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FBD_BMODEL
FASHION BIG DATA BUSINESS MODEL

D6.2

Design and develop digital visualizations of products

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FASHION BIG DATA BUSINESS MODEL

Project Information

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Deliverable title	Design and develop digital visualizations of products
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Nature	**R:** Document, report (excluding the periodic and final reports) **DEM:** Demonstrator, pilot, prototype, plan designs **OTHER:** Process, database
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Contributors	FITIZZY, ENSAIT
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Dissemination Level

PU	Public	
PP	Restricted to other programme participants (incl. Commission Services)	
RE	Restricted to a group specified by the consortium (incl. Commission Services)	
CO	Confidential, only for the members of the consortium (incl. Commission Services)	✓

Document Log

Version	Date	Author	Description of Change
1.0	M16 03/2019	FITIZZY	Thinking and designing the different user journeys based on the services and the targets
1.1	M21 05/08/2019	FITIZZY	Checking the deliverables provided by the three 3D design experts, developing the front of the platform including the 3D simulator
1.2	M22 20/09/2019	FITIZZY	Integrating the front development with the structure of the platform
1.3	M22 23/09/2019	FITIZZY	Providing a demo link for users (customers and brands) in the framework of the event 24.09 in La Fabrique (Paris)
1.4	M25 13/12/2019	ENSAIT	Completing the database of 3D digital garments and fitting effects, realization of the final report

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1 Executive Summary

FBD_BModel aims at creating a digital technology platform for delivering small series innovative functional garment products through a European Union-based local textile supply chain, meeting consumers' personalized requirements in terms of fashion and functional performances. This new supply chain will permit to get through the information channel from fabric materials to consumers via various processes, in order to dynamically organize design and production in the big data environment.

In this project, the digitalization process of products, human bodies and interactions between them constitutes a foundation for realizing all data-based services of WP4. Based on the previous work realized in ENSAIT, this process and related database for different brand partners have been developed in D6.2, in order to provide. In the first stage of the Task 6.2, we compared different 3D garment and fabric digitalization commercialized software and finally selected Modaris 3D Fit. A set of 3D parametric human models have been generated by exploiting human body data of different morphologies, measured from the 3D body scanning system of ENSAIT. The fitting effects of different human models (body shapes) with various 3D garments (different fabric parameters and garment styles) have been simulated. All these three parts (digitalized human bodies, digitalized garments, 3D virtual fitting effects) will constitute an important database for development of data-based services in WP4 such as interactive design recommendation system (D4.3).

For successfully developing the deliverable D 6.2, the Fitizzy team and ENSAIT team collaborated by working together on the fabric samples, real garments and data provided by the brand partners (Bivolino, Kuvera, GZE, BESTE, AZADORA). This database has been partly implemented on the platform of Fitizzy, in which the structure and a number of interfaces have been designed in order to be adapted to various users. The real products of 2 Business cases (chosen by the Consortium) have been digitally designed and visualized on the platform for the Live demo (on 24th of September in Paris).

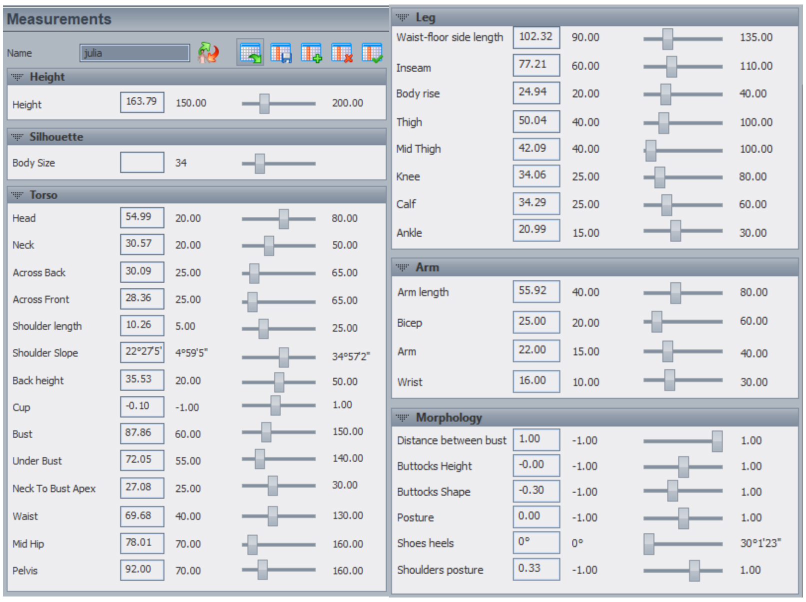
2 Deliverable D6.2: design and develop digital visualizations of products

The creation of the database for digital products is composed the following steps: 1) building 3D human models by exploiting data measured from a 3D body scanner; 2) digitalization of fabrics; 3) creation of 3D digital garments; and 4) creation of 3D virtual garment fitting effects for simulating interactions between various human models and created garments.

