DIGITAL AGRICULTURE IN ACTION: KRISHI-SETU AS A MODEL FOR FARMER-TO-CONSUMER PLATFORMS

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Abstract: The agricultural sector is often burdened by middlemen and brokers, leading to unfair pricing for farmers and higher costs for consumers. Many farmers struggle to receive a fair value for their produce, while customers face affordable challenges in accessing fresh, healthy fruits and vegetables. System project introduces a digital e-commerce platform to bridge this gap by directly connecting farmers with consumers. By eliminating intermediaries, the platform ensures farmers maximize their earnings, while buyers receive farm-fresh produce at reasonable prices. Farmers can list their produce, set their prices, and sell directly to consumers without relying on third-party distributors. For consumers, the platform offers a direct farm-to-table experience, ensuring high-quality, chemical-free, and organic food options. The integration of demand forecasting and AI-driven recommendations helps both farmers and customers make informed decisions, reducing wastage and optimizing supply chain efficiency. System research evaluates the platform's impact on the economic empowerment of farmers, improved market accessibility, and the overall efficiency of agricultural trade. By leveraging technology to create a sustainable and fair agricultural ecosystem, system contributes to enhancing food security, promoting transparency, and fostering economic growth in rural communities.

Index Terms - E-commerce, Agriculture, Agri-Tech, Digital marketplace, Farmer-to-consumer, Supply chain, Agricultural marketing, Rural digitization, Online fruit market, E-grocery, Agriculture innovation.

I. INTRODUCTION

Agriculture is the backbone of many economies, providing food, employment, and raw materials for various industries. Despite its fundamental importance, the sector faces numerous challenges, particularly in the distribution and marketing of agricultural produce. One of the major concerns is the dominance of middlemen and brokers in traditional supply chains. These intermediaries often exploit farmers by purchasing their produce at low prices and selling it to consumers at significantly higher margins, leaving farmers with minimal profits and consumers with inflated costs [1]. This imbalance not only affects the economic stability of farmers but also reduces accessibility to fresh and healthy food for end consumers.

The emergence of digital technology and e-commerce presents a transformative opportunity to address these inefficiencies in the agricultural supply chain. By bypassing middlemen, farmers can directly engage with consumers, creating a more transparent, efficient, and equitable market. The project proposes an agriculture-focused e-commerce platform that directly connects farmers with consumers, allowing producers to list their produce, set their prices, and sell directly to buyers. In doing so, the platform ensures fair pricing for farmers while providing consumers with affordable, fresh, and high-quality agricultural products. System approach not only boosts farmers' incomes but also helps consumers access healthier food options at more reasonable prices, contributing to greater food security and economic equity[2].

The platform integrates cutting-edge technological features such as real-time pricing analytics, secure payment gateways, and logistics optimization[3]. These features enable farmers to access market insights, optimize supply chains, and reduce food waste by aligning production with demand. Additionally, the platform promotes sustainable farming practices, including organic and chemical-free farming, as consumers are more likely to trust and purchase directly from verified farmers, rather than through unknown intermediaries.

- **Agricultural Supply Chain Challenges**
  The Role of Middlemen in Agriculture: You can describe how middlemen contribute to price inflation and the barriers farmers face due to the lack of direct access to markets. Explain the history of these supply chains and how they evolved to include multiple layers of intermediaries[4]. Impact on Farmers: Include statistics or case studies showing how middlemen affect farmers' incomes. You could reference studies on the disparity in farmgate prices (prices farmers receive) and retail prices (prices consumers pay). Post-Harvest Losses: Discuss the significant losses of produce that occur in the traditional supply chain due to poor transportation, lack of cold storage, or inefficient handling of produce.

- **Technological Innovations in Agriculture**
  Blockchain for Transparency: Explain how blockchain technology can provide transparency in food traceability, ensuring that consumers know the origin of their products and guaranteeing food safety. Internet of Things (IoT) and Smart Farming: Describe how IoT devices (such as soil sensors, drones, and automated irrigation systems) are helping farmers monitor crops, optimize water usage, and increase productivity [5]. Market Trends and Consumer Preferences: You can analyze current trends in consumer behavior, especially in the context of food purchases. This can include the growing demand for fresh, organic, and locally sourced food and how platform can address these trends.
  Rise of the Health-Conscious Consumer: Discuss the increasing consumer demand for organic, pesticide-free, and locally grown products. Highlight how direct connections with farmers allow consumers to access fresher and healthier products.

