CREDIT CARD SPENDING PATTERN & CUSTOMER TRANSACTION ANALYTICS DASHBOARD

[1] N Ramya Krishna, [2] P Supritha, [3] V Nithin Raj, [4] S Vijay
[1]AssistantProfessor, [234]Students
Department of CSE
Siddhartha Institute of Technology & Sciences, Narapally
n.ramya@siddhartha.org.in, 23tq1a05f5@siddhartha.co.in, 24tq5a05i1@siddhartha.co.in,
24tq5a0522@siddhartha.co.in,

ABSTRACT

The Credit Card Spending Pattern & Customer Transaction Analytics Dashboard is a data analytics and visualization system designed to analyze credit card transaction patterns and customer spending behavior. Credit card transactions generate large amounts of information related to purchase amounts, transaction categories, locations, payment channels, and transaction dates. Analyzing these patterns can help financial organizations understand spending trends and improve business planning.

The proposed system collects appropriate transaction information such as transaction date, transaction amount, merchant category, transaction type, payment channel, geographic region, customer segment, and transaction status. The system processes this information and calculates important Key Performance Indicators (KPIs) such as total transaction value, transaction count, average transaction amount, spending by category, monthly spending growth, and transaction success rate.

The dashboard presents the analyzed information using interactive charts, graphs, tables, maps, and KPI cards. Authorized analysts and managers can compare spending patterns across different merchant categories, customer segments, regions, payment channels, and time periods. Filters allow users to focus on specific transaction categories or reporting periods.

The system can identify changes in spending behavior, high-volume transaction categories, seasonal spending patterns, and differences between customer segments. It can also help identify unusual aggregate transaction patterns that may require further investigation. These insights can support customer-service planning, product strategy, financial reporting, and transaction monitoring.

Overall, the Credit Card Spending Pattern & Customer Transaction Analytics Dashboard provides a centralized platform for transforming transaction data into meaningful business insights. It reduces manual reporting efforts and supports data-driven financial analysis. Future enhancements can include anomaly detection, spending forecasting, customer segmentation, personalized financial insights, real-time transaction monitoring, and AI-assisted trend analysis.

I. INTRODUCTION

Credit cards are widely used for purchasing products and services, making payments, and managing short-term financial transactions. Every transaction generates valuable information that can be analyzed to understand customer spending patterns. Monitoring these patterns helps financial organizations understand transaction volumes, spending categories, customer segments, and changes in payment behavior.

Credit card transaction data can contain information such as transaction amount, merchant category, date, location, payment channel, and transaction status. When analyzed over time, this information can reveal seasonal trends, changes in spending levels, and differences between customer groups. However, large transaction datasets can be difficult to analyze manually.

Traditional transaction reporting often depends on spreadsheets, database queries, static reports, and separate banking systems. Analysts may need to collect information

from multiple sources before preparing spending summaries. This process can consume time and may make it difficult to obtain a consistent and interactive view of transaction behavior.

The Credit Card Spending Pattern & Customer Transaction Analytics Dashboard provides an interactive platform for analyzing transaction activity. It can display total spending, transaction volume, average transaction value, category-wise spending, regional patterns, and customer-segment trends. Users can apply filters to compare different time periods, merchant categories, regions, and payment channels.

The main objective of the system is to support data-driven transaction and customer analytics. The dashboard is intended to provide aggregate insights for authorized financial analysts and managers. It should not expose unnecessary customer information or make unsupported assumptions about individual customers, and all sensitive financial information should be handled using appropriate security and privacy controls.

II. LITERATURE SURVEY

Traditional banking and payment systems are primarily designed to process credit card transactions, maintain account information, authorize payments, and generate transaction records. These systems provide essential financial services and store large volumes of transaction data. However, detailed spending-pattern analysis may require additional analytics and Business Intelligence tools.

Customer transaction analytics commonly examines metrics such as transaction volume, total spending, average transaction value, merchant category distribution, transaction frequency, and geographic activity. These measures help financial organizations understand how customers use payment services. Segment-based analysis can further reveal differences between customer groups.

Data visualization is widely used for financial transaction analysis because it allows large datasets to be presented in an understandable form. Line charts can display spending trends over time, while bar charts can compare merchant categories. Maps can show geographic transaction distribution, and KPI cards can summarize important financial indicators.

