and efficient market for agricultural merchandise. Through advanced technology, together with blockchain or clever contracts, the system guarantees that all transactions are recorded and without difficulty available. This transparency allows build trust between farmers and shoppers, because it allows them to affirm the starting place and first-rate of the products.

Moreover, the gadget helps direct connections between farmers and consumers, allowing them to talk and negotiate at once. This direct interaction fosters fair pricing, as farmers can negotiate charges based totally on their production costs and shoppers can make informed selections about the cost of the products. By doing away with the want for intermediaries, the gadget empowers farmers to have more control over their pricing and earnings.

In addition, the Farming Management System objectives to reduce emissions associated with the transportation of agricultural products. By connecting farmers direct-to-consumer and eliminating intermediaries, promoting sustainability, creating a transparent market, and reducing emissions, the system aims to create a more equitable and efficient agricultural industry. Through advanced technologies and user-centric design, the system enables farmers to thrive in the competitive market and contribute to a more sustainable future.

References

[1] https://www.researchgate.net/figure/Use-Case-Diagram-Data-Flow-Diagram-A-data-flow-diagram-DFD-is-a-graphical_fig1_362531108

[2] https://eternalsunshineoftheismind.wordpress.com/2013/03/05/context-level-dfds-level-1-dfds/

[3] Okihiro Yoshida, Tatsushi Nishi, Guoqing Zhang and Jun Wu, "Design of optimal quantity discounts for multi-period bilevel production planning under uncertain demands," Advances in Mechanical Engineering, Volume 12, Issue 2, February 2020.

[4] https://techdiagrammer.com/database-er-diagrams

[5] https://www.geeksforgeeks.org/advantages-and-disadvantages-of-an-er-model/

[6] https://vertabelo.com/blog/why-need-an-er-diagram/

[7] https://www.slideshare.net/slideshow/ejercicio-11-74505671/74505671

[8] https://www.cin.ufpe.br/~ajca/

[9] https://www.oracle.com/database/what-is-database/

[10] https://www.geeksforgeeks.org/database-design-in-dbms/

[11] Carlo Giua, Valentina Cristiana Materia, Luca Camanzi, "Management information system adoption at the farm level: evidence from the literature," in British Food Journal, November 2020.

[12] Carrer, M.J. (2023). Farm Management Information Systems (FMIS). In: Zhang, Q. (eds) Encyclopedia of Digital Agricultural Technologies. Springer, Cham.