Northeastern Coffee

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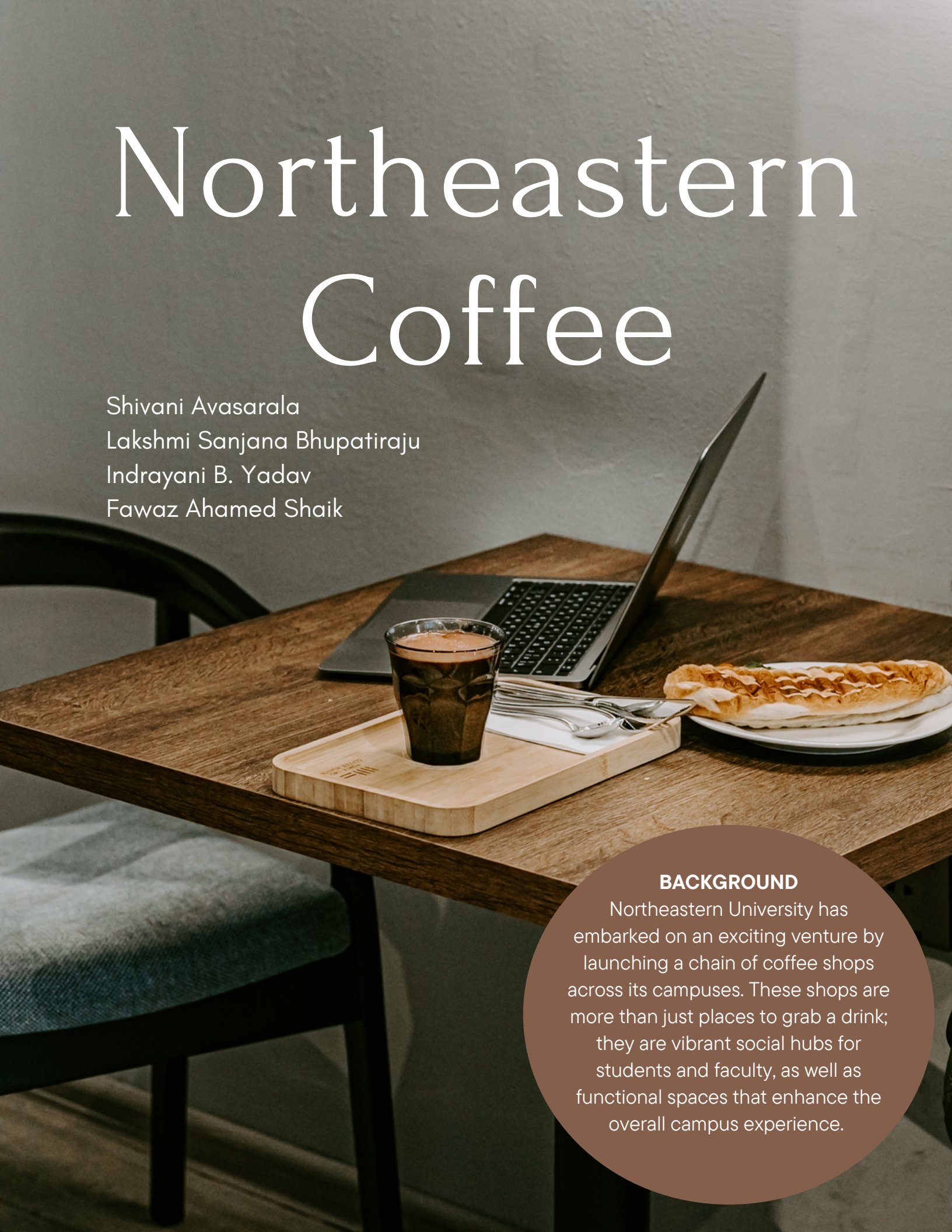


BACKGROUND

Northeastern University has embarked on an exciting venture by launching a chain of coffee shops across its campuses. These shops are more than just places to grab a drink; they are vibrant social hubs for students and faculty, as well as functional spaces that enhance the overall campus experience.

