

AI-Driven Smart Consumer Intelligence and Product Decision System

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Abstract—In the modern digital era, e-commerce platforms have become an essential part of everyday life, but they also introduce challenges related to trust and transparency. This project presents an intelligent solution to assist consumers in making informed purchasing decisions through an AI-powered product analysis system. Traditional systems rely only on ratings and reviews, which can be misleading due to fake reviews, manipulated pricing, and edited product images. The proposed system integrates advanced analytical techniques including Natural Language Processing for sentiment analysis, heuristic-based fake review detection, price trend evaluation, and image authenticity verification. The system processes real-time data from multiple platforms and generates a composite trust score, enabling users to compare and select the most reliable product efficiently.

Keywords—Artificial Intelligence, Sentiment Analysis, Fake Review Detection, Price Trend Analysis, Image Authenticity, E-Commerce, Natural Language Processing, Next.js, FastAPI, Consumer Intelligence.

I. INTRODUCTION

The rapid growth of e-commerce platforms such as Amazon and Flipkart has transformed the way consumers purchase products, providing convenience, variety, and accessibility. In India, the e-commerce sector is expanding at a significant rate, with millions of users relying on online platforms for their daily needs. Despite these advantages, consumers face several challenges that affect their purchasing decisions.

One of the major issues is the presence of fake and manipulated reviews, which can mislead users into selecting low-quality products. Additionally, dynamic pricing algorithms cause frequent fluctuations in product prices, making it difficult for consumers to determine the best time to purchase. Misleading or edited product images further reduce trust by creating false expectations about product quality.

II. PROBLEM STATEMENT

The proliferation of e-commerce in India has introduced a set of critical consumer trust challenges that existing tools fail to address comprehensively:

Fake Reviews: Up to 30% of online product reviews are estimated to be fraudulent, artificially inflating product ratings and misleading consumers into poor purchase decisions.

Dynamic Pricing Manipulation: Algorithmic pricing can cause product prices to fluctuate multiple times per day, making it difficult for consumers to assess whether they are receiving fair value. **Misleading Product Images:** Sellers may use digitally manipulated, stock, or non-representative product images that fail to accurately portray the actual item being sold.

III. EXISTING SYSTEM

Existing e-commerce platforms provide basic features such as product ratings, reviews, and price listings. However, these systems have limitations:

- Reviews can be fake or biased
- No mechanism to verify authenticity of product images
- Lack of price trend analysis
- No integrated trust evaluation system

Although some tools focus on individual aspects like sentiment analysis or price tracking, there is no comprehensive system that integrates all these features.



Fig 1: Block diagram of Existing system

IV. WORKFLOW

The complete workflow can be summarized as follows:

1. User searches for a product
2. System fetches real-time data from APIs
3. Reviews are analyzed using sentiment analysis
4. Fake reviews are detected using pattern analysis
5. Price trends are evaluated
6. Product images are checked for authenticity
7. Trust score is calculated
8. Results are displayed to the user

Step 1: User Input

The process begins when the user enters a product name or keyword into the search interface. The system captures the query and sends it to the backend for processing.

Step 2: Data Collection

The backend fetches real-time product data from multiple e-commerce platforms such as Amazon and Flipkart using APIs. The collected data includes:

Step 3: Data Preprocessing

The collected raw data is cleaned and structured. This includes:

Step 4: Sentiment Analysis

The processed reviews are analyzed using Natural Language Processing techniques. Each review is classified as:

- Positive
- Negative
- Neutral

This helps in understanding the overall customer opinion about the product.

Step 5: Fake Review Detection

The system identifies suspicious or fake reviews using heuristic and behavioral analysis. It detects:

- Repetitive review patterns
- Unusual rating distributions
- Spam-like content

This ensures that only genuine reviews influence the final result.

Step 6: Price Trend Analysis

The system analyzes historical and current price data using moving average techniques.

