

KrishiSahyog: A Farmer-Focused E-commerce platform with Auction Capabilities

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Abstract—Farmer empowerment is crucial for addressing the challenges faced by Indian farmers, such as low profit margins, limited market access, and exploitation by intermediaries. To tackle these issues, this study introduces an e-commerce platform that serves as both a marketplace and an auction system for agricultural products. The platform eliminates intermediaries by directly connecting farmers with consumers and buyers, ensuring fair pricing and reducing the commerce chain. It offers features like product listings, real-time auctions for high-value crops, secure transactions, and personalized dashboards, all while supporting regional languages to cater to the diverse needs of Indian farmers. The platform provides a robust, scalable, and user-friendly system that leverages modern information technology to enhance farmers' market reach, improve profitability, and provide insights into consumer demand. By doing so, it contributes to the digital transformation of India's agricultural economy.

Keywords- Farmer empowerment, E-commerce, Agricultural marketplace, Digital transformation

I. INTRODUCTION

Agriculture plays a crucial role in the Indian economy, making a significant contribution to the nation's Gross Domestic Product (GDP) and providing employment to a large segment of the population. However, despite its critical role, the agricultural sector faces persistent challenges that threaten the livelihoods of farmers. Issues such as fluctuating crop prices, exploitative middlemen, limited market access, lack of transparency in pricing, and inadequate technological integration exacerbate the struggles of farmers. These problems often result in low profit margins for farmers, who work tirelessly but remain unable to reap the full value of their produce. Additionally, the existing agricultural commerce chain is lengthy and inefficient, causing consumers to pay inflated prices while farmers receive minimal returns.

The root of these challenges lies in the lack of direct connectivity between farmers and buyers, limited awareness of market trends, and an absence of accessible technological platforms tailored for agricultural needs. These issues call for

an innovative solution that empowers farmers by bridging the gap between rural producers and urban consumers. Our project addresses these challenges by introducing a MERN stack-based e-commerce platform, specifically designed to serve as a marketplace and auction system for agricultural products.

The proposed platform aims to eliminate intermediaries, enhance market transparency, and offer farmers a direct, fair, and scalable way to sell their produce. By incorporating features such as real-time auctions, and secure transactions, the platform not only simplifies the commerce process but also promotes digital adoption among farmers. It has the potential to revolutionize agricultural marketing, improve farmers' income, and contribute to a more equitable and sustainable agricultural economy in India.

II. LITERATURE REVIEW

In [1], proposed by S. Kathar *et al.*, an auction system utilizing blockchain technology was developed to enhance agricultural trade. The framework ensures transparency and efficiency in crop auctions while safeguarding farmers' interests through a guaranteed Minimum Support Price (MSP). Challenges addressed include trust deficits in traditional markets and the need for decentralized control. Bhukta *et al.* [2] The "KisanConnect" platform proposes a dynamic pricing model for agricultural trade. By utilizing predictive analytics and market data, the system improves the fairness and efficiency of auctions between farmers and retailers, effectively addressing regional price disparities and forecasting crop demand.

Khedekar *et al.* [3] developed "Farmer Circle," an online auction website that directly connects farmers to businesses. By bypassing intermediaries, this system aims to provide higher profit margins for farmers while offering a transparent bidding process, improving accessibility to competitive market pricing. In [4], Kumarathunga *et al.* introduced a technology-enabled marketplace for smallholder farmers. The system aggregates produce from multiple farmers and employs auction-

based sales mechanisms to secure better prices, focusing on overcoming challenges related to low farm-gate prices in developing regions.

Shrivastava *et al.* [5] introduced a framework for agricultural marketing in India, integrating digital auctions and group marketing strategies. This approach seeks to enhance farmers' incomes by facilitating collective bargaining power and creating a more efficient and transparent market environment for agricultural products. Vasisht *et al.* [6] investigated a secure auctioning process using a task auctioning algorithm designed to promote transparency and reliability in agricultural transactions. The model emphasizes secure transaction protocols to safeguard the integrity of bids and market operations, minimizing fraud risks and fostering trust among participants.

