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A Scalable Architecture for Real-Time Multi-Vendor Price Aggregation and Comparison

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Abstract: ***Nowadays, Quick Commerce (Q-Commerce) has rapidly transformed retail business by enabling ultra-fast delivery of essentials through platforms like Blinkit, Zepto, Swiggy Instamart, and BigBasket. However, inconsistent pricing and also lack of transparency across platforms creates confusion for customers while making decisions on purchasing. This paper addresses this challenge by designing and implementing a scalable centralized architecture that will aggregates and compares real-time product prices from multiple vendors or platforms. Also, the proposed architecture allows customers to view delivery times, offers, and vendor reliability. Finally, the proposed architecture enables customers to effortlessly find the best value, save money, and make better purchasing choices, while simultaneously driving healthier competition in the market.***
Keywords: Multi-Vendor, Price Comparison, Q-Commerce, and Web Scraping.

I. INTRODUCTION

In recent years, the concept of Q-Commerce has revolutionized the consumer retail experience, primarily in urban and semi-urban areas [1-3]. Also, Q-Commerce platforms like Blinkit, Zepto, Swiggy Instamart, and BigBasket have rapidly expanded their reach by its promise of ultra-fast delivery of groceries, household essentials, and daily needs. However, the major drawback of these platforms from the customer point of view is the lack of price transparency. i.e., customers frequently encounter variations in the prices of the same product across different platforms [4], which not only leads to confusion but also missed opportunities to save money. The increasing demand for digital solutions that empower customers to make informed decisions has paved the way for the development of our proposed architecture tailored specifically for Q-Commerce. The proposed architecture serves as a centralized system that aggregates prices from multiple vendors, processes this data using customized algorithms, and displays it in a user-friendly format. Customers can also filter results based on criteria such as price, delivery time, vendor rating, and active promotions. The primary goal is to streamline the online shopping experience while ensuring that customers receive the best value for their money. On the other hand, the proposed system promotes fair competition among Q-Commerce providers by making price differences more transparent. The rest of the paper is organized as follows: literature review, proposed system, snapshots, and conclusion.

II. LITERATURE REVIEW

The literature on price comparison tools and Q-Commerce platforms reveals a growing academic and industrial interest in optimizing consumer purchasing behaviours through digital innovations.

Several studies have addressed the challenges and potential of integrating web scraping and API-based systems to develop real-time price comparison platforms. One notable work in the literature [5] discusses a methodology that uses web mining techniques such as web crawling and scraping to gather data across e-commerce platforms. This research highlights the importance of consolidating product information into a single interface, allowing users to make faster and better purchasing decisions. It also underscores the technical complexities involved in handling dynamic content, frequent updates, and maintaining data integrity.

Another significant study [6] focuses on the development and testing of a web application that monitors product prices in real-time across multiple vendors. The study validates the effectiveness of web scraping tools like Beautiful Soup and Selenium in extracting structured data from Hypertext Markup Language (HTML) content, even when APIs are unavailable. It emphasizes the role of user-friendly design in improving the usability of price comparison tools. The researchers conclude that real-time price comparison platforms substantially improve user satisfaction and shopping efficiency, especially when integrated with intuitive filtering and ranking mechanisms. The paper [7] explores the behavioural impact of such platforms on customers. It introduces the concept of E-switching, where users switch between platforms based on pricing, service quality, or user experience. This study found that while price comparison websites influence customer behaviour, the degree of influence depends on individual traits such as service consciousness and perceived usefulness of advertisements. Innovativeness, although less impactful on platform usage, plays a pivotal role in customer's willingness to try new price comparison tools.

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Studies [8] and [9] have proposed systems that not only scrapes product prices from multiple e-commerce platforms but also uses machine learning models to provide accurate, up-to-date price information. These hybrid models have focused on enhancing customer experience by providing purchasing suggestions and alerts based on forecasted price trends. Both papers have demonstrated the advantage of combining traditional scraping with machine learning to achieve proactive price comparison, thus extending the value proposition beyond just real-time aggregation.

On the other hand, recent significant contribution [10] offers insightful information about how to choose the best online scraping methods for developing real-time pricing comparison tools and also emphasizes how platform-specific issues affect the precision and effectiveness of data extraction.

Further, the study [11] has focused on developing a framework and criteria for the complete evaluation of e-commerce web sites.

Collectively, these studies form a solid foundation for the development of the proposed system. They emphasize not only the technical feasibility of building such a tool using web scraping and API methods but also highlight its socio-economic importance. By addressing the identified gaps in existing literature namely lack of real-time updates, limited platform integration, and user interface design this work aims to contribute both academically and practically to the growing field of digital customer analytics.

