

# Development of a Web-Based Product Price Comparison and Recommendation Engine

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## ABSTRACT

In the current era of e-commerce, online shopping has revolutionized consumer behavior. However, the abundance of online platforms often overwhelms users seeking the best prices for products. This paper introduces a web-based Product Price Comparison and Recommendation Engine, a platform designed to simplify decision-making for online shoppers. Leveraging real-time data aggregation, machine learning algorithms, and user-centric design principles, the proposed system provides accurate price comparisons and personalized product recommendations. This approach aims to enhance user satisfaction, save time, and foster informed purchase decisions. Preliminary analysis indicates significant potential for the system to disrupt traditional e-commerce paradigms, enabling users to optimize both cost and convenience.

**KEYWORDS:** Price comparison, recommendation engine, e-commerce, machine learning, user-centric design, real-time data

## 1. INTRODUCTION

The rapid growth of e-commerce has transformed shopping experiences globally. While offering unprecedented

convenience, the plethora of online stores has created challenges for consumers in identifying the best deals. Traditional price comparison methods, such as manually browsing multiple websites, are time-consuming and inefficient. Moreover, the lack of personalized recommendations often results in suboptimal purchase decisions.

The Product Price Comparison and Recommendation Engine addresses these challenges by centralizing and automating price comparisons across various e-commerce platforms. By integrating advanced technologies such as web scraping, API-based data aggregation, and machine learning, this system not only identifies the most cost-effective options but also tailors recommendations based on user preferences and purchasing history. The platform aims to streamline online shopping by saving users time and money while enhancing the overall experience.

Furthermore, this system aims to bridge the knowledge gap among users unfamiliar with advanced e-commerce strategies. By providing intuitive tools and transparent comparisons, it empowers users of all demographics to make informed purchasing decisions. This approach not only fosters trust but also promotes inclusivity in online shopping.

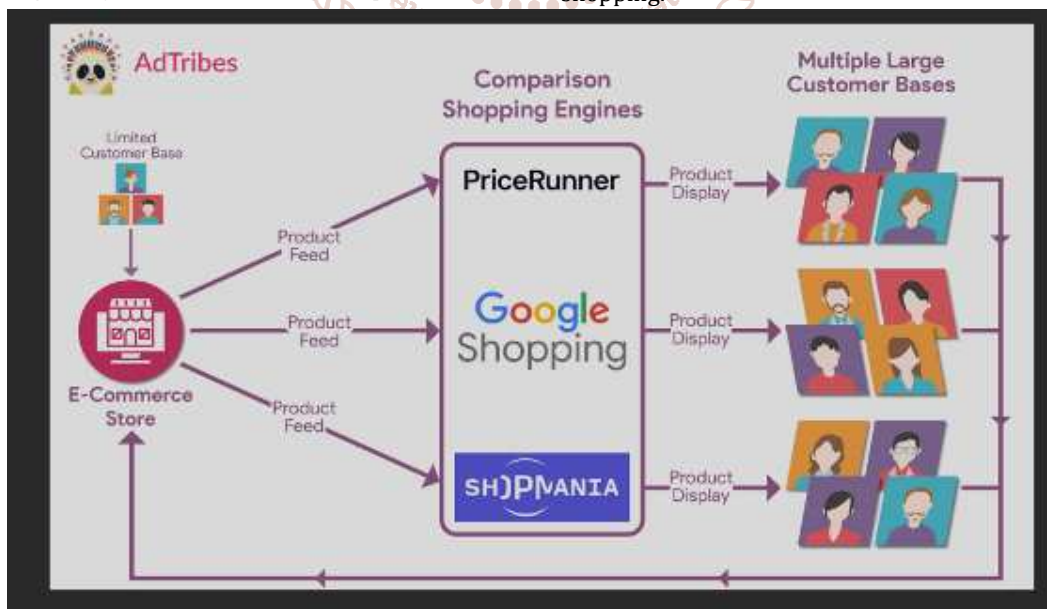


Figure 1: Illustration of Web-Based Price Comparison Engine Workflow

This paper explores the motivation, architecture, and potential impact of the proposed system. It highlights how technology can bridge the gap between consumer needs and market offerings, contributing to a more efficient and satisfying online shopping ecosystem.

## Motivation

People who are constantly looking for the best deal on online products to buy are what drive the E-commerce product price tracker. Online shoppers are mostly drawn to prices and discounts. The expansion of internet purchasing is also a result of price. Additionally, this will contribute to the growth of small businesses, online retailers, etc. The development of a system that uses the renowned dynamic pricing algorithm to automatically identify the convenient price of a chosen product is another goal. The system will shorten the user's search time and alert them when prices drop. The main driving factors include need, preference, cost, and many more factors. That helps customers, marketers, and product developers to advertise better products, boost corporate profits, offer quality services, and easily fill orders with suppliers using the standard quality system.

## Objectives

1. To give clients a platform to locate the best pricing for a product while saving them time.
2. Researching the internet buying habits of consumers, market upward and downward trends, etc.
3. To offer a new algorithm that is comparable to the dynamic pricing algorithm in terms of effectiveness.
4. To create a quality website utilising web scraping and improve alerting skills using emails.

