



SAPIENZA
UNIVERSITÀ DI ROMA

Department of INGEGNERIA INFORMATICA,
AUTOMATICA E GESTIONALE "ANTONIO RUBERTI"

Master's Degree in Engineering In Computer Science



WHAT TO WEAR

Human Computer Interaction

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1. Introduction

In today's fast-paced world, many people face a familiar daily dilemma:

What should I wear?

Whether it's for important events, casual outings, or simply to avoid repeating the same outfit, selecting the right look can often feel stressful and time-consuming. This project introduces *WhatToWear*, a mobile application designed to make outfit selection smarter, faster, and more enjoyable, not only for users who struggle with matching clothes but also for fashion enthusiasts eager to explore and elevate their personal style.

The application provides users with daily outfit suggestions generated from their own digital wardrobe, which they can easily create by uploading photos of their clothes. Through the integration of real-time weather data, the app ensures that suggestions are both stylish and weather-appropriate. Users can also generate personalized outfits starting from a single garment: the app considers occasion, style, location, date, and time to build a context-aware look that fits their needs.

Beyond functionality, *WhatToWear* fosters creativity and community. Users can share their outfits, explore others' looks, and save their favorites for future inspiration. Through personalized tags and visual profiles, individuals can express their fashion identity while connecting with others who share similar tastes. The wardrobe feature also supports capsule wardrobe creation, helping users make the most of what they already own.

By combining wardrobe management, smart recommendations, and community engagement, *WhatToWear* positions itself as a complete fashion companion, bridging practicality and style in everyday outfit planning.

Match it. Wear it. Share it.

2. Application scenario

The *WhatToWear* project is positioned within the growing field of fashion-tech mobile applications aimed at simplifying everyday clothing decisions through intelligent digital support. The application is designed for anyone comfortable using basic mobile applications who seeks convenience, personalization, and inspiration in choosing what to wear. It targets not only students and fashion enthusiasts, but also professionals and older users who may benefit from a simplified, guided experience in everyday outfit decision-making.

Our group proposed this application to solve a common problem: choosing what to wear when you're short on time and dealing with factors like the weather, special events, or uncertainty about your style. To address this, the app supports two main use cases:

- Daily outfit suggestions, which are automatically generated based on real-time weather data. This is ideal for quick, everyday decisions.
- Event-based planning, where users need help putting together the right look for specific occasions like job interviews, dates, or themed parties.

The app enables users to either request suggestions starting from a selected garment or receive full outfit recommendations directly. By considering weather conditions, occasion, personal style, and garment availability, the system adapts to real-life constraints and user intentions. Additionally, users can digitize their entire wardrobe, reducing outfit repetition and enabling more efficient use of their clothing inventory.

From a development perspective, the app integrates several modules: garment recognition, real-time weather API integration, tagging systems, and a community-sharing platform. These elements contribute to both the utility and inspiration side of the experience.

Key constraints include:

- Device and platform variability, requiring a responsive and intuitive UI.
- User privacy concerns, particularly when handling image uploads and location-based services.
- Backend dependency for dynamic features such as real-time weather updates and image processing.

At last, the application scenario reflects a real-world need for digital wardrobe assistance that is both practical and expressive, placing *WhatToWear* at the intersection of personal convenience, self-expression, and social fashion culture.

3. Requirement Analysis

Before diving into the design of the WhatToWear application, it was essential to conduct a thorough requirement analysis to ensure that the system would align with real user needs and behaviors. This chapter outlines the research and evaluation process carried out to define the app's core functionalities and user experience direction. We begin with an in-depth user analysis supported by a questionnaire, aimed at identifying the habits, struggles, and expectations of our target audience. This is followed by the definition of representative personas and realistic scenarios that help us empathize with potential users and guide feature development. A competitor analysis then explores existing applications in the fashion-tech domain to assess their strengths, weaknesses, and gaps. To further understand how users might interact with our system, we introduce a Hierarchical Task Analysis (HTA), which breaks down key actions into manageable steps and provides a foundation for intuitive interface design. The chapter concludes with a summary of the insights gathered, which directly inform the development of the app's structure, content, and functionality.

1. Personas and Scenarios

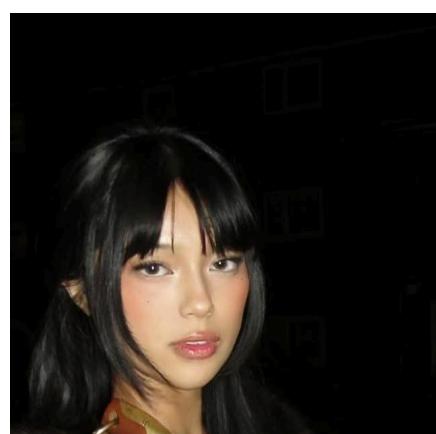
Our target users generally fall within the following demographics:

- **Age range:** 16–45 years old
- **Location:** Urban areas in Italy (Rome, Milan, etc.)
- **Digital expertise:** Comfortable with smartphones, social media, and common mobile apps
- **Lifestyle:** Busy schedules, socially active, fashion-conscious or style-curious

These users often face similar wardrobe-related problems: time constraints, difficulty pairing clothes, seasonal mismatches, or a lack of inspiration. The app is designed to serve not only those who find outfit planning stressful but also those who see fashion as a creative outlet.

Persona 1: Victoria Dechamp

- **Age:** 23
- **Location:** Rome, Italy
- **Occupation:** University Student (Communication Sciences)
- **Background:** Originally from Paris, Victoria is currently studying in Rome. Her multicultural lifestyle has expanded her fashion sensibility, blending Parisian classics with bold Italian trends.
- **Lifestyle:** Active on Instagram, follows fashion influencers, often attends themed events and parties.



Scenario:

It's Saturday evening, and Victoria is preparing for a 90s-themed party with her friends. Despite her excitement, she's frustrated as she stares at her closet. She wants to build a fun and

cohesive 90s-inspired look but feels overwhelmed by her options. She's unsure how to pair her pieces and doesn't have time to endlessly scroll through inspiration online.

How the app solves her problem:

Victoria opens "What to Wear" and uses the *Explore* tab to search for "90s." Instantly, she sees outfits shared by other users that spark ideas. She selects her favorite leather culottes from her wardrobe and asks the app to suggest a look. Within seconds, the app generates an on-theme outfit, tailored to her taste and wardrobe, removing all the guesswork and helping her arrive at the party feeling confident and stylish.

Persona 2: Federico Totti

- **Age:** 39
- **Location:** Milan, Italy
- **Occupation:** Financial Consultant
- **Background:** With over ten years in finance, Federico's wardrobe has evolved from casual wear to high-end formal attire.
- **Lifestyle:** His days are packed with meetings, networking events, and client lunches. Time is limited, and he prefers efficient solutions.



Scenario:

Federico's morning is hectic. He has three meetings across the city and no time to overthink what to wear. The weather is unpredictable — it might rain in the afternoon. He wants to look sharp, feel comfortable, and ensure his outfit matches both the formality and the climate.

How the app solves his problem:

Federico opens "What to Wear." The app uses his geolocation and calendar to check weather forecasts and the nature of his events. It then recommends an outfit from his digital closet that is weatherproof, formal, and professionally appropriate. Federico selects the option, gets dressed, and walks out the door knowing he looks and feels prepared — no stress, no second guessing.

2. User Analysis

To support the user analysis phase, we conducted a questionnaire distributed to 45 participants, including students, peers, friends, and family members. Their responses provided valuable insights into user behaviors, preferences, and expectations, helping us shape design decisions and ensure the mobile application would better align with real user needs.

