Arab Academy for Science, Technology and Maritime Transport

College of Computing and Information Technology

Virtual Fitting Room

Principles of Software Architecture

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INTRODUCTION

Virtual fitting room is complementary tool for small and large retailers. It is a unique system which allows users to combine up their body measurements and generates a 3D model avatar for them. Helping them to shop online easily and removing the consumer's obstacles while shopping online.

Problem statement:

A survey has been done reveals consumer's fear of buying the wrong size and hassle of returns as a top reason why people hesitate of buying online. Also, Due to the current pandemic people are afraid to try clothes or shop from malls. As finding your expected item is totally doable using our system.

DISCUSSION

Requirement Analysis

1. Functional Requirement

- **Registration**:
  - Provides a link for the Users/Client Registration.
- **Login:**
  - Can login by entering username and password.
- **Logout:**
  - Redirects the user back to the login page.
- **Save information:**
  - Enter all its necessary information by filling personal info form and system save that information and accordingly a recommended outfit that may suits you are showed.
- **Get your size:**
  - recommends the user the ideal size for every piece corresponding with the Size Guide of each manufacture.
- **Customize your avatar:**
  - It requires from the user entering their age, weight, height , waist and hip measurements
- **Purchase premium avatar:**
  - For entering more detailed data like your skin tone and otherwise which increases the accuracy of shopping
- **Change requirements (Filter):**

- Clients can change any of their requirements any time by choosing whether they want tops or bottoms and they may choose a specific color.

❖ **Shop now**:

- Clients enter all details of its order and system save all that details.

❖ **Reserve Item**

- Clients pay a deposit to reserve their items by entering their payment information and choosing the closest store to receive it there.

❖ **Show all items**:

- System display list of available clothes.

❖ **Display pictures**:

- In order to gain more attraction photographs of the properties held by company is displayed.

❖ **Provide feedback:**

- Clients can provide feedback about services through feedback option.

❖ **Mark as like:**

- a user can like a specific cloth items and according to the liked items a list of items will appear.

❖ **Notify me:**

- According to each user's profile a notification will be sent to them if an item is out of stock and their size is available now as well as notifications for any item that may suit them according to their personal information, their liked items and previously purchased items.

2. Non-Functional Requirement

❖ **Security**: "Safety is our first priority"
- Protects the users accounts against attacks.
- It uses secured database.

- Also prevents any attacks to sensitive data such as payment information
- Secure access of confidential data (customer's details)

❖ **Portability**: Which operating system is required?

- Our system can be easily accessed from any operating system and any device with an internet connection.

❖ **Localization**: does it match the local specifics?

- It is available for many countries and offers different languages.
- Providing customers with fully translated and localized pages.
- It filters the stores and converts the currencies based on customer's choices.

❖ **Usability**: how easy is it?

- **Learnability**: Providing a friendly interface to help customers to customize their avatars, choose the suitable item, get the best fit size and complete their main actions once they see the interface.
- **Efficiency:** Providing a faster way for the customers to reach their items and sizes. Customers obtain a result in 5 or 10 seconds after selecting.
- **Memorability**: Users can return back to the interface after some time and update their body measurements easily without facing any problems.
- **Errors:** Users rarely make mistakes.
- **Satisfaction:** The design is totally pleasant to use.

❖ **Availability & Accessibility:** "24/7 availability"

- **Server uptime**: Visitors don't get an error trying to load. It has almost no downtime which makes it reliable and trustworthy service platform.
- **No Broken Links**: we usually double check that there are no dead links on our site
- **Mobile responsiveness**: it can handle different screen sizes. Its totally compatible for mobiles, tablets and desktop screens. The layout is flexible and adjusts automatically as the screen size is reduced. For mobile, there is an explicit version of the site with a clean interface, less clutter, and a clear hierarchy of the content.

Factors that affect the design of software architecture of our system

- **Stakeholders:** "Top priority"
  - Stakeholders play the main role. Meeting their requirements is necessarily to develop a successful system.
  - Each stakeholder has a different set of concerns that should be noted
    - Our Customers have to tell us what they want
    - Our Architects and Designers must understand it
    - Our Programmers have to achieve it
    - Our Testers have to test it accurately
    - Knowing who our competitors are, and what they are offering, can help us to make our services stand out.

- **Risks:** "minimize risk"
- Functional risk, time risk, and financial risk.
  - Risks play a crucial role as part of designing our software is to identify and mitigate risks. We need to be careful not to face avatars problems, non-accurate measurements, and also make sure that the delivered items are similar to the actual products and the specified measurements.
  - We need to be careful to deal only with trusted brands.
  - Financial risk includes all thoughts and concerns of the customer about what happens to the money paid in the event of a return or complaint. Will I be stuck with the costs? Will I get my money back? Is the shop even safe? Should I really leave my credit card information here? If we learn these things about our customers and act on them accordingly, it would make our system way popular.

- **Skills and Development teams**: "Team expertise"
  - This is definitely a main factor as teams must be qualified enough and able to handle the architecture within the expected release deadline even if it's tight. in case the team wouldn't know how to handle the architecture or doesn't have enough skills it will be impossible to reach the required output.
- **Schedule:** "priorities"

- Estimating a correct schedule to keep track with every single detail. Also, to plan what should be handled first and then comping up with a sequence or order of doing things.

❖ **Materials & Technologies:**

- Providing the ideal tools and materials to cover all features. Also, a good Architects & Engineers to obtain an accurate avatar using 3Dmax to satisfy customers.

❖ **Scale:** "Project size"

- We should take into account the size of our system and how large it would evolve to cover every single detail and avoid facing new risks.

❖ **Cost:**

We must estimate the cost early to prepare and deal with it as long as it doesn't exceed our budget. Also, be careful to avoid making faults to not face any maintenances.

Software Architecture Levels

1. Business Architecture

Our main aim is removing the consumer's obstacles while shopping online. Virtual fitting room is complementary tool for small and large retailers. It is a unique system which allows users to combine up their body measurements and generates a 3D model avatar for them. Helping them to shop online easily. Avoid retouching the items again from the store thus avoiding contagious diseases.

2. Technical Architecture

We want our system to be portable and we want customers to have the best user experience and interface. So we chose to make it as a website

Advantages:

-As a website makes you look professional
-Your website can attract new customers through Google
-You can clearly show your products and services

-You can integrate your website with Google Maps so people can find you more easily

Technologies to be used:

-WordPress

-HTML

Basics of how the web page should look like, Doesn't give the perfect shape but only a basic with no styling website. Great for a beginning.

-CSS

CSS manages how a page should look like by styling it starting from the colors to the fonts.

-CSS frameworks

CSS frameworks are used to structure and develop websites. They are so important to provide high end design for the website. Such as bootstrap

-JavaScript

A programming language that controls how websites and dynamic web applications operate

-Programming Languages

Web developers should be professional in programming languages as Python, or PHP.

-Responsive Web Design.

To help the website to be adaptive on all screens for example ipad or computers.

-3D max

To develop the 3D model as 3D Max is often **used for** character modeling and animation and with the rendering option it will be more realistic which is what we need in our project

-Testing.

All coding stuff includes bugs which is expected so a testing team is highly needed who are familiar with testing software frameworks such as Jasmine.

-Backend

To know how to use PHPMYADMIN

-Database management

Who are familiar with SQL and database analysis and data entry because data analysis is highly needed to notify users with items that match their style or liked items as well as the importance of creating a database of the user's information and sizes of the 3D model of each user.

-Project management

To manage when all the steps should be done and the check that the requirements of the websites are fully fulfilled.

3. Solutions Architecture

-Getting a graphic designer who is an expert in 3D max for making a 3D model to be implemented on our application.

-Get an updated expert in web development.

Who have updated information about all of the mentioned technologies, so we need to make a team of experts

-User Experience Designer

The task of these people is to understand how users feel about a technical product or website so people can easily use it without the need for a user manual.

-Web Administrator

Who is in complete management of all the workspace including the website. He identifies and corrects server or web page issues; performs application data backups; and check for bugs and try to solve them.

-Testing expert

After all the processes are done an expert testing team have to check the validation rules and how well the website will be working

-Database and backend Developer

Using database programs such as Microsoft SQL, phpMyAdmin for creating a database and a website that is able to create and add and delete items .

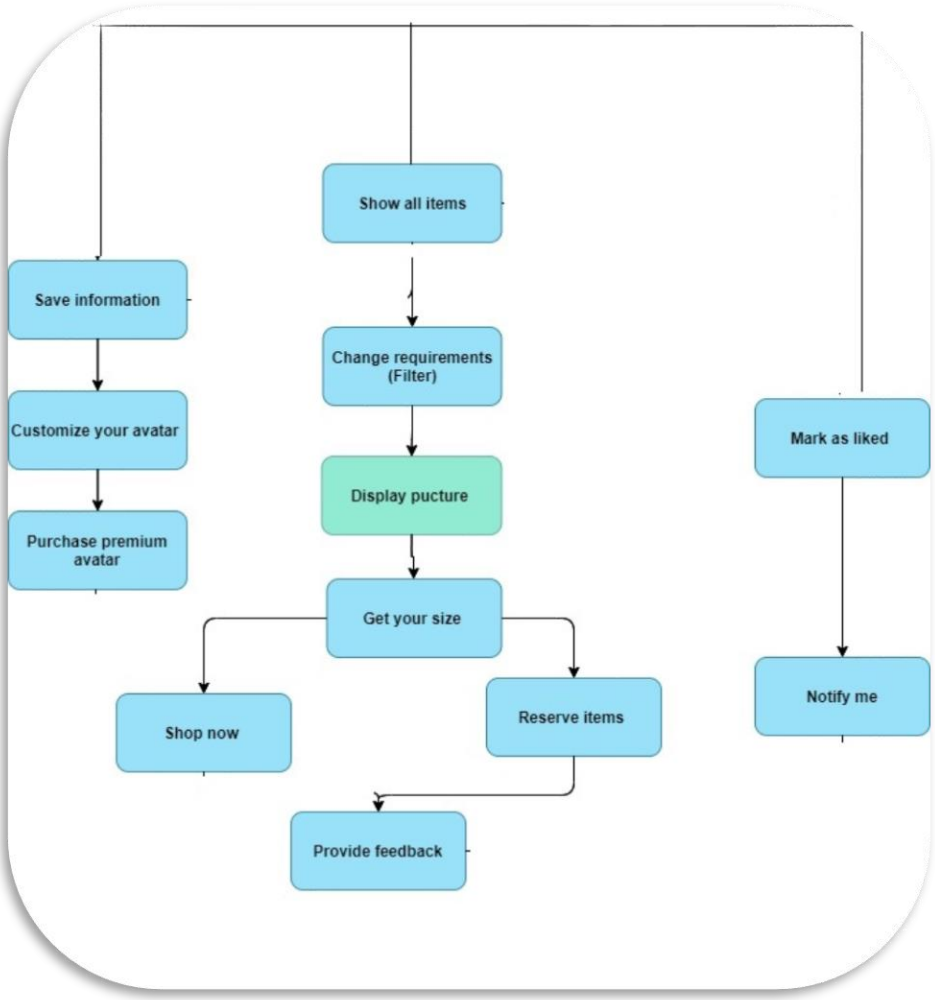
-Project manager

He directs all the teams and tells them in which phase they are. Divides the project into phases and makes sure that each phase is finished within the given mentioned time range. Project managers communicate with upper management and outside vendors and clients as needed.

