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Krishi-Bridge

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ABSTRACT

India's agricultural sector faces significant challenges in transporting materials from farms to markets, leading to increased costs, spoilage, and reduced profitability for farmers. "Krishi Bridge" is an innovative digital platform aimed at addressing these issues by connecting farmers directly with transporters, thereby streamlining the supply chain, reducing dependency on intermediaries, and ensuring timely delivery of agricultural materials. This paper explores the functionalities, implementation strategies, and potential impacts of the Krishi Bridge platform, highlighting its role in transforming agricultural logistics and enhancing the livelihoods of farmers.

INTRODUCTION

Agriculture sustains nearly 60% of India's rural population, but inefficient supply chains and unreliable transportation systems significantly reduce farmers' profits. Most farmers depend on local agents to arrange transport, which often leads to high costs and delivery delays. The "Krishi Bridge" project was conceptualized to modernize this system using technology. It provides a direct link between farmers and transporters via an easy-to-use digital platform. The platform enables transparent bidding, booking, and delivery of vehicles for transporting produce. By digitalizing these interactions, it removes intermediaries and promotes trust. This paper details the Krishi Bridge system's architecture, features, and initial testing. It provides insights into how such platforms can improve logistics efficiency and empower rural stakeholders.

I. EXISTING SYSTEM

The existing system lacks integration, transparency, and real-time digital support for various stakeholders in the agricultural supply chain. Farmers, buyers, and transporters operate in silos, with inefficiencies at every stage — from produce posting to transportation and payments. These limitations form the basis for developing the *Krishi-Bridge* platform, which aims to bridge the gap by providing an all-in-one digital ecosystem.

II. PROPOSED SYSTEM

The *Krishi-Bridge* proposed system is a **digital bridge** connecting India's farmers, transporters, and buyers into one platform. It simplifies the produce supply chain, boosts profits for farmers, creates steady income for transporters, and gives buyers better control over their sourcing. All of this is achieved through **user-friendly dashboards, smart matching systems, and transparent digital workflows**.

III. LITERATURE SURVEY

The integration of technology into agricultural logistics has been an essential area of research, with a focus on optimizing supply chains, improving transport efficiency, and ensuring transparency. Several studies have examined various facets of agricultural logistics, including real-time tracking, the application of smart logistics systems, and the use of IoT technologies. These areas have particular relevance to the development of platforms like Krishi Bridge, which aims to enhance the agricultural supply chain in rural settings.

A. Kumar et al., "Real-Time Tracking of Agricultural Vehicles in a Smart Farming System," IEEE Transactions on Industrial Informatics, vol. 15, no. 3, 2019.

Kumar et al. (2019) explore the use of real-time GPS tracking and vehicle management systems within the agricultural supply chain. Their work focuses on creating a system that monitors the movement of agricultural vehicles, ensuring better route optimization and timely deliveries. The authors emphasize the importance of real-time data to improve the logistics of farm-to-market transportation. This study is highly relevant to the Krishi Bridge platform, which integrates GPS tracking and route management for improving visibility and efficiency in agricultural transport. By leveraging similar real-time tracking technology, Krishi Bridge aims to provide both farmers and transporters with essential tools to optimize transportation and ensure the timely delivery of agricultural goods.

S. A. S. S. Karthik et al., "A Smart Logistic System for Efficient Agricultural Supply Chain Management," IEEE Access, vol. 7, 2019.

Karthik et al. (2019) propose a smart logistics system designed to improve agricultural supply chain management by utilizing automated systems and real-time data collection. Their system focuses on tracking both the goods in transit and the transportation vehicles, which enables efficient management of inventory and logistics. By integrating technology into the supply chain, the system ensures better coordination and timely deliveries. This work is directly related to Krishi Bridge's goal of improving logistics by offering a modular platform that connects farmers with transporters and market players. The smart logistics approach discussed in this paper highlights the potential for Krishi Bridge to integrate similar technology to reduce inefficiencies, optimize routing, and improve decision-making in agricultural transportation.

