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V. Shop

(Voice Based E-commerce Website and App)

By

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Bachelor of Science in Software Engineering (2018-2022)

DECLARATION

We hereby declare that this software, neither whole nor as a part has been copied out from any source. It is further declared that we have developed this software documentation and accompanied report entirely based on our efforts. If any part of this project is proved to be copied out from any source or found to be a reproduction of some other. We will stand by the consequences. No portion of the work presented has been submitted to any other degree or qualification of this or any other university or institute of learning.

Muneeb Ur Rehman   **Nouman Habib**   **Zain Ul Abadin**

CERTIFICATE OF APPROVAL

It is to certify that the final year project of BS(SE) "V. Shop (Voice Based E-commerce System)" was developed by **"Muneeb Ur Rehman (18-Arid-2979)", "Nouman Habib (18-Arid-2982)"** and **"Zain Ul Abadin (18-Arid-2997)"** under the supervision of "**Ms. Farkhanda Qamar**" and that in their opinion; it is fully adequate, in scope and quality for the degree of Bachelors of Science in Software Engineering.

Supervisor

(   )
External Examiner

Administrator UIIT

Executive Summary

We will develop a voice-based E-commerce system (Website and Android Application) that allows users to shop online using voice commands. Voice assistants are not new but voice technology in E-commerce is relatively new. As a customer, you get instant access to product information in audio format, and you can go over available items even as you do other work. This is also helpful for people with visual disabilities. Voice-based E-commerce is a technology that helps reduce the end-user's dependence on hardware and allows them to use voice commands to search and purchase products online. According to Google, 20% of all searches are already made via voice commands.

Acknowledgment

All praise is to Almighty Allah who bestowed upon us a minute portion of His boundless knowledge, by virtue of which we were able to accomplish this challenging task.

We are greatly indebted to our project supervisor "**Ms. Farkhanda Qamar**" for personal supervision, advice, valuable guidance, and completion of this project. We are deeply indebted to her for her encouragement and continual help during this work.

And we are also thankful to our friends and family who have been a constant source of encouragement for us and brought us the values of honesty & hard work.

Muneeb Ur Rehman   **Nouman Habib**   **Zain Ul Abadin**

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Chapter 1: Introduction

In this chapter, we will discuss an overview of our whole project, its brief introduction, and how it is relevant to the courses which we have studied during our degree. We will also discuss the project literature review and its analysis and methodology that we will use in the project.

1.1 Brief

Various web and mobile assistive technologies have been created over time to solve the issues of visually impaired users' experience. These technologies have aided users by reading, permitting voice commands, or offering techniques for screen magnification to interpret page contents. However, because misinterpretation is so common, most of these techniques have failed in terms of accuracy. In the modern age, AI and NLP (Natural Language Processing) change the way we interact with systems. Web and mobile apps with voice-enabled systems can boost the usability of applications for ordinary users who are unable to use standard human-computer interaction mechanisms, as well as give flexibility in terms of users' choice of interaction. Our system will allow users to use voice commands for purchasing online products. Users with visual disabilities can easily get product information, add products to the cart, and then make an order using voice commands.

With voice recognition processing becoming more powerful, we're witnessing the rising popularity of smart speakers, like Amazon's Echo, Google Home, and Apple's Home Pod, all of which use voice recognition technology to process voice commands.

Voice commerce makes use of advancements in voice recognition and leverages interfacing apps, such as Amazon's Alexa, Google Assistant, and Apple's Siri to communicate a customer's voice to the processing bot, and then receiving responses, which are then converted to voice and played for the customer, creating an instantly engaging experience.

Simply put, voice commerce is delivering a hands-free online shopping experience to the masses.

1.2 Relevance to Course Module

Almost everything which we are using in our project "Voice-Based E-commerce Website and App" is relevant to our course materials.

The android app which we are developing in our project is relevant to the subject "Android Development".

Java programming is taught to us in the "Modern Programming Languages" course.

The data of the users which will be stored in the Database and status will be shown on screen, is relevant to the subject "Database Management System".

The website we are developing is relevant to the "Web Engineering" course.

Programming concepts we are using like OOP taught to us in the course "Object-Oriented Programming".

1.3 Project Background

According to WHO, there are around 161 million people who are visually impaired people and around 36 million are blind. These people are taking help from family members or friends each day for their needs. It is difficult for blind people to choose clothes with different colors or they find it difficult to online shopping.

The concept of interacting with a computer using voice has led to a new research area of SRS (Speech Recognition Service/Software) over the years which has significantly improved human-to-computer interactions. It allows people to control their surroundings with their voices. Speech recognition technology can be used to dictate short messages, and thereby, reduce the effort needed to send a short text or email message, which otherwise needs to be typed. It can also be used to recognize and index speeches and lectures so that users can easily find the information that is interesting to them. SRSs can be used to address the communication and interaction problems faced by people with disabilities.

Modern SRSs are built on statistical principles. The architecture of a typical SRSs consists of a voice input source or speech signal, feature extraction module, search engine, language model, acoustic model, adaptation model, and output or transcription components. The input data is the speaker's voice or speech, which is transformed into a speech waveform or signal data, and passed on to the feature extraction module for noise removal and transformation to the required representation format. The extracted signal is then moved to a search engine that is connected to language and acoustic models. The acoustic model includes knowledge about acoustics, phonetics, microphone and environment variability, and gender and dialect differences among speakers. The language model includes semantic knowledge or primarily

meanings of words. It also describes what constitutes a possible word, what words are likely to co-occur, and in what sequence. It also houses the semantics and functions related to an operation a user may wish to perform. A modern SRS can handle a lot of uncertainties associated with speaker characteristics, rate, and style of speech; recognize basic speech segments, possible words, likely words, unknown words, and grammatical variations; process noise interference and non-native accents, and compute confidence scores of the results. This is the main function of the search engine component. The adaptation unit is used to modify the outputs from the acoustic or language models coming via the search engine to improve the overall performance.

1.4 Literature Review

Many studies have been conducted where the researchers have integrated the SRS functionality with applications to make them usable by visually-impaired users. Also, there are thousands of E-commerce systems present. But most E-commerce systems don't have voice assistant functionalities. People with visual disabilities are not able to purchase online using these platforms. Here we discuss different systems like Daraz and Amazon Alexa one which is an E-commerce system and the other is a voice assistant.

a) Daraz

We are going to implement a system that includes different functionalities from Daraz. Daraz is an E-commerce system in Pakistan but does not support voice-enabled E-commerce. Daraz allows customers to view products and add different products to the cart. They can pay online or choose the "cash on delivery" option and place an order.

b) Amazon Alexa

Alexa is Amazon's voice AI. You can ask Alexa to buy products for you from Amazon. But you have to buy special hardware from the Amazon store to use this feature. We are going to implement voice command functionality within the website and app. This will allow users to easily access the voice services that our system is providing.

1.5 Analysis from literature review

The goal is to make a cleaner and less complex system for e-commerce with a voice-enable assistant. So as per the idea, we enabled a futuristic system that will reduce the work of manpower and proceed towards automation. Here the system is designed in a way that everyone can use easily even with voice commands. The system is flexible for adding products to the cart and for the checkout process. Performance is key to success in this system as the customer wants a fast response from the voice assistant.

1.6 Methodology and Software Life Cycle

We are going to use Waterfall Model. The waterfall model is a breakdown of project activities into linear sequential phases, where each phase depends on the deliverables of the previous one and corresponds to a specialization of tasks. It is very simple to understand and use. The waterfall model has a classic and iterative approach. In a classic waterfall model, each phase must be completed before the next phase can begin and there is no overlapping in the phases. In a practical software development project, the classical waterfall model is hard to use. So, we are going to use an iterative waterfall model. The iterative waterfall model provides feedback paths from every phase to its preceding phases, which is the main difference from the classical waterfall model.

1.6.1 The rationale behind Selected Methodology

- Project complexity.
- Standard and well-defined requirements for an E-commerce system.
- Using an iterative approach, we allow for changes in the project.

Chapter 2: Problem Definition

2.1 Purpose

The main aim that we have is to create a completely automated voice-based shopping system with no human interference. In the context of the present age, it is said that we do not have time. In recent years online shopping has grown significantly worldwide. As the technology advanced, new techniques are used in e-commerce websites and apps to visually present information. However, these new techniques have accessibility problems for people with disabilities when accessed using assistive technology. And that is why we have to plan this system. There has been a lot of research on this before. But we hope our ideas will be different and more perfect than others. Because, we have seen in existing systems there are some problems like voice recognition issues, lack of visual interface, etc. In our project we propose a smart and automated voice-based shopping model that will help the user in searching, choosing, and buying products using voice. Hence, we aim to provide a completely safe and automated experience that is robust and can be implemented in real-time.