-3D max expert

must have high imagination for our vision and to be able to use powerful rendering and 3D modeling tools for creating professional-quality 3D animations and design visualizations.

4. Enterprise Architecture



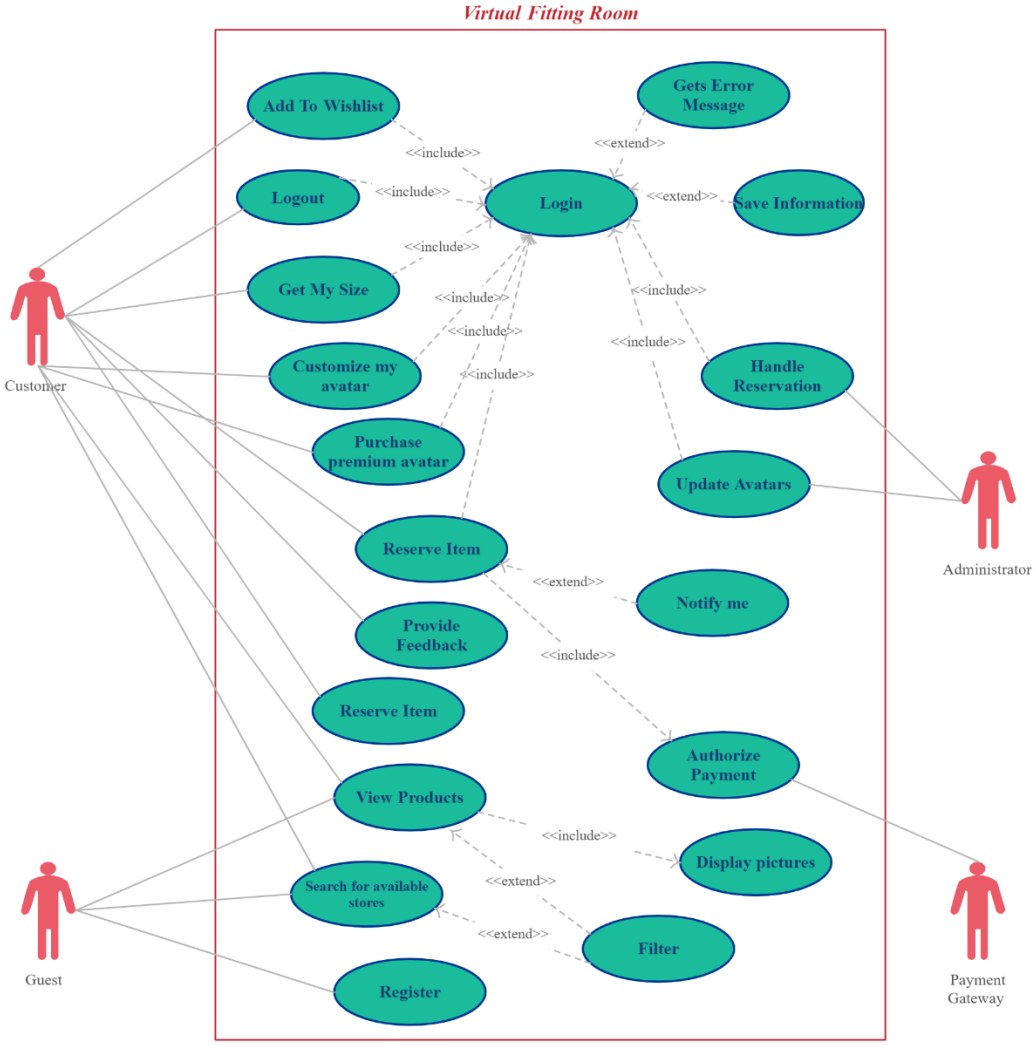
5. Product Line Architecture

Input	Process	Output
User's information	**Registration**	Account made
The account registered with	**Login**	The brand's page
	Logout	Login page
More details about the user	**Save information:**	Recommended items
Measurements of the user	**Get your size:**	Suitable size for the item

Measurements of the user	**Customize your avatar:**	Generated avatar
Measurements of the user and more specified info and the credit card	**Purchase premium avatar:**	A more realistic Avatar
User requirements regarding the items	**Change requirements (Filter):**	Filtered items
Details of the order and credit card info	**Shop now**:	Save the information
Details of the order	**Reserve Item**	Save the information and request reservation
Home page	**Show all items**:	List of available items
Item	**Display pictures**:	Item's picture
Details of the item	**Provide feedback:**	Save the information
Details of the item	**Mark as like:**	Save the information
Saved information	**Notify me:**	Restocked items according to the likes and profile

Architecture Views (4 view point + 1)

1. Use Case Diagram



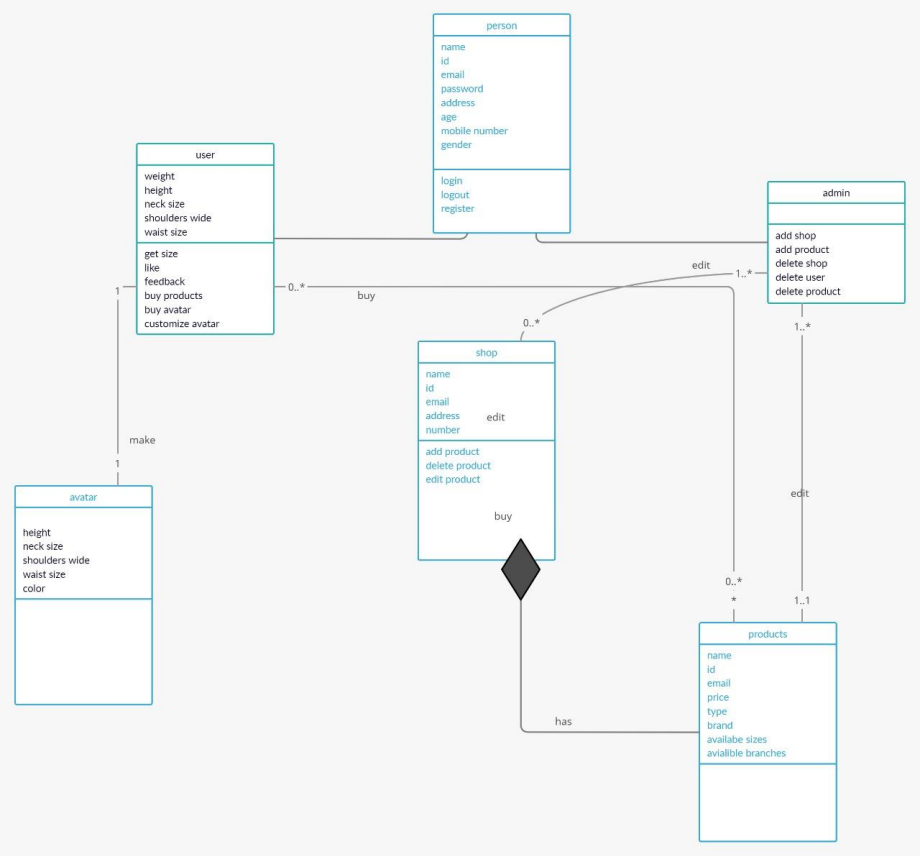
The use case specifies the main actors of the system and their privileges where the customer can access many features differ compared to the guest. Also, most of customer's function are including login.

2. Logical View

Stakeholders addressed: End-users

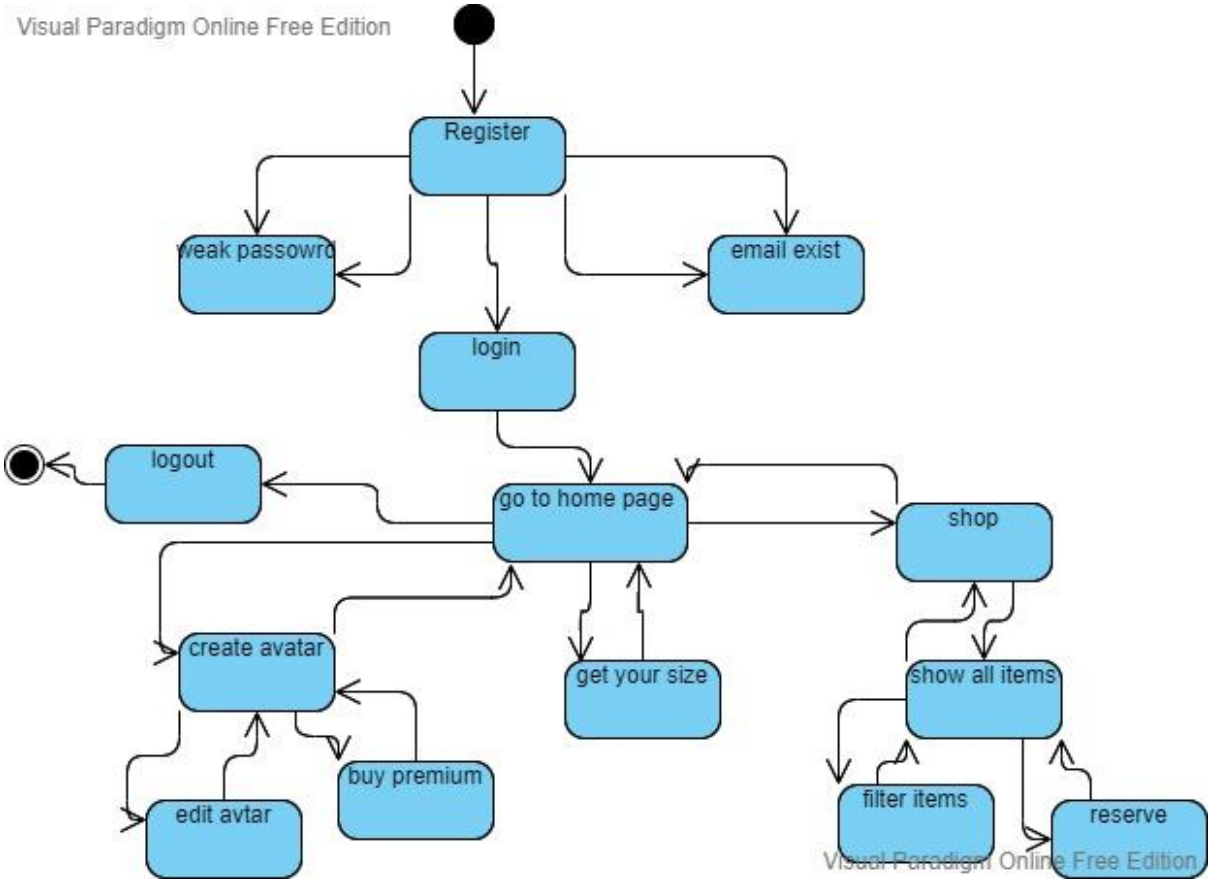
Concerns addressed: Functionalities

i) Class Diagram



the class diagram design the static view of the project , describe the responsibilities of the project and shows most of the classes that should be used implementing it. So here it shows the classes person, admin, user, shop, products, and avatar and how they are connected to each other's.