III.PROPOSED SYSTEM

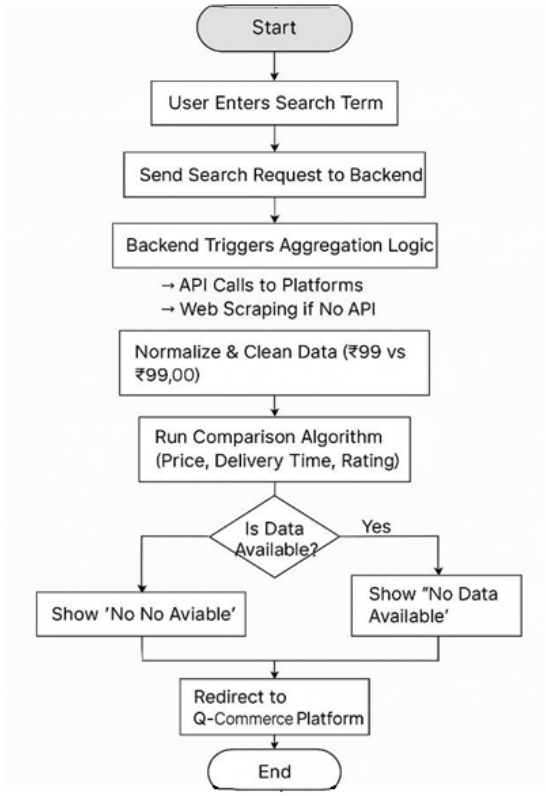


Fig. 1 Flow diagram of our proposed system

The proposed system shown in Fig. 1 is structured using a modular, layered architecture consisting of three core layers: the Frontend, Backend, and Data Aggregation Layer, aligned with an agile development methodology for iterative improvement and scalability. The Frontend, developed using React.js, is designed for seamless user interaction. It enables functionalities such as product search, filtering based on price, delivery time, vendor rating, and promotional offers. This layer communicates with the backend via RESTful APIs to retrieve real-time data dynamically and display it in a user- friendly format.

The Backend, built using Flask (or optionally Node.js for asynchronous operations), manages critical operations including request handling, session management, and price comparison logic. It connects to both the database and scraping modules to ensure accurate and up-to-date information. It also handles custom ranking algorithms that prioritize results based on delivery speed, vendor reliability, and discounts, giving users an optimized view of all available options.

The Data Aggregation Layer forms the backbone of the platform's intelligence. This hybrid layer uses both API integration (where platform support is available) and web scraping techniques via tools like Beautiful Soup, Selenium, and Puppeteer to collect data from Q-Commerce websites. These tools are capable of handling static as well as JavaScript-rendered content, ensuring that even platforms without public APIs can be accurately included in the comparison engine. The data is periodically refreshed to maintain real-time accuracy with minimal latency.

For data storage and management, databases such as MongoDB (for schema- less dynamic data) or MySQL / PostgreSQL (for structured relational data) are used. These databases store not only the current prices but also historical data, which can be leveraged for trend analysis in future versions of the platform. The entire development has followed the Agile model, involving iterative phases of requirement gathering, prototyping, testing (unit, integration, and performance), and deployment. Cloud services such as Amazon Elastic Compute Cloud (AWS EC2), Firebase, or Google Cloud are employed for deployment to ensure scalability, high availability, and effective load balancing. GitHub is used for version control and collaboration among developers.

In summary, the proposed system is a robust, scalable, and user-centric platform that promotes smarter and more transparent online shopping. It empowers consumers to make informed decisions while fostering healthy competition among Q-Commerce vendors.

IV. SNAPSHOTS

This section discusses some of the snapshots of the proposed system.