2.2 Product Functions

The product functions of Voice-Based Ecommerce are

- The system will allow the user to register himself so that he can make orders.
- The system will authenticate the user through login functionality.
- The system will display the available products and their details.
- The system will allow the user to add items to the cart.
- The system will allow the user to make an order and payment.
- Payment methods available are online payment, cash on delivery.
- The system will confirm the order by sending an email notification.
- Users can also download order invoices in pdf form.
- The system will allow the admin to define new products, modify the data of existing products, view the data of all existing products and also delete the products.
- Admin can create, delete, update customers of the system.
- Admin can update, delete and change the status of orders placed by customers.
- Voice assistants can run a website for the user as per the commands of the user.

2.3 Proposed Architecture

3-Tier Architecture has been used in our project.

We have three layers in 3-Tier Architecture:

- Presentation Tier
- Application Tier
- Data Tier

Presentation Tier

We will develop an Android App in which we will create interfaces by using Java Language. We will develop a website in which we will create interfaces by using HTML, CSS, and JavaScript Language. These interfaces will display all the information to the User.

Application Tier

In this layer, we will apply logic in our Android Application by using Java Language and we will also apply logic in our web application by using PHP. This tier is also called the Middle tier, Logic tier and Business tier pulled from the presentation tier.

Data Tier

Data in this tier is kept independent of application servers and Business logic. In this layer, we will use MySQL to store the data of users and products.

2.4 Project Deliverables

2.4.1 Project Deliverables

In this project we have to deliver a working website and an android app. Project is divided into different modules and each module is a major milestone in the project. We have to deliver documentation for this project which include Introduction, Overview, Requirements, Design & Analysis, Implementation and Testing overviews. We have to create different UML diagrams for our project.

2.4.2 Development Requirements

Software requirements for website development and android app development are Visual Studio Code, MySQL Workbench, Android Studio, MS Word, MS PowerPoint, Figma, Google Chrome. Hardware Requirements for website and android app are Computer, Laptop, Android Mobile Device.

2.5 Operating Environment

The operating environment for Voice-Based E-commerce is as listed below:

- **Operating System:** An OS support web browser and Android Operating system
- **Database:** MySQL
- **Platform:** Android studio in which android app will be developed using java language. The front end will be designed in android and the backend will be designed in Laravel.

2.6 Assumptions and Dependencies

Assumptions

The application developed from this technique is more efficient than others. This software gives perfect results in real-time for shopping online using voice. Customers can easily search, choose and buy any product on our website and android app.

Dependencies

This software is dependent on internet connectivity. Application is also dependent on the proper placement of hardware like the microphone and speaker.

Chapter 3: Requirement Analysis

In this chapter, we will define all the requirements of the proposed system that including functional and non-functional requirements. We will also discuss use cases of the system and see how our system will respond to various use cases.

3.1 Functional Requirements

For our system to work and facilitate the user number of functional requirements have been are needed. It is all about the functions and core operations of our e-store that enable a user to take action on the system. They can be implemented as a single system feature and form the basis of the whole software development process.

- The system will allow the user to register himself so that he can make orders.
- The system will authenticate the user through login functionality.
- The system will display the available products and their details.
- The system will allow the user to add items to the cart.
- The system will allow the user to make an order and payment.
- Payment methods available are online payment, cash on delivery.
- The system shall be integrated with a 2checkout payment system.
- The system will confirm the order by sending an email notification.
- Users can also download order invoices in pdf form.
- The system will allow the admin to define new products, modify the data of existing products, view the data of all existing products and also delete the products.
- Admin can create, delete, update customers of the system.
- Admin can update, delete and change the status of orders placed by customers.
- The system shall show the following order statuses: confirmed, processing, shipped, returned.
- Our product info should be shared on Facebook, Instagram, Pinterest, and LinkedIn.
- Voice assistants can run the website for the user as per the commands of the user.
- The website should be responsive.
- The system should be a website and an android based Application.

3.2 Non-Functional Requirements

Named as quality attributes of a system, they form user experience and imply some global, abstract expectations from the system. Non-functional requirements may derive from a sum of functional requirements and are implemented as a sum of web features.

- The system should be able to handle the concurrent requests from different users.
- The system should provide confidentiality for user data.
- A customer should easily find the right product for them, understand what problems it solves, and make the purchase without contacting us.
- The system should be stable and reliable enough to handle the exceptions.
- The system should be available 24/7 of the time to handle the concurrent request of the users.
- The system should permit only authorized users to ensure its security.
- Interface and the system itself should be user-friendly so that the customer will feel it is easy to use.
- The system will authenticate the user by verifying the credentials to the database.
- Voice assistant performance must be good, so that interaction between user and assistant comfortably takes place.

3.3 Use Case Model

In the Unified Modeling Language (UML), a use case diagram can summarize the details of your system's users (also known as actors) and their interactions with the system. Following are the use cases of the V. Shop.
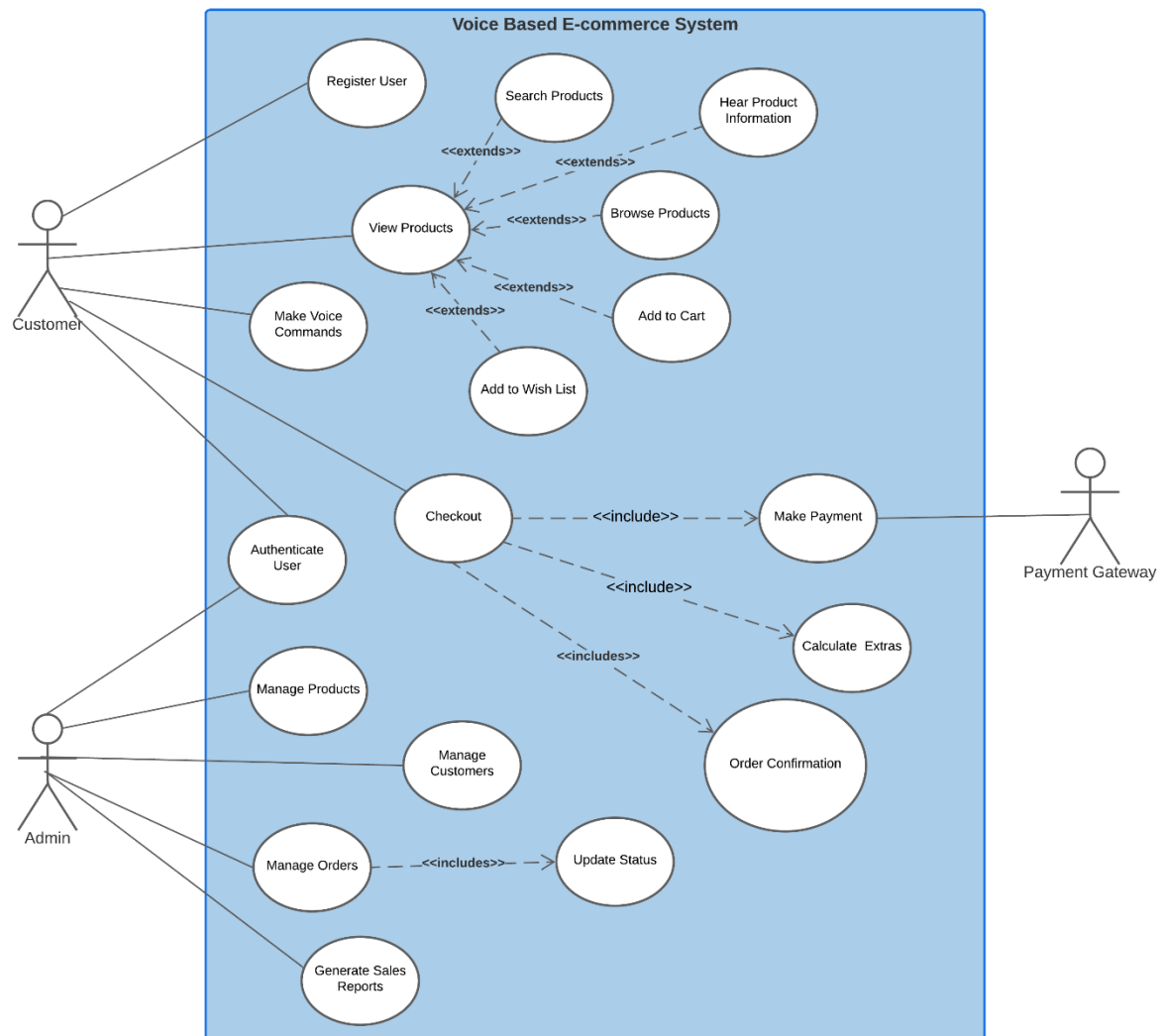
3.3.1 Use Case Diagram

Figure 3. 1: Use Case Diagram

3.3.2 Actor Description

We have three types of actors.