Anandaraja *et al.* [7] emphasized the implementation of web and mobile-based platforms to deliver dynamic market information to farmers. The system provides real-time updates on market conditions, empowering farmers to make informed decisions about the optimal timing and location for selling their produce, thus enhancing their strategic market participation. Viswanadham *et al.* [8] created the "Mandi Electronic Exchange," a platform that digitizes agricultural markets in India. It offers functionalities like real-time price discovery, auction scheduling, and logistics optimization, focusing on maximizing social welfare and lowering costs for farmers. The platform addresses inefficiencies in the traditional Mandi system by integrating minimum support price mechanisms.

Ahmed *et al.* [9] introduced "Easy Mandi," an agricultural production trading platform tailored for the Indian market. This system simplifies the process of crop auctions by involving the Agricultural Produce Market Committee (APMC) to manage bidding processes. It promotes transparent pricing mechanisms and enables farmers to achieve better prices through competitive bidding. Imesha *et al.* [10] proposed a conceptual mobile application prototype designed to connect Sri Lankan farmers with retailers. This solution addresses challenges such as middlemen dependency by creating an online marketplace that reduces transaction costs and improves the efficiency of agricultural trade.

Gunawardana *et al.* [11] presented the "Ceylon E-Agro" mobile application, a technology-driven marketplace enabling farmers to auction crops and access real-time market prices. The system integrates IoT for crop yield monitoring and predictive analytics, ensuring better market participation and profitability for farmers. Gunavathie *et al.* [12] designed the "FAAP" mobile application to enhance agricultural trade using advanced technology. The platform allows farmers to conduct auctions by submitting crop details and setting initial prices, fostering transparent market dynamics and connecting directly with buyers.

Adhikari *et al.* [13] Proposed a market intelligence system for agricultural commodities, with cardamom as a case study. The system leverages auction data and predictive analytics to assist farmers in choosing profitable crops and strategizing their market participation based on historical trade trends. Khedekar *et al.* [14] introduced "AgriTech," an e-

commerce platform that integrates real-time crop management and market trends with auction functionalities. This system encourages sustainable agricultural practices by leveraging digital technologies for efficient resource utilization and decision-making.

Almutwa *et al.* [15] presented an electronic date market in Saudi Arabia, using a sellers' consortium to optimize auction processes. The model includes real-time bidding, market price discovery, and transparent allocation mechanisms, empowering farmers to negotiate better prices collaboratively.

III. PROPOSED SYSTEM

The system utilizes the auction algorithm to select winners based on the highest bid, while integrating a commission model to ensure the platform's sustainability.

A. Workflow of the Auction Algorithm

- 1) **Initialization:** The auction starts with the seller setting a base price p_{base} . Buyers (bidders) register their bids, initially set to $b_i = 0$.
- 2) **Bidding Process:** Each buyer i updates their bid based on the current price p and a minimum increment ϵ as:

$$b_i = p + \epsilon \quad (1)$$

The system stores all bids in a *priority queue* to efficiently retrieve the highest bid.

- 3) **Bid Evaluation:** At every iteration, the price of the item is updated as:

$$p = \max(p, b_i) \quad (2)$$

The system ensures that bids meet or exceed the current price, maintaining a competitive bidding process.

- 4) **Winner Determination:** After the bidding duration ends, the system declares the winner w as the participant with the highest bid:

$$w = \arg \max_i (b_i) \quad (3)$$

If two or more bidders submit the same highest bid, the system resolves ties based on the earliest submission or predefined criteria such as proximity to the seller.

- 5) **Transaction Confirmation:** The winner w is notified, and payment is processed. If the winner fails to finalize the transaction, the system automatically shifts to the next highest bidder.

• Time Complexity:

$$O(N \cdot M \cdot \log M)$$

where:

- N = number of bidders.
- M = number of auctioned items.
- $\log M$ accounts for maintaining the priority queue for bids.

