
Software Requirements Specification

for
Nouvell's Shoes

Version 1.0

Requirements Engineering 2024/25l

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Executive Abstract

The Custom Product 3D Model Visualizer is a software solution designed to address a critical challenge for Nouvell's Shoes: enabling customers to confidently visualize and personalize their footwear. This system seeks to eliminate the uncertainty faced by the customers when customizing their shoes and increase the sales team's ability to communicate the value of these personalized options.

The proposed software provides an intuitive platform where customers can explore a extensive catalog of customization options, filter choices by cost, delivery time, or features, and interactively modify their selections. Through a realistic, real-time 3D model allows them to preview their customizations with precision, fostering confidence and satisfaction. Additionally, the software integrates secure payment processing and order placement functionalities for both customized and standard products. This streamlined workflow ensures a seamless customer journey, from product design to checkout, while supporting the sales team in driving engagement and conversions.

Our motto, "Connecting suppliers and clients for better shoe design," reflects our commitment to fostering collaboration and innovation in footwear customization. By bridging the gap between customer preferences and supplier capabilities, we aim to create a seamless experience where clients can bring their unique designs to life while suppliers efficiently meet these demands with high-quality materials and craftsmanship.

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1 Introduction

This Software Requirements Specification (SRS) document provides an overview of the requirements and goals for addressing the problem faced by the company Nouvell's Shoes, which is a company that sells ceremonial shoes. This introduction gives a brief explanation of the purpose and scope of the software, as well as some relevant details about this one. here it is also stated definitions/abbreviations, external references and a guide to the structure of this document.

1.1 Purpose

The purpose of this SRS is to outline the requirements needed for developing a software system designed to address Nouvell's Shoes' challenge of enabling customers to visualize the final result of personalized products. The system aims to showcase all available features and the extensive catalog of customization options, ensuring that customer needs are met effectively. By providing a realistic and interactive visualization of personalized products, the solution seeks to enhance customer engagement, ease the sales process, and improve overall satisfaction.

The intended audience for this SRS includes the project development team responsible for implementing the application, as well as stakeholders at Nouvell's Shoes, such as the owners, sales team, and other relevant workers involved in the project.

1.2 Scope

The software to be developed is a Custom Product 3D Model Visualizer, which will showcase personalization features and provide a realistic 3D model of the chosen customizations. This tool aims to improve the customer experience by making the customization process much more intuitive and transparent.

It is important to refer what we pretend that the software is able to do or not do so, firstly, is mentioned what the software will do followed what won't do.

What the software will do: The software will allow customers to visualize the final appearance of their customized products through an interactive 3D model that reflects their custom choices. The process will begin with the customers exploring a catalog that presents all available personalization options in an interactive manner. Once selections are made, the software will generate a 3D representation, allowing the customers to visualize exactly what their customized product will look like and if corresponds to their needs.

The software will include a filtering system, enabling customers to sort their customization options based on factors such as cost, estimated delivery time, and the specific features or enhancements they desire. This functionality ensures that customers can efficiently explore personalization choices that align with their preferences and constraints, improving the decision-making process.

The software will also offer customers the option to modify their choices on-the-fly, ensuring they have a clear understanding of the product they are creating. This iterative process will boost customer confidence, aid decision-making, and provide a less stressful shopping experience. By offering transparency and flexibility, the software is expected to drive greater interest in personalized products and improve overall sales performance.

Additionally, the software will integrate a payment system, allowing customers to securely input their payment details and finalize their purchase. Upon completion, customers will receive a detailed confirmation email outlining the specifics of their purchase, whether for a customized or non-customized product. This feature not only simplifies the checkout experience but also ensures a reliable and professional follow-up, contributing to customer satisfaction and trust.

What the software will not do: The solution will not address supply chain communication issues or provide real-time updates on material availability or restock dates.

The main goal of this software is to enhance customer engagement and satisfaction by bridging the communication gap between the sales team and the customer. By presenting visually appealing, accurate representations of personalized products, the software will be able to solve a significant challenge faced by the sales team in communicating the value and appeal of their products, overcoming, this way, a significant hurdle in their sales process.

For customers, the software will help to reduce the customer hesitation by providing a clear and realistic visualization of their customized product, ensuring they are confident in their purchase. This will be essential to avoid customers to either settle for a non-personalized product that feels less tailored to their needs or, worse, turn to competitors who can provide a clearer and more appealing purchasing experience.

1.3 Definitions, Acronyms, and Abbreviations

Term	Definition
Nouvell's Shoes	The company commissioning the development of the software solution.
Custom Product 3D Model Visualizer	The software product designed to provide a realistic visualization of personalized products.
Personalized Product	A product that can be customized according to the customer's preferences, such as color, material, pattern between others.

Table 1.1: Definitions

Acronym/Abbreviation	Full Form
SRS	Software Requirements Specification
3D	Three-Dimensional

Table 1.2: Acronyms and Abbreviations

1.4 External References

The following documents and resources were referenced during the preparation of this SRS:

Internal problem statements and data from Nouvell's Shoes, provided by Paulo Borralho (contact: nouvellshoes.paulo@gmail.com).

Nike By You - <https://www.nike.com/u/custom-nike-p-6000-by-you>

Ray Ban - <https://www.ray-ban.com/portugal/c/customize>

Louis Vuitton: <https://br.louisvuitton.com/por-br/reportagens/personalization>

1.5 Document Overview

This SRS document is organized to provide a comprehensive understanding of the software project and its requirements.

- **Section 1: Introduction** — This section introduces the purpose, scope, definitions/acronyms/abbreviations, external references, and the document's overall structure.
- **Section 2: Overall Description** — Provides an overview of the product's perspective, key functions, design context, constraints, assumptions, and dependencies.
- **Section 3: Specific Requirements** — Details the functional requirements, including user stories, workflows, use cases, navigation layouts. This section also addresses quality attributes, shows the business, legal, and regulatory constraints and presents wireframes to validate usability.
- **Section 4: Requirements Engineering Techniques Assessment** — Describes the techniques used to capture, refine, and validate the requirements.
- **Annexes** — A series of annexes provide additional details, including:
 - Annex A: Full List of Requirements (Functional, Non-functional, Business, and Legal/Regulatory).
 - Annex B: Traceability Matrix to track requirement fulfillment.
 - Annex C: High-resolution diagrams.
 - Annex D: Survey results related to the project.

2 Overall Description

This section provides a general overview of the product and the context in which it will operate. It does not state specific requirements but offers background information to facilitate a deeper understanding of the detailed requirements described in Section 3.

2.1 Product Perspective

The Custom Product 3D Model Visualizer is a dependent software application designed to enable customers to visualize their personalized shoes in real time. This system is intended to complement and interact with other applications within Nouvell's Shoes' ecosystem. Specifically, it relies on a backend application to provide critical data on the availability of customization features, and restock dates.

It is important to refer that this dependency requires that the backend application works as a reliable source of up-to-date information of what comes to suppliers information, then the Visualizer will access to this data through interfaces, that will allow the communication between the backend application and the visualizer, ensuring a accurate availability and restock data.

The Visualizer is a solution designed for deployment on tablets, smartphones, or other touchscreen devices in physical store, this system will integrate an advanced 3D modeling technology in order to meet the customization problems identified earlier.

The following context diagram illustrates the relationship between the Custom Product 3D Model Visualizer and other components of the ecosystem:

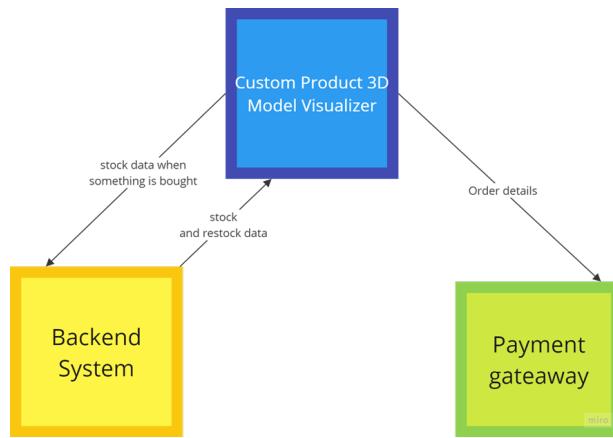


Figure 2.1: Context Diagram.

