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A Multi-Platform E-Commerce Cart Optimisation System

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ABSTRACT

In day-to-day life We use and explore multiple e-commerce platforms and we purchase many products, But at last we look for better price options. When we search for a product, we basically look for the platform that offers the lowest price, discounts, offers and delivery charges. To check Each and every platform and compare the product prices, discounts, and delivery charges manually consumes more time, and selecting the lowest-priced option for each product may not always result in the lowest overall cart cost. This paper presents Cart Fusion, a multi-platform e-commerce cart optimisation system designed to assist users in finding the lowest price combinations of each e-commerce platform. The proposed system enables users to search for products and compare their prices, discounts, offers, and delivery charges across available e-commerce platforms. It calculates the lowest price for each product and optimises the complete cart by determining suitable platform selections for individual products. The system is mainly designed using React.js for the frontend and Node.js, Express.js, and MongoDB for the backend. Cart Fusion aims to reduce manual comparison effort and help users identify potential savings while shopping online.

Keywords— E-commerce, Cart Fusion, Cart Optimisation, React.js, Node.js, Express.js, MongoDB

INTRODUCTION

The rapid growth of e-commerce has provided consumers with multiple platforms for purchasing products. The same product may be available at different prices with varying discounts, offers, and delivery charges. Manually comparing these factors across multiple platforms becomes time-consuming, especially when users purchase several products at the same time.

To address this problem, this paper proposes Cart Fusion, a multi-platform e-commerce cart optimisation system. The system allows users to search for products and compare their prices, discounts, offers, and delivery charges across available e-commerce platforms. It calculates the effective cost of products and identifies suitable platform combinations for constructing a cost-effective shopping cart. Different products can be selected from different platforms when this reduces the overall cart cost.

Cart Fusion is implemented using React.js for the frontend and Node.js, Express.js, and MongoDB for backend and data management. The proposed system aims to reduce manual comparison effort and help users identify potential savings while making online purchasing decisions.

Problem Statement

Online shoppers often need to compare the same or similar products across multiple e-commerce platforms to find a cost-effective purchase. However, differences in product prices, discounts, offers, and delivery charges make manual comparison difficult and time-consuming. When multiple products are purchased together, the lowest-priced option for each product may be available on different platforms, making it difficult to determine the minimum overall cart cost. Therefore, there is a need for an automated system that

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can compare product costs across multiple e-commerce platforms and optimise the complete shopping cart to identify a cost-effective combination of purchases.

Literature Survey

Existing research in e-commerce has explored different approaches for improving online shopping through price comparison, recommendation systems, and optimisation techniques.

- **Internet Shopping Optimisation Problem:** This work studies online shopping as an optimisation problem where consumers need to select products from different sellers while considering factors such as product prices and purchasing constraints. It provides a foundation for treating online shopping as a computational optimisation problem rather than simple product selection.
- **Clever Shopper Problem:** The Clever Shopper Problem focuses on finding cost-effective ways to purchase multiple products from different stores. The study considers the possibility that purchasing items from different sellers can reduce the overall shopping cost. This concept is closely related to Cart Fusion because the proposed system also allows different products in a cart to be obtained from different e-commerce platforms.
- **Shopping Recommendation Systems:** Research on shopping recommendation systems has focused on analysing user preferences and shopping history to recommend relevant products. These systems mainly improve product discovery and personalisation. However, recommendation alone does not necessarily determine the lowest overall cost of purchasing multiple products.
- **E-Commerce Price Comparison Systems:** Several studies have investigated automated price comparison across online stores. These systems help users identify differences in product prices and offers. However, many approaches concentrate on comparing individual products rather than optimising the complete cart by considering product price, discounts, and delivery charges together.
- **Optimization-Based Online Shopping Approaches** Optimisation techniques have also been applied to online purchasing problems to determine suitable combinations of products and sellers. Such approaches demonstrate that mathematical and algorithmic methods can reduce purchasing costs. However, practical e-commerce systems must also handle changing prices, offers, delivery charges, product availability, and platform-specific information.

