



# RETAIL BILLING SYSTEM AND ANALYSIS

IT606 Programming Lab Python

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# **Project Report:**

## **Retail Billing System And Exploratory Data Analysis**

### **I. Introduction**

A Retail Billing System is a smart tool that helps stores manage the process of selling products to customers. It's like the brain behind the cash register, making sure everything adds up correctly. This system not only makes the buying process smooth for customers but also helps store owners keep track of their products and sales

#### **1.1 Objectives**

##### **1. Automation of Billing Process:**

- Goal: To automate the calculation of total costs during transactions.
- Objective: Develop a system that calculates the total cost accurately based on purchased items, quantities, and prices.

##### **2. Bill Receipt Generation:**

- Goal: Generate digital bill receipts for each transaction.
- Objective: Implement a feature that creates detailed and organized bill receipts, including product details, quantities, prices, and total amount.

##### **3. Search Functionality for Previous Bills:**

- Goal: Enable users to easily search for and retrieve information from previous bills.
- Objective: Implement a search mechanism using a unique bill number to access and display details of previous transactions.

##### **4. Data Management in Text File:**

- Goal: Manage and store all billing information in a structured text file.
- Objective: Develop a system that efficiently writes and reads billing data to and from a text file, ensuring data integrity and easy retrieval.

##### **5. User-Friendly Interface:**

- Goal: Provide an intuitive and user-friendly interface for efficient use.
- Objective: Design and implement a graphical user interface (GUI) that simplifies the billing process, making it accessible and easy for users to navigate.

## II. Technologies Used

Describe the technologies and tools employed in the project:

- **Programming Language:** Python
- **User Interface:** Tkinter
- **Data Storage:** Excel, Text File
- **Analysis:** Exploratory Data Analysis (EDA)

## III. System Architecture

The Retail Billing System architecture is designed to efficiently handle the process of generating bills, managing data, and ensuring smooth interactions between various components. Here's an overview of its architecture:

1. **User Interface (UI):**
  - **Description:** The UI is the front end of the system that interacts with users. It includes elements such as buttons, input fields, and displays where users input data and receive information.
  - **Functionality:** Allows users to enter product details, quantities, and initiate billing processes.
2. **Billing Module:**
  - **Description:** The billing module is the core component responsible for calculating the total cost, including taxes, based on user inputs.
  - **Functionality:** Takes product details, quantities, and prices from the UI, performs necessary calculations, and generates a detailed bill.
3. **Data Management Module:**
  - **Description:** Manages the storage and retrieval of billing data.
  - **Functionality:** Writes and reads billing information to and from a text file or database, ensuring data persistence and easy retrieval for search and reporting functionalities.
4. **Search Module:**
  - **Description:** Facilitates the retrieval of previous bills based on a unique identifier.
  - **Functionality:** Takes user input (unique bill number) from the UI, searches the

5. Email Service:

- Description: Sends bills to customers via email.
- Functionality: Takes the finalized bill information and sends it to the customer's email address. It may include attaching a PDF or other suitable file format.

6. Text File and Excel (or Database):

- Description: Serves as the data store for billing information.
- Functionality: Stores data such as product details, quantities, prices, and unique identifiers for each transaction, allowing for easy retrieval and historical tracking.

## IV. Implementation

### 4.1 User Interface (Tkinter)

from tkinter import \*

from tkinter import messagebox

The screenshot displays a Tkinter-based Billing Software interface. The window title is "Billing Software". The main title "Billing Software" is centered at the top. Below it, the "Customer Details" section includes input fields for Customer Name (kushal barot), City (kalol), Phone No (9313450613), and Bill No (2723), along with a SEARCH button. The interface is divided into three columns for product selection: "Cosmetics" (Bath Soap, Face Cream, Face Wash, Hair Spray, Body Lotion), "Grocery" (Rice, Food Oil, Daal, Wheat, Sugar), and "Others" (Maza, Coke, Frooti, Nimkos, Biscuits). Each product has a corresponding quantity input field. To the right, the "Bill Area" displays a welcome message, bill details (Bill No. : 2723, Customer Name : kushal barot, Phone No. : 9313450613), and a table of items with their quantities and prices. At the bottom, the "Bill Menu" section shows totals and taxes for each category, along with buttons for Total, Print, Generate Bill, Clear, and Email.

Product	Qty	Price
Bath Soap	12	400
Face Cream	3	420
Face Wash	1	240
Hair Spray	3	1020
Body Lotion	1	260
Wheat	6	600
Food Oil	6	1080
Daal	7	560
Rice	5	400
Sugar	6	1020
Maza	5	100
Frooti	4	200

## 4.2 Email Service:

```
import smtplib
```

Send Email

SENDER

Sender's Email:

202318006@daiict.ac.in

Password

RECIPIENT

Email Address:

kushalbarot1224@gmail.com

Message:

Welcome To DAIICT's Retail

Bill No. : 2723

Customer Name : kushal barot

Phone No. : 9313450613

.....

Product	Qty	Price
Bath Soap	12	480
Face Cream	3	420
Face Wash	1	240

.....

SEND

Customer get the bill on his/her Gmail :

The screenshot shows a Gmail interface. On the left is the sidebar with the 'Compose' button and a list of folders: Inbox (2,021), Starred, Snoozed, Sent, Drafts, Categories (Social: 79, Updates: 1,901, Forums, Promotions: 14), and Labels (+). The main area displays an email from '202318006@daiict.ac.in' to 'me'. The email content includes a welcome message and a bill for 'DAIICT's Retail'. The bill lists 15 items with their quantities and prices, totaling 7161.0 (including tax). A toast message at the bottom states 'Conversation removed from "Inbox".' with an 'Undo' option.