It is essential to have in mind that the Visualizer will need this data inputs from the backend system:

1. Availability os customization features.
2. Stock levels for each feature.
3. Estimated restock dates for out-of-stock options.

2.1.1 Relate to existing solutions

The importance of real-time customization and interactive 3D settings has been demonstrated by several leading brands in the fashion and accessories industries:

- Nike By You: Allows customers to create their own shoe design, selecting colors and materials, supported by an intuitive 3D visualizer.
- Ray-Ban: Offers a 3D configurator for sunglasses, allowing users to customize frame and lens colors and even add engravings.
- Louis Vuitton: Provides a personalization system for wallets, bags, and accessories, allowing customers to preview customized prints, colors, and initials using 2D models. While the platform does not utilize 3D models, it provides a preview of the personalized product to enhance the customer experience.

Beyond fashion and accessories, several other brands in the consumer goods sector are embracing similar technologies to enhance customer engagement:

- IKEA and Wayfair: Employ augmented reality (AR) features, allowing customers to visualize items within their own spaces before purchase, improving decision-making and satisfaction.

These examples highlight that personalized experiences in e-commerce are important to many big companies around the world. This aligns with the vision shared by Harley Finkelstein, COO of Shopify, he believes that the ability to personalize products in real time using 3D technologies reflects the evolution of digital retail, where “the customer is not just a passive buyer, but a co-creator.” He said this is essential to capture younger generations who value authenticity and exclusivity. Such insights suggest that the proposed software will offer a significant competitive advantage for Nouvell’s Shoes.

Ensuring the feasibility of the application requires strict adherence to regulatory and legal standards. For custom shoes, there may be intellectual property considerations, as well as compliance with consumer protection laws around product descriptions, materials used, and warranty claims. Modern platforms can help by automating compliance tracking, ensuring that companies meet all necessary legal standards without compromising efficiency or creativity. According to European Union legislation, footwear, when placed on the market, must be labeled indicating the material used in its manufacture.

Historically, personalized product manufacturing has often relied on manual processes for communication with suppliers and visualizing product outcomes. While effective in the past, these practices lack the responsiveness and transparency that today's market demands. By challenging these traditional methods, there is an opportunity to introduce a more agile, technology-driven approach that not only allows customers to visualize their personalized products in real time but also allows to explore available options efficiently and make changes seamlessly during the creation process.

Table 2.1: Attributes of Other Solutions

Solution	Attributes	Requirements	Insights
Nike By You	Extensive customization, real-time 3D visualization and sharing system	Online access, user account	Offer an extensive selection of customizable components, complemented by a vast catalog of models, colors, patterns, textures, and materials, enabling customers to express their unique style. Incorporate a highly detailed 3D model for accurate visualization.
Ray-Ban	3D configurator for frames and lenses, engraving options, AR model that makes use of webcam to try on the glasses	Web-based application, user account	Include a big variety of base models. Opt for a simple interface in order to not push away customers
Louis Vuitton	Customization for bags, options for colors, prints, initials	User account, Online access	Provide a range of price points tailored to different levels of customization, ensuring accessibility for a broader audience. Additionally, design a user-friendly interface that is intuitive and straightforward, making it accessible to users of all skill levels.

2.2 Product functions

The major functions of the Custom Product 3D Model Visualizer include:

1. **Filtering System:** Enable users to refine their customization options based on specific criteria such as cost, delivery time, and design features. Users should be able to set a cost limit and sort options in ascending order of price. For delivery time, provide the ability to set a deadline and arrange options by delivery date.

Additionally, allow users to prioritize design features, with the ability to sort by popularity or most-sold features.

2. **Interactive Customization Catalog:** Providing an interface for users to browse, select, and combine various options to create their desired product.
3. **Modification Tools:** Enabling customers to make real-time adjustments to their selections during the customization process.
4. **Real-time 3D Visualization:** Allowing customers to preview their customized shoes with accurate rendering of selected features, including materials, colors, and textures.
5. **Order Placement:** Allowing customers to secure checkout and place their orders directly through the visualizer platform. Receiving a detailed confirmation email summarizing the specifics of their purchase.

These functions will help to improve the customer engagement, reduce uncertainty in purchasing customized products, and support the sales team's efforts to promote the quality of their customized products.

2.3 Product Context

2.3.1 Contextual Design

By analyzing current workflows, client needs, and supplier interactions, we aim to develop a user-focused design platform that enhances client engagement. We conducted the contextual interviews in the store in Torres Novas, in early October. The interviewed users were:

- **Paulo Borralho:** Nouvell's Shoes store manager, nouvellshoes.paulo@gmail.com.
- **Telmo Montes:** Nouvell's Shoes suplier, 919 542 387.

Each profile provided insights into the client's journey, internal design workflows, and supplier interactions central to the scope of this project.