The questionnaire administered to participants was structured as follows:

#	Question	Possible answers
1	What is your age range?	- Under 18

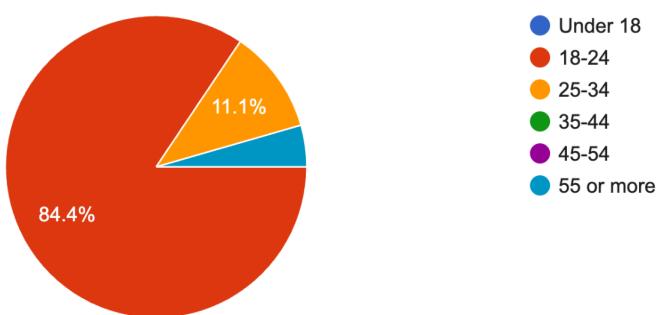
		<ul style="list-style-type: none"> - 18-24 - 25-34 - 35-44 - 45-54 - 55 or more
2	What is your gender?	<ul style="list-style-type: none"> - Female - Male - Other - I prefer not to answer
3	How much time do you usually spend selecting an outfit before going out?	<ul style="list-style-type: none"> - Less than 5 minutes - 5-10 minutes - 11-20 minutes - More than 20 minutes
4	How often do you feel uncertain about how to match your clothes?	<ul style="list-style-type: none"> - Never - Rarely - Sometimes - Often - Always
5	Do you use apps or websites for outfit inspiration?	<ul style="list-style-type: none"> - Yes, frequently - Yes, occasionally - No, but i'm interested - No, I'm not interested
6	What channels do you currently use to find outfit inspiration? (select all that apply)	<ul style="list-style-type: none"> - Magazines - Social media (e.g., Instagram, Pinterest) - Fashion blogs - Friends and family - I don't actively seek inspiration
7	How interested would you be in an app that suggests outfit combinations based on a specific item you want to wear?	<ul style="list-style-type: none"> - Not interested at all - Slightly interested - Neutral - Quite interested - Very interested
8	Which features Would you find most useful in an app like this? (select up to 3 features)	<ul style="list-style-type: none"> - Quick outfit suggestions without cataloging my wardrobe - Personalized style recommendations based on your preferences (e.g., casual, formal, trendy) - Ability to save and revisit favorite outfits - A community to share, explore, and receive feedback on outfits (e.g., post your outfits, receive comments, and explore outfits using keywords) - Outfit suggestions based on events in your calendar (e.g., meetings, social events, appointments) with push notifications for suggestions or reminders - Receive daily notifications with suggestions on

		what to wear based on the weather
9	How important is it for you to receive feedback on your outfits from an online community?	<ul style="list-style-type: none"> - Not at all important - Not very important - Neutral - Somewhat important - Very important -
10	What kind of feedback would you prefer to receive from the community?	<ul style="list-style-type: none"> - Comments on outfits - Suggestions for improving outfits - Ratings on how the outfit looks
11	What additional features or functionalities would you like to see in an app that helps you with outfit selection?	Open answer

3. Result Analysis

What is your age range?

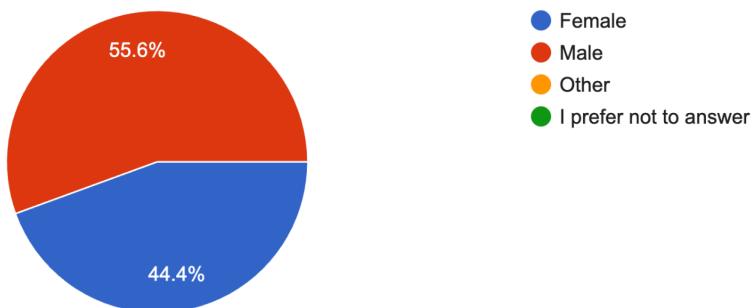
45 responses



1. The majority of the people that answered the questionnaire are aged between 18-24 (mostly students that are our peers).

What is your gender?

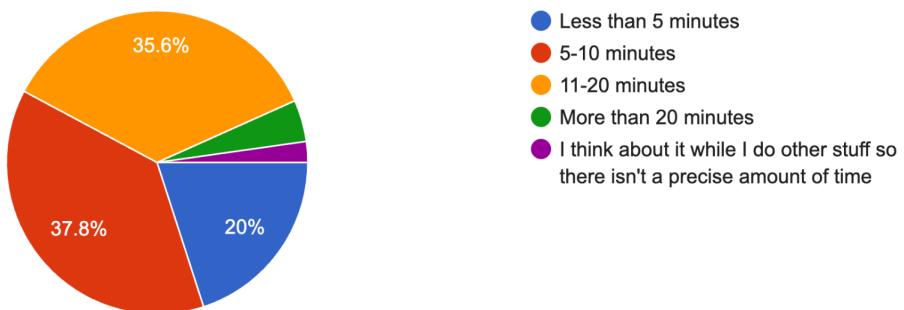
45 responses



2. The responses were fairly balanced in terms of gender, with roughly equal numbers of male and female participants.

How much time do you usually spend selecting an outfit before going out?

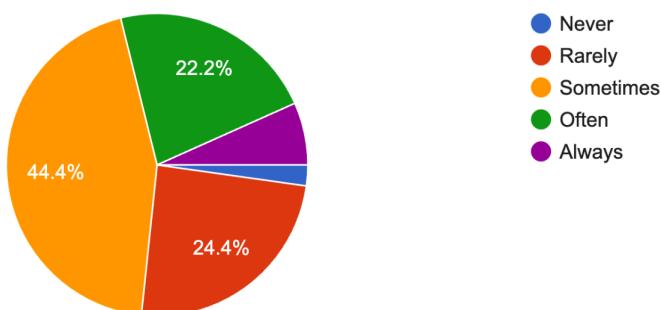
45 responses



3. Most participants reported spending between 5 and 20 minutes on the task.

How often do you feel uncertain about how to match your clothes?

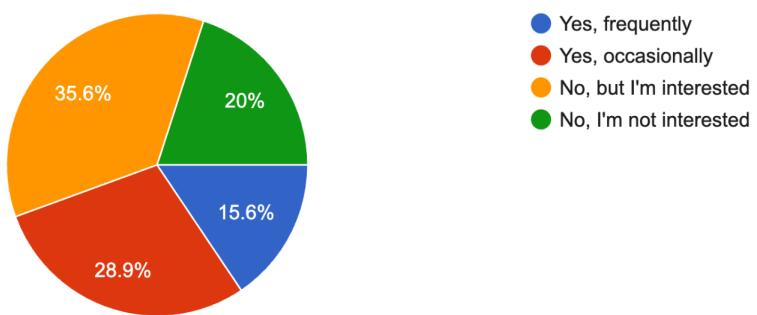
45 responses



4. The majority reported experiencing uncertainty at least sometimes.

Do you use apps or websites for outfit inspiration?

