

Virtual model integration for online clothing website



Project ID: F21-00

Session: BSCS Fall 2021 to 2025

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Declaration

We have read the project guidelines and we understand the meaning of academic dishonesty, in particular plagiarism and collusion. We hereby declare that the work we submitted for our final year project, entitled **Virtual model integration for online clothing website** is original work and has not been printed, published or submitted before as final year project, research work, publication or any other documentation.

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Statement of Submission

This is to certify that **Hamza Ijaz** Roll No. **2021-UET-shCET-LHR-CS-04**, **Rubaisha Khan** Roll No. **2021-UET-shCET-LHR-CS-12** and **Mahnoor** Roll No. **2021-UET-shCET-LHR-CS-21** have successfully submitted the final project named as: **Virtual model integration for online clothing website**, at Computer Science Department, The Sharif College of Engineering & Technology, Lahore Pakistan, to fulfill the partial requirement of the degree of **BS in Computer Science**.

Supervisor Name:

Signature:

Date:

Dedication

This project is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

Acknowledgement

We truly acknowledge the cooperation and help make by **Sir Ahsan Nabi**, Lecturer of Sharif College of Engineering and Technology . **He** has been a constant source of guidance throughout the course of this project. We would also like to thank **Miss. Hirra Mustafa** from Lecturer of Computer Science Department for his help and guidance throughout this project. We cannot forget our teachers in the faculty of Computer Science & Engineering for the academic interactions and Ideas.

Date:

Dec 25, 2024

Abstract

The increasing demand for personalized online shopping experiences has led to the development of virtual model integrations for e-commerce websites. This project aims to solve the problem of uncertainty in online clothing shopping by integrating 3D avatars that allow users to virtually try on clothes. The platform will provide personalized recommendations and incorporate Google Cloud Vision to enable image-based product search. Additionally, accessibility features for colorblind users will ensure a broader user base. The goal is to create a seamless and user-friendly platform that improves the accuracy of product visualization, reduces return rates, and enhances the overall online shopping experience.

Area of the Project

- E-commerce
- Image Processing
- 3D Modeling
- Artificial Intelligence (AI)

Technologies used

- **Frontend:** HTML, CSS, JavaScript, React/Angular
- **Backend:** Node.js, Python Django
- **Database:** MySQL
- **3D Modeling and Image Processing:** OpenGL, Three.js, Blender
- **Google Cloud Vision:** Visual search capabilities
- **Accessibility Features:** Color Oracle, Contrast Checker

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Chapter 1: Introduction to the Problem

1.1 Introduction

The clothing industry is embracing new technologies due to the increasing demand for personalized and efficient online shopping experiences. This project aims to build an advanced online clothing platform with virtual models, image searches, and user-friendly features. Customers can virtually try on clothes using digital avatars that match their body sizes, providing a more realistic and engaging shopping experience. The platform will include Google Cloud Vision so users can search for clothes by uploading or scanning images, and image processing will quickly find similar products. To make the platform easier for everyone, there will be special features for colourblind users. It will also focus on solving common problems like improving navigation and making the site work well on different devices. AI recommendations will help users find products that fit their personal style, making shopping more tailored.

1.2 Purpose

The purpose of Virtual Model Integration for an online clothing website is to transform how users shop for clothes online. The goal is to combine advanced technologies like 3D avatars, image-based searches, and smart recommendations to create a highly interactive and personalized shopping experience. The platform will allow customers to virtually try on clothes, visualize how they fit, and easily find products that suit their preferences. This project aims to bridge the gap between physical shopping and digital convenience, providing a user-friendly and engaging experience for everyone.

1.3 Objective

- Creating an e-commerce platform that combines image processing and 3D modeling for virtual try-ons.
- Generating user avatars using body measurements to improve customization.
- To implement a virtual wardrobe feature that allows users to mix and match clothing items effortlessly.
- To reduce return rates by providing a more accurate visual representation of products.
- Include a Google Cloud Vision feature for users to search for clothes by uploading or scanning pictures
- Make the platform accessible for colorblind users with special features.
- Improve navigation and mobile responsiveness so the website works well on all devices.

1.4 Existing Solution

Current platforms like ASOS, Zara, and Amazon provide basic virtual try-on features but lack customization options. They rely on generic body models that fail to represent users actual body shapes, leading to dissatisfaction and higher return rates. These platforms also miss out on integrating personalized recommendations and advanced technologies like accurate 3D avatars, which limits the overall shopping experience for users.

1.5 Proposed Solution

WearFlare will allow users to virtually try on clothes using 3D avatars. It provides a more personalized shopping experience, using advanced technology to ensure accurate size and fit. With features like image-based search and accessibility options for colorblind users, WearFlare offers a safer, more convenient, and efficient online shopping experience compared to traditional methods

Chapter 2: Software Requirement Specification

2.1 Introduction

2.1.1 Purpose

The purpose of this Software Requirement Specification (SRS) document is to outline the requirements and expectations for the development of the WearFlare platform. It will serve as a guide for the development team, providing a clear understanding of the features and functionalities that need to be implemented, such as 3D avatars for virtual clothing try-ons and AI-based personalization. The intended audience for this SRS includes project stakeholders, such as developers, testers, project managers, and clients.

2.1.2 Scope

- The product is **WearFlare**, an e-commerce platform for virtual clothing try-ons with 3D avatars and AI features.
- WearFlare will allow virtual try-ons and personalized shopping but won't have physical stores.
- WearFlare will improve online shopping by providing better fit and personalization, reducing returns.
- The scope follows the system requirements to meet user and technical needs.

2.1.3 Definitions, acronyms, and abbreviations

Definitions:

- **WearFlare:** An e-commerce platform for virtual try-ons using 3D avatars and AI-driven personalization.
- **3D Avatar:** A digital representation used for virtual clothing try-ons.
- **AI Personalization:** AI technology used to recommend products based on user preferences.

Acronyms:

- **SRS:** Software Requirement Specification

- **AI:** Artificial Intelligence

Abbreviations:

- **VR:** Virtual Reality
- **3D:** Three-Dimensional
- **UI:** User Interface
- **UX:** User Experience

2.2 Overall description

2.2.1 Product perspective

This project aims to build a system that works independently and includes all required components. It provides users with a complete online shopping platform using advanced features like virtual try-ons and visual searches. Below are the key points of the system:

- **System interfaces**
The software will work with the system to provide virtual try-ons and other features, ensuring compatibility and proper functionality.
- **User interfaces**
The platform will have a clean and user-friendly layout, including screens for creating avatars, searching for products, and browsing categories.
- **Hardware interfaces**
The system does not require special hardware, but it should work smoothly on devices like laptops, tablets, and mobile phones.
- **Software interfaces**
It will depend on tools like Google Cloud Vision and frameworks like React for the frontend and Node.js or Django for the backend
- **Communications interfaces**
The system will support network protocols for secure data transfer and responsive performance across devices.
- **Memory**
The platform will require enough memory for running 3D models, processing images, and managing a database of clothing items.
- **Operations**
The system will include backup and recovery features to protect data and ensure smooth operations in case of issues.
- **Site adaptation requirements**

The system can be adapted to specific sites with custom data or settings based on user needs or operational modes.

2.2.2 Product functions

ID:	FR_01			
Name:	Create Account			
Description	Input	Output	Requirements	Basic Work Flow
Allows users to create an account by entering their details.	Name, Email, Password etc.	Account created successfully	Internet Connectivity required	Enter correct information, click the submit button, and system saves the record in the database.

Table 1 Functional Requirement Create Account

ID:	FR_02			
Name:	Login Account			
Description	Input	Output	Requirements	Basic Work Flow
Users can log in using their registered email and password.	Email, Password	Access to the user account	Valid email and password required	User inputs credentials, clicks the login button, and the system verifies the details to grant access.

Table 2 Functional Requirement login Account

ID:	FR_03			
Name:	Search Product			
Description	Input	Output	Requirements	Basic Work Flow
Users can search for products using text or image input	Text or product image	List of matching products displayed	Integration with Google Cloud Vision for image input	User enters a Text/image, system processes input, and displays search results.

Table 3 Functional Requirement Search Product

ID:	FR_04			
Name:	Virtual Try-On			
Description	Input	Output	Requirements	Basic Work Flow
Allows users to try on clothes virtually using 3D avatars	User's body measurements and selected clothing item.	Virtual representation of the user wearing the selected clothing.	3D modeling software integration.	User uploads measurements, selects an item, and the system generates a virtual try-on view.

Table 4 Functional Requirement Virtual Try-on

2.2.3 User characteristics

The users of this platform will include a wide range of people with different levels of education and experience. Most users will have basic knowledge of using online shopping websites or mobile applications. They may not have advanced technical skills but should be comfortable navigating simple interfaces.

- **Educational Level:** Users may have varying educational backgrounds, from high school students to professionals. No specific educational level is required to use the platform.
- **Experience:** Some users might be experienced with online shopping, while others may be new to the concept. The platform is designed to be user-friendly for everyone, regardless of their experience.
- **Technical Expertise:** Users are not expected to have technical expertise. The platform will be simple and intuitive, so even users with minimal technical knowledge can use it easily.

2.2.4 Constraints

- The platform must follow e-commerce laws and data privacy regulations.
- It should work on basic devices, including older smartphones and laptops.
- Integration with tools like Google Cloud Vision
- The system should support multiple users without slowing down.
- User activity and transactions need to be logged for security.
- Admins must have control over inventory, accounts, and technical issues.
- Reliable programming languages like Python or Node.js will be used.
- Secure data transmission protocols will be implemented.
- The platform should provide a stable and error-free experience.
- Strong security measures must protect user data and payments.

2.2.5 Assumptions and dependencies

The "WearFlare" project operates under certain assumptions and dependencies that may impact its requirements:

Assumptions

- Users will have stable internet access while using the platform.
- Accurate and complete information will be provided by users during account creation and transactions.
- Users will find features like virtual try-ons and recommendations engaging and useful.
- The platform will work as expected on commonly used browsers and devices.