Information Flow

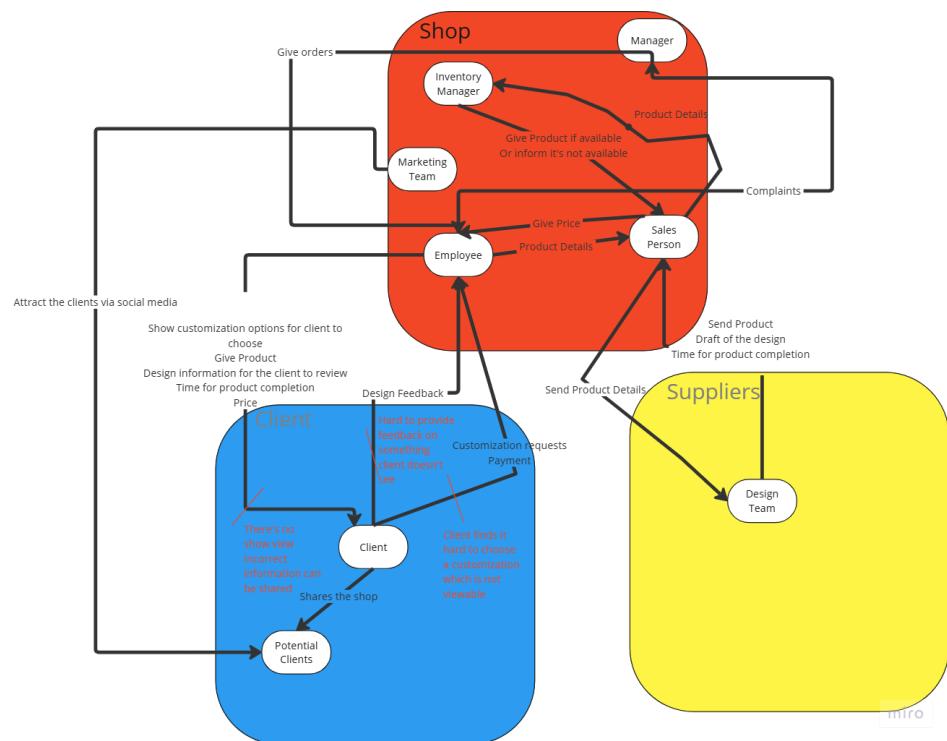


Figure 2.2: Flow Model

Cultural Model

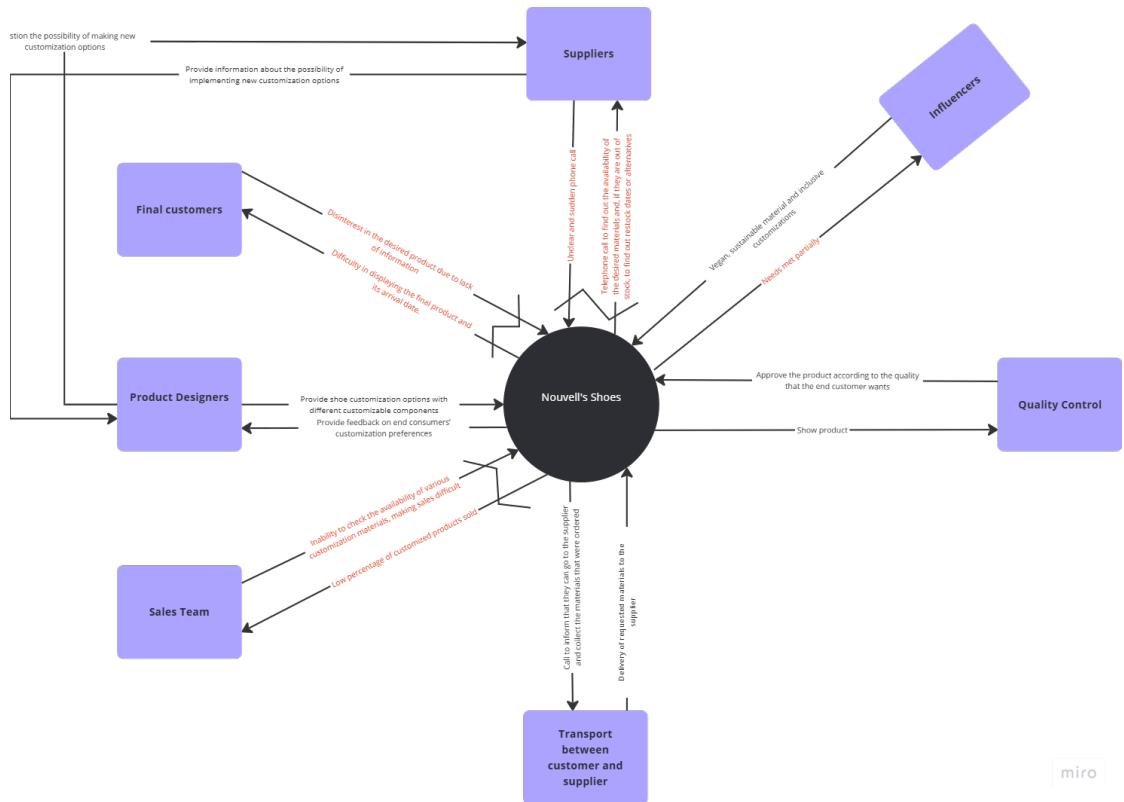
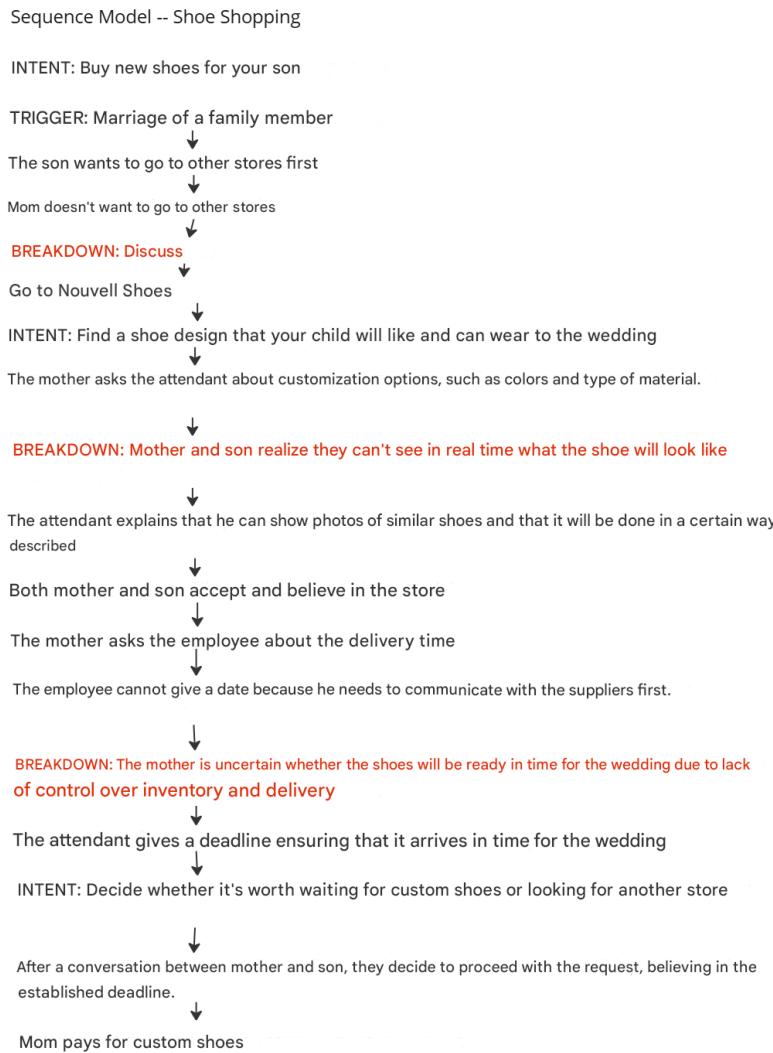


Figure 2.3: Cultural Model

Sequence



Fruit

Figure 2.4: Sequence Model

Physical

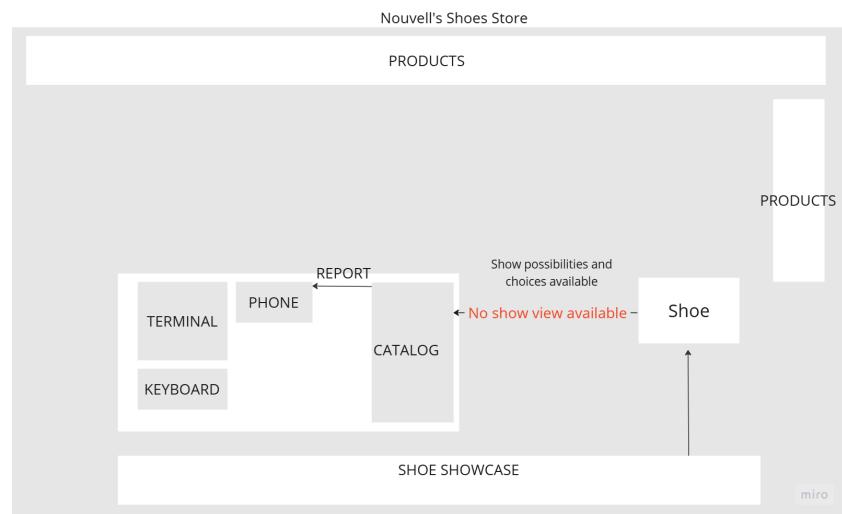


Figure 2.5: Physical Model

Artifact



Figure 2.6: Artifact Model

2.3.2 Affinity Diagram

Problems of Communication	Customization Problems	Nouvell's Shoes Info
Phone calls are inconvenient and provide information at the last minute	The consumer feels some hesitation choosing models that cannot be seen, often opting for the ones that are in the store exhibited	Shop focused on client needs and preferences
The lack of communication between the supplier and the client results in stock shortages	Inform the client about all the customization possibilities.	Declining sales in personalized products due to missed deadlines
There is a lack of communication between supplier and client due to the fact that phone calls are inconvenient and not practical		
These items tend to be requested with a deadline associated; avoiding delays could be beneficial		

Table 2.2: Affinity Diagram

2.3.3 Breakdown resolution

BRK.ID	Description	REQ.ID
BRK001	No shoe visualization	FR008
BRK002	Hard to customize	FR001-8
BRK003	Hard to give shoe feedback	FR008
BRK004	Bad suppliers communication	N/A

Table 2.3: Breakdown resolution

2.3.4 Personas

Carlos, a inventory manager

Demographics

Carlos is a 42-year-old inventory manager with very little experience in supply chain logistics. He is responsible for tracking materials and coordinating orders with suppliers.

Behaviours

Likes efficiency and clear communication
Dislikes manual tracking



Struggles

He frequently faces delays and communication breakdowns that disrupt production schedules. Carlos is frustrated by the lack of real-time updates from suppliers and relies heavily on phone calls and emails to confirm shipments.

Needs & Goals

He needs an integrated inventory system with automated supplier updates, so he can manage stock accurately and ensure that production runs smoothly.

miro

Figure 2.7: Persona 1

Carolina, Nouvell's Client

Demographics

Carolina is a 28-year-old marketing professional. She regularly visits Nouvell's Shoes.

Behaviours

Likes having customized footwear in her wardrobe
Dislikes the customization on paper



Struggles

She finds the paper-based process slow and limiting, as it's hard to visualize her choices or make changes on the spot.

