KrishiSetu: MERN software platform E-Commerce direct Farmer-to-Consumer Trade

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Abstract:

The traditional farming supply chain model in most developing economies relies on middlemen. As a result, farmers' profit margins are extremely low, or consumers make very expensive purchases. To solve this problem, this paper presents KrishiSetu, an e-commerce web project that is an agricultural MERN stack (MongoDB, Express.js, React.js, Node.js). The KrishiSetu principle is to ensure that farmers and buyers have real-time access to each other. The platform offers the farmer a convenient dashboard where he can post crop details and set prices, in addition to reading orders. On the other hand, consumers have the chance to search and compare prices for fresh vegetables and fruits online and order them directly from farms. The paper outlines the system's technical architecture, the different modules that comprise it, and how this platform has been used in the real world. It is implied in the conclusion that resolving the crisis with farmers and consumers through the use of web technologies not only increases farmers' profits but also provides new, traceable food products to purchasers.

Keywords: E-Agriculture, MERN Stack, Direct-to-Consumer (D2C), Supply Chain Management, Web Application, E-Commerce, Digital Farming.

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1. INTRODUCTION

This study has a background that will be described below.

1.1 Background of the Study

Agriculture is a very important part of our economy, yet farmers who feed us are often faced with financial difficulties [1].

1.2 Problem Statement

The chain of intermediaries is one of the biggest drivers of farmers' financial difficulties. A vegetable has to pass through local agents, wholesale mandis, transportation services, and then retail shopkeepers before reaching the customer's kitchen. It has a commission in each of these [2]. Farmers are thus being paid about 15-20% of the amount the customer pays. Moreover, the labour (days) that the food spends in this traditional supply chain means that a huge percentage of farm products go to waste before reaching the market [7].

1.3 Proposed Solution: KrishiSetu

As of today, almost all citizens have access to a smartphone and the internet, even in the village. The rapid adoption of digital infrastructure in India presents a great opportunity to leverage technology to address this problem [6]. To eliminate intermediaries, we developed KrishiSetu. It is an online platform built entirely on the current MERN stack [3]. A direct online listing allows farmers to sell their products on KrishiSetu. This is a peer-to-peer (P2P) business model that guarantees farmers a fair price for their labour and the final consumer a lower price for fresh food, as the middleman does not take a fee [4].

2. OBJECTIVES

2.1 Removing Middlemen

The ultimate goal is to eliminate commission agents. Direct farmer/consumer communication and trade will eliminate the added high cost at the supply end, directly impacting the seller and increasing the margin.

2.2 Fair Pricing Control

Farmers lack the time to support the prices of their products, so huge customers usually dictate the price of farm products. Using our platform, farmers can enter the price at which they wish to sell their goods, based on their quality, market demand, and their sense of effort.

2.3 Improve Quality and Freshness.

Under normal conditions, the supply of vegetables to urban markets will take 2-3 days. Direct selling radically reduces the transit time. Customers will receive fresher products, and the risk of post-harvest losses, including food spoilage during loading, is low [7].

2.4 Offer an Interface-friendly Interface to Farmers.

Many farmers are not so well-educated about computer operations. Thus, we were set to develop a highly simplistic, mobile-friendly User Interface (UI) that can be easily used by anyone who is familiar with the nature of the simplest applications, such as WhatsApp or Facebook.