Central Challenge

The main challenge is effectively aggregating and analyzing data from diverse sources across these multiple branches. Each coffee shop generates a wealth of data encompassing sales, human resources, operations, and customers. As each branch functions with a degree of autonomy, the data they produce varies in nature and format, presenting a significant challenge in terms of central consolidation and analysis.

Sales and Customer Engagement Analysis	Understanding customer behavior, preferences, and purchasing patterns is crucial. The management needs to analyze data to discern peak times, most sought-after products, and customer demographics across different campus locations.
Marketing Strategy Optimization	With diverse customer bases at each location, customized marketing strategies are essential. The challenge lies in harnessing sales and customer engagement data to tailor marketing efforts effectively for each branch.
Human Resources Data Integration	Each branch has its team, and managing staffing levels, across all locations requires a cohesive approach. Centralized HR data would facilitate better workforce management and training programs.
Operational Data Coordination	Operational aspects like inventory management, supply chain logistics, and equipment maintenance need to be synchronized across branches. Disparate operational data can lead to inefficiencies and increased operational costs.
Data Integration Technology	Perhaps the most significant challenge is the lack of a unified technological framework for integrating and analyzing data from varied sources. This results in difficulties in aggregating data for comprehensive analysis.

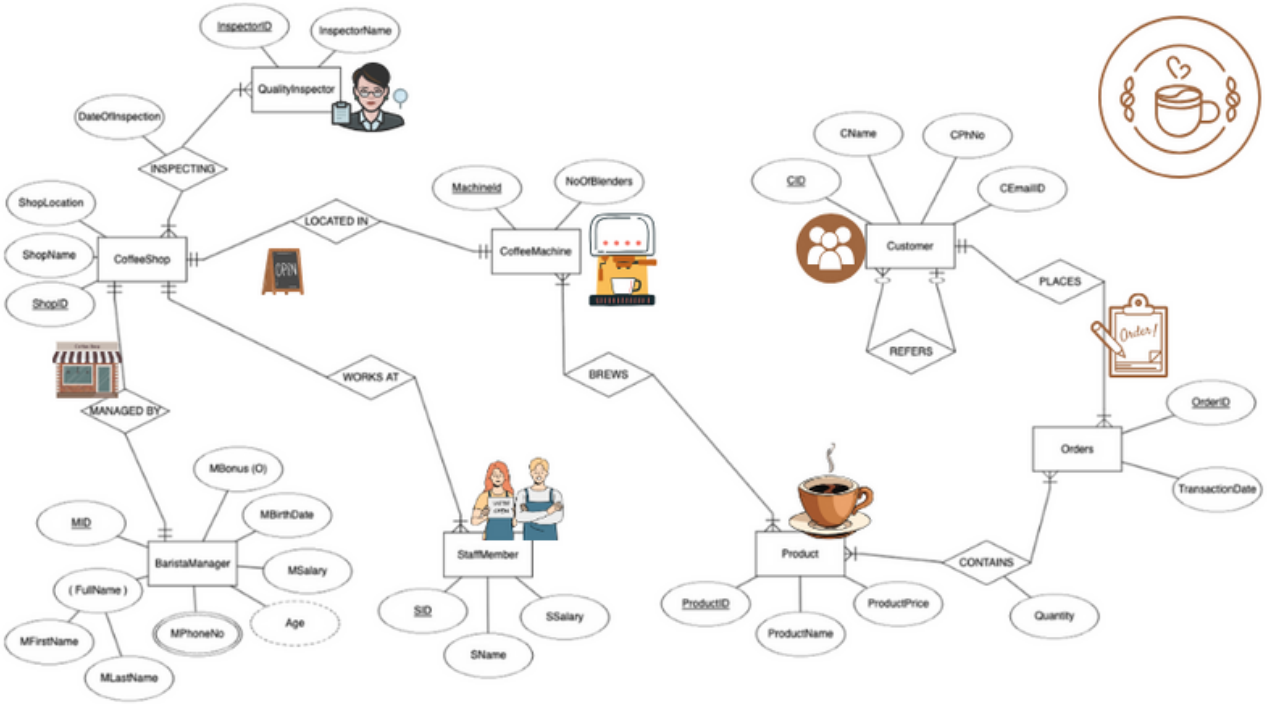
- **Comprehensive Data Analysis**: To develop a centralized system that can effectively aggregate, analyze, and interpret data from all branches. This system should offer real-time insights to support dynamic decision-making.
- **Identifying Success Factors**: By analyzing sales and customer engagement data, the university aims to identify key drivers of success, such as popular products that can lead to effective marketing techniques and optimal operational practices.
- **Tailoring Strategies for Improvement**: Using the insights gained from data analysis, the goal is to fine-tune marketing strategies, enhance operational efficiency, and improve the overall customer experience across all coffee shop branches.
- **Benchmarking and Best Practices**: Establish benchmarks for performance and identify best practices that can be replicated across branches to ensure a consistent and high-quality customer experience.
- **Future Planning**: Leverage the data insights for strategic planning, including potential expansion, menu changes, and other initiatives that align with evolving customer preferences and market trends.