Needs & Goals

She is excited about the possibility of an online platform, where she could explore designs interactively and see real-time previews of her choices before finalizing her order. She hopes an online tool would make her design experience quicker, easier, and more creatively engaging.

miro

Figure 2.8: Persona 2

<p>Manuel, leather supplier</p> <p>Demographics Manuel, 50, owns a local leather supply business that works with artisans and small footwear companies like Nouvell's Shoes</p>	<p>Behaviours Likes providing quality materials Dislikes inconsistent orders</p> 
<p>Struggles Struggles to keep up with Nouvell's ordering system, which often requests rush deliveries or unexpected quantities</p>	<p>Needs & Goals Manuel would benefit from a more predictable order process that allows her to plan inventory better and reduce last-minute logistics issues. A reliable communication system would help her align with Nouvell's production timelines and minimize delays on both ends.</p> <p style="text-align: right;">miro</p>

Figure 2.9: Persona 3

2.4 Constraints

The software for Nouvell's Shoes is designed to be simple and efficient, with minimal complexity and few constraints. However, there are key considerations related to data security and hardware limitations that must be addressed to ensure smooth operation. These constraints are outlined below.

- GDPR: Nouvell's Shoes collects some customer data. The company must ensure data security, protecting customer information from unauthorized access.
- Hardware limitations: The software should run on the store devices, which might be limited. The system must be developed ensuring it will not need advanced hardware to run.

2.5 Assumptions and Dependencies

This section outlines the factors that may influence the requirements for Nouvell's Shoes customization software

- **Access to 3D Rendering Libraries:** The system assumes the availability of reliable 3D rendering libraries (e.g., WebGL or Three.js) to provide real-time visualizations of customized shoes. Any changes or unavailability of these libraries could require adjustments to the customization interface.
- **Integration with Payment Gateway:** The software relies on a stable and secure payment gateway (such as Stripe, PayPal, or another service) to handle

transactions. Any issues or changes in the payment gateway's API could impact the checkout process and require modifications to the software.

- **Inventory Management System:** The software assumes that an up-to-date inventory management system is available and accessible for real-time stock updates. This system will ensure that the customization process reflects the available materials and styles of shoes. If this system is unavailable or changes significantly, the software's functionality related to stock management would need to be adjusted.
- **Operating System and Hardware Requirements:** The software assumes that store devices will run on widely-used operating systems (such as Windows or macOS) with sufficient hardware specifications to support the 3D customization and visualization features. Any change in store hardware or operating system may require optimization of software.
- **Internet Connectivity:** The system assumes reliable Internet access to allow customers to access the customization tool and complete transactions. Inconsistent or slow internet connectivity could disrupt the customization and purchasing process, requiring potential modifications to handle such issues.
- **Customer Data Privacy Compliance:** The software depends on the assumption that customer data privacy regulations (e.g., GDPR) will be complied in the design and implementation. Any changes in data privacy laws could require updates to the software's data collection, storage, and processing features.

3 Specific Requirements

3.1 Functional Requirements

3.1.1 User Stories

User Story 1

As a customer, I want to view a 3D model of the customized product I designed so that I can ensure it meets my expectations before making a purchase.

User Story 2

As a customer, I want to purchase a product that I have customized according to my preferences, so that I can have a unique, personalized item that reflects my style.

User Story 3

As a customer, I want to filter my customization options based on criteria such as cost, delivery time, and specific design features, so that I can easily find a product that meets my needs.

3.1.2 Workflows (BPMN)

In the following section, we present the Business Process Model and Notation (BPMN) for our customized shoes application. This model outlines the key processes involved in the system's operation, providing a clear overview of its efficiency and simplicity. Through the BPMN, we demonstrate the system's practical value and reliability in handling high-traffic events, showcasing how it enhances the customizing shoes experience for users and also the organizing the requests with the suppliers.

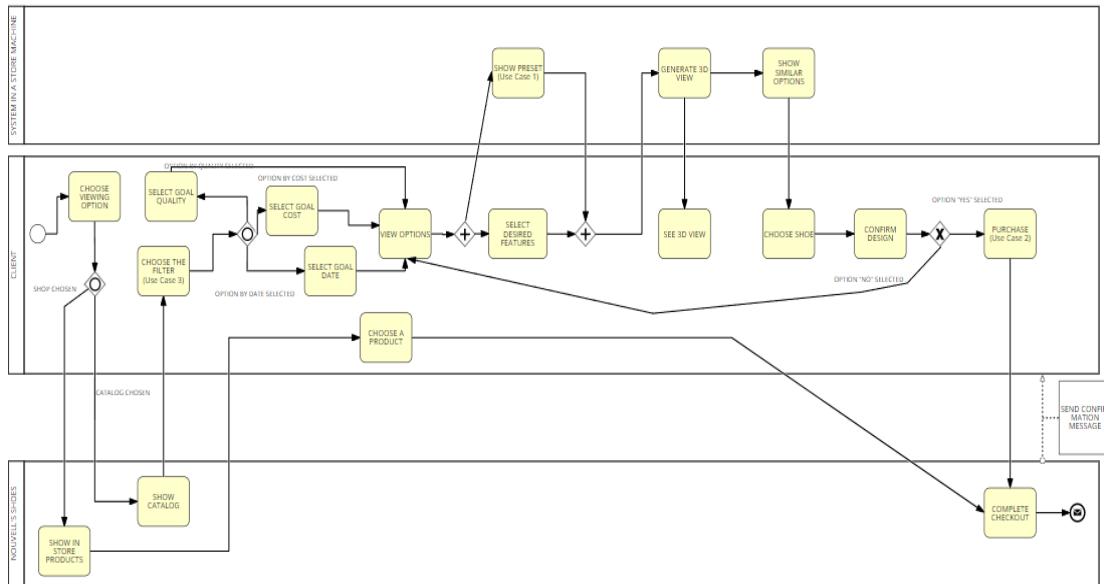


Figure 3.1: 1.Workflow

3.1.3 Use Cases

Nouvell's Shoes is a family-owned company that specializes in customized footwear and apparel. The company prides itself on providing unique and personalized designs tailored to individual customer preferences. However, one of its main challenges lies in the inability to offer customers a real-time preview of their personalized products, which affects customer satisfaction and decision making during the purchasing process.

Use Case 1 - View a customized product in real time

Use-case Context Diagram

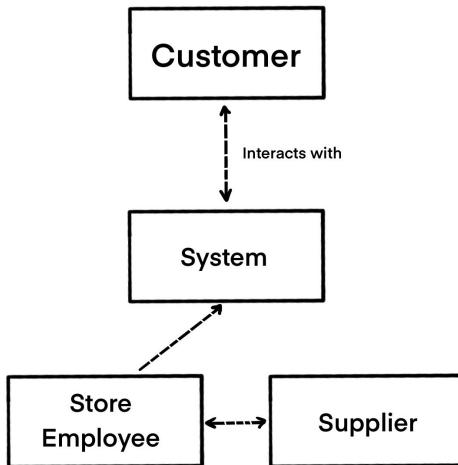


Figure 3.2: Use-case 1 Context Diagram

Description of the actors

Customer - The customer is looking for a customized product, so to visualize what he desires, interacts with the system viewing previews of the customized product he has in mind.

Employee - It is the one responsible for checking the availability of the features in the customized product and inform the customer about the options or the re-stock dates.

Supplier - Provides updated information on availability and restock dates externally, which is manually input into the system by employees to ensure accurate data are available for customers.

System - Provides a 3D modeling of the product that client's customer desires and then shows different outputs of diverse alternatives. Taking into consideration costs, arrival dates and re-stock dates.

ID+Name	1.View a customized product in real time
Level	Sea Level
Source	Client
Description	View a customized product created by customer through a 3D model
Minimal guarantees	If the preview fails, the system saves the current features selected by the customer.
Success guarantees	The customer identifies their ideal product and makes a purchase
Trigger	The system identifies the customer's interest in a more exclusive product or alternative features to enhance the product's appeal by selecting the option to customize the product.
Main actor	Customer
Secondary actors	Store employees, System
Preconditions	The system includes all the features ready for selection, along with a 3D modeling function.
Description of Step	The system receives a request for a customized product based on the customer's preferences (1). It processes the customer's selected features for the product (2), applies these customizations, and generates a corresponding 3D model (3). The system then presents the model for the customer's review, enabling them to decide whether to proceed with the purchase (4).
Exceptions	(2) Some features like textures and colors might not be available so it offers alternatives
Post-conditions	The customer buys the product and proceeds to checkout.