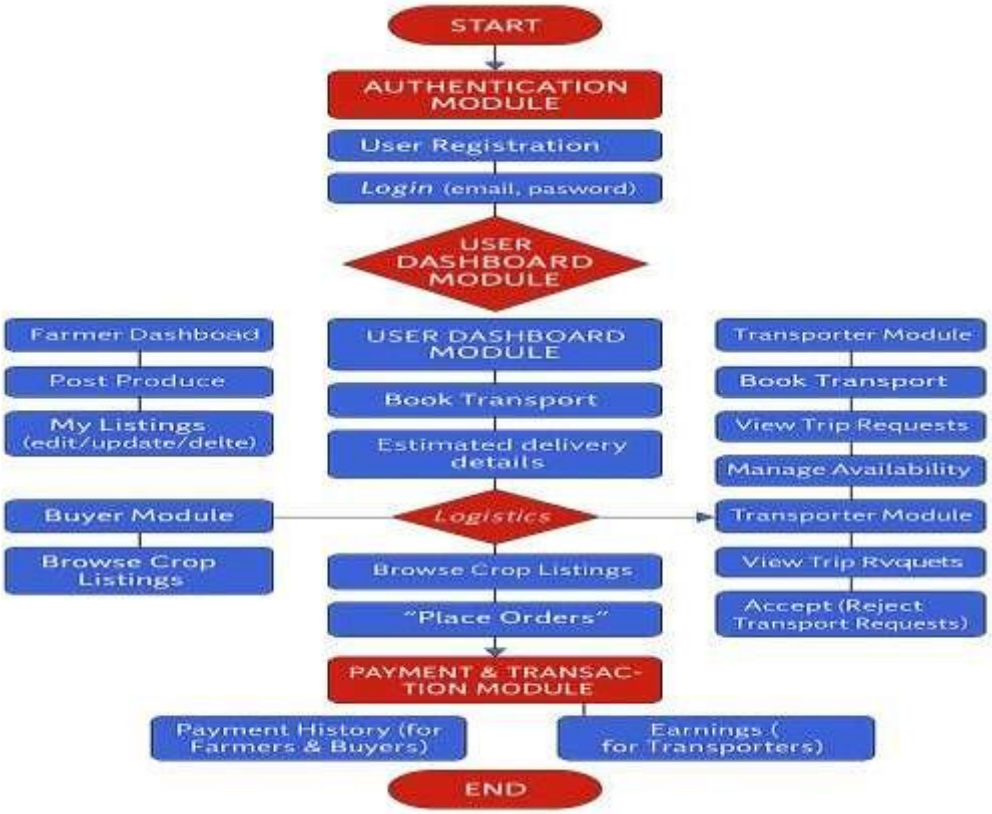
A. H. Al-Saidi et al., "The Use of IoT in the Agriculture Supply Chain: A Review," IEEE Internet of Things Journal, vol. 8, no. 6, 2021.

Al-Saidi et al. (2021) provide an extensive review of IoT applications in the agricultural supply chain, emphasizing the role of IoT technologies like smart sensors, cloud computing, and real-time analytics in improving the transparency and efficiency of agricultural logistics. Their work demonstrates how IoT solutions can help track environmental conditions, monitor agricultural products, and enhance decision-making by providing accurate, real-time data. Krishi Bridge draws directly from these innovations, employing IoT technologies for real-time visibility and data-driven decision-making. The platform's use of IoT for tracking goods and vehicles aligns with the findings of Al-Saidi et al., reinforcing the importance of transparent supply chains and data-driven logistics in modern agricultural transportation

IV. METHODOLOGY

The Smart Agricultural Marketplace System provides role-based access for farmers, buyers, and transporters to streamline crop trading, logistics, and payments. Farmers post produce, buyers browse and place orders, and transporters manage deliveries, all within an integrated digital platform. Secure authentication, live tracking, structured dashboards, and seamless transactions enhance efficiency, transparency, and direct market access.

