

BESPOKY

(AR Shopping Application)

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Chapter 1: Introduction

1.1. Abstract

Today, physical and online clothes shops face the same problem: people come, look at the clothes they offer and... just leave.

This project aims to solve the issue of high return rates and the misery of trying on several articles of clothing in a fitting room by developing an augmented-reality app that allows customers to visualize how things will fit before placing an order. Simply input your height and weight into the program, then choose one of the featured body types from a virtual 3D model. In-app purchases are another option for customers to purchase their chosen clothes.

1.2. Introduction

A shopping mobile app that uses augmented reality (AR) techniques and is developed with Flutter can provide an innovative and immersive shopping experience for customers. By leveraging the power of AR, customers can visualize and interact with virtual 3D models of products, allowing them to make more informed purchase decisions.

With Flutter, the app can be developed for both iOS and Android platforms, providing a seamless and consistent user experience across devices. The app can also be easily customized and updated with new products and features, thanks to Flutter's modular and scalable architecture.

The AR technology used in the app allows customers to view products in a 3D space and interact with them in a realistic way, providing a more engaging and informative shopping experience. Customers can view products from different angles, zoom in to see details, and even visualize how the product might look in their own home or environment.

Overall, a shopping mobile app that uses AR techniques and is developed with Flutter can provide a unique and compelling shopping experience for customers,

allowing them to explore and interact with products in a more immersive and intuitive way. This can ultimately lead to increased customer engagement, higher conversion rates, and a more successful online shopping experience for both customers and retailers.

1.3. Aims Of Project

- Provide a more immersive and engaging shopping experience for customers, allowing them to visualize and interact with virtual 3D models of products.
- Increase customer engagement and conversion rates by providing a unique and innovative shopping experience that stands out from traditional e-commerce websites.
- Allow customers to customize and personalize their clothes by selecting different textures, colors, and designs using Blender.
- Provide a scalable and modular app architecture that can be easily updated and customized with new products and features.
- Leverage the power of Flutter to develop a cross-platform app that can be deployed to both iOS and Android devices, providing a consistent user experience across different devices and operating systems.
- Use AR technology to provide customers with a more realistic and informative view of products, allowing them to make more informed purchase decisions.
- Increase customer loyalty and brand awareness by providing a differentiated shopping experience that promotes customer satisfaction and loyalty.
- Enabling one-click purchases of the chosen things to save power and time.

Overall, the aims of this project are to create a shopping mobile app that uses augmented reality techniques and Flutter, with custom clothes created using Blender, that provides a unique and engaging shopping experience for customers and adds value for retailers by increasing customer engagement and conversion rates.

1.4. Project Objectives

- 1. Reduce operating expenses** – Investing in an AR fashion project or a good shopping Application will allow you to choose the best and suitable items for you. Not to mention, this will help you reduce power consumption and unnecessary overtime costs.
- 2. Save time** – “Time is money”-people of all centuries have realized how true the statement is. There are occasions when you get stuck in the rows of dressing rooms for several minutes or spend a lot of time trying to find what fits you.
- 3. Increase Online Sales** – Window shopping is trendy among online customers as looking at clothes online from the comfort of your home is accessible and absorbing.
According to the survey, brick-and-mortar stores would see conversion rates as high as 67% if they can get their customers into dressing rooms. Simple as that. Once your customers have the opportunity to try on clothing or shoes, they are significantly more likely to make a purchase. Additionally, when a buyer can really use a thing before feeling comfortable enough to buy it, the barrier between them and it just dissolves.
- 4. The power of augmented reality** – helping brands and creative agencies to build, publish, analyze, and scale engaging marketing campaigns across their complete customer journey.
- 5. Reduce Return Rates**– Fashion brands provide replacing the items after delivering it in many cases. Average return rates for online clothing retailers are about 20% but go as high as 50% for some (Forrester Research). You can reduce this by as much as 35%! Another great benefit of an AR Shopping App, isn't it?

1.5. Challenges

1. **Hardware issues:** Currently, every available AR headset is a bulky piece of hardware that may be too expensive for the masses. Also, most AR headsets need to be tethered to a computer, making the entire experience limited and inconvenient. Alternatively, consumers can use their smartphones or tablets for AR applications. However, mobile AR faces major issues in displaying visuals accurately. For instance, mobile sensors such as accelerometers can be disturbed by electric interference, which is commonly witnessed in urban areas. Additionally, smartphone cameras are built for 2D image capture and are incapable of rendering 3D images. Hence, the hardware required for AR technology needs to be enhanced before mass adoption.
2. **Limited content:** One of the major challenges with augmented reality is creating engaging content. The content created for augmented reality devices consists of games and filters used in social networks such as Instagram and Snapchat. However, creating content that can promote businesses can be extremely complicated and expensive. Also, augmented reality developers have not created enough high-functioning use cases that can be used by consumers daily.
3. **Lack of regulations:** Currently, there are no regulations that help businesses and consumers understand which type of AR applications can be used and how data can be processed. Hence, the technology can be used with malicious intent. For instance, a cybercriminal can hijack personal accounts by mining data output and manipulating AR content. In such cases, consumers may have questions like who could be held accountable, which mitigation strategies can be used, and how to avoid such incidents in the future. Hence, one of the significant challenges of augmented reality is creating regulations that can ensure the privacy and security of consumer data as well as simplify mainstream adoption of the technology.
4. **Public skepticism:** Although augmented reality is a popular topic of discussion among tech experts, consumers are unaware of the benefits of the technology.

Consumers have only used the most popular applications of augmented reality such as trying out glasses, wardrobes, and accessories. Therefore, consumers need to be informed about the various applications and benefits of augmented reality. Additionally, a lack of awareness may lead to concerns about privacy and security while using augmented reality technology. Hence, users' concerns need to be addressed to accelerate the mainstream deployment of augmented reality.

- 5. Data Management:** Managing data related to user preferences, customizations, and purchases can be challenging, as this requires a robust and secure backend infrastructure.
- 6. Compatibility and Testing:** Testing the app across different devices and operating systems can be challenging, as compatibility issues can arise. This requires thorough testing and optimization to ensure that the app works well across different platforms.
- 7. Physical safety risks:** Augmented reality applications can be immensely distracting and may lead to physical injuries. For instance, many people were injured while playing Pokémon Go. Likewise, augmented reality applications can lead to serious injuries in case they are used in potentially risky environments such as busy roads, construction sites, and medical institutions. Although augmented reality technology is still in its infancy, its existing applications have shown that further research and development to address the challenges with augmented reality can enable large-scale deployment of the technology. And once that happens, the implementation of augmented reality can be witnessed in law enforcement, healthcare, finance, and other critical areas.

1.6. Impact on society

How can this project impact society?

21 Days Only are needed to build a habit according to “Making Habits, Breaking Habits” by **Dr. Jeremy Dean**

Here we’re speaking about some tools to make life better and save a great time so what will stop people from impacting?

1.6.1. Advantages

- Save Money & Time.
- Improve business marketing.

1.6.2. Disadvantages

- Reduce the physically needed store sales.

Chapter 2: Background And Related Work

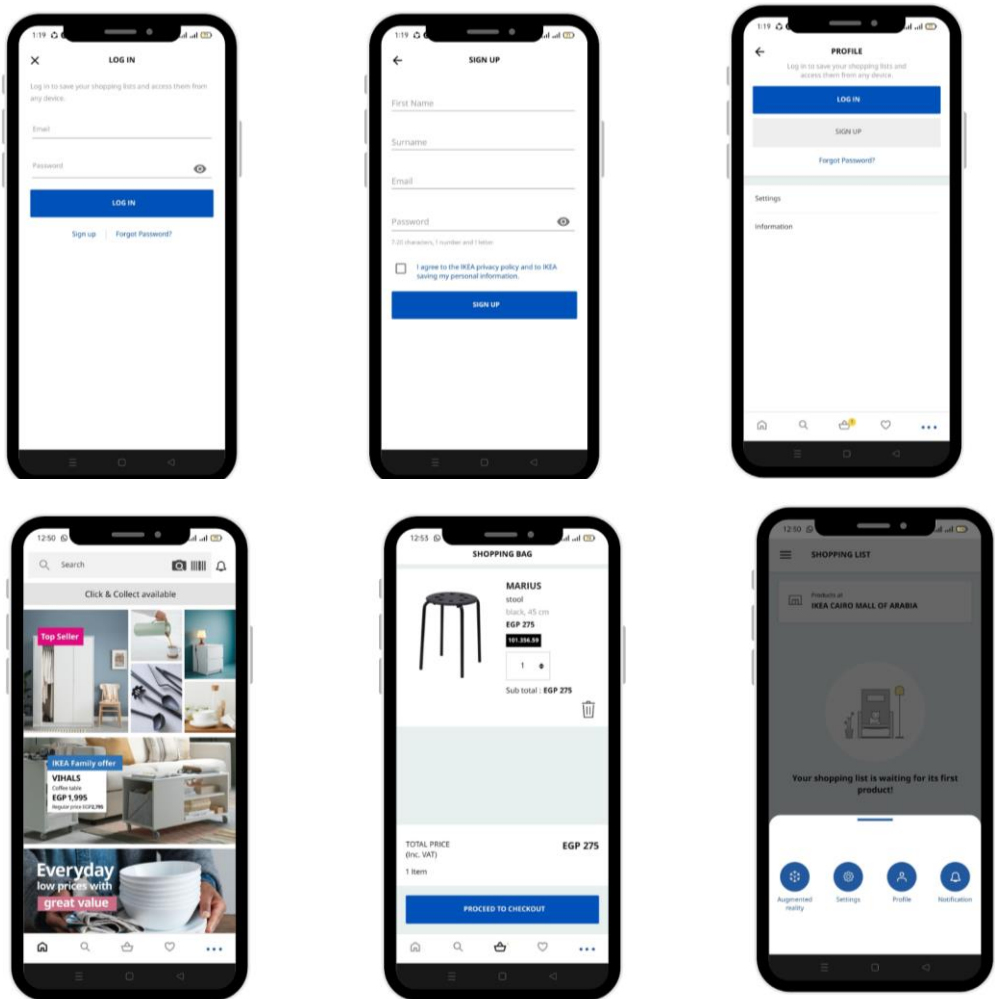
2.1 Similar Projects

2.1.1. IKEA

IKEA stores are typically blue buildings with yellow accents (also Sweden's [national](#) colors). They are often designed in a one-way layout, leading customers counter-clockwise along what IKEA calls "the long natural way" designed to encourage the customer to see the store in its entirety (as opposed to a traditional retail store, which allows a customer to go directly to the section where the desired goods and services are displayed). There are often shortcuts to other parts of the showroom.

Most IKEA stores offer an "as-is" area at the end of the warehouse, just before the cash registers. Returned, damaged, and formerly showcased products are displayed here and sold with a significant discount, but also with a no-returns policy.