- **Supply Chain Efficiency through E-commerce**
  Above section could explore how e-commerce platforms are disrupting traditional agricultural supply chains and improving operational efficiency. Reducing Supply Chain Complexity: Explain how platform minimizes intermediaries and directly connects farmers to buyers, reducing logistical and operational costs. Demand Forecasting: Describe how your platform can use AI to predict consumer demand, helping farmers plan their harvest and production to match demand, thereby reducing wastage[6]. Logistics and Delivery Optimization: Discuss how integrating logistics and delivery solutions within the platform can improve delivery times and reduce costs, especially for perishable goods like fruits and vegetables.

- **Impact on Farmers' Profits and Social-Economic Benefits**
  Reducing Food Waste: Explain how your platform can reduce food waste by ensuring that products are sold before they spoil and are distributed. [7]. Direct Access to Consumers: Explain how direct sales to consumers help farmers set their prices and eliminate the exploitation of middlemen, resulting in better profit margins. Financial Empowerment for Small-Scale Farmers: Discuss how small-scale farmers benefit from accessing larger markets and receiving better prices for their produce. Community Development: Highlight the broader

social and economic impact of empowering farmers with access to new markets, potentially increasing their access to finance, education, and healthcare. The Environmental Sustainability and Ethical Farming section on the environmental benefits of the platform and its support for sustainable, organic, and ethical farming practices would further strengthen it[8]. Sustainability in Agricultural Practices: Discuss how the platform is being used efficiently. Supporting Local Farming: Describe how the platform supports local farmers and minimizes the carbon footprint associated with long-distance transportation. Market Competition: Discuss how the platform will compete with existing agricultural intermediaries or another online markets[9].
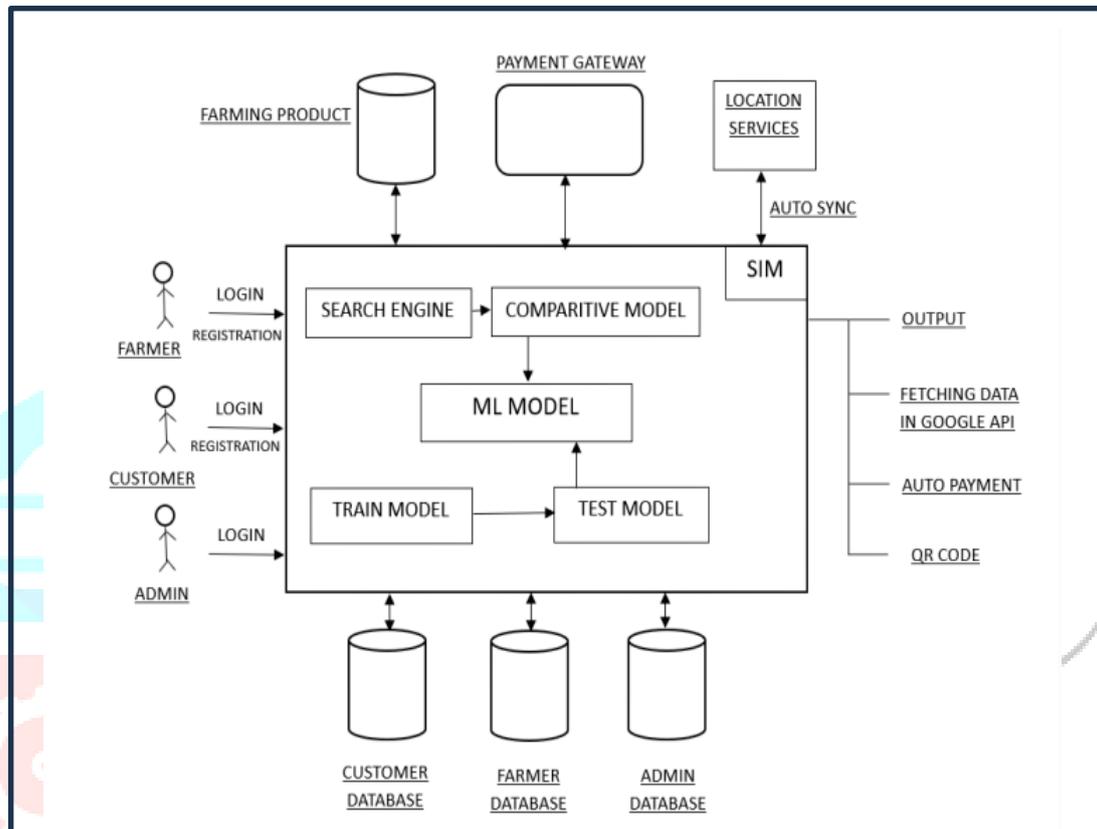
II. Methodology:

Fig1: System Architecture.

- **Search Engine Component:**
  The search engine component in an e-commerce platform is crucial for enabling users to efficiently find agricultural products or services based on specific queries. It leverages algorithms and indexing techniques to retrieve relevant results. Typically, the search engine incorporates the following functions:
  Query Processing**:** When a user submits a query, the system processes the input using natural language processing (NLP) or keyword matching techniques[10].
  Product Indexing**:** The platform indexes agricultural products by categories, tags, and attributes (e.g., price, type, size, etc.), allowing for faster retrieval during searches.
  Ranking Algorithms**:** Results are ranked according to relevance, which may be determined by factors such as user reviews, product popularity, or proximity to the user's location. The search engine is optimized to ensure that users receive the most pertinent products based on their search criteria.

- **Comparative Model:**
  The comparative model within the e-commerce platform is designed to facilitate the direct comparison of agricultural products. The feature enhances the decision-making process for users by displaying the comparative attributes of selected items. Key functionalities include:
  Feature Comparison**:** Users can select multiple products to compare their specifications, features, and other key metrics. This includes aspects like price, quality, and product ratings.
  Ranking Mechanism**:** The comparative model may rank products based on predefined parameters, such as lowest price, highest rating, or best value, thus helping users to evaluate their options more effectively[11].

User-Centric Customization**:** Depending on the user's preferences or previous interactions, the system may highlight specific attributes or products that align with their needs, further enhancing the relevance of comparisons. Above system component aims to reduce the cognitive load on users by streamlining the evaluation of agricultural products, ultimately fostering informed purchasing decisions.

- **Machine Learning (ML) Model:**
  The machine learning (ML) model is at the core of personalization and predictive analytics within the e-commerce platform. The model leverages historical user data, product information, and external factors (such as market trends or weather data) to make intelligent predictions and recommendations. The primary functions of the ML model include:

  Recommendation System**:** By analyzing user behavior (e.g., past purchases, browsing history, and preferences), the ML model suggests relevant agricultural products to users. It employs collaborative filtering, content-based filtering, or hybrid methods to ensure recommendations are personalized and contextually appropriate[12]d.

  Demand Prediction**:** The ML model can forecast the demand for specific agricultural products based on seasonal trends, historical data, and external variables like weather patterns. System allows the platform to optimize inventory and pricing strategies.

  Market Segmentation**:** The ML model can segment users based on various factors, such as demographics, purchase patterns, and geographic location. System segmentation enables more targeted marketing and personalized promotions.

- **Train and Test Mode:**
  The train and test modes are integral to the development and evaluation of the ML model. The process ensures that the model can generalize effectively and perform optimally when deployed in real-world scenarios. The steps involved are:

  Training Mode**:** In the phase, the model is trained using historical data, such as past user interactions, product attributes, and external factors (e.g., weather or market trends). During training, the model learns to identify patterns and relationships within the data that can inform its predictions and recommendations.

  Testing Mode**:** After training, the model is evaluated using a separate set of data (test data) that it has not seen before. Above step is crucial for assessing the model's accuracy, precision, recall, and overall performance. It ensures that the model is not overfitting to the training data and can generalize well to new, unseen data.