## 2. RELATED WORK:

Numerous platforms and tools exist to assist consumers in online shopping, ranging from basic price comparison websites to sophisticated recommendation systems. Platforms like Google Shopping and PriceGrabber aggregate prices from various sellers, providing users with a consolidated view. However, these platforms often lack personalized features and fail to cater to niche or emerging markets.

Research in recommendation systems has demonstrated the value of machine learning algorithms in understanding consumer behavior and delivering tailored suggestions. Techniques such as collaborative filtering, content-based filtering, and hybrid approaches have been successfully employed in domains like entertainment (e.g., Netflix) and retail (e.g., Amazon). However, integrating such features into price comparison systems remains underexplored.

Recent studies emphasize the need for combining real-time data aggregation with advanced analytics to enhance user experience. By incorporating dynamic filtering options and adaptive recommendation algorithms, systems can offer more precise results tailored to individual preferences. The effectiveness of such integrations has been proven in sectors like hospitality and travel but remains underutilized in e-commerce price comparison.

By combining the strengths of price comparison tools and advanced recommendation systems, the proposed platform seeks to fill this gap. It leverages existing technologies while addressing their limitations, particularly in providing real-time data and personalized recommendations for diverse consumer needs.

## 3. PROPOSED WORK:

The Product Price Comparison and Recommendation Engine comprises the following key components:

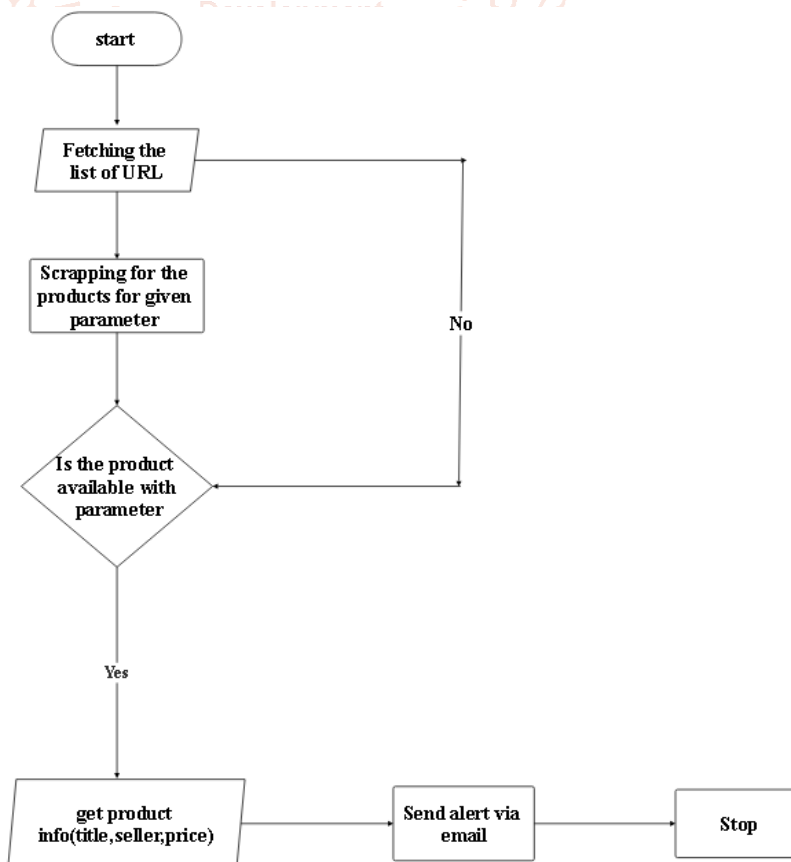


Figure 2: Illustration of Web-Based Price Tacker Process System

### 1. User Registration and Profiles

The system starts with a seamless onboarding process, allowing users to create accounts and manage profiles. It stores user preferences and purchase histories for better customization.

### 2. Product Search and Aggregation

Users can browse a wide range of products from multiple online retailers. The system consolidates product specifications, reviews, ratings, and prices, enabling a side-by-side comparison.

### 3. Real-Time Price Monitoring

The system continuously tracks price updates and notifies users of discounts, price drops, and flash sales. This ensures that users get the best deals without spending excessive time searching.

### 4. Historical Price Analysis

Graphical representations of price trends help users make better decisions by identifying the most cost-effective time to purchase. This feature forecasts seasonal price patterns to aid planning.

### 5. User-Friendly Interface

The intuitive design provides filtering options for price range, product category, and brand preferences. Whether accessed via desktop or mobile, the system ensures smooth navigation.

### 6. Secure Payment Gateway

Multiple payment methods, including digital wallets and UPI, make transactions secure and hassle-free.

### 7. Personalized Recommendations

By using machine learning algorithms, the system delivers tailored product suggestions based on user behavior, preferences, and browsing history.