Dependencies

- Proper functioning of third-party services like Google Cloud Vision.
- Availability of required development tools, frameworks, and libraries.
- Regular updates to ensure compatibility with new browser and device versions.
- Adherence to current e-commerce regulations and policies, with updates as needed.

2.2.6 Apportioning of requirements

- Advanced AI-based product recommendations can be delayed to a future version.
- Features for enhanced accessibility, such as text-to-speech or additional language support, may be added later.
- Integration with augmented reality (AR) for real-time try-ons can be planned for future updates.
- Development of a mobile app version can be postponed until the web platform is fully functional.
- Advanced analytics dashboards for admin users may be introduced in later phases.
- Expanded payment options, such as region-specific gateways, can be included in future updates.

2.3 Specific requirements

2.3.1 Functional Requirement

Admin:

1. Manage user accounts (create, update, delete).
2. Add, update, or delete products.
3. Approve, monitor, and manage orders.

Customer:

1. Register and log in to their account.
2. View 3D models of products and browse/search for items.
3. Add items to the cart, track orders, and manage wishlist.
4. Provide feedback on products.

Product Manager:

1. Ensure accurate product listings.
2. Upload and manage 3D models for virtual try-on features.

2.3.2 Non-functional Requirements

- **Usability:** The platform should be simple and easy to use for everyone.
- **Reliability:** It must work smoothly without errors and always be available.
- **Performance:** Pages should load quickly, within 3 seconds, and handle many users at the same time.
- **Portability:** It must run smoothly on both mobile and desktop systems.
- **Maintainability:** Updates and fixes should be easy to apply with little downtime.

Chapter 3: Use Case Analysis

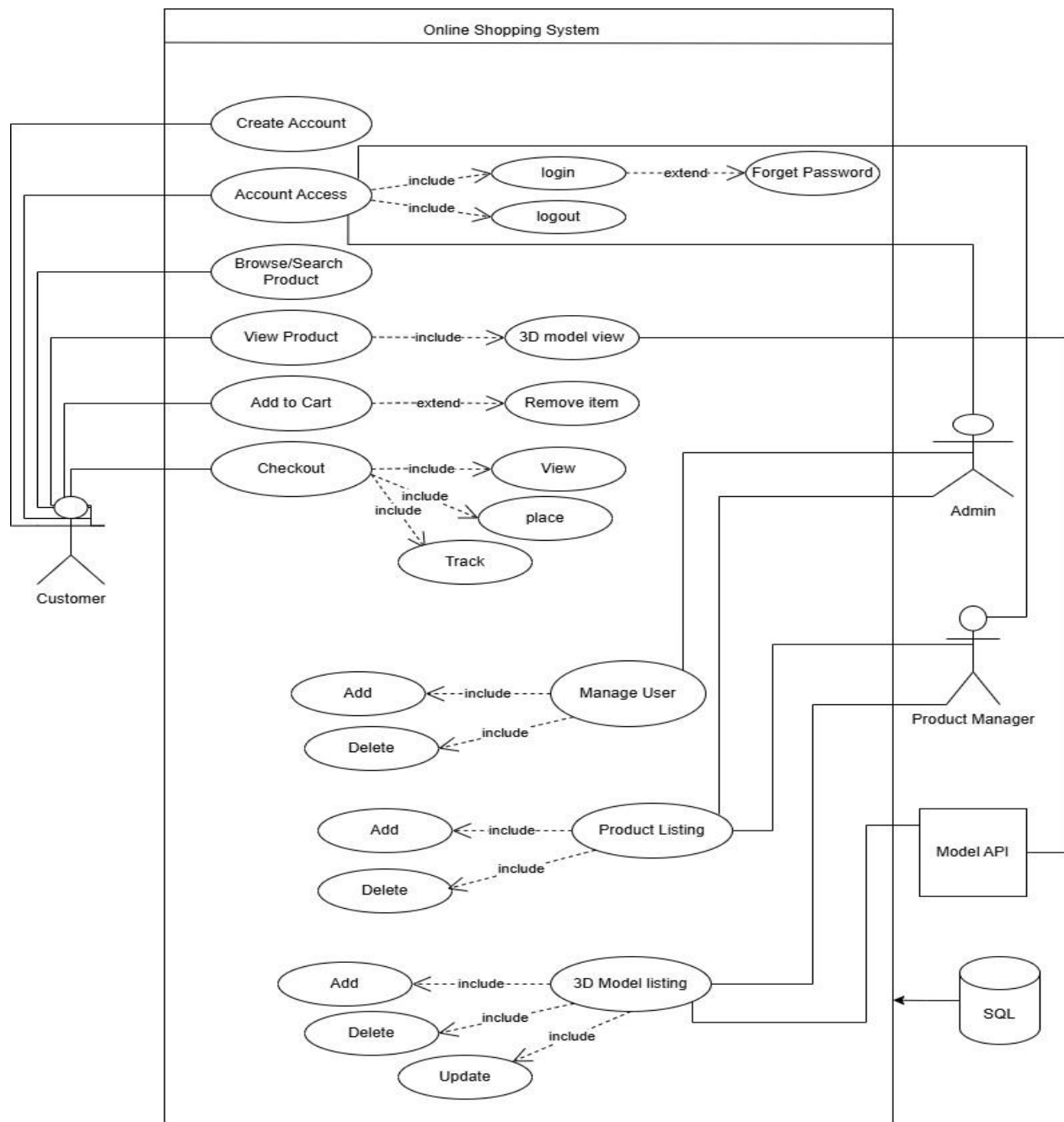
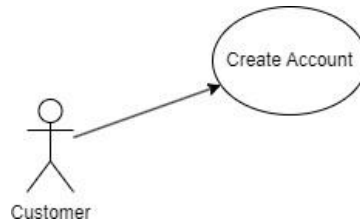


Figure 1 Use Case

Use Case Diagram Detail

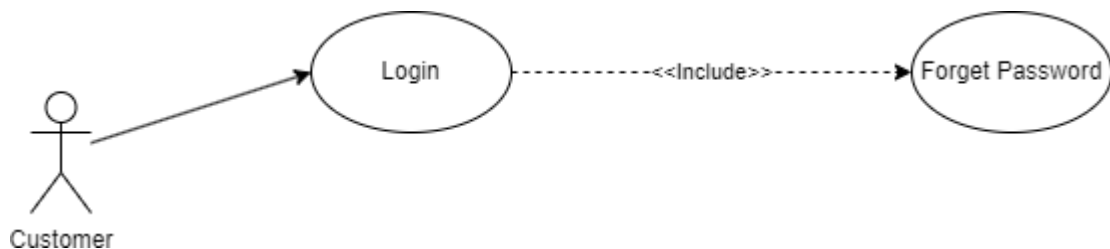
Create Account:



Use Case ID	UC_01	
Use Case Name	Create Account	
Description	If user is a newcomer, he/she must signup first.	
Primary Actor	Customer	
Secondary Actor		
Pre-Condition	Download and open app first.	
Post-Condition	Go to login page.	
Basic Flow	Actor Action	System Action
	1-The user downloads and opens the application 2- Register an account by filling in the required details.	1- Register Interface is displayed 2- Account Registered

Table 5.1 Use Case for Place Order

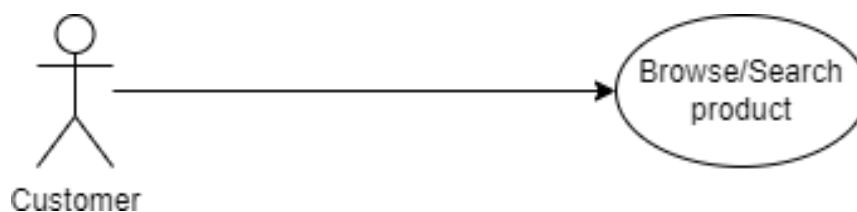
Login:



Use Case ID	UC_02	
Use Case Name	Login Account	
Description	After registration customer can go and login.	
Primary Actor	Customer	
Secondary Actor		
Pre-Condition	Must registered him/her first.	
Post-Condition	Land to browse page or product catalog.	
Basic Flow	Actor Action	System Action
	1-the user login him/herself.	System open product catalog page.

Table 5.2 Use Case for Login Account

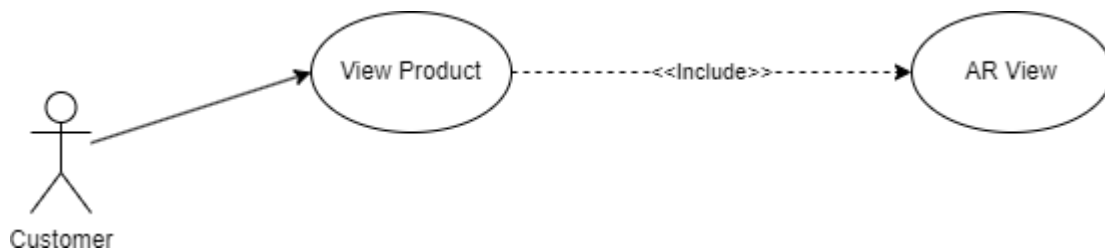
Browse/Search Product: -



Use Case ID	UC_03	
Use Case Name	Browse/Search Product	
Description	After login the customer go to browse or search product.	
Primary Actor	Customer	
Secondary Actor		
Pre-Condition	Login first.	
Post-Condition	Go to view product.	
Basic Flow	Actor Action	System Action
	1- user browse/search a product	1- showed browse or search different furniture.