Step 7: Image Authenticity Verification

Product images are analyzed to detect possible manipulation. The system checks:

- Image consistency
- Signs of editing or enhancement
- Mismatch between product description and image

Step 8: Trust Score Generation

All outputs from different modules are combined to calculate a composite trust score. This score reflects:

- Review authenticity
- Customer sentiment

Step 9: Result Display
Finally, the analyzed results are presented to the user through a user-friendly interface. The output includes:

- Product comparison
- Sentiment summary
- Price trend graph

V. PROPOSED SYSTEM

The proposed system introduces an AI-driven platform that integrates multiple analytical modules into a single system to enhance transparency in e-commerce.

Key features include:

- Real-time product data collection from multiple platforms
- Sentiment analysis of reviews using NLP techniques
- Fake review detection using heuristic and behavioral models

This system provides a comprehensive and reliable evaluation of products, helping users make informed decisions while reducing the impact of misleading information.

VI. SYSTEM ARCHITECTURE

6.1 Overview

The system is designed as a full-stack web application that integrates frontend, backend, database, and AI modules. It follows a modular architecture to ensure scalability, flexibility, and efficient data processing.

6.2 Architecture Components

6.2.1 User Module:

Allows users to search, view, and compare product analysis results through an interactive interface.

6.2.2 Backend Module:

Processes product data, handles API requests, and executes AI algorithms efficiently.

6.2.3 API Layer:

Fetches real-time product data from e-commerce platforms and ensures smooth data communication.

6.2.4 Database Module

Stores user information, product data, and analysis results securely for future access.

6.2.5 AI Processing Module

Performs sentiment analysis, fake review detection, price analysis, and image verification to generate insights.

6.3 Advantages of Architecture

- Modular and scalable design
- Supports real-time processing
- Easy integration of new AI models
- Efficient data handling
- Improved system performance

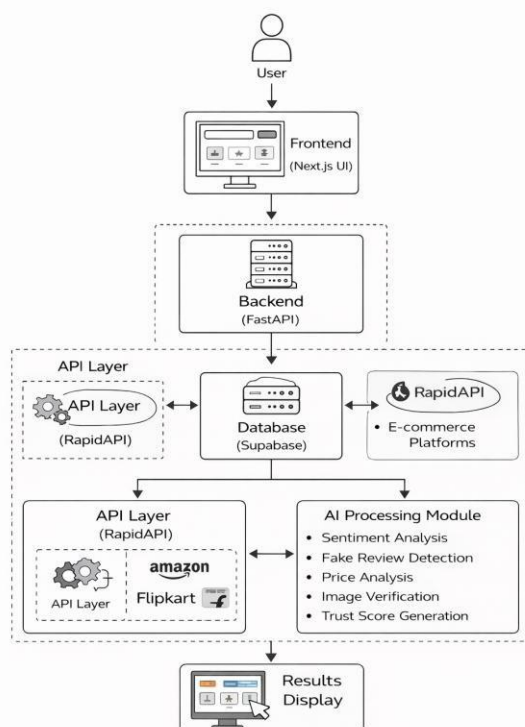


Fig 2: System Architecture

VII. MODULE DESCRIPTION

The proposed Smart Consumer Platform is divided

into several functional modules, each responsible for a specific task in the overall system. These modules work together to analyze product data and provide reliable decision support to users.

7.1 User Module

The User Module acts as the interface between the user and the system. It allows users to interact with the platform easily and efficiently.

- Users can search for products using keywords
- View detailed product analysis results
- Compare multiple products based on trust score
- Save products for future reference

This module ensures a user-friendly and interactive experience, enabling smooth navigation and quick access to information.

7.2 Data Collection Module

The Data Collection Module is responsible for gathering real-time product data from various e-commerce platforms.

- Fetches data using APIs (Amazon, Flipkart via RapidAPI)
- Collects product details, reviews, ratings, price, and images
- Ensures updated and accurate information

This module acts as the data source layer, providing input for further analysis.

