

# Model Garment Design Webapp Report

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## Summary


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## Introduction to Model Garment Design (MGD)



[Model Garment Design](#) (MGD) is a **demo project** powered by a multi-modal artificial intelligence, developed using **Stable Diffusion** technology. The primary goal of MGD is to facilitate the **design and creation of garments** through a user web interface. As in many industries, the fashion world is increasingly embracing artificial intelligence to streamline processes. MGD aims to assist designers in accelerating the creation of garments by offering an initial concept through a combination of sketches and brief descriptions, providing a quick first impression of the design.

**Britney:** is possible to design shirts, long-sleeved tops, sweaters, or bikinis.





Draw on the Model



### Realize your design!

Describe fabric, color, or distinct characteristics


+

Blue cotton shirt

Small buttons

Dark color

Generate Design



## How the System Works: From Sketch and Text to AI-Generated Garment

The process of generating a custom garment design with AI involves several key steps. Using the [Multimodal Garment Designer](#), a fine-tuned version of **Stable Diffusion** specifically trained to design garments for selected models, the system translates user input into fully realized clothing designs. Here's how it works:

- The web interface, hosted in [vercel](#), sends both the sketch and written descriptions to the backend.
- The backend, hosted on a Hugging Face (HF) [space](#), handles all user requests and hosts the AI model.
- The AI processes the sketch and descriptions together to create a garment tailored to the selected model.
- Once the design is complete, the HF space returns the generated image to the frontend for display.

## User Interface and User Experience

The User Interface allows the user to interact with the AI model and it's designed to be responsive and adaptable to different devices with different screen sizes.

UI is made of a single page, but instead of creating a full-page layout that uses the entire screen, we opted for a centered card-based design within a grid structure. This decision is made to enhance focus, usability, and visual clarity.

The grid layout is organized into two sides:

- On the **left side of the interface**, users can select a model from a series of small boxes placed at the bottom of the grid and visualize the image of the model selected. Above the model, users can read some phrases about the model, which are different for each of them. This functionality is added to improve the user experience on the app and to clarify which type of garment can be drawn on the model selected. Below the models the user can see 2 buttons, the pencil and the trash. The first one enables the ability to draw on the model and the other one to delete the drawing. Once clicked on the pencil, the user can draw the sketch directly on the model.
- On the **right side of the UI**, there is a textarea where the user has to write or describe details about the garment. Before collecting feedback, the number of phrases to indicate was dynamic and based on the user's idea. To provide greater clarity to the user, we decided to fix the number of phrases to 3, which is the minimum number to pass to the model. Before writing, the UI shows 3 placeholders, each containing a different example detail. They will be replaced by statements inserted by the user. In this way, the user is guided and understands what to write.

Under these 2 buttons, there is the "generate design" button which completes the procedure and generates the final image of the model with the new garment. When the final image is generated, the button to download the image as jpeg will be displayed under the picture.

If the user didn't write the three statements or didn't draw the sketch on the model and try to generate the design, an **alert message** would be displayed at the bottom of the screen device based on the missing information.

## Survey outcome description

The results of the survey can be viewed at the following link:

[+ User Experience Survey: Multimodal Garment Designer Webapp](#)

### Targeting of users

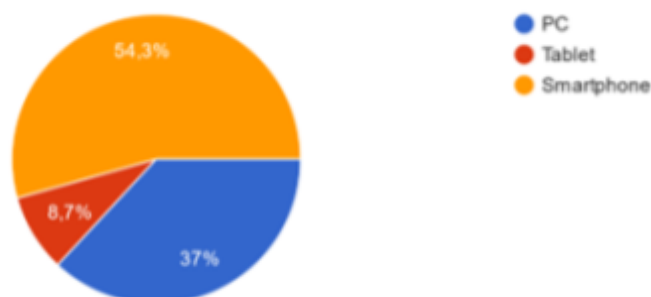
We started collecting feedback from 28 to 29 August 2024 as soon as we reached a working beta version. After that, we analyzed the reported problems and improved our application accordingly.

The first questions in the form are aimed at extracting useful information about the users. Relevant for development and debugging purposes is information about:

- the device used
- the browser
- manual input
- the user's expertise in using design apps
- the user experience in the fashion industry.

From which device did you access the webapp?

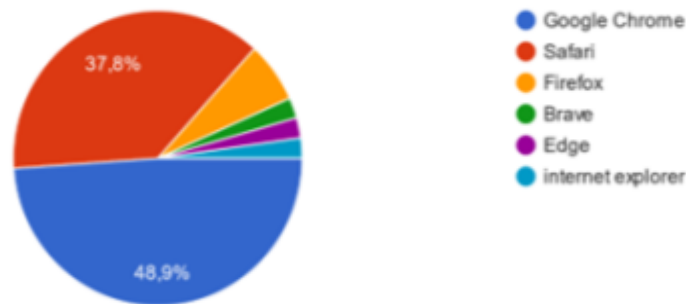
46 risposte



% of users that used a PC, a smartphone or a tablet

From which browser did you access the webapp?