Customer segmentation techniques are often used to group customers according to characteristics such as transaction frequency, spending levels, product usage, or demographic categories. Segmentation can help financial organizations understand different customer behaviors and design appropriate services. However, customer segmentation should be performed using appropriate privacy and fairness controls.

Machine learning and Artificial Intelligence have increasingly been applied to financial transaction analytics. These methods can support anomaly detection, spending forecasting, transaction classification, customer segmentation, and risk analysis. Automated models require high-quality data, appropriate validation, explainability, and security because financial decisions can have significant consequences.

Existing research demonstrates the importance of transaction analytics, visualization, and predictive techniques in financial services. However, traditional reports may require manual consolidation and may provide limited interactive comparison across spending categories and customer segments. The proposed **Credit Card Spending Pattern & Customer Transaction Analytics Dashboard** combines KPI monitoring, spending analysis, trend comparison, segmentation, visualization, and reporting in a centralized platform.

III. SYSTEM ANALYSIS

The Credit Card Spending Pattern & Customer Transaction Analytics Dashboard is designed to analyze aggregate credit card transaction and spending patterns. The system collects appropriate information such as transaction date, amount, merchant category, transaction type, payment channel, region, customer segment, and transaction status. A data-ingestion module imports approved information from banking systems, payment platforms, transaction databases, spreadsheets, or supported APIs. The preprocessing module validates records, handles missing values, removes duplicates, and standardizes transaction dates, categories, and amounts. The system organizes information according to customers or approved segments, merchant categories, regions, payment channels, and reporting periods. A KPI engine calculates total transaction value, transaction count, average transaction amount, category-wise spending, and transaction success rate. A trend-analysis engine examines changes in spending and transaction volumes over time. A comparison engine compares aggregate spending across merchant categories, regions, customer segments, and payment channels. An anomaly-analysis module can identify unusual aggregate transaction patterns for further review. The visualization layer presents results through KPI cards, line charts, bar charts, tables, and maps. Interactive filters allow authorized users to select specific periods, categories, regions, and customer segments. Finally, authorized analysts can generate reports to support transaction monitoring, customer analytics, and financial planning.

Existing System

Existing financial organizations commonly use core banking systems, credit card processing platforms, transaction databases, spreadsheets, data warehouses, and manually prepared financial reports. These systems record information about transactions, customers, merchants, payments, and account activity. However, transaction information may be distributed across multiple systems and departments. Analysts may need to export and combine data before calculating spending metrics. Comparing spending across merchant categories, customer segments, or regions can require several separate reports. Historical spending trends may also be difficult to analyze when information is stored across different reporting systems. Static reports provide limited interactive visualization and filtering capabilities. Manual data processing can introduce calculation errors and consume significant analyst time. Traditional systems may show transaction counts without providing a complete visual understanding of spending patterns. Identifying unusual aggregate transaction trends may require separate analytical tools. Reports can also become outdated as new transactions are processed. Therefore, existing systems provide essential transaction-processing capabilities but may require an integrated analytics dashboard for comprehensive spending-pattern analysis.

Disadvantages of Existing System

- Transaction information may be distributed across multiple systems.
- Heavy dependence on spreadsheets and manual reports.
- Time-consuming data consolidation.
- Manual calculation of spending KPIs.
- Limited interactive visualization.
- Difficult to compare spending categories.
- Limited customer-segment analysis.
- Difficult to analyze regional spending patterns.
- Historical trends may require separate reports.
- Limited automated anomaly identification.
- Reports may become outdated quickly.

- Manual processing can introduce calculation errors.

Proposed System

The proposed **Credit Card Spending Pattern & Customer Transaction Analytics Dashboard** provides a centralized platform for monitoring and analyzing credit card transaction behavior. The system collects appropriate transaction information from approved banking systems, payment platforms, transaction databases, spreadsheets, and APIs. A preprocessing layer validates, cleans, and standardizes the collected data before analysis. The system organizes transaction information according to merchant categories, customer segments, regions, payment channels, and reporting periods. A KPI engine calculates total transaction value, transaction count, average transaction amount, spending growth, and transaction success rate. A trend-analysis engine identifies changes in spending and transaction activity over time. A comparison engine allows authorized users to compare aggregate spending across categories, regions, customer segments, and payment channels. An optional anomaly-analysis module can identify unusual aggregate patterns for further investigation. The visualization engine presents results through KPI cards, line charts, bar charts, tables, and geographic views. Users can apply interactive filters to explore selected time periods and transaction categories. The dashboard can highlight important spending trends and changes for authorized analysts to investigate. Finally, reports can be generated to support financial planning, transaction monitoring, and customer-service strategy.