Based on the reviewed literature, existing approaches mainly address individual aspects such as product recommendation, price comparison, or shopping optimisation. There is a need for an integrated system that combines multi-platform product comparison with complete-cart cost analysis. **Cart Fusion** addresses this gap by comparing available product information and calculating the effective cost of products while optimising the overall cart across multiple e-commerce platforms.

Research Gap

Existing research in e-commerce mainly focuses on **product price comparison, online shopping optimisation, and recommendation systems**. Some studies address the problem of selecting products from multiple shops, while others focus on discounts, shopping preferences, or personalised recommendations.

However, there is a gap in combining these aspects into a **single cart-level optimisation system**. Existing approaches may compare individual product prices or provide recommendations, still, they do not sufficiently address the problem of selecting different platforms for multiple products while considering **product price, discounts, offers, and delivery charges together**.

Therefore, an integrated system is needed to compare products across multiple e-commerce platforms and optimise the **complete shopping cart**, rather than optimising each product independently.

Cart Fusion addresses this gap by analysing available platform options for multiple products and identifying a cost-effective combination for the overall cart.

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PROPOSED METHODOLOGY

The proposed Cart Fusion system follows a sequence of steps to identify a cost-effective shopping cart.

- **Product Search:** The user searches for the required products through the Cart Fusion interface.
- **Data Collection:** Product details such as price, discount, offers, and delivery charges are collected from available e-commerce platforms.
- **Product Matching:** The system identifies and matches the same or equivalent products available across different platforms based on product information.
- **Product Comparison:** The matched products are compared across different platforms based on their available price and offer information.
- **Cost Calculation:** The effective cost of each product is calculated by considering the product price, Discount, and delivery charges.

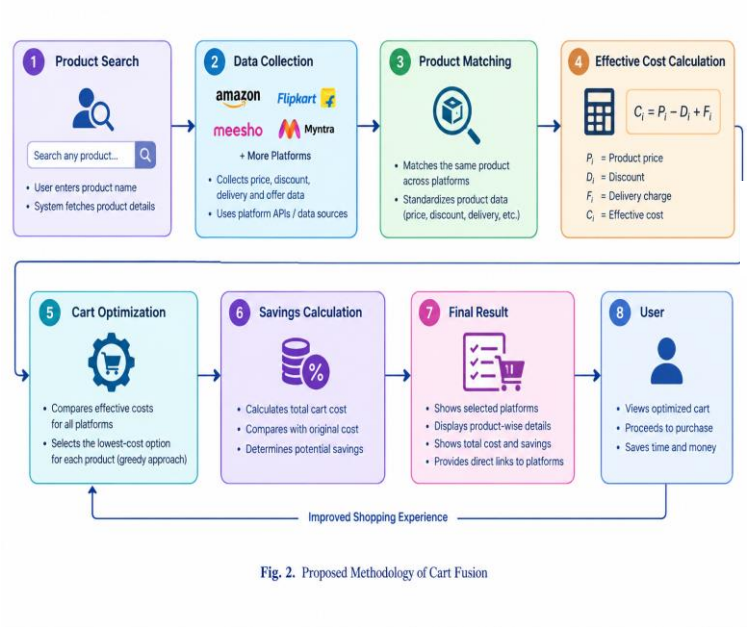


Fig. 2. Proposed Methodology of Cart Fusion

Fig 1: Proposed Methodology of Cart-Fusion

- **Cart Formation:** The selected products are combined to form the user's complete shopping cart.
- **Cart Optimisation:** The system evaluates the available platform options and selects a cost-effective combination for the products in the cart.
- **Savings Calculation:** The optimised cart cost is compared with the initial cart cost to determine the potential savings.
- **Result:** The optimised cart, selected platforms, total cost, and potential savings are displayed to the user.