45 response



% of users for each browser

What device did you use to design your dress?

46 response



% of users for each manual input modality

- **Device used:** Although the app was designed specifically for tablets or PCs, and this was clearly stated in the invitation to complete the form, more than half of the users still accessed the app from smartphones
- **Browser:** A number of users with an iOS phone and recent version of Safari browser have complained of problems with garment generation. We have investigated and solved the problem subsequently. More details are provided in the next chapter.
- **Manual input:** User testing allowed us to gather feedback on the drawing area from users who used a mouse or their fingers, as well as from those who had an optical pen—a tool that none of the team members had. This gave us proof that we had done a good job with regard to the development of the drawing area.

## User expertise

What is your level of experience in the fashion industry, both in terms of professional background and personal interest?

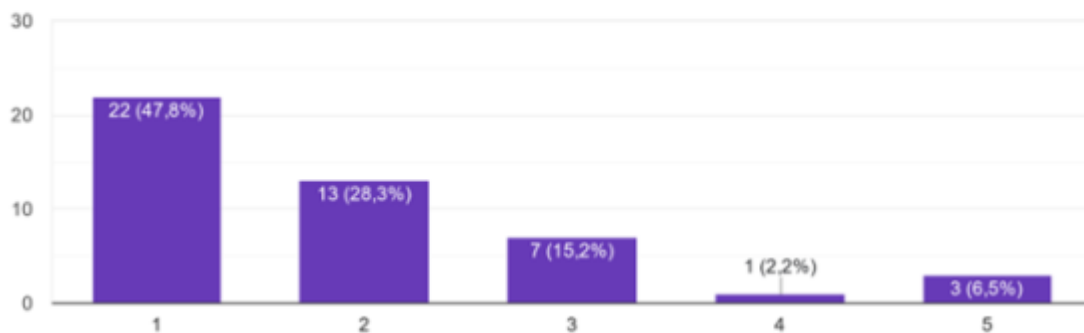
46 response



Level of experience of users in fashion industry in %

How often do you use your device for drawing?

46 response



Use of the device for drawing from 1 (Never) to 5 (Every day)

Although our application has the ambition of targeting users who have experience in fashion and are used to using drawing tools, the survey suggests that most of the users surveyed do not have a strong interest in fashion and do not use software of this type on a regular basis. However, as this is the first release of the product, the feedback gathered in this first phase was absolutely valid in order to be able to develop a usable application that can be understood by everyone. Gathering feedback from a more experienced audience could be part of a future update cycle and can be included in the list of future improvements to be implemented.

## Usability

Did you immediately understand how to use the app, or did you find it unclear at first?

46 risposte



Level of immediate understanding of app operation in %

As shown by the graphic, most users immediately understood how the application worked. Others had problems understanding how it worked as soon as they opened the page. Among the textual suggestions they had for improving the usability of the application were:

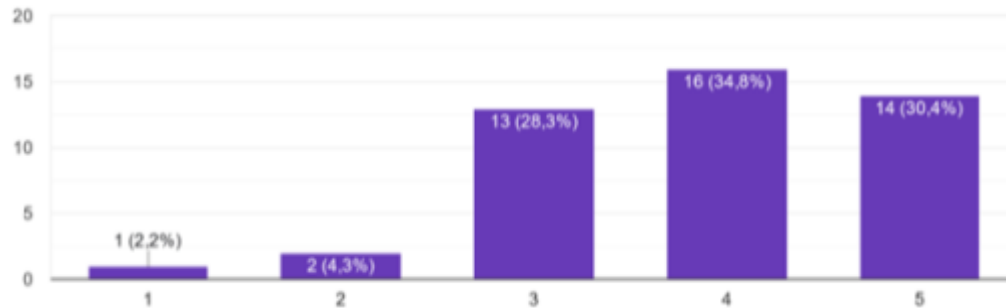
- **Add a textual or video description of how the app works.** We added a description for each model where the gather that is possible to generate is described. We also introduced alerts to notify users of the need to add textual input or edit the canvas before generating the garment.
- **Improving the GUI on smartphones.** After receiving this feedback, we worked to improve the responsiveness of the GUI on smartphones by defining a flexbox that avoids overlapping drawing area elements (canvas, toolbar, model selector)



## Feedback on the generated garment

How much do you think the text descriptions influence the outcome?