2.1 The digitalization process

2.1.1 Creation of 3D human models and avatars

From measured 3D body scanning data obtained from a target population, we used the human body shape classification algorithm developed in the team of ENSAIT [1] in order to generate a set of parametric 3D human models each characterizing one morphotype, i.e. one category of body shapes of the target population without various body sizes. The number of classes or morphotypes and other parameters of the classification algorithm can be defined according to the requirements of designers on the specific garment collection in terms of size precision, aesthetics and comfort. In the Task 6.2, a database of human models has been created by exploiting the data obtained from the French Human Body Scanning Campaign organized by IFTH. Once a human model is selected, its basic body shape can be uniquely defined, permitting to cover to a set of avatars with different sizes. For a new specific consumer, his/her human model can be determined by comparing his/her personal body sizes or body ratios and those of the already generated human models. The corresponding 3D virtual human body (avatar) can be created by inputting or adjusting a number of body sizes at key body positions in the Modaris Software. One example is given in Figure 1.



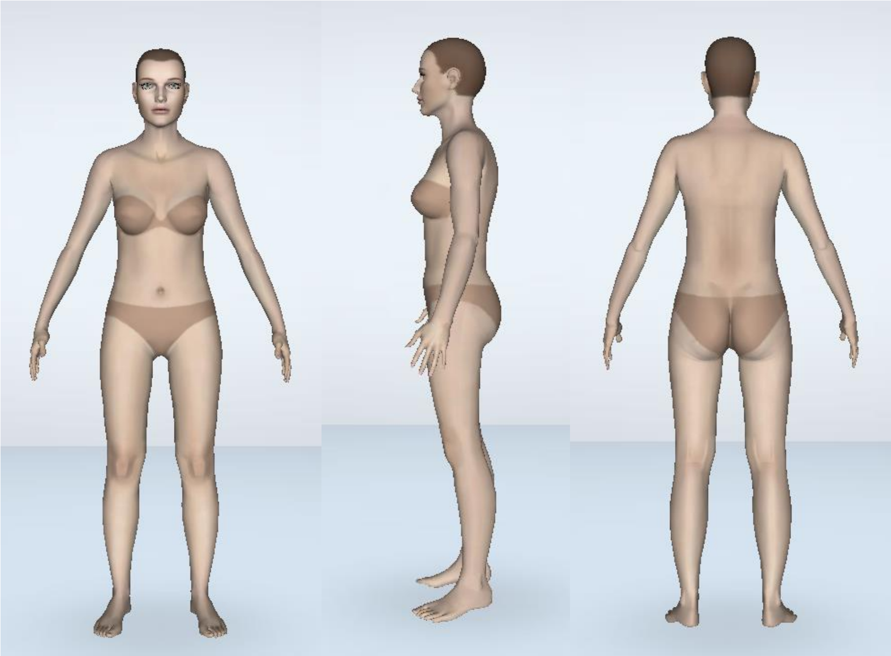
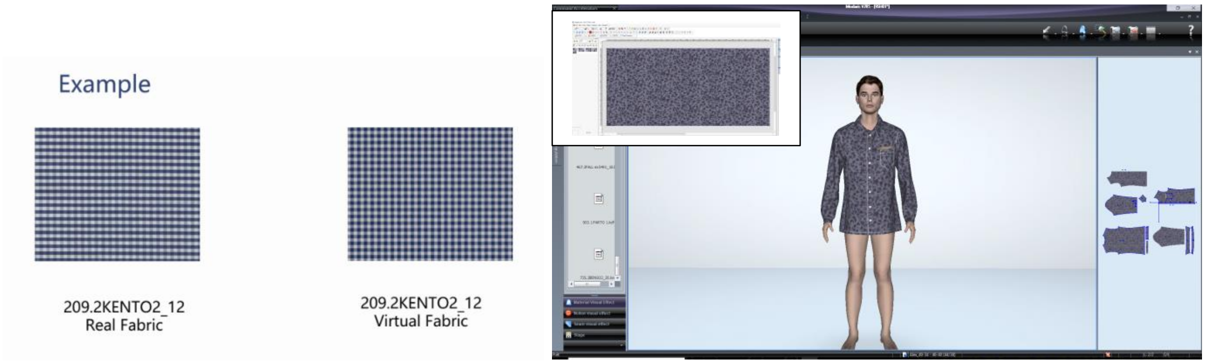


Figure 1: One example of 3D virtual human body (3D avatar)

2.1.2 Fabric digitalization

In our project, fabric digitalization has been realized using the Kaledo CAD software. Kaledo is a Lectra product dedicated to digital design of weave, knit and print. It generates fabric simulations with a realism that allows designers to visualize and adjust their work in real-time down to the smallest detail, without needing to create any actual fabric samples. Designs can be imported, or directly created with the weave/knit/print tools.