2.1.1.1 Screenshots

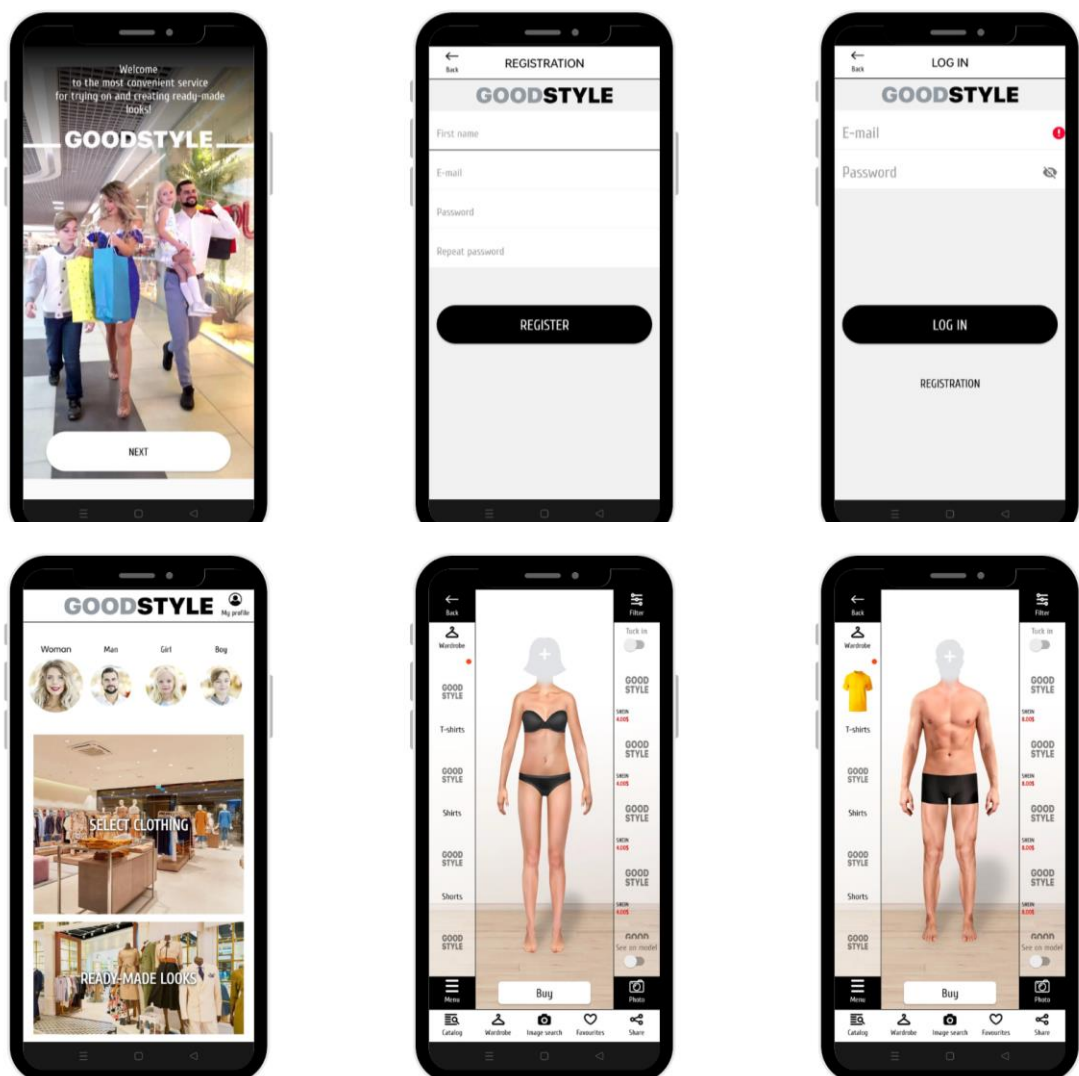


A **virtual dressing room** (also often referred to as a **virtual fitting room** and **virtual changing room** although they do, on examination, perform different functions) is the online equivalent of an in-store changing room.

Having begun to emerge in 2005, fit technologies started to be widely reported in 2010, but are now available from an increasing variety of providers and are in use by a growing number of prominent retailers in their websites.

A fit technology may be categorized according to the problem that it resolves (size, fit, or styling) or according to the technological approach. There are many different types of technological approaches.

2.1.2.1 Screenshots



2.2 Tools

2.2.1 Hardware and Software Requirements:

2.2.1.1 Hardware requirements for AR include:

- Battery life.
- Field of view in 3D view.
- inputs/outputs (buttons).
- display capacity.
- visual tracking. (Face tracking, body tracking).

2.2.1.2 Software requirements for Augmented Reality include:

- Google Play Service for AR.
- AR software works in conjunction with devices such as tablets, phones, headsets, and more. These integrating devices contain sensors and digital projectors, and hence require.
- appropriate software that enables computer-generated objects to be projected into the real world.
- on-board operating system and user interface to support the software.
- authoring to allow the user to use API links to other databases and websites to display information.

2.2.1.3 General Requirements for our APP:

- Smartphone with a high-quality Front-Camera.
- Smartphone that supports Google Play Service for AR.
- Strong Connection to Internet.

2.2.2 Software's Used:

2.2.2.1 Augmented Reality technologies:

- Vuforia.
- Wikitude.
- ARKit.
- ARCore.
- MaxST.
- Unity Mars.

					
Platforms	Android, iOS, UPW and Unity Editor	Android, iOS, Windows for tablets	iOS 11+	Android 7.0+, iOS 11+	Android, iOS, Windows and Mac OS
License Type	Free, Commercial	Commercial	Free	Free	Free, Commercial
Smart Glasses Support	+	+	+	+	+
Unity Support	+	+	+	+	+
Cloud Storage	+	+	+	+	-
3D Recognition	+	+	+	+	+
Geolocation	+	+	+	+	-

2.2.2.2 Flutter technologies:

- Android Studio.
- FireBase ==> Cloud Firestore & Authentication.
- **Packages:**
 1. Flutter.
 2. Dart persistent_bottom_nav_bar.
 3. sizer.
 4. google_fonts.
 5. cupertino_icons.
 6. circle_nav_bar.
 7. appbar_animated.

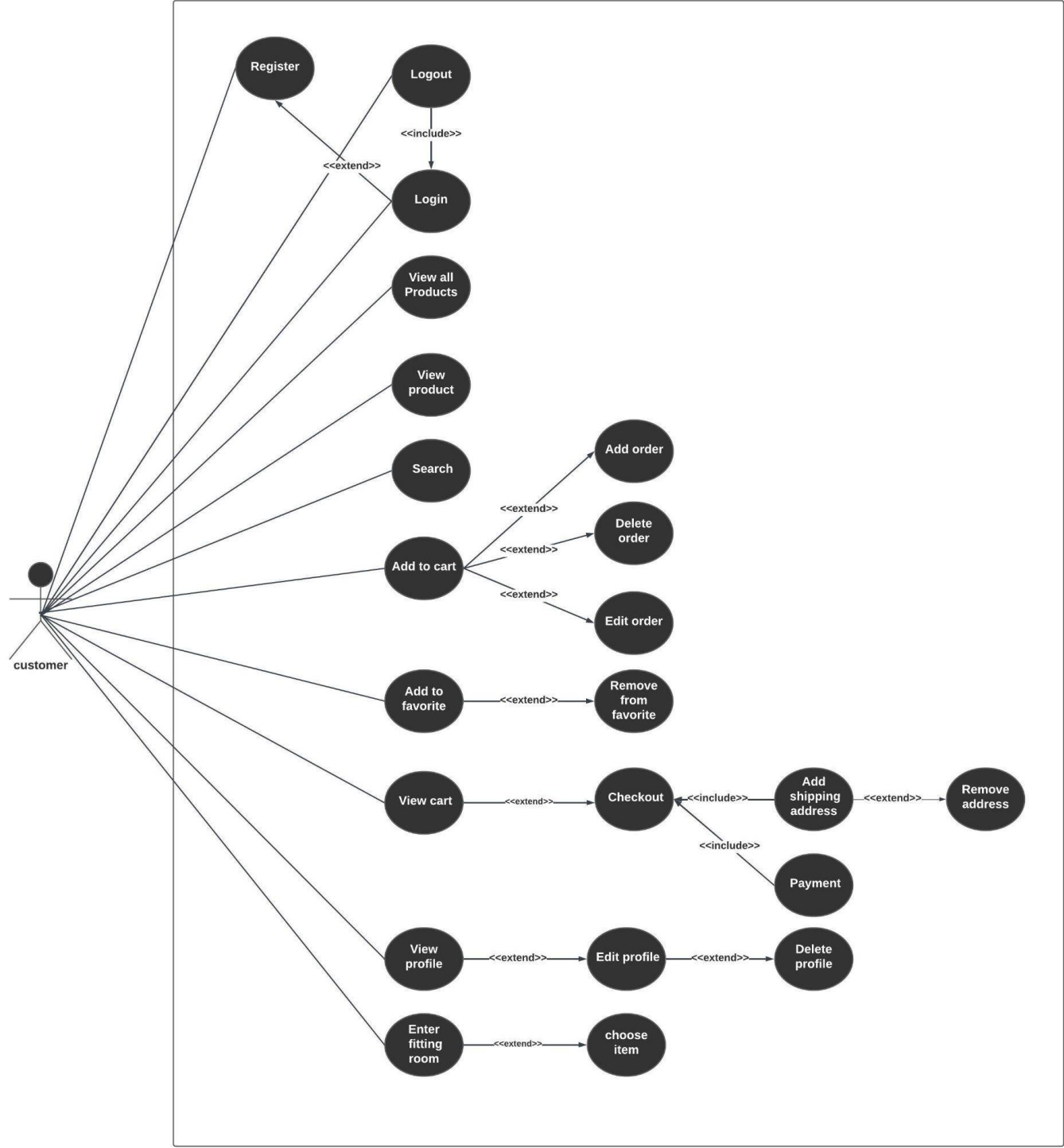
2.2.2.3 Computer Vision technologies:

- Spyder.
- tkinter.
- Anaconda ⇒ For computer vision environment.
- **Libraries:**
 1. cvZone.
 2. openCV.
 3. pose detector.
 4. os.