ii) State Diagram



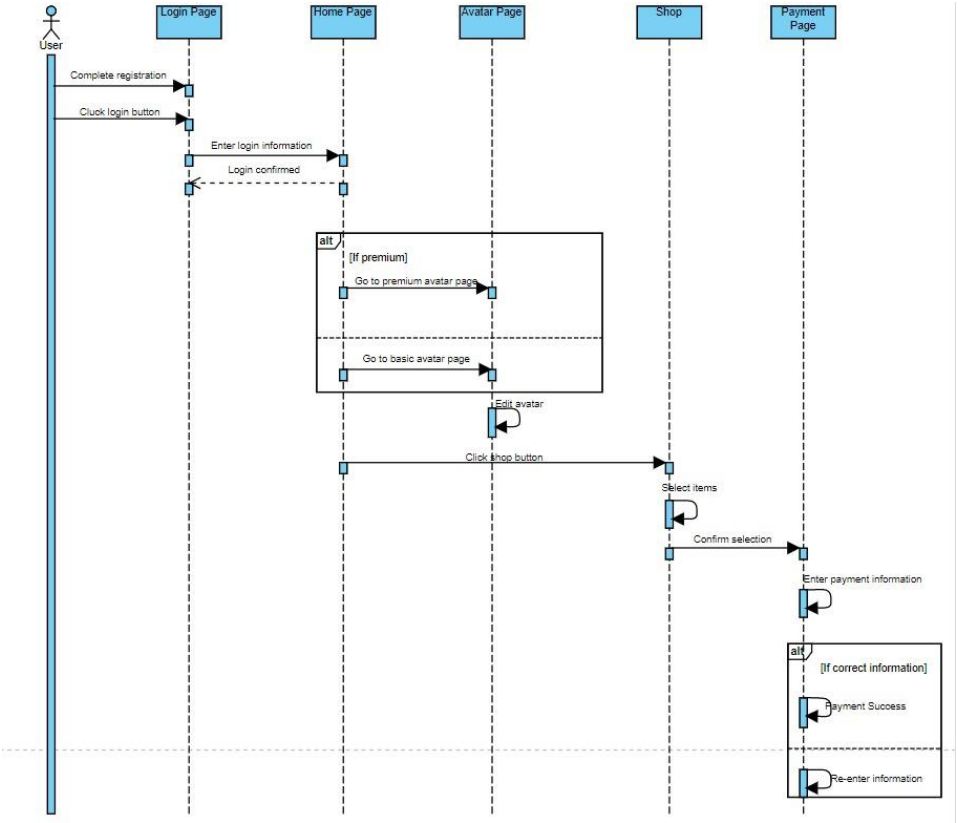
State diagram main purpose is to show how the program reacts to actions and how its sequence goes. So here this diagram for our project shows how the application goes form initial state through registration login and website action (showing products, reserving them, creating avatar ,etc.…) until it reaches the final state.

3. Process View

Stakeholders addressed: Integrators

Concerns addressed: Performance and scalability

i) Sequence diagram



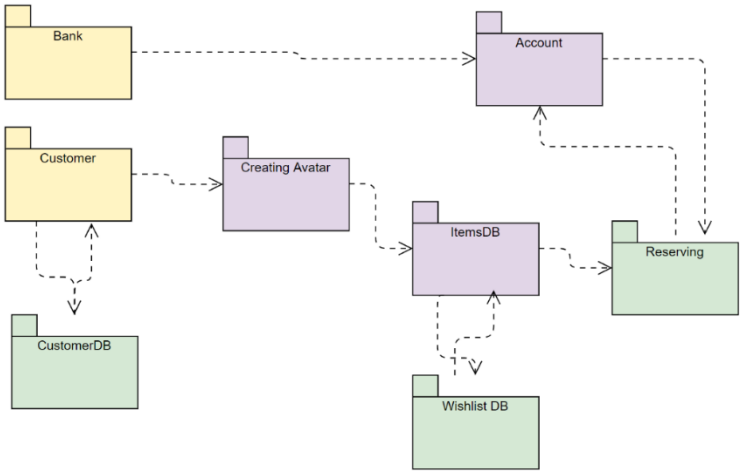
The sequence diagram shows how the systems moves sequentially through the system from the beginning until the las possible state in the system, in this situation the diagram shows a generic scenario that works through the whole system from logging in to finalizing a purchase

4. Implementation View

Stakeholders addressed: Programmers

Concerns addressed: managing software

i) Package diagram



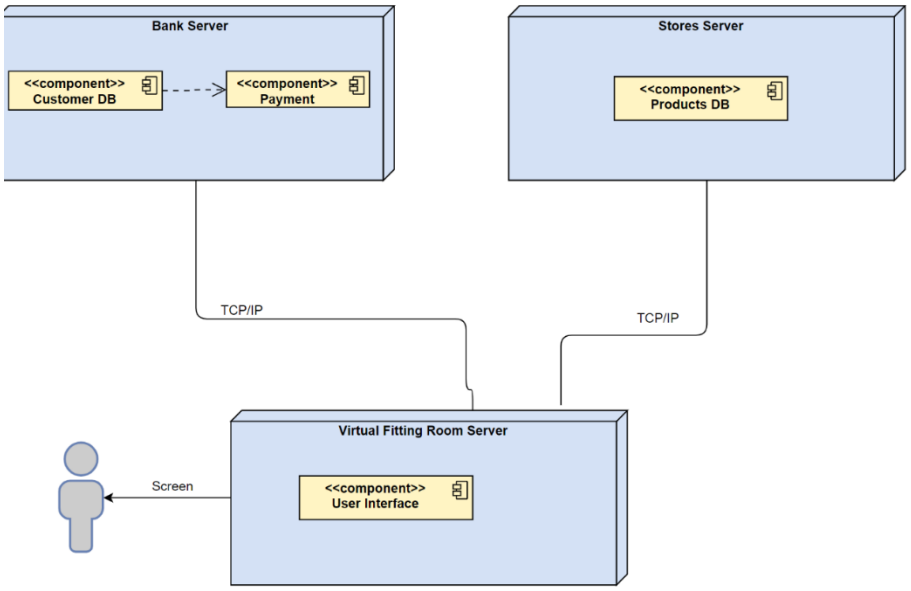
The package diagram classifies our project into different packages to be easily for programmer such as customer database which is connected to the customer. For example, to reserve item you to check the account database from the bank then back to reserve.

5. Deployment View

Stakeholders addressed: System Engineers

Concerns addressed: Topologies and communications

i) Deployment Diagram



The deployment diagram is mainly for system engineers to check the hardware of the system such as connecting the VFR system's server with the bank and store servers. Where the VFR server contains UI's components that are displayed to

users and connected by a TCP/IP cable the bank server to check customer database and also connected with the store to reach items database.

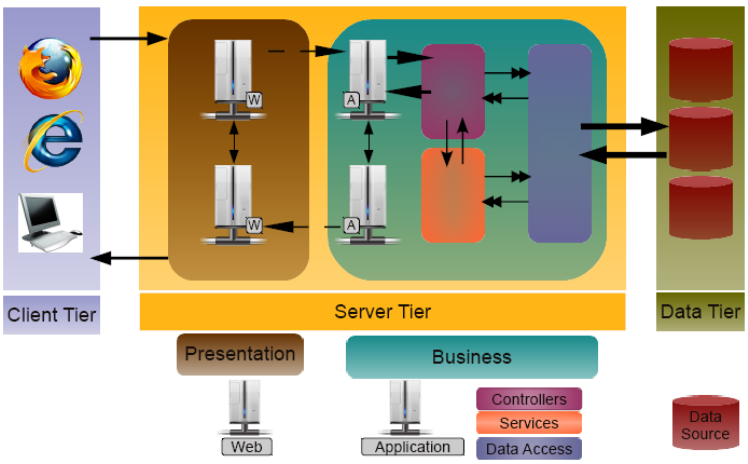
Architectural Patterns

- An architectural pattern is a general, reusable solution to a frequently occurring problem in software architecture. The architectural patterns address a variety of software engineering problems, including computer hardware performance limitations, high availability, and business risk minimization. Architectural patterns should be used to solve specific problems faced in the development of the software.
- The layered architectural pattern is applied in the project due to it being a desktop application that can be divided into separate tasks where each layer provides a service to a higher layer. The layers will be divided into: -
  - Presentation layer
  - Application layer
  - Business logic layer
  - Data access layer

Architectural Styles

"Putting It All Together" architectural style is the most suitable one.
The reason why we choose it:
The most suitable for our business model specifically the budget and resources that are to be chosen in terms of application development, database system and user interface that we plan to use in order to develop the application.

- ✓ Also, to divide our server tier to two parts (presentation and business) to make sure that the database is secure enough and away from client. In addition to adding firewall to protect it against any attacks

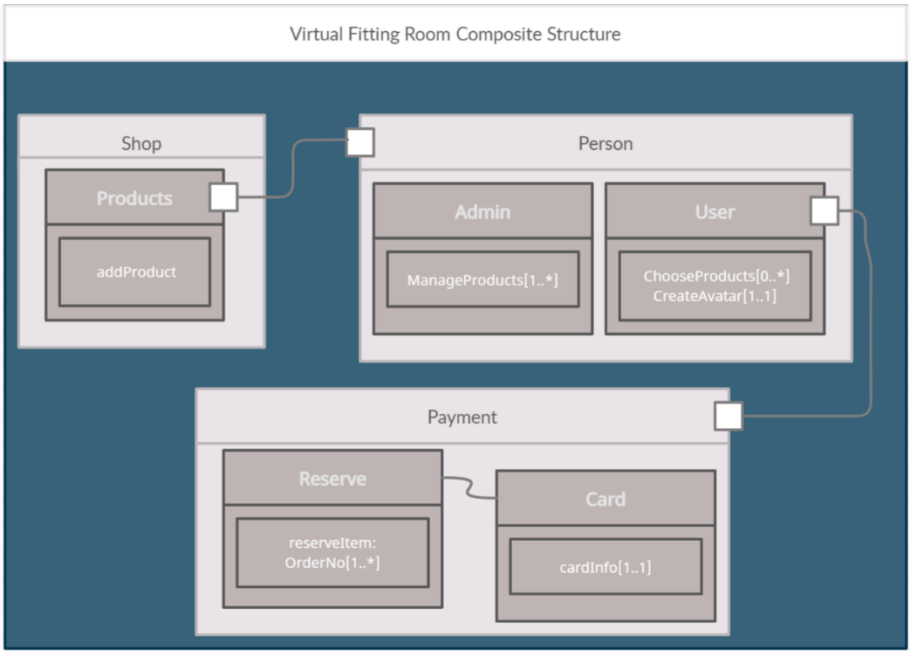


We used the basic style as our system is web-based so the figure generally describes it.

