# E-COMMERCE CUSTOMER ANALYTICS DASHBOARD

[1] DR.B.Anil, [2] K Tulasi, [3] A Shravan Kumar, [4] M Manasa, [5] Y Sunil
[1]AssistantProfessor, [2345]Students
Department of CSE
Siddhartha Institute of Technology & Sciences, Narapally
badaralaanil_cse@siddhartha.co.in, 23tq1a05d4@siddhartha.co.in, 23tq1a05g1@siddhartha.co.in, 23tq1a05g0@siddhartha.co.in, 23tq1a05e8@siddhartha.co.in

## ABSTRACT

The **E-commerce Customer Analytics Dashboard** is a data analytics and visualization system designed to help online businesses understand customer behavior, purchasing patterns, and overall sales performance. E-commerce platforms generate large amounts of data from customer registrations, product searches, orders, payments, reviews, and website interactions. Analyzing this information can help businesses understand their customers and improve their marketing and sales strategies.

The proposed system collects customer-related information such as customer ID, order history, purchase frequency, order value, product categories, location, browsing activity, and transaction dates. The system processes this information and calculates important customer metrics such as total customers, active customers, average order value, purchase frequency, customer retention, and customer lifetime value.

The dashboard presents customer analytics through interactive charts, graphs, tables, and Key Performance Indicators (KPIs). Business users can analyze customer segments based on purchase behavior, spending level, location, product preference, and engagement. Filters allow users to select specific time periods, product categories, customer groups, or geographic regions.

The system can also help identify important customer behavior patterns. Businesses can observe high-value customers, frequently purchased products, inactive customers, repeat-purchase trends, and changes in customer engagement. Customer segmentation can help organizations design more targeted marketing campaigns and improve customer retention strategies.

Overall, the **E-commerce Customer Analytics Dashboard** provides a centralized platform for transforming raw customer and transaction data into meaningful business insights. It reduces manual analysis and supports data-driven decision-making. Future enhancements can include AI-based customer segmentation, churn prediction, personalized product recommendations, sales forecasting, sentiment analysis, and real-time customer analytics.

## I. INTRODUCTION

E-commerce has transformed the way customers purchase products and interact with businesses. Online stores generate large amounts of information from customer registrations, product views, searches, shopping carts, orders, payments, and reviews. This data contains valuable information about customer preferences and purchasing behavior.

Understanding customer behavior is important for improving sales and customer satisfaction. Businesses need to know which customers purchase frequently, which products are popular, how much customers spend, and when purchasing activity increases or decreases. Without proper analytics, it can be difficult to identify these patterns from large amounts of raw transaction data.

Traditional e-commerce analysis often relies on spreadsheets, database queries, and manually prepared reports. Business teams may need to combine information from different systems before analyzing customer behavior. Preparing these reports repeatedly can consume significant time and may make it difficult to obtain a frequently updated view of customer activity.

The **E-commerce Customer Analytics Dashboard** is designed to provide a centralized and interactive platform for analyzing customer and transaction data. It provides KPIs, charts, customer segments, product analysis, geographic analysis, and purchasing trends. Users can apply filters to explore specific customer groups, product categories, and time periods.

The objective of the system is to help e-commerce businesses make better decisions using customer data. The dashboard can support marketing planning, customer retention, product strategy, sales analysis, and business performance monitoring. By converting complex datasets into understandable visualizations, the system makes customer analytics accessible to business managers and analysts.

## II. LITERATURE SURVEY

Traditional e-commerce systems primarily focus on processing orders, managing products, handling payments, and maintaining customer accounts. These systems generate large amounts of transaction data but may provide limited analytical capabilities. Businesses often export this information into spreadsheets or reporting tools for further analysis.

Customer Relationship Management systems are widely used to maintain customer profiles and interaction histories. CRM platforms can provide information about customer purchases, communications, and engagement. However, organizations may require additional analytical dashboards to combine customer information with detailed transaction and behavioral data.

Customer segmentation is an important area of e-commerce analytics. Traditional segmentation methods can divide customers according to demographic information, purchase frequency, spending, recency, or product preferences. Techniques such as Recency, Frequency, and Monetary (RFM) analysis are commonly used to identify different customer groups.

Data visualization is widely used to present e-commerce analytics in an understandable form. Line charts can show sales and customer trends over time, while bar charts can compare customer segments or product categories. KPI cards can provide quick summaries of customers, orders, revenue, and average order value.

Machine learning and Artificial Intelligence are increasingly used in e-commerce for customer behavior analysis. Predictive models can support customer churn estimation, product recommendations, demand forecasting, and personalized marketing. These systems can improve decision-making but require reliable data, appropriate validation, and responsible use of customer information.