**Search mail**

**Compose**

**Inbox** 2,021

- Starred
- Snoozed
- Sent
- Drafts
- Categories
  - Social** 79
  - Updates** 1,901
  - Forums
  - Promotions** 14
- More
- Labels +

**202318006@daiict.ac.in**  
to me

Welcome To DAIICT's Retail

Bill No. : 2723  
Customer Name : kushal barot  
Phone No. : 9313450613

Product	Qty	Price
Bath Soap	12	480
Face Cream	3	420
Face Wash	1	240
Hair Spray	3	1020
Body Lotion	1	260
Wheat	6	600
Food Oil	6	1080
Daal	7	560
Rice	5	400
Sugar	6	1020
Maza	5	100
Frooti	4	200
Coke	4	240
Nimko	5	100
Biscuits	5	100

Total(with Tax) : 7161.0

Conversation removed from "Inbox". [Undo](#)

## 4.2 Search module:

Search for bill:-2210

It is to be done by the help of 'OS' module

The screenshot displays the 'Billing Software' application window. At the top, the title bar reads 'Billing Software'. Below it, the main header is 'Billing Software'. The interface is divided into several sections:

- Customer Details:** This section contains input fields for 'Customer Name', 'City', 'Phone No', and 'Bill No.' (which has the value '2210'). A 'SEARCH' button is located to the right of these fields.
- Product Selection:** This section is divided into three columns: 'Cosmetics', 'Grocery', and 'Others'. Each column contains a list of products with corresponding quantity input fields (all set to '0').
  - Cosmetics:** Bath Soap, Face Cream, Face Wash, Hair Spray, Body Lotion.
  - Grocery:** Rice, Food Oil, Daal, Wheat, Sugar.
  - Others:** Maza, Coke, Frooti, Nimkos, Biscuits.
- Bill Area:** A window on the right side of the interface showing the bill details. It includes a welcome message 'Welcome To Hanan's Retail', the bill number '2210', customer name 'kushal', and phone number '2949293'. Below this is a table with columns 'Product', 'Qty', and 'Price'. The table shows 'Bath Soap' with a quantity of '12' and a price of '480'. The total amount is '504.0'.
- Bill Menu:** This section at the bottom contains input fields for 'Total Cosmetics', 'Total Grocery', 'Others Total', 'Cosmetics Tax', 'Grocery Tax', and 'Others Tax'. To the right of these fields are buttons for 'Total', 'Print', 'Generate Bill', 'Clear', and 'Email'.



## V. Exploratory Data Analysis (EDA)

→ Importing libraries:

pandas, matplotlib.pyplot, seaborn, NumPy, plotly.express

→ Data Information:

info, shape, data type, duplicated, empty/non-empty values, column names and unique values.

→ Data visualization and interpretation:

Bar graph, sunburst graph, line chart, stacked bar chart, heatmap

### 5.1 Data Cleaning

No missing values, outliers, or inconsistencies.

#### Dropping of bill\_id and phone number Column:-

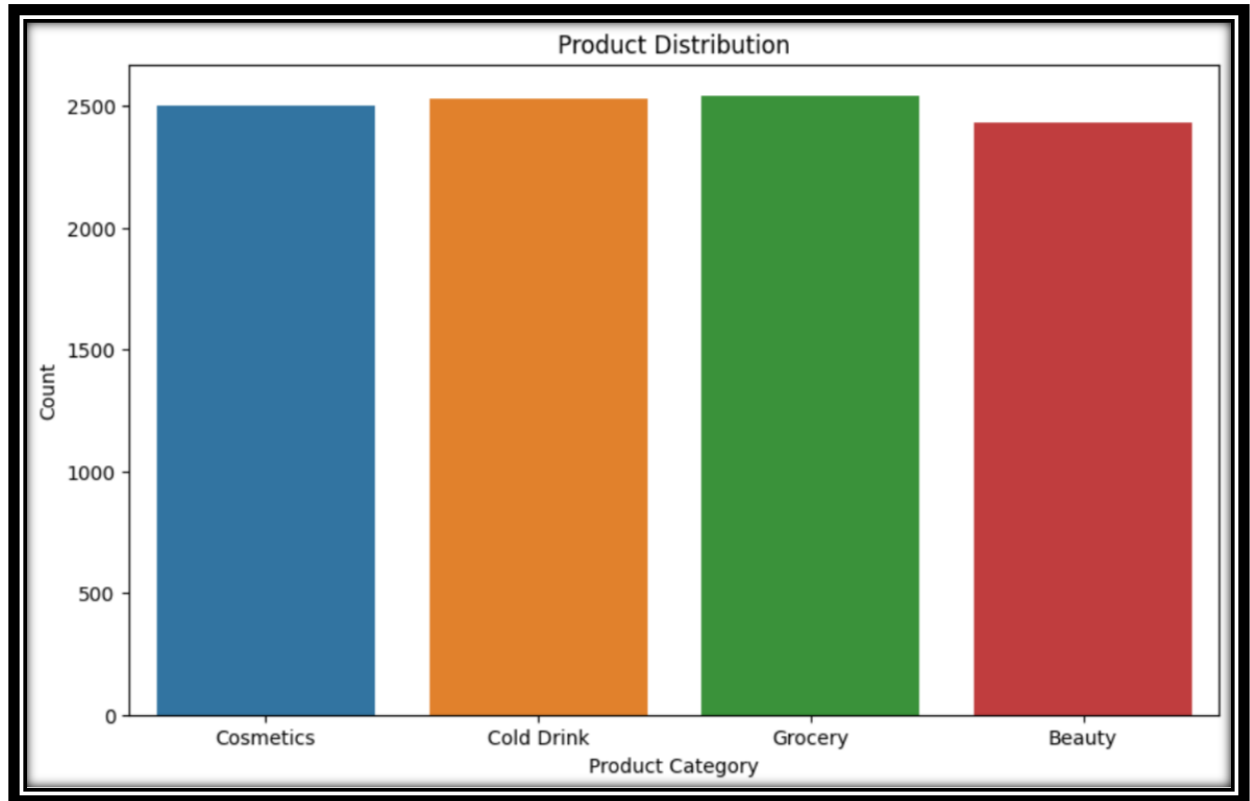
	date	customer_name	city	product_name	category	quantity	price_per_unit	total_amount
0	27-02-2023	Daniel Kemp	Jaipur	Body Lotion	Cosmetics	3	200	600
1	23-12-2022	Charles Wyatt	Bangalore	Mazaa	Cold Drink	8	20	160
2	02-06-2022	Kimberly Weber	Kolkata	Rice	Grocery	7	100	700
3	02-05-2022	Suzanne Blankenship	Hyderabad	Bath Soap	Cosmetics	5	80	400
4	24-12-2022	Miguel Nunez	Bangalore	Coca-Cola	Cold Drink	6	40	240

