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Bilateral Exchange System for Fresh Produce Selling using Auction Simulator

L.Vasanth[1], P. Kavitha[2], S. Kamalakkannan[3]
PG Student, Department of Computer Applications[1]
Assistant Professor, Department of Computer Applications[2]
Associate Professor, Department of Computer Applications[3]
Vels Institute of S0cience Technology and Advanced Studies, Pallavaram, Chennai, India
vasanth3649@gmail.com, pkavikamal@gmail.com, Kannan.scs@velsuniv.ac.in

Abstract: *Fresh products (such as produce, meats and seafood, etc.) are a necessity of life, and, as such, play a pivotal role in human evolution. Traditional selling systems often rely on local markets and direct sales, limiting the reach to a specific geographic area. Producers often rely on middlemen or local distributors in traditional systems, which can lead to reduced profit margins for farmers. Maintaining consistent quality throughout the supply chain can be challenging in traditional systems. Fresh produce has a limited shelf life, and maintaining its freshness throughout the supply chain is crucial. Short shelf life requires quick turnover, and any delays in transportation or storage can lead to spoilage, resulting in losses for producers. Producers may lack access to market intelligence and information on pricing trends, demand forecasts, and emerging consumer preferences. Addressing these problems this project develops a truthful and efficient Double Auction mechanism for produce trading systems.In the context of fresh produce selling, a double auction system proves invaluable as it allows both Procures and Producers to actively engage in the market dynamics. In this trading system, an e-commerce platform acts as the auctioneer, organizing and overseeing an auction between procurers and growers. Procurers submit bids, and the auctioneer confirms and halts the auction. Winners are then announced along with the final prices. Winning procurers obtain allocated produce and make payments, while growers receive payment and provide the produce according to the allocation results.*

Keywords: Security, User data, financial transactions, Regulatory Compliance, Regulations Auctions, Financial transactions.

I. INTRODUCTION

Farmers have a variety of options when it comes to selling their agricultural products. Direct-to-consumer outlets like farmer's markets and community supported agriculture (CSA) subscription programs typically garner the best price point compared to other outlets, but they are also the most labor intensive and require a significant amount of time and money spent on marketing. Self-managed wholesale to restaurants, grocers, and institutions can be profitable but are also logistically complex, in terms of availability lists, order communications, custom packing, and delivery routes. The ever-changing technological requirements to manage these processes and stay competitive can be a barrier for farmers without those technologies (such as members of the Plain communities).

The produce auction, in contrast, provides a one-stop market outlet that allows farmers to spend less time searching for buyers and customizing orders and more time doing what they do best: farming. Buyers win, too. Produce auctions give buyers a front-row seat to the abundance of the season. For the right price, this could mean walking away with the very first tomatoes of spring (ahead of other market outlets) or the last peppers of autumn. Buying at the auction gives buyers the opportunity to see products and judge their quality before they commit to purchasing. Auctions also give buyers immediate cost benefits (lower prices) when supply is high that might not be reflected in other mediated market outlets.Auctions provide advantageous sourcing opportunities for a variety of food businesses – restaurants, retail farm markets, supermarkets, hospitals, universities, K12 schools, and more. Auctions bring together a wide variety of

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seasonal products from dozens of farms. This creates a one-stop shop for buyers and makes sourcing from local farms easier than coordinating with each farm individually. For buyers dealing in high volume, auctions are a great solution.
Both bidders and sellers are aware of the bids that are submitted when performed in an open format. Bidders aren't aware of other bids when in a closed environment. Auctions may be live, or they may be run on an online platform. The asset or service in question will be sold to the party that places the highest bid in an open auction, and to the highest bidder in a closed auction.

II. LITERATURE SURVEY

This literature survey focuses on auctions and bidding behavior, analyzing them through various theoretical and experimental lenses. Here's a breakdown of the key themes explored in the provided references

Auction Mechanisms: Several articles explore different auction formats, including sealed-bid auctions (Smith 1962; Cox et al. 1992), multi-unit demand auctions (Kagel & Levin 1991), Vickrey auctions (Kagel & Levin 1991), clock-proxy auctions (Cramton & Ausubel 2005), and combinatorial auctions (Cramton & Ausubel 2005).Shogren et al. (2000) delve into the connection between auction mechanisms and measuring willingness to pay (WTP) and willingness to accept (WTA).

Experimental Analysis: A significant portion of the research employs experimental methods to study auction behaviour. Smith (1962) presents a foundational experimental study on competitive markets.Kagel& Levin (1991, 1995) analyse bidding behaviour in different auction formats through experiments.

