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SOFTWARE ENGINEERING

**PoS System
for restaurants and hospitality businesses**

3rd course

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1 Introduction to PoS

1.1 Understanding Point of Sale (PoS)

The Point of Sale (PoS) system, traditionally, was a cash register where financial transactions occurred. However, with advancements in technology, PoS has evolved from mere cash registers to comprehensive systems that not only handle payments but also manage inventory, customer data, and business analytics.

Key Points:

- **Historical Overview:** Originally manual and purely transactional, PoS systems have transitioned into digital solutions, integrating with various other business tools.
- **Modern PoS Landscape:** Modern PoS systems are a fusion of software and hardware that help businesses process sales transactions efficiently. They're often integrated with various other tools, from inventory management systems to customer relationship management tools.

1.2 Objective of This Laboratory Work

In this laboratory work, our objective is multifaceted:

- **Implementation:** Ensuring our system runs smoothly, handling complex calculations behind the scenes, from taxes to tips.
- **Flexibility:** Catering not only to the restaurant and beauty industries but extending our scope to health services. This adds layers of complexity given the varied nature of these services.

Why is this PoS Special? Our system is focused on customizability and versatility. We emphasize the integration of loyalty programs, diverse payment options, and streamlined booking systems for services.

1.3 Techniques & Methodologies

To design a system that's robust yet flexible, several methodologies and techniques will be employed:

- **User-Centered Design (UCD):** By keeping the end-user in focus, we'll ensure that the system is intuitive and meets the unique requirements of each industry. This will involve user interviews, prototyping, and iterative testing.
- **Agile Development:** Given the vast scope and need for customization, an iterative approach to design and development will be essential. Agile will allow regular feedback and ensure the end product aligns with user needs.
- **Database Normalization:** As the system will be handling a large volume of data, ranging from menu items to service bookings, it's essential that the database is optimized to prevent redundancies and ensure fast retrievals.
- **Tools & Software:** Discuss the potential tools you might employ, like UML for sequence diagrams, and database modeling tools for ERDs.

1.4 Challenges & Solutions

Every endeavor comes with its own set of challenges. With multiple industries in focus, standardizing processes while retaining flexibility will be a challenge. Discuss potential pitfalls and your strategic approach to counteract them. This can include rigorous testing, modular design for scalability, and open channels of communication with end-users to ensure alignment with industry requirements.

End this section by reaffirming the importance of this project, not only as an academic exercise but as a potential real-world solution for diverse industries looking for an integrated, efficient, and user-friendly PoS system.

2 Main Users of the System

2.1 Introduction to System Users

Every system is essentially designed around its users. A deep understanding of who the users are, their roles, and their interactions with the system, shapes the design and functionality of the software. Given the diverse industries our PoS is catering to, the array of users is broad, each bringing with them unique requirements and challenges.

2.2 System Users

2.2.1 Customer:

- **Role & Responsibilities:** Primary end-user who initiates transactions. They expect a seamless experience, from selecting items or services to payment and receipt generation.
- **Interactions with PoS:** Customers primarily interact with the system indirectly unless there's a self-checkout option. Their choices are recorded, and they receive the final bill. In a more sophisticated setup, they may also use it to check loyalty points or redeem offers.
- **Challenges & Needs:** Speed and accuracy are crucial. The system should be intuitive enough to minimize errors. Integration with loyalty programs and offers is a plus for regular customers.

2.2.2 Waiter/Receptionist/Salesperson/Administrator:

- **Role & Responsibilities:** Acts as the intermediary between the customer and the PoS. They are responsible for entering orders, applying discounts, managing payments, and handling any issues or queries from the customer side.
- **Interactions with PoS:** Continuous interaction. They rely on the PoS for almost every aspect of their role, from recording orders to generating bills and receipts.
- **Challenges & Needs:** A user-friendly interface that reduces input errors, a fast system to manage peak times, and easy access to features like discounts and loyalty program adjustments.

2.2.3 Manager:

- **Role & Responsibilities:** Overlooks the business operations and uses the PoS for insights, analytics, and to make informed decisions. They are also responsible for managing promotional offers and loyalty programs.
- **Interactions with PoS:** While not involved in transactional aspects, they heavily rely on the system for reports, analytics, and monitoring daily operations.
- **Challenges & Needs:** Require detailed reports and insights. The ability to easily integrate and manage discounts or offers, and monitor overall business health.

2.2.4 Admin:

- **Role & Responsibilities:** Ensures the system's smooth running. They handle user access, system updates, backups, and any technical troubleshooting.
- **Interactions with PoS:** Dive deep into the system's backend, ensuring everything operates as it should.
- **Challenges & Needs:** A robust backend interface, quick troubleshooting tools, and a secure system to protect business data.

2.3 Non-System Users

These are the users indirectly affected by the system's operation:

2.3.1 Service Providers (e.g., Beauticians, Therapists, etc.):

They need timely information about bookings, special requirements, or customer preferences.

That is why they interact directly with the PoS, as they rely on the information it provides.

2.3.2 Suppliers:

They might interface with the system for inventory checks, restocking, and to provide updates on available products or services.

2.4 Tailoring the PoS to Users

Given the variety of users, it's vital to customize the user interface and experience based on roles. For instance, a cashier doesn't need access to in-depth business analytics, whereas a manager might not need detailed transactional data.

We will conclude this section by adding users feedback in the future. Emphasizing the importance of continuous feedback from all user categories and regular feedback loops ensure that the system remains adaptive and continues to serve the evolving needs of its users.