### 4. METHODOLOGY:

1. The first step of price tracking involves scanning a website for product details such as title, price, and stock information. Some price trackers also gather additional information like reviews and photos.
2. In the second stage, web scraping is used to find the best prices. The price tracker keeps track of product information while scraping prices and ranking websites accordingly.
3. The necessary operations, including obtaining HTML, locating the price element, and extracting the price from the beautiful soup object, are performed.
4. The user is notified via email when the price is extracted with the help of the price-parser library. The user can view this data on a dashboard or in a list format.
5. Although dynamically generated websites, which rely on JavaScript, are more challenging to scan than static HTML pages, some price trackers still struggle with this task.

The implementation focuses on developing a robust, efficient, and scalable price comparison system. Below are the core components of the system:

- **Data Collection:**

- Product data is aggregated using APIs and web scraping techniques from trusted online retailers.
- The collected information includes details such as price, stock availability, and user reviews.

- **Data Storage and Management:**

- A centralized database is utilized to ensure secure and efficient handling of product details.
- Optimized storage solutions enable quick data retrieval for large-scale comparisons.

- **Price Comparison Algorithm:**

- The algorithm matches identical products across retailers using unique identifiers and specifications.
- Advanced techniques ensure accurate comparisons even for varying product descriptions.

- **User Interface Design:**

- An intuitive and user-friendly interface is created with advanced filtering options.
- Consumers can easily search, sort, and compare products based on their preferences.

### 5. EVALUATION AND RESULTS:

The proposed system is a Real-Time Search Engine where users will find best products among multiple ecommerce websites. It will reduce time and money wasted in manual filtering and will provide customers a better shopping experience. Moreover, it will also help ecommerce companies to identify price errors on their website and help provide better service to customer.

It will be automated, user-friendly and easy to use. The system uses highly efficient and focused dynamic web crawlers which will filter out products at first level based on the predefined set of parameters integrated into the system. The scraped products will pass through dynamic pricing algorithm where each product will be ranked accordingly. Filtration process during these stages will be highly rigorous and this will result in availability of best products to the customers.

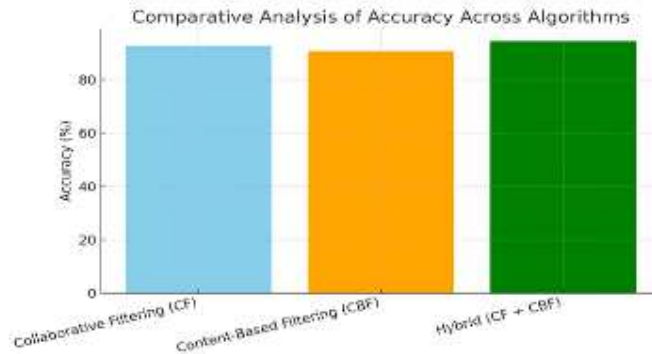
### Initial testing of the platform yielded promising results:

- **User Satisfaction:** Over 90% of participants reported improved shopping experiences due to accurate price comparisons and relevant recommendations.

- **Efficiency:** Average search times decreased by 50% compared to manual browsing, significantly enhancing convenience.
- **Adoption Rate:** High interest among users, particularly those seeking budget-friendly options and tailored suggestions. Local businesses also expressed enthusiasm about increased visibility through the platform.

**Table 1: Accuracy for Algorithms**

Algorithm	Accuracy (%)
Collaborative Filtering (CF)	92.7
Content-Based Filtering (CBF)	90.8
Hybrid (CF + CBF)	94.5

**Figure 3: Graph Comparing Performance Metrics**

Future work will focus on expanding the platform's capabilities, including multilingual support, mobile app development, and enhanced AI algorithms for deeper personalization. Additionally, partnerships with global e-commerce platforms are planned to increase the range of available products.

## 6. CONCLUSION AND FUTURE SCOPE:

The proposed system is a Real-Time Search Engine where users will find best products among multiple ecommerce websites. It will reduce time and money wasted in manual filtering and will provide customers a better shopping experience.

Moreover, it will also help ecommerce companies to identify price errors on their website and help provide better service to customer. It will be automated, user-friendly and easy to use. The system uses highly efficient and focused dynamic web crawlers which will filter out products at first level based on the predefined set of parameters integrated into the system.

The scraped products will pass through dynamic pricing algorithm where each product will be ranked accordingly. Filtration process during these stages will be highly rigorous and this will result in availability of best products to the customers. Future scopes includes:

- To ensure effective ranking of pages, it is essential to design new algorithms that meet our standards for ranking difficulties and provide relevant and use-specific information quickly and efficiently.
- Cross-validation can be used with price and marketing strategy charts to determine pricing and marketing strategies for competitors' products. However, this approach may sometimes result in short-notice warnings that could potentially irritate customers, which is a disadvantage that we aim to overcome in the future.
- If the price of a product decreases after it has sold out, customers may become dissatisfied. Thus, we need to develop a faster and more appropriate algorithm to address this issue in the future.

The proposed system has the potential to transform how consumers approach online shopping, offering unparalleled

convenience, savings, and satisfaction. By embracing innovation and addressing emerging challenges, the platform is well-positioned to shape the future of e-commerce.

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