7.3 Sentiment Analysis Module

This module analyzes customer reviews to understand user opinions about the product.

- Uses Natural Language Processing (NLP) techniques
- Classifies reviews as positive, negative, or neutral
- Calculates overall sentiment score

It helps in identifying whether a product is generally liked or disliked by customers.

7.4 Fake Review Detection Module

The Fake Review Detection Module identifies suspicious or spam reviews that may mislead users. This module improves system reliability by filtering out non-genuine reviews.

7.5 Price Analysis Module

The Price Analysis Module evaluates product price

trends over time.

- Tracks historical price data
- Uses moving average techniques
- Identifies price drops and fluctuations
- Suggests the best time to purchase

This helps users make cost-effective purchasing decisions.

VIII. IMPLEMENTATION

8.1 Overview

The system is implemented as a web-based application using modern technologies and AI techniques to provide real-time product analysis.

8.2 Development Environment

- Frontend: Next.js, Tailwind CSS
- Backend: Python (Fast API)
- Database: Supabase (PostgreSQL)
- APIs: RapidAPI (Amazon & Flipkart)

8.3 System Implementation Modules

i) Frontend Implementation

Provides a responsive and user-friendly interface for searching and viewing product details.

ii) Backend Implementation

Handles API integration, data processing, and execution of AI modules.

iii) API Integration

Fetches real-time product data and ensures up-to-date information.

iv) AI Modules Implementation

Processes reviews, prices, and images to generate meaningful insights.

8.4 Database Design

- User Table – stores user details
- Product Table – stores product information
- Review Data Table – stores review data
- Saved Products Table – stores user preferences

IX. SYSTEM TESTING

System testing is a crucial phase in the software development lifecycle that ensures the complete system functions correctly and meets the specified requirements. The proposed Smart Consumer Platform is thoroughly tested to verify its functionality, performance, and reliability.

The testing process ensures that all modules work

both independently and together as an integrated system. It also validates that the system provides accurate results and maintains efficiency under different conditions.

9.1 Testing Methodology

The system follows a structured testing approach to ensure quality and reliability.

- Test cases are designed based on system requirements
- Each module is tested individually (unit testing)
- Combined modules are tested for interaction (integration testing)
- The complete system is validated (system testing)

This methodology ensures that errors are identified and resolved at early stages.

9.2 Types of Testing

1. Unit Testing

Unit testing is performed on individual modules to verify their functionality.

Modules tested include:

- Sentiment Analysis Module
- Fake Review Detection Module
- Price Analysis Module
- Image Verification Module

Each module is tested with sample inputs to ensure correct outputs.

2. Integration Testing

Integration testing ensures that all modules work together correctly.

- Verifies data flow between frontend and backend
- Ensures proper communication with APIs

3. Accuracy Testing

Accuracy testing is performed to evaluate the correctness of AI modules.

- Sentiment analysis accuracy: ~78%
- Fake review detection accuracy: ~72%

This ensures reliability of analysis results.

4. User Interface Testing

UI testing ensures that the system is easy to use and visually clear.

- Checks layout and design
- Verifies navigation and usability
- Ensures proper display of results This improves overall user experience.

9.3 Testing Results

The testing results demonstrate that the system performs effectively:

- Accurate sentiment classification
- Successful detection of fake reviews
- Efficient data processing
- Fast response time
- Reliable trust score generation

X. SECURITY MECHANISMS

1. User Authentication: Secure login system to allow only authorized users
2. Data Encryption: Uses HTTPS to protect data during transmission
3. API Security: Secure handling of API keys and requests
4. Database Security: Safe storage of user and product data
5. Input Validation: Prevents malicious inputs and attacks
6. Session Management: Ensures secure user sessions

XI. SYSTEM FEATURES

- Real-time product analysis
- Fake review detection
- Price trend prediction
- Image authenticity verification
- Trust score generation
- User-friendly interface
- Multi-platform data integration

XII. RESULTS AND DISCUSSION

The system demonstrates efficient performance with fast response time and reliable outputs.