• Space Complexity:

$$O(N \cdot M)$$

for storing bids, items, and auction metadata.

Metric	Auction Algorithm	Greedy Allocation	Static Pricing
Fairness of Pricing	High	Low	Medium
Resource Utilization	Optimal	Suboptimal	Suboptimal
Computational Cost	Medium	Low	Low
Scalability	High	Medium	Medium

Fig. 1: Auction Algorithm comparison with other bidding algorithms

B. Commission Logic

The *Krishisahyog* system sustains itself by charging a **commission fee** on completed transactions. The logic is as follows:

1) *Commission Fee Equation*: Let:

- b_w : Winning bid (highest bid).
- r : Commission rate (percentage charged by the platform).

The commission fee C is calculated as:

$$C = r \cdot b_w \quad (4)$$

The final payout to the seller P_{seller} is:

$$P_{\text{seller}} = b_w - C \quad (5)$$

The platform offers dynamic rates based on transaction value to incentivize higher-value auctions:

$$r = \begin{cases} r_1 & \text{if } b_w \leq T_1 \text{ (low-value transaction)} \\ r_2 & \text{if } T_1 < b_w \leq T_2 \text{ (medium-value transaction)} \\ r_3 & \text{if } b_w > T_2 \text{ (high-value transaction)} \end{cases}$$

where T_1 and T_2 are thresholds, and $r_1 > r_2 > r_3$.

2) *Revenue Equation for the Platform*: Let n be the number of completed transactions in a day. The total revenue R_{platform} is:

$$R_{\text{platform}} = \sum_{i=1}^n C_i \quad (6)$$

where C_i is the commission for transaction i .

IV. WORKING MODULE

In this section, we detail the key modules of the e-commerce platform designed to connect farmers with buyers through an intuitive and efficient system. The platform is comprised of multiple interconnected modules, each designed to address specific components of the buying and selling process. These include the Registration, Login, User, Crop, and Bid modules, which streamline user onboarding, product listing, and the auction process.

A. Registration

The Registration Module supports admins, buyers, and farmers with role-based access. It includes error handling, secure image storage via Cloudinary, and ensures smooth registration with role-specific permissions and data security.

B. Login

The Login Module enables users to access the platform with credentials and role selection (admin, farmer, or buyer). It includes error handling, secure authentication, and role-based access control for feature availability.

C. User

The User Module manages user profiles and their specific details based on their roles—Admin, Farmer, and Buyer. It provides a central location for users to view and update their personal information.

Admin:

- Name: Full name of the admin.
- Mobile: Admin's contact number for platform-related queries.
- Address: Admin's office or contact address.
- Role: Admin has full management privileges over the platform.
- Permissions: Ability to manage users, approve listings, and monitor transactions.

Farmer:

Farmer:

- Name: Full name of the farmer.
- Mobile: Farmer's contact number for communication and orders.
- Email: Unique email address for the farmer.
- Farm Address: The address of the farmer's farm.
- Farm Size: Size of the farm (e.g., in acres or hectares).
- Farming Type: Type of farming practiced (e.g., organic, conventional).
- Farming Experience: Number of years of farming experience.
- Farming Practices Description: Detailed description of farming techniques and practices.
- State: The state where the farmer operates.
- Region: The specific region or area within the state.
- Field Image: Uploaded image of the farmer's agricultural field (optional).