Other UML Diagrams

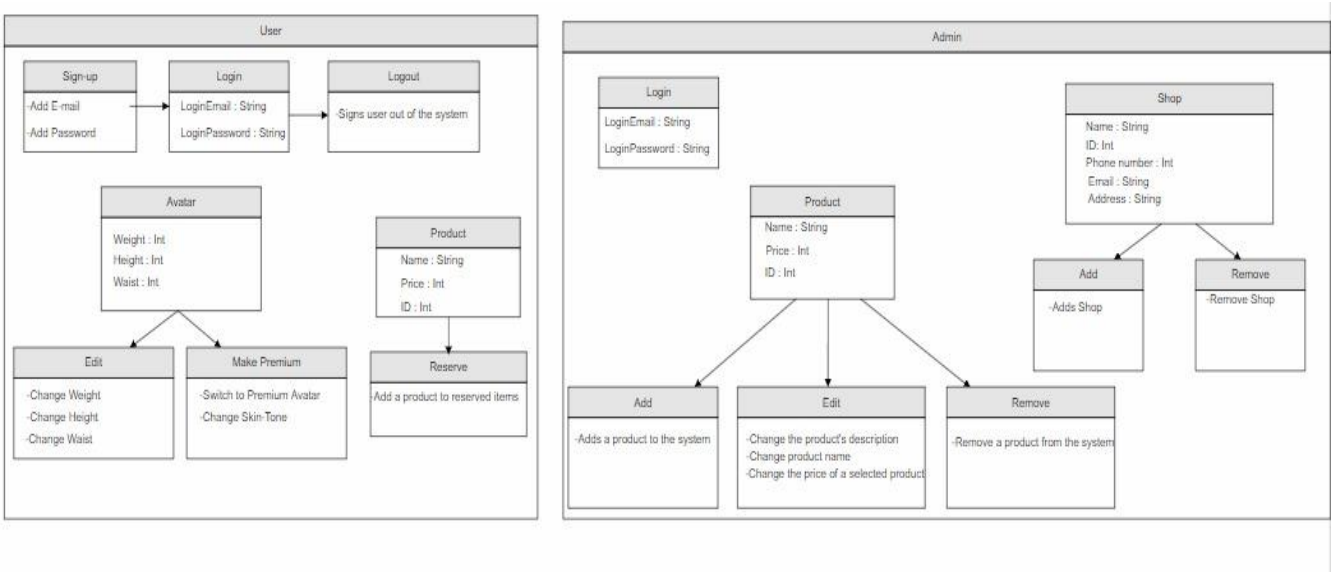
1) Structural Diagrams

i) Composite structure diagram



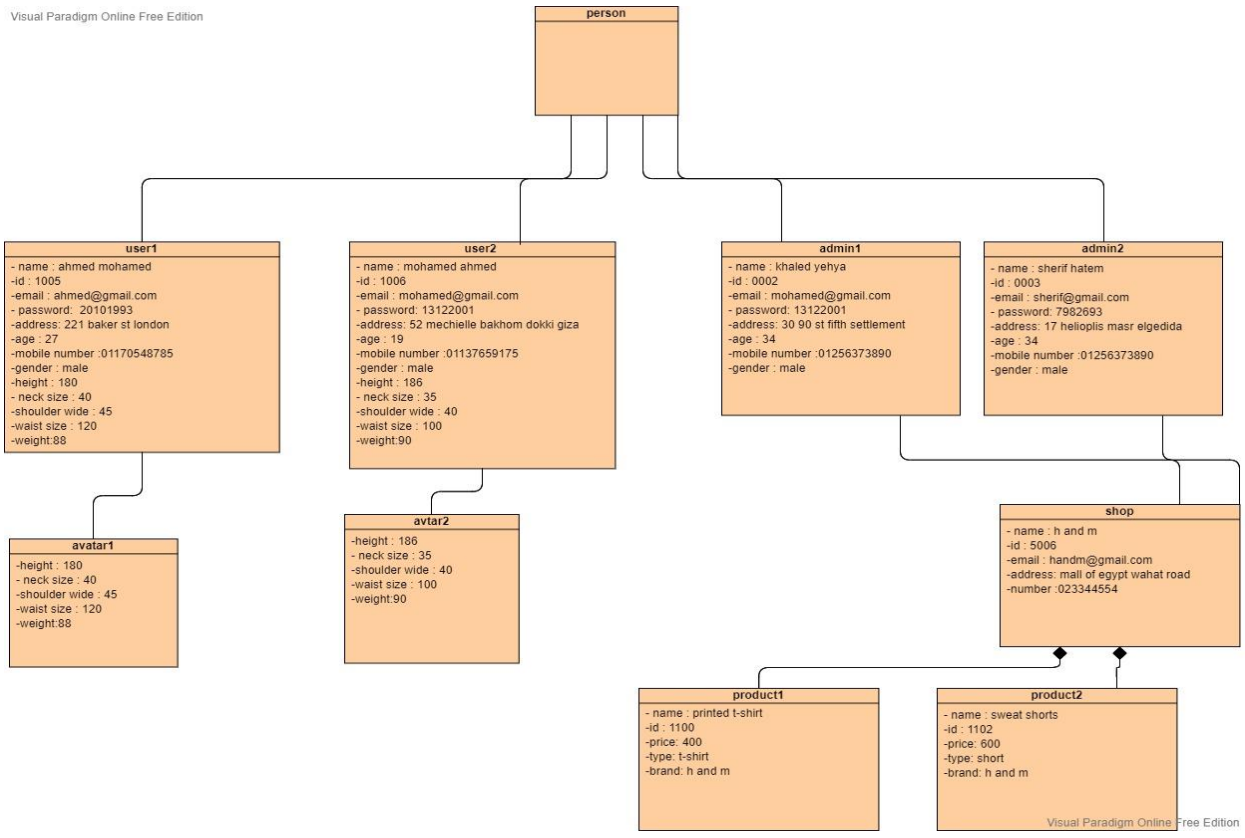
Composite structure diagram is similar to a class diagram in that it allows you to go into greater detail when explaining the basic structure of numerous classes and illustrating how they interact. Inner classes and parts can be visually represented, as well as connections between and within classes. as an example, it's shown in the diagram how the shop is composed of the products and how the shop is connected to admin through those products.

ii) **Profile diagram**



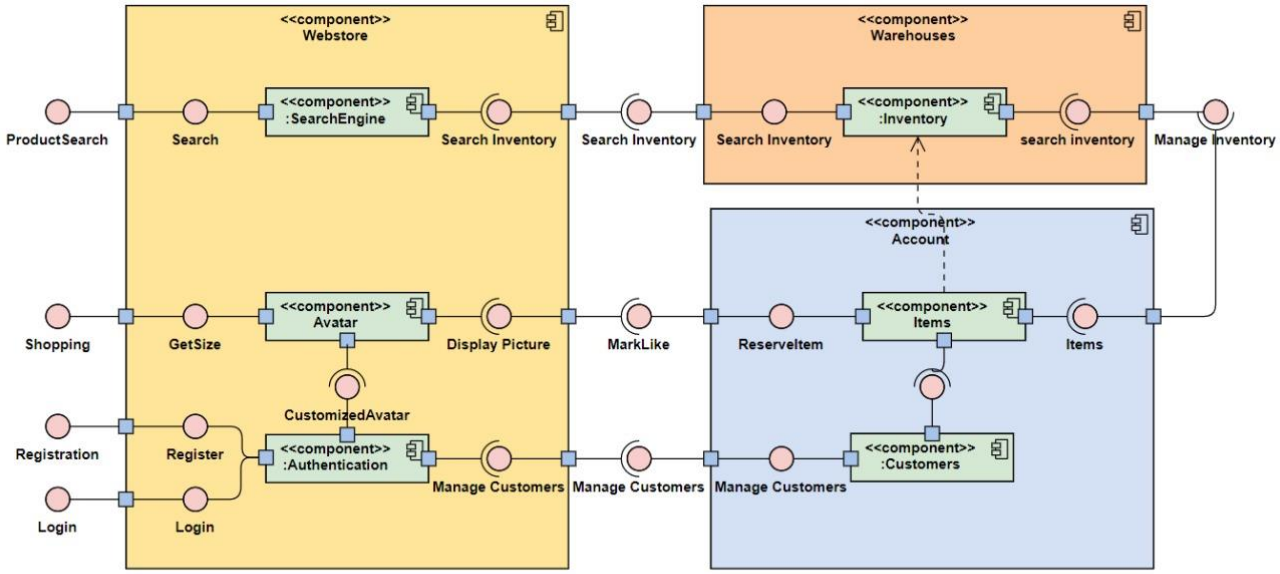
The profile diagram shows the main actors of the system and how they are able to affect the system, where any of the main actions that are needed to be present in the project are described from the point of view of both the user and the admin of the website

iii) **Object diagram**



Object diagram is mainly class diagram but with creating instances from the classes as if we are dealing with OOP. It's purpose is to show how those instances or objects deal with each other and their relation. As it's shown in this figure how these objects are connected as an example the relation between each user and it's avatar or the composition relation between the shop and the products that it is composed of.

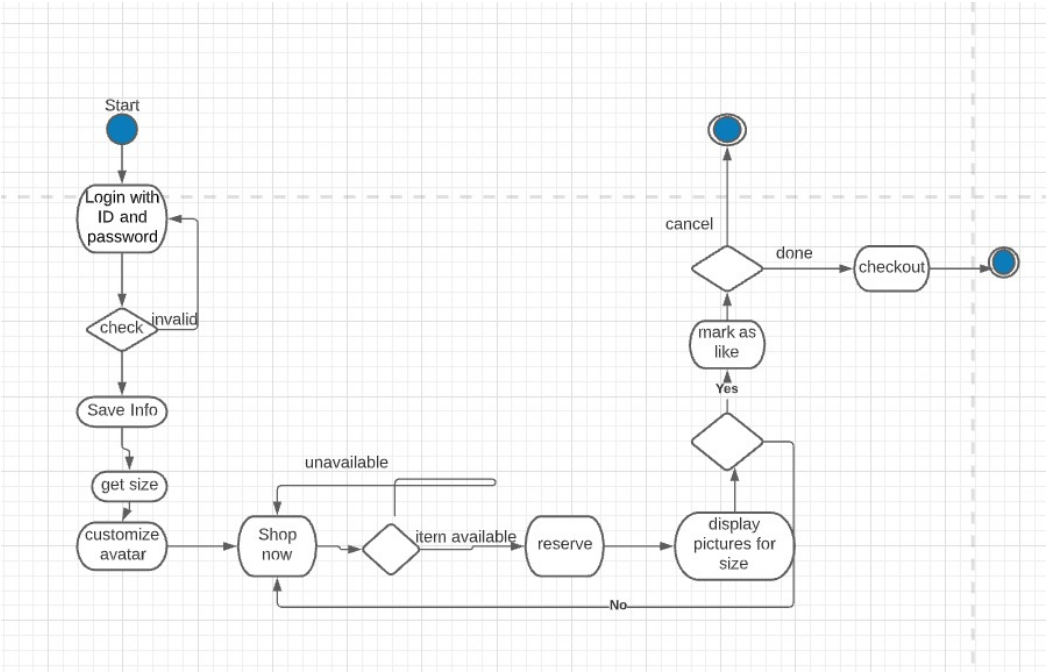
iv) Component diagram



Component diagram shows provided interfaces which has ports and connections (according to the dependencies) with the parts and components of the website and the operation. Components are connected with each other for examples, search engine component requires to search within the inventory which is another component.