Customer

The customer is the main actor in the system which can use the system to do online shopping. He / She can view products, search products, and place orders.

Admin

Admin authenticates himself. He manages the database which contains information regarding products, customers, and orders.

Payment Gateway

It is another system that is used as a payment gateway in our system to authenticate online payments.

3.3.3 Use Case Description

Use Case ID:	ID-01
Use Case Name:	Authenticate Customer
Actors:	Customer, Admin
Description:	The user will provide its credentials and be authenticated by the system through the database.
Trigger:	When the user clicks on the login button.
Preconditions:	username and password must be provided by the users.
Postconditions:	The user will be logged in successfully.
Normal Flow:	Credentials will be entered by users Credentials will be authenticated from the database of the system User will be successfully login
Alternative Flows:	If the user is not already registered, then the user will first sign up The user will then provide credentials User will again be authenticated through the database
Exceptions:	If the user will be not authenticated, an error message will appear.
Special Requirements:	Internet is required.
Assumptions:	None
Notes and Issues:	None

Table 3. 1: Authenticate Customer

Use Case ID:	ID-02
Use Case Name:	Client Registration
Actors:	Customer
Description:	The user will provide information and credentials to the system that saves to the database.
Trigger:	When the user clicks on the register button.
Preconditions:	Name, Email, Password, Password Confirmation, Phone, City, Address must be provided by the users.
Postconditions:	The user will register successfully and log into the system.
Normal Flow:	Data will be entered by the user. User data will be saved in the database. The user will be successfully registered.
Alternative Flows:	If some required field is empty then the user will be redirected back with an error message. The user then enters the correct data and will be registered in the system. If the email is already registered, then the user will login.
Exceptions:	If some required field is missing an error is returned.
Special Requirements:	The user should not be already registered in the system.
Assumptions:	None
Notes and Issues:	None

Table 3. 2: Client Registration

Use Case ID:	ID-03
Use Case Name:	View Products
Actors:	Customer
Description:	The system will display the products available. Users can see product descriptions, search and browse through products and add a product to the cart if interested.
Trigger:	When the user starts the system.
Preconditions:	User opens App or enters Website URL in a web browser.
Postconditions:	The system will show a list of products with search and filter options.
Normal Flow:	The user will open the App or enter the Website URL in the web browser. He / She can see a list of products. They can browse, search from the list and add a product to the cart/Wishlist. Users can also hear product information.
Alternative Flows:	The user uses a voice assistant and uses commands to interact with the system.
Exceptions:	To use voice assistant microphone and speaker access are required.
Special Requirements:	To use add to cart functionality user must be authenticated.
Assumptions:	None
Notes and Issues:	Users must have to interact with the system once to use a voice assistant.

Table 3. 3: View Products

Use Case ID:	ID-04
Use Case Name:	Checkout
Actors:	Customer, Payment Gateway
Description:	The customer added some products to the shopping cart and now he/she wants to place an order. They have to fill in the payment information to place the order.
Trigger:	When the user clicks the checkout button.
Preconditions:	At least one product is present in the shopping cart.
Postconditions:	Order placed successfully.
Normal Flow:	Customers add products to the cart. Click on the checkout button. Choose payment method and payment information. The system validates credentials for payment and then creates a new order. Email invoice should be sent to the customer. The user cart should be made empty and the user redirects to the order page.
Alternative Flows:	The user uses voice commands to interact with the system and place a new order.
Exceptions:	No product is present in the cart.
Special Requirements:	The user must be authenticated.
Assumptions:	None

Table 3. 4: Checkout

Use Case ID:	ID-05
Use Case Name:	Make voice commands
Actors:	Customer
Description:	The user wants to use voice to interact with the system. The system will recognize the voice, covert it into text, and do specific actions.
Trigger:	When user speech for something.
Preconditions:	The user must allow microphone access.
Postconditions:	Depending on the user's command, the system should do what the user speaks.
Normal Flow:	User opens website/app and gives microphone access. The user speaks voice commands and asks the system to do something. The system will do that specific action.
Alternative Flows:	If the user command is not present in the system, then no action is taken.
Exceptions:	If so, many background noise and speech recognizer does not recognize the command. If the microphone is broken, the system will not able to respond to any command.
Special Requirements:	Microphone
Assumptions:	None
Notes and Issues:	None

Table 3. 5: Get voice commands

Use Case ID:	ID-06
Use Case Name:	Manage Products
Actors:	Admin
Description:	Admin can delete, update, create and view all products available in the database.
Trigger:	When admin opens manage product section.
Preconditions:	Admin update, delete or create a new product.
Postconditions:	The product will be changed by admin action.
Normal Flow:	Admin open manage product section. Admin can view all products available in the database. Database record changes as per admin action.
Alternative Flows:	1. Admin clicks on delete button product will be deleted. 2. Admin clicks on update and updates the product information, then click on the Save button. The product will be updated. 3. Admin click on the insert button and add new product information.
Exceptions:	If the admin will be not authenticated, an error message will appear.
Special Requirements:	The admin must be authenticated.
Assumptions:	None
Notes and Issues:	None

Table 3. 6: Manage Products

Use Case ID:	ID-07
Use Case Name:	Manage Orders
Actors:	Admin
Description:	Admin can delete, update, create and view all orders available in the database. Admin can also change the status of an order.
Trigger:	When admin opens manage order section.
Preconditions:	Admin changes the status, delete, or update button on the order page.
Postconditions:	The order will be changed by admin action.
Normal Flow:	Admin open manage order section. Admin can view all orders available in the database. Database record changes as per admin action.
Alternative Flows:	1. Admin clicks on delete button order will be deleted. 2. Admin clicks on update and updates the order status, then click on the Save button. The order will be updated.
Exceptions:	If the admin will be not authenticated, an error message will appear.
Special Requirements:	The admin must be authenticated.
Assumptions:	None
Notes and Issues:	None

Table 3. 7: Manage Orders

Use Case ID:	ID-08
Use Case Name:	Generate Sales Reports
Actors:	Admin
Description:	Admin can generate sales reports for a specific period or specific product and download them in pdf form.
Trigger:	Admin clicks generate report button.
Preconditions:	Admin chooses from and to dates.
Postconditions:	The report will be generated.
Normal Flow:	Admin open generates report section. Admin chooses from and to dates. Admin clicks on generate report button. Report generated and available for download.
Alternative Flows:	Admin chooses from and to dates. Admin also chooses product for which sale report to generate. The system will generate a sale report for the only specified product.
Exceptions:	If the admin will be not authenticated, an error message will appear.
Special Requirements:	The admin must be authenticated.
Assumptions:	None
Notes and Issues:	None

Table 3. 8: Generate Sales Reports

Chapter 4: Design and Architecture

4.1 System Architecture
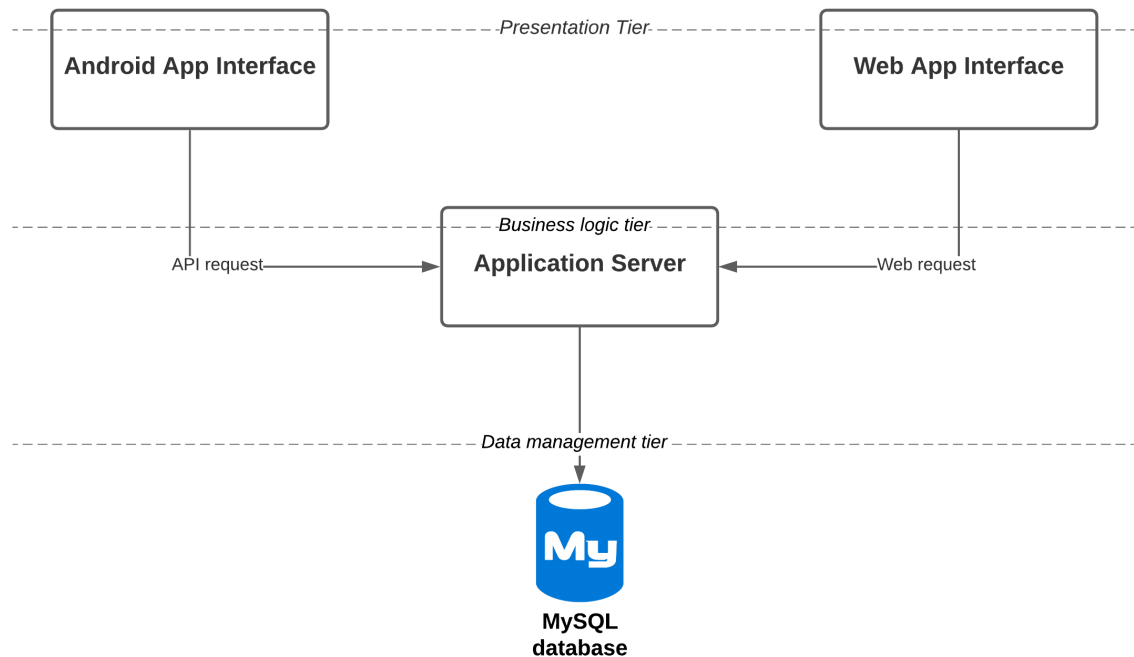
Figure 4. 1: System architecture diagram

4.2 System Design

Systems design is the process of defining elements of a system like components, modules, architecture, and their interfaces and data for a system based on the specified requirements. The purpose of the System Design process is to provide sufficient detailed data and information about the system. Following is the system design of the Voice Shop.