Buyer:

- Name: Full name of the buyer.
- Mobile: Buyer's contact number for order updates.
- Address: Delivery address for purchased goods.
- Order History: Access to a list of past purchases and orders.
- Cart: Ability to add crops for purchase.
- Bid: Can place a bid

Each user can update their details, and the platform ensures secure access to their role-specific information through the User Module

D. Crop

The Crop Module contains all essential information related to the agricultural products being listed. This includes details such as the crop name, type, price, and images. Sellers can capture photos of their crops during the bidding process and

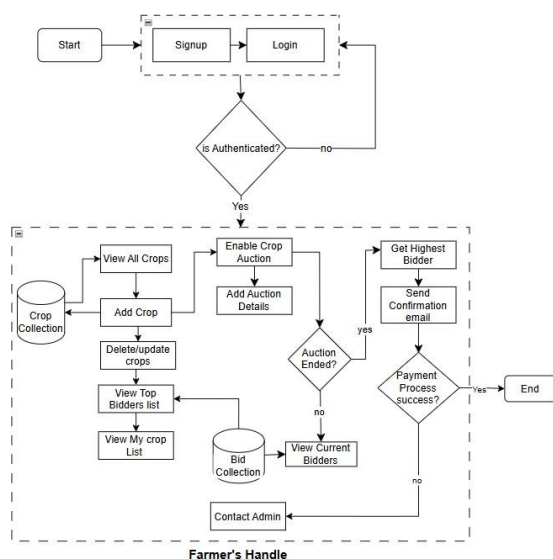


Fig. 2: Farmer's flowchart

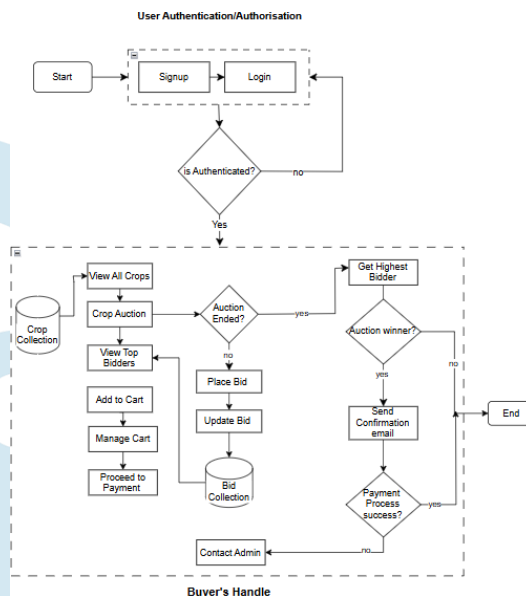


Fig. 3: Buyer's flowchart

upload them to the module, along with a detailed description of the product. The seller also sets a base price for the crop, which serves as the foundation for the starting bid. Buyers can view the crop details in this module to assess whether they want to participate in the auction. If interested, they can place a bid through the PLACE BID option. The seller also defines the duration for the auction, ensuring a clear timeframe for bidding.

E. Bidding

The Bid Module provides essential details regarding the auction, including the scheduled date and time for the bidding event. It displays information about active participants in the auction and includes the duration of the bidding process. These bidding details are accessible to all users on their respective portals, and those interested can choose to participate. To place a bid, the buyer's bid must exceed the starting price set by the seller. Bidders can only participate before the auction time expires. At the close of the auction, the product will be awarded to the highest bidder.

V. RESULT

The Krishi Sahyog platform is designed to connect farmers with buyers through an intuitive, user-friendly interface. The main outcomes of the platform's primary features, such as user registration, login, crop listing, bidding, and user interaction.

• Registration and User Management

The Registration Module supports three roles—admin, farmer, and buyer—ensuring tailored access and privileges for each. While the User Module makes it simple to manage profiles by enabling users to change personal information like contact details, farm data, and order history, the Login Module offers safe access depending on user role.