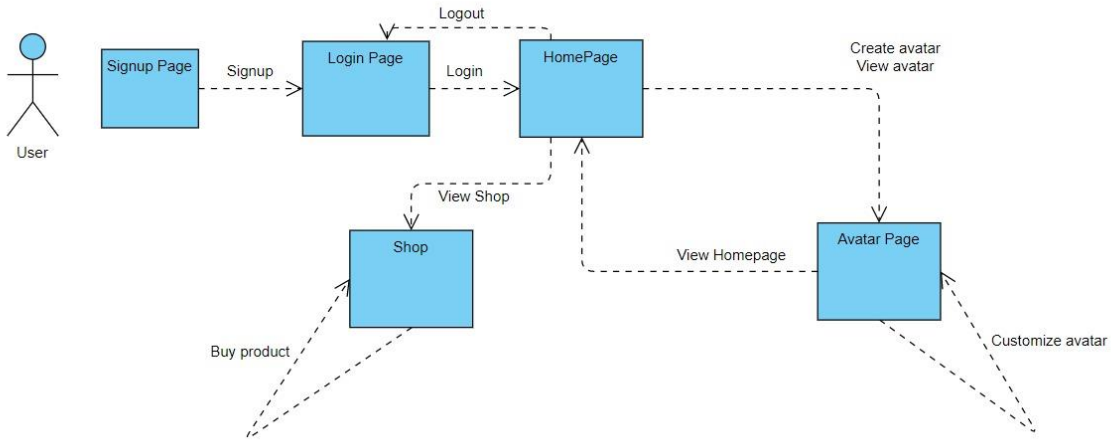
2) Behavioral Diagrams

i) Activity diagram



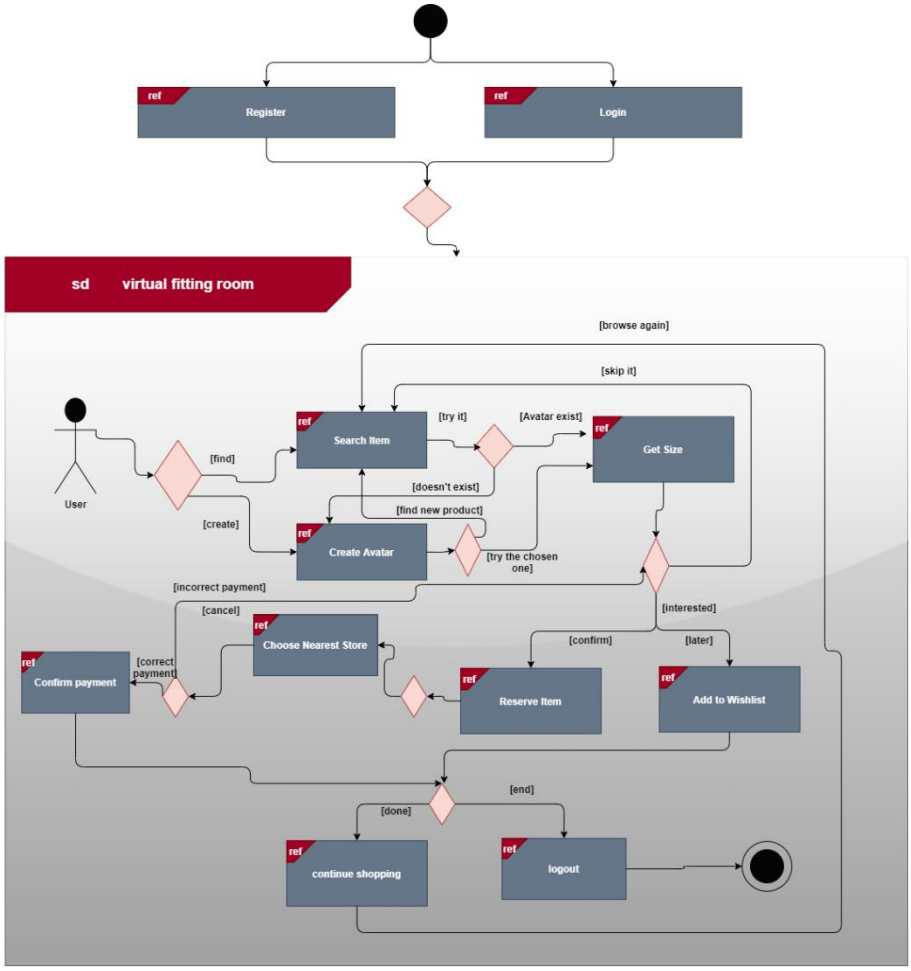
It checks the process for all the activities from starting position till reserving and checking out.

ii) **Communication diagram**



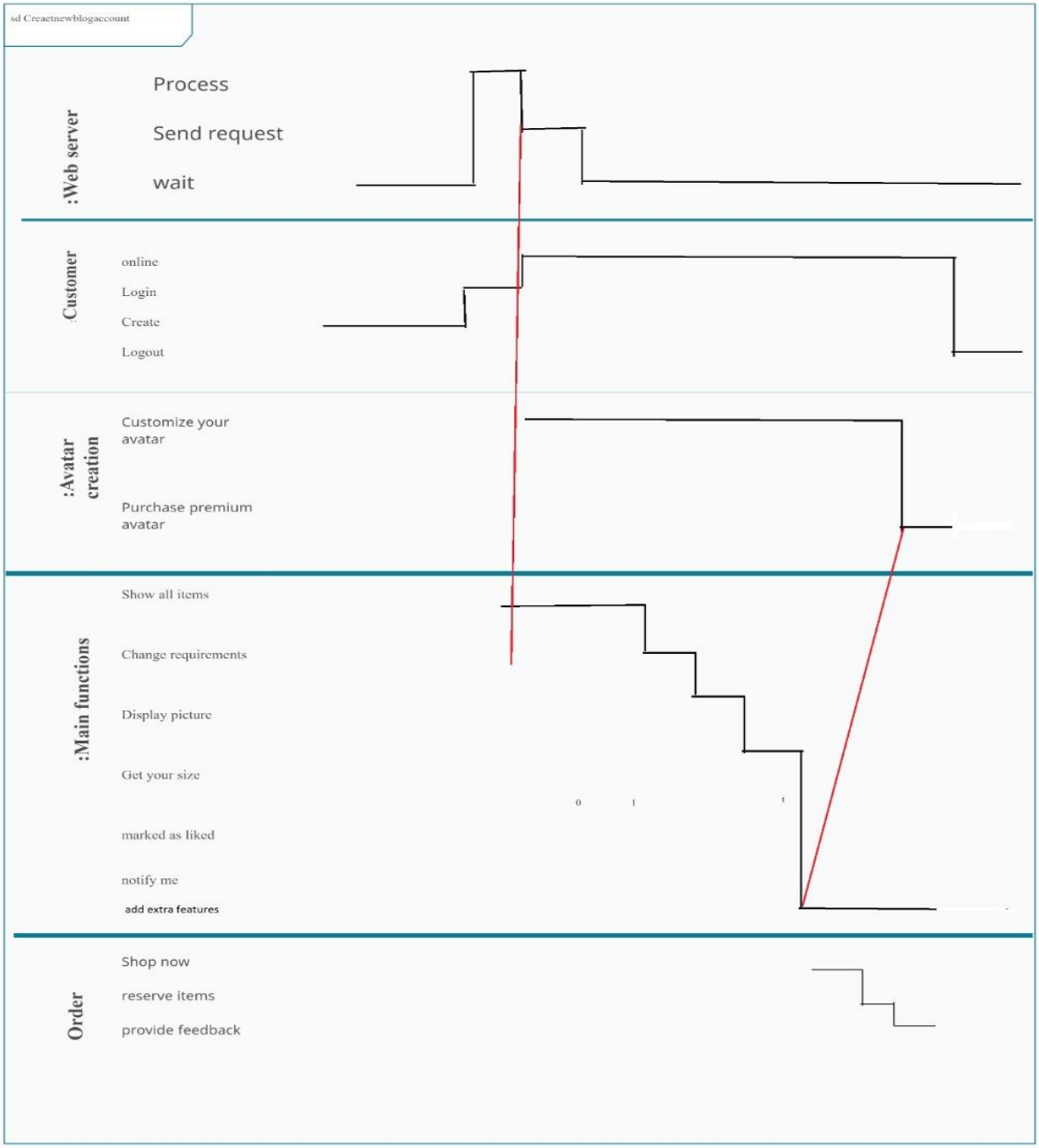
The communication diagram is similar to the sequence diagram where it shows the interaction between all the pages together, but the difference is that this diagram focuses on the relationships between them instead of the time factor and in this case the communication diagram simply shows the traversal of the user through the different pages.

iii) **Interaction overview diagram**



The interaction overview diagram shows all the actions happening in the system from the initial point when the user chooses to login or register till the end point at logout. The system is considered as sd interaction containing different ref sub interactions. All cases are handled in the decision with either true or false such as trying item if avatar exists, user will get his size. Else, he needs to create avatar first, etc...

iv) Timing diagram



Timing diagram focuses on conditions changing within a lifeline and their sequence so the first thing to start with is to connect with the web server and from this point the journey starts with the logging in form and the user is able to do several processes as long as he's connected to the server till, he logs out.

CONCLUSION

The recent technology innovations helped us to eliminate our fears of online shopping like buying wrong sizes and hassle of returns. Also, During the current pandemic people are extremely afraid to retouch items or wait for long queues. So, our system is considered nowadays as an obligatory tool to reduce the number of returns from online consumer and increase the percentage of relying on online shopping to avoid visiting malls. As finding your expected item is totally doable using our system.

-To summarize, planning a good architecture is mandatory to enable stakeholder to communicate and analyzing the system before coding to avoid wasting money.