All technical parameters on the fabric to be digitalized (fabric type, colors, threads mapping, fabric structure, surface image obtained from a microscope, final garment application, etc.) will be input to the Kaledo software. All the digitalized fabric samples constitute the inputs of the Modaris 3D fit software for displaying the fabric effect on a selected human body (avatar). The defects made during the fabric design process can be quickly found and further corrected. The perfect fitting effect of clothing and fabric will appear on the 3D fitting by adjusting the parameters of the virtual fabric sample. The digitalization process of a woven fabric is composed of the following seven steps: 1) scanning the real fabric sample in order to acquire its image; 2) selecting the relevant fabric structure from the structure library provided by the Kaledo software; 3) selecting the relevant yarn from the yarn library of the software; 4) setting relevant basic design parameters, including Density Stripes, Design Mode/Palette Data Mode, Colored/Yarn Stripes and Weave Stripes, Warp Count and Weft Count, etc., 5) modifying the warp and weft density; 6) using the Shading Control and fancy yarn in order to make the virtual fabric closer to a real fabric; 7) saving the digitalized fabric in a file for future use. For the other fabrics such as knitted fabrics and printed fabrics, the digitalization processes are almost the same. In the environment of Kaledo, the digitalized fabrics can be directly used in garments in order to visualize the fabric properties in real 3D applications.



(a) Real and virtual fabrics (b) digital fabric (2D) and its application in a garment (3D)

Figure 2: One example for fabric digitalization process

2.1.3 Garment digitalization and 3D garment fitting

A digital (virtual) 3D garment is created based on the parameters of digitalized fabrics, presented previously and selected garment patterns, designed by a garment maker. This process enables to cut digital fabrics into different pieces according to the garment patterns and then put them on the avatar of a selected consumer and adjust the digitalized garment according to the garment fitting effects visualized by the designer. Therefore, it is a customized and interactive design process, leading to the best fitting effect by a series of virtual garment try-on [2].

Concretely, the garment digitalization process is composed of the following steps: 1) establishing the garment style and size according to the consumer's morphology and fashion requirements; 2) garment patterns making and grading; 3) 3D garment fitting simulation; 4) evaluation and adjustment of the digital garment by the designer and concerned consumer; 5) details modification for meeting specific requirements of the consumer; 6) garment pattern parametrization.

Pattern making methods are mainly divided into draping cutting and flat cutting. Draping cutting is mainly used in more complex clothing style, such as usually some dresses and wedding dress with many folds and waves because it is very three-dimensional, it is difficult to use flat cutting methods and its one-time molding is higher, generally do not need to be adjusted repeatedly. Flat cutting is mainly suitable for daily garment, after getting the dimensions of the body clothes pattern can be made. Besides, the flat cutting is divided into prototype method and proportional method. In the Task 6.2, as our process is based on the body scanning data in order to make the garment structure design, it is more appropriate to use flat cutting and proportional method for generating garment patterns of different styles. The prototype method is more adapted to the mass production of clothing factories.

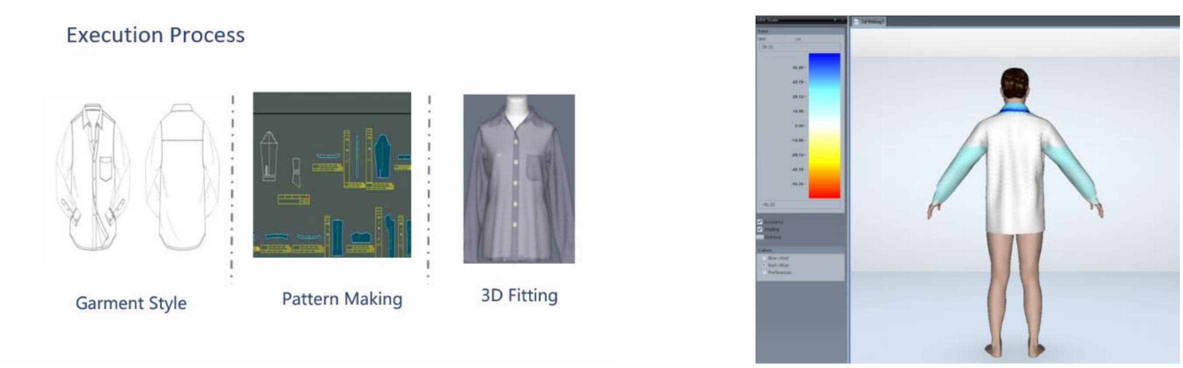


Figure 3: One example for garment making – 3D garment generation – 3D garment fitting

Figure 4: The complete digitalization process for textiles and garments

By combining the fabric and garment digitalization processes as well as corresponding fitting effects, we obtain a complete digitalization process for textiles and garments from testing on physical samples to 3D garment fitting via garment style selection, pattern making and 3D garment simulation. The digitalized fabrics are collected in a fabric virtual library and fitted garments in a database of digital garments with matched avatars and body sizes [3].