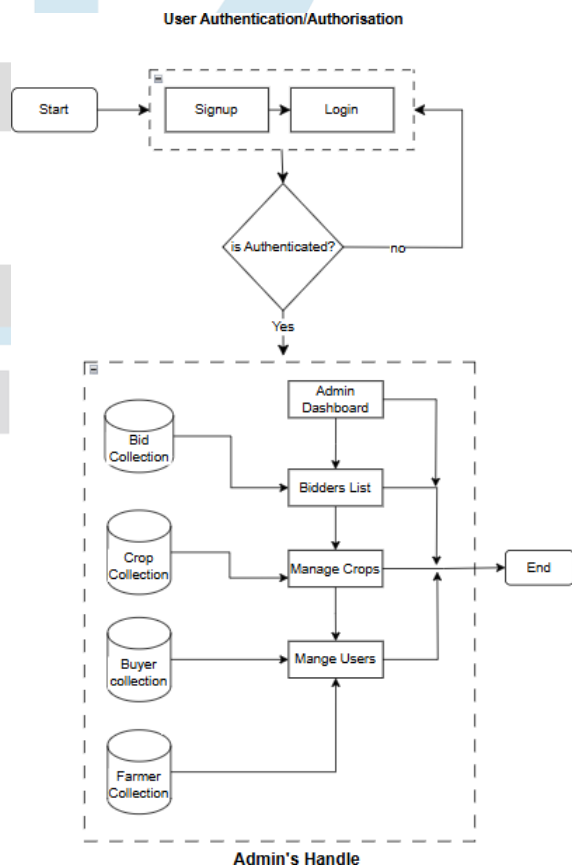


Fig. 4: Admin's flowchart



Fig. 5: Register



Fig. 6: Login

Crop Listing

The Crop Module allows farmers to list crops for sale by uploading images, providing descriptions, and setting base prices for auctions. It ensures that buyers can view detailed crop information, facilitating informed decisions. This module streamlines the process for farmers to showcase products and for buyers to find the crops they need.

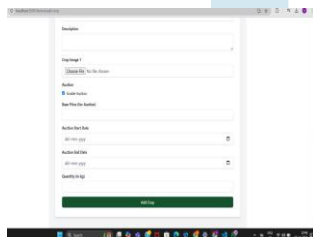


Fig. 7: Add crop

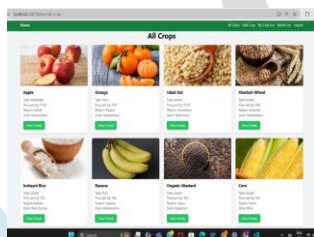


Fig. 8: All crops

Auction

The Auction Module enables farmers to list their crops for auction, specify base prices, and upload images along with descriptions. Buyers can view available crops, place bids, and track auction details. This module ensures a seamless exchange between buyers and sellers by streamlining the auction process.

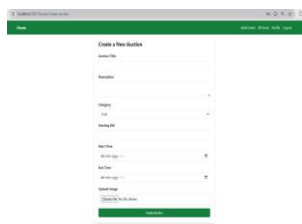


Fig. 9: Create Auction

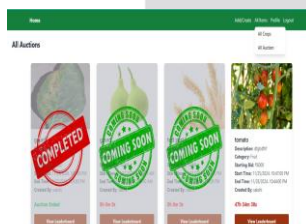


Fig. 10: Current Auctions

Buyer

The Buyer Module empowers buyers to acquire crops either by directly purchasing them from the marketplace or participating in auctions. In the marketplace, buyers can browse crops with detailed information such as name, type, price, and images, and make immediate purchases using the BUY NOW option. Alternatively, buyers can place bids in active auctions through the PLACE BID feature, provided their bid exceeds the starting price set

by the seller. The module ensures that buyers have a seamless experience, with options to view their order history, manage their cart, and track bids, making the process efficient and user-friendly.

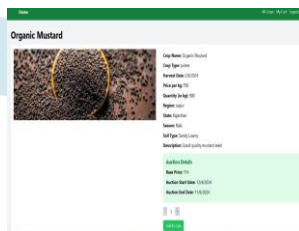


Fig. 11: Buy crop

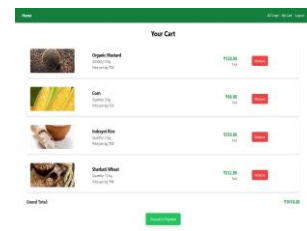


Fig. 12: My cart

Admin Dashboard Overview

The Admin Dashboard provides a comprehensive summary of platform activities. It displays key statistics such as a total of 19 users (10 farmers and 9 buyers), 11 crops listed, and 12 bids placed, with no crops sold yet. Among the comprehensive tables on the dashboard is "Crop vs. Maximum Bid," which shows the maximum bid for every crop. Additionally, it features a "Buyer Leaderboard," which ranks buyers according to their purchasing activity, and "Crop Categories vs. Distribution," which displays the quantity of crops in each category.