Table 5.3 Use Case for Browse/Search Product

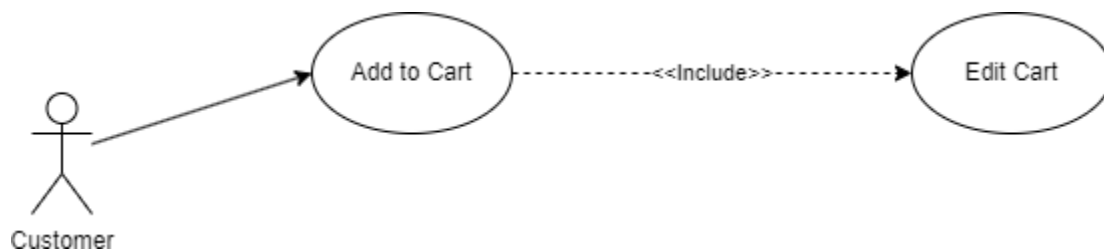
View Product: -



Use Case ID	UC_04	
Use Case Name	View Product	
Description	After going to view product customer can view images of product and also can create or customize model.	
Primary Actor	Customer	
Secondary Actor	3d avatar	
Pre-Condition	Search or browse product first.	
Post-Condition	3d model view	
Basic Flow	Actor Action	System Action
	1- View image. 2- Customize 3d model.	1- Showed images and 3D models of customer

Table 5.4 Use Case for View Product

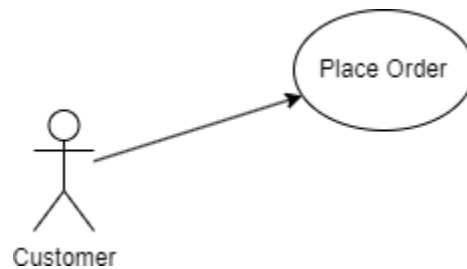
Add to Cart: -



Use Case ID	UC_05	
Use Case Name	Add to cart	
Description	After viewing 3D model customer can add product into cart or search other item/product.	
Primary Actor	Customer	
Pre-Condition	Virtually try on products	
Post-Condition	Place and finalize order.	
Basic Flow	Actor Action	System Action
	1- Add product into cart after try on.	1- Adding selected product into cart.

Table 5.5 Use Case for Add to Cart

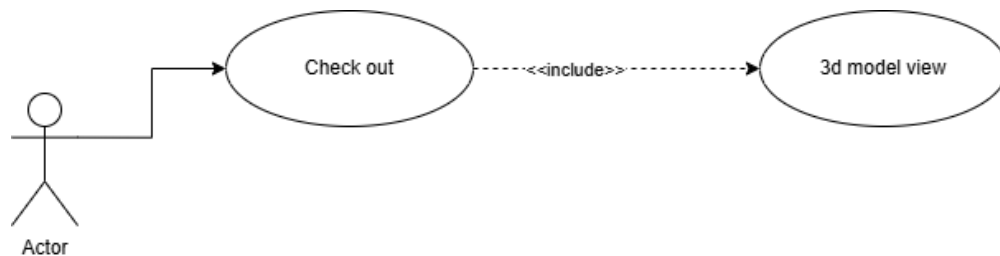
Place Order: -



Use Case ID	UC_06	
Use Case Name	Place Order	
Description	After adding product in cart customer goes to Confirm order.	
Primary Actor	Customer	
Pre-Condition	Add product to cart	
Post-Condition	Add order placing information.	
Basic Flow	Actor Action	System Action
	1- After finalizing product order will confirm by giving information of user.	1- check and process detail and confirm order.

Table 5.6 Use Case for Place Order

Place Order: -



Use Case ID	UC_07	
Use Case Name	Check out	
Description	After placing order customer can track order.	
Primary Actor	Customer	
Pre-Condition	Track order	
Post-Condition	Add order placing order	
Basic Flow	Actor Action	System Action
	1- After placing order, order will be tracked by user.	1- check and process detail of order.

Table 5.7 Use Case for Check out

Chapter 4: Design

In this section, we provide the design analysis of our modules including the following designs

1. Architecture Diagram
2. ERD with data dictionary
3. Data Flow diagram
4. Class Diagram
5. Activity Diagram
6. Sequence Diagram
7. Collaboration Diagram
8. State Transition Diagram
9. Component Diagram
10. Deployment Diagram