- **The Farming Product:**
  The farming product section of the e-commerce platform is specifically designed to showcase agricultural products that include fruits, vegetables, pulses, etc. Above section serves as a digital marketplace where users can browse, compare, and purchase fresh produce, offering them a direct link between producers and consumers. The main features of above section are:

  Product Categorization**:** The farming product section is divided into different categories, such as Fruits, Vegetables, and Pulses. Each category may be further subdivided into specific types or varieties (e.g., leafy vegetables, root vegetables, tropical fruits, legumes, etc.), helping users navigate more easily.

  Fruits: System category includes fresh produce like apples, oranges, bananas, mangoes, and seasonal fruits that are grown in different agricultural regions. Vegetables**:** Vegetables such as tomatoes, potatoes, carrots, onions, and leafy greens are displayed, ensuring that users can find essential fresh produce easily. Pulses**:** Various pulses like lentils, chickpeas, beans, and peas are listed for sale. Pulses play a significant role in the diet, and offering them on the platform helps diversify the available agricultural products.

- **Product Specification:** Each product listing includes detailed information that helps users make informed decisions. Key attributes typically include:

  Freshness Assurance**:** As fresh produce is perishable, the platform highlights product freshness, which could include:

  Packaging and Storage**:** The platform may guide how the products are packaged and stored to ensure minimal spoilage during transportation.

  Product Filtering and Sorting**:** Users can filter the products by categories such as type of produce (fruits, vegetables, pulses), price, organic or non-organic, delivery location, or availability. Additionally, the platform can provide sorting options such as best-selling, most popular, price (low to high), or newest arrivals.

Seasonal Offerings: Depending on the time of year, certain fruits and vegetables may be more readily available. The platform may feature a seasonal section that highlights produce currently in season, ensuring users have access to fresh, locally available items.

- **Payment Gateway:**

  The payment gateway is an essential component that facilitates secure online transactions between users and the e-commerce platform. It ensures that customers can make payments for agricultural products securely and reliably. Key features of the payment gateway include[13]:

  Multiple Payment Methods: The gateway supports a variety of payment methods, including credit/debit cards, online wallets (e.g., PayPal, Google Pay), bank transfers, and cash-on-delivery (COD) options. System flexibility caters to diverse user preferences.

  Security Features: Security protocols, such as Secure Socket Layer (SSL) encryption, are implemented to protect sensitive financial data during transactions. The payment gateway may also support tokenization and fraud detection to ensure that payments are secure.

  Payment Confirmation and Notifications: After a payment is made, the system sends a confirmation message to the user (via email or SMS) to notify them of successful payment and order processing. The payment status is updated in the database for further order management.

  Refund and Cancellation Management: The payment gateway allows for the easy handling of refunds or order cancellations, ensuring that customers are reimbursed in case of issues with their purchases.

- **Location Services:**

  Location services are an integral part of an e-commerce platform, particularly in the context of agriculture, where delivery and product availability are often region-specific. These services enhance the platform's functionality by providing users with personalized experiences based on their geographic location. The key features include:

  Geolocation for Delivery: Location services allow the platform to determine the user's shipping address and estimate delivery times. System ensures that products are only shown if they can be delivered to the user's region. Additionally, it helps calculate shipping fees based on the delivery distance.

  Regional Product Availability: Some agricultural products may only be available in specific regions due to climate, regulatory restrictions, or local farming needs. Location services allow the platform to display region-specific products to users.

  Localized Pricing: Depending on the user's location, the platform can show prices in the local currency and adjust pricing based on regional economic conditions.

  Weather Integration: Advanced location services may integrate weather data to offer region-specific agricultural recommendations. For example, the platform may recommend certain seeds or fertilizers based on the local climate.

  Map Integration: The platform may include a map interface to help users track delivery progress or find nearby physical stores or agricultural suppliers.