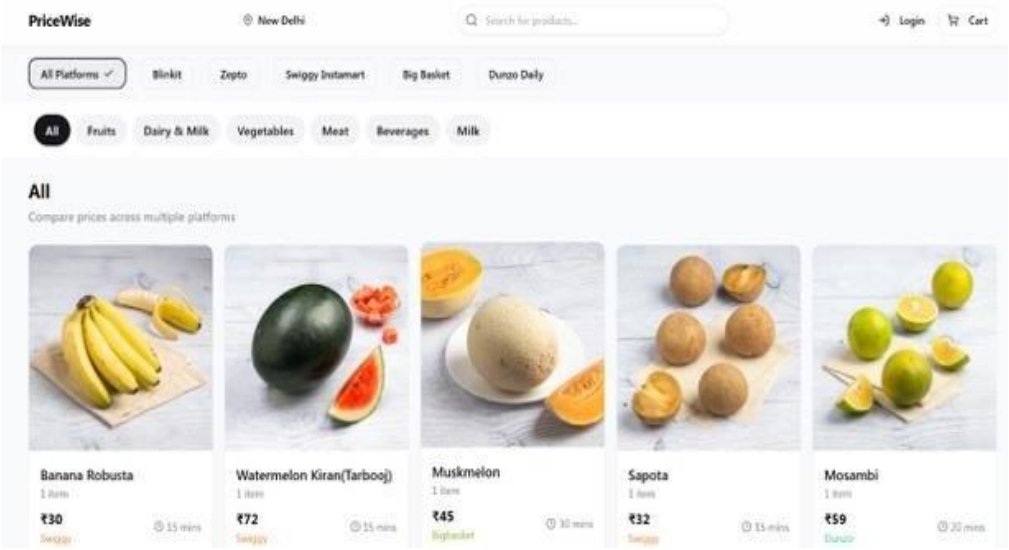


Fig. 2 Homepage

Fig. 2 shows the homepage of the proposed system. The homepage has the search bar where customer can search for the product they want and also they can search according to the platform they want. It also displays the recommendations for products according to their latest search.

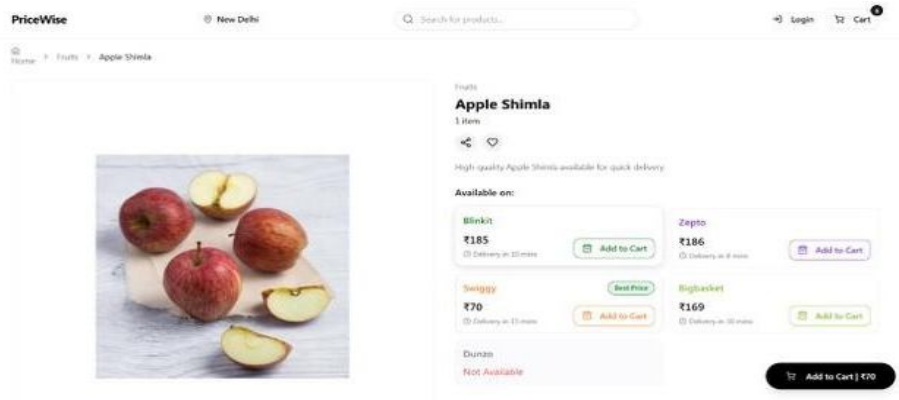


Fig. 3 Price of the product shown in different Q-Commerce sites

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As shown in the Fig. 3, when the customer click on the particular product, it shows the price of that product in various Q-Commerce platforms by which the customer can save the time by not visiting to various platforms for checking the price in various platforms. Further, the customer no need to visit multiple vendor sites to view price of the required products.

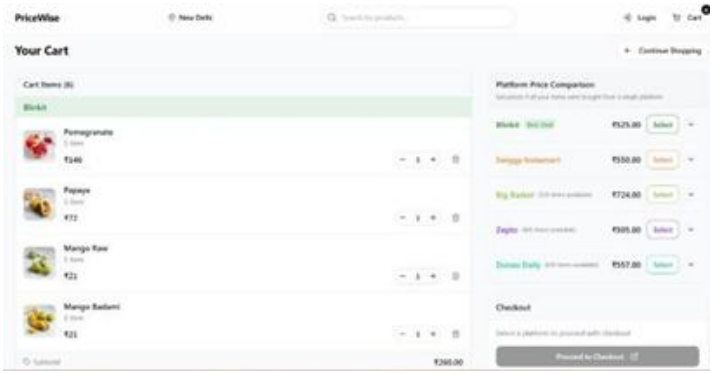


Fig. 4 Best deals for the products shown by various Q-Commerce sites

In addition, when the customer selects two or more products than our platform shows the best deal of that products across various Q-Commerce platforms as shown in Fig. 4.

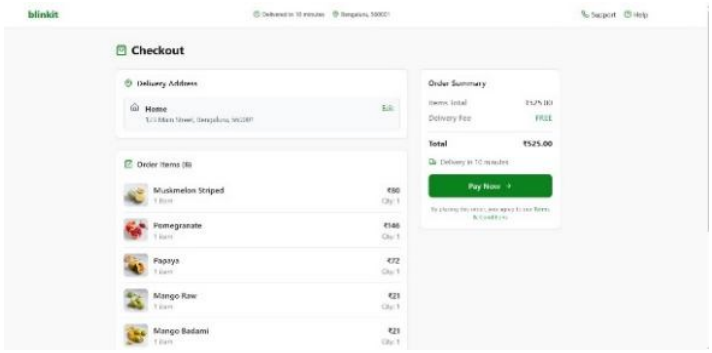


Fig. 5 Payment Window

Finally, our platform allows customers to pay online after selecting the best deal of the products as shown in Fig. 5. Also, the customers can track the purchase order.