Advantages of Proposed System

- Provides centralized credit card transaction analytics.
- Automatically calculates important spending KPIs.
- Supports merchant-category analysis.
- Enables customer-segment comparison.
- Provides regional spending analysis.
- Displays historical spending trends.
- Supports payment-channel comparison.
- Provides interactive charts and KPI cards.
- Helps identify unusual aggregate transaction patterns.
- Reduces manual reporting effort.
- Supports data-driven financial analysis.
- Improves visibility into customer spending trends.

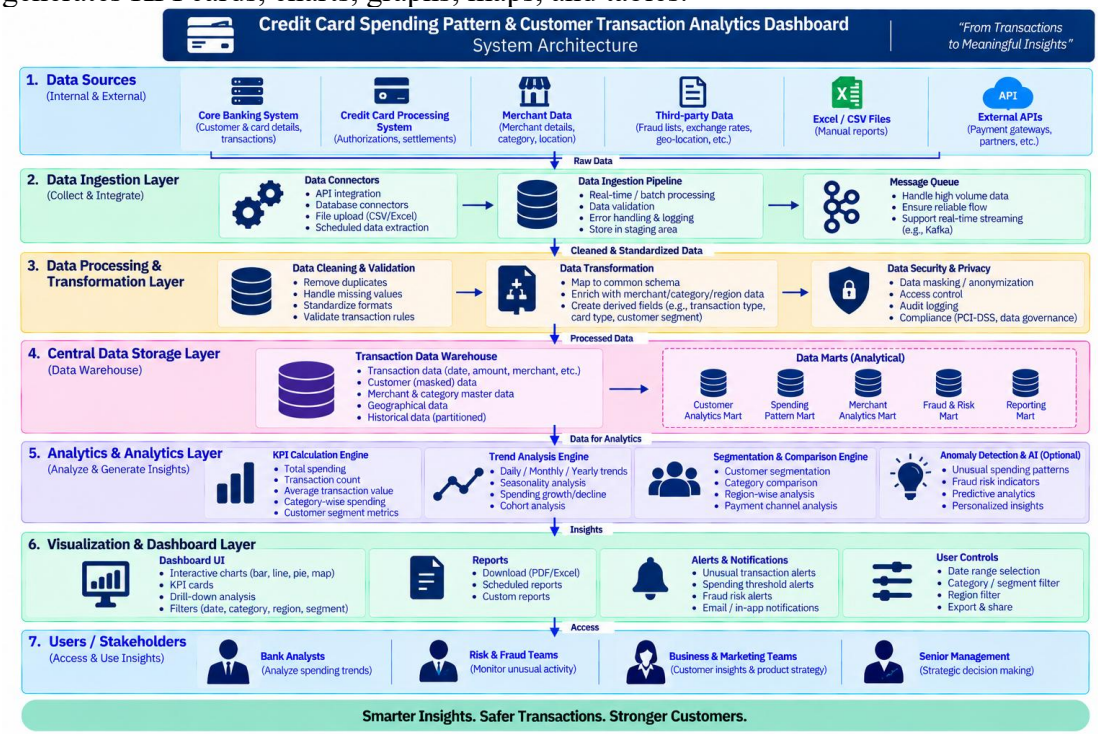
IV. METHODOLOGY

The methodology begins by collecting approved credit card transaction information from banking systems, payment platforms, transaction databases, spreadsheets, or supported APIs. The data-ingestion module imports transaction amount, date, merchant category, payment channel, region, customer segment, and transaction status information. The preprocessing module validates records, removes duplicates, handles missing values, and standardizes transaction dates, categories, and monetary fields. The cleaned information is organized into structured datasets containing transactions, categories, regions, segments, and reporting periods. A KPI engine calculates total transaction value, transaction count, average transaction amount, category-wise spending, and transaction success rate. A trend-analysis module examines spending and transaction changes across daily, weekly, monthly, quarterly, and yearly periods. A comparison engine evaluates aggregate spending across merchant categories, regions, customer segments, and payment channels. An optional anomaly-analysis module identifies unusual aggregate transaction patterns for further investigation. The visualization engine converts processed information into KPI cards,