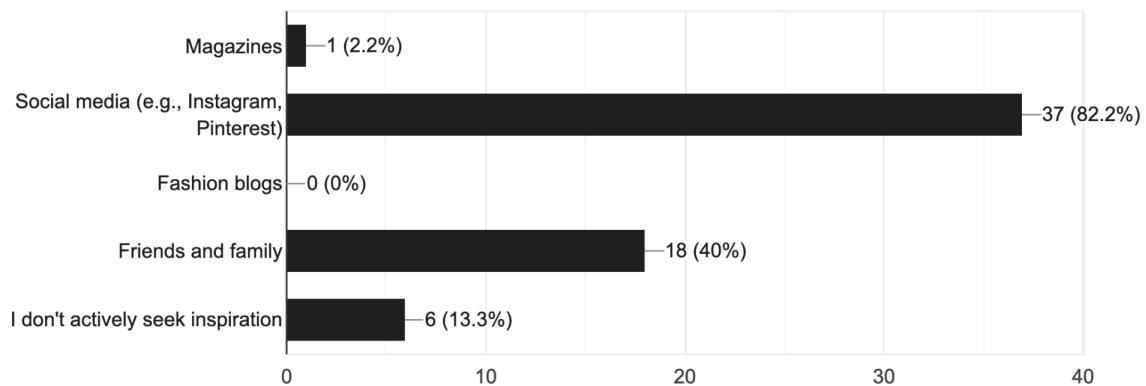
45 responses



- While a portion of users regularly consult apps or websites, many express interest despite not currently using such tools.

What channels do you currently use to find fashion inspiration? (Select all that apply)

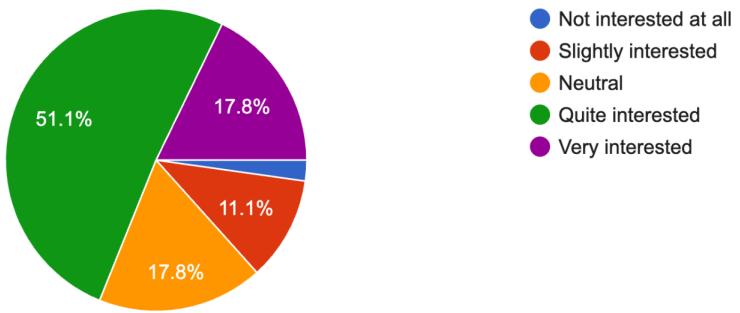
45 responses



- Social media emerges as the dominant source, far surpassing traditional outlets like magazines or blogs.

How interested would you be in an app that suggests outfit combinations based on a specific item you want to wear?

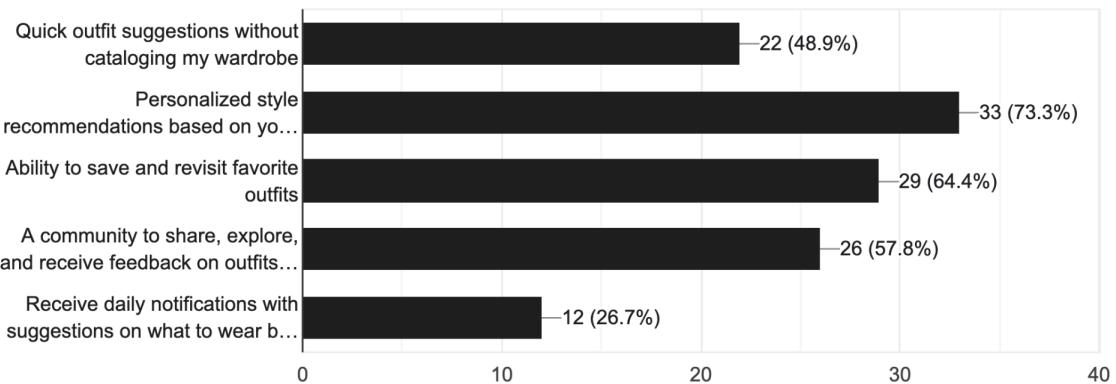
45 responses



7. Most respondents showed strong enthusiasm, confirming potential user demand for this feature.

Which features would you find most useful in an app like this? (Select up to 3 features)

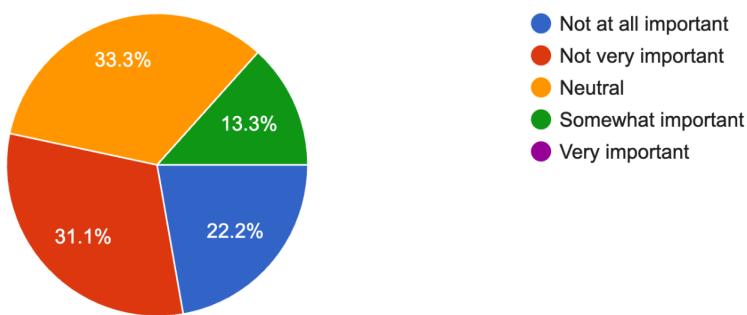
45 responses



8. Personalized suggestions and the ability to save favorite outfits were the top preferences, followed closely by community interaction.

How important is it for you to receive feedback on your outfits from an online community?

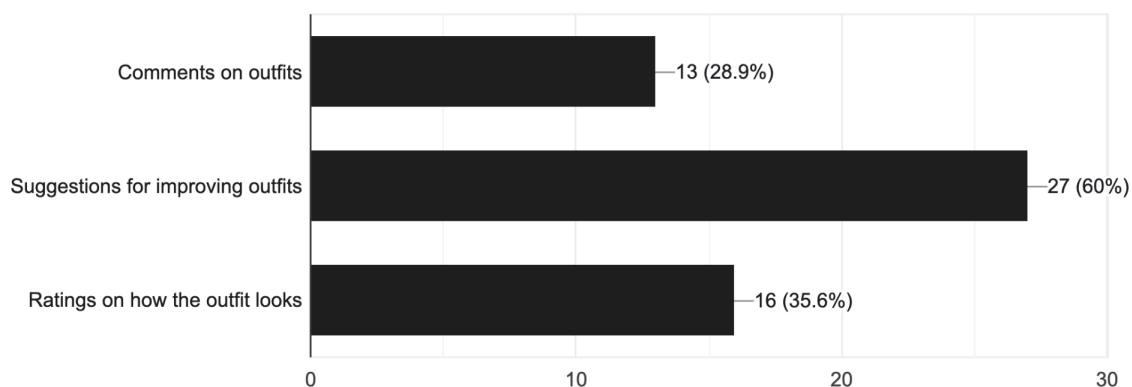
45 responses



9. Most users expressed neutral to moderate interest in getting outfit feedback from an online community, with fewer placing strong importance on it.

What kind of feedback would you prefer to receive from the community? (Select all that apply)

45 responses



10. Most users showed interest in receiving suggestions for improving their outfits, while fewer preferred ratings or general comments.

For the open question: What additional features or functionalities would you like to see in an app that helps you with outfit selection? – We received 14 answers:

- Weather suggestions
- suggestions based on colors
- una funzionalità che ti permette di esaminare se un capo, un dato accessorio sia appropriato/ conveniente da mettere in alcuni tipi di contesti es.(Stadio, Matrimonio, Concerto)
- Outfit suggestions based on the weather
- None
- Wardrobe cataloguing
- A feature that tells us trends around the world, so that we can also take inspiration from them.

- Scan outfit from photos like Google lens but Better
- wardrobe organiser, like having your wardrobe digitalised so I can choose and match my clothes previously and maybe even have a plan going on for the week with everyday items, managing to synchronise the laundry as well
- suggesting combinations to level up my style using my wardrobe's clothes
- Nessuna in particolare
- Download in the app photos of clothes that you have in the wardrobe and from it get some suggestions on cool outfits
- outfit ispirati in base all'occasione in cui questi devono essere indossati
- No one, proposals are fine

4. Conclusions

Our questionnaire reached a sample of 45 users, mostly aged between 18 and 24 years old, with a gender distribution that is approximately balanced between males and females. The data collected confirms that choosing an outfit is often a time-consuming task: many participants reported spending more than 10 minutes deciding what to wear, and a significant portion stated they often or sometimes feel uncertain when matching clothes.