2.2 Delivery of digital garments for the business cases

The five business cases have been clearly defined in D3.4. They include:

- Business Case 1: Fashion Shirts Made-to-Measure (Bivolino).
- Business Case 2: Technical Performing Underwear (Kuvera).
- Business Case 3: Technical Sportswear and Outerwear (AZADORA).
- Business Case 4: Men's Fashion Urban Wear and Performing Clothing (BESTE).
- Business Case 5: Customized Performing and Fashion Accessories (Kuvera).

In the Task 5.2, we consider the digitalization of fabrics and garments only. In this context, we have collected samples and generated data from the four first business cases. From the involved brand partners, we have collected a number of representative fabric samples, related garment samples and technical parameters such as patterns, fibre compositions. Finally, we have generated 70 digital fabrics, including 29 for Bivolino, 6 for Kuvera, 12 for BESTE, and 23 for AZADORA. From these digital fabrics, we have realized 12 digital garment styles of 5 different fabrics and 5 different sizes, including 8 shirt styles for Bivolino, 2 underwear styles for Kuvera, 1 raincoat style for BESTE and 1 sportswear style for AZADORA. If we consider different fabrics and different garment sizes, the total number of 3D digital garments is 300. All these digital garments and related fitting effects are stored in the databases of ENSAIT and FITIZZY. They are considered as one important part of the fashion knowledge base (IDS6) of WP4 and used in the fashion recommendation system to be delivered in Feb 2020 (D4.3).

2.2.1 Business Case 1: Bivolino

Bivolino Company aims at designing and producing made-to-measure fashion shirts. By using the previous digitalization process, we generate 8 shirts. Other digital shirts are being created. Two examples are given below.

Figure 5: Digital men shirt of size 42 realized for Bivolino

Figure 6: Digital women shirt of Size 38 for Bivolino

Figure 7: Bivolino shirt fitting effects with FB-24-94% Cotton 5% polyamid 1% Lycra.mat fabric

2.2.2 Business Case 2: Kuvera

Kuvera Company aims at designing and producing technical performing underwear. By using the previous digitalization process, we generated 2 women leggings.

Figure 8: Legging Jaked Sizes S

(a) Visual effects of fitting (b) fabric pressure on the skin

Figure 9: Legging fitting effect with polyester elasthane Jersey fabric

In the 3D garment fitting process, we can visualize both visual effects of fitting and pressure of the fabric on the skin (or ease allowance if the fabric is not in direct contact with the skin). The latter is more significant when designing garments of tight style because it can help the designer to select the best fabric material optimizing human comfort and desired garment style in the same time. Red color represents high pressure between fabric and skin and yellow color means lower fabric pressure but still having direct contact with skin.

2.2.3 Business Case 3: AZADORA

AZADORA Company aims at designing and producing technical sportswear and outerwear. By using the previous digitalization process, we generated 1 women sportswear of tight style with 5 different sizes and 5 fabrics. One example is given below.

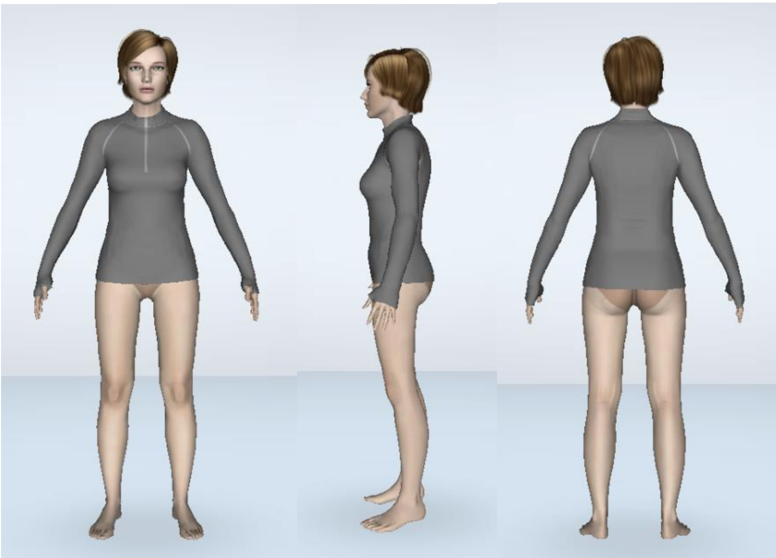


Figure 10: Women sportswear visual fitting effect with 364 Aldabra Carvico fabric