1**. Relational Database Design**: The primary goal here is to apply the principles of relational database design to create a well-structured database that efficiently organizes coffee-related data. This involves defining tables, and relationships between them, and establishing data integrity constraints to ensure accurate and consistent data storage.

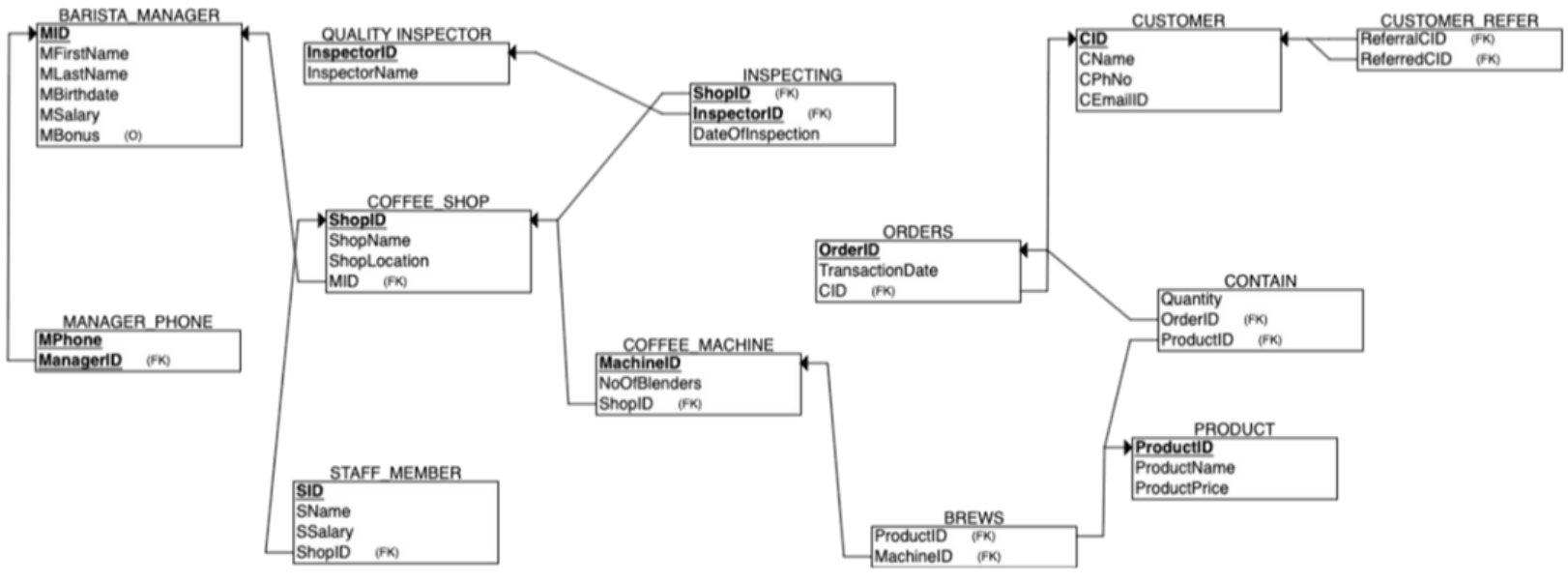
2. **Entity-Relationship Diagram (ERD):** The development of a clear ERD is crucial for visually representing the relationships between various entities within the database. This diagram helps stakeholders, including developers and non-technical personnel, understand the database structure and how different components relate to one another.
3. **Normalization:** Normalization techniques are employed to minimize data redundancy and eliminate anomalies, enhancing data integrity. This process optimizes overall database efficiency by ensuring that data is stored in a structured and consistent manner.
4. **SQL Implementation:** This objective focuses on creating SQL scripts that define the database schema, establish relationships between tables, and enforce data consistency through constraints. SQL scripts are essential for both creating the initial database and managing it over time.
5. **Efficient Query Optimization:** Query optimization strategies, such as creating indexes and optimizing SQL queries, are implemented to enhance the performance of data retrieval operations. This ensures that data can be accessed quickly and efficiently, contributing to timely decision-making.