Chapter 3: System Design

3.1 System Required Analysis

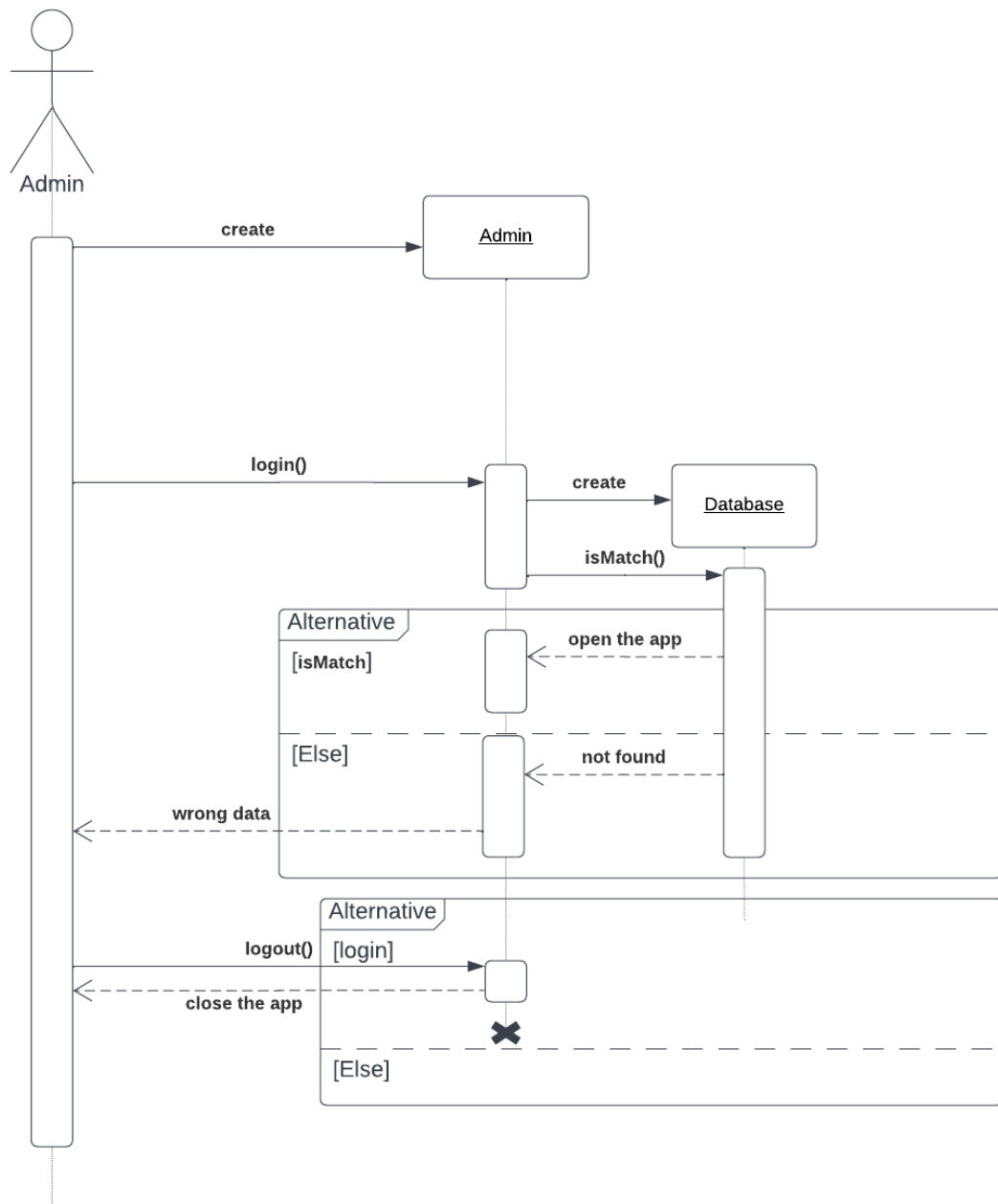
3.1.1 Use Case



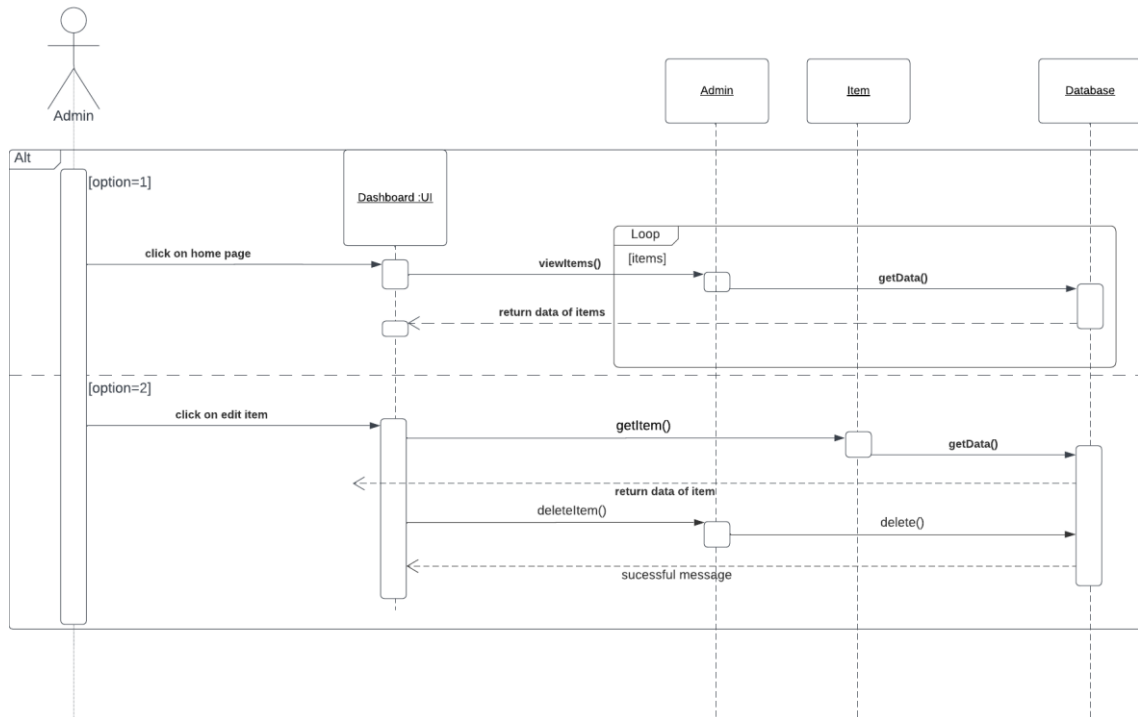
3.1.2 Sequence Diagram

3.1.2.1 Admin

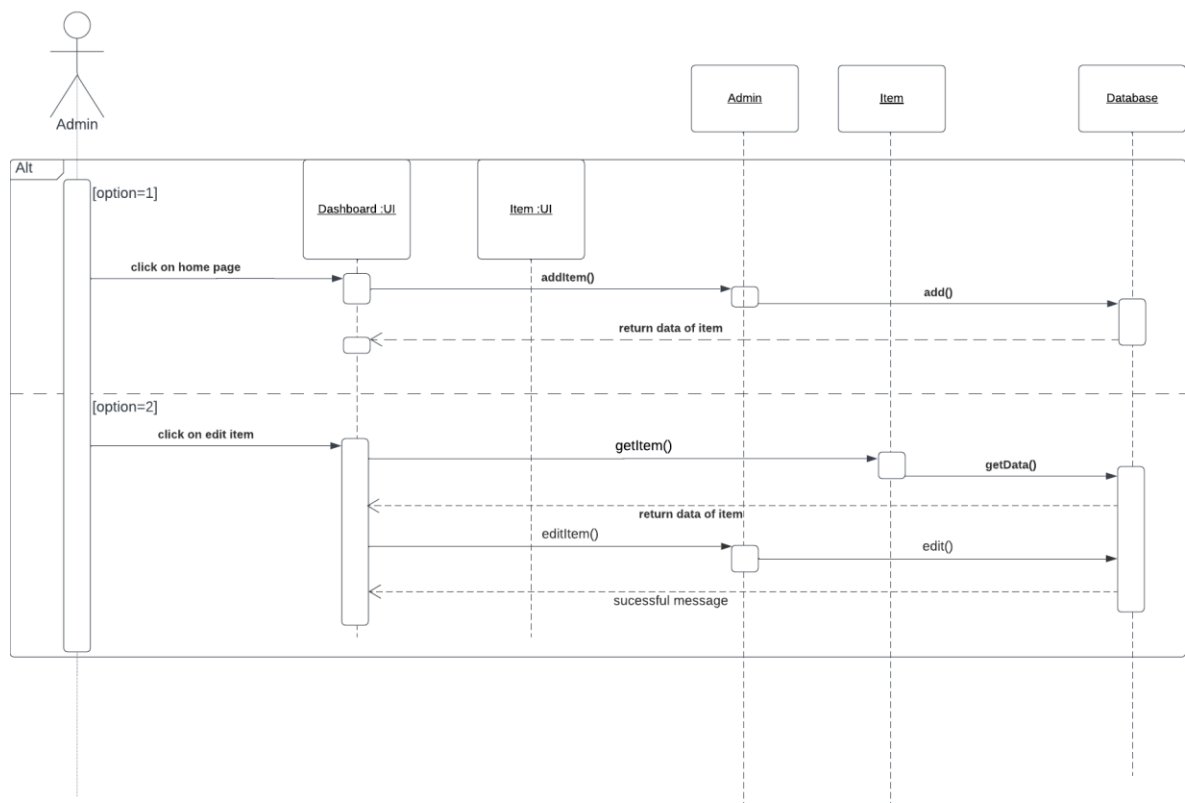
3.1.2.1.1 Login || Logout



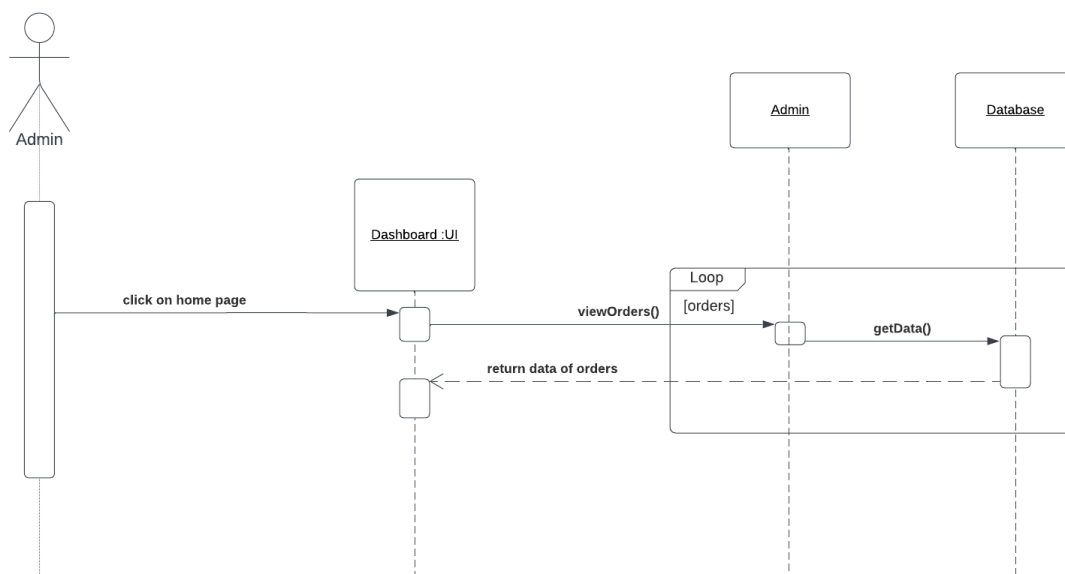