## 5.2 Descriptive Statistics

	quantity	price_per_unit	total_amount
count	10000.000000	10000.000000	10000.000000
mean	5.561200	82.861000	461.083000
std	2.875045	59.235425	441.288308
min	1.000000	20.000000	20.000000
25%	3.000000	30.000000	160.000000
50%	6.000000	80.000000	300.000000
75%	8.000000	120.000000	690.000000
max	10.000000	230.000000	2300.000000

### 5.3 Data Visualization

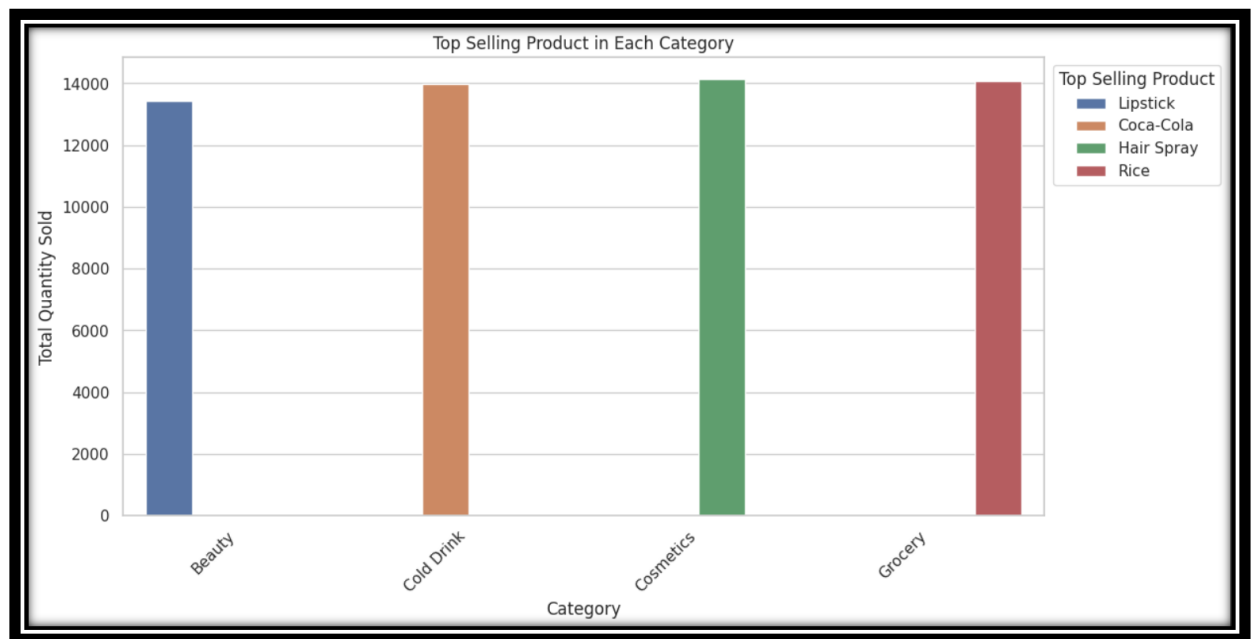
**Product distribution:-**



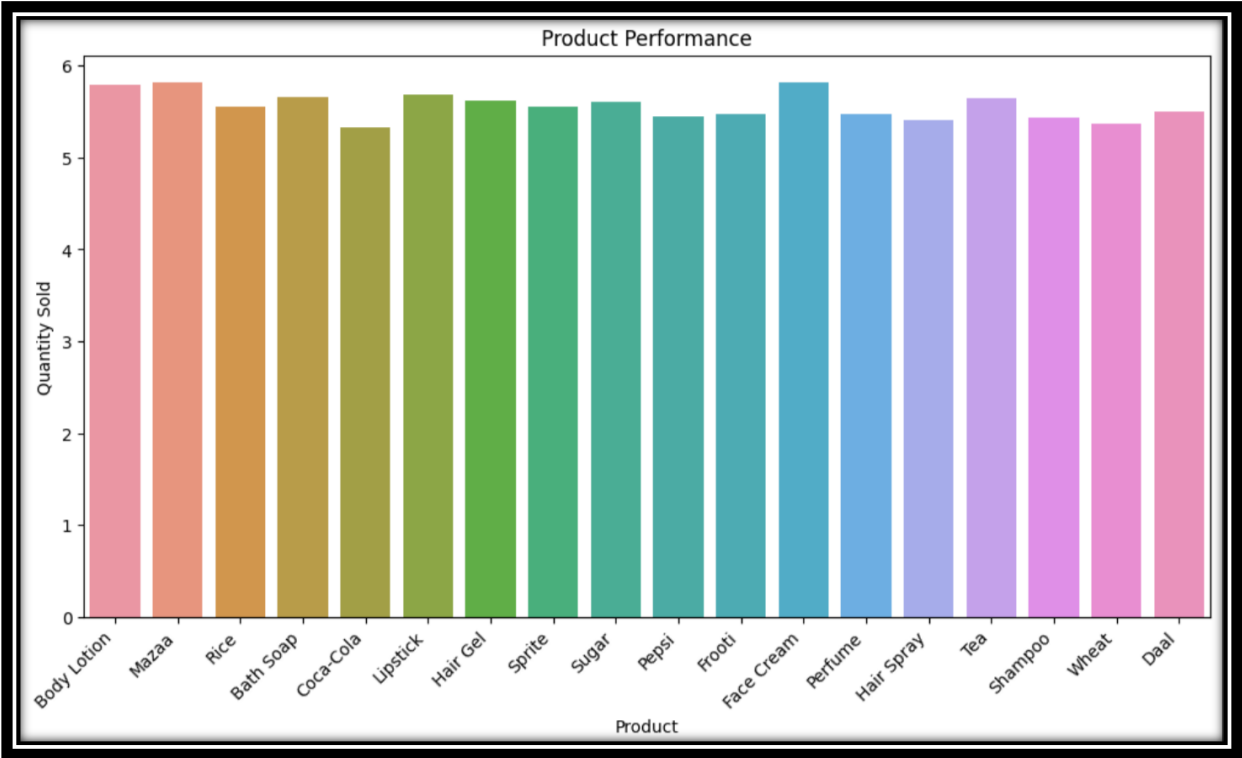