4.2.1 UML Structural Diagrams

The followings are UML structure diagrams for Voice Shop.

4.2.1.1 Component Diagram
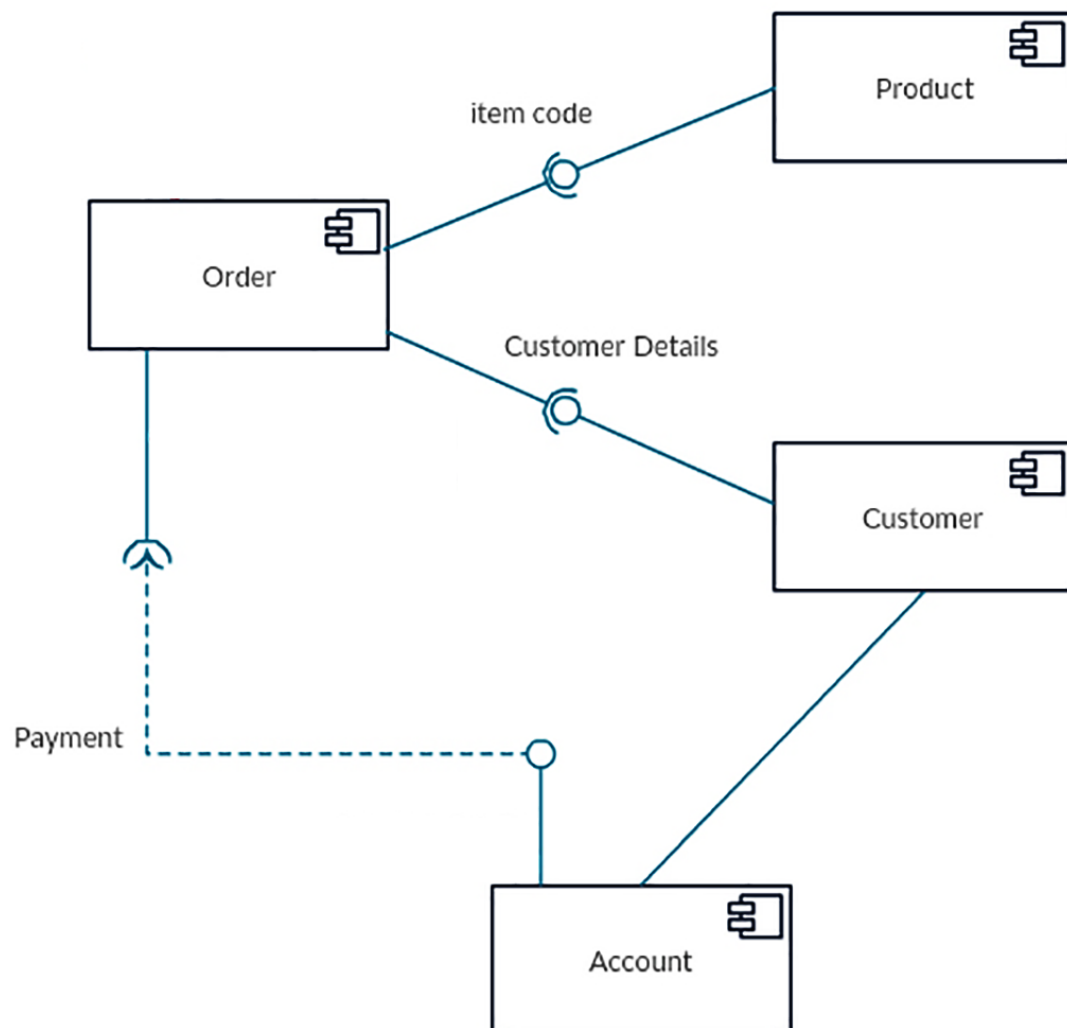
Figure 4. 2: System component diagram

4.2.1.2 Package Diagram
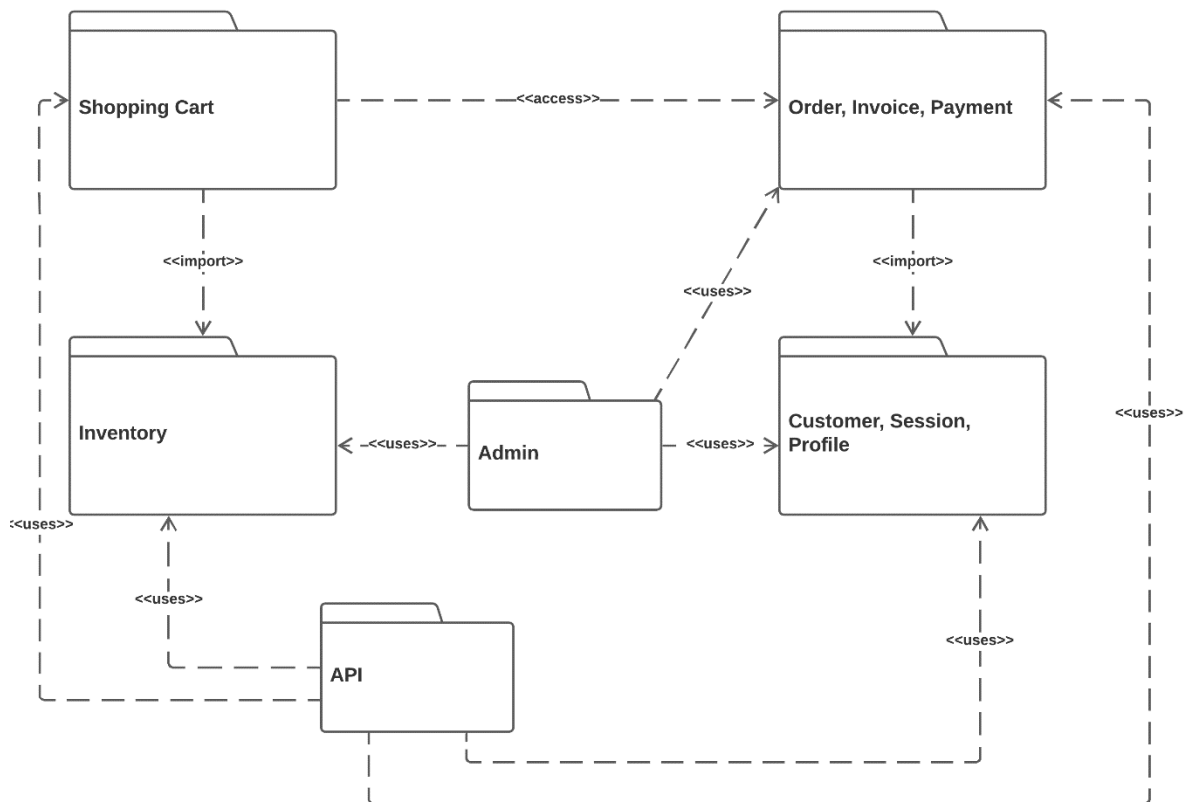
Figure 4. 3: System package diagram

4.2.1.3 Deployment Diagram
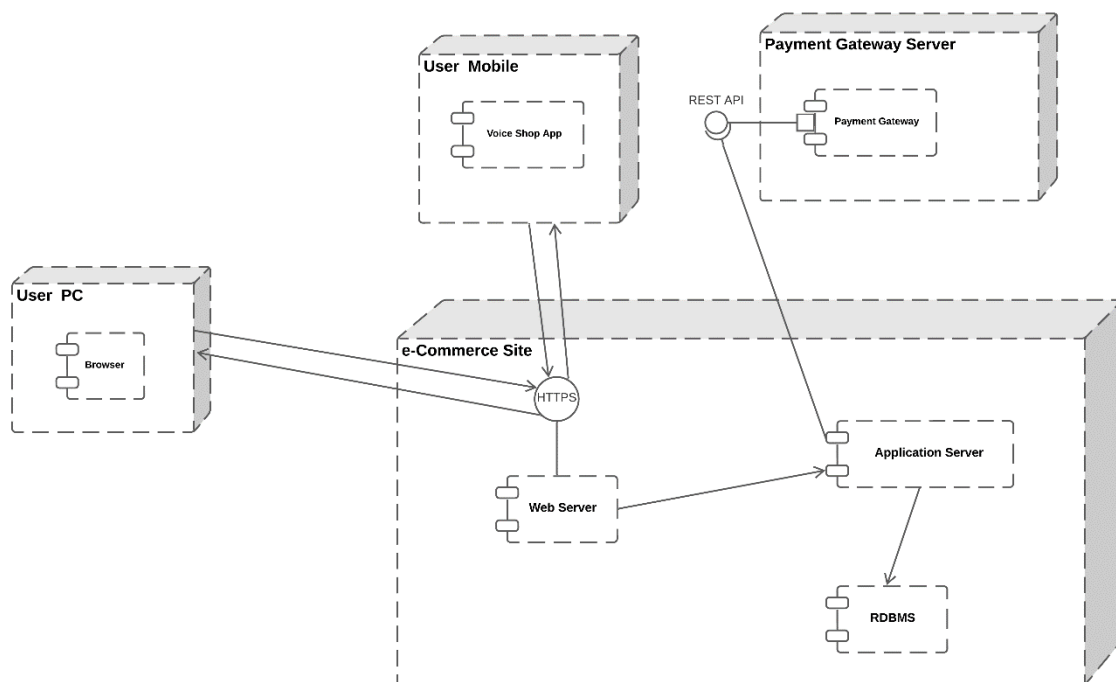
Figure 4. 4: System deployment diagram