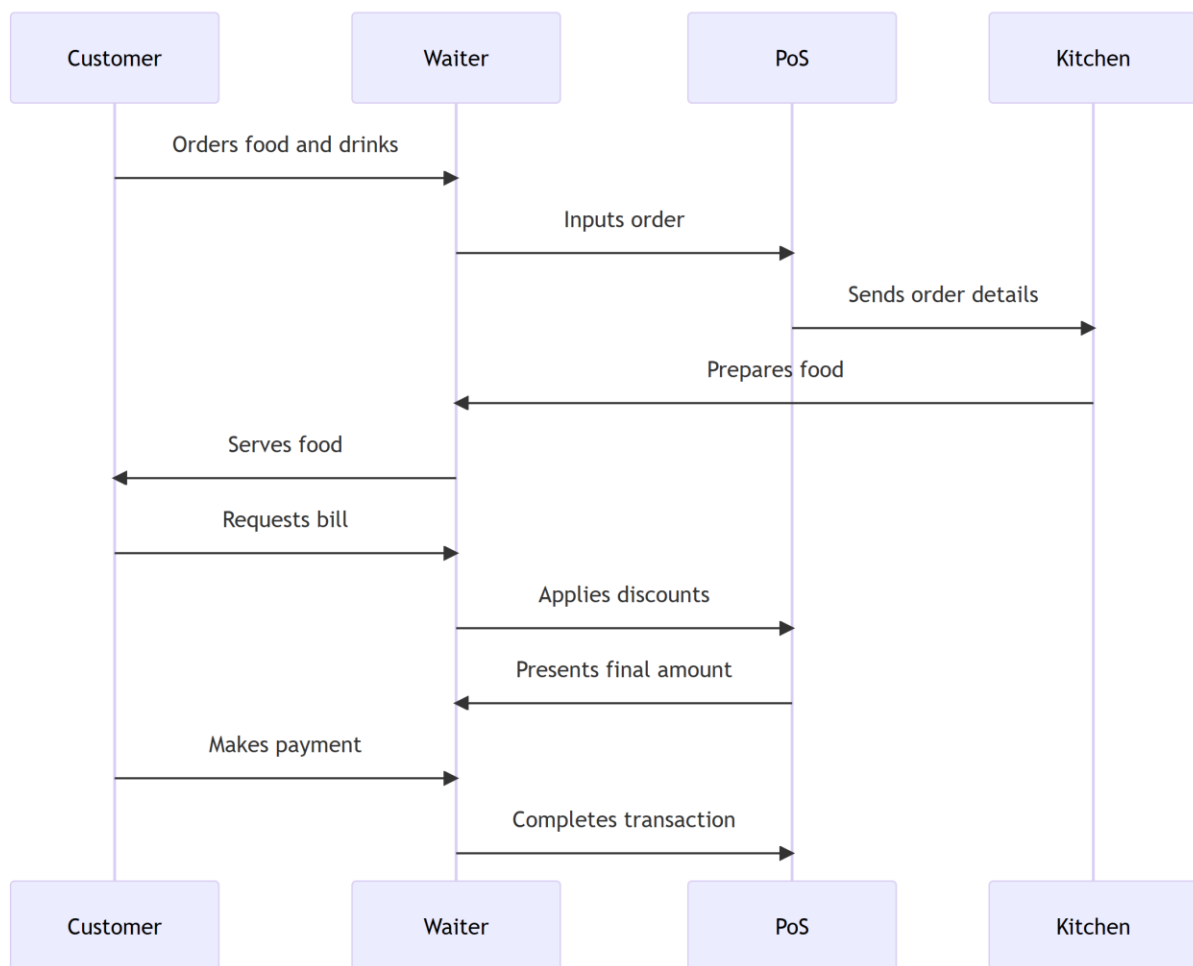
3 Main Business Scenarios

3.1 Introduction to Business Scenarios

Business scenarios are crucial in understanding the real-world applications of our PoS system. They provide a clear picture of how different users interact with the system and how the system responds to these interactions. By mapping out these scenarios, we can ensure that our system is equipped to handle the diverse needs of its users across various industries.

3.1.1 Scenario 1: Ordering Food and Drinks at a Restaurant

Sequence Diagram:

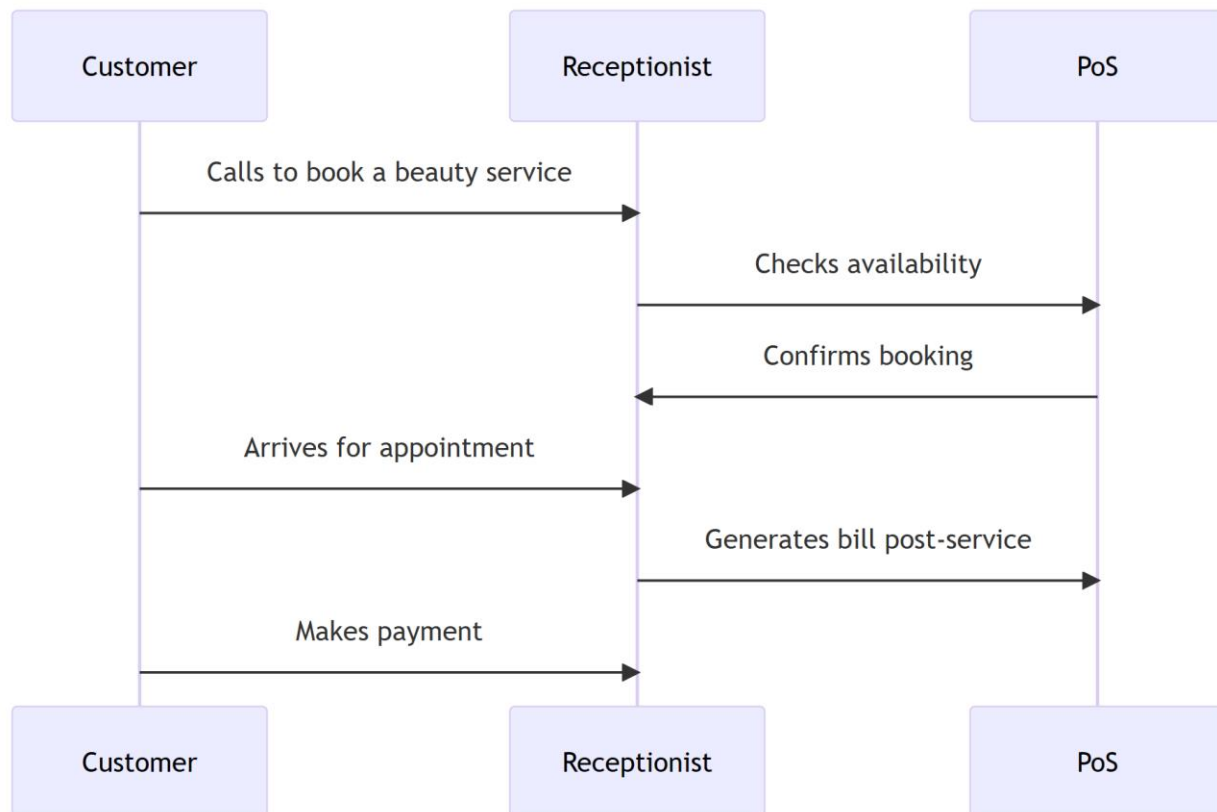


Description: A customer enters a restaurant and is seated by the host. They browse the menu and decide on their order. The waiter takes the order and inputs it into the PoS system. The kitchen

receives the order details. Once prepared, the food is served. The customer requests the bill, any applicable discounts or loyalty points are applied, and the final amount is presented. The customer pays, and the transaction is completed in the PoS system.