4.1 Architecture Diagram

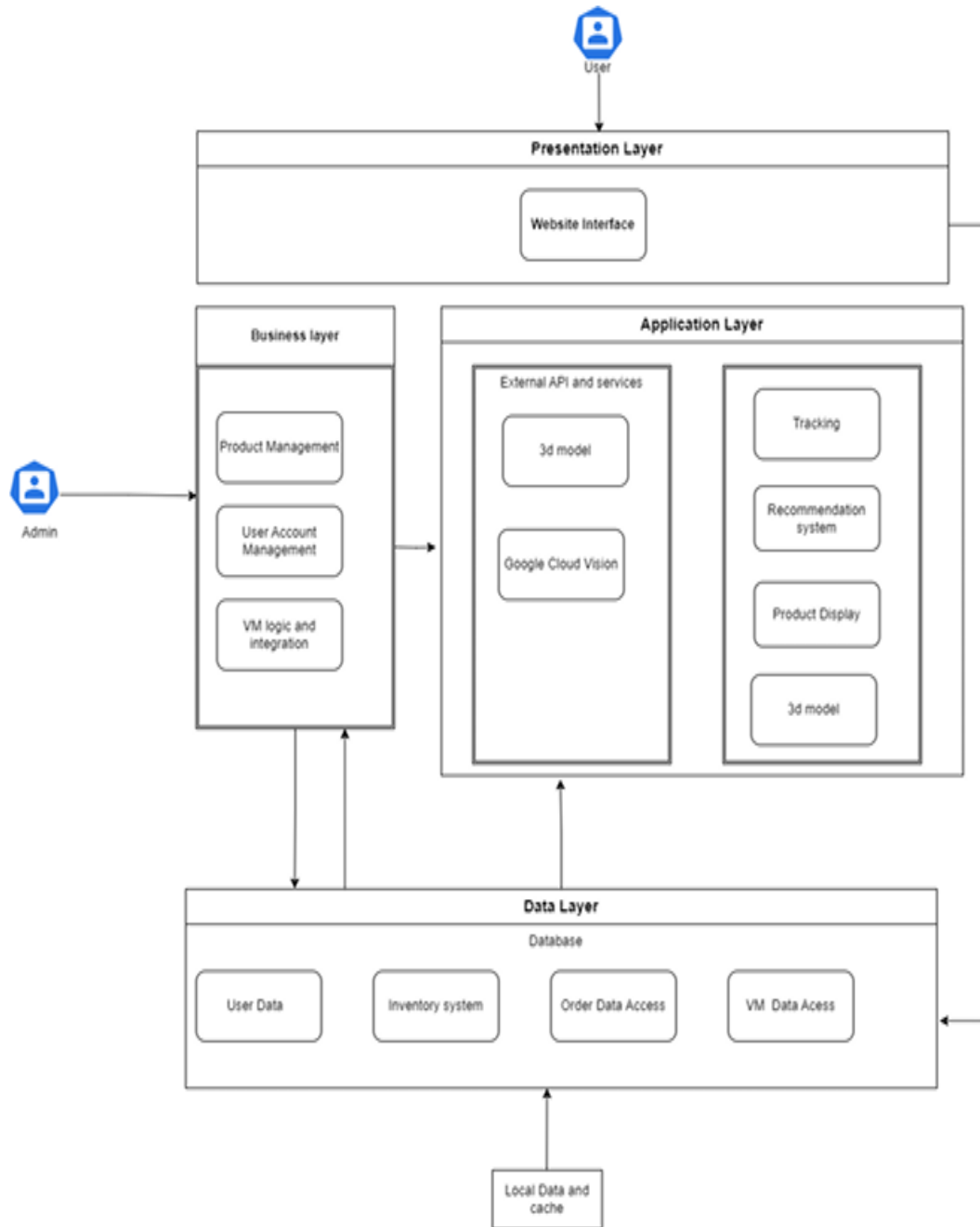


Figure 2 Architecture Diagram

4.2 ERD

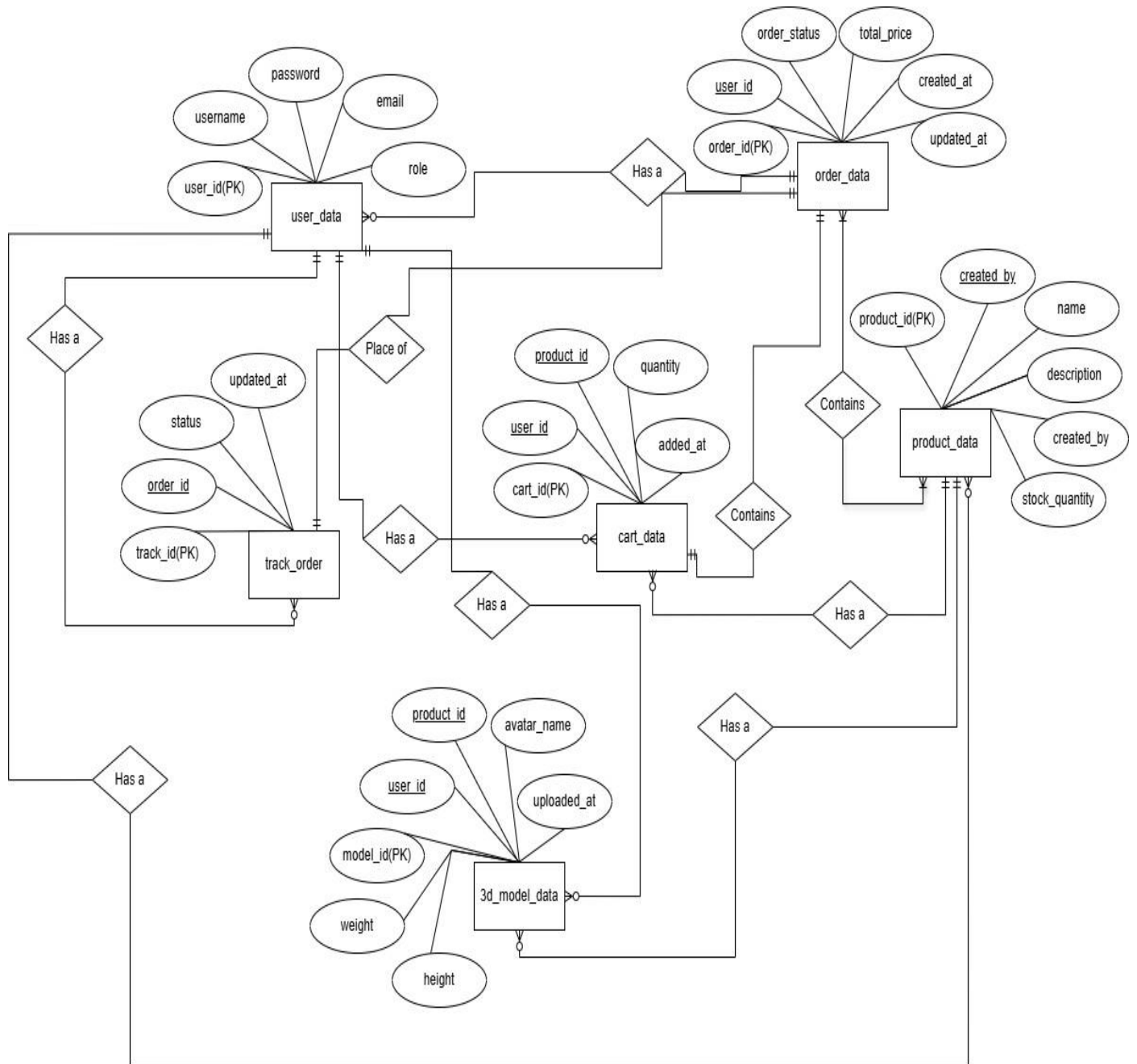


Figure 3 ERD

4.3 Data Flow diagram

4.3.1 The level 0