1. CoffeeShop keeps track of ShopID (unique), ShopName, ShopLocation
2. CoffeeMachine keeps track of MachineID (Unique), NoOfBlenders (number of blenders in the machine)
3. Customer: CID (unique), CName, CPhNo, CEmailID, CGender, CBirthDate, CAge (derived from CBirthDate and current date)
4. BaristaManager: MID (unique), MFullName (composed of MFirstName and MLastName), MPhNo(Multivalued column), MBirthDate, MAge (derived from MBirthDate and current date), MSalary, MBonus (optional), MGender
5. StaffMember: SID (unique), SName, SSalary, SGender, SBirthDate, SAge (derived from SBirthDate and current date)
6. Quality Inspector: InspectorID (unique), InspectorName, DateofInspection
7. Orders: OrderID(unique), Transactiondate
8. Product: ProductID(unique), ProductName, ProductPrice
9. Each coffee machine is located in one coffee shop, but a coffee shop can have multiple coffee machines
10. Each customer can place different orders, but one order can be placed by only one customer
11. Each customer can refer many customers, and a customer can be referred by many customers
12. Each order can contain multiple products and multiple products can be ordered in one order and they will be linked together by the Quantity of the products in the order
13. Each coffee machine is used to brew various products, and a product can be brewed in multiple machines
14. Each coffee shop has more than one staff member, and each staff member works in only one coffee shop
15. Each coffee shop is managed by one manager, and a manager can only manage one coffee shops
16. Each coffee shop is inspected by one or many inspectors, and each inspector inspects multiple shops

ERD



Relational Schema



CREATING TABLES

```sql
DROP DATABASE IF EXISTS Northeastern_Coffee;
Create Database Northeastern_Coffee;
Use Northeastern_Coffee;

-- Create the BaristaManager table
CREATE TABLE BaristaManager (
    MID INT PRIMARY KEY,
    MFirstName VARCHAR(255) NOT NULL,
    MLastName VARCHAR(255) NOT NULL,
    MSalary DECIMAL(10, 2) NOT NULL,
    MBonus DECIMAL(10, 2),
    MBirthDate DATE NOT NULL,
    MAge INT,
    MGender VARCHAR(10)
    );

    -- Create a trigger to update MAge
DELIMITER //
CREATE TRIGGER calculate_age
BEFORE INSERT ON BaristaManager
FOR EACH ROW
SET NEW.MAge = TIMESTAMPDIFF(YEAR, NEW.MBirthDate, CURDATE());
//
DELIMITER ;
```

INSERTING VALUES

```sql
-- Insert data into BaristaManager
INSERT INTO BaristaManager (MID, MFirstName, MLastName, MSalary, MBonus, MBirthDate, MAge, MGender)
VALUES
    (1, 'Ram', 'Kumar', 55000.00, NULL, '1980-05-15', NULL, 'Male'),
    (2, 'Emily', 'Davis', 80000.00, 6000.00, '1965-08-25', NULL, 'Female'),
    (3, 'Alex', 'Johnson', 70000.00, 4500.00, '1972-03-10', NULL, 'Male'),
    (4, 'Sophia', 'Williams', 78000.00, NULL, '1968-11-30', NULL, 'Female'),
    (5, 'William', 'Brown', 76000.00, 4800.00, '1975-06-20', NULL, 'Male');

-- Insert data into CoffeeShop
INSERT INTO CoffeeShop (ShopID, ShopName, ShopLocation, MID)

VALUES

    (101, 'Capital Coffee Hungtington', 'Boston', 1),

    (102, 'Capital Coffee Terry', 'Seattle', 2),

    (103, 'Capital Coffee', 'Boston', 3),

    (104, 'Capital Coffee NW', 'Miami', 4),

    (105, 'Capital Coffee Hawkins', 'Charlotte', 5);
```