V. CONCLUSION

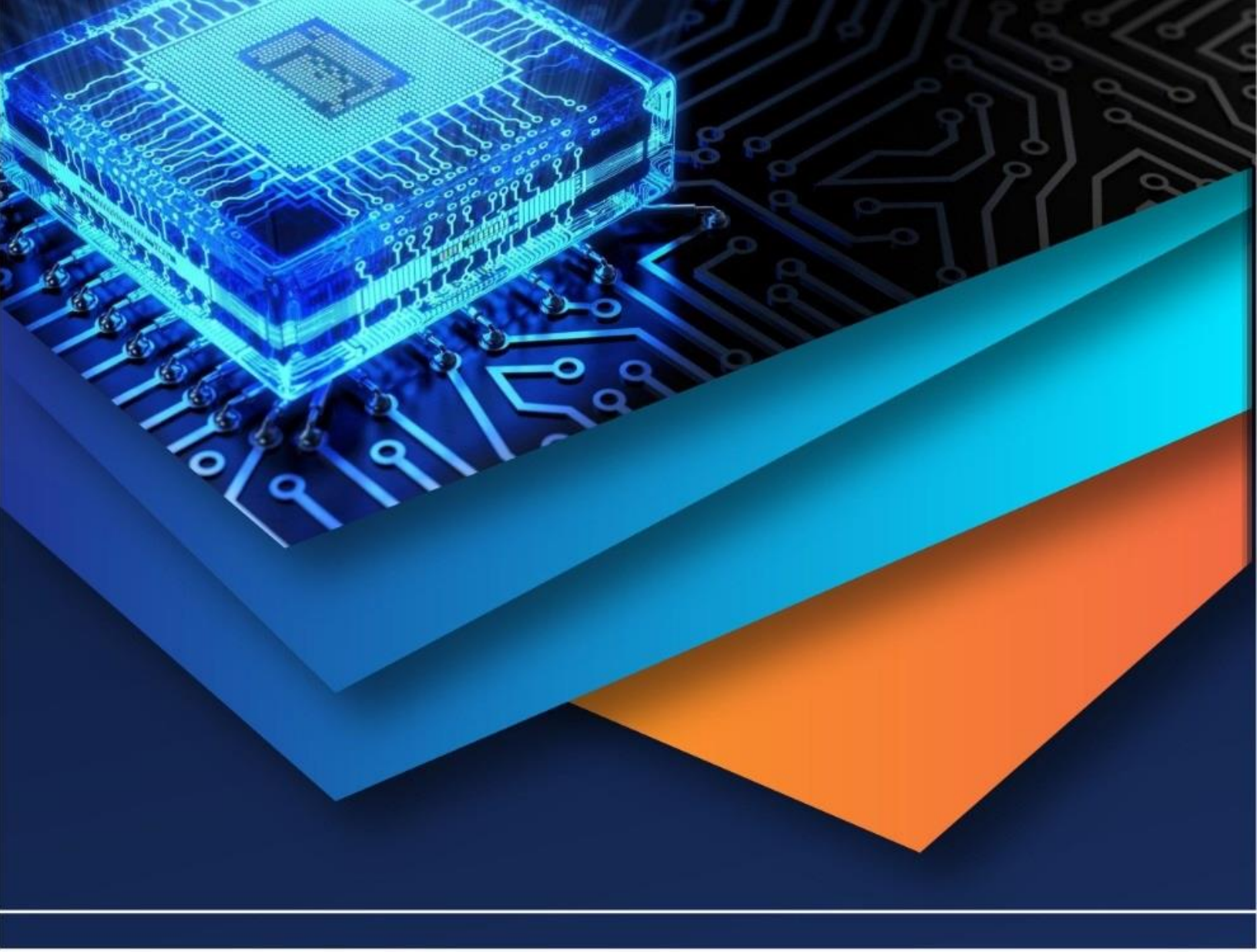
This paper addresses the significant problem of lack of price transparency and inconsistent pricing across popular Quick Commerce platforms such as Blinkit, Zepto, Swiggy Instacart, and BigBasket by proposing a centralized, web-based architecture that aggregates and compares real-time product prices from these multiple vendors. Also, the proposed system allows users to view not only prices but also compare factors like delivery times, offers, and vendor reliability, enabling them to make more informed and smarter purchasing decisions. Future plans involve enhancements such as AI-driven recommendations and price trend analytics.

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