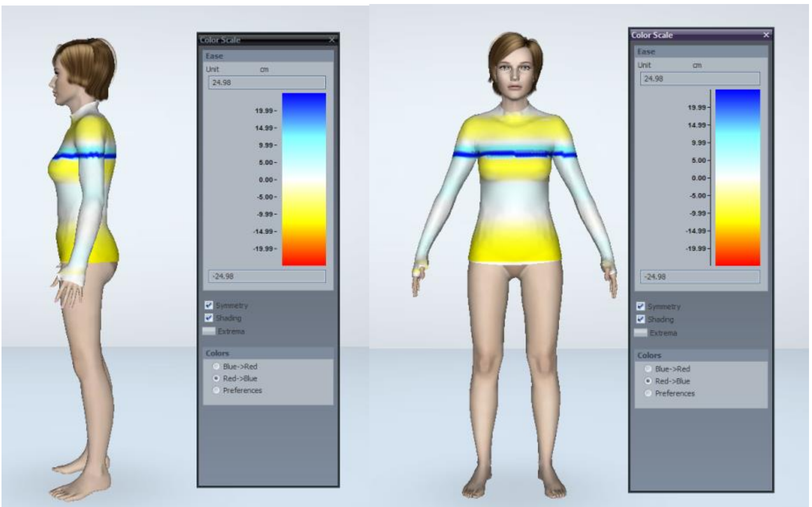


Figure 11: Women sportswear pressure fitting effect with 364 Aldabra Carvico fabric

Similar to the Business Case 2, from Figure 10 and Figure 11, we can check the designed sportswear fitting effect in terms of appearance and fabric pressure on the skin at different body positions.

2.2.4 Business Case 4: BESTE

BESTE Company aims at designing and producing Men's Fashion Urban Wear and Performing Clothing. By using the previous digitalization process, we generated 1 raincoat with 5 different sizes and 5 fabrics. One example is given below.

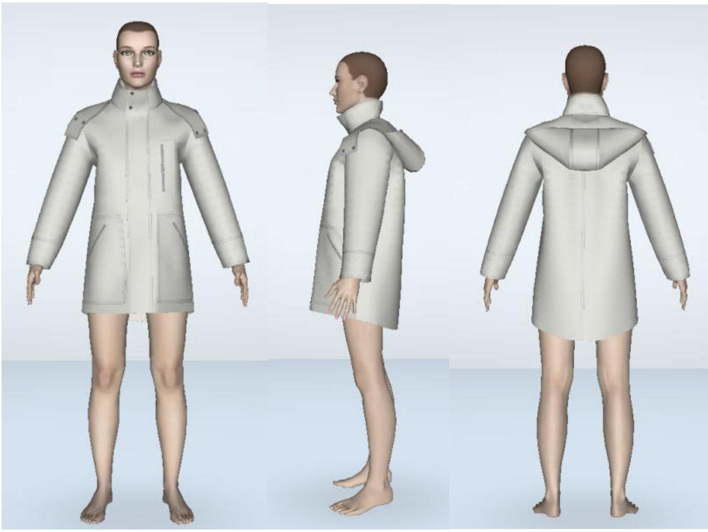


Figure 12: Raincoat visual fitting effect with 124 Lectra fabric

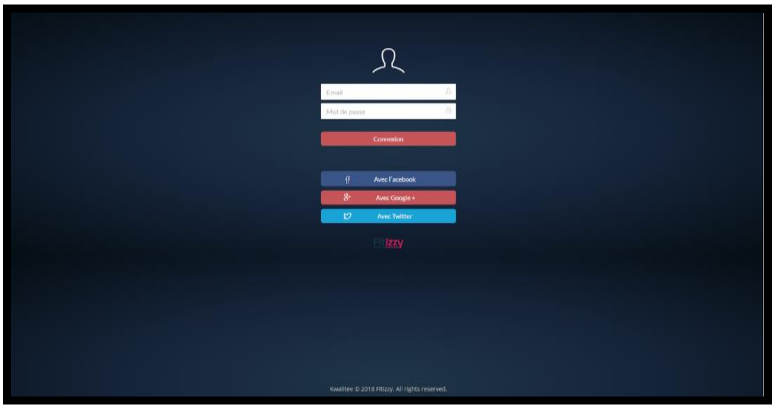
Figure 13: Raincoat pressure fitting effect with 124 Lectra fabric