Buyer Behavior and Market Outcomes: The impact of buyer identity and online auctions is addressed by Noussair & Medema (2008).Bulow & Klemperer (1996) explore auctions as an alternative to negotiations, examining their effects on prices. McAfee & McMillan (1996) analyze a specific case - the airwaves auction - to understand bidding strategies and market outcomes.

Theoretical Frameworks: Enge lbrecht-Wiggans (1989) provides a survey of auction and bidding models, offering a theoretical foundation for understanding these concepts.

Behavioral Economics: Gneezy & Rustichini (2000) explore the connection between auctions and behavioral economics, suggesting that fines can function similarly to prices.

This literature survey establishes a comprehensive overview of auction theory and its experimental validation. It delves into various auction mechanisms, buyer behaviour, market outcomes, and theoretical frameworks. Additionally, it touches upon the intersection of auctions and behavioural economics. By analysing these references further, you can identify research gaps, develop your research question, and position your study within the existing body of knowledge.

III. METHODOLOGY SECTION

This document describes an Auction Simulator designed to replicate a Bilateral Exchange System. Here's a concise breakdown:

- **Functionality:** Simulates real-world auctions with bilateral exchange (buying and selling directly between participants)
- **Technology Stack (Example):** Python, Flask, MySQL, Bootstrap (other options possible).

Modules:

- **Double Auction Mechanism:** Facilitates price discovery through simultaneous bids and offers.
- **User Dashboards:** Separate interfaces for Auctioneers, Producers (sellers), and Procurers (buyers).
- **Producer Dashboard:** Manage product listings, bids, auction participation, deliveries, and payments.
- **Procurer Dashboard:** Manage procurement needs, bids, auction participation, payments, and product receipt.
- **Auction Request:** Allows Auctioneers to define auction parameters (start time, duration, rules).
- **Auction Organization:** Schedules auctions, enforces rules, and provides real-time monitoring.
- **Bidding Model:** Interface for submitting bids and offers (buying/selling price).
- **Auction Halt:** Pauses or stops auctions based on pre-defined rules (volatility, irregularities).
- **Winner Determination:** Identifies winning bids/offers based on auction rules.

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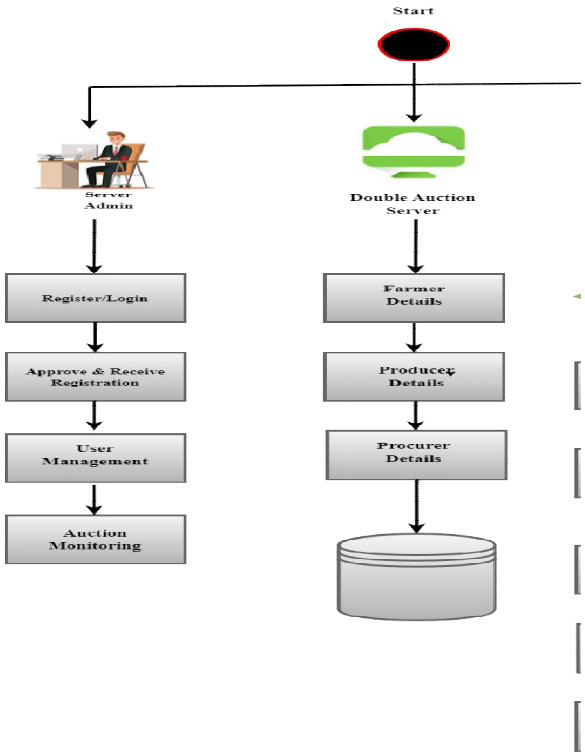
- **Produce Allocation:** Assigns winning bids/offers to corresponding producers and procurers.
- **Payment Processing:** Handles financial transactions between participants and the Auctioneer.
- **Notification:** Informs participants about key events (auction start, bid updates, halts, results).
- **Reports:** Generates reports on completed auctions (bids, prices, allocations, transactions).
- **Security:** Implement robust security measures to protect user data and financial transactions.
- **Regulatory Compliance:** Ensure the simulator adheres to relevant regulations governing auctions and financial transactions (if applicable).

By incorporating these enhancements, the Bilateral Exchange Auction Simulator can become a more versatile and powerful tool for various stakeholders, including researchers, businesses, and educational institutions.
This simulator can be a valuable tool for understanding and simulating real-world auction dynamics.