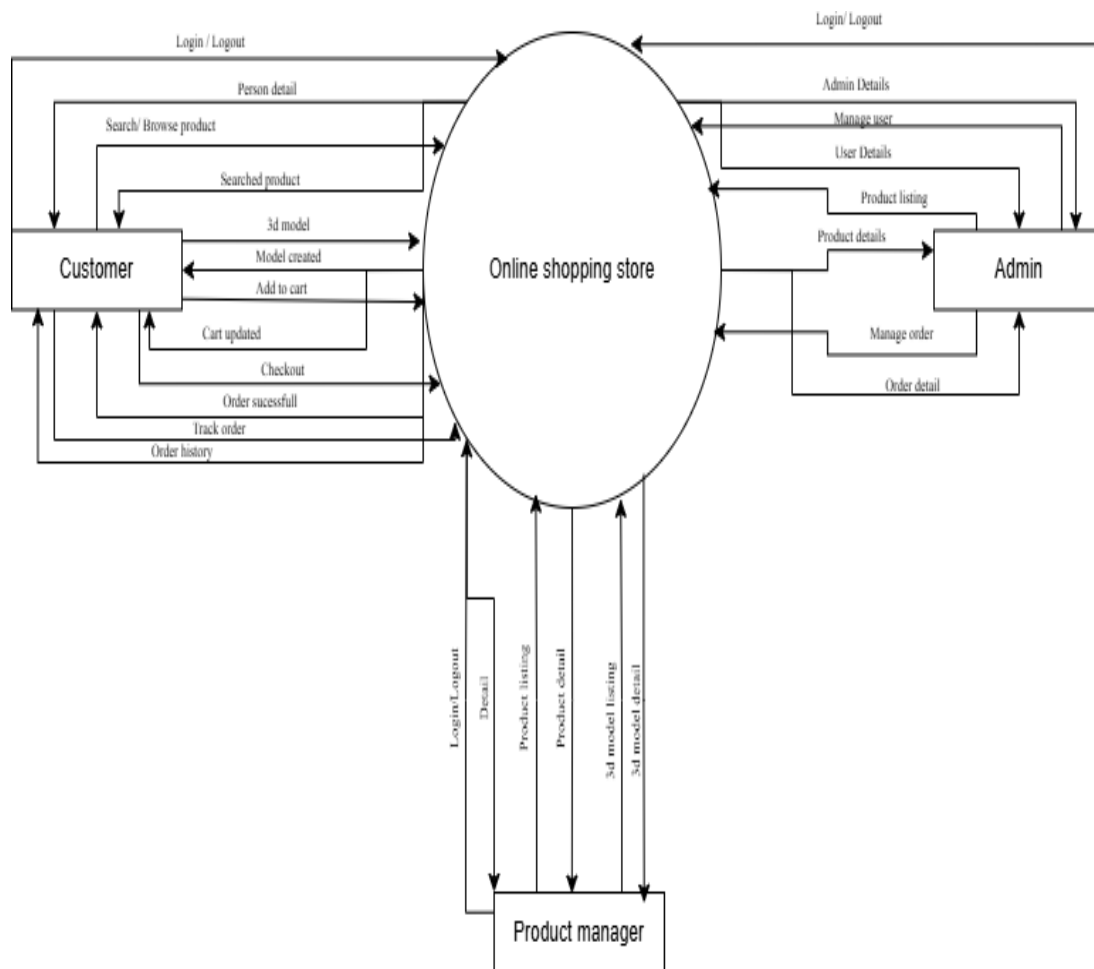


Figure 4 DFD level 0

4.3.2 The level 1

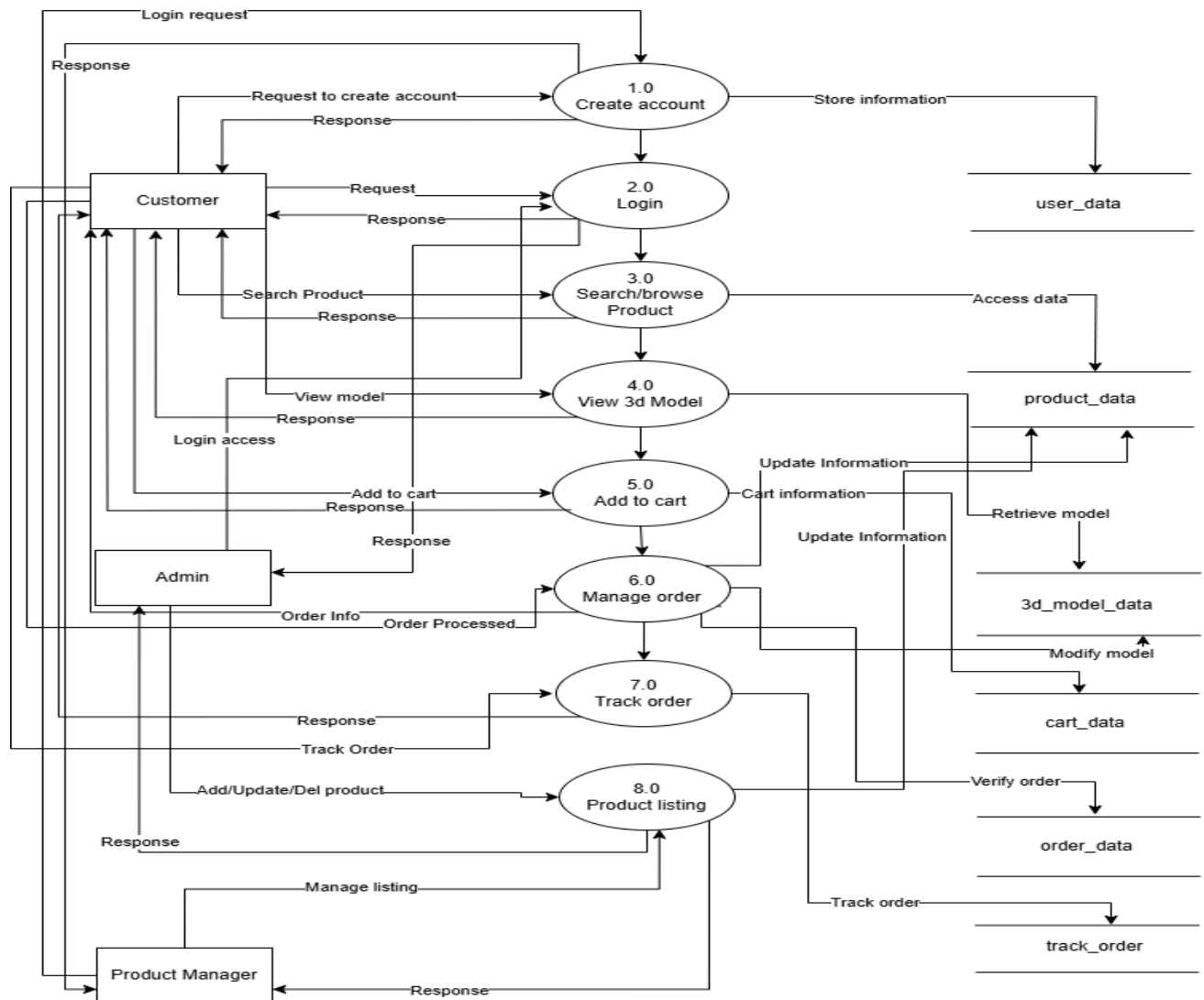
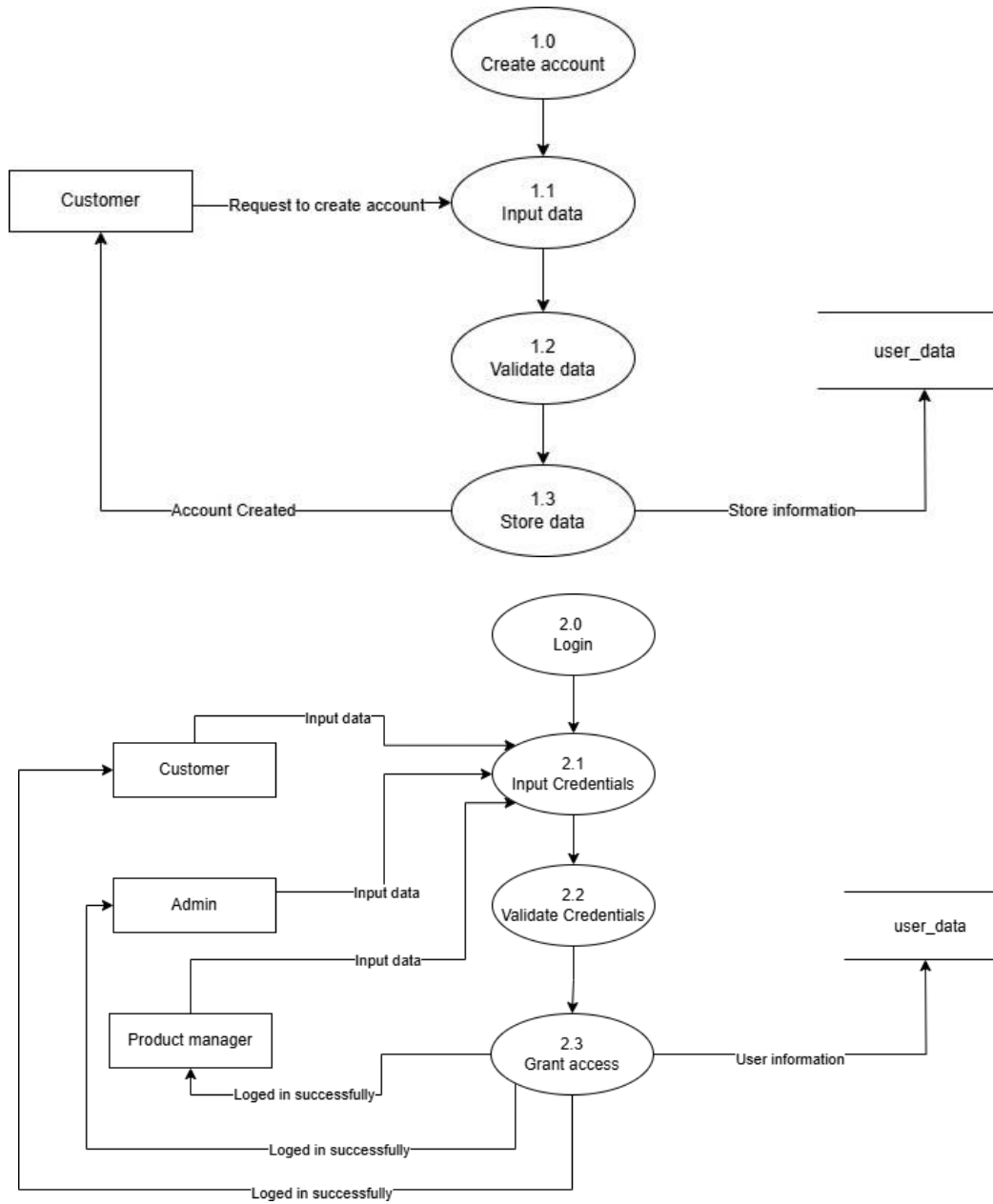
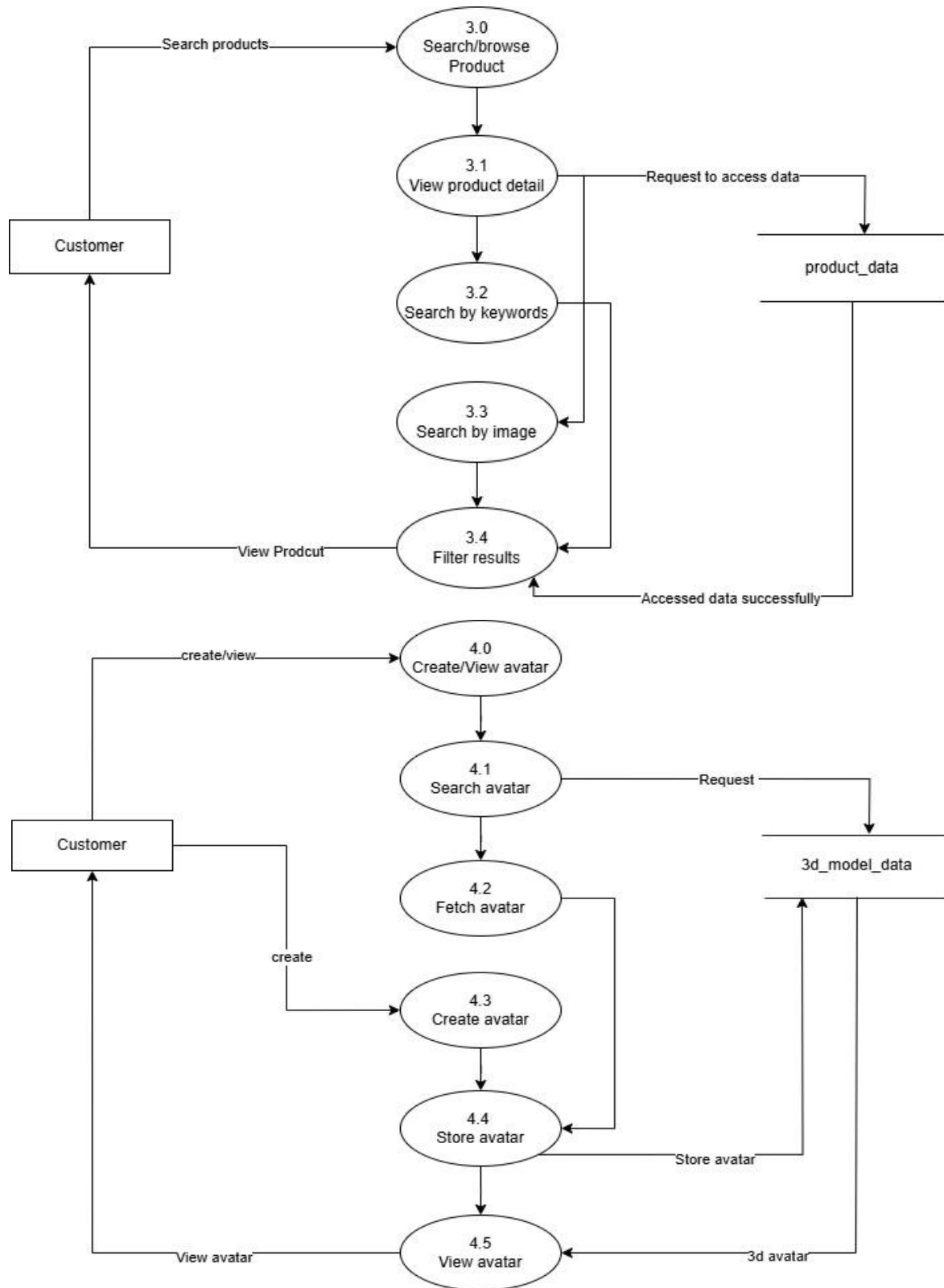
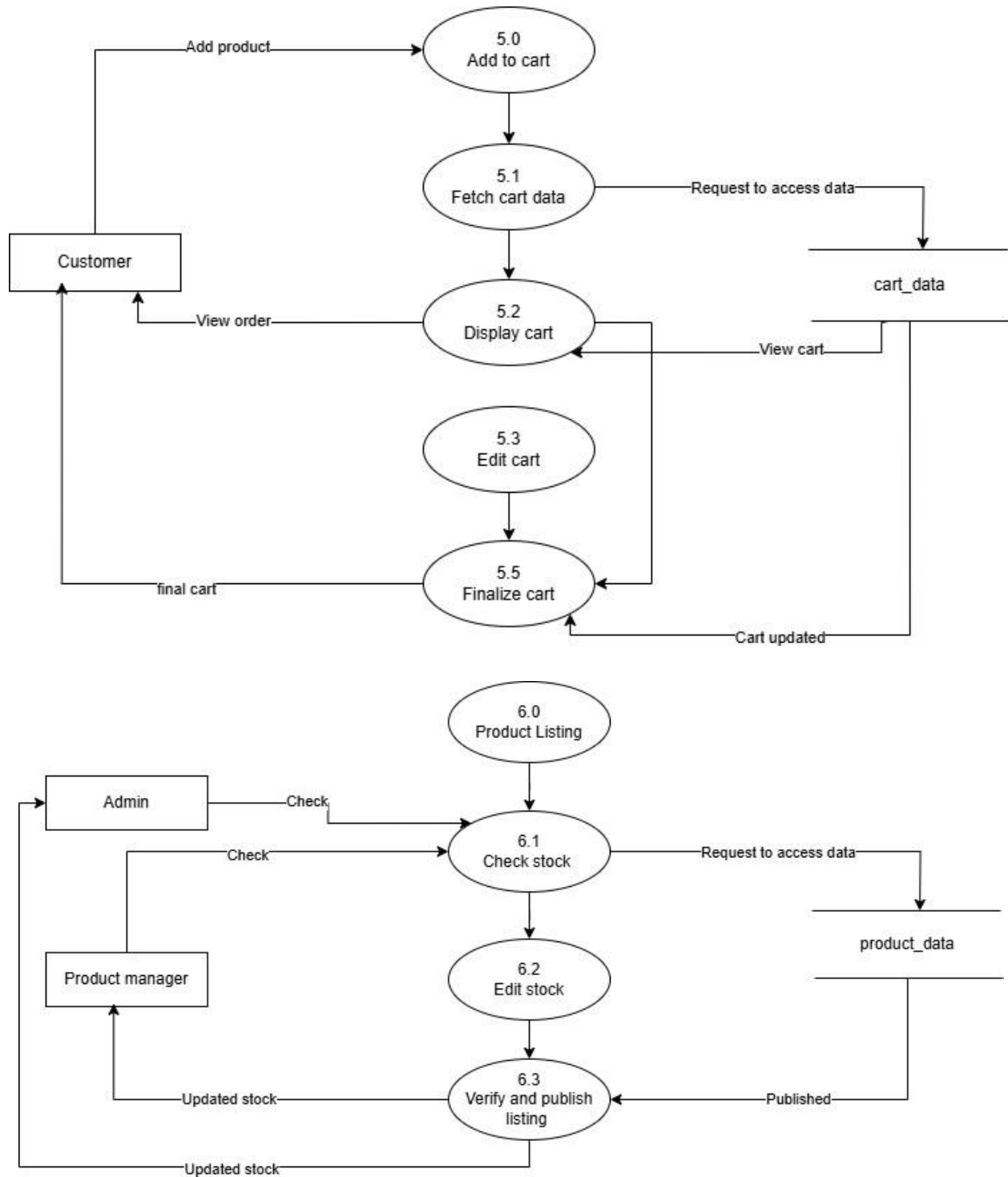