3.1.2 Scenario 2: Booking a Beauty Service

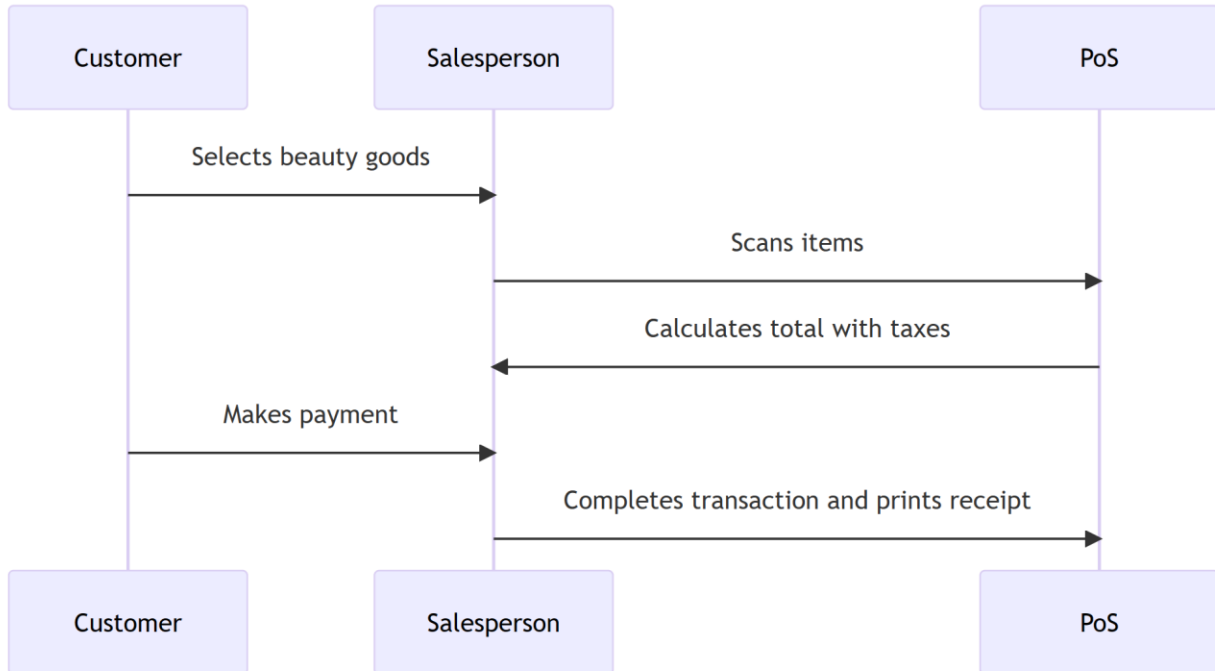
Sequence Diagram:



Description: A customer calls a beauty salon to book a service. The receptionist checks the availability in the PoS system and confirms the booking. On the day of the appointment, the customer arrives and avails the service. Post-service, the receptionist generates a bill, applies any discounts or loyalty points, and the customer makes the payment.

3.1.3 Scenario 3: Purchasing Goods at a Spa

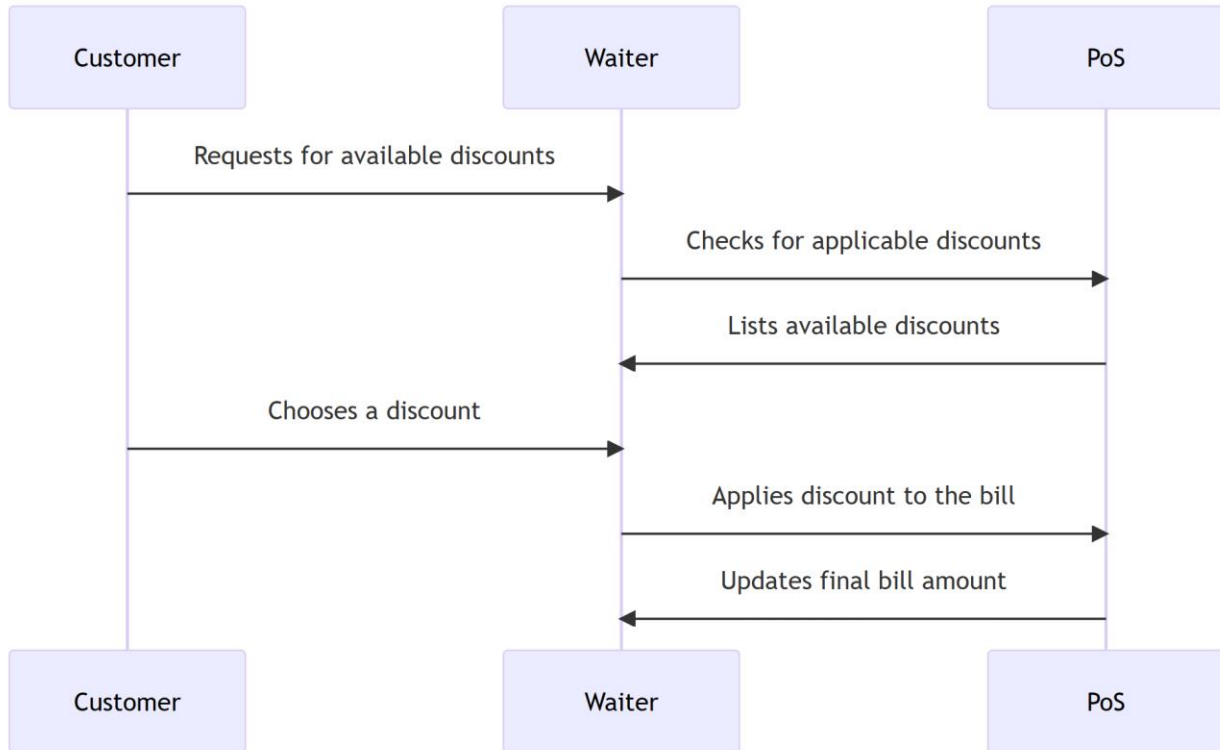
Sequence Diagram:



Description: A customer visits a spa and after availing a service, decides to purchase some spa products. The cashier scans the products, checks them out in the PoS system, applies any discounts, and the customer pays for the goods.