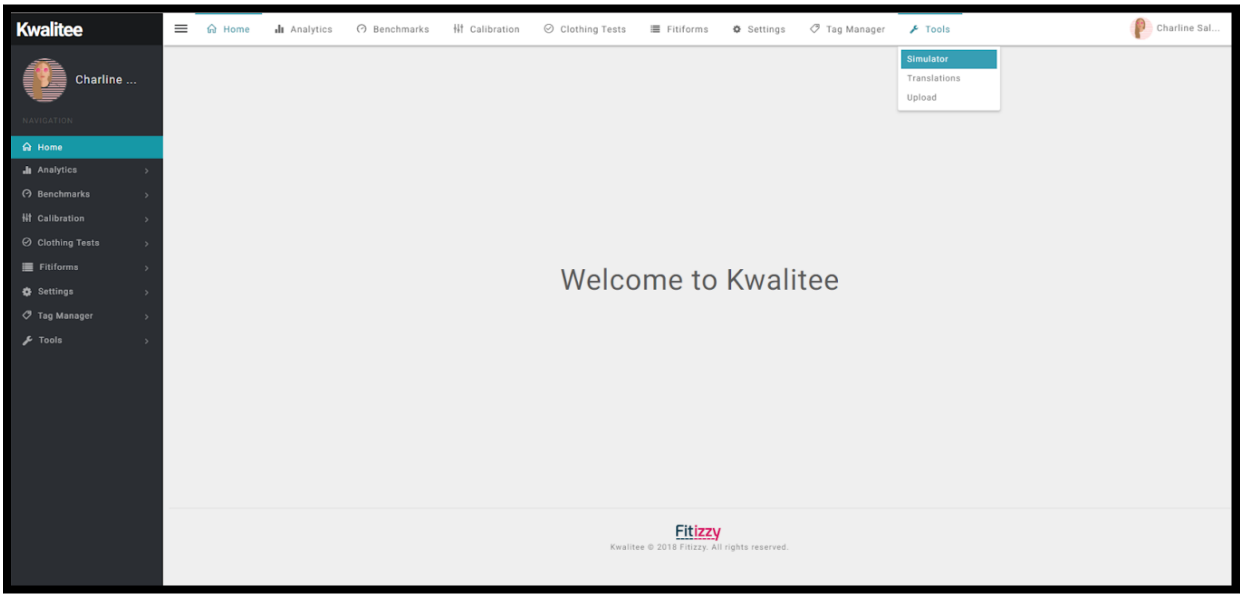
In this context, as the garment style is relatively loose (white and blue colors), the pressure between fabric and skin represents ease allowance, i.e. distance between the fabric surface and skin.

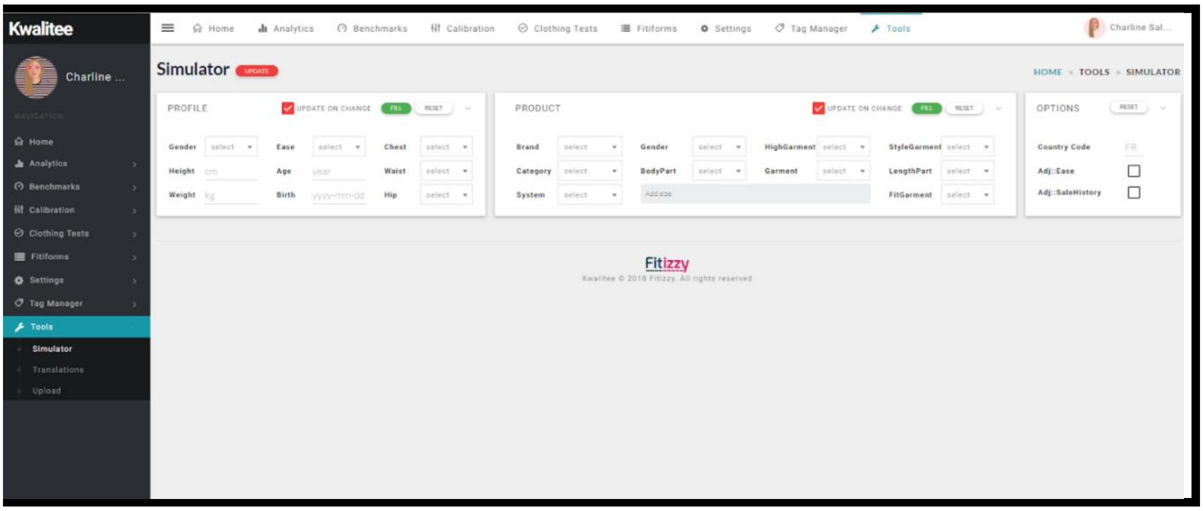
3 Digital Products in the Platform

3.1 Front development of the interface based on the mock-ups

From M7 to M12, FITIZZY designed the 1st mock-ups for the digital products to be developed.