Fig. 13: Analysis 1

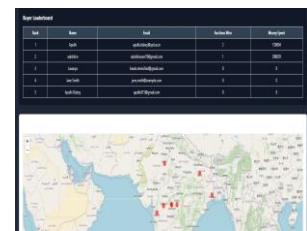


Fig. 14: Analysis 2

Multilingual Support

To enhance accessibility and reach a global audience, we integrated multilingual support into our platform using the Google Translate API. The process of integration included setting up the API using an authentication key, enabling real-time translations for both static (headers, buttons) and dynamic (user-generated text) content. The platform detects the user's preferred language based on browser settings or explicit selection, defaulting to English if unavailable. Once the language is detected, the content is sent to the API, which returns the intended translated text. The translated content is then dynamically rendered on the platform in real time, providing a seamless multilingual experience for users.

VI. CONCLUSION AND FUTURE WORK

In conclusion, the platform offers a robust solution for agricultural auctions, enabling secure registration, login, and role-based access for admins, farmers, and buyers. It ensures efficient crop listing, bidding, and transaction processes while

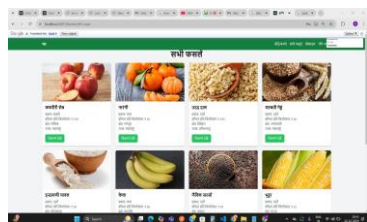


Fig. 15: Result 1

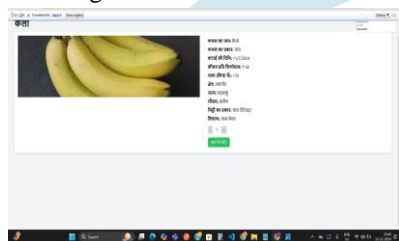


Fig. 16: Result 2

maintaining security through features like Cloudinary integration for image hosting and error handling. Future work includes developing a mobile application for wider accessibility, integrating secure payment systems, adding real-time notifications, and implementing advanced search and filter options. Additionally, machine learning for pricing optimization, multi-language support, and sustainability certifications can further enhance the platform's value, making it more efficient, user-friendly, and scalable for the agricultural community.