- Sentiment analysis accuracy: ~78%
- Fake review detection: ~72%
- Response time: ~3 seconds

The results indicate that the system effectively filters misleading information and provides reliable insights. This significantly improves user decision-making and increases trust in online shopping platforms.

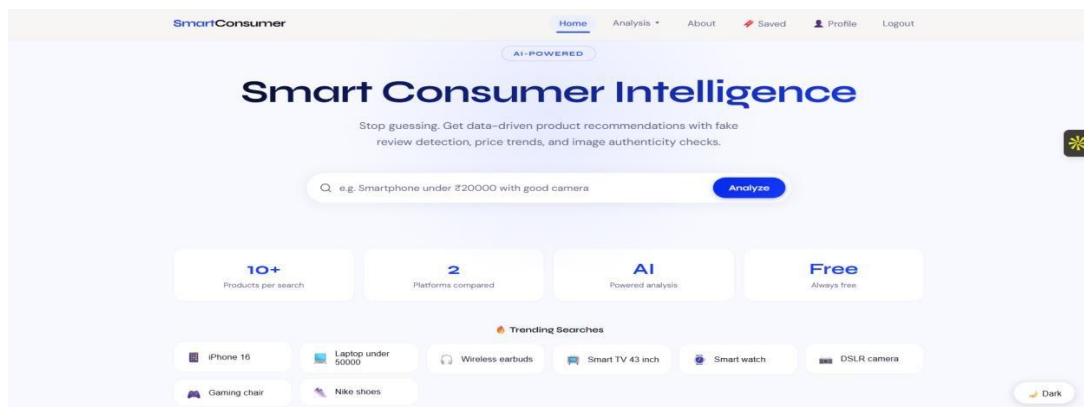


Fig 3: Screenshot of landing page

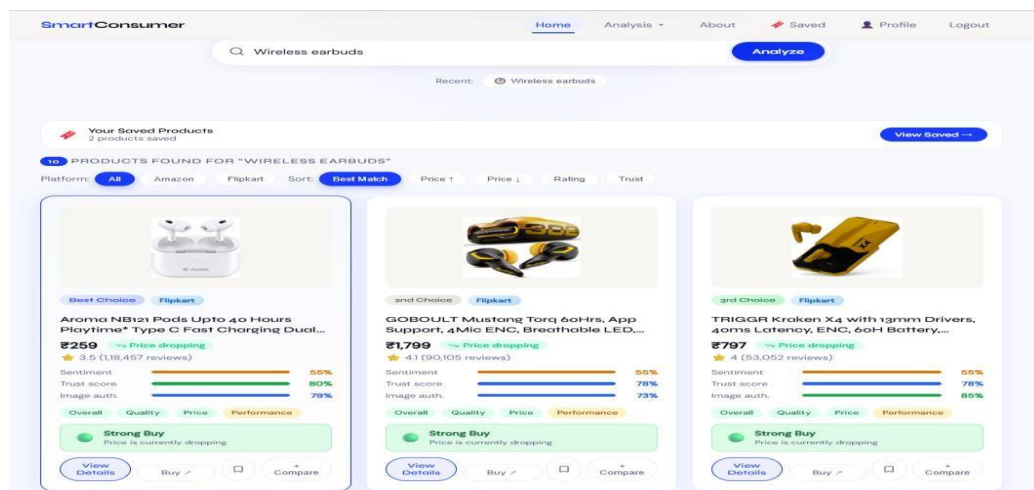


Fig 4: Screenshot of Product page

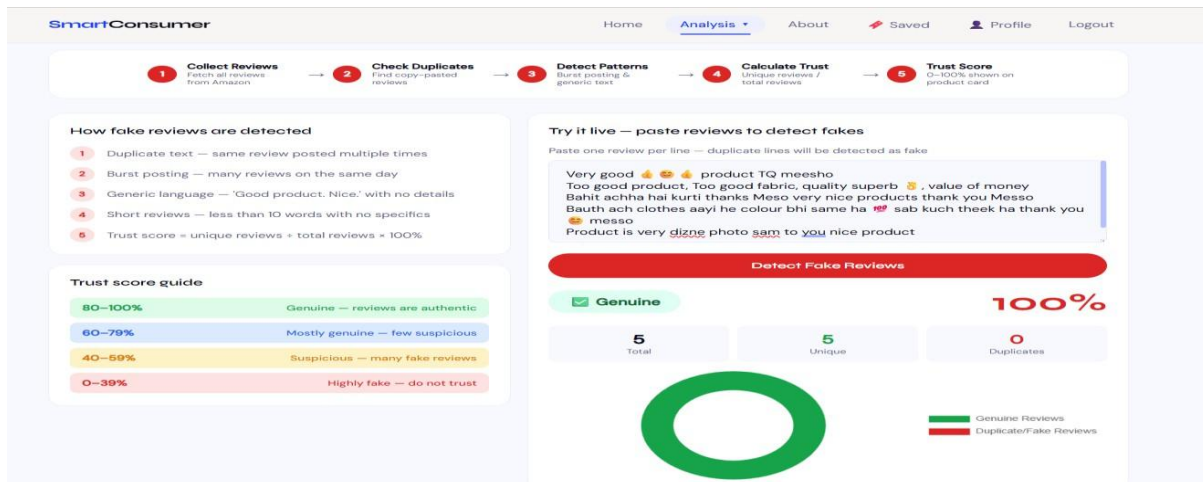


Fig 5: Screenshot of Fake Review Detection

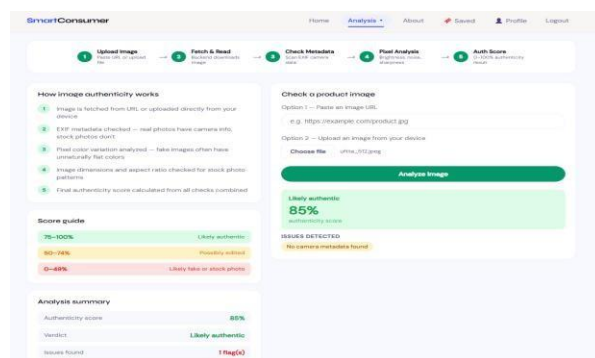


Fig 6: Screenshot of Image Authenticity

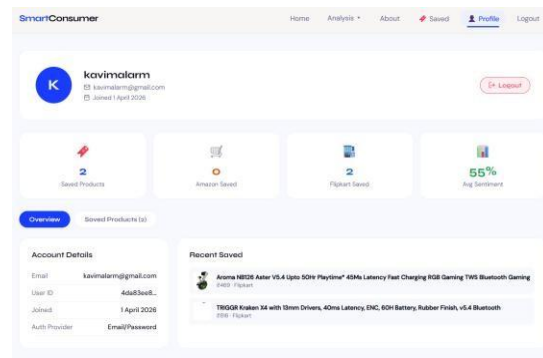


Fig 7: Screenshot of Profile page

XIII. FEATURE ENHANCEMENTS

1. Integration of deep learning models for higher accuracy
2. Expansion to additional e-commerce platforms
3. Personalized recommendation system based on user behavior
4. Development of a mobile application
5. Advanced image forensics techniques

XIV. CONCLUSION

The Smart Consumer Platform provides a comprehensive solution for improving trust in e-commerce systems. By integrating multiple AI techniques, the system offers accurate product evaluation and enhances user decision-making. The system successfully reduces the impact of fake reviews, misleading images, and price manipulation. Future improvements can further enhance accuracy, scalability, and user experience, making it a valuable tool for smart online shopping.

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