Most respondents occasionally or frequently seek inspiration online, primarily from social media platforms like Instagram or Pinterest. This confirms a strong interest in visual and trend-based content. Users expressed clear enthusiasm for an app that could assist them in choosing what to wear, especially one that can generate outfit suggestions starting from a specific garment. The majority indicated they would find this feature quite or very useful.

From the feedback, it is evident that personalization is key: participants highly valued features such as personalized style recommendations, the ability to save and revisit favorite outfits, and the presence of a community to share looks and receive feedback. Additionally, users appreciated the idea of suggestions based on context and weather, reinforcing the importance of environmental adaptation in daily outfit planning.

Community interaction was generally perceived as moderately important, with many users showing interest in receiving suggestions for improving their outfits more than simple comments or ratings. This supports the inclusion of a constructive feedback system within the app.

Among the open answers, users proposed several useful features: weather-based suggestions, context-aware outfit recommendations (e.g., for events like weddings, concerts, or sports games), integration of worldwide fashion trends, digital wardrobe cataloguing, and even a visual recognition tool for clothing. Some users also expressed the desire to organize their wardrobe digitally, plan weekly outfits in advance, and synchronize outfit planning with practical aspects such as laundry.

To respond to these needs, our application should integrate:

- Outfit generation from a single item, considering the occasion, weather, and location;
- A digital wardrobe feature, allowing users to upload photos of their clothes;
- A social space for inspiration, sharing, and feedback;

- Global trend insights and color-coordination support;
- Context-sensitive suggestions, helping users match garments to events.

These insights will guide the development of a fashion app that is both practical and creative, supporting users in expressing their personal style with ease and confidence.

3. Competitor Analysis

As part of the development of *WhatToWear*, we conducted a competitor analysis to explore how existing platforms address similar user needs in the intersection of fashion and technology. Studying these applications allowed us to gain interesting insights on user behavior and the features that contribute to a successful user experience.

We focused in particular on **21buttons** and **Getwardrobe**, two apps that approach the fashion space from different but complementary angles.

21buttons operates primarily as a social fashion network, enabling users to share their outfits, follow style influencers, and build a visually curated fashion identity. Its strength lies in its strong community component and the ability to draw inspiration from others, which aligns with our app's goal of fostering user interaction and idea-sharing.

Getwardrobe, by contrast, adopts a more utility-driven model. It allows users to digitize and organize their wardrobe, plan outfits, and keep track of garment usage. This functional approach responds to a clear user need for practical wardrobe management, which is a core feature of our application.

This comparative analysis helped us identify a gap that *WhatToWear* can fill by combining the social inspiration of platforms like 21buttons with the practical tools offered by apps like Getwardrobe. Our aim is to create a hybrid solution that is both expressive and functional, supporting users in choosing, organizing, and experimenting with their style in a smart and engaging way.

mobile application	pros	cons
 21buttons	Active community: Users can follow people with similar taste, like and comment on posts, and find daily inspiration through shared looks. Useful search engine: The	Visually appealing with limited practicality: The app focuses on visual inspiration and aesthetics but offers fewer tools for practical wardrobe management or outfit planning.

	<p>app allows users to search for looks starting from specific items or find people with a similar fashion style, making discovery more targeted.</p>	<p>Lack of weather-based suggestions: The app does not consider current weather conditions when displaying outfit ideas, which limits the practicality of the recommendations for everyday use.</p>
 GetWardrobe	<p>Detailed wardrobe organization: Users can upload photos of their clothes and categorize them by type, color, season, or brand, making wardrobe management easier.</p> <p>Outfit planning features: The app allows users to create and save custom outfits, with a built-in calendar to plan what to wear on specific days.</p>	<p>No social features: The app is designed for personal use only and doesn't include a community or the ability to browse or get inspired by other users' outfits.</p> <p>No weather integration: Getwardrobe doesn't take current weather conditions into account, which limits the practicality of its outfit suggestions for everyday use.</p>

To summarize:

			
Community features	✓	✗	✓
Style suggestions	✓	✓	✓
Wardrobe organization	✗	✓	✓
Weather-based recommendations	✗	✗	✓

4. Task Analysis: HTA & STN

To design an intuitive and effective user experience, it is essential to understand how users interact with the application. Task analysis allows us to break down user goals into concrete actions and visualize the flow of interaction within the app. In this section, we focus on two key methods used for this purpose: HTA and STN.

Hierarchical Task Analysis (HTA) is a method used to describe user tasks by breaking them down into a hierarchy of goals, sub-goals, operations, and plans.

State Transition Network (STN) is a diagram that models the flow between different states of a system, illustrating how users move from one state to another based on their actions.

In our case, we used HTA and STN to map out the core functionalities of the application through realistic usage scenarios. These models help us analyze both the structural and dynamic aspects of user interaction, supporting a smoother and more guided experience.

The tasks included in our analysis are:

- Posting a custom outfit to the community
- Saving an edited daily outfit in the wardrobe
- Searching in the community new outfit ideas from other users

Each of these tasks is integrated into a clearly structured flow designed to help users reach their goals efficiently and confidently.

1. Posting a custom outfit to the community

Users can create a new outfit directly from the home screen via the designated button. They can choose to use an item from their personal wardrobe, select one from our database, or upload a photo of a garment. Based on the selected or uploaded item, a complete outfit will be automatically generated around it. The user is then prompted to plan when they intend to wear the outfit by specifying the occasion, location, date, and time. Finally, they have the option to share their custom outfit with the community.

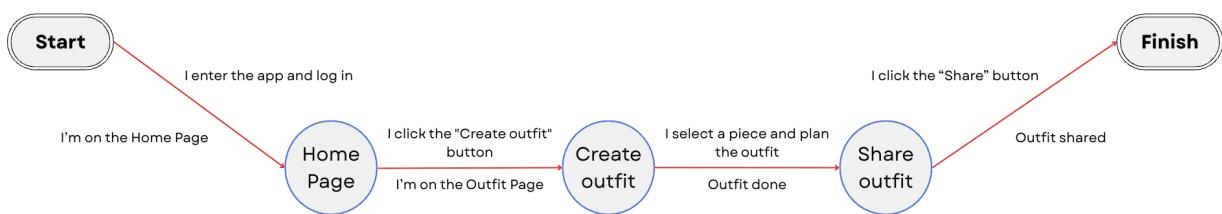


Figura 5.1: STN

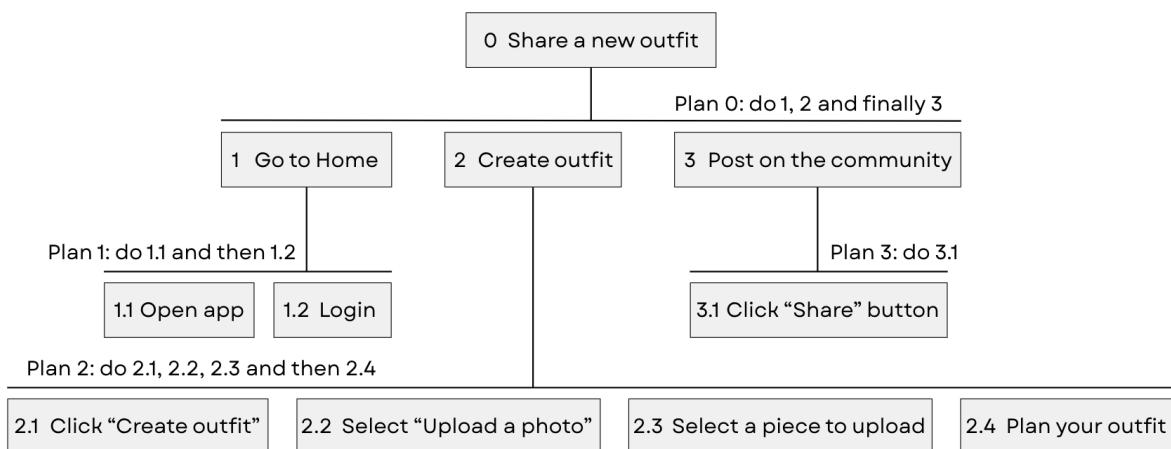


Figura 5.2: HTA

2. Saving an edited daily outfit in the wardrobe

Users can draw inspiration from the daily outfit we suggest on the home screen. They have the option to save it, mark it as a favorite, or customize it as they wish. When saving the outfit, the user is prompted to select a style and specify the occasion. Once saved, the outfit is added to their personal wardrobe and becomes available for future use.