3.1.4 Scenario 4: Applying Discounts to Orders

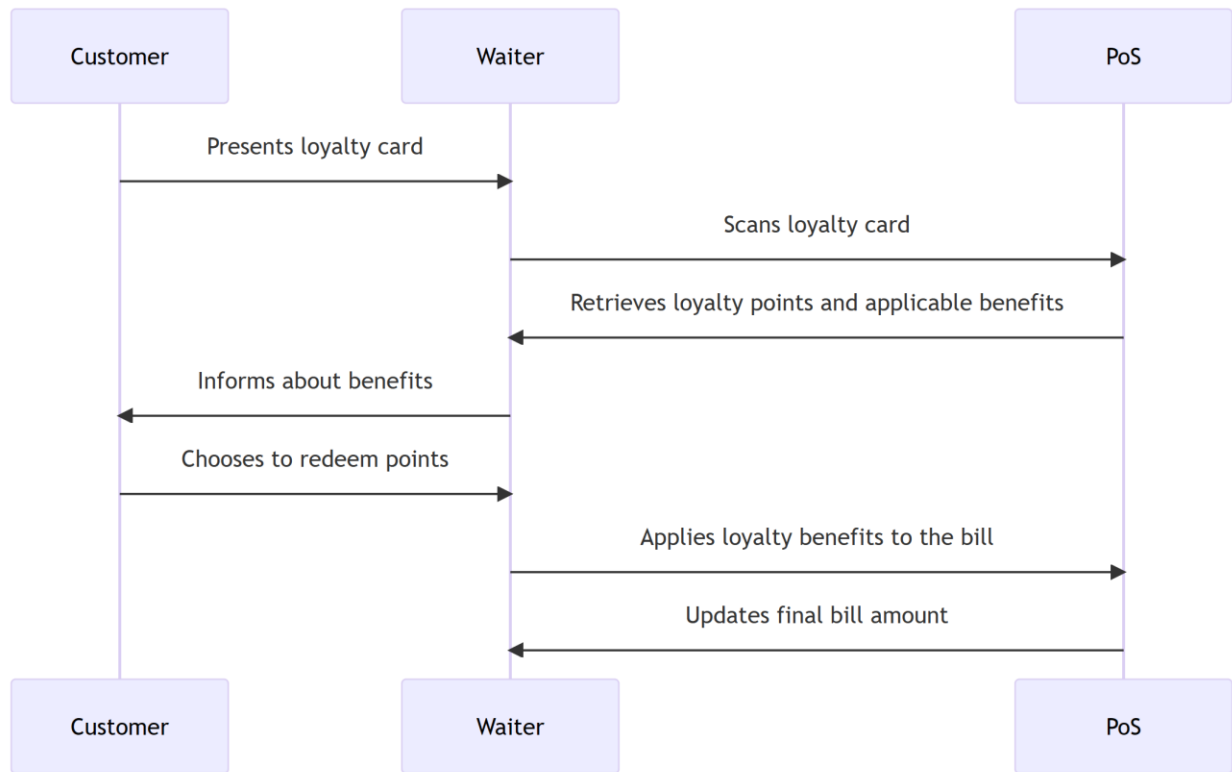
Sequence Diagram:



Description: A regular customer visits a cafe and orders their usual. The cashier, recognizing the customer's loyalty, offers a discount based on his social status (retired, student, etc.). The cashier selects the discount option in the PoS, applies it to the total bill, and the customer pays the discounted amount.

3.1.5 Scenario 5: Loyalty Program Application

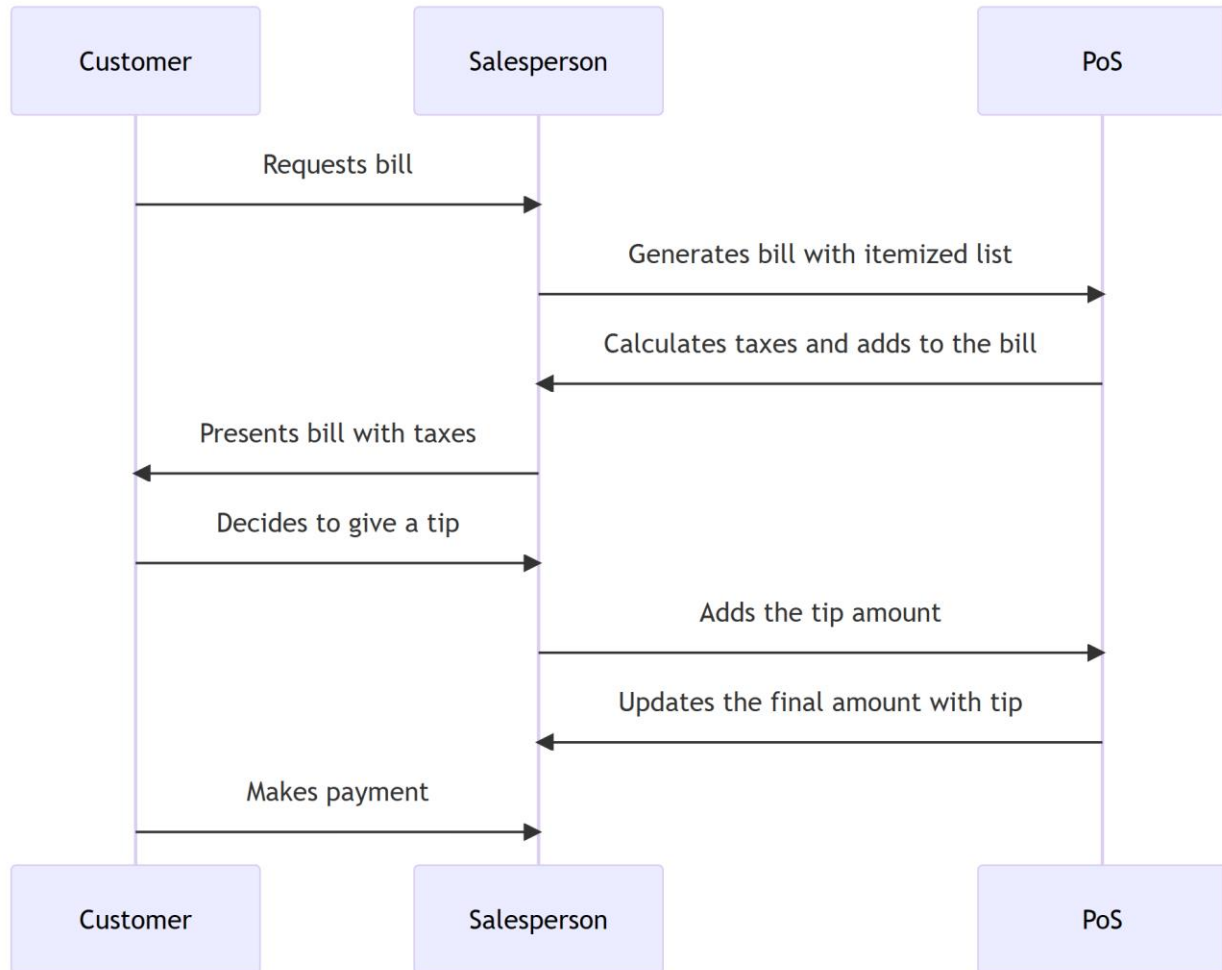
Sequence Diagram:



Description: A customer visits a restaurant. After the visit, the customer provides his loyalty card, waiter scans it and the loyalty program is applied – customer gets loyalty points. On subsequent visits, points are added to their card, which can be redeemed later.

3.1.6 Scenario 6: Tax and Tip Calculation

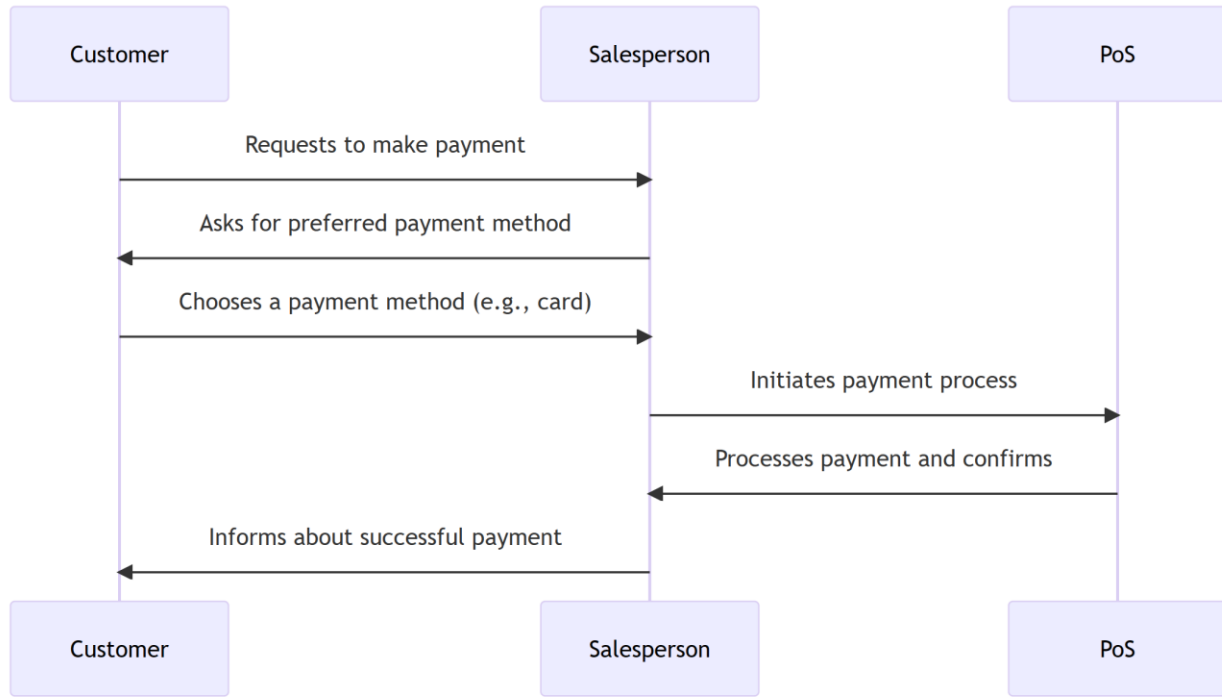
Sequence Diagram:



Description: At a bar, a group of friends orders several rounds of drinks. When asking for the bill, the PoS system automatically calculates the necessary taxes. The group decides to leave a tip, which is added to the total amount in the PoS system.

3.1.7 Scenario 7: Making Payments

Sequence Diagram:



Description: At a massage center, after a relaxing session, the customer proceeds to make a payment. They have multiple options - cash, card, or a gift certificate. They choose to pay partly by card and partly using a gift certificate. The PoS system processes both payments seamlessly.

3.2 Conclusion

Understanding these business scenarios is pivotal in ensuring our PoS system is comprehensive and user-friendly. By visualizing these real-world interactions through sequence diagrams, we can identify potential challenges and ensure our system is equipped to handle them efficiently. As we progress, we'll continuously refine these scenarios based on user feedback and industry trends.

4 Data Model

4.1 Introduction to the Data Model

The data model provides a structured representation of the data elements, their relationships, and the rules governing these relationships within the PoS system. Given the diverse industries our PoS caters to, the data model is designed to be both comprehensive and flexible, ensuring it captures the nuances of each sector while maintaining a standardized structure.