- The dataset includes a variety of products categorized into different categories such as Grocery, Cold Drink, Beauty, and Cosmetics.
- The highest-selling category is 'Cold Drink,' followed by 'Grocery' and 'Beauty.'

### Top selling product in each category

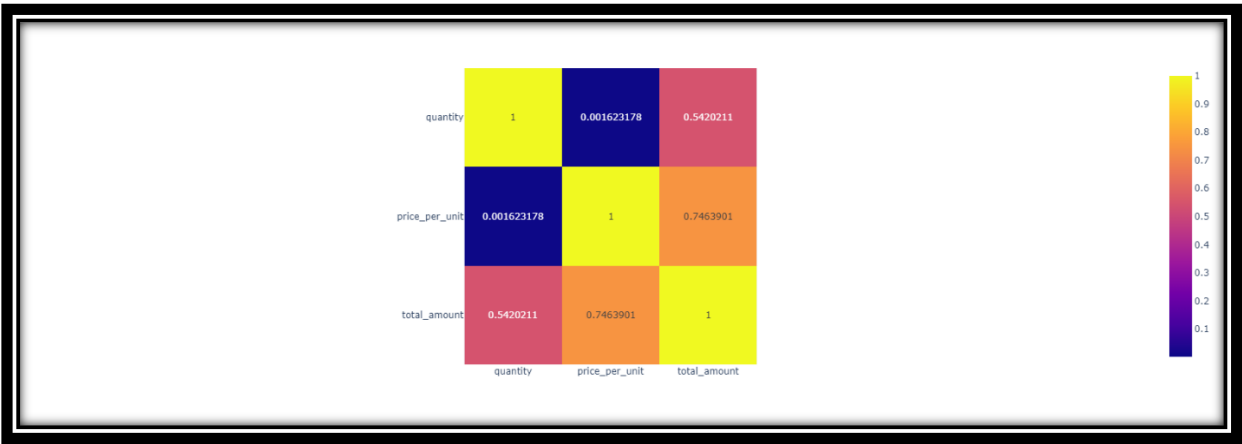
category	top_selling_product	total_quantity
Beauty	Lipstick	13433
Cold Drink	Coca-Cola	13975
Cosmetics	Hair Spray	14136
Grocery	Rice	14068