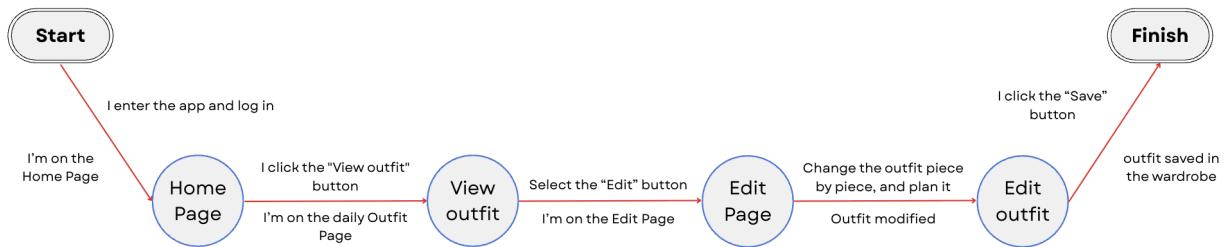


Figura 5.3: STN

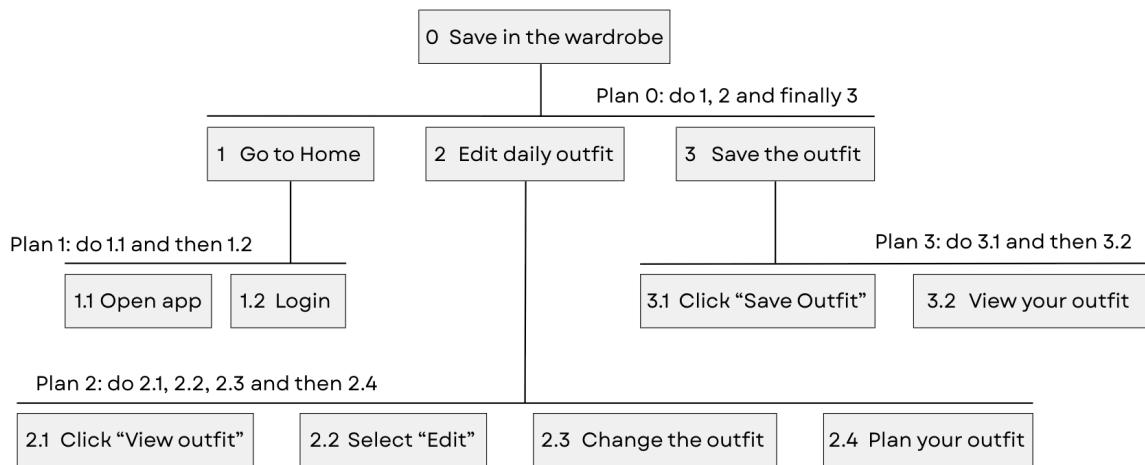


Figura 5.4: HTA

3. Searching in the community new outfit ideas from other users

Users can explore the community to find inspiration for new outfits. They can browse outfits created by others, view which of their own items are used in the outfits, and check the profile of the user who posted them. If they like a creator's style, they can start following them to stay updated on their future posts and outfit ideas.

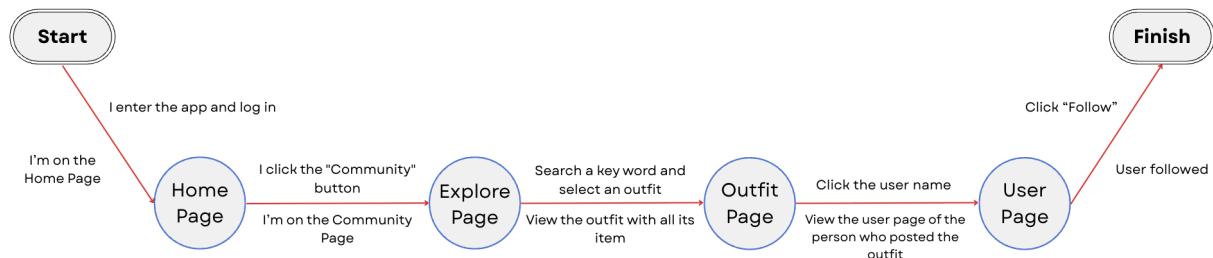


Figura 5.5: STN

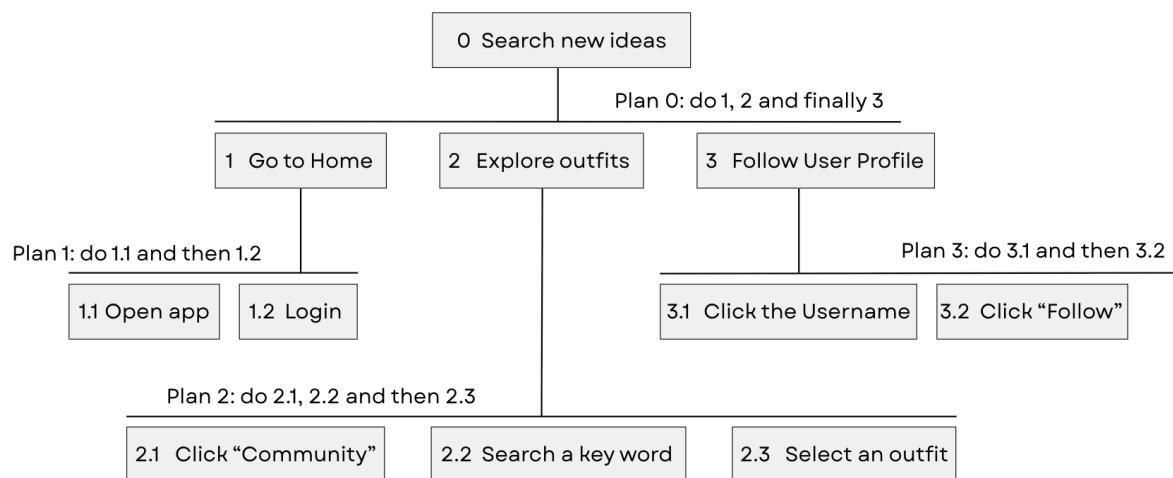
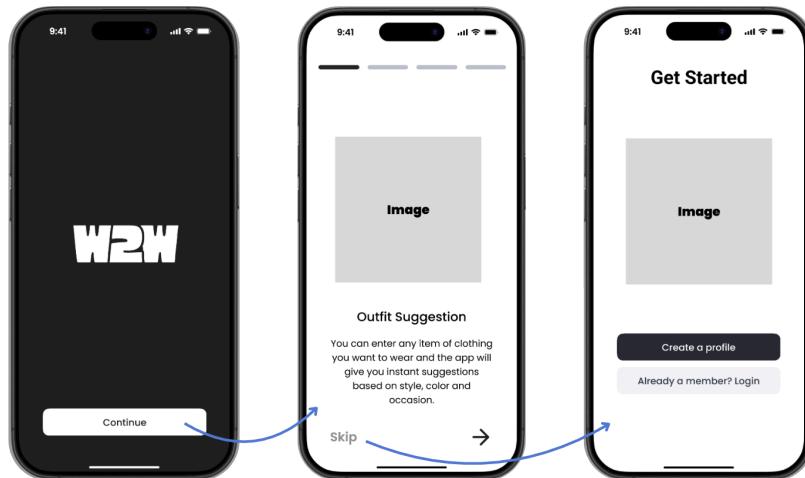