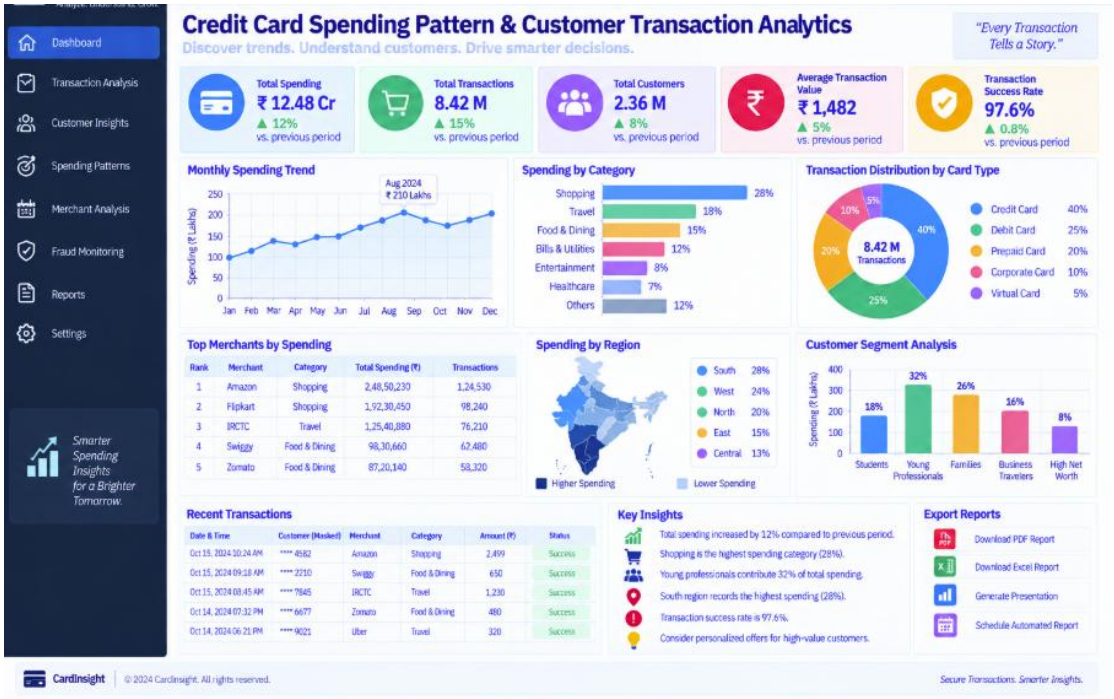
line charts, bar charts, maps, and tables. Authorized users can apply filters to analyze selected periods, categories, regions, or segments. The system highlights significant changes in aggregate spending patterns and provides analytical summaries. Finally, authorized financial analysts and managers can generate reports to support transaction monitoring, customer analytics, financial planning, and business strategy.

SYSTEM ARCHITECTURE

The Credit Card Spending Pattern & Customer Transaction Analytics Dashboard consists of several interconnected layers for securely collecting, processing, analyzing, and visualizing transaction information. The User Interface allows authorized financial analysts and managers to access dashboards, filters, visualizations, and reports. The Data Ingestion Layer collects approved information from banking systems, credit card processing platforms, transaction databases, spreadsheets, and APIs. The Security and Privacy Layer applies authentication, authorization, encryption, data minimization, and appropriate access controls. The Data Cleaning and Transformation Module validates transactions, removes duplicates, handles missing values, and standardizes dates, categories, and monetary fields. The Central Transaction Data Warehouse stores structured transaction, merchant-category, regional, and approved customer-segment information. The KPI Calculation Engine calculates total spending, transaction volume, average transaction amount, category spending, and success rates. The Trend Analysis Engine identifies changes in spending patterns over time. The Comparison and Segmentation Engine compares aggregate spending across categories, regions, payment channels, and approved customer segments. The Optional Anomaly Analytics Module identifies unusual aggregate transaction patterns for further investigation. The Visualization Engine generates KPI cards, charts, graphs, maps, and tables.