3.1.2.1.2 View & Delete Item



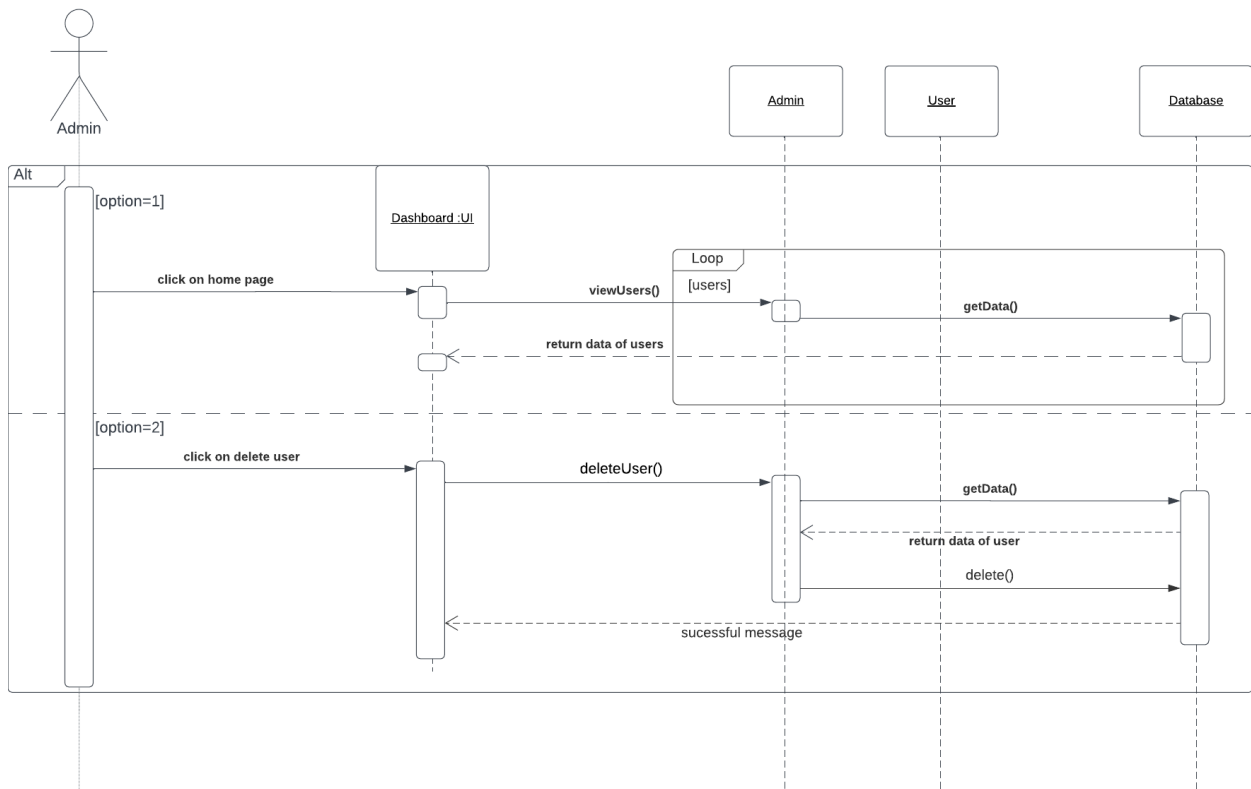
3.1.2.1.3 Edit & Add Item



3.1.2.1.4 View Orders

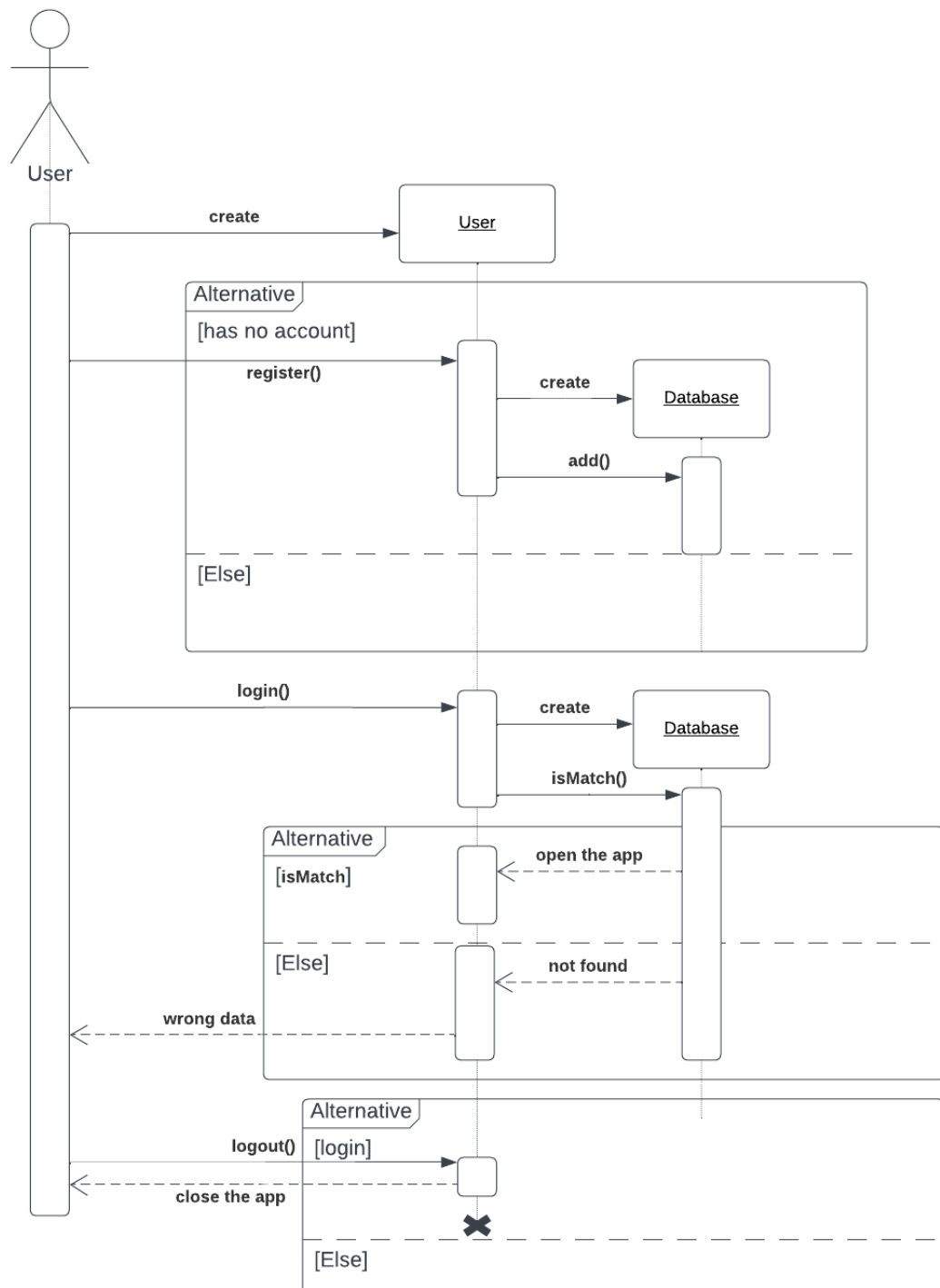


3.1.2.1.5 View & Delete User

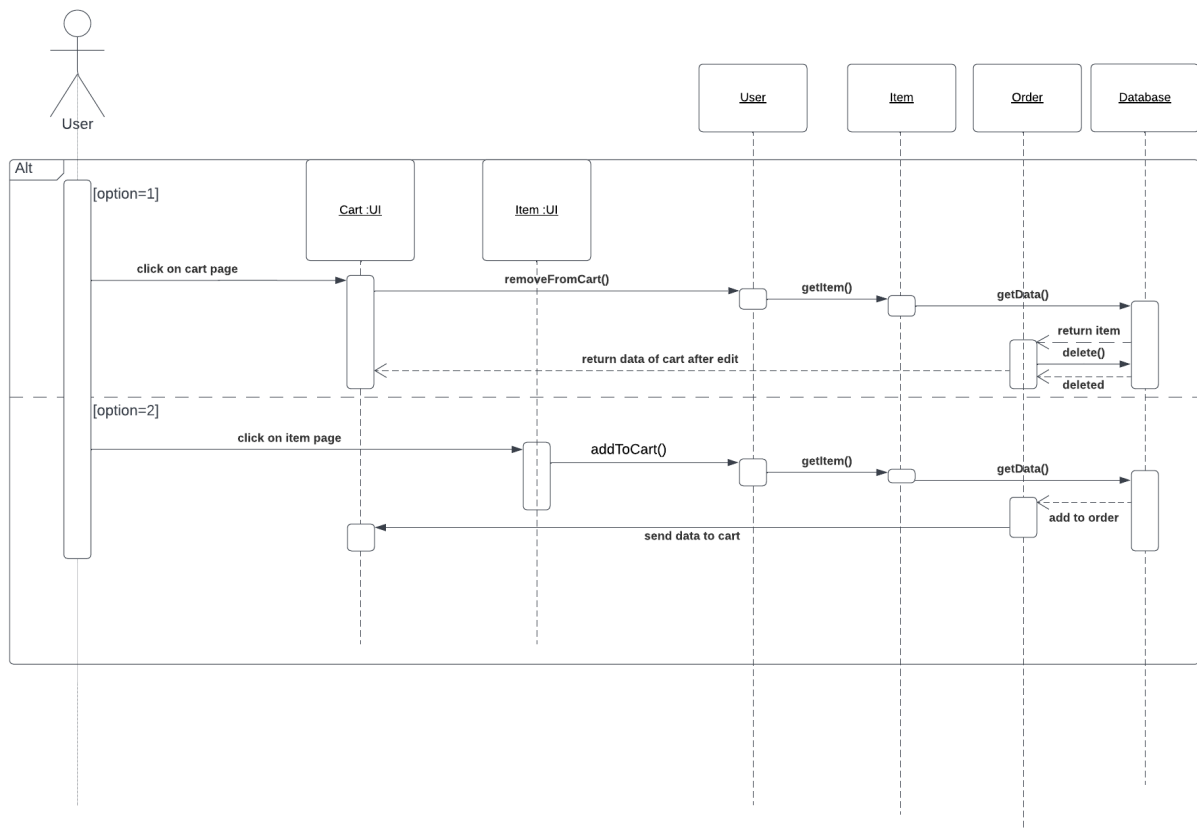


3.1.2.2 User

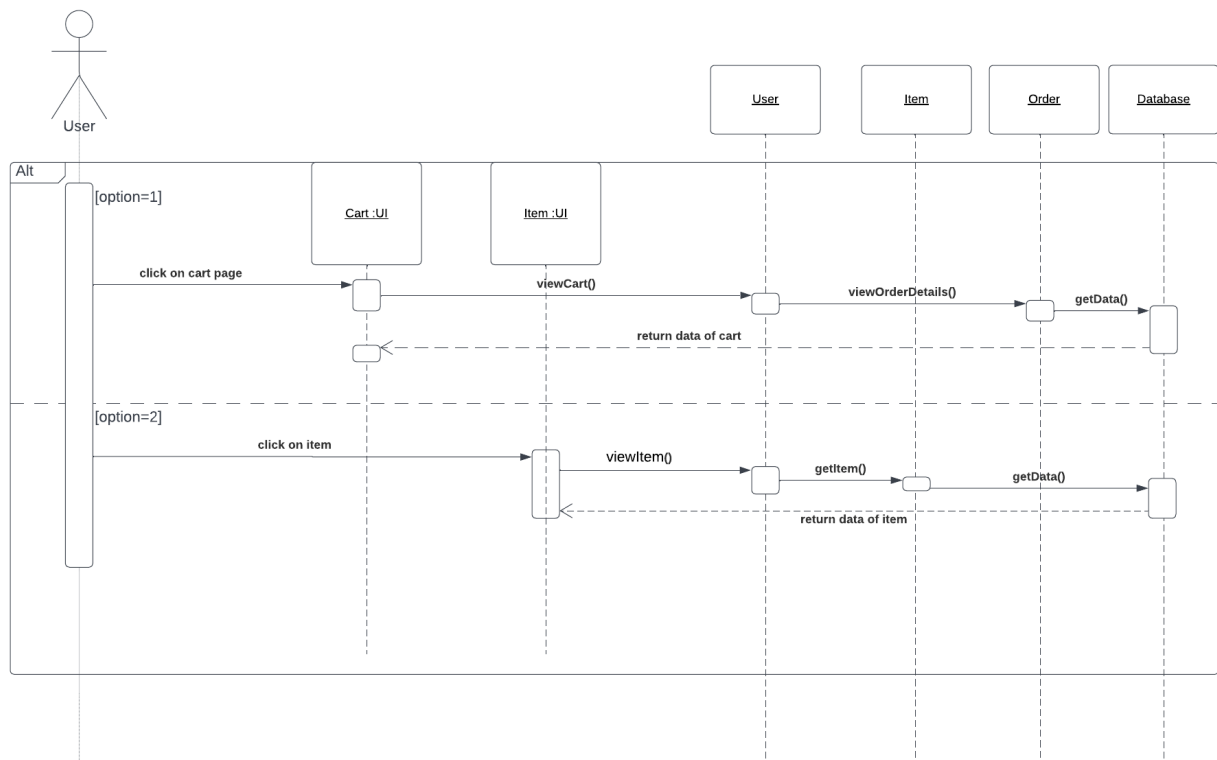