Use Case 2 - Purchase a customized product

Use-case Context Diagram

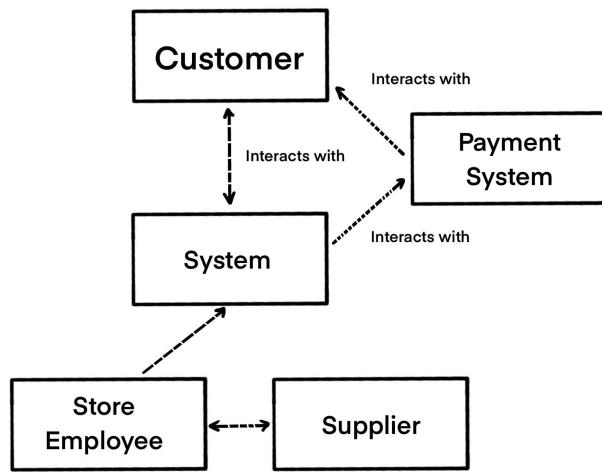


Figure 3.3: Use-case 2 Context Diagram

Description of the actors

Customer - The customer is the end user who wishes to purchase a customized product. They interact with the system to view, configure, and buy a product tailored to their preferences, such as color, material, and specific design.

Store Employee - The store employee assists the customer, if needed, by checking the availability of customized components and answering any questions about the product or the purchasing process.

Payment System - The payment system is responsible for securely processing the financial transaction between the customer and the company, ensuring payment confirmation and sending a purchase notification.

Supplier - Provides updated information on availability and restock dates externally,

which is manually input into the system by employees to ensure accurate data are available for customers.

System - The system supports all interactions by managing customer preferences, generating 3D models, processing transactions, and ensuring that the relevant data from the store and payment system are accurately integrated.

ID+Name	2.Buy a customized product
Level	Sea Level
Source	Client
Description	Purchase a customized product created by costumer
Minimal guarantees	If the purchase is not completed, the system will save the customizations.
Success guarantees	The customer finalizes the purchase with success and receive a confirmation with the details of the transaction and a preview of the delivering process.
Trigger	The system registers the customer's decision to purchase the customized product they created and visualized.
Main actor	Customer
Secondary actors	Store employees, Supplier, System, Payment Service
Preconditions	The customer creates a customized product in the system, and the product with all made customizations is available
Description of Step	The system registers the addition of a customized product to the shopping cart (1) and awaits the customer's confirmation to proceed with the purchase (2). It then verifies the availability of the product's components (3). Upon confirmation, the system prompts the customer to select a payment method and provide the necessary transaction details (4). Finally, the system processes the transaction (5) and generates a purchase confirmation, notifying the customer with the details (6).
Exceptions	(5) If the payment fails, the system shows a error message and allows the client to buy with a different payment method, retry or cancel.
Post-conditions	The purchase is registered in the system, the client receives a confirmation with the details of the purchase, and the payment is processed.

Use Case 3 - Filtering System

Use-case Context Diagram

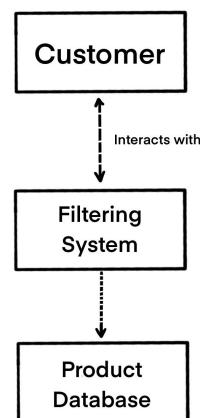


Figure 3.4: Use-case 3 Context Diagram

Description of the actors

Customer - The main user who interacts with the system to filter customization options based on specific preferences (cost, delivery time, design features).

Filtering System - The system that allows customers to apply filters and refine their options based on the provided criteria.

Product Database - A repository that contains all available product options and their respective details (such as cost and design features).

ID+Name	3. Filtering System
Level	Sea Level
Source	Customer
Description	Allows the customer to filter product customization options by cost, delivery time, and design features.
Minimal guarantees	If filtering fails, the system will notify the customer and keep the previously available options.
Success guarantees	The system will successfully filter the options and display results that match the customer's criteria.
Trigger	The system detects the customer's intent to refine product options by selecting the filter option.
Main actor	Customer
Secondary actors	Filtering System, Product Database, Delivery System
Preconditions	The customer is logged in and has access to the product catalog.
Description of Step	The customer selects filtering criteria such as cost, delivery time, and design features (1). The system applies the selected filters to the product catalog (2) and displays a list of products that match the criteria (3). The customer reviews the filtered products and selects one for further customization or purchase (4).
Exceptions	(1) No products match the filter criteria. (2) The system experiences an error while applying the filters.
Post-conditions	The filtered products are displayed, showing those that meet the customer's preferences

3.1.4 Navigation layout (UED)

In this section, we present the navigation layout developed for our application.

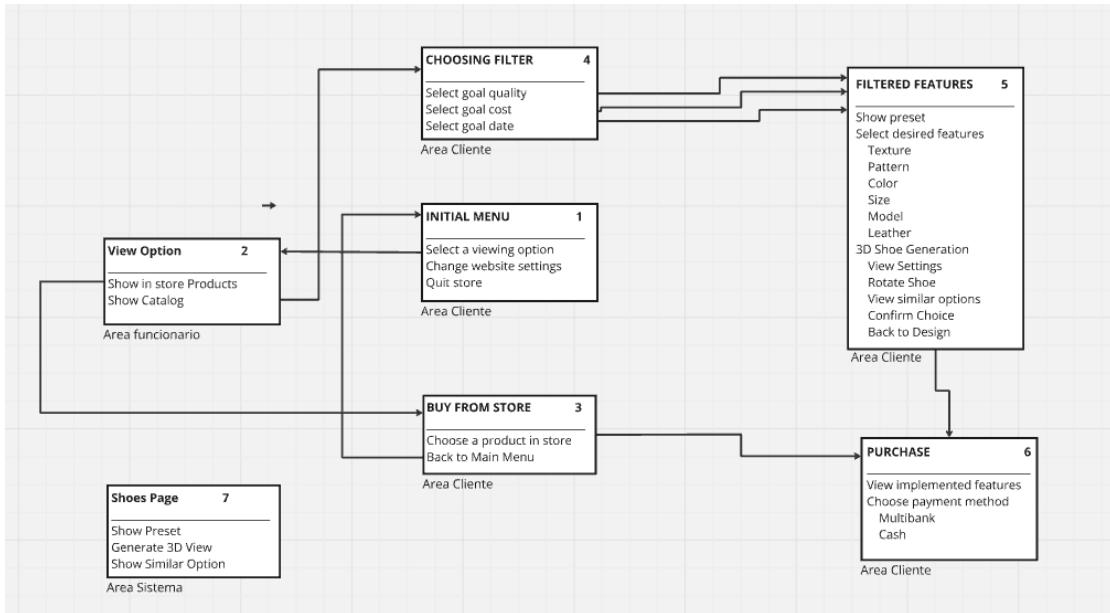


Figure 3.5: UED

This layout was designed to provide an intuitive and efficient user experience for the end customer, the employee, and the system.

3.2 Quality Attributes

3.2.1 Quality Attribute concrete scenario

Quality attributes are crucial for Nouvell's Shoes to provide a reliable, secure, and efficient experience for personalized previews and transactions. This section defines these attributes, illustrates them with scenarios, and outlines how they'll be balanced to meet customer and business goals.

We will divide the attributes from our system in 2 groups, important for users and developers.

Important for Users

- Efficiency: Our system is very simple and doesn't require too much processor capacity. The most resource-intensive use case is the real-time rendering of the 3D model as users make customizations, but even this process is optimized to require minimal CPU and RAM capacity. This ensures that the platform runs smoothly on a variety of devices, providing fast response times and promoting a good user experience. All the above information is based on our Benchmarking and performance tests of real-time rendering made in a variety of devices, giving

a average fps of 50fps, within the range of 30fps to 60fps and a response time of less than 1 second.