System Architecture



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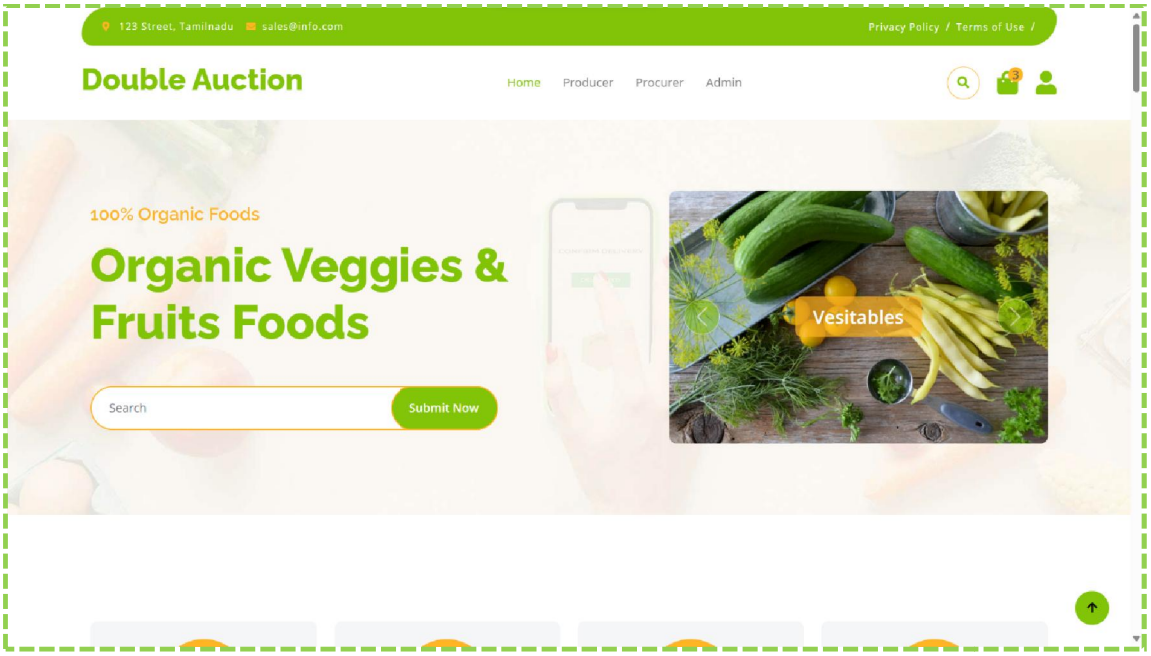
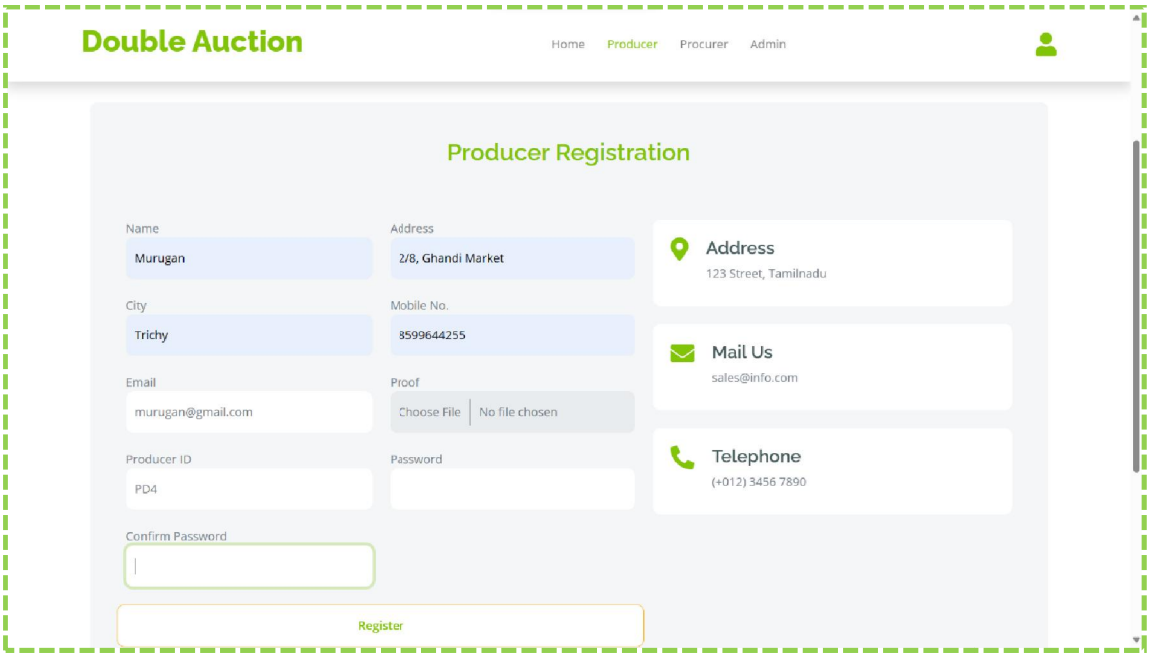
IV. EXPERIMENTAL RESULTS