4.2.2 UML Behavioral Diagrams

The followings are UML behavioral diagrams for Voice Shop.

4.2.2.1 Activity Diagram
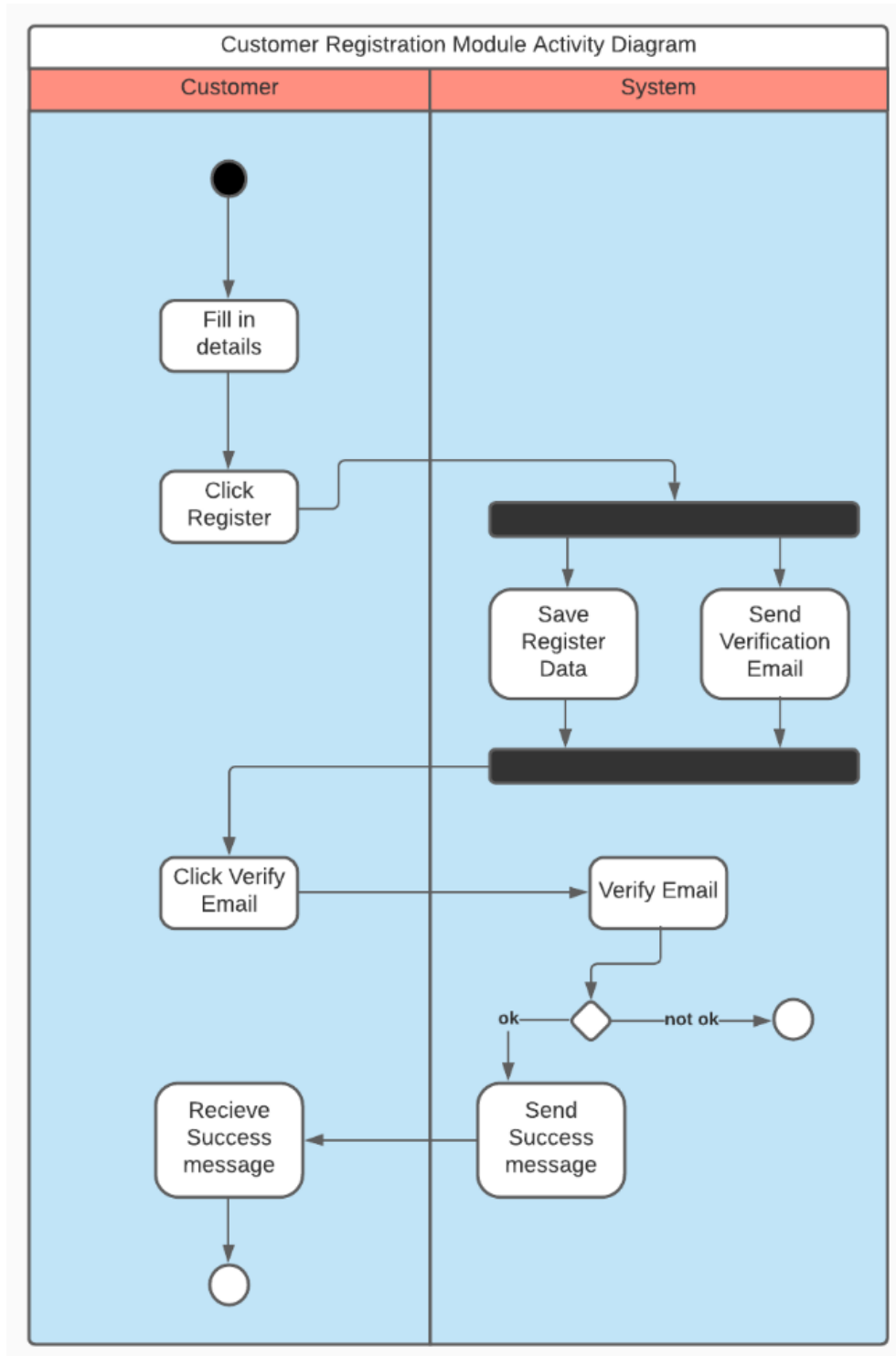
Figure 4. 5: Registration module activity diagram
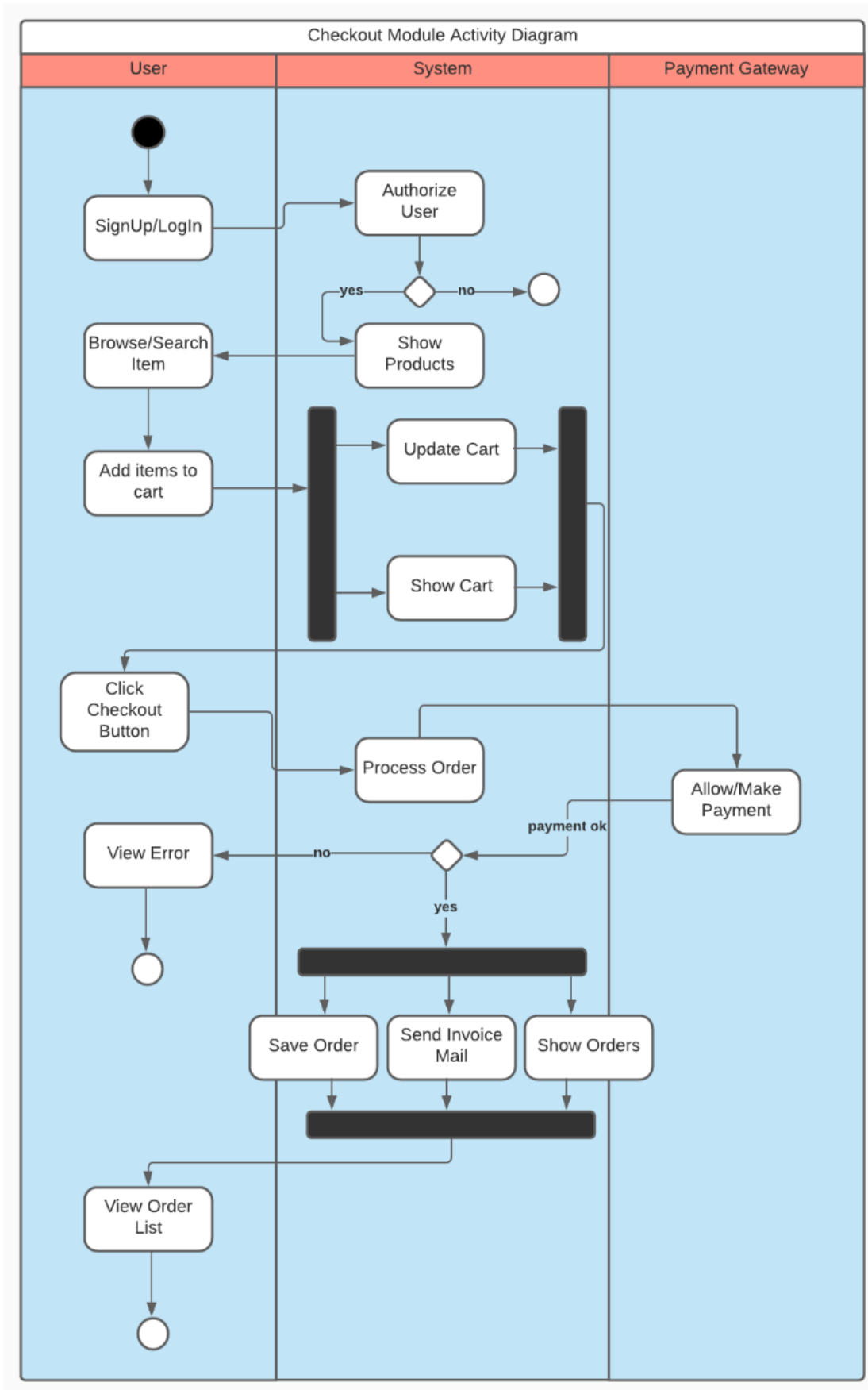
Figure 4. 6: Checkout module activity diagram
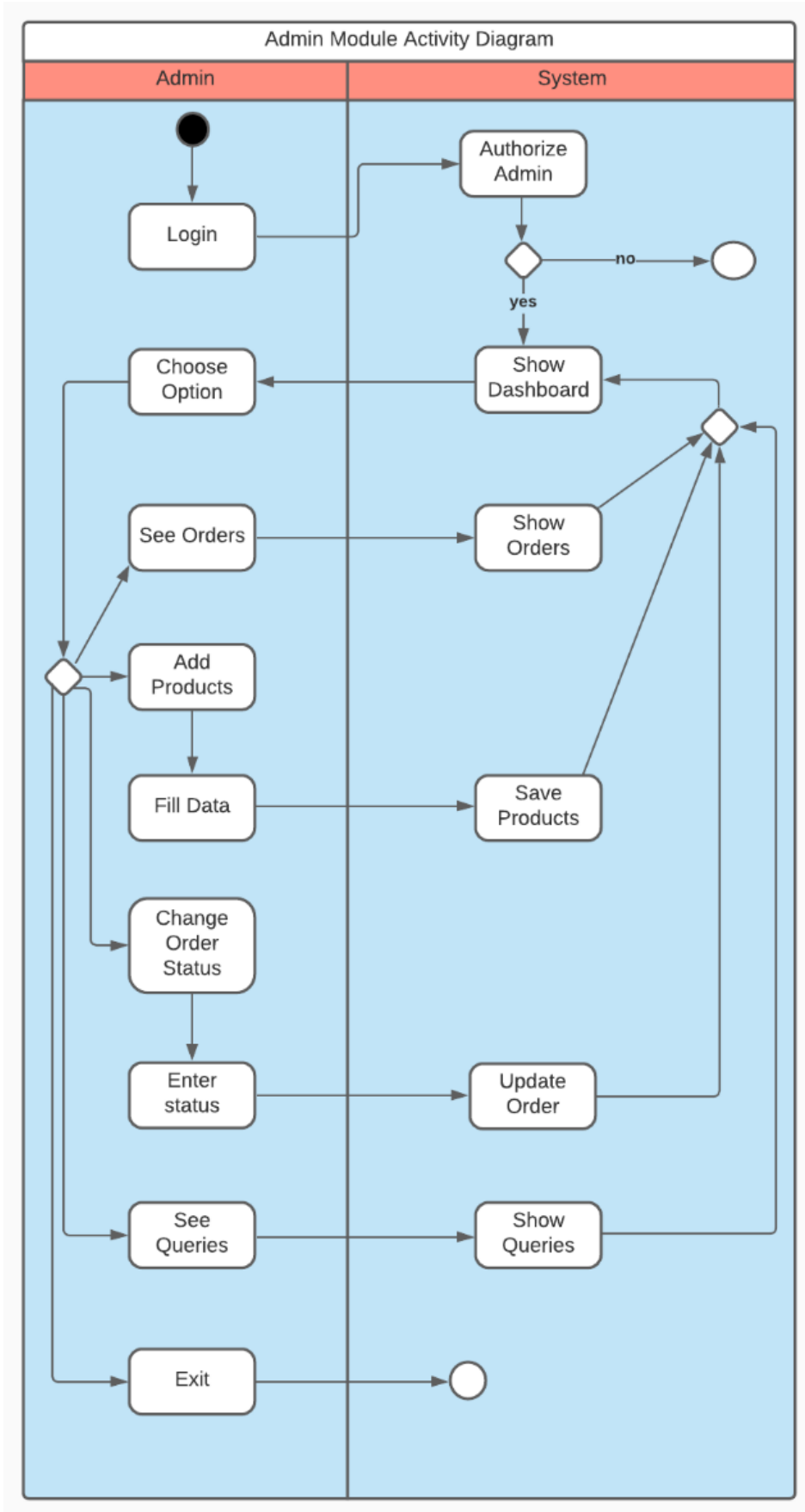
Figure 4. 7: Admin module activity diagram