4.2 ERD (Entity-Relationship Diagram)

An Entity-Relationship Diagram (ERD) visually represents the structure of a database, showcasing how entities (like tables) relate to one another. Below are the ERDs for different modules of our PoS system:

4.2.1 Module: Ordering Food and Drinks at the restaurant

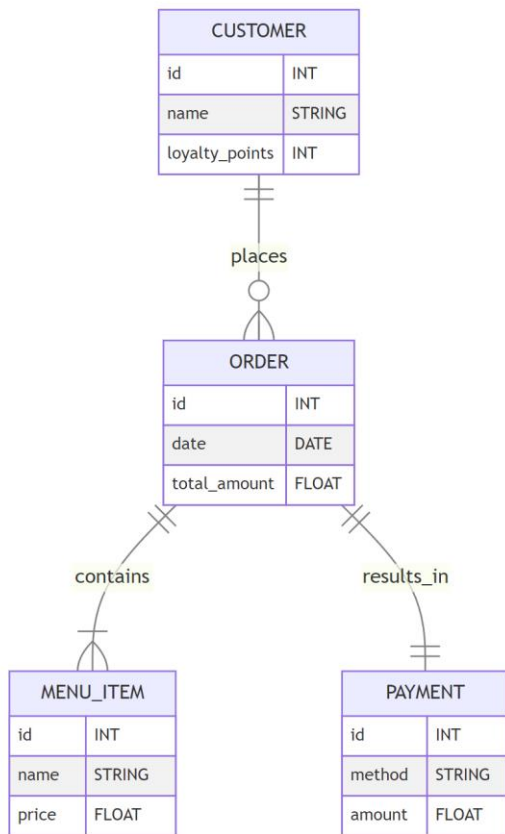
This module captures the ordering process in restaurants, cafes, and bars.

4.2.1.1 Entities:

- Customer
- Order
- Menu Item
- Payment

4.2.1.2 Relationships:

- A customer can place multiple orders.
- An order can contain multiple menu items.
- Each order results in a single payment.



4.2.2 Module: Beauty and Spa Services

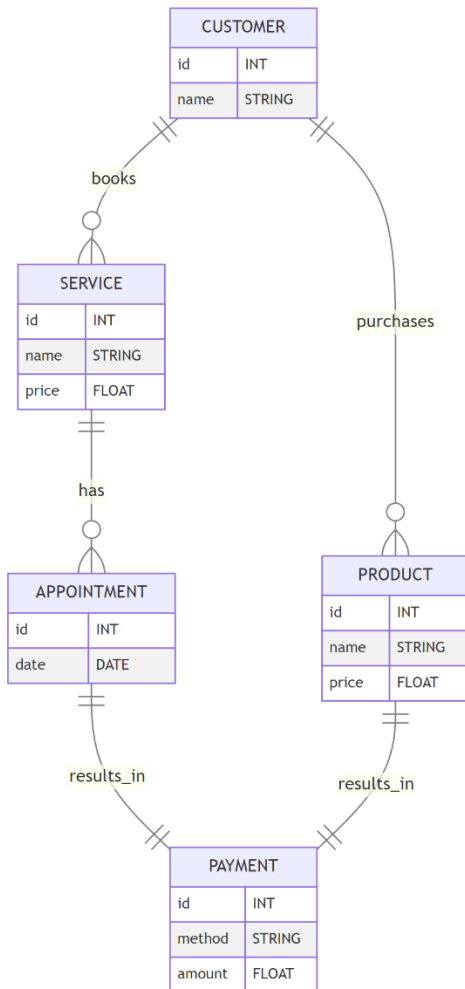
This module focuses on the booking and purchasing of beauty and spa services.

4.2.2.1 Entities:

- Customer
- Service
- Appointment
- Payment

4.2.2.2 Relationships:

- A customer can book multiple services.
- Each service can have multiple appointments.
- Each appointment results in a single payment.



4.2.3 Module: Purchasing Goods at Spa

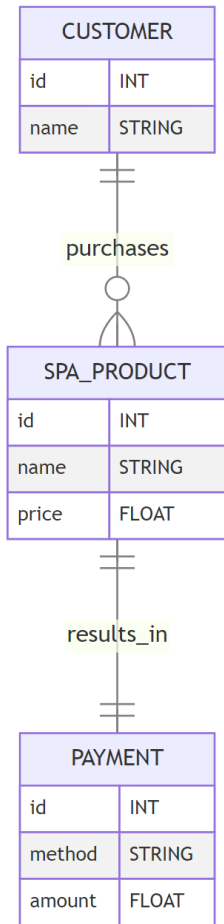
This module focuses on the purchasing of goods at a spa.

4.2.3.1 Entities:

- Customer
- Spa_Product
- Payment

4.2.3.2 Relationships:

- A customer can purchase multiple spa products.
- Each spa product results in a single payment.



4.2.4 Module: Applying Discounts to Orders

This module focuses on the application of discounts to customer orders.

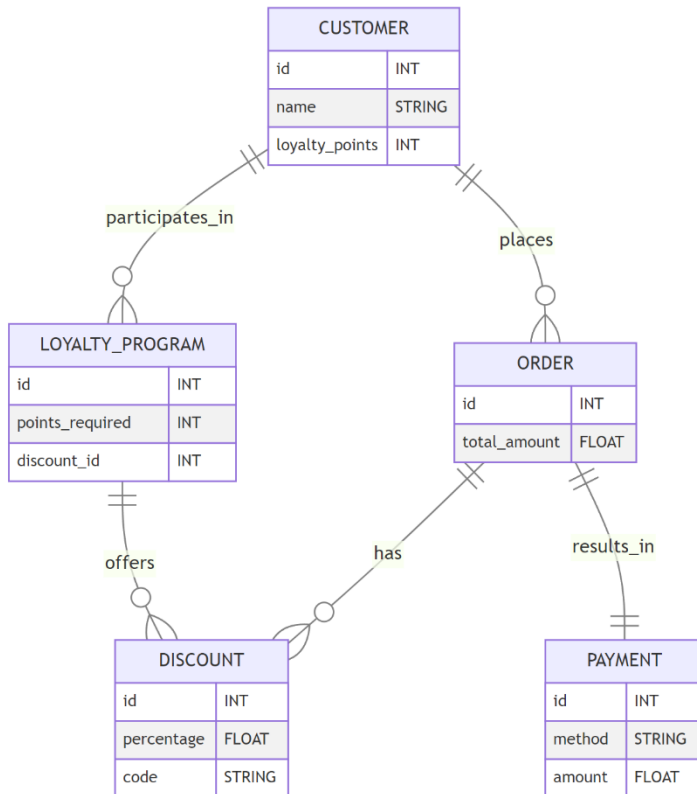
4.2.4.1 Entities:

- Customer
- Order
- Discount
- Loyalty_Program
- Payment

4.2.4.2 Relationships:

- A customer can place multiple orders.
- Each order can have a discount applied.