Product Performance

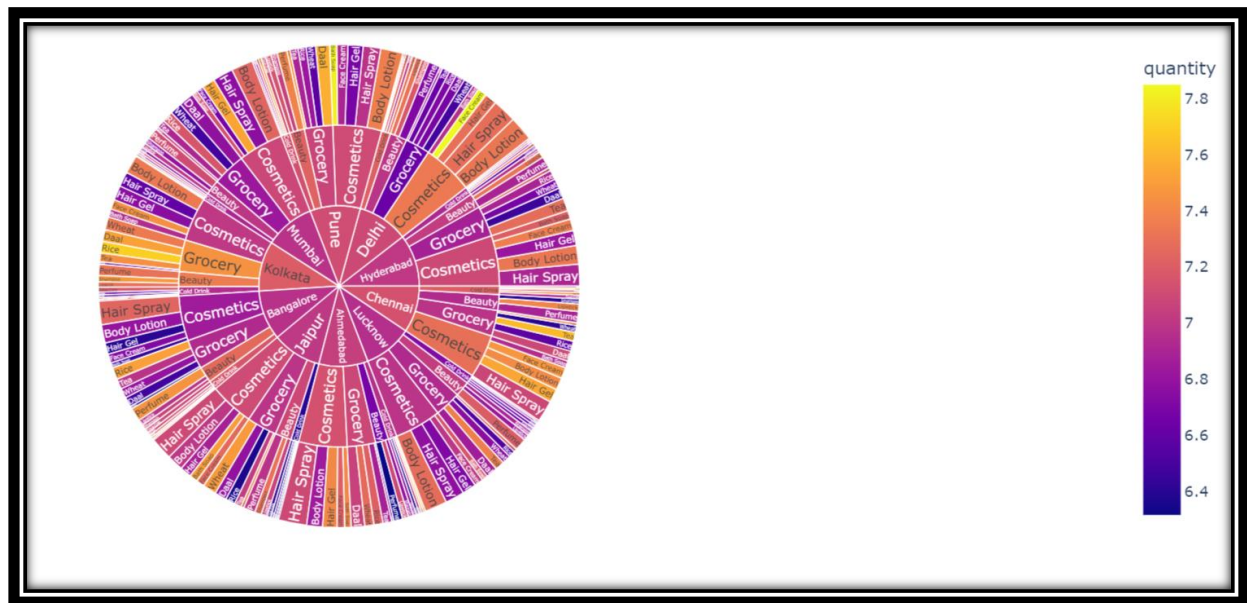


Heatmap for numeric values

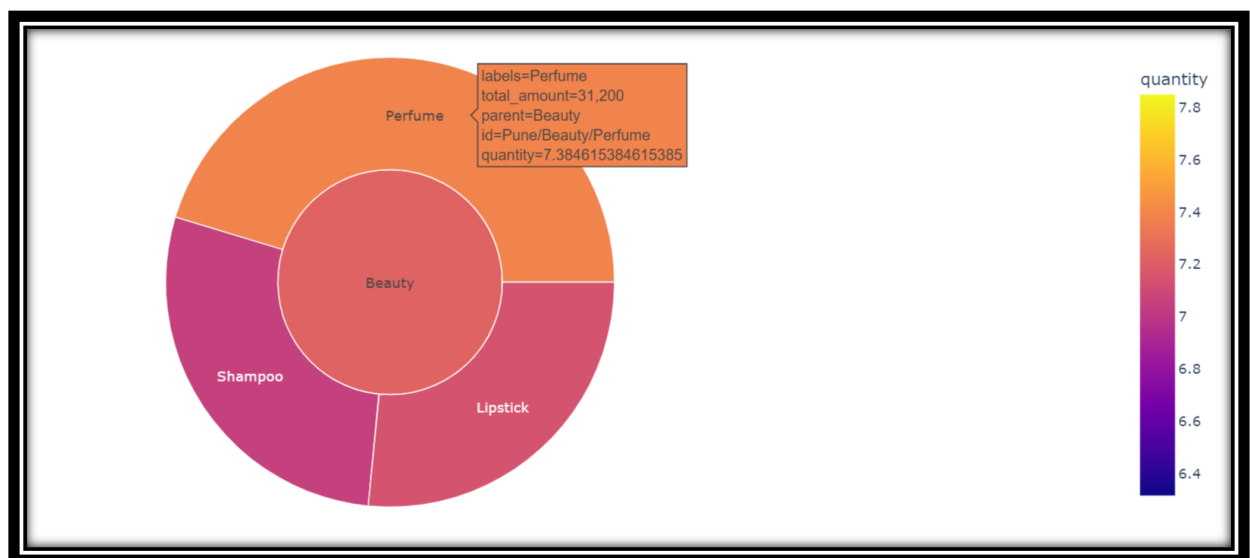
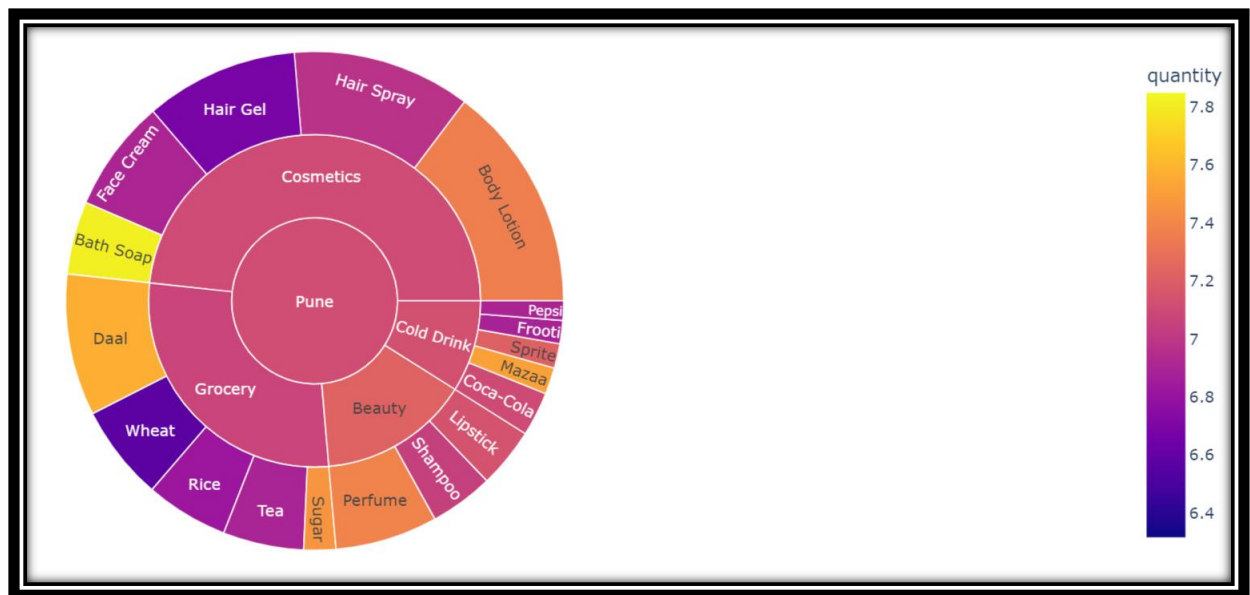