REFERENCES

- [1] S. Kathar, H. Hardel, Z. Alam, S. Phansalkar and R. Sajjan, "Auction System for Agricultural Trade Using Blockchain Technology: A Survey with Proposed Framework," 2021 IEEE Pune Section International Conference (PuneCon), Pune, India, 2021, pp. 1-10, doi: 10.1109/PuneCon52575.2021.9686543.
- [2] S. Bhukta, A. Shil, A. Dutta and B. Sadhukhan, "KisanConnect: Reshaping Agricultural Trade with Dynamic Pricing Model," 2024 2nd International Conference on Networking, Embedded and Wireless Systems (ICNEWS), Bangalore, India, 2024, pp. 1-7, doi: 10.1109/ICNEWS60873.2024.10730822.
- [3] L. Khedekar et al., "Farmer Circle: An Online Auction Website for Selling Crops Directly to Businesses," 2023 7th International Conference On Computing, Communication, Control And Automation (ICCUBEA), Pune, India, 2023, pp. 1-3, doi: 10.1109/ICCUBEA58933.2023.10391970.
- [4] M. Kumarathunga, R. Calheiros and A. Ginige, "Technology-enabled online aggregated market for smallholder farmers to obtain enhanced farm-gate prices," 2021 International Research Conference on Smart Computing and Systems Engineering (SCSE), Colombo, Sri Lanka, 2021, pp. 28-37, doi: 10.1109/SCSE53661.2021.9568292.
- [5] S. Shrivastava and S. N. Pal, "A Framework for Next Generation Agricultural Marketing System in Indian Context," 2019 IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE), Bangalore, India, 2019, pp. 1-4, doi: 10.1109/WIECON-ECE48653.2019.9019983.
- [6] S. Vasishth, M. Pranav and D. B. Srinivas, "A Secured Auctioning Process Using Task Auctioning Algorithm," 2021 IEEE International Conference on Mobile Networks and Wireless Communications (ICM-NWC), Tumkur, Karnataka, India, 2021, pp. 1-5, doi: 10.1109/ICM-NWC52512.2021.9688389.
- [7] N. Anandaraja, N. Sriram, C. Kathiresan, S. Sebastian and E. Vadivel, "Web cum mobile based dynamic market information support for Agri-Horti produces: Linking the farmers with market," 2009 International Conference for Internet Technology and Secured Transactions, (IC-ITST), London, UK, 2009, pp. 1-6, doi: 10.1109/ICITST.2009.5402541.
- [8] N. Viswanadham, S. Chidananda, Y. Narahari and P. Dayama, "Mandi electronic exchange: Orchestrating Indian agricultural markets for maximizing social welfare," 2012 IEEE International Conference on Automation Science and Engineering (CASE), Seoul, Korea (South), 2012, pp. 992-997, doi: 10.1109/CoASE.2012.6386465.
- [9] S. Ahmed, M. K. Gurve and S. Shukla, "Easy Mandi - An Agricultural Production Trading Platform for Indian Markets," 2022 8th International Conference on Signal Processing and Communication (ICSC), Noida, India, 2022, pp. 112-116, doi: 10.1109/ICSC56524.2022.10009210.
- [10] N. Imesha et al., "Building a Digital Bridge Between Sri Lankan Farmers and Retailers: Conceptual Mobile Application Prototype," 2023 IEEE 17th International Conference on Industrial and Information Systems (ICIS), Peradeniya, Sri Lanka, 2023, pp. 115-120, doi: 10.1109/ICIS58898.2023.10253567.
- [11] L. A. Imalka, K. G. A. Gunawardana, K. M. S. K. Kodithuwakku, H. K. E. Arachchi, S. M. B. Harshanath and S. Rajapaksha, "Farming Through Technology Driven Solutions For Agriculture Industry Ceylon E-Agro mobile application-find technology based solutions for agricultural problems," 2022 IEEE 10th Region 10 Humanitarian Technology Conference (R10-HTC), Hyderabad, India, 2022, pp. 306-310, doi: 10.1109/R10-HTC54060.2022.9929335.
- [12] M. A. Gunavathie, K. S. K. Rani, G. Renugadevi and M. Manikandan, "FAAP – A Farmer's Amiable Application to Enhance Agriculture using Mobile Technology," 2023 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India, 2023, pp. 1-5, doi: 10.1109/ICCCI56745.2023.10128421.
- [13] B. Adhikari, J. A. P and S. C. C., "Building Market Intelligence Systems for Agricultural Commodities: A Case Study based on Cardamom," 2021 2nd International Conference on Secure Cyber Computing and Communications (ICSCCC), Jalandhar, India, 2021, pp. 12-16, doi: 10.1109/ICSCCC51823.2021.9478105.
- [14] L. Khedekar et al., "AgriTech: Technology Driven E-Commerce Platform for Sustainable Agricultural Development," 2024 8th International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), Kirtipur, Nepal, 2024, pp. 1164-1168, doi: 10.1109/I-SMAC61858.2024.10714818.
- [15] S. Almutwa and S. Hong, "An Electronic Date Market with Sellers' Consortium in Saudi Arabia: A Mathematical Model and Simulation," 2019 International Conference on Computational Science and Computational Intelligence (CSCI), Las Vegas, NV, USA, 2019, pp. 505-509, doi: 10.1109/CSCI49370.2019.00097.