3.1.2.2.1 Login || Logout || Registration



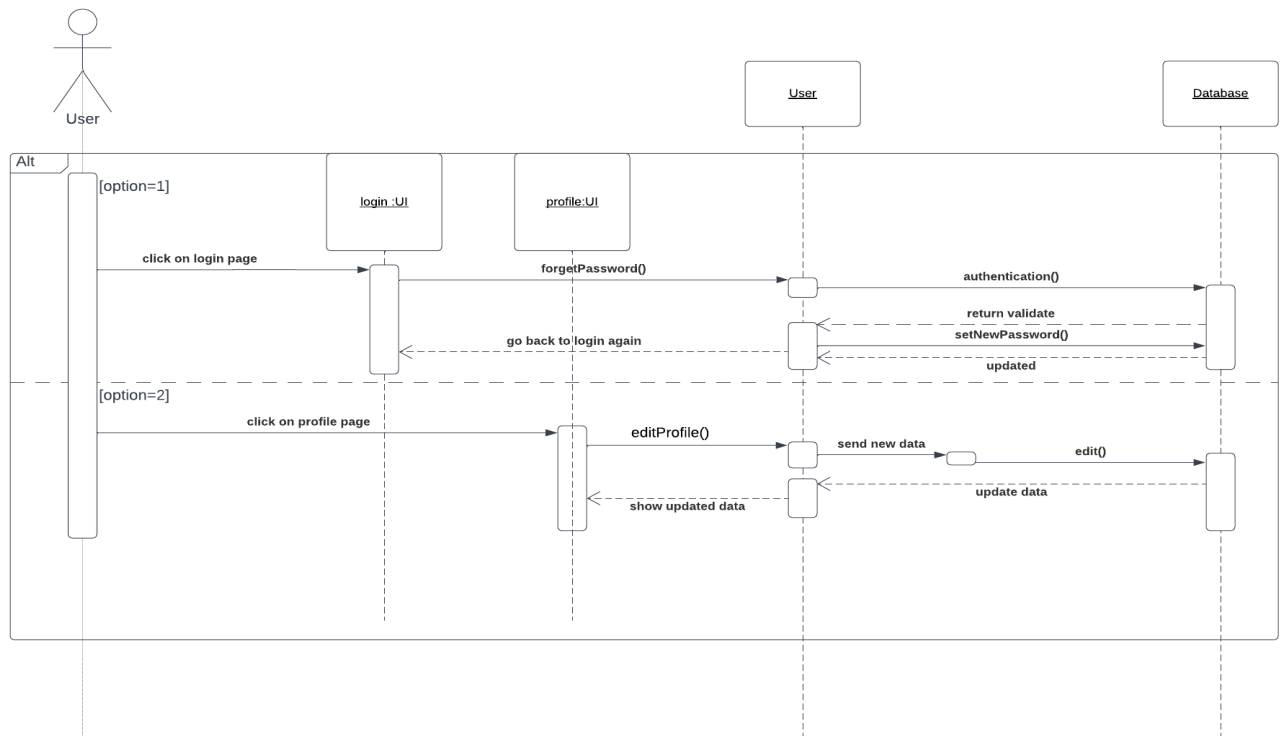
3.1.2.2.2 Remove & Add to Cart



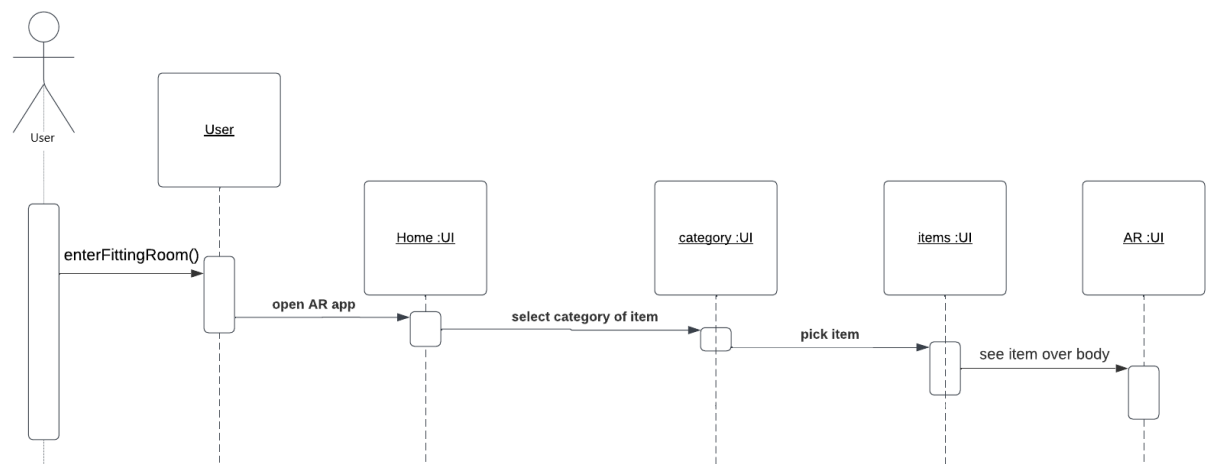
3.1.2.2.3 View Order & View Item



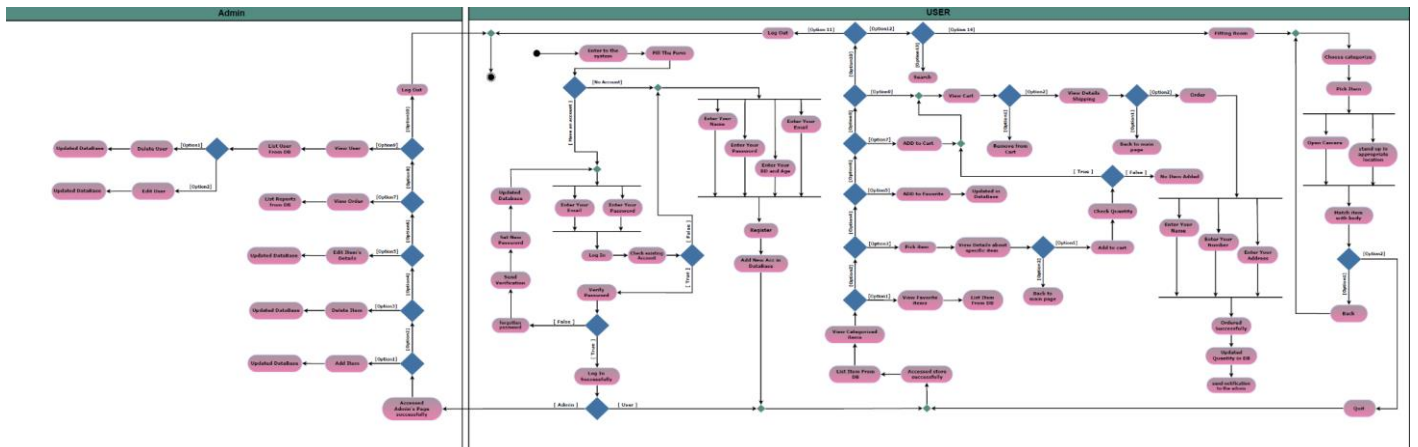
3.1.2.2.4 Edit profile & Forget password