Figure 5 DFD level 1

4.3.3 The level 2







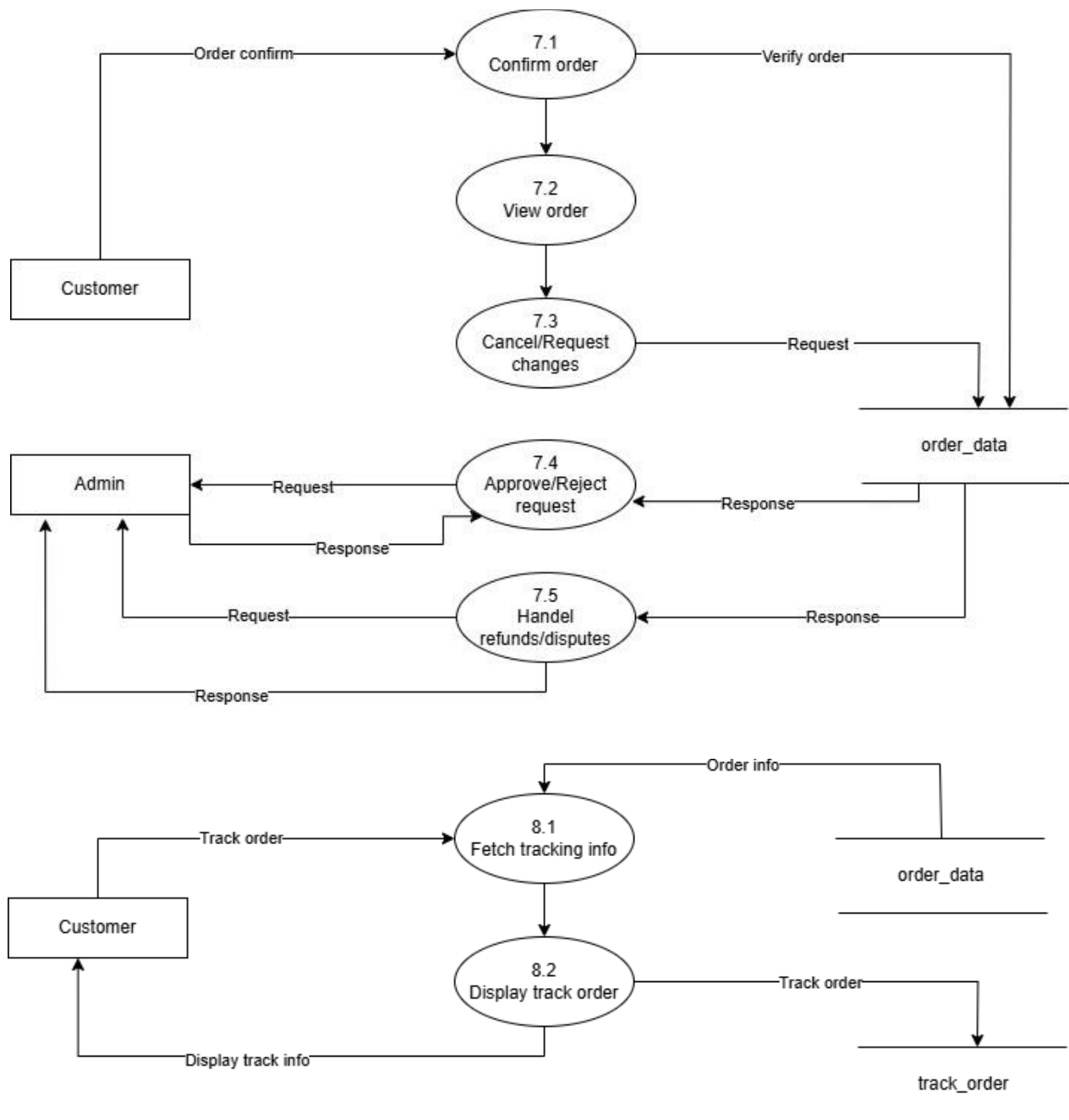
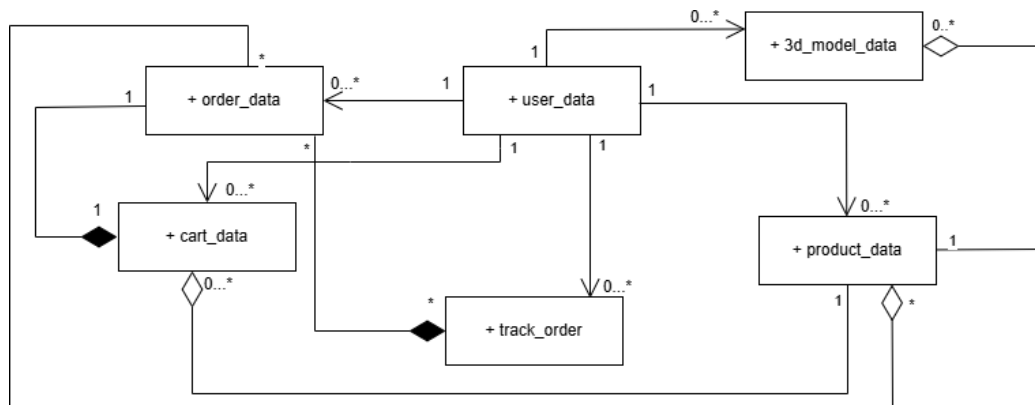


Figure 6 DFD level 2

4.4 Class Diagram



+ user_data
- user_id: INT - username: VARCHAR - password: VARCHAR - email: VARCHAR - role: ENUM
+ add_user(): void + update_user(): void + view_user(): void + authenticate_user(): bool + delete_user(): void

+ order_data
- order_id: INT - user_id: INT - order_status: ENUM - total_price: DECIMAL - created_at: TIMESTAMP - updated_at: TIMESTAMP
+ create_order(): void + update_order(): void + view_order(): void + cancel_order(): void

+ track_order
- track_id: INT - order_id: INT - status: ENUM - updated_at: TIMESPACE
+ track_order(): void + update_status(): void + view_tracking(): void

+ cart_data
- cart_id: INT - user_id: INT - product_id: INT - quantity: INT - added_at: TIMESPACE
+ add_to_cart(): void + update_cart(): void + view_cart(): void + clear_cart(): bool

+ product_data
- product_id: INT - name: VARCHAR - description: TEXT - stock_quantity: INT - created_by: INT
+ add_product(): void + update_product(): void + delete_prodcut(): void + view_product(): void + manage_stock(): void

+ 3d_model_data
- model_id: INT - avatar_name: VARCHAR - product_id: INT - height: DECIMAL - weight: DECIMAL - uploaded_by: INT - updated_at: TIMESPACE
+ add_model(): void + update_model(): void + delete_delete(): void + view_tracking(): void