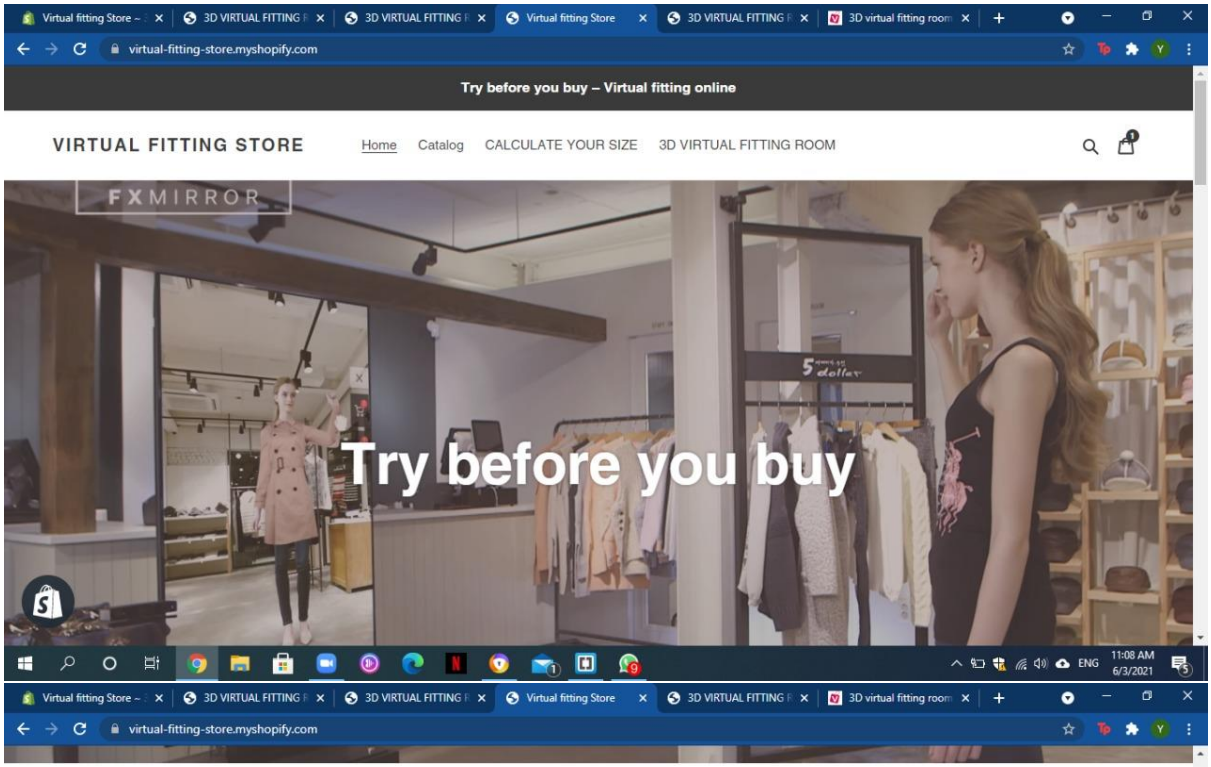
Also, planning software architecture well helps us to make sure that the database is secure enough and away from client by dividing the system into three tiers to isolate the database. In addition to adding firewall to protect it against any attacks. As bas architecture means bad security.

Making manifest and checking every step to keep track with all the updates

Using Documents to remember and share design decisions among the team

Finally, System's architecture makes it possible to grow that system efficiently and effectively through refactoring, by creating a stable platform for innovation, and by establishing a managed product line. "Governing"

Implementation



300+ real products in our database

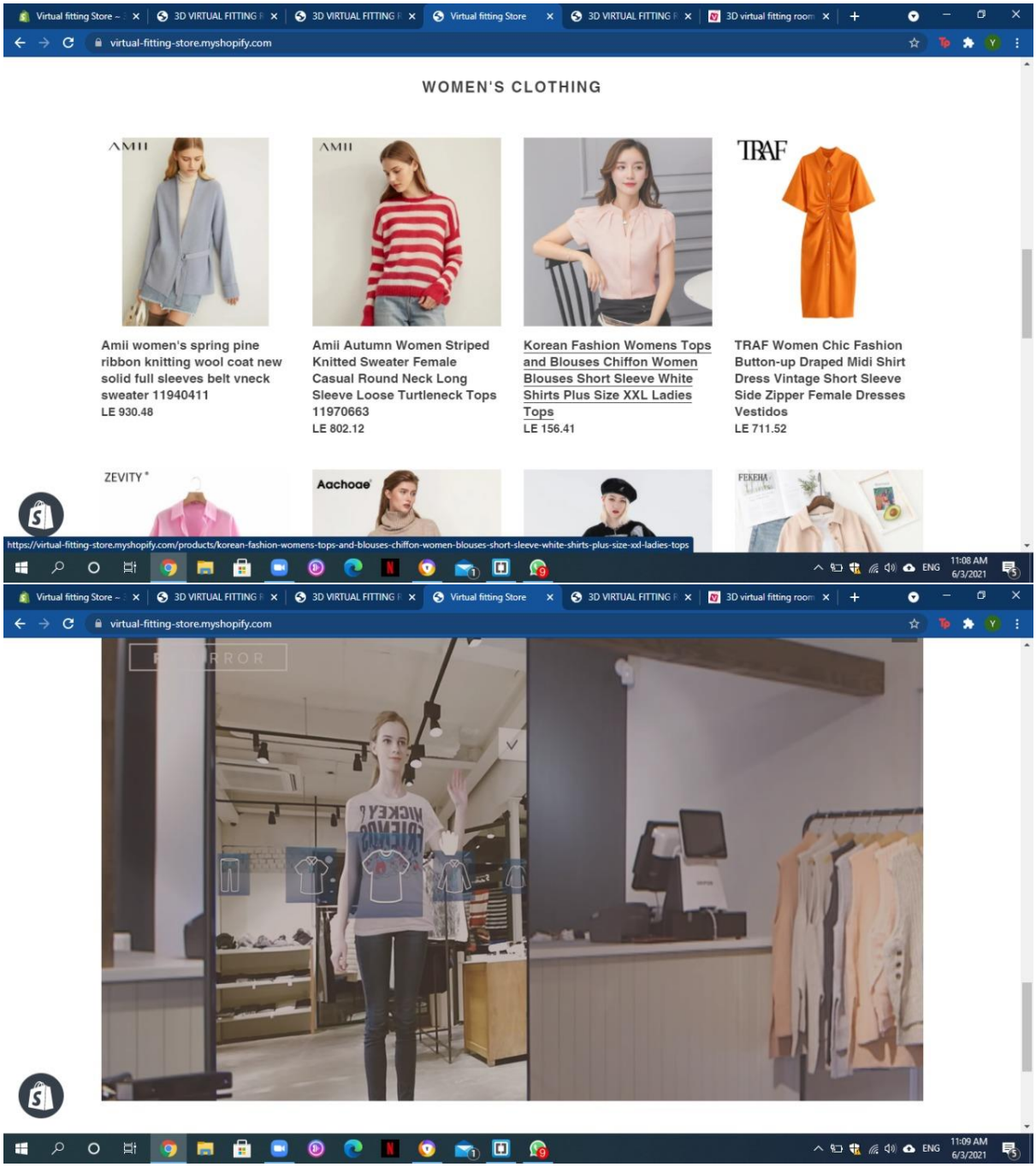
Artificial 3D model creation **from your 2D pictures**