System Architecture

The Cart Fusion system follows a client-server architecture consisting of a frontend, backend, database, and e-commerce data sources. The **React.js frontend** provides the user interface for product search, comparison, and optimised cart results. The **Node.js and Express.js backend** processes user requests, collects product information, performs cost calculations, and applies the cart optimisation process. **MongoDB** is used to store relevant user and product data. Available e-commerce platform APIs or data sources provide product prices, discounts, offers, and delivery information.

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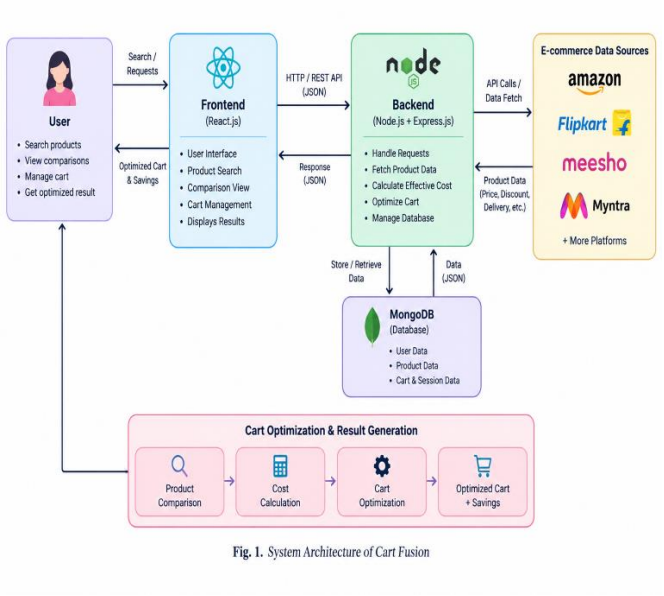


Fig. 1. *System Architecture of Cart Fusion*

Fig 2: System Architecture of Cart-Fusion

Implementation

Cart Fusion is implemented using a **React.js frontend** and a **Node.js with Express.js backend**. The frontend provides interfaces for product search, product comparison, and cart management. The backend handles user requests, product data processing, cost calculation, and cart optimisation.

Product information such as price, discounts, offers, and delivery charges is processed in a common format for comparison. The system calculates the effective cost of products and evaluates different platform combinations for multiple items. **MongoDB** is used for storing required application data.

The optimised results are then sent to the frontend, where users can view platform-wise product details, total cart cost, and potential savings.

Equations

Cart Fusion uses a **greedy selection approach** to identify cost-effective platform selections for the shopping cart. For each product, the system calculates its effective cost by considering the product price, discount, and delivery charge. The available platform options are then compared, and a suitable lower-cost option is selected.

The greedy approach is very straightforward to implement; it can reduce the effort of comparing multiple product options

The process is repeated for all products in the cart, and the selected costs are combined to calculate the total cart cost. The optimised result is then presented to the user along with the potential savings.

The effective cost is calculated as:

$$C_i = P_i - D_i + F_i \quad \ldots\ldots (1)$$

where $P_i$represents the product price, $D_i$represents the discount, and $F_i$represents the delivery charge.

The Total cost is calculated as:

$$C_cart = \Sigma\, C_(i,a_i), \text{ for } i = 1 \text{ to } n \quad \ldots\ldots (2)$$

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Where C_{cart} represents the total calculated cost of the cart; n denotes the number of products in the cart, a_i represents the platform selected for product i, and C_{i,a_i} denotes the effective cost of the selected product option on the chosen platform.

Total Savings:

Total Savings = Initial Cart Cost − Selected Cart Cost ……(3)

Percentage Savings:

Percentage Savings = [(Initial Cart Cost − Selected Cart Cost) / Initial Cart Cost] × 100 …….. (4)

Experimental Setup

The Cart Fusion prototype was evaluated using predefined sample product records containing listed prices, discounts, and delivery charges across different e-commerce platforms. The evaluation focused on calculating the effective cost of each product option, comparing available platform choices, and identifying lower-cost alternatives using the greedy selection approach.