3.1.2.2.5 AR

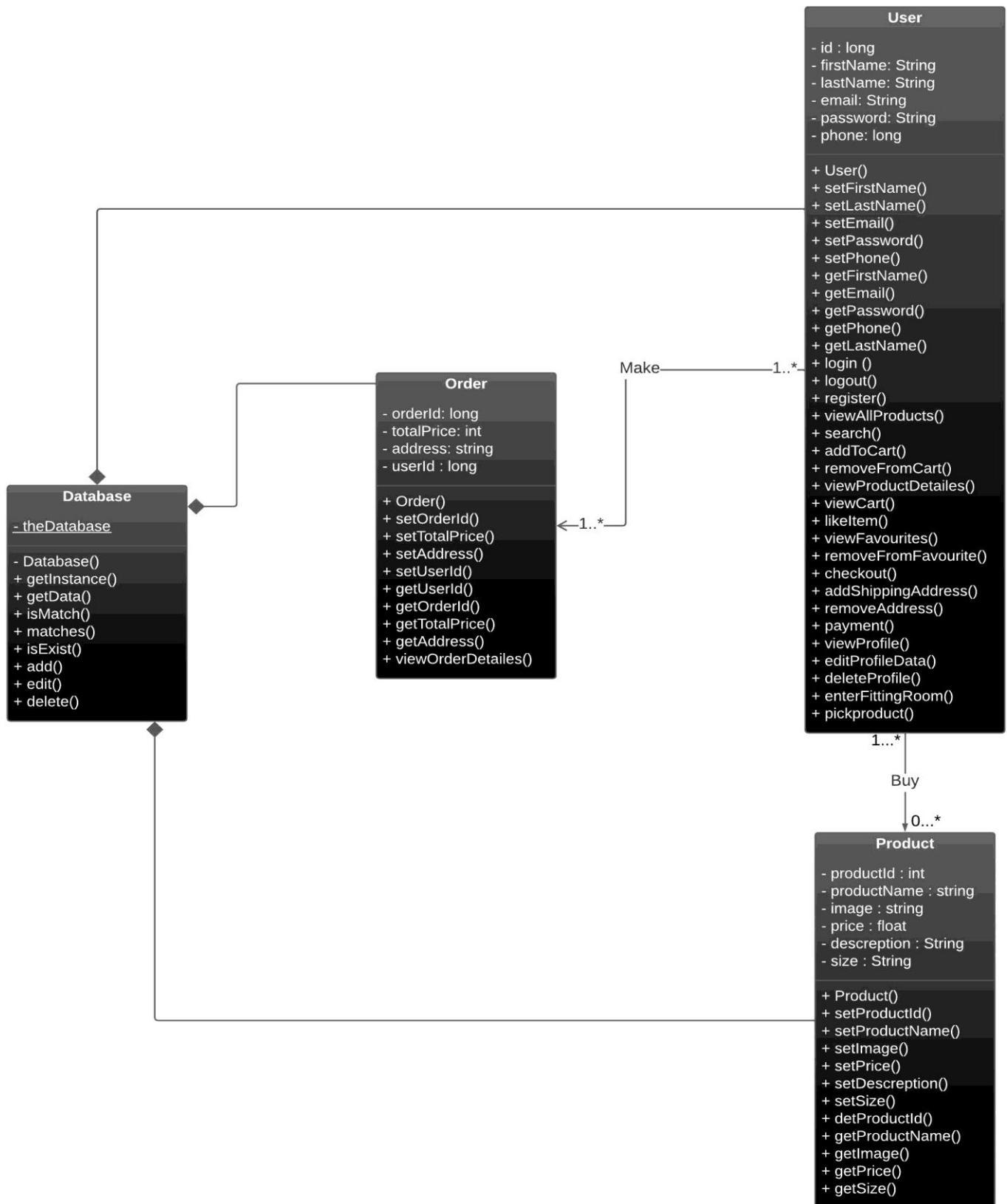


3.1.3 Activity Diagram

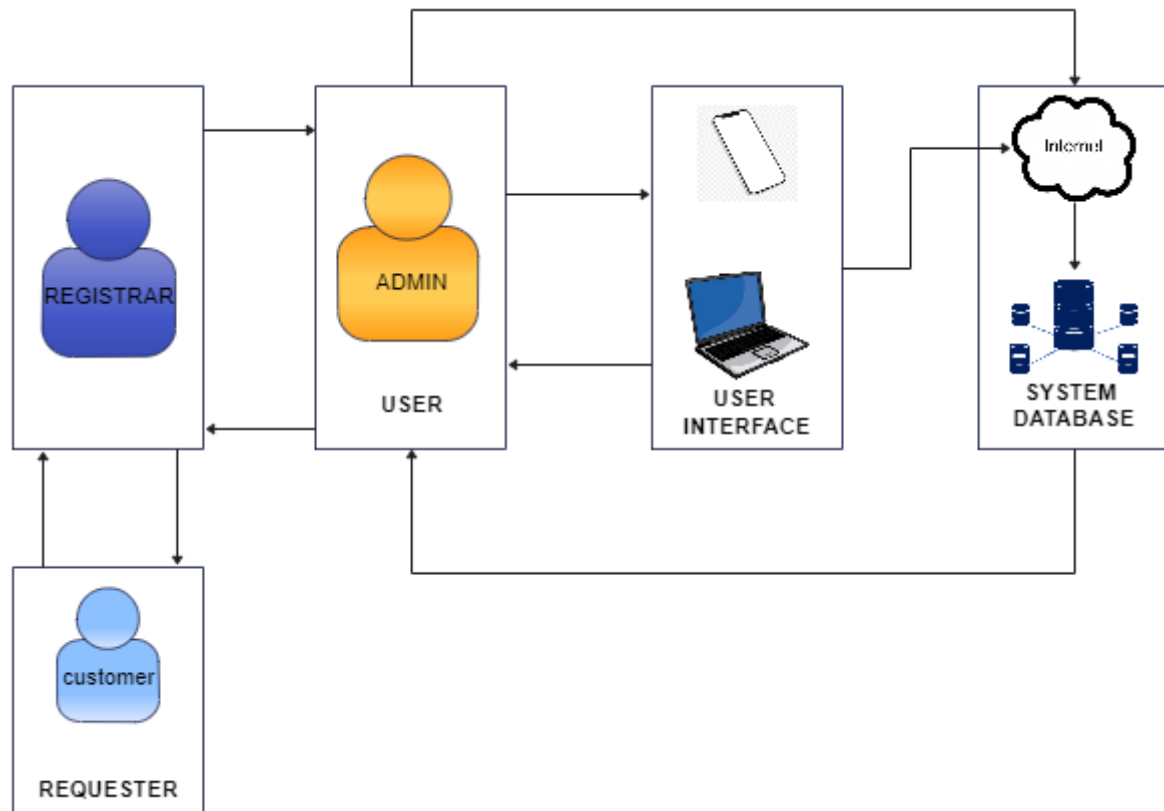


3.1.4 Class Diagram:

\\



3.2 System Architectures:



3.3 What We Have Accomplished:

Our application is designed to address the significant challenges faced in the e-commerce industry by providing an innovative solution: an online fitting room for clothing and accessories. We have successfully developed and implemented the following features:

- **User Registration and Authentication:**

Users can create new accounts or log in to existing ones, ensuring secure access to the application.

- **Product Navigation and Exploration:**

Users can easily browse through a wide range of products, view detailed information such as colors and available quantities, and add products to their favorites or cart.

- **Cart Management and Checkout:**

Users can manage their cart, add or remove items, and proceed to the checkout process for purchasing the selected items. We have integrated various payment methods for a seamless and secure transaction experience.

- **Online Fitting Room with Augmented Reality (AR):**

Our application incorporates advanced AR technology, allowing users to virtually try on accessories, hats, glasses, and different colors of products in the online fitting room. The AR experience utilizes the user's front camera, enabling them to visualize how the items will look on themselves.

- **Virtual Try-On for T-Shirts using Computer Vision:**

In addition to AR, we have implemented a computer vision system that enables users to try on T-shirts virtually. By utilizing their front camera, users can see how the T-shirts fit and look on themselves.

- **Account Management:**

Users have the flexibility to log out of the application or deactivate their accounts if desired, ensuring a seamless user experience.

Chapter 4: System Development

4.1 Implementation Details:

4.1.1 Flutter Details:

- In the Flutter part of our AR shopping app, we will be using the Dart language and the following key features:
- **Authentication:**
Implement user authentication using Firebase Authentication.
Provide functionalities for signing in, signing out, and signing up.
Allow users to delete their account if needed.
- **User Profile:**
Allow users to create and update their profiles.
Collect relevant information such as name, email, and profile picture.
Display user information on the profile screen.
- **Cart and Favorites:**
Implement a cart feature to allow users to add and remove products.
Provide functionality to manage cart items, including quantity adjustments.
Allow users to mark products as favorites and view their favorite items.
- **Checkout:**
Implement a checkout process for users to complete their purchases.
Integrate with a payment gateway to handle payment transactions securely.
Provide order confirmation and status updates to the user.
- **Fitting Room:**
Connect the Flutter app with the AR Unity Mars app for the virtual fitting room experience.
Enable users to try on virtual clothes or accessories in AR.
Implement communication between the Flutter app and Unity app to exchange data and trigger actions.

- **Professional Approach:**

Write clean, readable, and maintainable code following best practices.

Use proper naming conventions and code organization.

Implement error handling and exception management to provide a smooth user experience.

Optimize performance by considering factors such as memory usage and rendering efficiency.

Implement unit tests to ensure the reliability of critical functionalities.

Include proper documentation and comments to facilitate code understanding and future maintenance.

By incorporating these implementation details, you can create a professional and robust AR shopping app using Flutter, Dart, and Firebase authentication.

4.1.2 Computer Vision Details:

To commence the implementation, we incorporated several essential libraries into our project, including `os`, `cvzone`, `cv2`, `PoseDetector`, and `tkinter`. These libraries played crucial roles in various aspects of our application:

- **OS Library:**

We utilized the `os` library to effectively manage directories associated with the t-shirts. This allowed us to organize and access the necessary shirt-related files efficiently.

- **cvzone Library:**

The `cvzone` library, which is a comprehensive computer vision package, proved instrumental in simplifying image processing and AI functions within our application. By leveraging the functionalities offered by `cvzone`, we were able to streamline complex operations seamlessly.

- **cv2 Library:**

As a powerful open-source computer vision and machine learning software library, `cv2` played a pivotal role in enabling real-time dressing of shirts. By harnessing the capabilities of `cv2`, we could integrate advanced computer vision techniques into our application effortlessly.