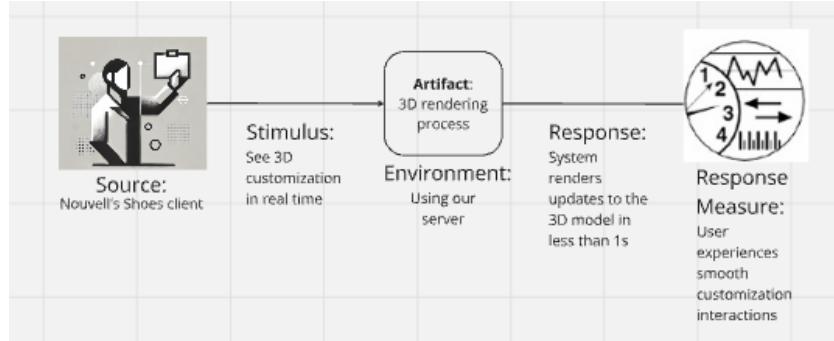


Figure 3.6: Efficiency Scenario

- Robustness: The system architecture includes mechanisms to ensure the robustness of the application, such as a persistent caching mechanism that is updated every 30 seconds, where if the editor saves a customized shoe, for example, but it fails for some reason, the editor shall be able to recover all changes made in the shoe being edited up to one minute prior to the failure after the editor is restarted.

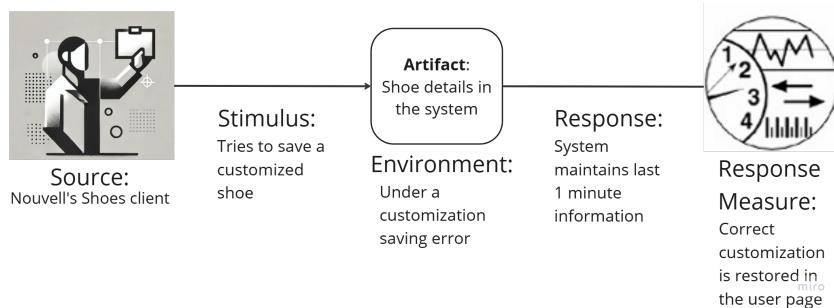


Figure 3.7: Robustness Scenario

- Usability: The system is very simple and user-friendly. Every input is connected to an output in real time, so users understand what they are doing. The menus are clear and direct, and the shoe customization offers a lot of options, with visual buttons.

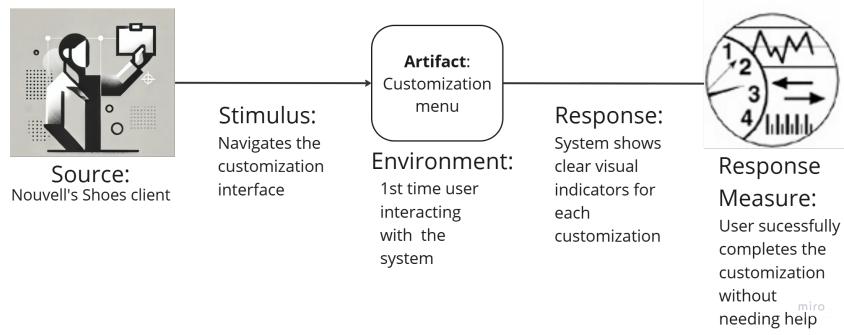


Figure 3.8: Usability Scenario

- **Fidelity:** The system offers a shoe model loyal to the real product. Clients will get the shoe they customized on the program. The system might not present the exact view, because the textures might be hard to show and colors might change slightly with the screen, but it accurately represents the design's overall appearance, proportions, and material choices.

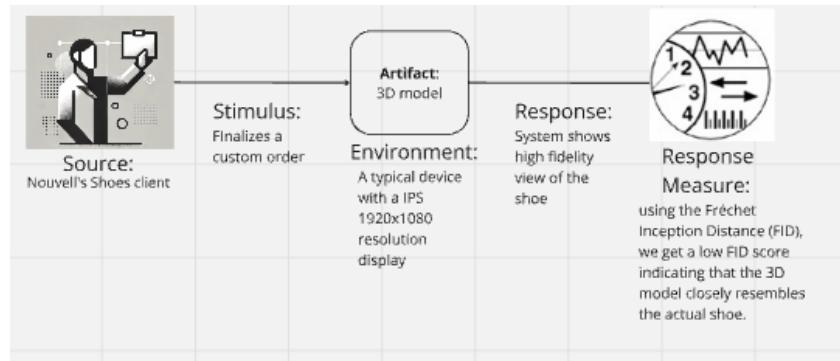


Figure 3.9: Fidelity Scenario

- **Portability:** The platform is designed to work across multiple environments, ensuring it functions consistently whether accessed on an iOS(version 14 or above) or Android device(version 11 or above), or viewed in Chrome(version 90 or above), Firefox(version 85 or above), or Safari browsers(Version 14 or above). Our system will also allow changing languages to include internationalization.

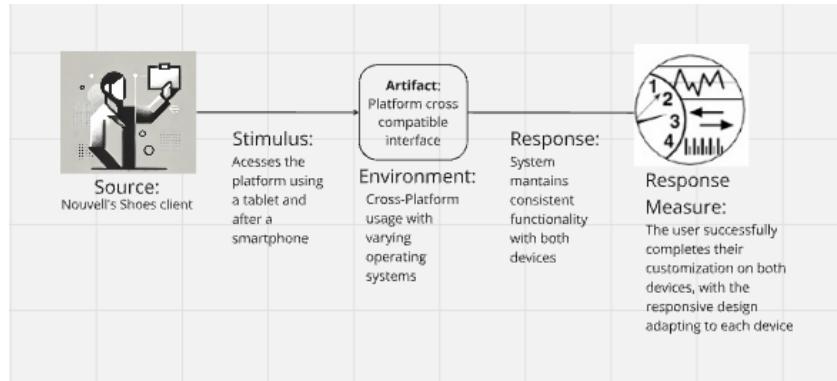


Figure 3.10: Portability Scenario

Important for Developers

- **Flexibility:** Our system is designed with flexibility in mind, making it easy to add new features and adapt to changing needs. For example, as customer preferences evolve, the platform can easily integrate new customization options, such as additional shoe styles, materials, or color choices, without requiring a major redesign. Similarly, if new payment methods or third-party services are introduced, the system can be updated to easily support these additions.

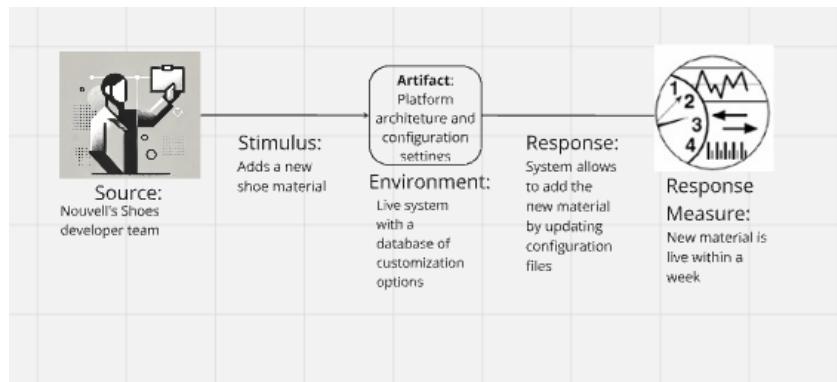


Figure 3.11: Flexibility Scenario

- **Testability:** Our system is organized to ensure that the addition of new functionalities does not compromise its testability, so a developer can test the product and change it if needed.

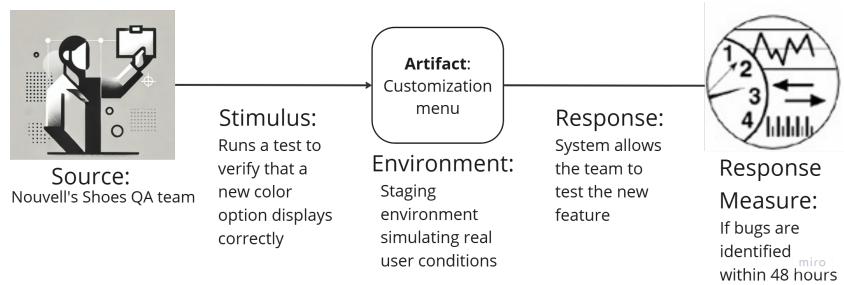


Figure 3.12: Testability Scenario

3.2.2 Conflicting Quality Attributes

While Nouvell's Shoes strives to balance quality attributes, conflicts may arise between certain goals, requiring strategic trade-offs.