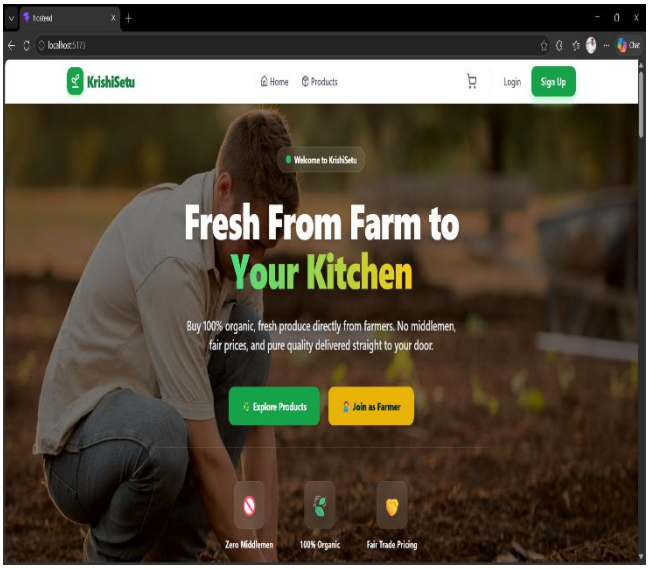
3. METHODOLOGY

3.1 System Architecture

KrishiSetu, developed using the MERN stack, was used because it can handle high traffic and scale efficiently, and it can be developed with JavaScript on both the front and back ends, thereby making the development process both efficient and smooth [3].

3.2 Frontend Implementation

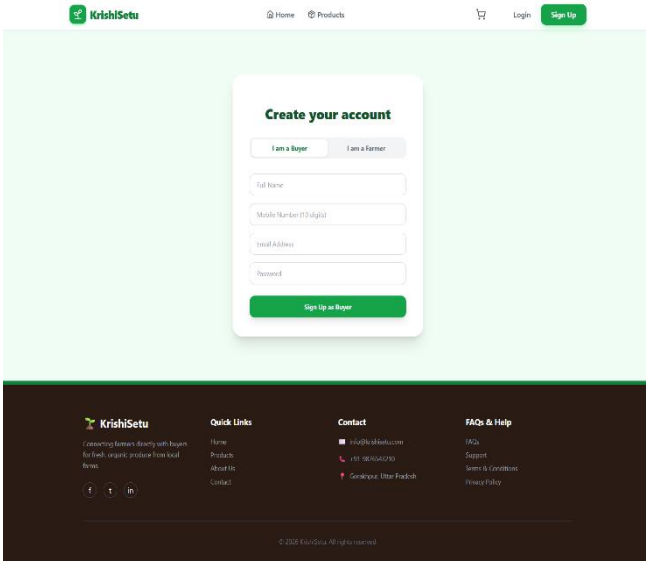
- Landing Page: The first page must be attractive and have definite Call-to-Action (CTA) buttons, i.e. to explore the products, or to join as a Farmer.



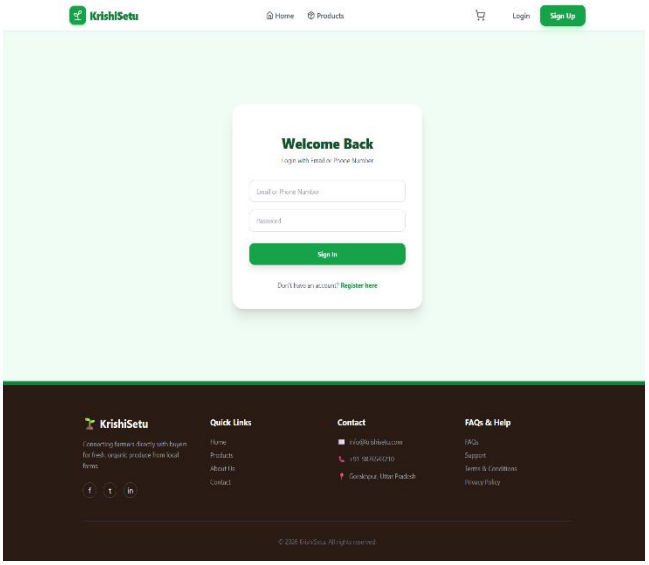
- Routing: React Router DOM v6 was used to allow page navigation and prevent a reload.

3.3 Backend Implementation & Security

- API Design: Our API is a RESTful API that will accept requests like user registration, product addition and order handling.



- Authentication: Passport.js middleware was adopted to ensure security, establish control and access to user sessions. We have applied the mechanism of authentication using password and username (passport-local).



- Schema Integration: We applied passport-local-mongoose at the database level to salt and hash passwords before storing them in MongoDB, which is secure without the need to code by hand Bcrypt.

4. TECHNOLOGIES USED

4.1 React.js

Rapidly built the lightweight, interactive Single Page Application (SPA) frontend. It manages the user interface quite effectively.

4.2 Node.js & Express.js

The server code is implemented in Node.js using the Express.js framework, which supports non-blocking I/O and fast RESTful APIs.