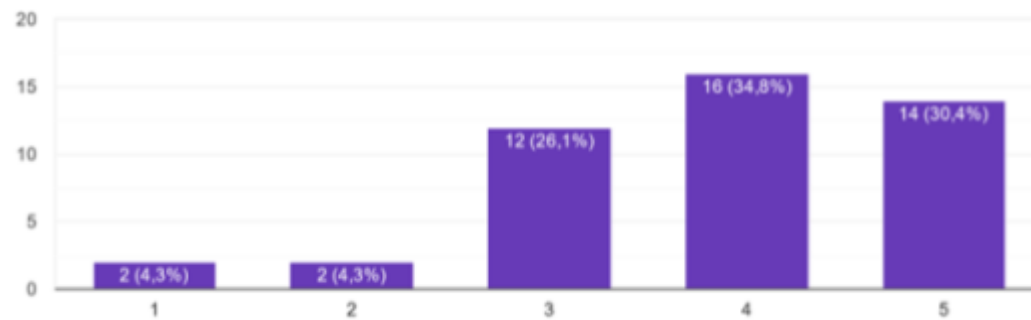
46 response



How text descriptions influence the outcome from 1 (Very low) to 5 (Very high)

How much do you think the sketch influences the outcome?

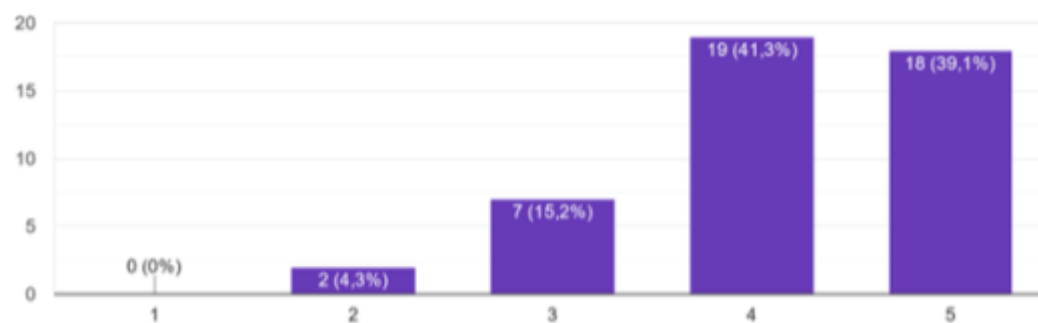
46 response



How the sketch influence the outcome from 1 (Very low) to 5 (Very high)

Did the image produced meet your expectations?

46 response



How the image produced met the user expectations from 1 (Absolutely not) to 5 (Absolutely yes)

The results of the survey show that for the majority of users, the output produced by the model used is consistent with the text descriptions and design used as input. Among the users who were dissatisfied with the generation output, there were a few who were confused by the type of garment generated.

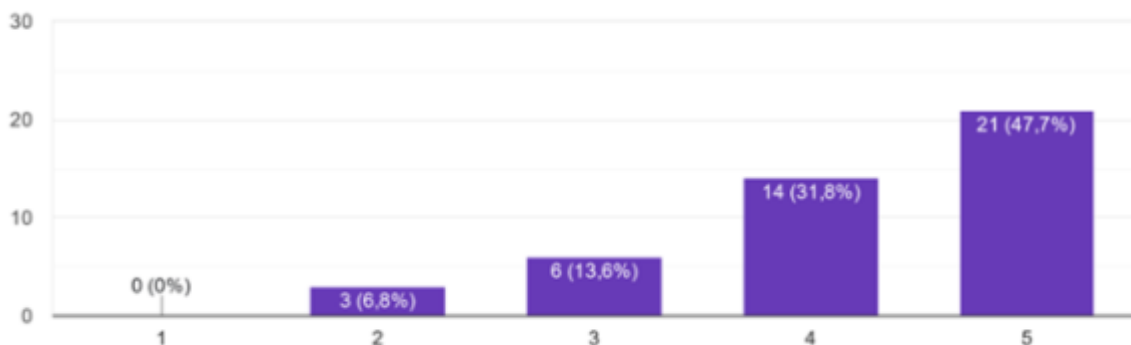
This problem was not due to a lack of the AI model, but a genuine frontend setting error that caused confusion for the user. Some users, in fact, complained that they had designed a T-shirt and received a pair of trousers as an output.

We solved this problem by adding a description for each model defining what type of garment can be produced.

## Overall final evaluation

In general, how did you rate your experience with the webapp?

44 response



General rate of the experience with the webapp from 1 (Very bad) to 5 (Excellent)

In general, most users had a positive experience with our app. Thanks to those who were unfortunately less fortunate, it was possible to improve the design and, in some cases, find serious faults that compromised the functioning of the app itself.

## Issues encountered during development

### · Making the service accessible to remote users (and us developers)

We were unable to run an instance of the AI model on our computer, due to hardware requirements that we were unable to meet. For this reason, we decided to host the model in the cloud on HuggingFace. This allowed us to host the model on a remote server, taking care to keep costs down, considering that the hosting would also serve us for the development phase and not only for deployment.