Efficiency vs. Flexibility:

It is important to keep in mind that optimizing the system for efficiency, would imply minimizing resource use, this sometimes might conflict with the need for flexibility. For example, supporting a wide range of customization features or third-party integrations will require some additional processing power and memory, and this might impact the performance. To solve this conflict it would be useful to prioritize the optimization only in core functionalities such as the 3D rendering, and use modular design patterns allowing updates without impacting efficiency.

Efficiency vs. Fidelity

Efficiency emphasizes minimal CPU and RAM use, ensuring smooth performance across a variety of devices. However, Fidelity aims to provide a highly accurate and realistic representation of the customized shoe. The effort to render complex textures and maintain color accuracy might conflict with efficiency goals, as achieving higher fidelity often requires more processing power and computational resources. To help this, the system should prioritize visual accuracy(fidelity) over performance, allowing it to deliver realistic shoe representations without excessive resource demands.

Robustness vs. Efficiency

Robustness requires the system to save and recover changes frequently, ensuring data integrity and user satisfaction in case of failure. However, frequent saving (e.g., every minute) could conflict with Efficiency, as these operations may add processing overhead, especially during the real-time rendering of 3D models. To fix this, the system should implement adaptive saving protocols that prioritize data integrity while minimizing the impact on performance, such as saving changes at intervals only when necessary or during low-usage periods.

3.3 Business constraints

3.3.1 Business Model Canvas

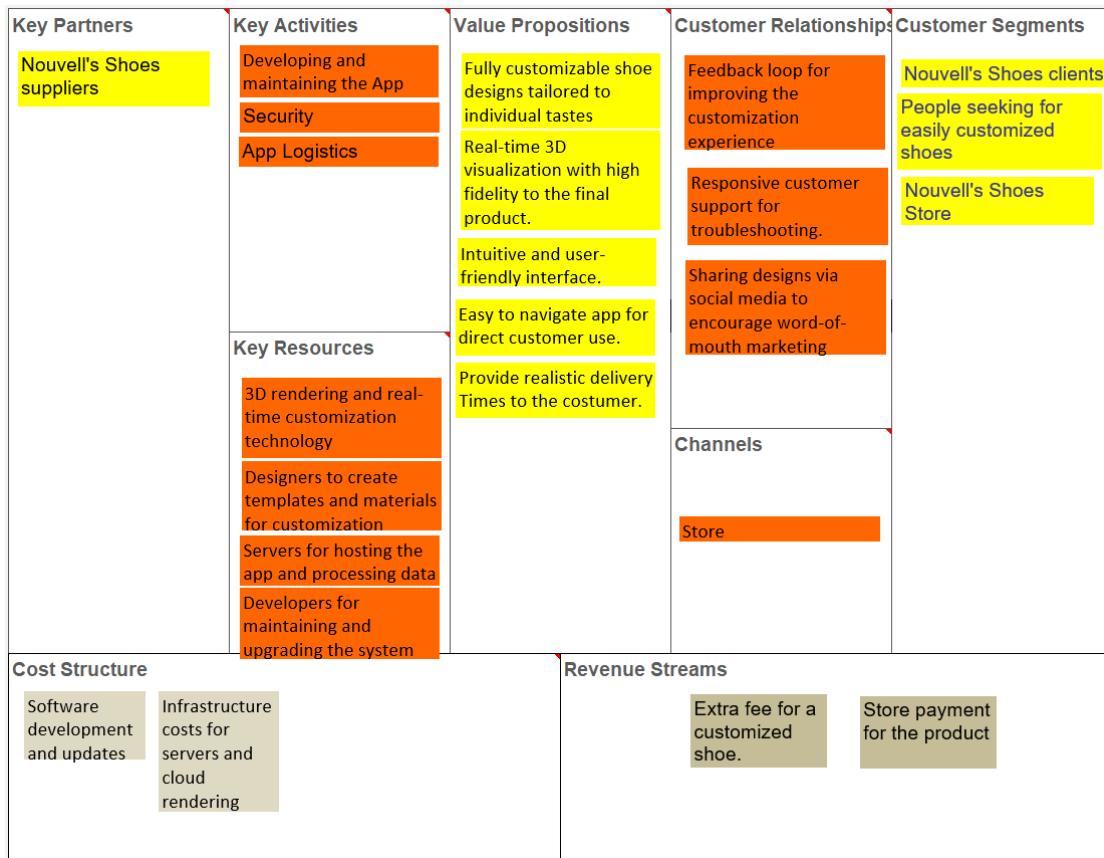


Figure 3.13: BMC

This business model focuses on creating a profitable software solution for Nouvell's Shoes through two primary revenue streams: customization fees for personalized shoe designs and direct product sales. The software adds value by enabling real-time 3D visualization and customization, which can justify a premium price for customized footwear and attract customers seeking unique products.

On the cost side, the business must account for software development and updates, as well as the infrastructure costs for cloud servers used in rendering 3D models and hosting the platform. Maintenance and customer support systems also contribute to ongoing expenses. This model balances these costs with a scalable revenue structure, using customization to drive additional profits while maintaining operational efficiency.

3.4 Legal and Regulatory constraints

Among the following regulations: GDPR, HIPAA, Regulation (EU) 2017/7450, DO-178C, Sarbanes–Oxley Act, and Directive 2014/56/EU, the only one applicable to our client, Nouvell's Shoes, is the GDPR. This is because Nouvell's Shoes collects the following customer data: name, email, phone number, number of purchases, age, and location.

With this regulation the company must ensure: Data Security, protecting customer information from unauthorized access or breaches and Customer Rights, providing customers the ability to access, modify, or delete their personal data upon request, in compliance with GDPR requirements. There is no need to implement Data Protection Impact Assessment, because Nouvell's Shoes' scale of data processing is likely small without complex operations. Additionally, since the app is used exclusively within Nouvell's Shoes and directly by consumers, the company ensures that consent for children under 13 is verifiable and provided by the child's parent or legal custodian, as required by GDPR.

3.5 Wireframes and usability checking

Next, we focus on the user interface of our application, examining its design, features, and impact on the user experience.

- Inicial App Page



Figure 3.14: Inicial Page

- The both options "Itens da Loja" and "Customizar Sapato"



Figure 3.15: Itens da Loja and Customizar Sapato Pages

- The "Elementos de Customizaçao" option

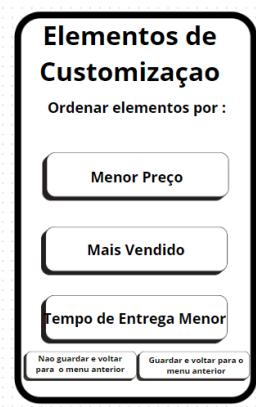


Figure 3.16: Elementos de Customizaçao Page

- At "Sapatos Personalizados" menu after pressing the "Continuar" Button, The main customizing menu



Figure 3.17: The main customizing page

- Each option in the customizing menu



Figure 3.18: Customizing Options

- The final customized shoe presented to the customer, a 360° in real time



Figure 3.19: The 3D Model of the shoe

- The similar shoes, at "Ver Sapatos Semelhantes" button



Figure 3.20: The "Sapatos Semelhantes" Page

We analyze how the visual and interactive elements work together to create an intuitive and efficient interface, which is crucial for the application's success.

For the usability checking, the three most important areas were selected:

- Customizing the Shoe
- Displaying the Customized Shoe
- Buy a customized product with priority delivery

Next, we will assess each of these areas using Nielsen's usability scale. The following table presents the evaluation in a scale of 0-10 for each area.

Usability heuristics	Customizing the shoe	Displaying the Customized Shoe	Buy a customized product with priority delivery
Simple and natural dialogue	YES	YES	YES
Speak the user's language	YES	YES	YES
Minimize user memory load	YES	YES	YES
Consistency	YES	YES	YES
Feedback	YES	YES	YES
Clearly marked exits	YES	YES	YES
Shortcuts	NO	YES	YES
Good error messages	NO	NO	NO
Prevent errors	NO	YES	NO
Help and Documentation	NO	NO	NO
TOTAL	6/10	8/10	7/10

Figure 3.21: Usability Heuristics

We can conclude, based on the table, that the system meets most of Nielsen's usability requirements. This was expected, as we developed it with simplicity and intuitiveness in mind.