Flow Chart :

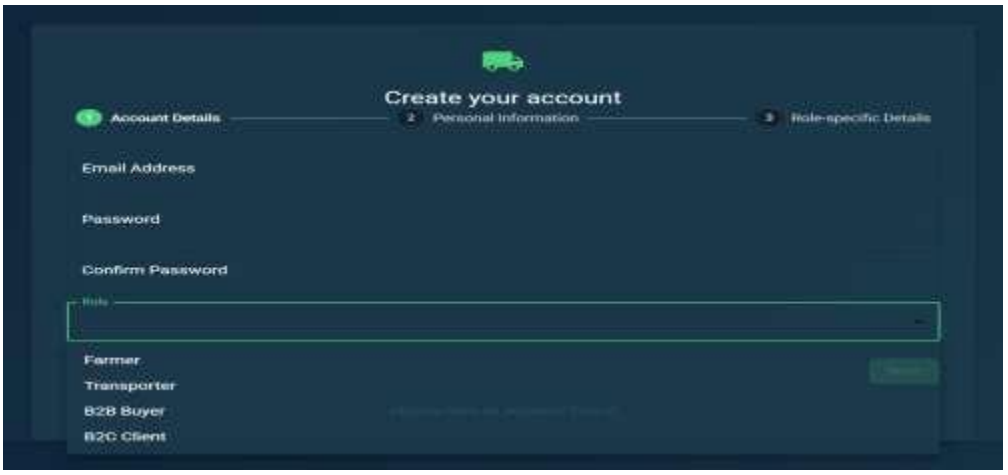


This Flowchart explains the working flow of Krishi-bridge Finder and Booking System. At start user or mechanic need to sign in through the app, if they already have an account, they can sign in and move to home page. Or else they need to sign up using their existing mail or need to sign in though google account

After login, users access their respective dashboards based on their role—Farmer, Buyer, Transporter, or Admin. They perform tasks like posting produce, placing orders, managing deliveries, or overseeing platform operations. The system then handles logistics, live tracking, and secure transactions to ensure smooth operations.

USER REGISTER MODULE

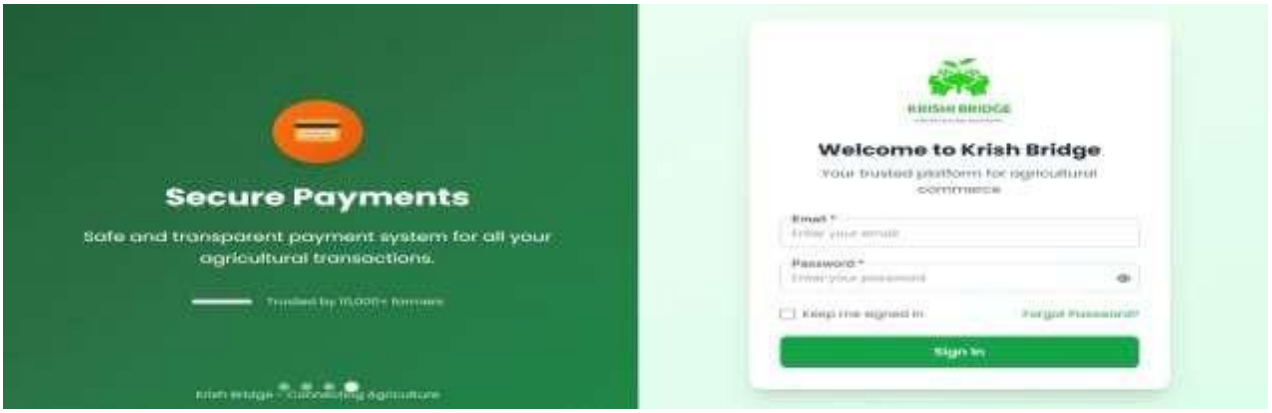
This module is known as register module. If the user doesn't have an account the user clicks the signup button it directs to **this module.**



This module asks the details of the user to create a new account. In the first box we must enter the name of the user the hint is also given as name in the text area. The next is mobile no here the user need to enter the mobile number, here there are some credentials to follow.We must enter only ten number example "1234567890" more or less than that it shows invalid number only numbers are allowed not alphabets and special characters are not allowed. The next text area is mail id the user needs to enter the mail id of the user. Here also there are some credentials the mail id should contain "@gmail.com" followed by mail id.