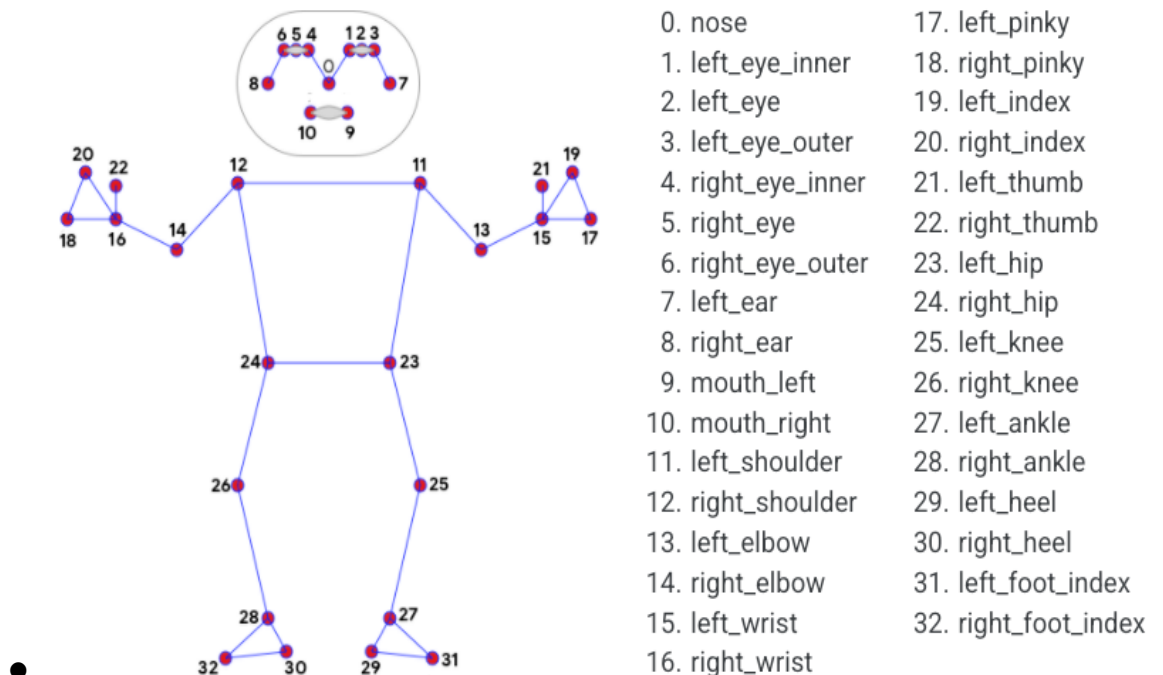
- **tkinter Library:**

`tkinter`, a robust library for creating graphical user interfaces (GUIs), provided us with a comprehensive set of tools and widgets. With `tkinter`, we were able to design and implement windows, buttons, labels, text boxes, and other GUI components seamlessly.

- **PoseDetector Module:**

Within the `cvzone` library, we made use of the `PoseDetector` module. This module facilitated the detection of human poses in images or

videos, allowing us to precisely place shirts on specific areas, such as the shoulders, based on the detected poses.



In terms of the implemented functions:

- **Root Function:**

This function was responsible for creating the GUI interface for our customers. It allowed them to select a shirt and pass the selection to our model for further processing.

- **VideoCapture Function:**

By utilizing cv2.VideoCapture, this function enabled us to capture video from various sources, including webcams, files, and network streams. This feature granted us access to real-time video frames, which we could subsequently process within our application.

- **ShirtSizes Function:**

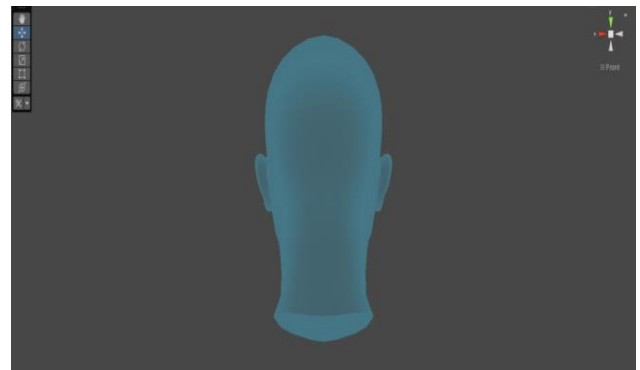
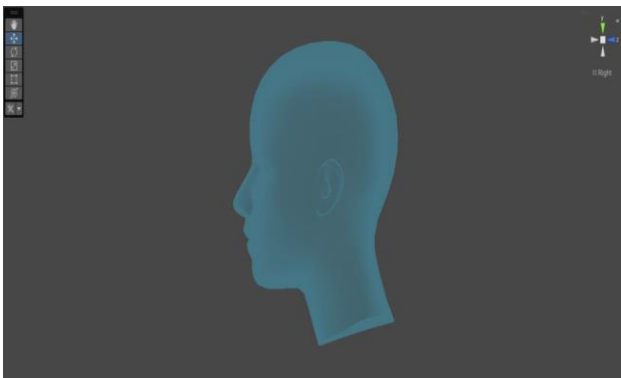
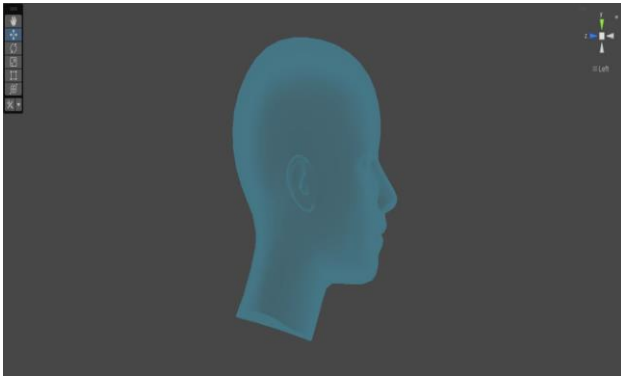
Leveraging the frames obtained from the previous function, ShirtSizes utilized the PoseDetector module to detect and analyze customer poses. The selected shirt name from the tkinter GUI was then utilized to overlay the shirt onto the detected poses. By returning the modified frames in

real-time at a rate of 60 frames per second (fps), we delivered a seamless and interactive dressing experience to our customers.

By skillfully integrating these functionalities and libraries, we were able to create a professional and efficient real-time dressing feature within our application, ensuring an engaging and user-friendly experience for our customers.

4.1.3 Augmented Reality Details (Fitting Room):

- **We used unity mars for face detection & tracking:**
 - Unity Mars is built on top of the Unity Editor and works in coordination with the AR Foundation. It exists as an additional layer that takes advantage of the data from AR Foundation or other custom data providers to allow creators to build multiple platforms in a more streamlined and intuitive way.
 - It provides an avatar of the human face for placing the 3d objects on.
 - It provides the ability of tracking & detecting the human face in the real-world.
 - Visual photos of unity mars.



- In order to enhance the functionality and user experience of our application, we implemented several C# scripts. These scripts utilized various packages to achieve their intended purposes:

1. Color Switching Script:

- This script enabled automatic switching between the available colors of each item. To accomplish this, we utilized the following packages:
- System.Collections
- System.Collections.Generic
- UnityEngine

2. Controller Removal Script:

- The purpose of this script was to remove the colors' buttons, allowing the user to have an unobstructed view of the screen. The packages employed in this script were:
- System.Collections
- System.Collections.Generic
- UnityEngine
- System

3. Scene Switching Script:

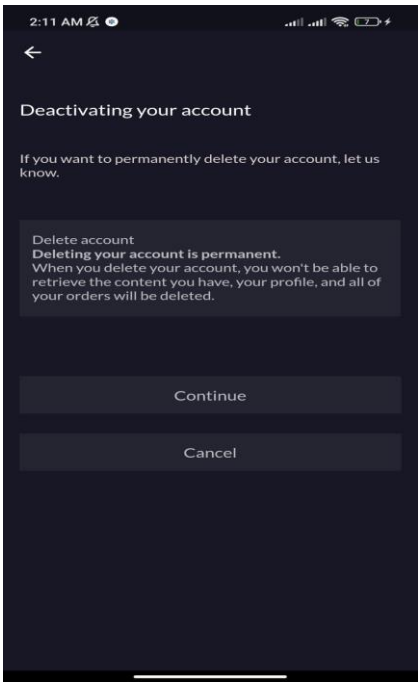
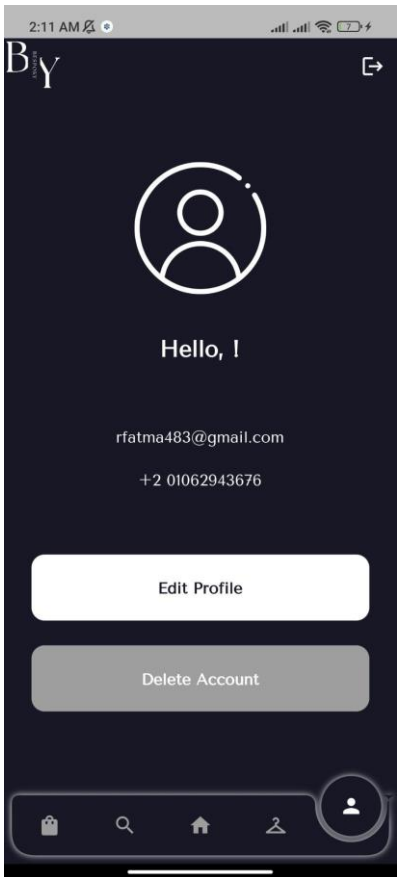
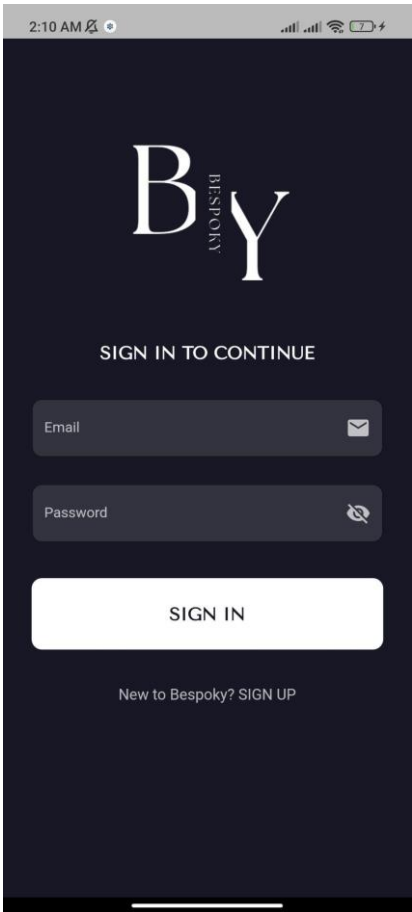
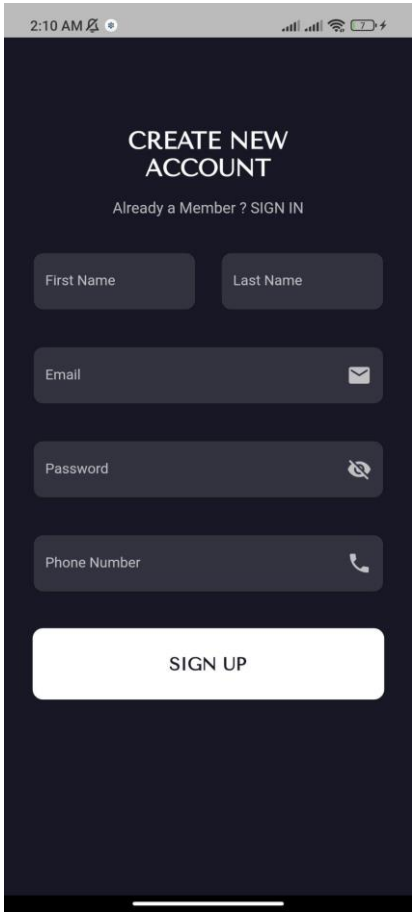
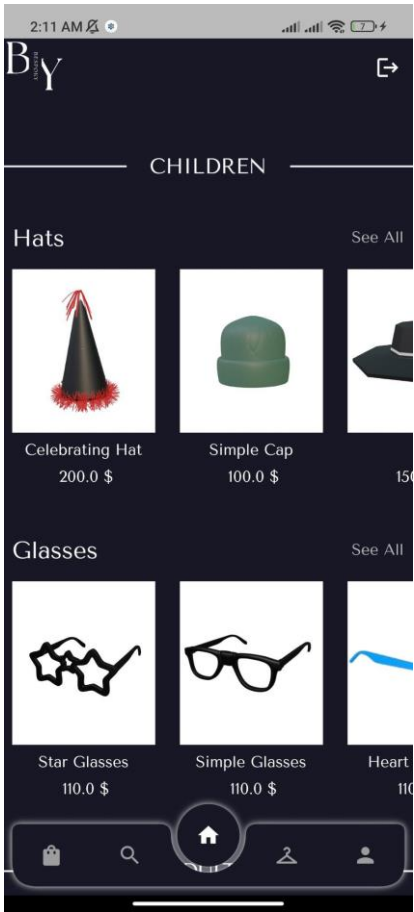
- To facilitate seamless navigation between the fitting room scenes, we developed a script that automatically switched scenes upon button selection. The packages used in this script were:
- System.Collections
- System.Collections.Generic
- UnityEngine
- UnityEngine.SceneManagement