V. RESULT AND OUTPUT



VI. CONCLUSION

The Credit Card Spending Pattern & Customer Transaction Analytics Dashboard provides an effective and centralized solution for monitoring and analyzing credit card transaction and spending patterns. The system brings important information such as total spending, transaction volume, average transaction value, merchant categories, payment channels, regions, and customer segments into a single interactive dashboard. By using data processing, KPI calculation, trend analysis, customer segmentation, comparison techniques, and data visualization, the system transforms large transaction datasets into meaningful financial insights. Authorized analysts can identify popular spending categories, compare regional transaction activity, understand customer-segment patterns, and monitor changes in spending behavior over different periods.

The dashboard also makes it easier to identify important transaction trends and unusual aggregate patterns that may require further investigation. Interactive charts, KPI cards, tables, maps, and filters provide a clear view of financial activity and reduce the need for manually prepared reports.

Overall, the Credit Card Spending Pattern & Customer Transaction Analytics Dashboard improves the efficiency and accessibility of transaction analytics. It supports data-driven financial planning, customer analytics, transaction monitoring, and business decision-making while reducing manual analysis efforts. Future enhancements can include AI-based spending forecasting, advanced anomaly detection, customer segmentation, real-time transaction monitoring, personalized financial insights, and predictive analytics.

Since credit card transactions contain sensitive financial information, the system should implement strong authentication, authorization, encryption, access control, audit logging, data minimization, and privacy measures. Automated insights should support qualified financial and business teams rather than independently making important financial decisions.

REFERENCES

[1] Kumar, R. D., Prudhviraj, G., Vijay, K., Kumar, P. S., & Plugmann, P. (2024). Exploring COVID-19 through intensive investigation with supervised machine

learning algorithm. In Handbook of Artificial Intelligence and Wearables (pp. 145-158). CRC Press.
[2] Swathi, B., Vijay, K., Sushanth Babu, M., & Dinesh Kumar, R. (2024, November). Machine Learning Techniques in Cloud Based Intrusion Detection. In The International Conference on Artificial Intelligence and Smart Environment (pp. 557-564). Cham: Springer Nature Switzerland.
[3] Sv satyakrishna, shirisha rangu ,bhargavi nalacheruve.(2024) Prospective investigation on colorectal cancer with SMOTE on machine learning Algorithm
[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.
[5] V. N. S. Manaswini, K. K, C. Nigam, S. S. Ali, R. Niranjana, and Suman, "Real-Time Object Detection in Drone Surveillance Using YOLOv5," in Proc. 2025 3rd Int. Conf. IoT, Communication and Automation Technology (ICICAT), Gorakhpur, India, 2025, pp. 1–6, doi: 10.1109/ICICAT68430.2025.11414670.
[6] B. Soundarya, V. N. S. Manaswini, M. Ayyakrishnan, R. D. Kumar, "Contextual Analysis of Big Data Analytics in Intelligent Transportation Frameworks," in Intersection of Artificial Intelligence, Data Science, and Cutting-Edge Technologies: From Concepts to Applications in Smart Environment, Lecture Notes in Networks and Systems, vol. 1353, Cham: Springer, 2025, doi: 10.1007/978-3-031-88304-0_79.
[7] R. D. Kumar, V. N. S.Manaswini, "Applications of blockchain in smart cities: detecting fake documents from land records using blockchain technology," in Blockchain for Smart Cities, Elsevier, 2021, pp. 105–117, doi: 10.1016/B978-0-12-824446-3.00017-X.
[8] Tejavath Veeramma, Badarla Anil, Guguloth Ravinder, "An advanced movie recommender using collaborative filtering and sentiment analysis," International Research Journal of Modernization in Engineering Technology and Science, vol. 7, no. 7, July 2025, doi: 10.56726/IRJMETS81618.
[9] Ravi Kumar Banoth, Ramana Murthy B V, "Automatic crop recommendation system using LightGBM and decision tree machine learning models," Journal of Machine and Computing, vol. 5, no. 1, pp. 343, Jan. 2025, doi: 10.53759/7669/jmc202505026.
[10] Ravi Kumar Banoth, Dr. B.V. Ramana Murthy, "Smart agriculture through IoT and machine learning for analyzing carbon footprints," in Proc. Int. Conf. Computer Science and Communication Engineering (ICCSCE), Apr. 2025.
[11] Ravi Kumar Banoth, B. V. Ramana Murthy, "Soil image classification using transfer learning approach: MobileNetV2 with CNN," SN Computer Science, vol. 5, art. no. 199, 2024, doi: 10.1007/s42979-023-02500-x.