Existing research demonstrates that combining customer data, transaction analysis, segmentation, and visualization can provide valuable business insights. However, basic reporting systems may provide limited interactive exploration and cross-dimensional customer analysis. The proposed **E-commerce Customer Analytics Dashboard** combines customer KPIs, segmentation, purchasing behavior, product analysis, geographic insights, and interactive visualization in one platform.

## III. SYSTEM ANALYSIS

The **E-commerce Customer Analytics Dashboard** is designed to analyze customer behavior and purchasing patterns using structured e-commerce data. The system collects information such as customer profiles, orders, transaction amounts, product categories, purchase dates, locations, and customer activity. A data-ingestion module imports information from e-commerce databases, CRM systems, order-management platforms, spreadsheets, or supported APIs. The preprocessing module validates records, removes duplicates, handles missing values, and standardizes data formats. The system organizes information according to customers, products, categories,

locations, and time periods. A KPI engine calculates total customers, active customers, orders, revenue, average order value, purchase frequency, and retention metrics. A customer-segmentation engine groups customers based on purchasing behavior and other approved business attributes. A trend-analysis engine examines changes in customer activity and purchasing patterns over time. The visualization layer presents results through charts, graphs, tables, and KPI cards. Interactive filters allow users to select customer groups, products, locations, and reporting periods. The dashboard highlights important customer and sales patterns for further analysis. Finally, business users can generate reports and use the insights to support marketing, sales, and customer-retention planning.

**Existing System**

Existing e-commerce businesses commonly use online-store platforms, CRM systems, databases, spreadsheets, and basic sales reports to analyze customers. Transaction systems record orders, payments, products, and customer information but may not provide comprehensive customer analytics. Business teams often export data into spreadsheets to calculate customer metrics and create reports. Customer segmentation may require manually defined rules and repeated data processing. Comparing customer behavior across product categories, locations, and time periods can be difficult with static reports. Historical customer trends may require multiple reports to be combined manually. Businesses may also use separate systems for sales analysis, customer management, marketing, and website analytics. This can create fragmented information and make it difficult to obtain a unified view of customer behavior. Manual analysis can introduce calculation errors and consume significant time. Reports may become outdated when new transactions are generated. Existing systems provide valuable operational data but may lack a centralized and interactive dashboard for comprehensive customer analytics.

**Disadvantages of Existing System**

- Heavy dependence on manual reports and spreadsheets.
- Customer data may be distributed across multiple systems.
- Time-consuming data preparation and analysis.
- Limited interactive customer visualization.
- Difficult to compare multiple customer segments.
- Manual segmentation can require repeated processing.
- Historical customer trends may be difficult to analyze.
- Limited real-time or frequently updated insights.
- Difficult to identify high-value and inactive customers quickly.
- Manual calculations can introduce errors.
- Limited integration of customer and product analytics.
- Businesses may need multiple tools for complete analysis.

**Proposed System**

The proposed **E-commerce Customer Analytics Dashboard** provides a centralized platform for analyzing customer behavior, purchasing patterns, and e-commerce performance. The system collects customer, order, transaction, product, and activity information from supported business systems. A preprocessing layer cleans, validates, and standardizes the collected information before analysis. The system organizes data according to customers, products, categories, locations, and time periods. A KPI engine calculates important metrics such as total customers, active customers, total orders, revenue, average order value, purchase frequency, and retention rate. A customer-segmentation engine groups customers according to purchasing behavior and selected business rules. The trend-analysis engine identifies changes in customer

activity and purchasing patterns over time. The dashboard provides interactive charts, graphs, tables, and KPI cards for easy interpretation. Users can filter results by customer segment, product category, location, and date range. The system can highlight high-value customers, repeat-purchase patterns, and inactive customer groups for further investigation. Reports can be generated for marketing and management teams. Optional AI capabilities can provide customer insights and recommendations while maintaining appropriate privacy and human review.