Additionally, we incorporated the TextMeshPro package to enhance the text resolution within our application, ensuring clear and visually appealing text representation.

By utilizing these scripts and packages, we were able to provide advanced functionality and improved user interaction within our application. These professional implementations greatly contributed to the overall quality and usability of our AR shopping experience.

4.2 Application Interface:

1. 4.2.1 The Online Shopping App UI:




2:11 AM

Checkout




Shipping address

Fatma Rida Change
6street
cairo, helwan, egypt

Payment Change

 **** * 2718

Delivery method

 3 days  5 days  2 days

Order: 125\$
Delivery: 15\$
Summary: 140\$

SUBMIT ORDER

2:11 AM

Edit Profile_

Name

Email
rfatma483@gmail.com

Phone Number


Current Password


New Password


SAVE


2:11 AM

T-shirts

 Flat Orange T-shirt
200.0 \$
[+ADD TO CART](#)

 Dark T-shirt
230.0 \$
[+ADD TO CART](#)


 Gray Pull T-shirt
210.0 \$
[+ADD TO CART](#)


 Simple T-shirt
197.0 \$
[+ADD TO CART](#)





2:11 AM


Search


 Circler Earrings
105.0 \$

 Simple Earrings
120.0 \$

 Long Earrings
140.0 \$

 Flat Orange T-shirt
200.0 \$

 Lighten T-shirt
188.0 \$

 Celebrating Hat
200.0 \$

2:11 AM

Shipping Address

Full Name

Address

Country

City

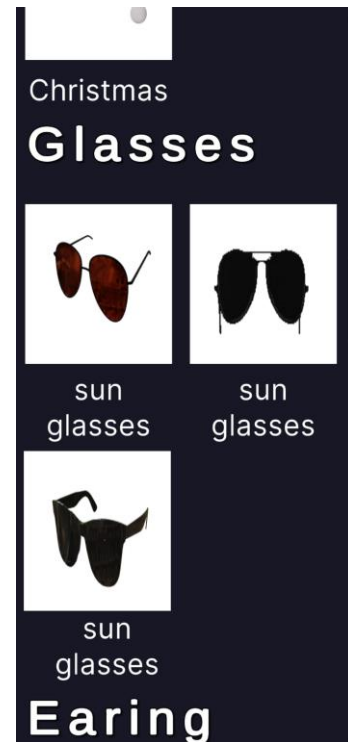
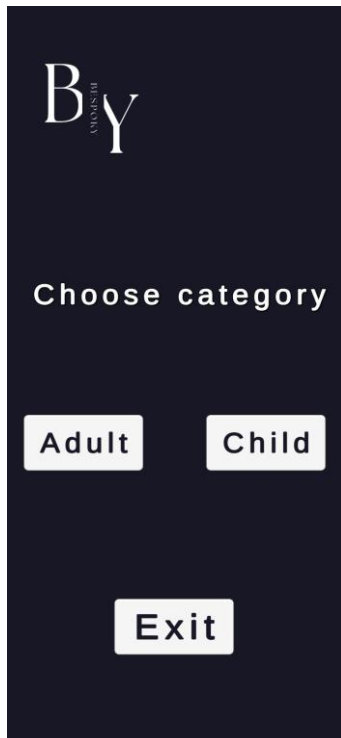
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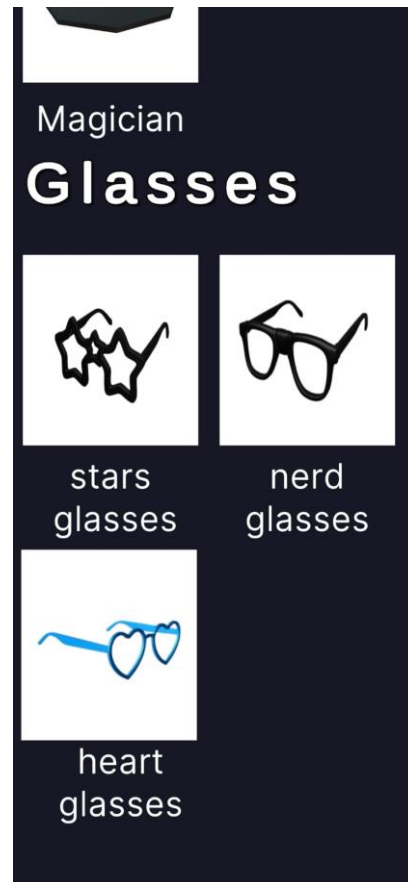
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4.2.2 The Fitting Room UI:

- Adults' category UI:



- Children category UI:



4.2.3 The Fitting Room of Computer Vision UI:



4.3 Testing & Evaluation:

4.3.1 Computer Vision:

1. Select x-large size T-shirt:



2. Select medium size T-shirt:



3. Select small size T-shirt:



4.3.2 Augmented Reality:



Chapter 5: Conclusions, and Future Work:

5.1 Summary & Conclusions:

- Our AR shopping application revolutionizes the way customers interact with the online shopping experience. By leveraging augmented reality technology, we provide users with the unique ability to visualize and explore virtual products in the real-world environment. This approach brings numerous benefits to both customers and businesses, resulting in a more efficient and immersive shopping experience.
- By integrating AR technology, we save valuable time and effort for customers by eliminating the need to visit physical stores or rely solely on product images. Our app allows customers to virtually try on clothes, visualize furniture in their homes, or see how accessories complement their outfits. This empowers customers to make informed purchasing decisions and eliminates the guesswork associated with online shopping.
- Furthermore, our application enhances the market value and online shopping experience for customers. With the ability to see what they can buy in the real-world, customers gain confidence in their purchases, leading to higher customer satisfaction and reduced product returns. By bridging the gap between the virtual and physical worlds, we elevate the online shopping experience to new heights.
- Through our app, businesses can offer a more personalized and interactive shopping experience, ultimately driving customer engagement and loyalty. By integrating AR technology, businesses can showcase their products in a visually stunning and immersive manner, capturing customers' attention and increasing the likelihood of conversions. This innovative approach sets businesses apart from competitors and positions them at the forefront of technological advancements in e-commerce.
- In conclusion, our AR shopping application represents a significant milestone in the evolution of online shopping. By leveraging the power of augmented

reality, we have created a platform that saves customers time and effort while enhancing their shopping experience. This technology not only benefits customers but also increases the market value and competitiveness of businesses. With our app, we have transformed the way people shop online and ushered in a new era of convenience, engagement, and customer satisfaction.

5.2 Future work:

To ensure the continuous improvement and growth of our AR shopping application, we have identified several areas for future development and enhancement. These endeavors will further solidify our position as a leader in the online shopping industry and provide an even more professional and comprehensive experience for our users. The following are key directions for future work:

1. Enhanced Admin Functionality:

We plan to empower administrators by adding functionality that allows them to easily manage the application's content. This includes the ability to add, edit, or remove items from the database, ensuring an up-to-date and diverse product catalog that meets the evolving needs of our customers.

2. Expanded Payment Methods:

In order to accommodate a wider range of customer preferences, we will integrate additional payment methods. By offering various secure and convenient options, we aim to further streamline the checkout process and cater to the diverse needs of our global user base.

3. Customer Feedback System:

To foster a customer-centric environment, we will implement a dedicated feedback page where customers can share their experiences and provide valuable insights about our products and services. This feedback will not only enable us to continuously improve but also help potential customers make informed decisions based on real user experiences.

4. Advanced Recommendation System:

We will develop a sophisticated recommendation system that leverages customer data such as previous transactions, feedback, and browsing activities. By utilizing machine learning algorithms, we will provide personalized recommendations to customers, enhancing their shopping experience and increasing the likelihood of finding products they love.

5. Improved Accessibility:

To make our app more inclusive and accessible, we will introduce a "Try It" button for each item. This feature will enable users to easily experience the virtual product in their real-world environment, ensuring a seamless and immersive shopping experience for all customers.

6. AR Body Detection for Clothes:

In order to provide more accurate and realistic virtual try-on experiences, we will explore integrating AR body detection technology specifically designed for clothing items. This will allow customers to visualize how clothes fit and move on their own bodies, providing a more reliable and satisfying shopping experience.

7. Expanded Product Categories:

To cater to a wider range of customer preferences, we will expand our product categories, ensuring a diverse and comprehensive selection. By continuously adding new and exciting items, we aim to satisfy the varying needs and interests of our growing user base.

8. Recommended Sizes Panel in the Fitting Room:

To assist customers in finding the perfect fit, we will introduce a recommended sizes panel within the fitting room feature. Leveraging AR detection and customer data, this panel will dynamically suggest the most suitable sizes for each item, reducing guesswork and increasing customer satisfaction.

9. Dynamic 3D Objects in the Fitting Room:

To provide a more realistic and interactive experience, we will enhance the fitting room feature by dynamically updating 3D objects based on changes made in the Flutter app. This synchronization ensures that customers see accurate representations of their chosen products in the virtual fitting room.

10. Admin Panel for Fitting Room Customization:

To offer a comprehensive branding experience, we will introduce an admin panel dedicated to fitting room customization. Administrators will have control over elements such as colors, fonts, and product images, allowing them to align the fitting room with their brand identity and create a consistent and immersive shopping environment.

By focusing on these future developments, we are committed to delivering a professional and cutting-edge AR shopping application that exceeds customer expectations, enhances the online shopping experience, and solidifies our position as industry leaders.