3.6 New Requirements

The system developed now has some more requirements:

- NF001: Mechanism for changing languages to include internationalization.
- NF002: Modular architecture to allow seamless addition of new feature.
- NF003: Cross-platform compatibility for all major operating systems.
- LG001: Mechanism for collecting explicit user consent for data collection and processing.
- LG002: Secure data storage with encryption to protect user information.
- LG003: Tools to allow users to access, edit, or delete their personal data.
- NF004: Optimized 3D rendering to minimize CPU and RAM usage during customization.
- NF005: Error-handling mechanisms to manage customization failures gracefully (e.g., restoration of previous state or error messages).
- NF006: Intuitive and user-friendly interface with clear navigation and visual feedback for customization options.
- NF007: High-quality, real-time 3D visualization that closely matches the final product, accounting for minor variations due to screen quality and lighting conditions.

4 RE Techniques assessment

4.1 Problem domain and Technique adopted

The nature of our problem domain is open and technique adopted is dynamic. It is open because our context is constantly changing slightly, as we are working with people's preferences, how they interact with applications, and the culture surrounding them. All of these aspects are constantly evolving, and there is always more to learn beyond what we already know.

It is dynamic because many of our requirements are derived from Quality Attributes, using brainstorming to create scenarios means that we need to explore and discover these requirements, as they are not straightforward.

4.2 Techniques Rank

The techniques we used in the first five deliverables are ranked as follows, from highest to lowest value: Ethnography - Brainstorming - Scenarios - Problem Frame - Prototyping - KJ Method - BPMN - Use Cases - User Stories

Ethnography is in the highest rank because it was crucial to understanding the context where our application will take place, from the problems our client is presenting to what attracts customers to use this app.

Brainstorming is in second because generating new ideas and possibilities for our app allowed us to go beyond what we already knew, expanding our ways of creating an app that provides value to the user.

Scenarios is in third because it used brainstorming as its base, creating the scenarios with the brainstormed ideas in mind, which allowed us to perceive new and important requirements.

Problem Frame is in sixth because we identified two additional requirements related to legal and regulatory aspects, a theme that is crucial for the success of our app.

Prototyping is in fourth because we could compare our visual ideas with our competitors and see what was missing. Also, seeing everything working together helped us identify inconsistencies that were resolved.

KJ Method is in fifth helped us organize, refine, and eliminate ideas, providing a consistent base to move forward.

BPMN is in seventh place because it helped us ensure the tasks and app functionalities were well-defined. However, its impact was limited since we were already familiar with how customization apps work.

User cases and user stories, were important to understand how users interact and understand the value of our app. However most of the cases and stories didn't add much to what we already knew, because the cases and stories used were more basic than what we discover with brainstorming and scenarios.

4.3 Reflection on techniques

In our opinion, the most important techniques align with the framework presented in 1 and our problem domain and technique used because they focus on exploration and understanding the context, the problem and new ways to solve it. Additionally, most of these techniques fall within the quadrant of our problem domain and technique used.

5 Annexes

5.1 Annex A-Full list of requirements

5.1.1 FR—Functional Requirements

ID	Description	Priority	Source
FR001	Shoe model selection	Must	Client
FR002	Shoe color selection	Must	Client
FR003	Shoe texture selection	Must	Client
FR004	Shoe material selection	Must	Client
FR005	Add text selection	Must	Client
FR006	Lace customization	Must	Client
FR007	Sole material selection	Must	Client
FR008	3D Visualization selection	Must	Client
FR009	Shopping Cart	Must	Client
FR0010	Social Media Sharing	Should	Client

Table 5.1: Functional Requirements

5.1.2 NF—Quality Attributes (non-functional requirements)

ID	Description	Priority	Source
NF001	Mechanism for changing languages	Should	Team
NF002	Modular architecture	Must	Team
NF003	Cross-platform compatibility	Should	Team
NF004	Optimized 3D rendering	Must	Team
NF005	Error-handling mechanisms	Must	Team
NF006	Intuitive and user-friendly interface	Must	UX
NF007	High-quality, real-time 3D visualization	Must	Team

Table 5.2: Quality Attributes

5.1.3 LR — Legal and regulatory requirements

ID	Description	Priority	Source
LG001	Collecting explicit user consent	Must	RGPD
LG002	Secure data storage with encryption	Must	RGPD
LG003	Allow users to access and edit their data	Must	GDPR

Table 5.3: Legal and regulatory requirements

5.1.4 Constraints

ID	Category	Description	Source
C001	NF	Application developed shouldn't need advanced hardware to run	Client

Table 5.4: Constraints

5.2 Annex B-Traceability matrix

REQ.ID	Description	UED	UC	Wireframe
FR001-7	Shoe options selection	[5]	UC001	3.18
FR008	3D Visualization	[5]	UC001	3.19
FR009	Shopping cart	[6]	UC002	3.19

Table 5.5: Traceability matrix

5.2.1 Breakdown resolution

BRK.ID	Description	REQ.ID
BRK001	No shoe visualization	FR008
BRK002	Hard to customize	FR001-8
BRK003	Hard to give shoe feedback	FR008
BRK004	Bad suppliers communication	N/A
BRK005	More sustainable and inclusive production	N/A
BRK006	Difficulty in showing arrival date	FR009
BRK007	Low percentage of customized products sold	FR001-8
BRK008	Inability to check materials availability	FR001-9

Table 5.6: Breakdown resolution

5.3 Annex C-Larger resolution diagrams

5.3.1 Affinity Diagram

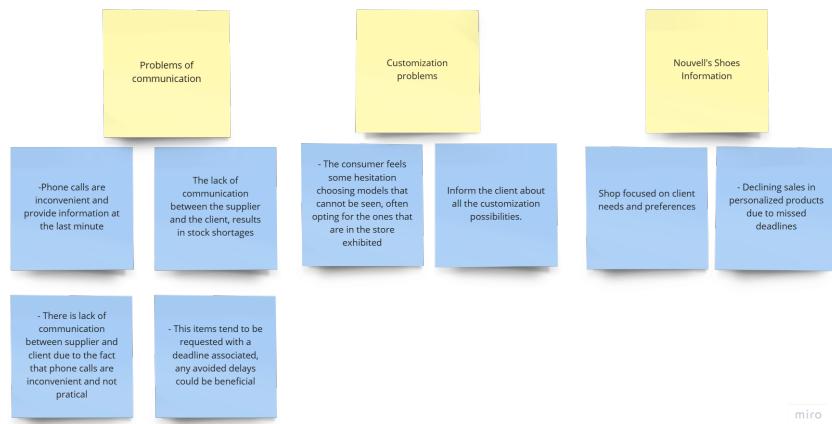


Figure 5.1: Affinity notes

5.4 Annex D-Survey

Current Solutions

Nike By You (formerly NikelD)

- **Description:** A platform offering shoe customization with a real-time 3D visualization feature. Users can change colors, materials, and styles, and instantly see updates reflected in a 3D model.
- **Technology Used:** Likely WebGL or similar 3D rendering technologies for the browser.
- **Limitations:** Limited customization options and scope, and only at a few shoes; primarily focused on aesthetic changes.

Converse Custom Platform

- **Description:** Similar to Nike By You, Converse offers a platform for customizing certain shoe models.
- **Technology Used:** Custom 3D rendering engine integrated with their e-commerce platform.
- **Limitations:** Relatively basic interactivity compared to cutting-edge gaming engines, and you can only customize 3 or 4 shoe characteristics.

Key Findings

Strengths of Current Solutions

- Advanced rendering technologies (e.g., WebGL, Three.js).
- Good integration with e-commerce workflows.

Limitations

- Lack of highly interactive 3D models in some cases.
- Limited customization options, you only can customize the shoe that they allow, you cannot customize all types of shoes.

Opportunities for Innovation

- Integration of AI-based suggestions (e.g., recommending colors or styles based on trends).
- Enhanced interactivity using gaming engines like Unity or Unreal for photo-realistic customization.

- Real-time connection between customer choices and supply chain updates.