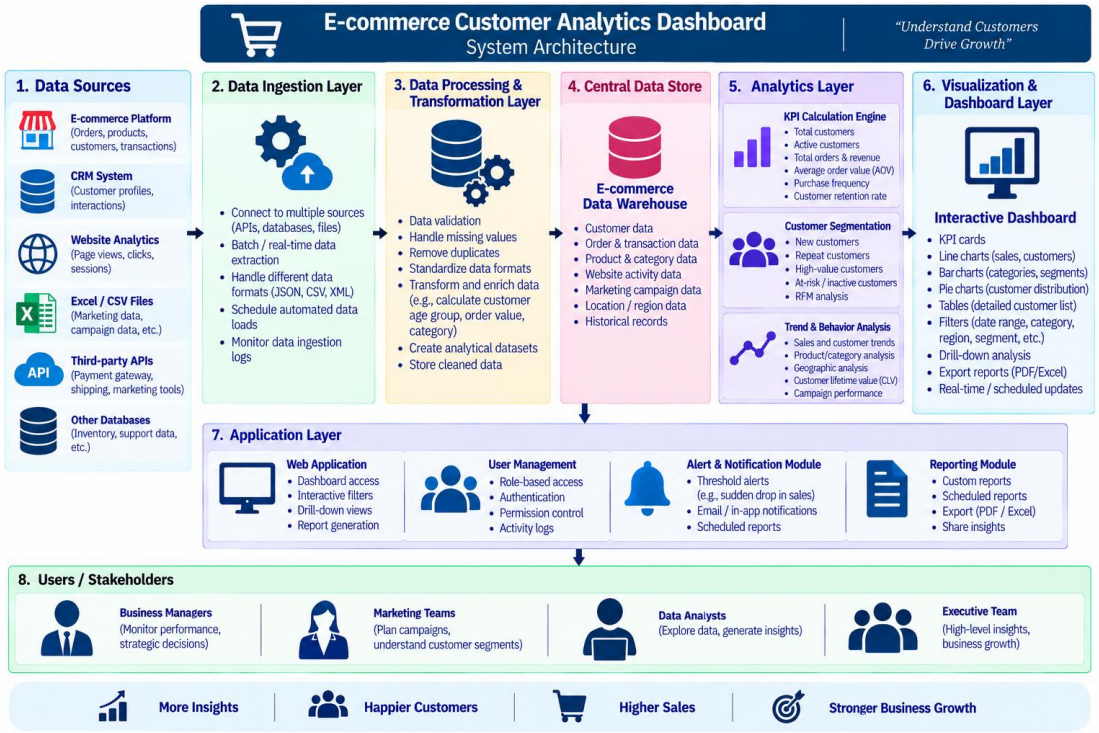
**Advantages of Proposed System**

- Provides centralized customer analytics.
- Automatically calculates important customer KPIs.
- Supports customer segmentation.
- Identifies purchasing behavior patterns.
- Provides interactive charts and visualizations.
- Supports product and category analysis.
- Enables geographic customer analysis.
- Helps identify high-value and repeat customers.
- Supports historical customer trend analysis.
- Reduces manual reporting effort.
- Supports marketing and retention planning.
- Enables faster data-driven business decisions.

## IV. METHODOLOGY

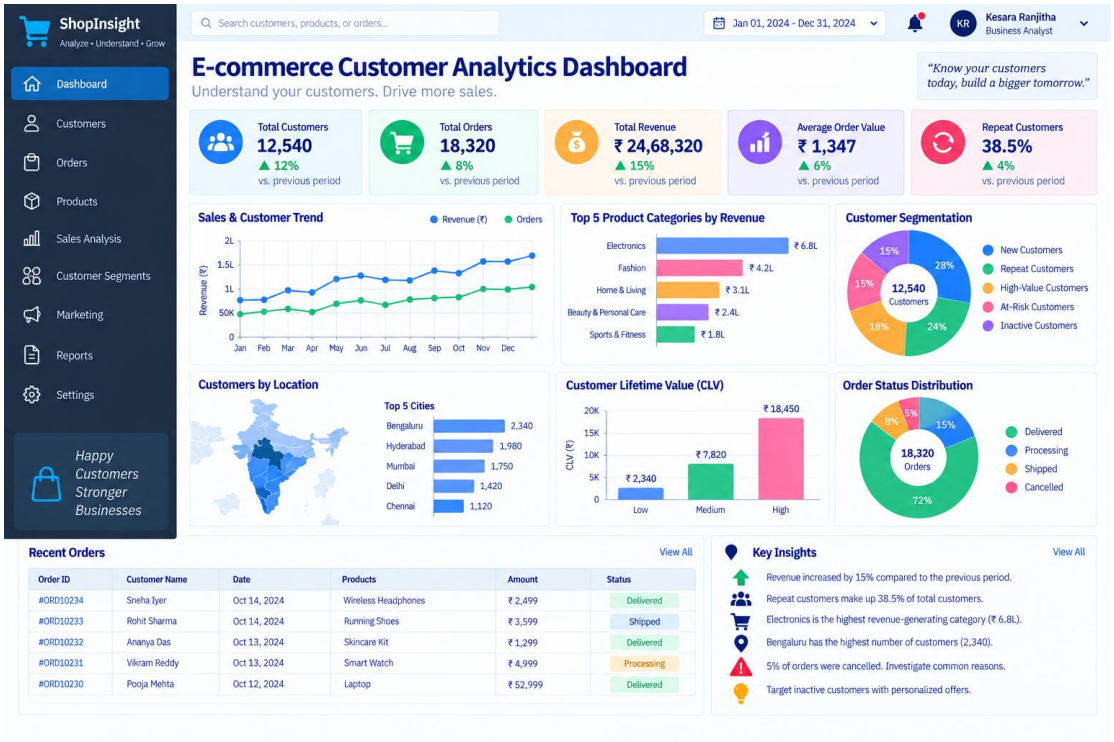
The methodology begins by collecting customer and transaction information from e-commerce platforms, CRM systems, databases, spreadsheets, or supported APIs. The data-ingestion module imports the available information into the analytics platform. The preprocessing module validates records, removes duplicates, handles missing values, and standardizes customer, product, date, and transaction information. The cleaned data is organized into structured datasets containing customers, orders, products, categories, locations, and transaction history. A KPI engine calculates total customers, active customers, orders, revenue, average order value, purchase frequency, and retention indicators. A customer-segmentation module groups customers according to selected purchasing and engagement characteristics. A trend-analysis module examines customer activity, order frequency, and spending patterns across different time periods. The visualization engine converts the processed information into KPI cards, charts, graphs, tables, and customer-segment views. Users can apply filters based on customer group, product category, location, and date range. The system highlights important patterns such as high-value customers, repeat purchasing, and declining customer activity. Optional AI analytics can generate summaries and business insights from aggregate customer patterns. Finally, the dashboard provides reports and visual insights that support marketing, sales, customer-retention, and business planning.