4.3 MongoDB & Mongoose

Stored as the main database to hold user credentials, product details, and order information without any hassle.

4.4 Passport.js

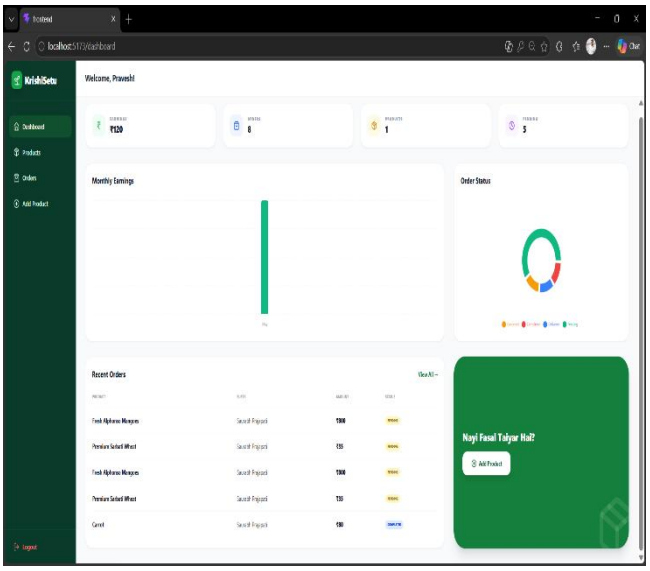
Reid and secures user authentication and session management.

4.5 Tailwind CSS

Edited to make the application look presentable and as responsive as possible on both laptops and cell phones.

5. RESULTS AND DISCUSSION

The implementation results in a highly functional, user-friendly, and intuitive dashboard. The centre of action is the Farmer Dashboard, where agricultural trade takes place.



The dashboard will give real-time information on:

- Earnings Analytics: This chart indicates the total earned.
- Order Manager: A table of Recent orders with the corresponding Order ID, Product, Quantity, Amount and Status (Delivered, Shipped, Pending).
- Product Management: the possibility to add and edit harvests.

As we took the KrishiSetu platform for a trial, we realised that the results were quite evident. The most important one is financial: the farmer receives nearly 100 percent of the amount paid by the consumer since no mandi tax or agent commission is involved. The second noticeable benefit is that the supply chain is transparent [9]. The dashboard allows farmers to use their profile to create unique branding, which builds consumer confidence.

Nevertheless, there were problems as well. In remote villages, many farmers and small/unique orders are unable to easily place orders at a reasonable price because internet access is low-quality (or unreliable) and home deliveries are difficult to coordinate. Regarding delivery, we are also considering using local third parties.

6. APPLICATIONS

KrishiSetu can be used practically in the existing market [5]:

1. Purchasing Fresh Vegetables Daily: Customers have access to the farmers to purchase their fresh vegetables daily.
2. Restaurant Supply (B2B): Hotel and restaurant owners have the opportunity to purchase raw materials in larger amounts and at wholesale prices.
3. Organic Food Market: It is easy to track farmers who produce non-chemical (organic) food. This fact is easily identified by health-conscious people willing to pay a premium [8].
4. Waste Minimisation: Given that the farmers will know what will be required to be made on the site, they will produce only the food that will be ordered, thereby minimising food waste.

7. CONCLUSION

While working on the KrishiSetu project, it was discovered that issues at the ground level in our country can be effectively resolved with the assistance of the latest web technologies. The MERN stack has enabled us to develop a fast, secure, and optimised mobile stack that allows a farmer to interface directly with consumers. It replenishes financial places in the hands of consumers with new, cheap, and traceable food products, thereby empowering the farmers.

8. FUTURE SCOPE

1. Payment Gateway: This will involve Razorpay or Stripe API (online payment).
2. Local Language Support: An opportunity to have a localisation choice should be offered whereby an individual is allowed to choose the language used in the site to either the Hindi language or another local language.
3. AI Price Predictor: In this case the most suitable would be to predict the prices which will be sold with assistance of the Machine Learning based on the past tendencies in the market [10].
4. Delivery Tracking: An interface to the supply logistics real-time GPS Tracking.

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