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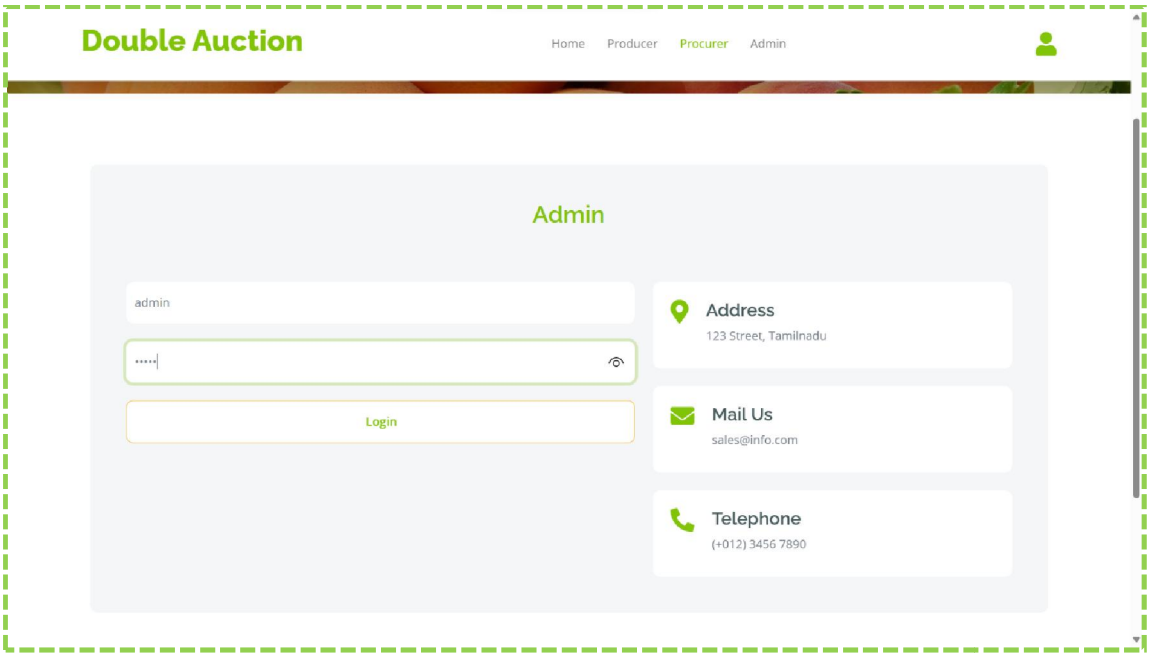

V. CONCLUSION

In conclusion, the project proposed a transformative approach to the traditional methods of fresh produce trading. This project addresses key challenges faced by producers and procurers in existing systems, introducing a dynamic and efficient Double Auction Mechanism facilitated by an e-commerce platform as the auctioneer. By leveraging this innovative system, the project aims to overcome the limitations of traditional local markets and direct sales, providing a broader market reach beyond geographic boundaries. The introduction of real-time bidding, bid confirmation processes, and dynamic price announcements ensures a transparent and streamlined auction experience for all participants. The integration of market intelligence into the platform empowers stakeholders with essential information on pricing trends, demand forecasts, and emerging consumer preferences. This knowledge facilitates informed decision-making, contributing to a more adaptive and responsive fresh produce market. The project also addresses issues such as middlemen dependency, limited shelf life, and quality consistency throughout the supply chain. Through the efficient allocation of produce and swift payment processes, it aims to improve profit margins for growers while minimizing losses associated with spoilage and delays. Furthermore, the system's adaptability to the perishable and fluctuating nature of fresh produce, along with its reduced refrigeration time, aligns with sustainability goals, contributing to a more environmentally conscious agricultural supply chain. In essence, the project is poised to revolutionize the fresh produce market, offering a dynamic, transparent, and efficient platform that benefits both producers and procurers. The project represents a significant step towards a sustainable and profitable future for the fresh produce industry.

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