## SYSTEM ARCHITECTURE




The E-commerce Customer Analytics Dashboard consists of several interconnected layers for collecting, processing, analyzing, and visualizing customer information. The User Interface allows business managers and analysts to access the dashboard, apply filters, and view reports. The Data Ingestion Layer collects information from e-commerce platforms, CRM systems, order databases, spreadsheets, website analytics, and supported APIs. The Data Cleaning and Transformation Module validates records, removes duplicates, handles missing values, and standardizes customer and transaction data. The Central Customer Data Warehouse stores structured information about customers, orders, products, transactions, categories, and locations. The KPI Calculation Engine calculates customer count, active customers, orders, revenue, average order value, purchase frequency, and retention metrics. The Customer Segmentation Engine creates customer groups based on selected purchasing behavior and business rules. The Trend Analysis Engine identifies changes in customer activity and purchasing patterns over time. The Product and Category Analytics Module analyzes customer preferences and product performance. The Visualization Engine generates KPI cards, charts, graphs, tables, and customer-segment visualizations. The Reporting Module creates downloadable analytics reports. Finally, the E-commerce Customer Analytics Dashboard presents the analyzed information in an interactive and easy-to-understand format.

## V. RESULT AND OUTPUT




## VI. CONCLUSION

The E-commerce Customer Analytics Dashboard provides an effective and centralized solution for understanding customer behavior and purchasing patterns in an online business environment. The system brings important information such as customer count, orders, revenue, average order value, repeat customers, product categories, locations, and customer segments into a single interactive dashboard.

By using data processing, KPI analysis, customer segmentation, trend analysis, and data visualization, the system transforms raw e-commerce data into meaningful business insights. Business managers and analysts can easily understand purchasing trends, identify high-value customers, compare product categories, analyze customer locations, and monitor changes in customer activity over different time periods.

The dashboard also helps businesses understand different customer segments, including new, repeat, high-value, inactive, and at-risk customers. These insights can support marketing campaigns, customer-retention strategies, product planning, and sales improvement. Interactive filters, charts, tables, and drill-down features make it easier to explore specific customer groups and business areas.

Overall, the E-commerce Customer Analytics Dashboard improves the efficiency, accessibility, and effectiveness of customer analytics. It enables organizations to make more informed and data-driven business decisions while reducing manual reporting effort. Future enhancements can include AI-based customer segmentation, churn prediction, personalized product recommendations, demand forecasting, sentiment analysis, real-time analytics, and intelligent marketing recommendations.

The system should handle customer information responsibly by applying appropriate data privacy, security, access control, and data-governance practices. Customer analytics should be used to support business decisions while respecting customer privacy and applicable regulations.

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[4] Dr.G.Vishnu Murthy, BhargaviNalacheruve 1Professor, Department of computer Science & engineering, Anurag University, TS, India. 2Student, Department of computer Science & engineering, Anurag University, TS, India.

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