Figure 7 Class Diagram

4.5 Activity Diagram

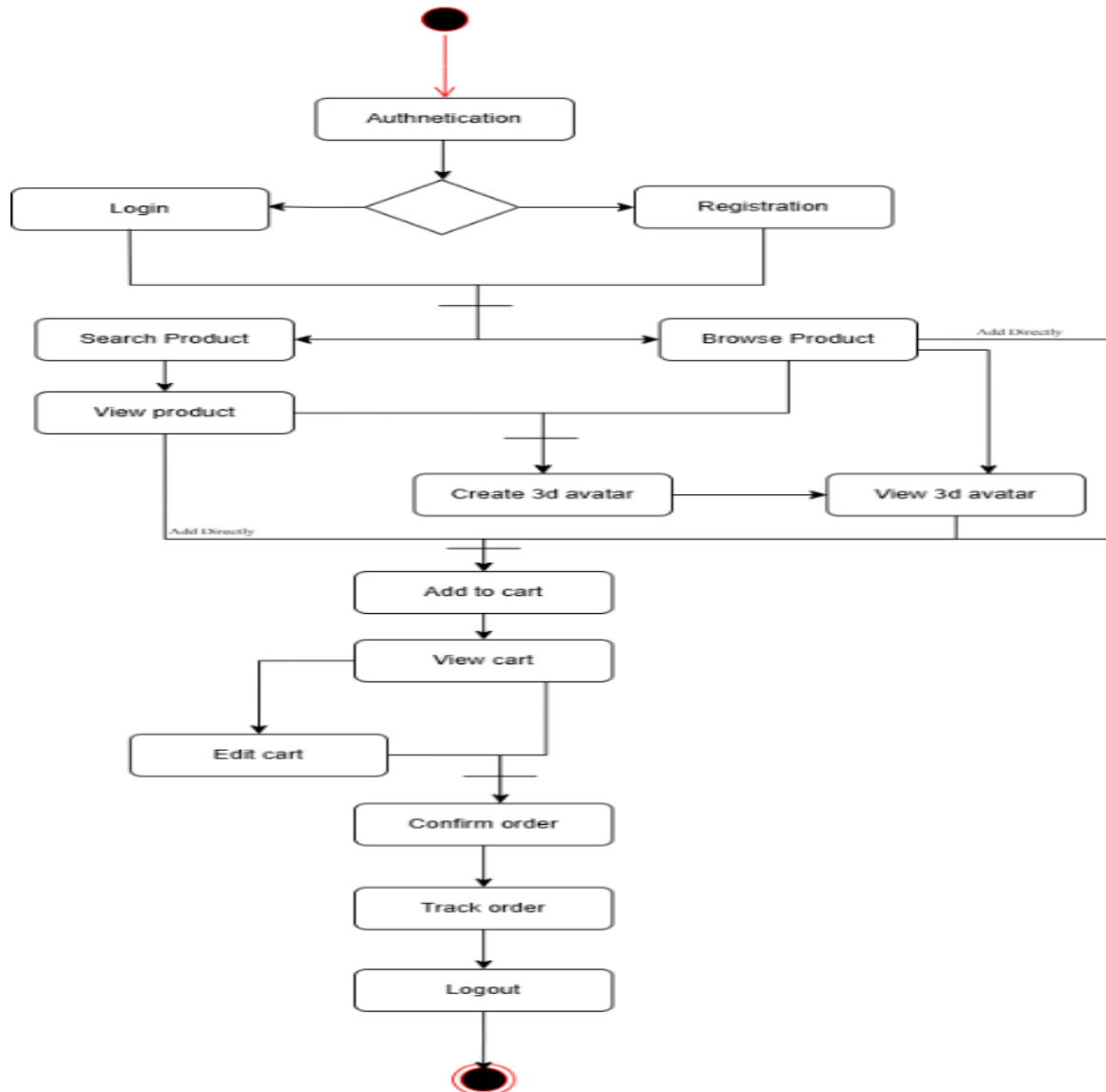


Figure 8 Activity Diagram

4.6 Sequence Diagram

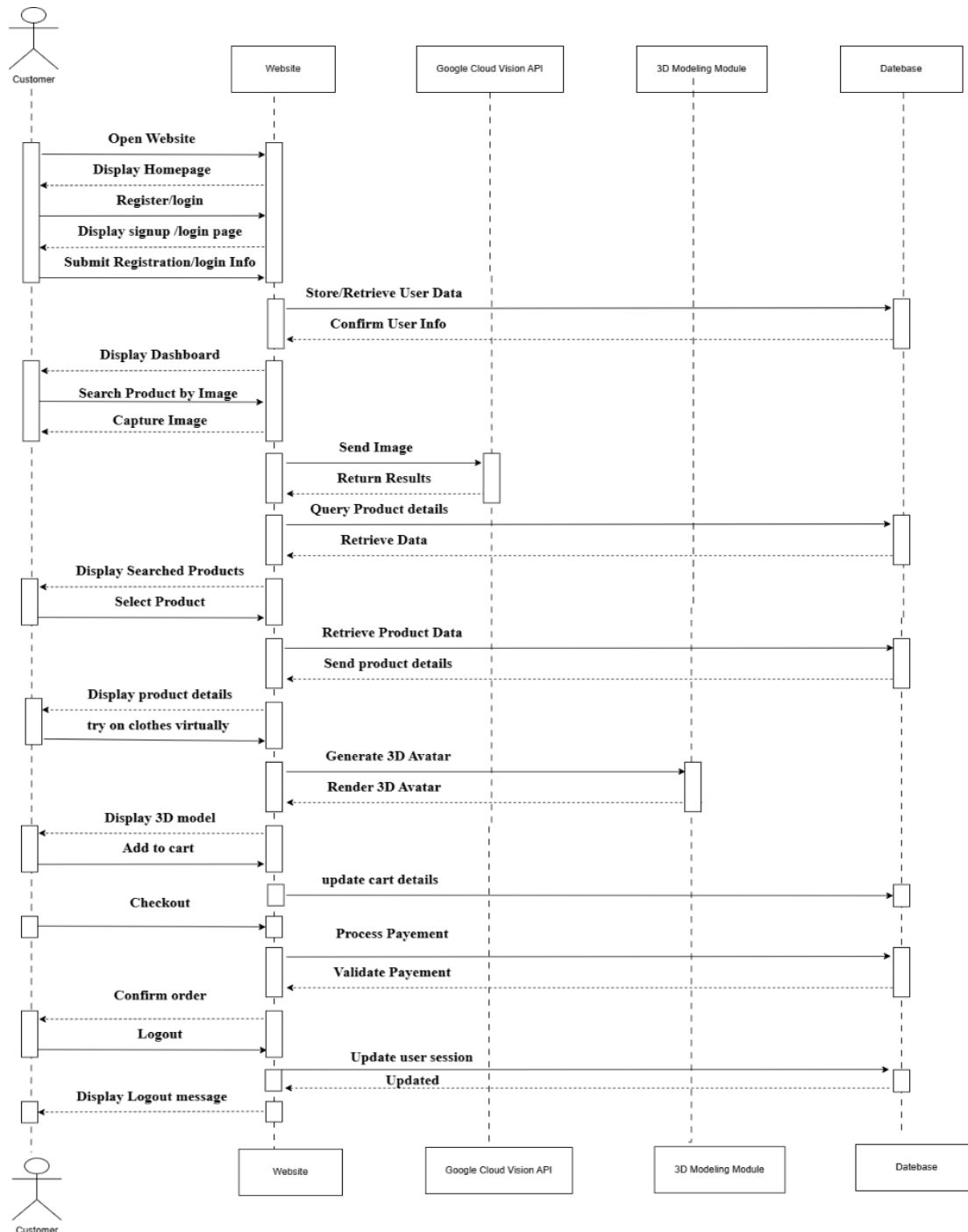


Figure 9 Sequence Diagram

4.7 Collaboration Diagram

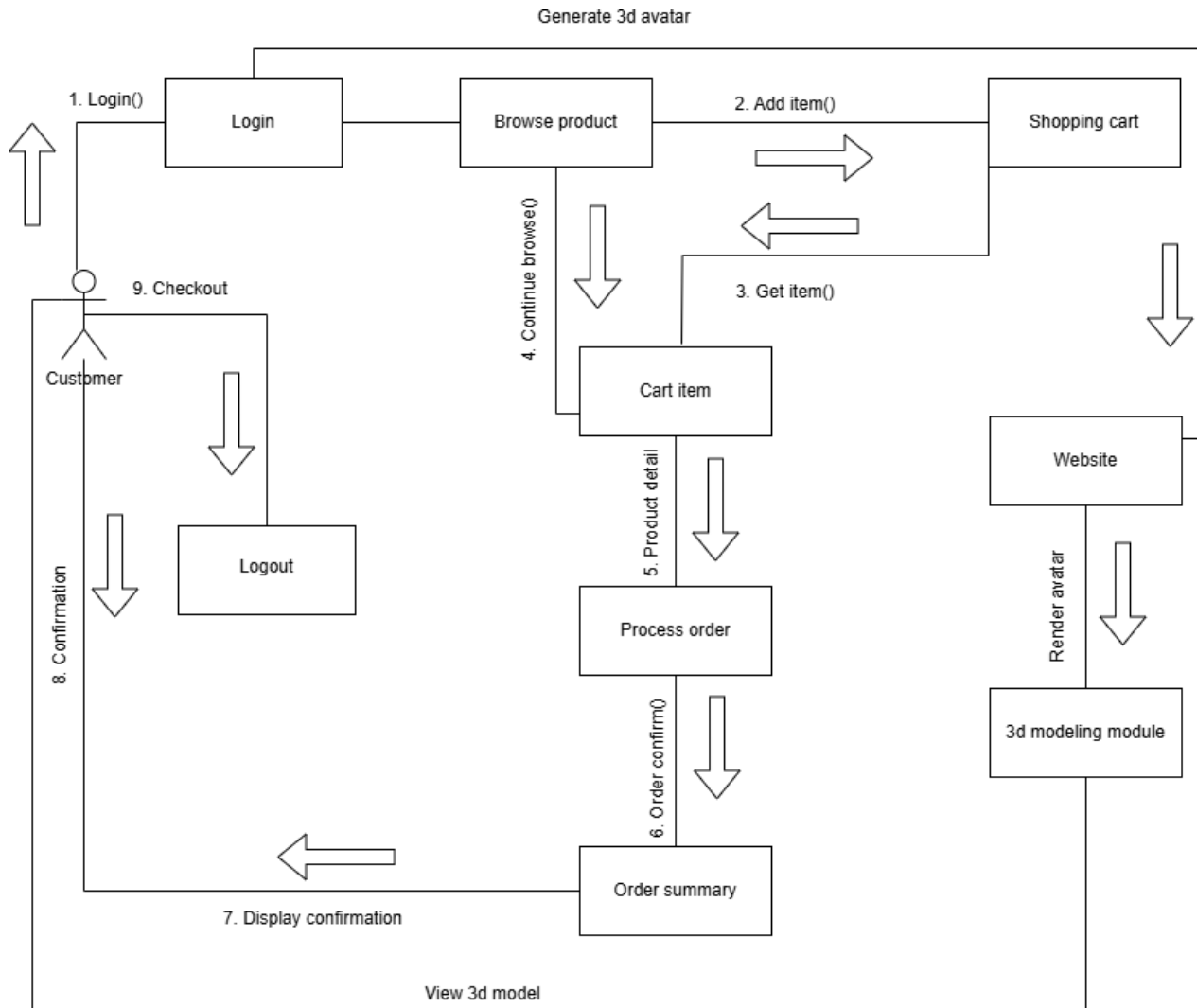


Figure 10 Collaboration Diagram

4.8 State Transition Diagram

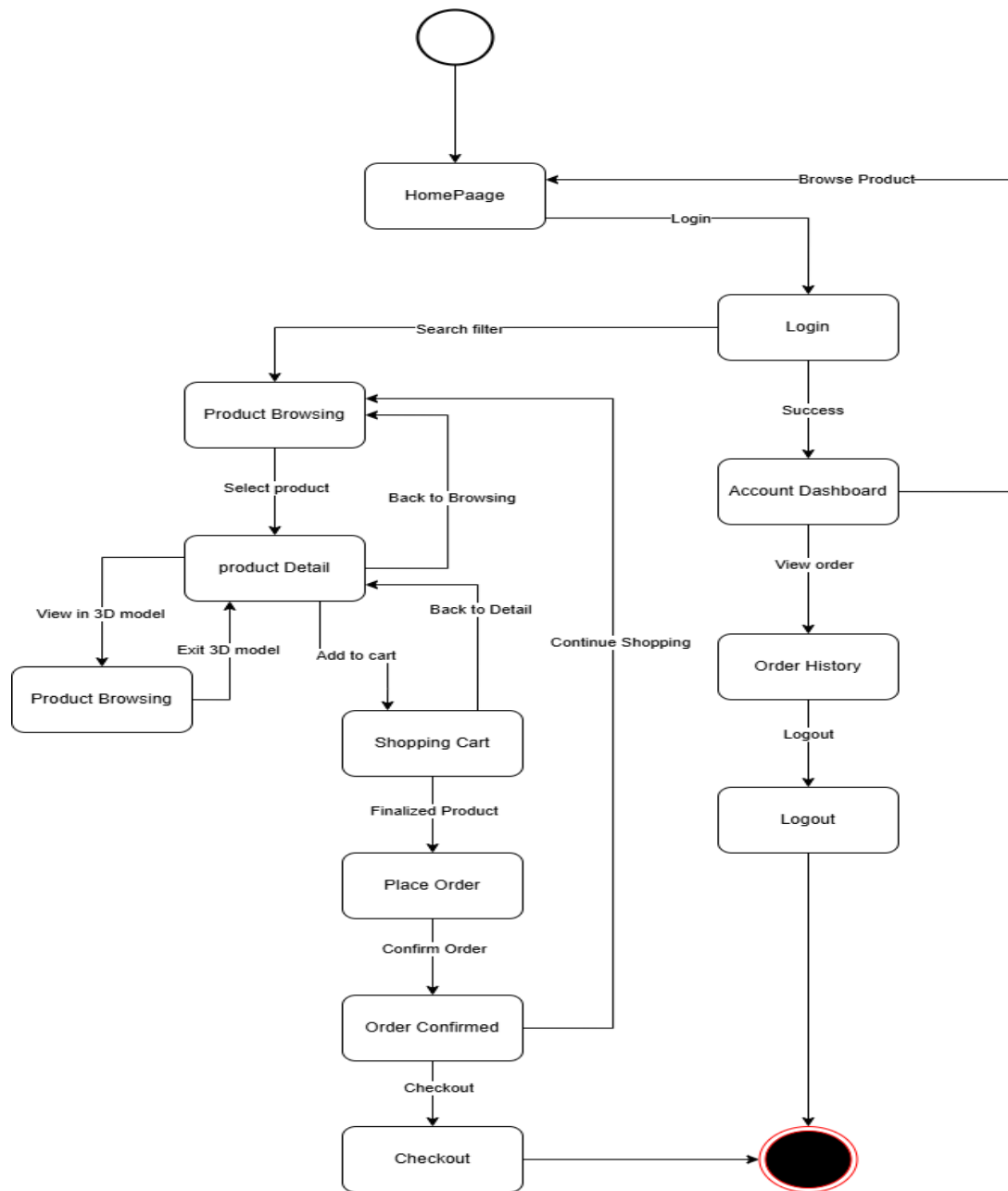


Figure 11 Diagram State Transition

4.9 Component Diagram