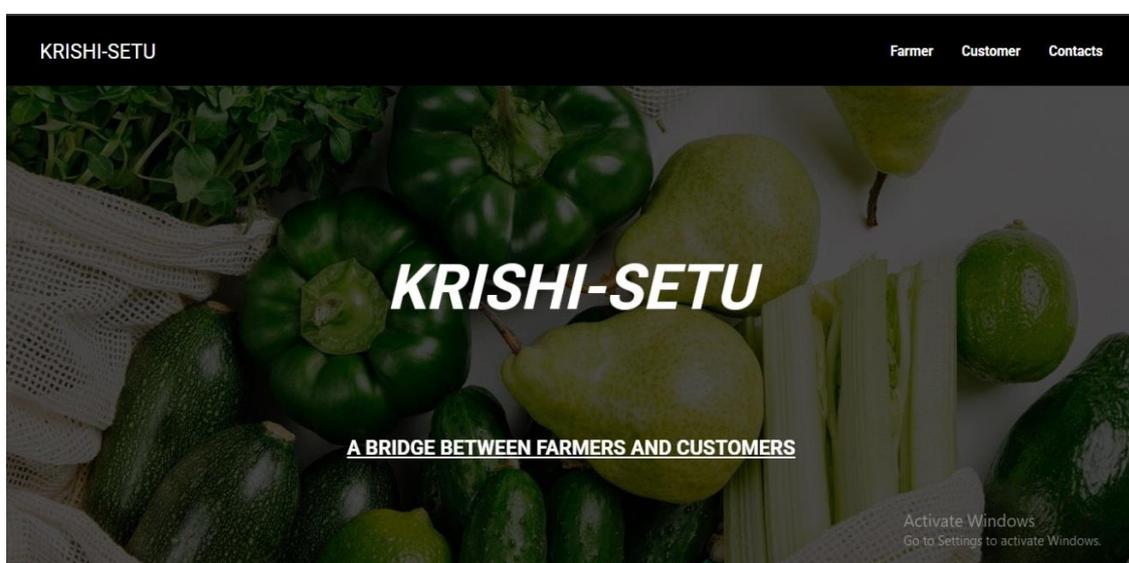## III. Result:

Here are some images of the system.

Fig. 1: Home page of the website.

The **Krishi-Setu** homepage presents a clean and modern interface with a vibrant background of fresh vegetables. It features a bold central title, "KRISHI-SETU" with a tagline, "A bridge between farmers and customers". The top navigation bar provides easy access to section for **Farmer**, **Customer** and **Contacts**. Overall, the design reflects a focus on connecting agriculture directly with consumers through a digital platform.

Fig. 2: Farmer Procedure.

The **Upload Product** page allows farmers to list their fresh, chemical-free produce for doorstep delivery. It features a simple form where users can enter their mobile number, name, and product details with pricing and an image. The tagline **"Your Farm, Our Tools – Together We'll Thrive"** emphasizes collaboration and empowerment.

A cheerful yellow background and clean layout make the submission process friendly and approachable.

Fig.3: Explore Varieties.

The **Pricing Plan** section lists fresh produce along with clear pricing, emphasizing quality and affordability. Each item, from tomatoes to strawberries and vegetables, includes brief descriptions to guide customer choices. The message promotes health and freshness, encouraging customers to **"Eat Fresh, Savor Every Bite."**

The design reinforces **Krishi-Setu's** mission of empowering farmers and delivering nutritious produce straight to homes.

IV. SCOPE:

- Marketplace for Direct Farmer-to-Consumer Sales: In the future, Krishi-Setu can include an integrated e-commerce platform that connects farmers directly to consumers, thereby reducing dependency on middlemen and increasing system transparency.
- AI & Data Analytics: Predicting demand, optimizing supply chains, and providing insights to farmers for better production planning.
- Rural & Urban Expansion: The platform can be expanded from local to national and even international markets.

V. CONCLUSION:

The system eliminates middlemen by directly connecting farmers with consumers, ensuring fair pricing, transparency, and access to fresh, unadulterated food. It empowers farmers, enhances public health, and promotes sustainable agriculture while reducing food wastage. By leveraging technology, the platform creates an efficient and ethical marketplace, revolutionizing the agricultural supply chain for a healthier and fairer future. Consumers gain reliable access to fresh, unadulterated, and locally sourced food, thereby contributing to better public health outcomes. The reduction in dependency on middlemen also plays a crucial role in minimizing post-harvest losses and food wastage, which has both economic and environmental implications.

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