Regarding the frontend, the solution found consists of Vercel (<https://vercel.com/>), a totally free service provided by the Github platform.

- **Stable diffusion deleted from HF**

During development, the Stable Diffusion model used was removed from HuggingFace and then reloaded. More information can be found at this link [https://www.reddit.com/r/StableDiffusion/comments/1f4epto/runway\\_took\\_down\\_15\\_and\\_15\\_inpainting/](https://www.reddit.com/r/StableDiffusion/comments/1f4epto/runway_took_down_15_and_15_inpainting/)

- **Dancing Canvas**

A problem encountered on smartphones is related to an abnormal movement of the page when the user attempts to draw a sketch with his or her fingers. We implemented a solution consisting of removing the "onTouch" methods, triggered when a user uses a touch screen to draw on the canvas, and replacing them with "onPointer" methods. The implementation of this type of event does not give rise to problems such as those reported by certain devices.

- **No dress for iOS**

A further issue that emerged from the feedback gathered from users was the failure to generate a garment when using iOS devices with recent versions of the Safari browser.

The execution was failing during the creation of the http request payload to be sent to our model, due to an error during the conversion of the user-drawn sketch to jpeg. Changing the method used to convert the sketch to jpeg was sufficient to address this issue, without breaking anything on other devices and browsers.

## Limitations of the Application

The current version of the application has several limitations that affect its performance and usability:

- **Artificial Intelligence Limitations**
  - At present, the AI model is the only one of its kind in scientific literature and requires vast amounts of data to improve performance
  - Like app such as ChatGPT or DALL-E, users need to learn effective prompting techniques, and in this case, also incorporate drawing techniques to achieve better results
- **Learning Curve for Effective Use**
  - The generated garments may not always match the user's expectations, as successful results require both strong prompting techniques and solid drawing skills. To achieve the desired design, users need to effectively combine clear descriptions with accurate sketches
  - These requirements are among the main reasons why the target audience for the application are designers and fashion professionals, who possess the necessary expertise to use the tool effectively
- **Providing Multiple Colors Affects Output Quality:**
  - Specifying multiple colors, even when assigning them to specific components of the garment, can result in outcomes that differ from user expectations
- **Inability to Work on Images Other Than the Default Ones**
  - Currently, it is not possible to modify new images, even if they are generated with the app. This is due to the need for remapping the image, which is a process that takes time and requires a deeper study
- **Only One Garment Can Be Designed at a Time:**
  - Requesting the generation of multiple garments simultaneously significantly reduces the model's performance. For this reason, it is recommended to work on one garment at a time
- **Limited to Three Input Phrases**
  - This is a design decision made to simplify the user interface. Although more phrases could technically be supported, managing them on the interface provided more complexity. Additionally, users tend to struggle when providing more than three phrases. A potential "premium" version could increase the number of allowed inputs
- **Impact of Language on Output Quality**

- The model performs significantly better when input is provided in English. While other languages may be supported, English offers the most consistent and accurate results
- **Smartphone Limitations**
  - The model is primarily designed for semi-professional use, and the limited screen space on smartphones makes it difficult to create precise designs. While the app can be tested on smartphones, it's not ideal for detailed work
- **Slow First Generation**
  - The first design generation is slower due to temporary economic constraints. This is a known issue that will be resolved in the future
- **Hardware Requirements for Local Testing**
  - Running the model locally requires a GPU with at least 5GB of vRAM. As a result, hosting the app in the cloud is necessary for widespread use
- **Issues with Text on Clothing**
  - Like many generative models, handling text on garments is a challenge, resulting in poorly generated designs when text is involved
  - In example, for the image on right, this was the input provided
    - Blue T-shirt
    - Write CAT on the chest
    - Silk



## Future improvements

Since this application is a demo for the first AI model which is used to facilitate design and creation of garments, user experience and user interface of the web application could be improved in the future.

- Firstly, we could give the opportunity to write more phrases as text input to pass to the model to give more dynamicity to users.
- Another important aspect could be the **responsiveness** of the user interface, which can be improved for some devices such as smartphones.
- Since the model is trained using English language, a future change can be the **finetuning** to other languages such as Italian to make the app more **accessible**.
- So far, feedback has been collected from users with various professional backgrounds, many of whom have little or no experience in the fashion industry or in drawing. While this has provided valuable insights into how intuitive and accessible the application is for non-experts, a potential area for improvement would be to gather feedback from **industry experts**—such as fashion designers, illustrators, or professionals with significant experience in garment design. Their input could offer **specialized recommendations** on how to refine the user experience and suggest additional tools or features that could better support more complex design workflows. This expert feedback could help further align the application with the needs of users who have a deep understanding of the fashion design process.
- User experience could be improved by also adding the possibility to upload a picture of a model from users and draw on that photo, rather than choosing only from 4 pre-trained models.