QUERIES

```sql
#2. Coffee products with sales and their total revenue
SELECT
    P.ProductName,
    SUM(C.Quantity) AS TotalSales,
    SUM(C.Quantity * P.ProductPrice) AS TotalRevenue
FROM
    Product P
JOIN
    Contain C ON P.ProductID = C.ProductID
GROUP BY
    P.ProductName
ORDER BY
    TotalSales DESC;
```

Result Grid — Filter Rows: Search — Export:

ProductName	TotalSales	TotalRevenue
French Press	9	108.00
Cold Brew	8	90.00
Cappuccino	7	71.75
Drip Coffee	6	57.00
Espresso	5	43.75
Macchiato	4	39.00
Affogato	4	58.00
Mocha	3	42.00
Caramel Macchiato	3	34.50
Latte	2	27.50
Iced Coffee	2	17.00
Chai Latte	2	30.00
Matcha Latte	2	28.50

Front End architecture

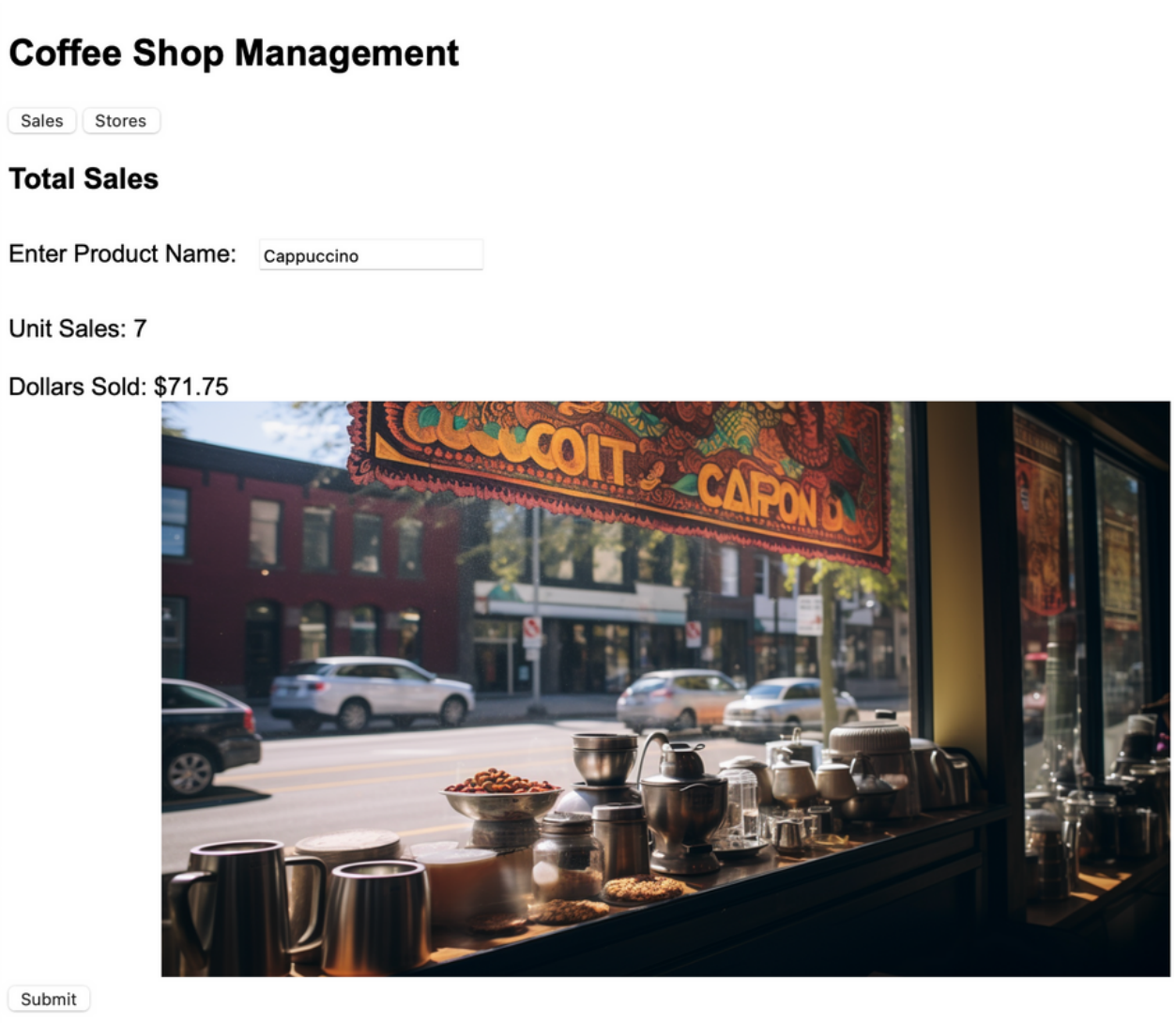
· We use a Flask Server in Python for the backend and HTML for the front end