Figura 5.6: HTA

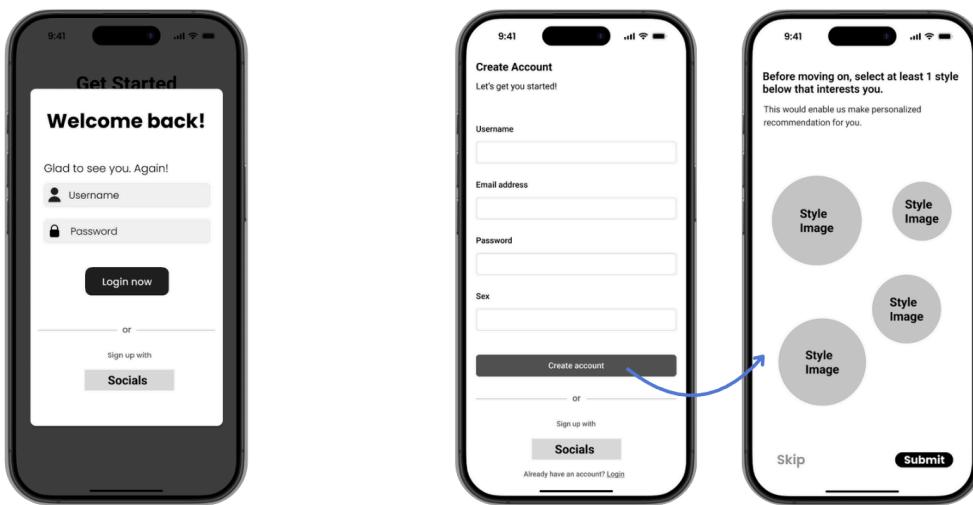
5. Mockups and Prototype 0

1. Wireframe

As a first step in developing our application, we began by creating a **wireframe**, a rough layout without images. This initial structure helped us determine how many screens we needed, how to design them, and which interactions to include. In many ways, the wireframe served as the backbone of our application, providing a clear foundation for the user experience.