4.2.2.2 State Machine Diagram
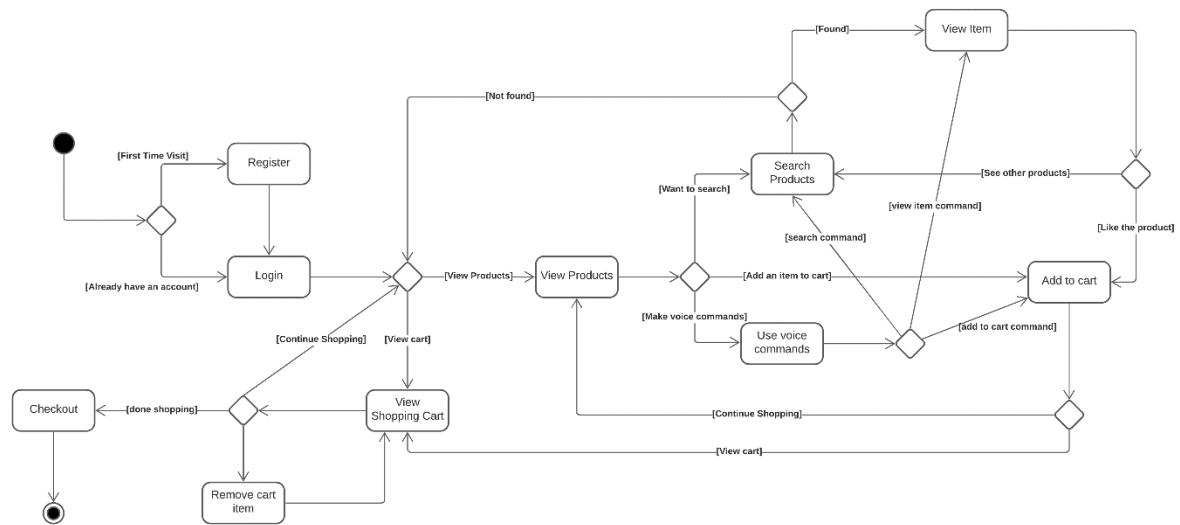
Figure 4. 8: Checkout module state machine diagram
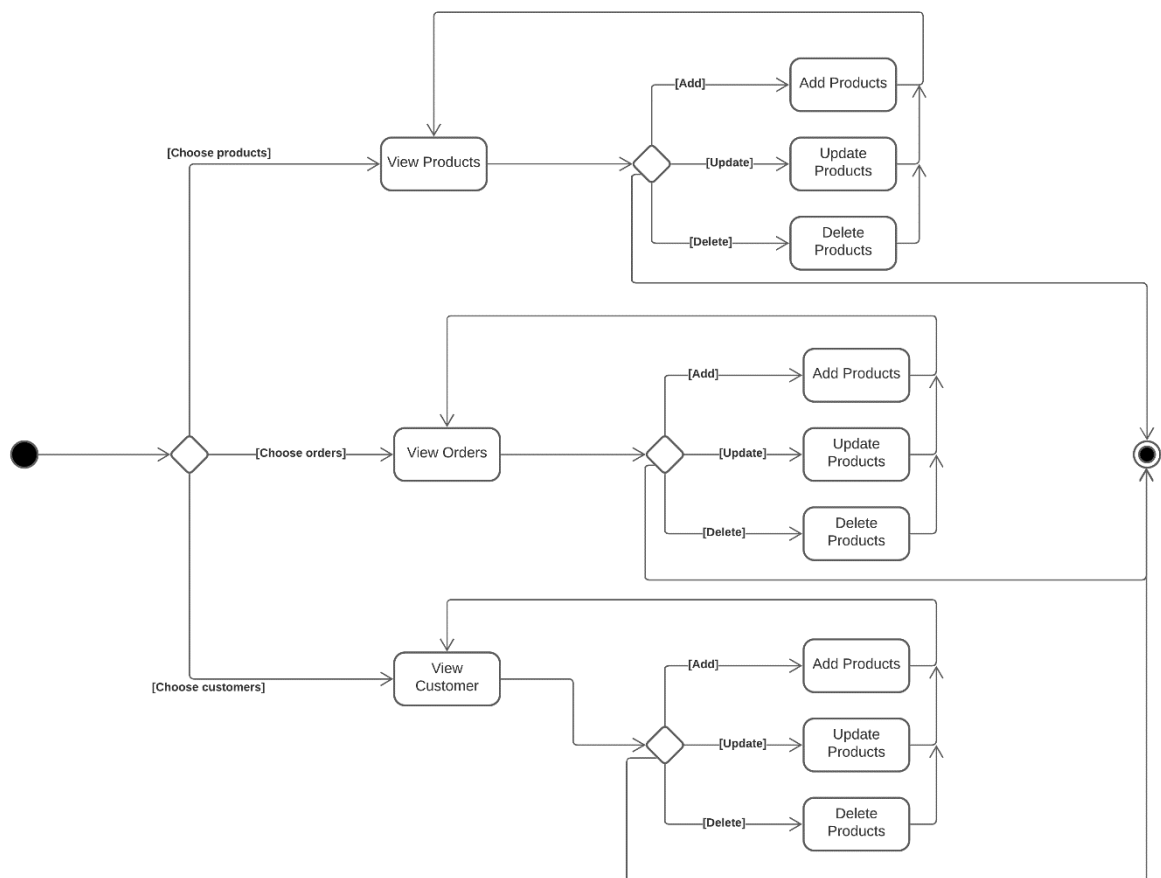
Figure 4. 9: Admin module state machine diagram

4.2.3 UML Interaction Diagrams

The followings are UML interaction diagrams for Voice Shop.