A sample product was used to demonstrate how discounts and delivery charges influence the final payable amount. The calculated costs were compared to identify the most cost-effective option among the available sample records. This evaluation demonstrates the basic cost-calculation and comparison functionality of the prototype. Since the current system uses sample data rather than live marketplace APIs, the results do not establish real-time price accuracy or actual savings during purchases. Further testing with larger datasets, multiple shopping-cart scenarios, and verified marketplace data is required to evaluate the system under more realistic conditions.

RESULTS AND DISCUSSION

The Cart Fusion prototype compares product prices, discounts, and delivery charges to identify cost-effective purchasing options. Table I presents an illustrative comparison of an iPhone 15 across four e-commerce platforms using sample data.

Table I. Comparison of Product Costs

Platform	Listed Price (₹)	Discount (₹)	Delivery (₹)	Effectiv Cost (₹)
Amazon	59,999	2,000	0	57,999
Flipkart	60,499	2,500	0	57,999
Meesho	61,299	1,500	99	59,898
Myntra	60,999	1,800	49	59,248

Note: These values are illustrative sample data, not live marketplace prices.

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The comparison identifies Amazon and Flipkart as the lowest-cost options at ₹57,999. This demonstrates the importance of considering discounts and delivery charges alongside listed prices. However, the results are based on sample data and do not establish real-time price accuracy or actual marketplace savings.

LIMITATIONS

The current Cart Fusion prototype uses predefined sample product data rather than live data retrieved from e-commerce platforms. Therefore, the displayed prices, discounts, and delivery charges may not reflect actual marketplace conditions. Frequent price changes and expired offers may also affect the accuracy of product comparisons.

Another limitation is product matching, as the same product may be listed under different names or descriptions across platforms. The prototype also does not fully account for location-based delivery charges, stock availability, user-specific coupons, bank offers, or platform-specific purchasing conditions. These factors may influence the final payable amount.

Furthermore, the greedy selection approach chooses lower-cost product options based on the available records but does not guarantee the globally lowest total cost in every situation. Complex discount conditions and delivery charges that depend on multiple products may affect the final result. Therefore, the current prototype demonstrates basic cost comparison and cart selection, but further development and testing are required before it can reliably support real-world purchasing decisions.

Future Scope

Cart Fusion can be enhanced by integrating authorized e-commerce APIs to retrieve updated product prices, discounts, delivery charges, and availability. This would help provide more accurate comparisons and reduce dependence on predefined sample data. In the future, improved product-matching techniques can be introduced to identify identical products across platforms even when their names, descriptions, or specifications differ. The system can also be extended to consider location-based delivery charges, user-specific coupons, bank offers, stock availability, and other conditions that influence the final payable amount.

Advanced optimisation algorithms can be explored to improve cart selection when discounts and delivery charges depend on combinations of products. Artificial intelligence techniques could also be used to analyse price trends, predict possible price changes, and provide price-drop alerts. Additionally, Personalised recommendations and a mobile application could improve usability and accessibility. These enhancements could make Cart Fusion more accurate, flexible, and useful for practical multi-platform shopping.

CONCLUSION

Cart Fusion presents a multi-platform e-commerce cart optimisation approach to support cost-effective purchasing decisions. The system compares product prices, discounts, and delivery charges using available sample data to calculate effective costs and identify lower-cost product options.

The prototype demonstrates how comparing product options across platforms can reduce the manual effort involved in shopping and provide users with a clear view of estimated cart costs and potential savings.

However, its current functionality depends on predefined data and has limitations in real-time price accuracy and complex cart optimisation. Future enhancements, including live data integration, advanced optimisation algorithms, and AI-based recommendations, could improve the system's accuracy, efficiency, and overall shopping experience.

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