The Krishi-Bridge registration process ensures secure onboarding for farmers, buyers, transporters, and admins Users provide their name, email, phone number, and password to create an account. hey select their role (Farmer, Buyer, Transporter, or Admin) during registration. OTP verification ensures authenticity before account activation. After successful registration, users are redirected to their respective dashboards. Farmers can list produce, manage transactions, and book transport. Buyers browse available crops, place orders, and track deliveries. Transporters manage delivery requests and availability. Admins oversee platform operations, user activities, and dispute resolution. Encrypted credentials ensure data privacy and prevent unauthorized access. Secure authentication methods like OTP and email verification enhance security. This structured process ensures smooth onboarding, role-based access, and secure transactions for all users in Krishi-Bridge

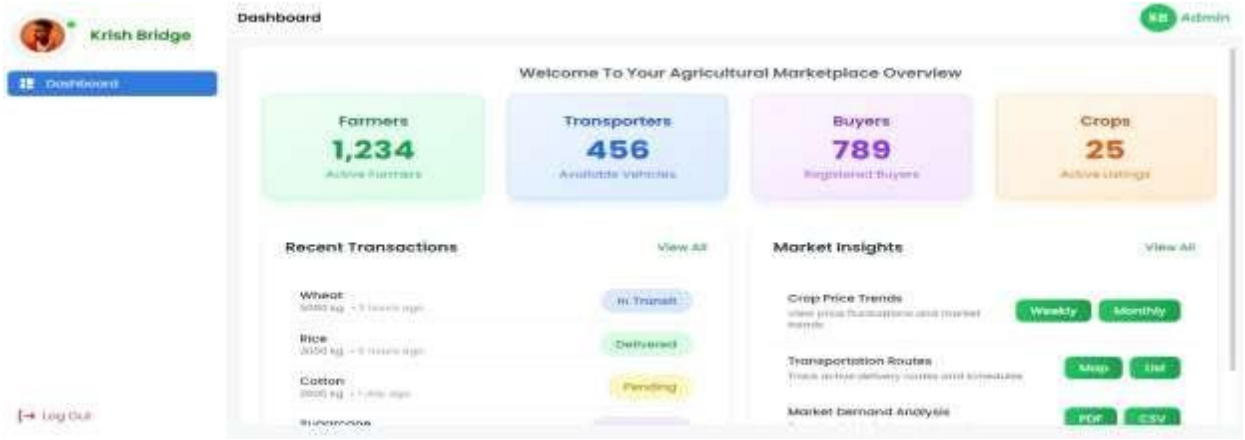
SIGN IN MODU



This module is known as sign in Module. In this page the user can login using the email id and password if the user is already registered. Here the first text area contains mail id where user should enter the mail id and user need to enter the password and click the login button, it directs to map module there is also a check box to show the password. Here the module contains forgot password were the user gets the OTP in mail id and the user can reset the password. The module contains a sign-up page if user is new to application he can register in the application. Google sign in is also in the module so that user can easily login through mail id and access the application.

Admin Portal

The **Admin Portal** in **Krishi-Bridge** manages users, transactions, and system operations to ensure smooth functionality. Admins oversee produce listings, transport scheduling, payments, and dispute resolution. They also generate reports and ensure security, keeping the marketplace efficient and transparent



Farmer Portal

The Farmer Dashboard allows farmers to manage their produce by posting, updating, and deleting listings. They can also view offers from buyers, helping them make informed selling decisions. Additionally, farmers track payment history, ensuring smooth transactions for their produce sales.

Transporter Portal:

The Transporter Dashboard allows transporters to view trip requests for produce delivery. They can manage availability, accept or reject transport jobs, and track ongoing trips. Earnings, completed deliveries, and route optimization features help ensur e efficient logistics.

Buyer Portal:

The Buyer Dashboard allows buyers to browse available crop listings and place orders seamlessly. It provides order tracking, payment history, and delivery updates for a smooth purchasing experience. Buyers can also manage preferences, view transaction details, and communicate with sellers efficiently.

V. Mathematical Module

1. Matching Function (M)

The system uses lustering and rule-based filtering to match farmers with buyers and transporters:

$$M(f, b, t) = \underset{x}{\operatorname{argmax}} \left(\sum_{i=1}^{n} W_i \cdot S_i \right)$$

)

Where:

- f = Farmer data (crop type, quantity, location)
- b= Buyer preferences (price, demand)
- t = Transport availability (cost, route efficiency)
- W_i= Weight assigned to each matching criterion
- S_i = Scoring function for match quality