Precise facial point detection

Automatic product size measurement

Native appearance & **higher conversion growth** compared to other solutions

WOMEN'S CLOTHING


virtual-fitting-store.myshopify.com
WOMEN'S CLOTHING
Amii women's spring pine ribbon knitting wool coat new solid full sleeves belt vneck sweater 11940411
LE 930.48
Amii Autumn Women Striped Knitted Sweater Female Casual Round Neck Long Sleeve Loose Turtleneck Tops 11970663
LE 802.12
Korean Fashion Womens Tops and Blouses Chiffon Women Blouses Short Sleeve White Shirts Plus Size XXL Ladies Tops
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TRAF Women Chic Fashion Button-up Draped Midi Shirt Dress Vintage Short Sleeve Side Zipper Female Dresses Vestidos
LE 711.52
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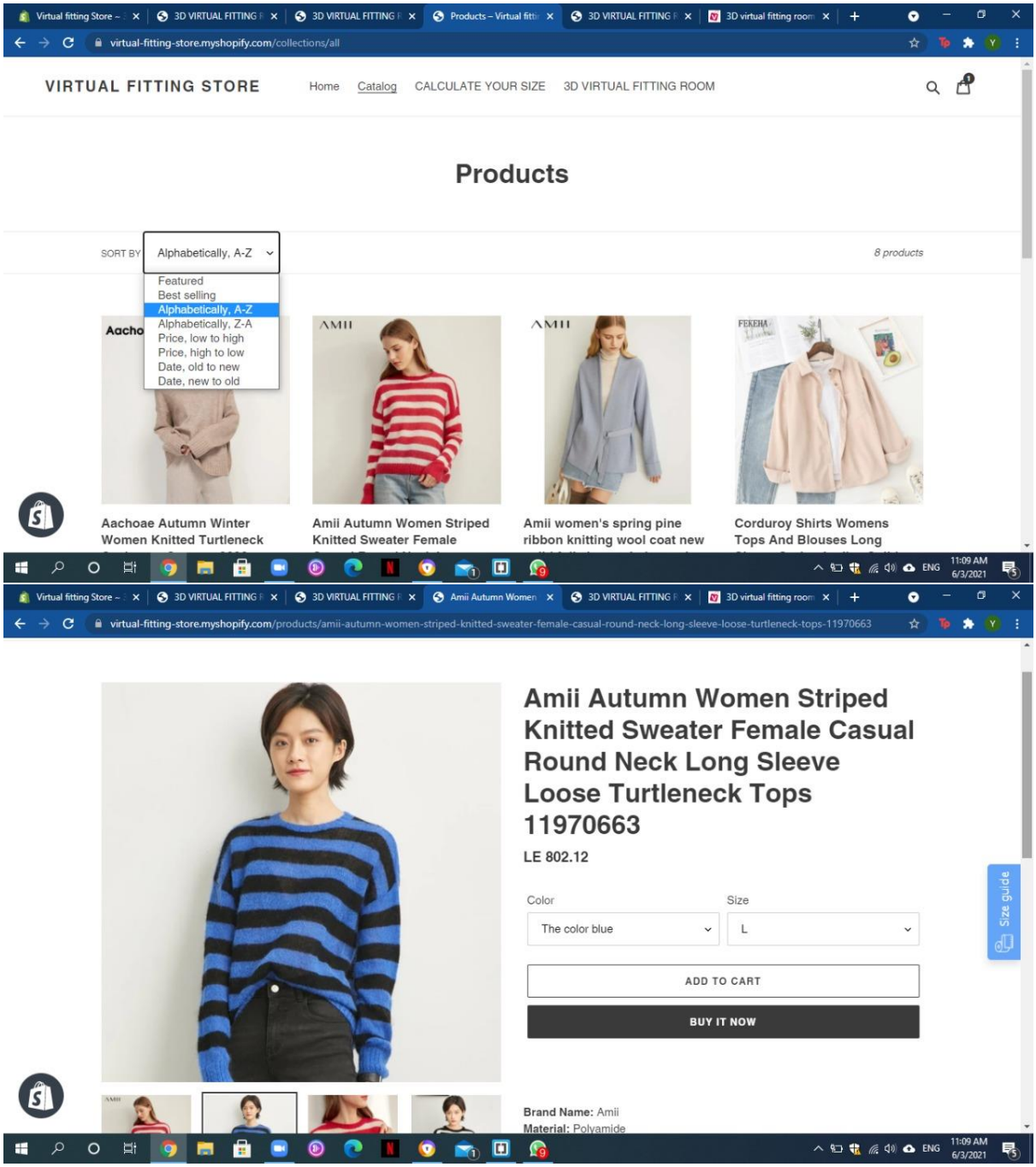
virtual-fitting-store.myshopify.com/collections/all
VIRTUAL FITTING STORE
Home
Catalog
CALCULATE YOUR SIZE
3D VIRTUAL FITTING ROOM
Products
SORT BY
Alphabetically, A-Z
8 products
Featured
Best selling
Alphabetically, A-Z
Alphabetically, Z-A
Price, low to high
Price, high to low
Date, old to new
Date, new to old
Aachoae Autumn Winter Women Knitted Turtleneck
Amii Autumn Women Striped Knitted Sweater Female
Amii women's spring pine ribbon knitting wool coat new
Corduroy Shirts Womens Tops And Blouses Long
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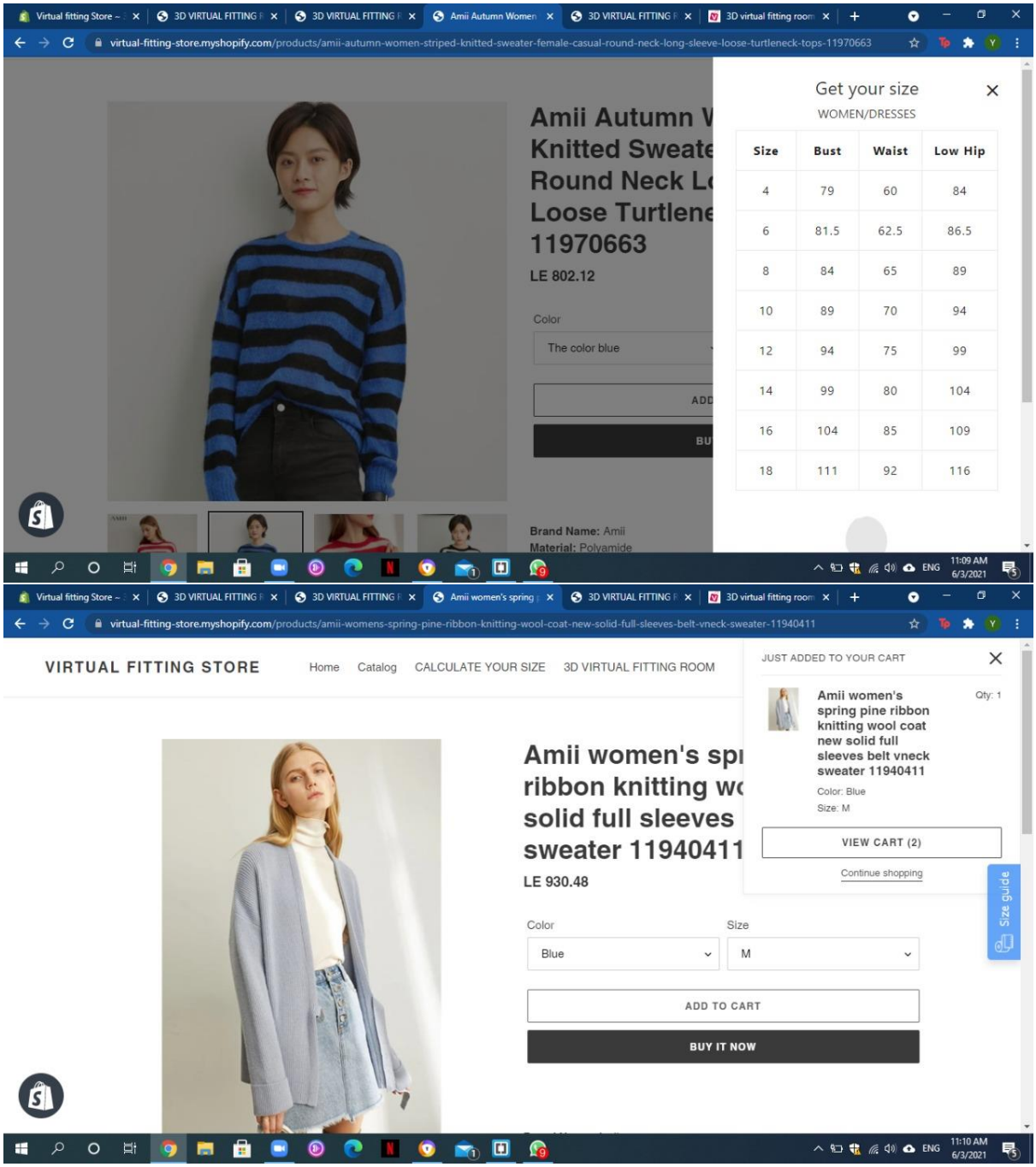
Color
The color blue
Size
L
ADD TO CART
BUY IT NOW
Size guide
Brand Name: Amii
Material: Polyamide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Round Neck Lo
Loose Turtlene
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LE 802.12
Color
The color blue
Brand Name: Amii
Material: Polyamide
Get your size
WOMEN/DRESSES
Size Bust Waist Low Hip
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6 81.5 62.5 86.5
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VIRTUAL FITTING STORE
Home
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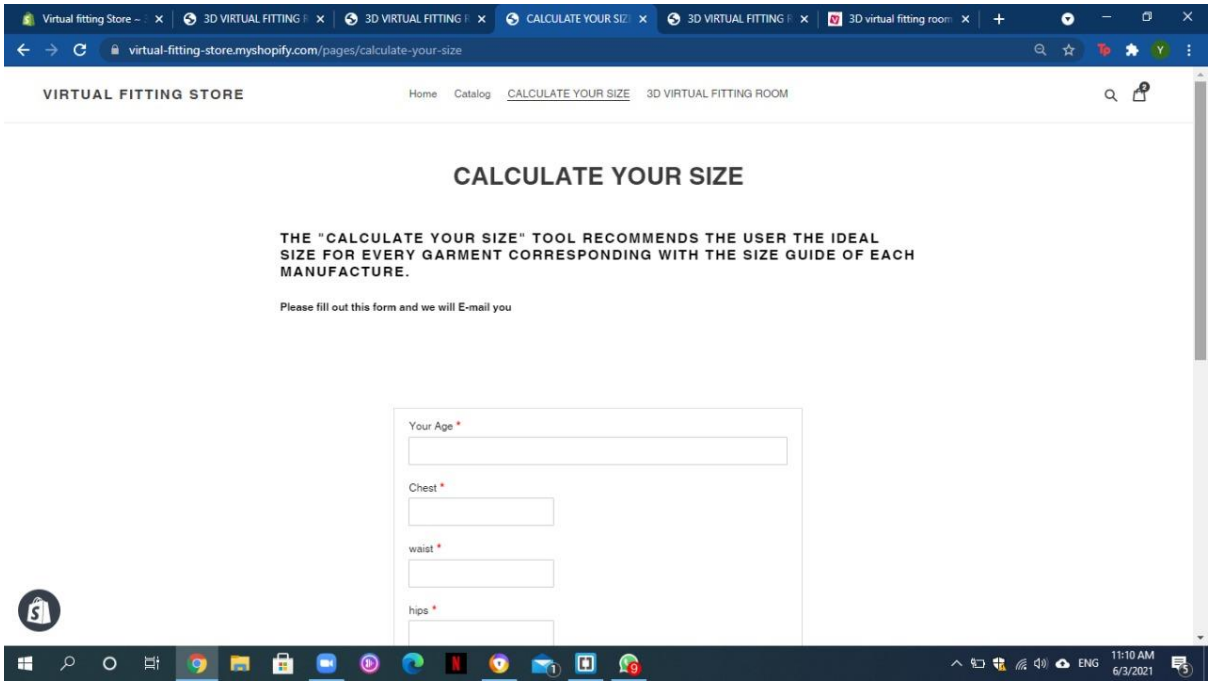
CALCULATE YOUR SIZE
3D VIRTUAL FITTING ROOM
JUST ADDED TO YOUR CART
Amii women's spring pine ribbon knitting wool coat new solid full sleeves belt vneck sweater 11940411
Qty: 1
Color: Blue
Size: M
VIEW CART (2)
Continue shopping
Amii women's spr
ribbon knitting wo
solid full sleeves
sweater 11940411
LE 930.48
Color
Blue
Size
M
ADD TO CART
BUY IT NOW
Size guide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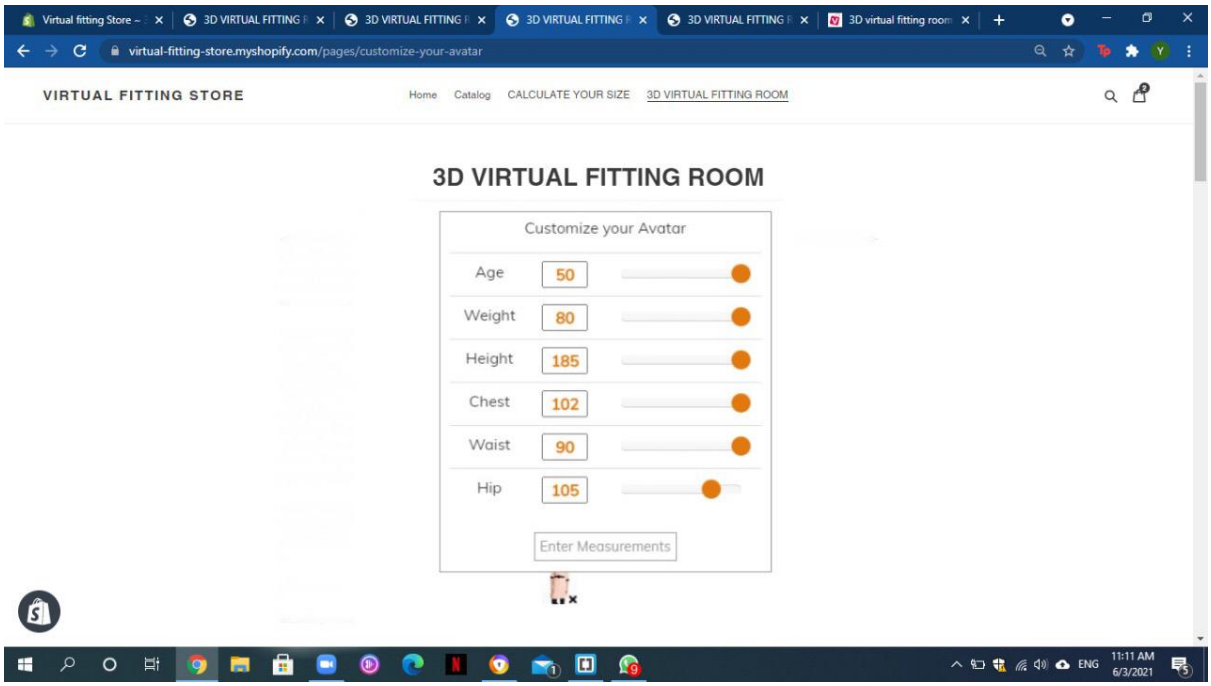
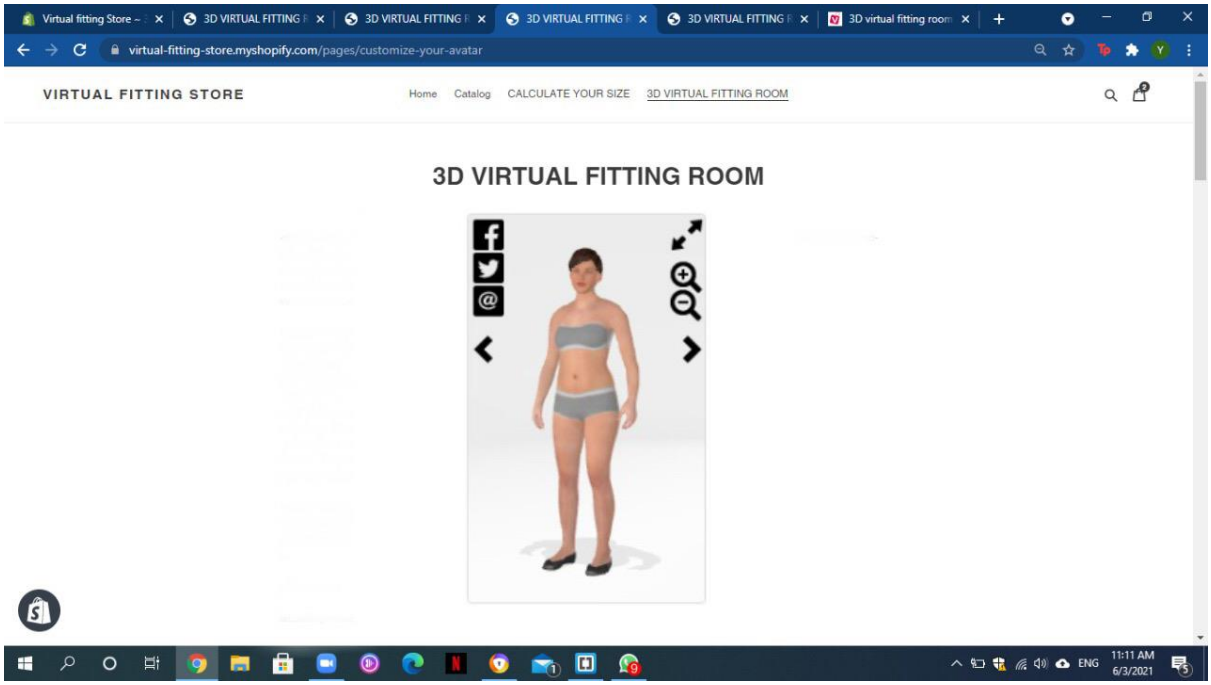
VIRTUAL FITTING STORE
Home
Catalog
CALCULATE YOUR SIZE
3D VIRTUAL FITTING ROOM
CALCULATE YOUR SIZE
THE "CALCULATE YOUR SIZE" TOOL RECOMMENDS THE USER THE IDEAL SIZE FOR EVERY GARMENT CORRESPONDING WITH THE SIZE GUIDE OF EACH MANUFACTURE.
Please fill out this form and we will E-mail you
Your Age *
Chest *
waist *
hips *