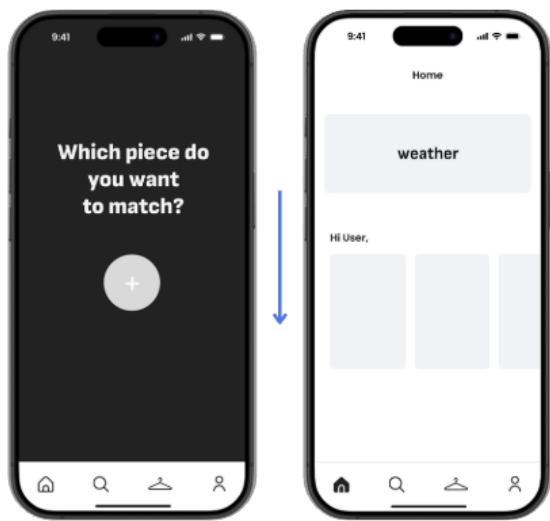


Welcome screen and Introduction

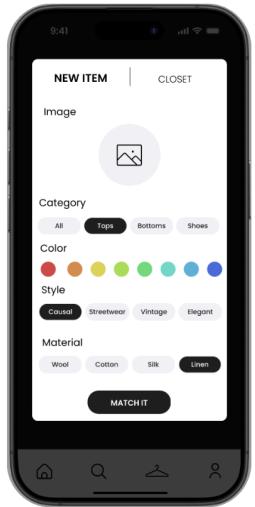


Login Page

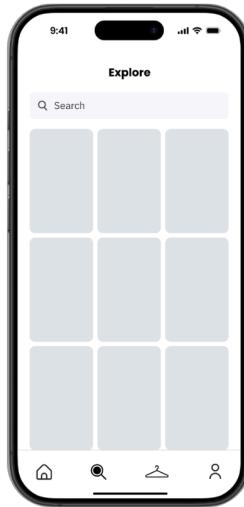
Sign in Page



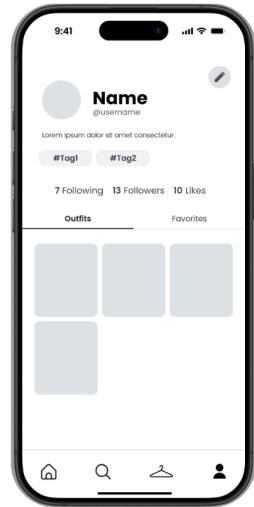
HomePage



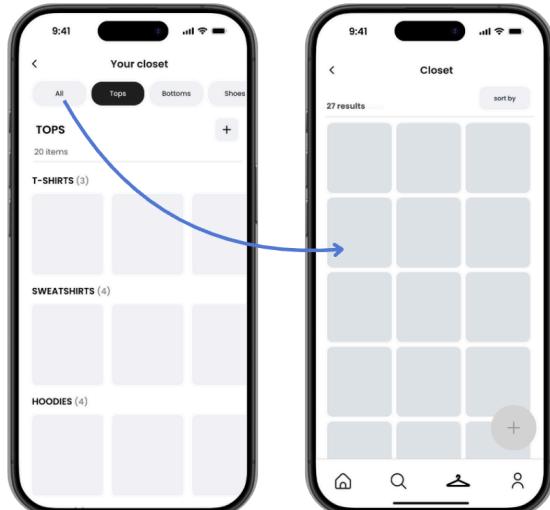
Insert new item



Community



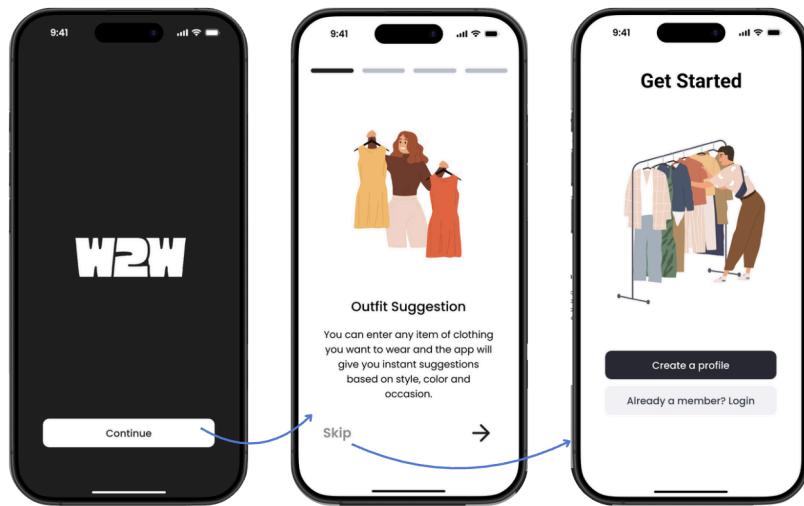
Profile Page



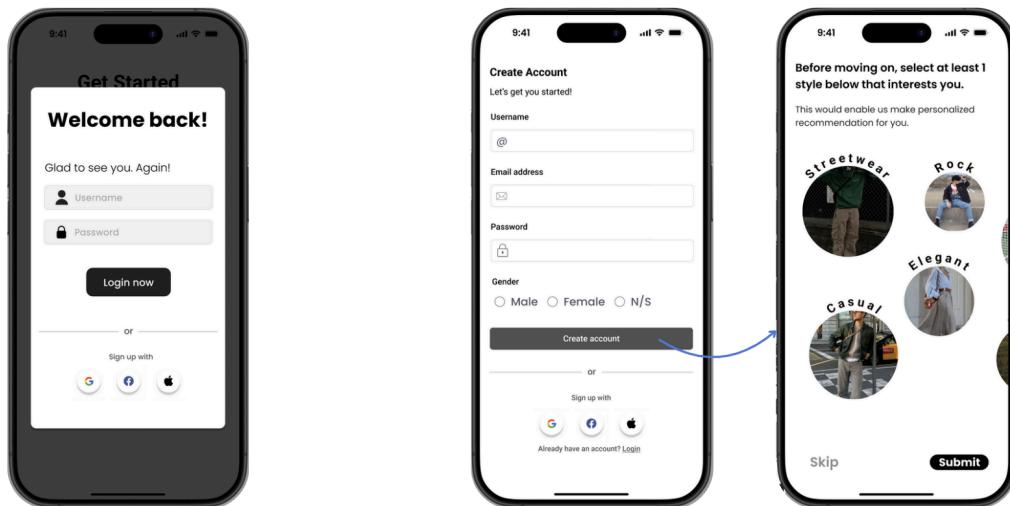
Closet

2. Mockup

After defining the structure through wireframes, we proceeded to create **mockups**, introducing visual elements such as images, colors, and typography. These mockups allowed us to explore the look and feel of the app, refine the visual hierarchy, and ensure consistency across screens. Unlike wireframes, mockups provided a more realistic preview of the final interface, helping us make informed design decisions and anticipate how users would visually engage with the app.