Kwalitee
Charline ...
Home
Analytics
Benchmarks
Calibration
Clothing Tests
Fitiforms
Settings
Tag Manager
Tools
Simulator
Translations
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PROFILE
PRODUCT
OPTIONS
Gender
Height
Weight
Ease
Age
Birth
Chest
Waist
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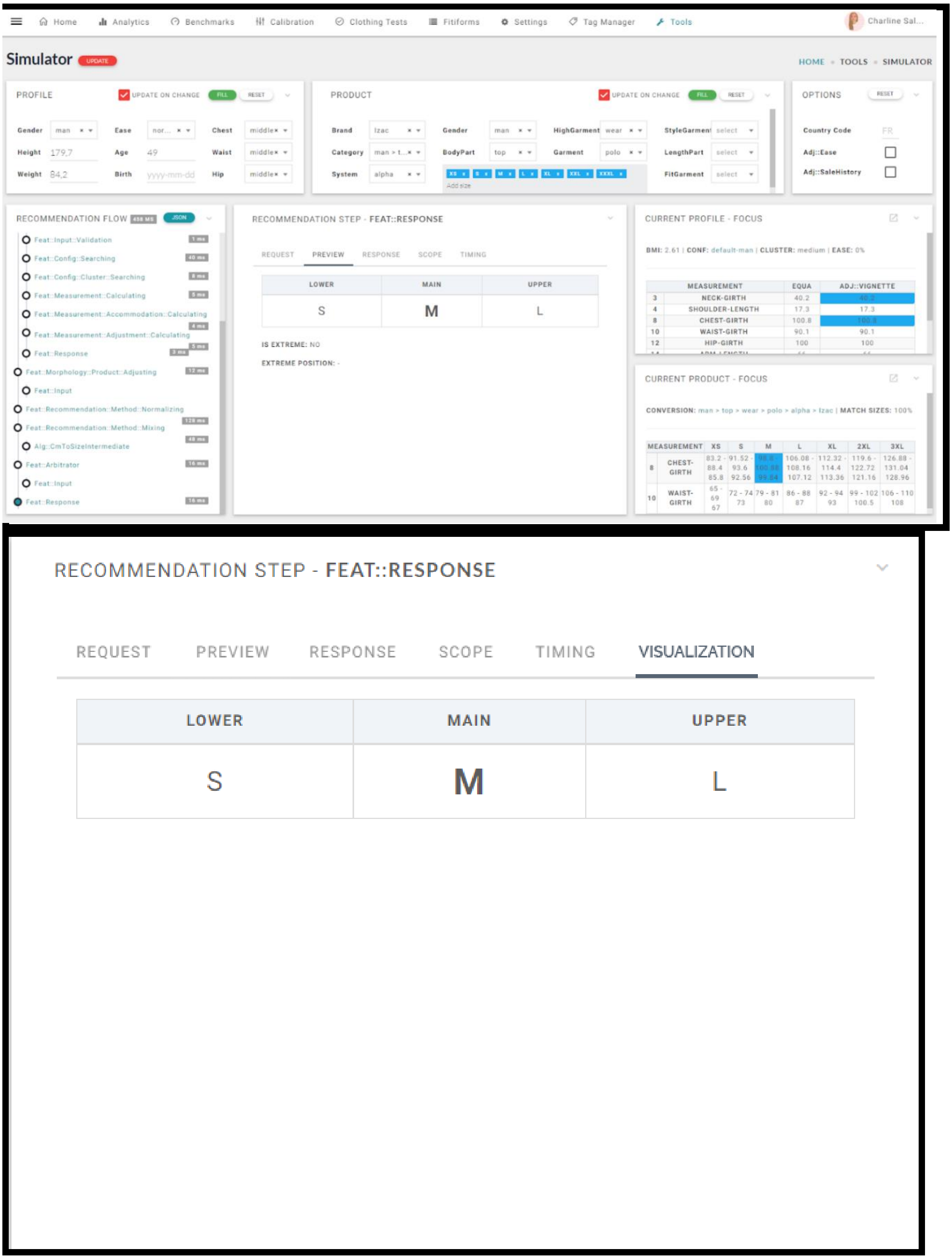


Figures 13: First design of the platform interface and the simulator for the visualization of the garments