4.2.3.1 Sequence Diagram
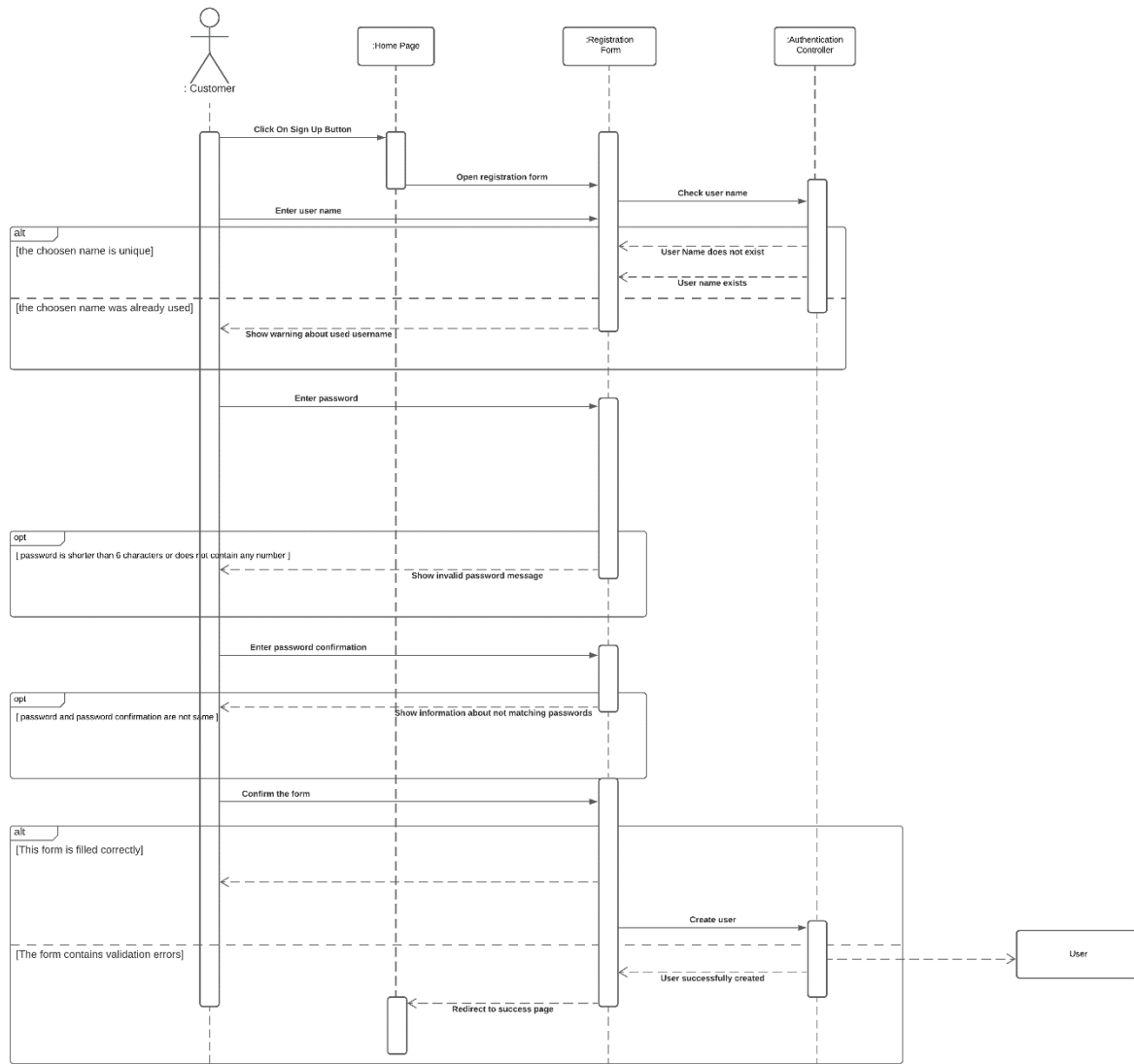
Figure 4. 10: Registration module sequence diagram
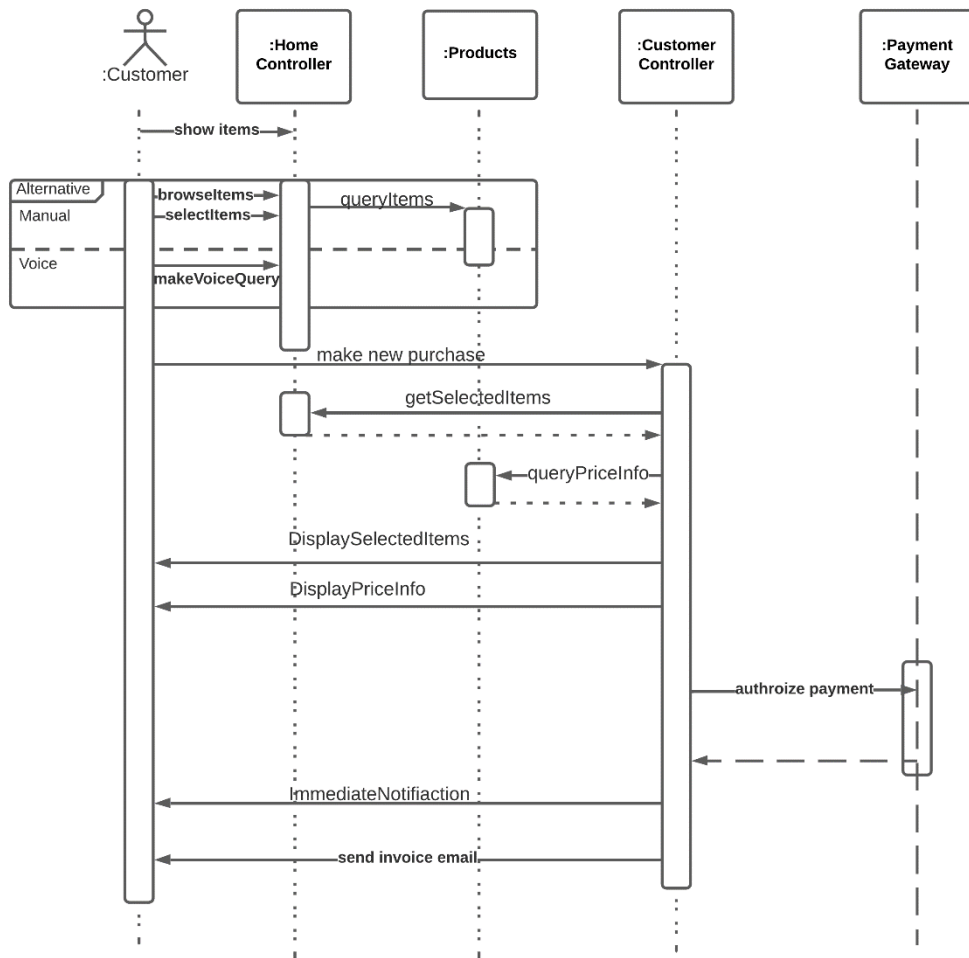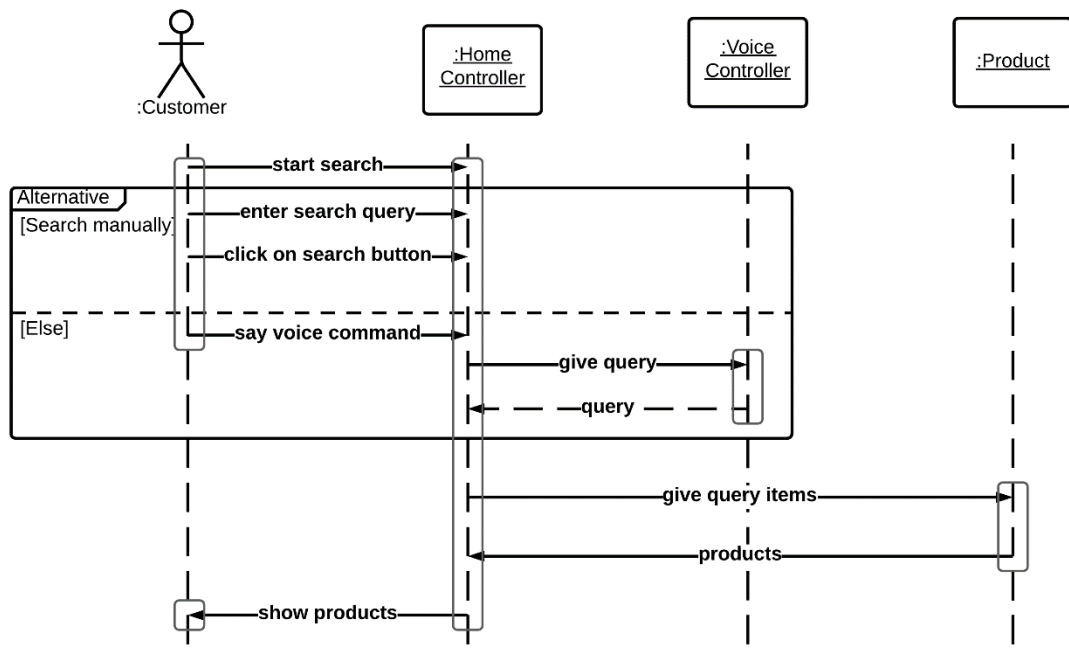
Figure 4. 11: Checkout module sequence diagram