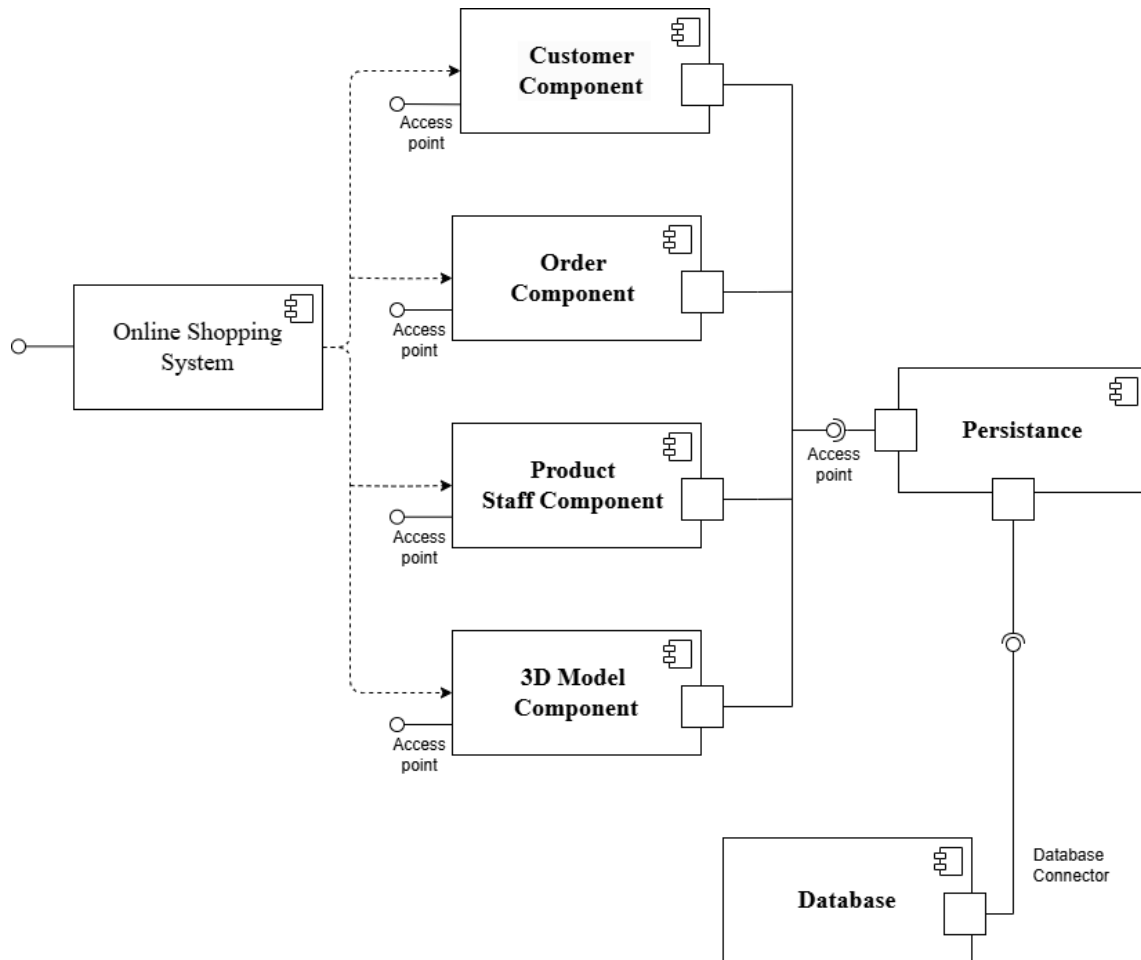


Figure 12 Component Diagram

4.10 Deployment Diagram

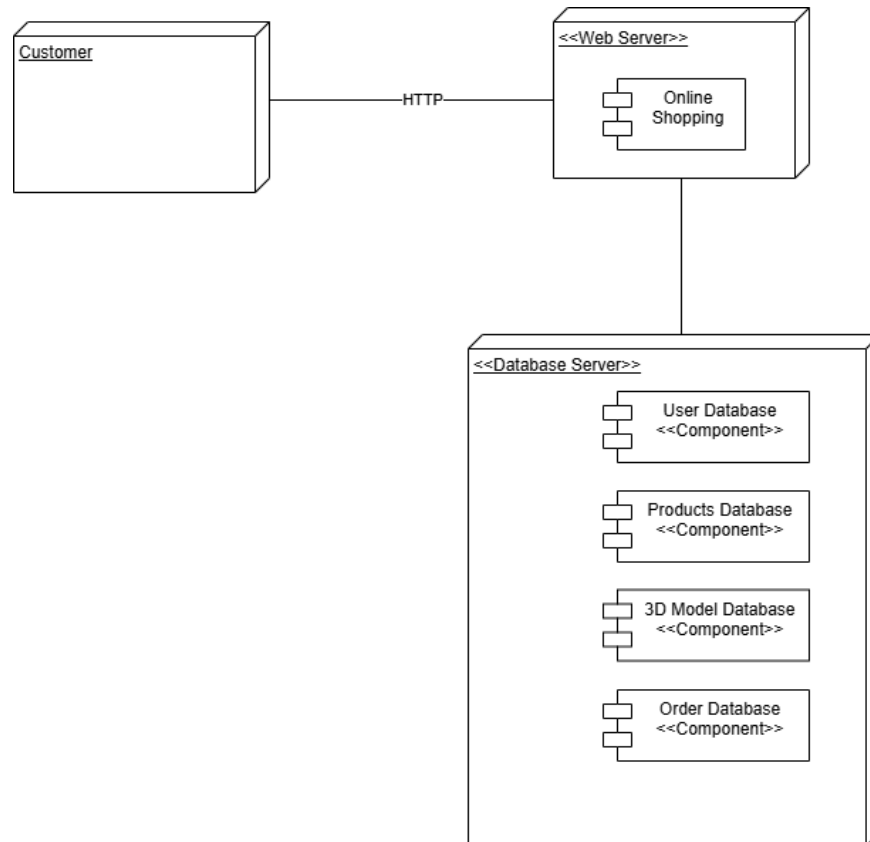


Figure 13 Deployment Diagram

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- • Color Oracle, “Color Blindness Simulator,” Available: <https://colororacle.org/>
WebAIM, “Color Contrast Checker for Web Accessibility,” Available: <https://webaim.org/resources/contrastchecker/>