- A customer can participate in a loyalty program.
- Each loyalty program offers a specific discount.
- Each order results in a single payment.



4.2.5 Module: Loyalty Program

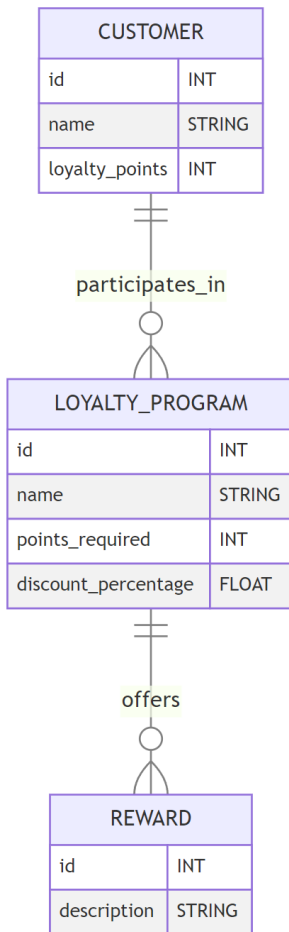
This module focuses on the loyalty programs offered to customers.

4.2.5.1 Entities:

- Customer
- Loyalty_Program
- Reward

4.2.5.2 Relationships:

- A customer can participate in multiple loyalty programs.
- Each loyalty program offers specific rewards.
- Rewards are given based on the points accumulated by the customer.



4.2.6 Module: Tax and Tip Calculation

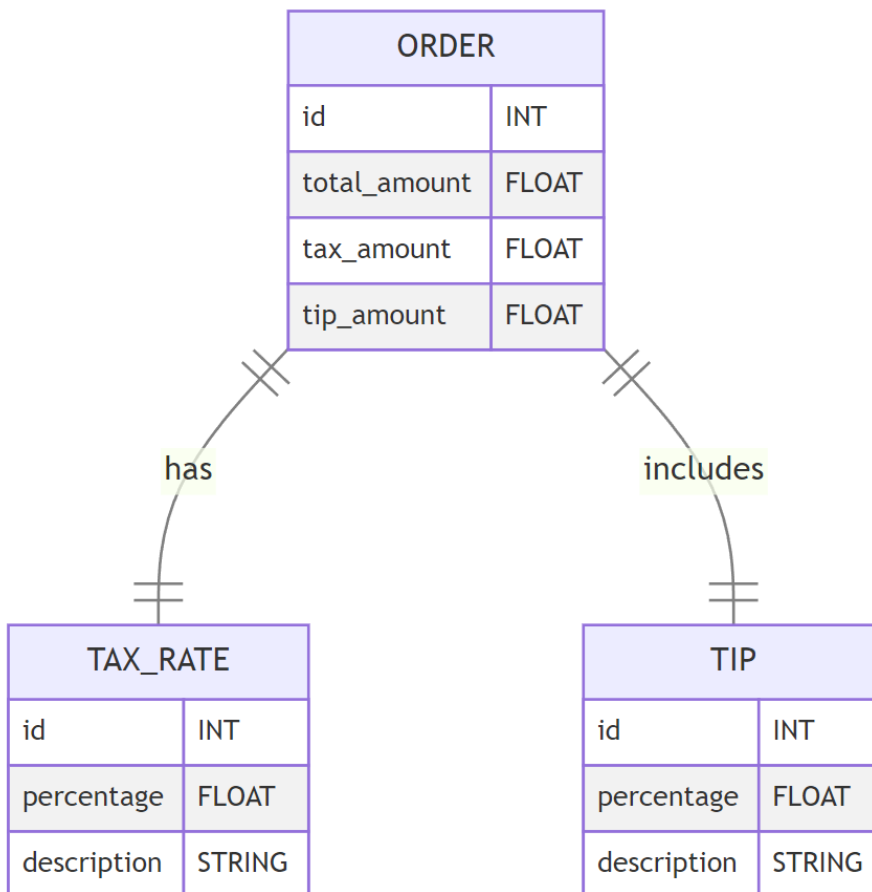
This module focuses on the calculation of taxes and tips for each order.

4.2.6.1 Entities:

- Order
- Tax_Rate
- Tip

4.2.6.2 Relationships:

- Each order has a specific tax rate applied based on the total amount.
- Each order includes a tip, which can be a fixed amount or a percentage of the total order amount.



4.2.7 Module: Making Payments

This module focuses on the various payment methods available to customers and how they interact with orders.

4.2.7.1 Entities:

CUSTOMER:

Represents the individual making the purchase.

- Attributes:
- id: Unique identifier for the customer.
- name: Name of the customer.

ORDER: Represents the items or services the customer wishes to purchase.

- Attributes:
- id: Unique identifier for the order.
- total_amount: The total cost of the order.

PAYMENT_METHOD:

Represents the different ways a customer can pay for their order.