Figure 4. 12: Search module sequence diagram
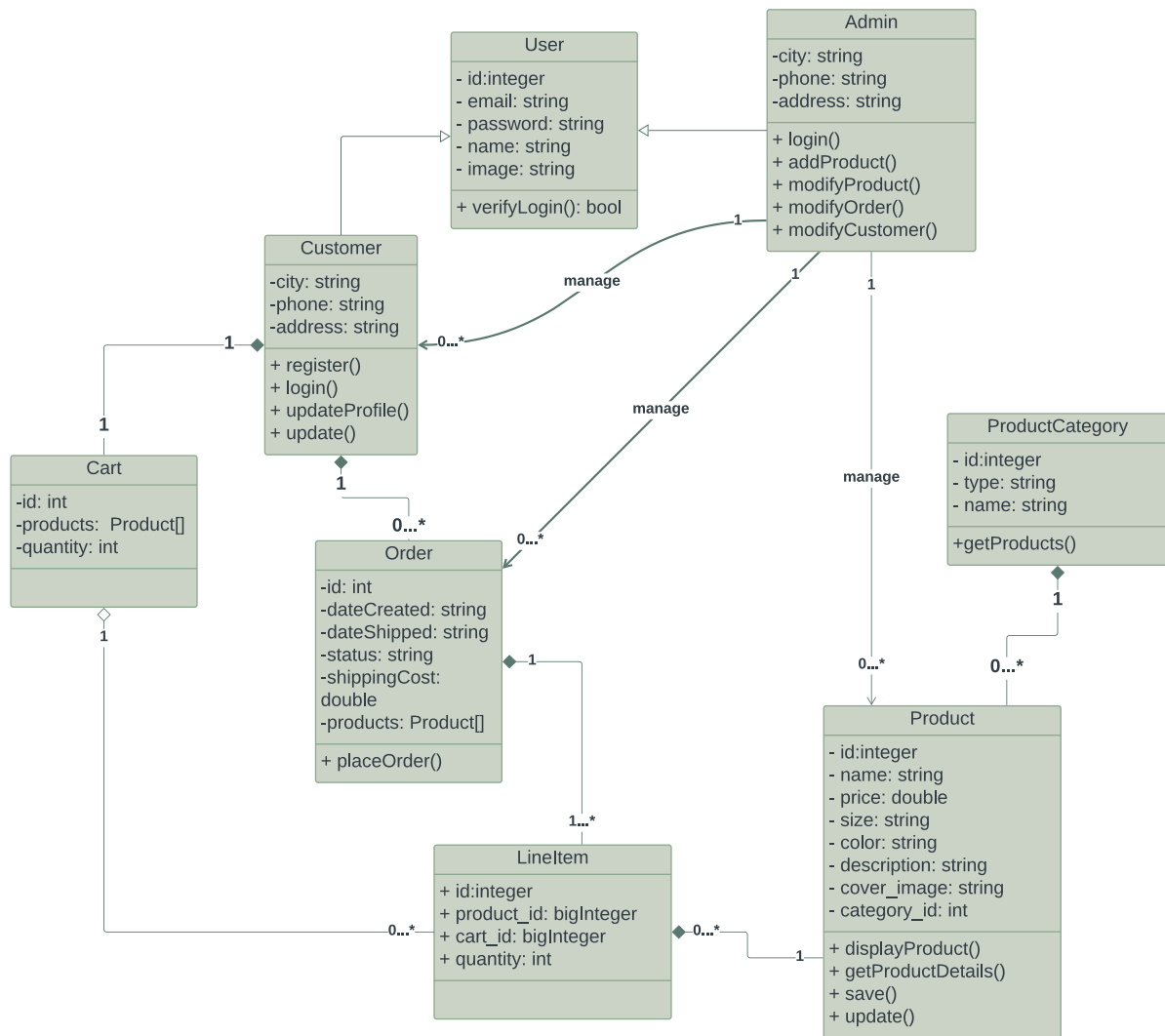
4.3 Class Diagrams
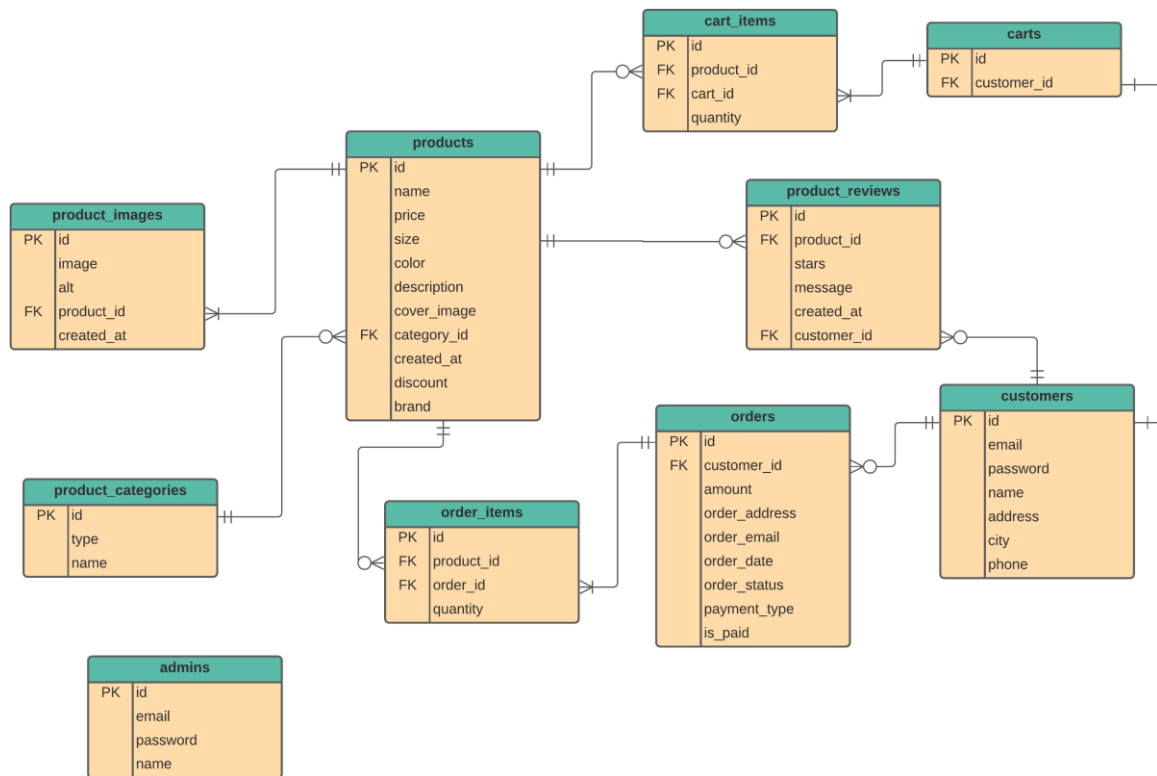

Figure 4. 13: System class diagram

4.4 Entity Relationship Diagrams

Figure 4. 14: System entity relationship diagram