2. Route Optimization (R)

The shortest path algorithm (Dijkstra's or A) is used to minimize transport costs:

$$R = \min \sum_{i=1}^{n} C_i \cdot D_i$$

Where:
- C_i= Cost per kilometer
- $D_{i=}$ Distance between farmer and buyer

3. Dynamic Pricing Model (P)
The system adjusts pricing based on demand-supply fluctuations:

P = P_0 + α. (D - S)

Where:
- P_0 = Base price
- α = Adjustment factor
- D= Current demand
- S= Available supply

VI. System Architecture

1. Presentation Layer (User Interface)
- Mobile/Web App (Flutter-based)
- Features: Crop listing, transport booking, real-time tracking, payment processing

2. Application Layer (Business Logic)
- Backend API (Node.js/Django)
- Functions:
  - Matching farmers with buyers
  - Route optimization
  - Secure transactions

3. Machine Learning Layer
- AI Models:
  - Demand forecasting (ARIMA, LSTM)
  - Price prediction (Regression models)
  - Transport efficiency (Graph-based algorithms)

4. Data Storage Layer
- Firebase / SQL Database
- Stores:
  - User profiles
  - Transaction logs
  - Historical pricing trends

5. Notification Layer
- Firebase Cloud Messaging (FCM)
- Sends:
  - Price alerts
  - Transport availability updates
  - Demand-supply insights

VII. Algorithm:-

Step 1: Load Farmer, Buyer, and Transport Data (D)
- Collect real-time requests from farmers (crop type, quantity, location).
- Gather buyer demands (required quantity, price preferences).
- Fetch transporter availability and pricing details.

Step 2: Preprocess Data
- Handle missing values (e.g., incomplete requests, unavailable transport).
- Normalize pricing and quantity values.

- Extract geolocation features for optimal matchmaking.

Step 3: Match Farmers with Buyers & Transporters
- Apply AI-driven smart matching algorithms (Clustering + Rule-Based Filtering).
- Rank buyers based on price offered, demand urgency, and location.
- Select the best transporter using route efficiency and cost parameters.

Step 4: Optimize Transport Routes
- Use Graph-Based Algorithms (Dijkstra's, A) for shortest delivery paths.
- Calculate fuel cost, road conditions, and estimated time of arrival.
- Reassign transport dynamically if delays are detected.

Step 5: Real-Time Monitoring & Tracking
- Enable GPS-based tracking for all shipments.
- Send live updates and notifications to farmers and buyers.

Step 6: Secure Payments & Verification
- Handle transactions securely with encrypted payment processing.
- Verify deliveries using OTP confirmation before completing payments.

Step 7: Push Analytics & Predictions
- Store transaction logs in Firebase or database for future recommendations.
- Generate insights on demand trends, price fluctuations, and logistic efficiency.

Step 8: Send Automated Alerts
- Notify farmers about high-demand crops to maximize profits.
- Alert buyers when new suppliers match their preferences.
- Warn transporters about urgent shipments needing priority dispatch.

VIII. CONCLUSION

Krishi Bridge offers a streamlined, digital approach to handling agricultural transportation needs. By bringing together farmers, transporters, and administrators, it solves many longstanding inefficiencies in farm logistics. The modular design allows scalability and adaptability to regional needs. However, future developments can enhance functionality. We plan to add AI-driven vehicle suggestions based on historical booking data, multilingual support for better accessibility, and an offline-first mobile application for rural areas with poor internet. Moreover, integrating cold chain logistics and warehouse modules will expand its use case beyond simple transportation. Field testing with real farmer groups and partnerships with cooperatives are planned next. With further enhancements, Krishi Bridge can contribute to building a resilient and technology-enabled rural supply chain Enables farmers and transporters to track vehicles and goods in real-time, ensuring transparency and timely delivery. GPS-Based Real-Time Tracking Crop-Based Load Estimation Calculates load requirements based on the type and volume of crops, improving vehicle utilization and logistics planning Integrated Analytics Dashboard Krishi-Bridge is more than just a logistics platform it is a catalyst for agricultural transformation. By leveraging AI, data analytics, and digital connectivity, it empowers farmers, optimizes transport networks, and strengthens rural economies With continuous innovation and strategic partnerships, Krishi-Bridge is set to redefine agricultural logistics, ensuring sustainable growth, fair trade, and enhanced profitability for farmers worldwide.

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