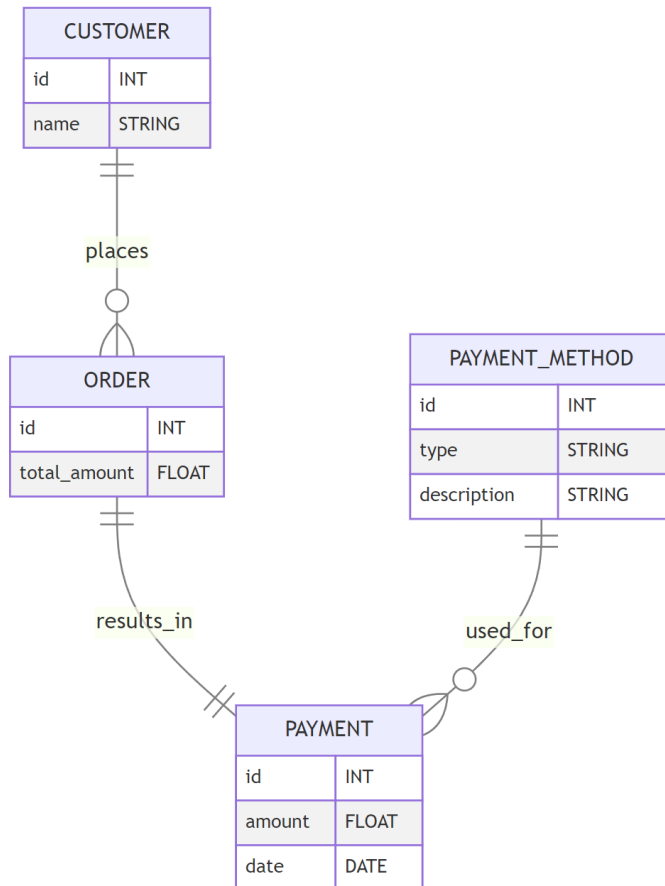
- Attributes:
- id: Unique identifier for the payment method.
- type: The type of payment method (e.g., cash, card, gift certificate).
- description: A brief description of the payment method.

PAYMENT: Represents the transaction made by the customer to pay for their order.

- Attributes:
- id: Unique identifier for the payment.
- amount: The amount paid by the customer.
- date: The date the payment was made.

Relationships:

- A **CUSTOMER** places multiple **ORDERS**.
- Each **ORDER** results in a **PAYMENT**.
- A **PAYMENT_METHOD** is used for multiple **PAYMENTS**.



4.2.8 Module: Health Services

CUSTOMER:

Represents the individual booking the service.

- Attributes:
- id: Unique identifier for the customer.
- name: Name of the customer.

THERAPIST:

Represents the professional providing the health service.

- Attributes:
- id: Unique identifier for the therapist.
- name: Name of the therapist.
- specialization: The specific field or service the therapist provides (e.g., massage, kinesitherapy).

SERVICE:

Represents the specific health service being offered.

- Attributes:
- id: Unique identifier for the service.
- name: Name of the service.
- description: A brief description of the service.

APPOINTMENT:

Represents the scheduled time for the service.

- Attributes:
- id: Unique identifier for the appointment.
- date: The date of the appointment.
- time: The time of the appointment.

PAYMENT:

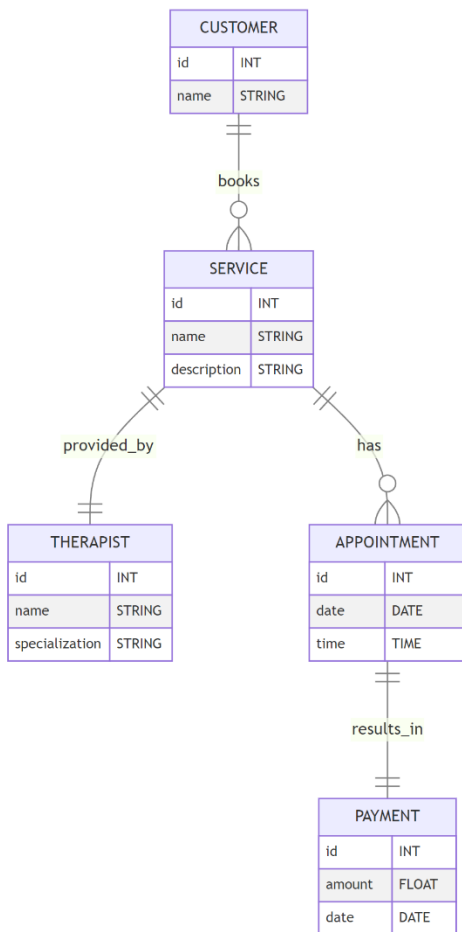
Represents the transaction made by the customer for the service.

- Attributes:
- id: Unique identifier for the payment.
- amount: The amount paid by the customer.
- date: The date the payment was made.

Relationships:

- A **CUSTOMER** books multiple **SERVICES**.
- Each **SERVICE** is provided by a **THERAPIST**.
- Each **SERVICE** can have multiple **APPOINTMENTS**.

Each **APPOINTMENT** results in a **PAYMENT**.



5 Conclusion

5.1 5.1 Reflecting on the Journey

As we conclude this laboratory work, it's essential to reflect on the journey we undertook. From understanding the intricacies of a Point of Sale (PoS) system to tailoring it to diverse industries, the challenges were manifold. Yet, with a structured approach and a keen focus on user-centric design, we were able to craft a comprehensive system that promises efficiency and adaptability.

5.2 5.2 Key Takeaways

- **Versatility:** The PoS system we designed is not just limited to traditional sectors like restaurants or beauty salons. By incorporating health services like odontology, kinesitherapy, and massages, we showcased the system's versatility and adaptability.
- **User-Centric Approach:** Emphasizing the roles and interactions of various users, from customers to managers, ensured that the system is intuitive and caters to the unique needs of each user category.
- **Visual Representations:** The use of sequence diagrams and ERDs provided clarity on system operations and data relationships. These visual tools not only aid in understanding but also serve as a blueprint for developers during the implementation phase.
- **Challenges & Solutions:** Every project comes with its set of challenges. By anticipating potential pitfalls and strategizing solutions in advance, we ensured that the system remains robust and efficient.

5.3 5.3 Looking Ahead

While this laboratory work served as a foundation, the real test lies in the implementation and real-world application of the PoS system. Continuous feedback loops, regular updates, and adaptability will be crucial in ensuring the system's success in diverse industries.

Moreover, as technology evolves, there will be opportunities to integrate more advanced features, from AI-driven analytics to augmented reality interfaces, ensuring that our PoS system remains at the forefront of innovation.

5.4 5.4 Final Thoughts

This laboratory work was not just an academic exercise but a deep dive into the world of system design and architecture. The lessons learned, the challenges faced, and the solutions crafted will serve as invaluable experiences as we venture into more complex projects in the future. With a user-centric approach and a keen eye for detail, we are confident that our PoS system will make a significant impact in the industries it serves.