- 1:-Strong positive correlation
- 1:-Strongly negative correlation

## Sunburst graph



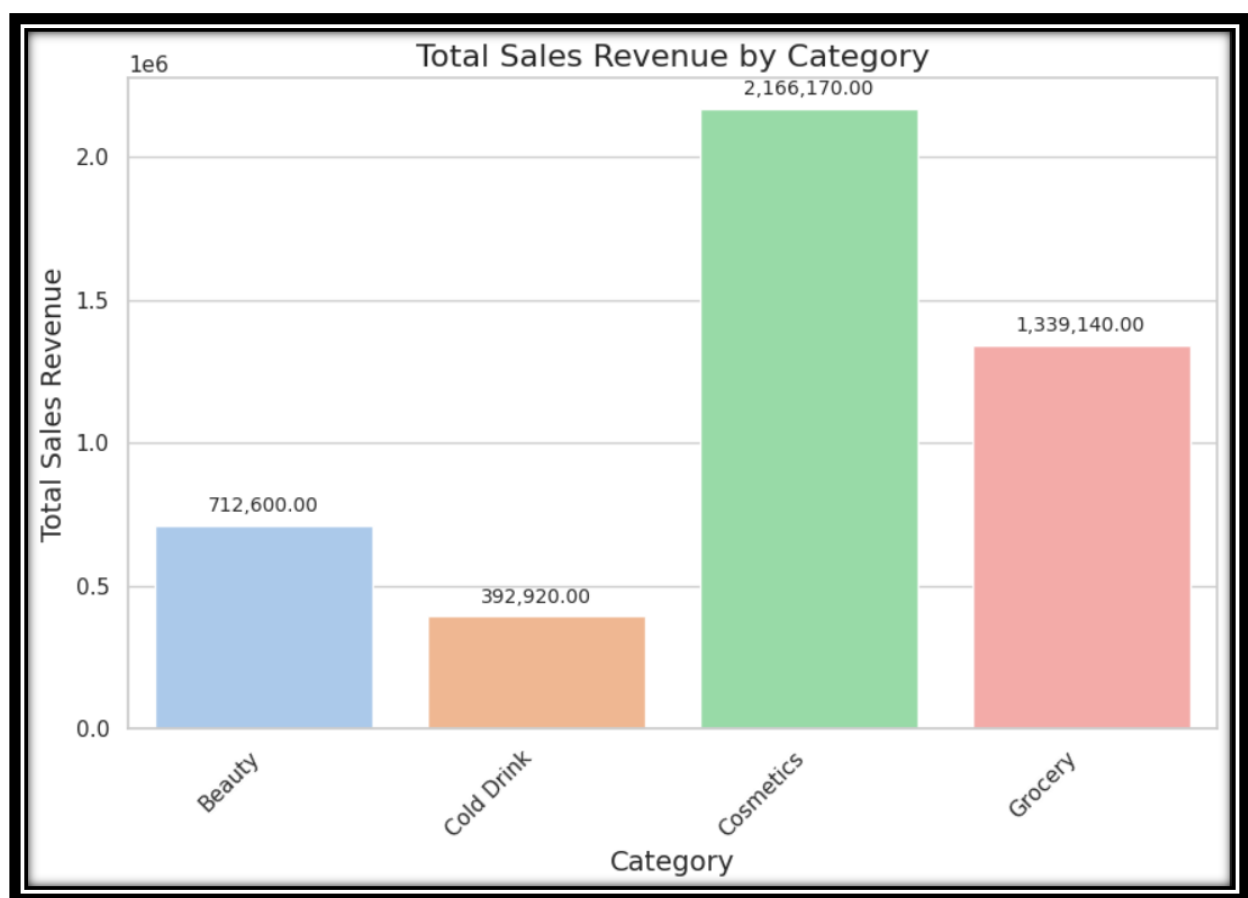
1. **Hierarchy of Data:** The path parameter specifies the hierarchical structure of your data. In this case, the sunburst chart visualizes the hierarchy based on the 'city', 'category', and 'product\_name'. Each level of the hierarchy is represented by a ring in the sunburst.
2. **Values and Color Encoding:** The values parameter determines the values associated with each segment, and the color parameter encodes another variable, 'quantity', as color. The color of each segment represents the 'quantity' of products sold.
3. **Sunburst Layers:** Each layer of the sunburst corresponds to one level in the hierarchy. The outermost ring represents 'city', the middle ring represents 'category', and the innermost ring represents 'product\_name'. Each segment in a ring represents a specific city, category, or product, and the size of the segment is proportional to the 'total\_amount' of sales in that category.
4. **Interactive Exploration:** Sunburst charts are interactive. You can click on a segment to zoom in, explore specific branches of the hierarchy, and see detailed information about each segment.



## Sales analysis

Total Sales Revenue by Product Category:

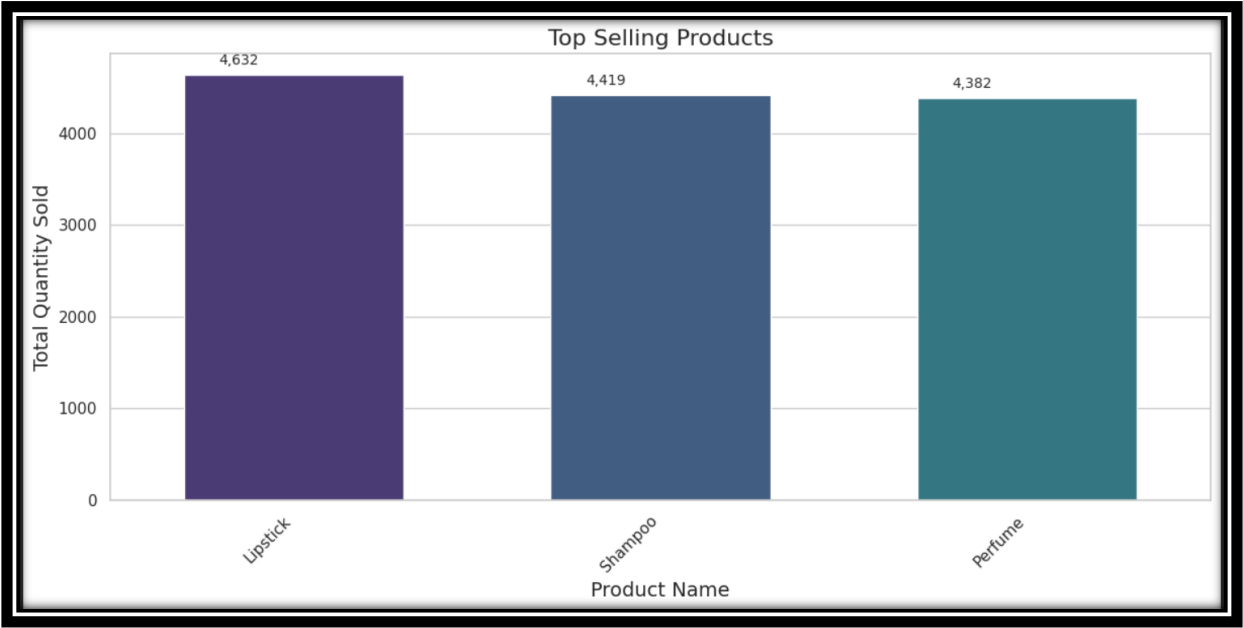
	Category	Total Quantity Sold	Total Sales Revenue
0	Beauty	13433	712600
1	Cold Drink	13975	392920
2	Cosmetics	14136	2166170
3	Grocery	14068	1339140





**Top-Selling Products in Terms of Quantity Sold:**

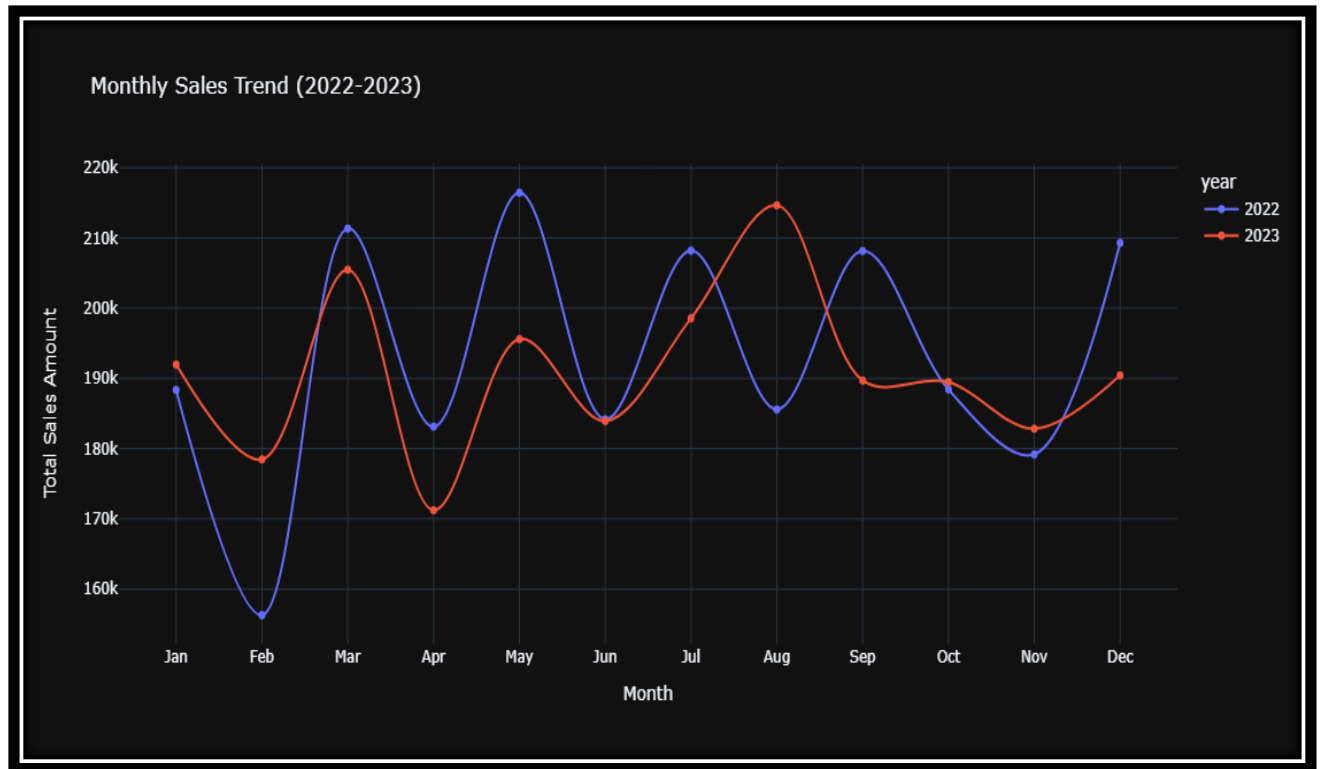
<i>Product name</i>	<i>Total Quantity Sold</i>
Lipstick	4632
Shampoo	4419
Perfume	4382



**How do sales vary over different months or seasons?**

**Are there any noticeable trends or seasonal patterns in sales?**

Sr. No.	year	month	total_amount
1.	2022	1	188340
2.	2022	2	156280
3.	2022	3	211350
4.	2022	4	183110
5.	2022	5	216440
6.	2022	6	184180
7.	2022	7	208200
8.	2022	8	185590
9.	2022	9	208130
10.	2022	10	188420
11.	2022	11	179180
12.	2022	12	209310
13.	2023	1	191980
14.	2023	2	178450
15.	2023	3	205480
16.	2023	4	171220
17.	2023	5	195600
18.	2023	6	183940
19.	2023	7	198550
20.	2023	8	214630
21.	2023	9	189710
22.	2023	10	189500
23.	2023	11	182820



Sales Trend Summary:

**1. Sales ups and downs:**

- Sales go up and down over the months.
- Some months have more sales, and others have less.