· For the current use case, we designed two options for searching information within the database which is displayed in the front end, these are:

1) Coffee Sales and Dollars Earned
2) Location specific top seller product

This is a snapshot of our front end.

Searching product Sales and Dollars Sold



Searching product Location specific metrics

Coffee Shop Management

Sales Stores

Stores and their top selling product

Enter Location: Seattle

Store Name: Capital Coffee Terry
Location Name: Seattle
Top Selling Product: French Press

Submit

· We use the mysql.connector package to build this application in python.
Example of one of our functions for getting product sales details is:

```
def product_sale(product):
    query = f"""
    SELECT
        P.ProductName,
        SUM(C.Quantity) AS TotalSales,
        SUM(C.Quantity * P.ProductPrice) AS TotalRevenue
    FROM
        Product P
    JOIN
        Contain C ON P.ProductID = C.ProductID
    WHERE P.ProductName = "{product}"
    GROUP BY
        P.ProductName;
    """
    cursor.execute(query)
    result = cursor.fetchall()

    return result
```

The {product} over here is placeholder where the product name is entered and sent to the MySQL server and returns a result. The HTML front end extracts this output and parses the values to display the information.

Robust Database System Development at Northeastern Coffee

· Designed and implemented a comprehensive database system tailored for Northeastern Coffee.
· The system efficiently handles vast amounts of data, including customer details, inventory records, and sales transactions.
· Enhanced data security and integrity, ensuring reliable information storage and retrieval.

Streamlining Operations

· Optimized various operational processes such as inventory management, order processing, and customer relationship management.
· Implemented automation in key areas, reducing manual errors and saving time.
· Improved the workflow between departments, leading to increased overall efficiency.

Facilitating Informed Decision-Making

· Integrated advanced data analysis tools for a better understanding of market trends and customer behavior.
· Provided regular, detailed reports to management, enabling data-driven decision-making.
· Identified key performance indicators (KPIs) and tracked them for continuous improvement.

Exploring Advanced Analytics

· Implement cutting-edge analytics tools for deeper insights into market dynamics and customer preferences.
· Utilize predictive modeling to forecast sales trends and inventory requirements.
· Analyse customer feedback and social media trends for improved product offerings.

Development of a Customer App

· Create a user-friendly mobile application to enhance customer engagement and convenience.
· Offer personalized recommendations, loyalty programs, and promotional offers through the app.
· Enable easy ordering and payment options, improving the overall customer experience.

Expanding Database Integration with Online Platforms

· Integrate the existing database system with online ordering and delivery platforms.
· Ensure seamless data flow between the company's website, mobile app, and third-party platforms.
· Enhance customer experience with faster and more accurate order processing.

Focus on Real-Time Data and Scalability

· Upgrade the database system to handle real-time data processing for instant insights.
· Ensure the system is scalable to adapt to the growing needs of Northeastern Coffee.
· Implement cloud-based solutions for better accessibility and disaster recovery options.