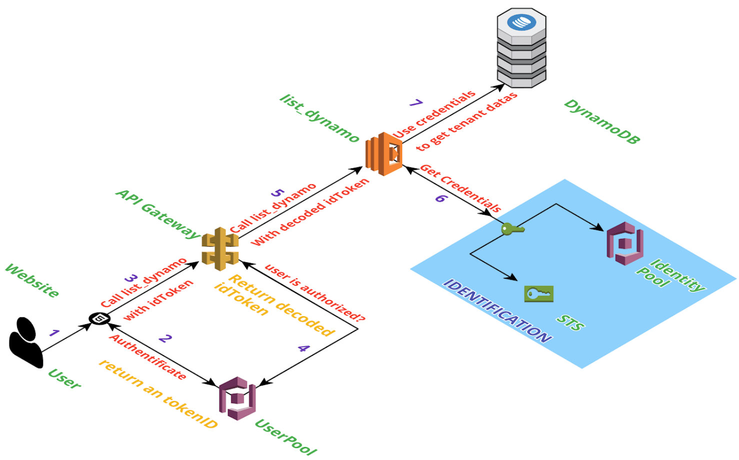
Next, from M13 to M16, after the Consortium validated the first mock-ups and the 4 user entries, an advanced version UX/UI was designed and proposed to the Consortium in Boras (M15) throughout videos and Adobe XD version to share comments.

From M19 to M21, last but not least, the UX/UI design has been developed in **REACT** (one of the best current language in front development).

3.2 Integration of the front development in the platform

In M22**,** the following technical services are integrated to provide a functional platform.

- **Multi-tenant service :**
    - Control rights and accesses for each partner granted in adequation with confidentiality and interests
    - Overall control and visibility for the ENSAIT to ensure smooth management
    - Use of AWS technologies :
        - Access control
        - Security assessment
        - Sensitive data classification
        - Threat detectio
        - Compliance reports



Figures 14: Example of tenant strategy to access data through AWS platform

Explanation:

- A user belonging to a specific company and which has a specific role wants to access some data. User accesses to the web platform, he connects and navigates to the page containing data he wants to consult. This action generates a call to a secure API to retrieve these data. The strategy is:

- The API is called and the request is decorated with user's authorization code
- The user's authorization code is checked and a tokenId is returned if the authorization code is valid
- The request is now decorated with user's tokenId
- The tokenId is checked to determine if the user has the right (from his role) to execute this type of operation on this type of data
- Once validated the right, the database operation can be executed
- The tokenId is exchanged by credentials linked to the scope (tenant) of the authorized data for this user
- The database operation is executed with these credentials, only data authorized for this tenant are returned

- **API back end**

The API has been developed.

- **Simulator**

The simulator has been implemented (cf demo 3.1.2 just below)

- **3D objects integration**

A process has been established to import the 3D files in the platform : Concerning the integration of the results in the platform, it has been proven that is feasible to implement an API between the platform and the solution Clo3D easily, thanks to the Clo-set service, which is part of the solution Clo3D. The process was :

- the designer export the files in one the following formats : ZPrj, ZPac ou AVT
- uploading of the files in clo-set
- requesting the clo-set API to get the ZREST Url of the file
- using the ZREST Url in the library

3.3 Demo of the two user journeys: B2C (consumers) and B2B (brands)

A demo version has been developed in September 2019, with the following access information:

Link: https://int-h2020.ftz.io/

- Consumer ->Login: demo@fitizzy.com / Password: Fitizzy2020!!

- Brand -> Login: demo-brand@fitizzy.com / Password: Fitizzy2020!!

In the same time, the team of ENSAIT created a database of digital fabrics and digital garments developed. The developed products are progressively added to this database. The link of this database is:

https://drive.google.com/drive/folders/1EYutVc9R12VE1oRiLxnZ6NiIfzzAI6ll

The corresponding technical parameters of these digital products can be found at:

https://drive.google.com/file/d/1Zn59z0g2ZNSUEavPV57-kHWeOnr_G8qf/view?usp=sharing

4 Conclusion

D6.2 corresponds to the Task6.2 of WP6, which is an important but very heavy task. It constitutes the foundation of several services to be created in WP4, especially IDS1 (classification of body shapes), IDS3 (fashion recommendation system), IDS5 (virtual fashion product evaluation and adjustment) and IDS6 (database and fashion knowledge base). The relevant data acquisition with concerned partners is a long process, requiring common efforts of all the brand partners, and research and IT partners.

Although the deliverable is realized much later related to the initially planned deadline due to different complex reasons such as human resource change, the current results are generally satisfactory and have no much impact on the other deliverables. The databases of digital products will be progressively improved by integrating new fabrics and new garments. Also, the related algorithms such as user interfaces and product visualization platform will also be further improved.

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[2] X.Tao, P.Bruniaux, "Toward advanced three-dimensional modelling of garment prototype from draping technique", International Journal of Clothing Science and Technology, Vol. 25 n°4.

[3] X.Tao, X.Chen, X.Zeng, L.Koehl, “A customized garment collaborative design process by using virtual reality and sensory evaluation on garment fit”, Computers & industrial Engineering, 2018; 115(10): 683-695.