**2. Best months:**

- May and August are the best months for sales.

**3. Comparing years:**

- When we compare the same months in 2022 and 2023:
  - March was better in 2022.
  - August was better in 2023.

**4. Consistency:**

- Overall, sales are kind of steady.
- Some months are always good or not so good.

### 5. No big change:

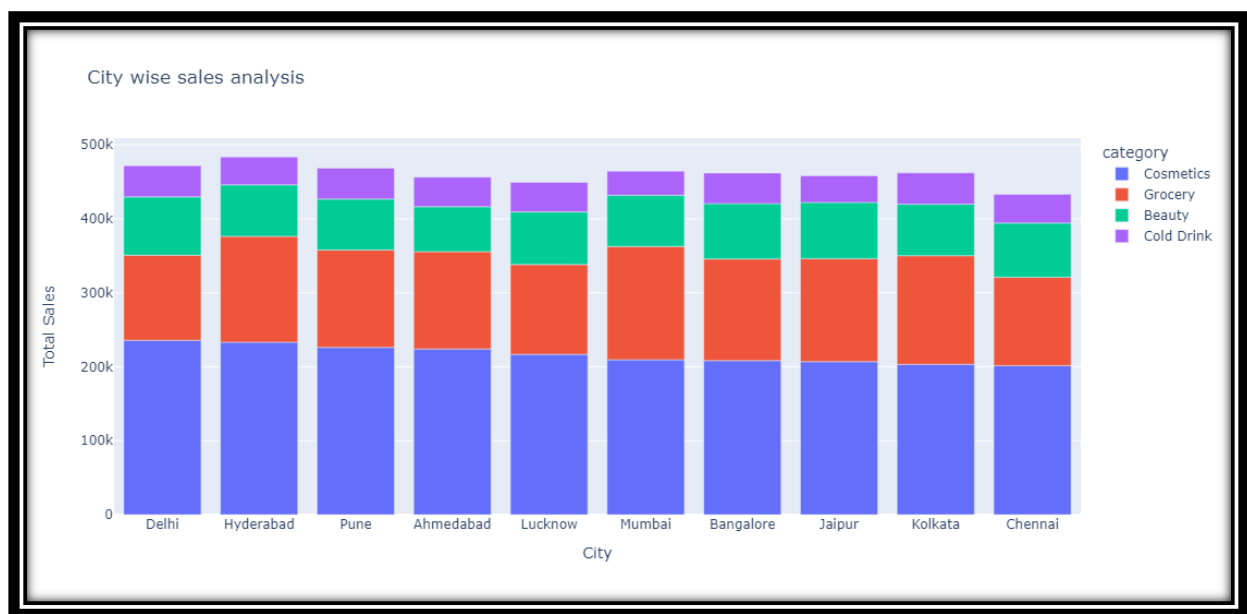
- There's no big increase or decrease in sales overall.

### 6. Important months:

- May and August—they're important for sales.

### *Location-Based Analysis:*

#### Which cities have the highest and lowest sales?



From the provided data, we can make several observations:

#### 1. Cosmetics Category

- Top Performing Cities: Delhi, Hyderabad, Pune
- Lowest Performing Cities: Kolkata, Chennai

#### 2. Grocery Category:

- Top Performing Cities: Mumbai, Kolkata, Hyderabad
- Lowest Performing Cities: Delhi, Chennai

### **3. Beauty Category:**

- Top Performing Cities: Delhi, Jaipur, Bangalore
- Lowest Performing Cities: Ahmedabad, Pune

### **4. Cold Drink Category:**

- Top Performing Cities: Kolkata, Delhi, Pune
- Lowest Performing Cities: Mumbai, Jaipur

## **VII. Results and Findings**

The implementation of the Retail Billing System has yielded significant results and valuable findings:

### **Efficient Billing Automation:**

Streamlined and accurate generation of unique bill numbers, reducing manual effort and potential errors.

### **Dynamic Product Management:**

Successful integration of diverse product categories, including cosmetics, cold drinks, and grocery items, facilitating smooth retail operations.

### **Automated Printing and Emailing:**

Seamless mechanisms for automated bill printing and emailing, enhancing customer convenience and communication.

### **Insights from EDA:**

Exploratory Data Analysis (EDA) on sales data revealed actionable insights, such as top-performing products, sales trends, and peak transaction periods.

### **User-Friendly Interface:**

Positive feedback from users regarding the system's intuitive interface and ease of use.

### **Improved Record-Keeping:**

Enhanced record-keeping capabilities, enabling quick and efficient retrieval of historical transactions.

## VIII. Conclusion

In conclusion, the **Retail Billing System** project has successfully achieved its objectives, offering an innovative and efficient solution for **managing retail transactions**. The seamless automation of billing processes, integration of diverse product categories, and **insightful Exploratory Data Analysis (EDA)** have collectively contributed to an enhanced retail experience. This project serves as a testament to the power of technology in streamlining operations and providing valuable insights. As we move forward, we remain committed to continuous improvement and innovation, ensuring that the Retail Billing System remains a reliable and adaptable solution in the dynamic landscape of retail management.

## IX. Future Work

We accept the suggestion that give possible enhancements or additional features that could be implemented in the future.

## X. References

1. **Matplotlib Documentation:**
  - [Matplotlib Documentation](#): Official documentation for Matplotlib for creating visualizations.
2. **Pyplot Documentation:**
  - [Pyplot Documentation](#): Pyplot documentation within Matplotlib for specific plotting functions.
3. **EDA article:**
  - [GFG article](#) : Consulted the GeeksforGeeks article to study Exploratory Data Analysis.