virtual-fitting-store.myshopify.com/pages/customize-your-avatar
VIRTUAL FITTING STORE
Home
Catalog
CALCULATE YOUR SIZE
3D VIRTUAL FITTING ROOM
3D VIRTUAL FITTING ROOM
Customize your Avatar
Age 50
Weight 80
Height 185
Chest 102
Waist 90
Hip 105
Enter Measurements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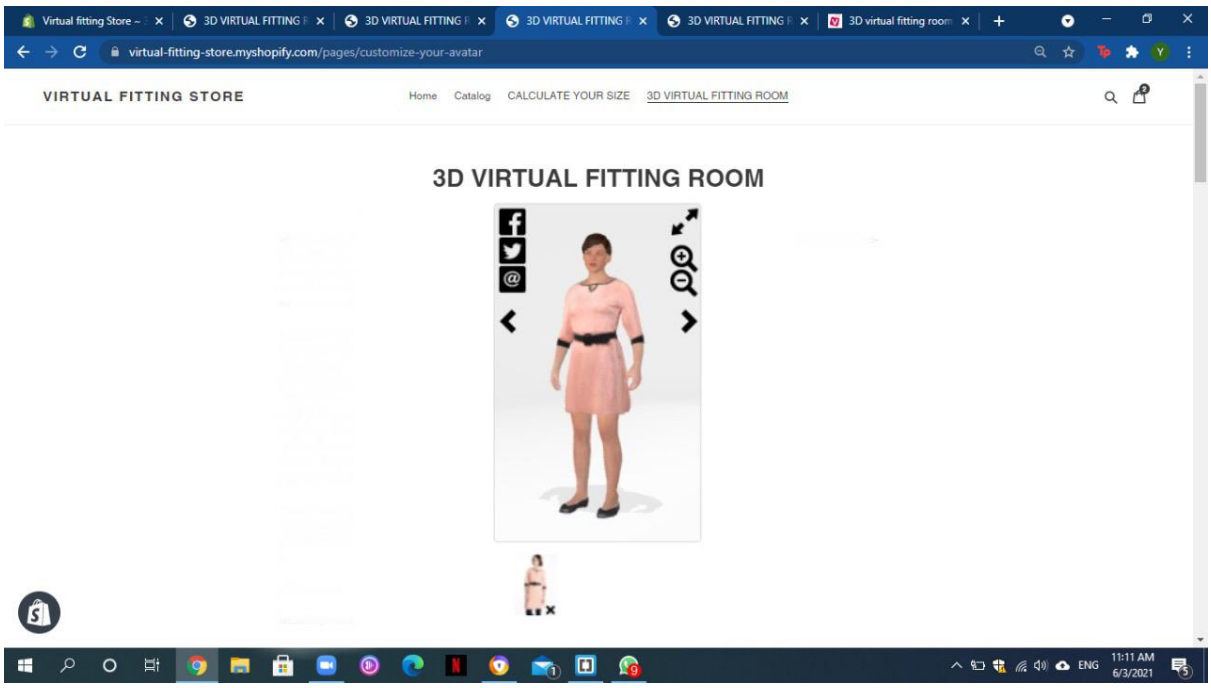
VIRTUAL FITTING STORE
Home
Catalog
CALCULATE YOUR SIZE
3D VIRTUAL FITTING ROOM
3D VIRTUAL FITTING ROOM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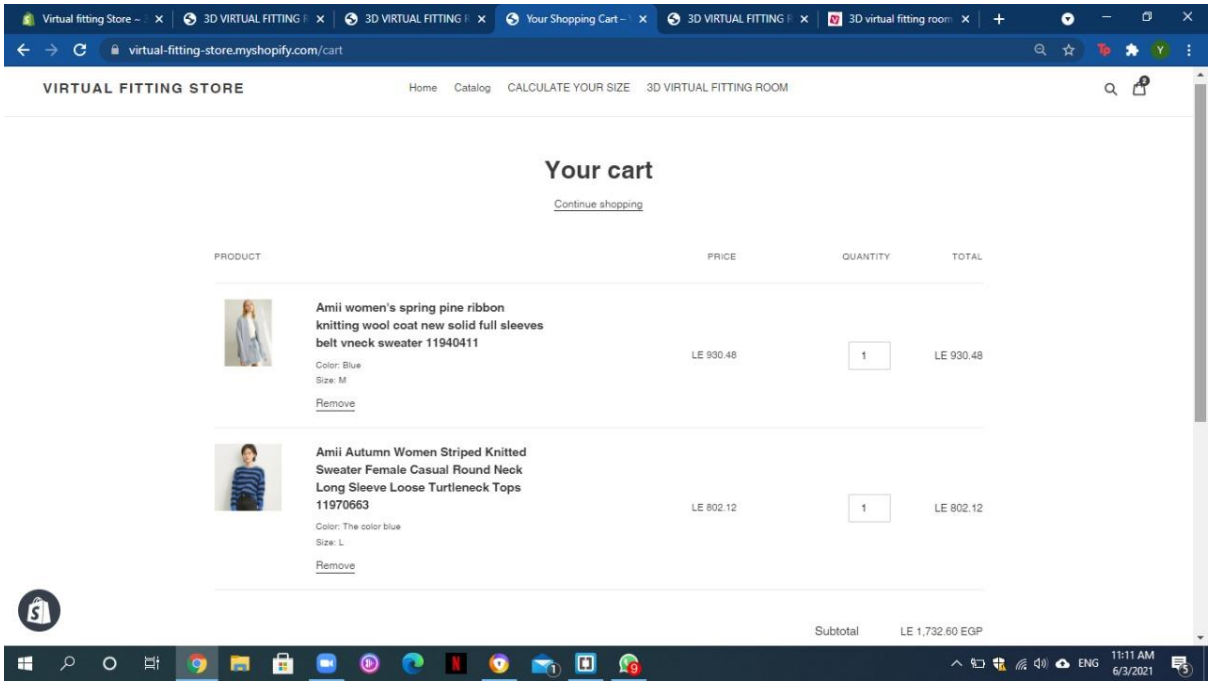
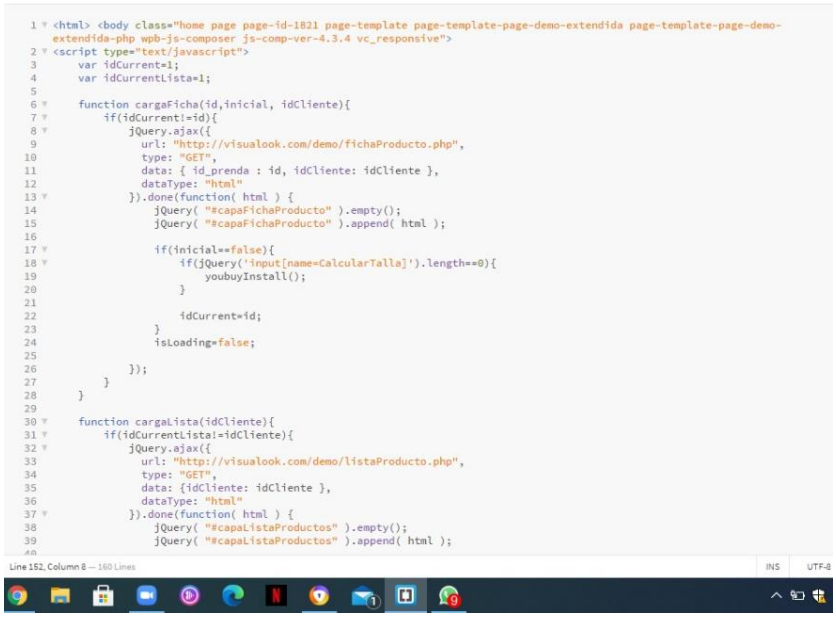
CALCULATE YOUR SIZE
3D VIRTUAL FITTING ROOM
3D VIRTUAL FITTING ROOM





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extendida-php wpb-js-composer js-comp-ver-4.3.4 vc_responsive">
<script type="text/javascript">
    var idCurrent=1;
    var idCurrentLista=1;

    function cargaFicha(id,inicial, idCliente){
        if(idCurrent!=id){
            jQuery.ajax({
              url: "http://visualook.com/demo/fichaProducto.php",
              type: "GET",
              data: { id_prenda : id, idCliente: idCliente },
              dataType: "html"
            }).done(function( html ) {
                jQuery( "#capaFichaProducto" ).empty();
                jQuery( "#capaFichaProducto" ).append( html );

                if(inicial==false){
                    if(jQuery('input[name=CalcularTalla]').length==0){
                        youbuyInstall();
                    }

                    idCurrent=id;
                }
                isLoading=false;

            });
        }
    }

    function cargaLista(idCliente){
        if(idCurrentLista!=idCliente){
            jQuery.ajax({
              url: "http://visualook.com/demo/listaProducto.php",
              type: "GET",
              data: {idCliente: idCliente },
              dataType: "html"
            }).done(function( html ) {
                jQuery( "#capaListaProductos" ).empty();
                jQuery( "#capaListaProductos" ).append( html );
```

REFRENCES

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