Welcome screen and Introduction

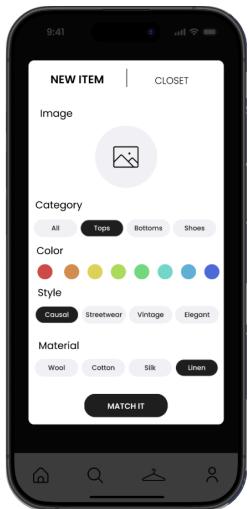


Login Page

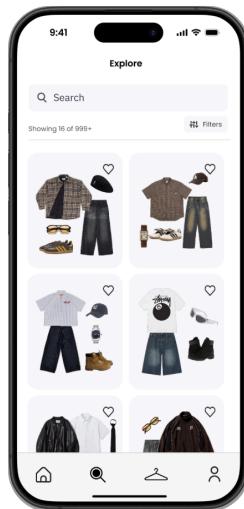
Sign in Page



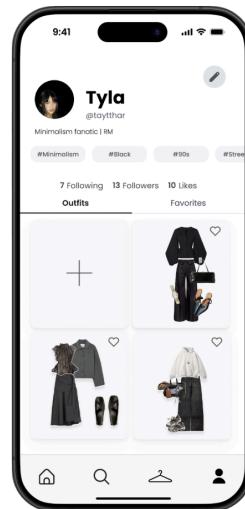
HomePage



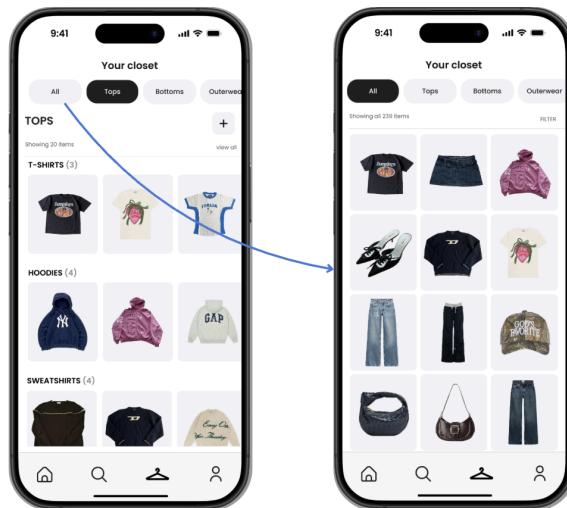
Insert new item



Community



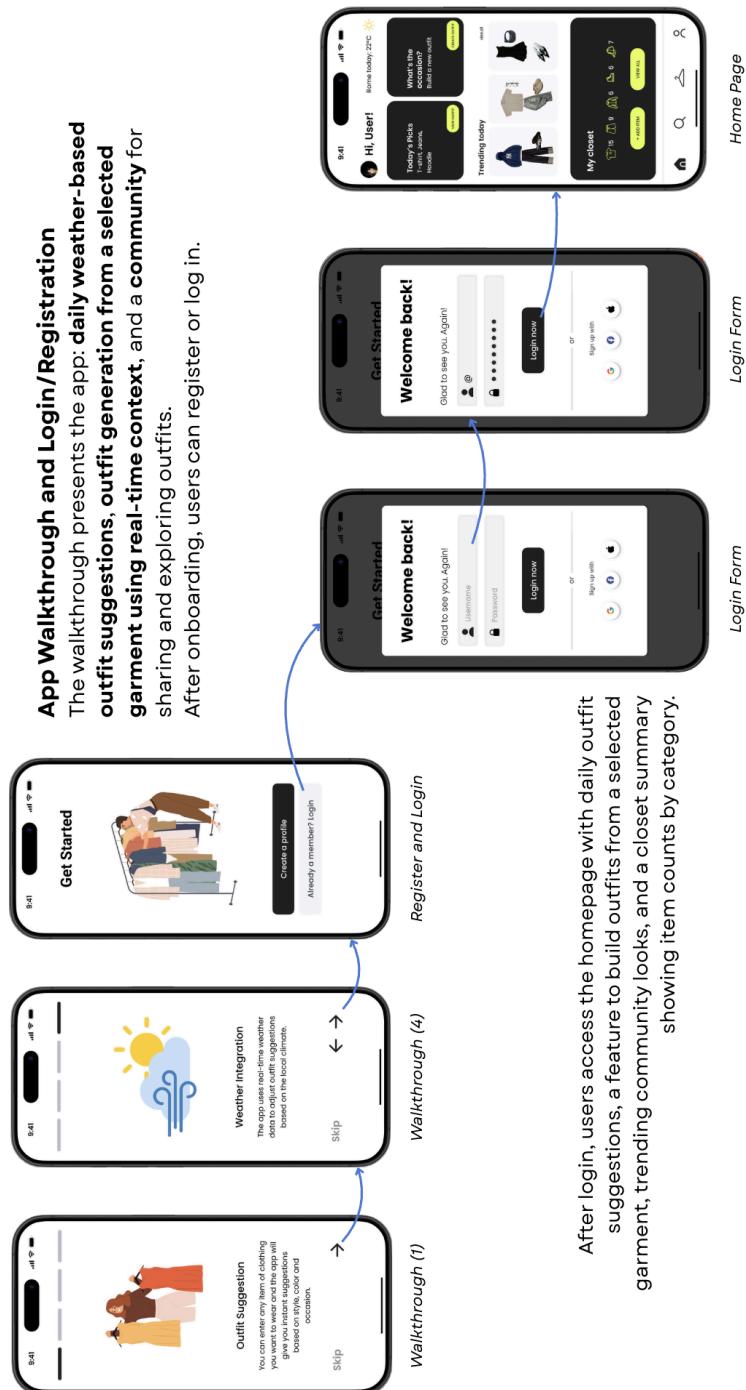
Profile Page



Closet

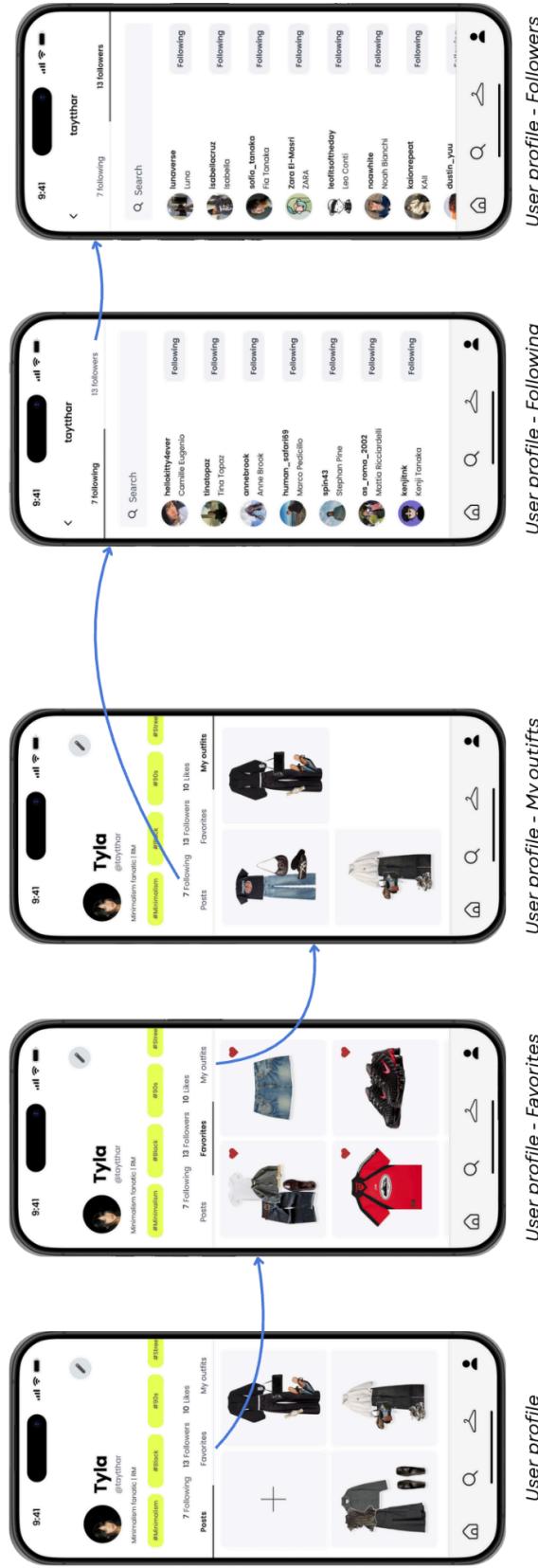
3. Prototype 0

Once the mockups were finalized, we developed **Prototype 0**, an interactive version of the app that simulates key user flows. This early prototype allowed us to test navigation, validate the layout, and identify usability issues before moving into full development. While the prototype closely followed the structure defined in the mockups, some changes were made during the development process, most notably in the **Home screen**, where we refined both the layout and the content to better support real user needs and behaviors. These adjustments reflect our iterative design approach, where continuous testing and feedback drive improvements.



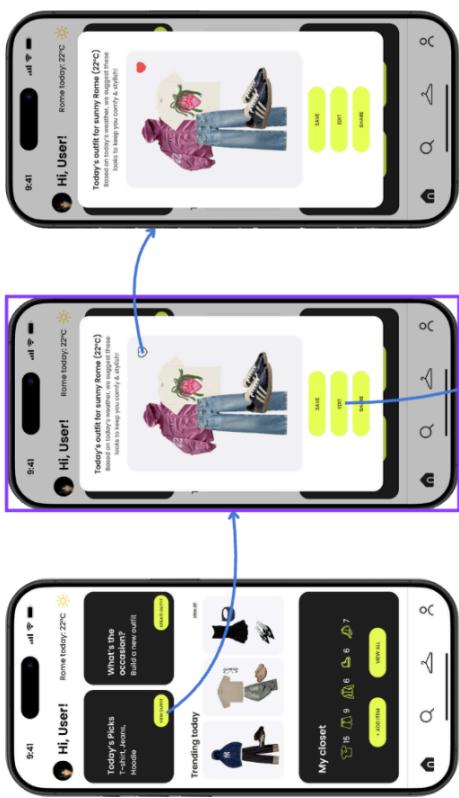
User profile

Users **personalize** their profile by selecting preferred styles at registration.

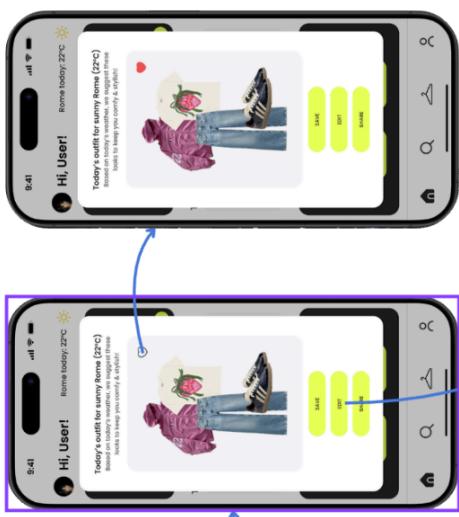


The profile includes **posts** (shared outfits), **favorites** (liked outfits from the community), and **saved outfits** (generated by the app and saved by the user).

Users can **follow** and **search** for other users.

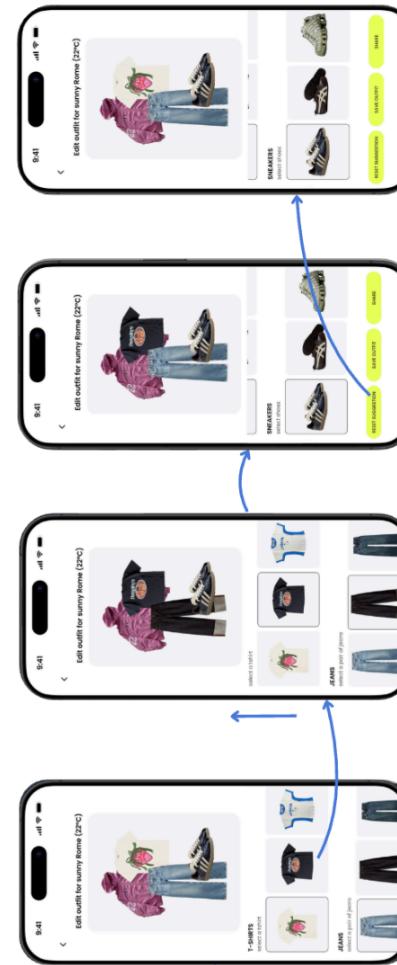


Home Page
Today's pick



Outfit I liked

Weather-based daily outfit suggestion feature
By clicking "Today's Picks", users see the weather-based outfit suggestion for the day.
They can **save**, **edit**, or **share** the outfit.

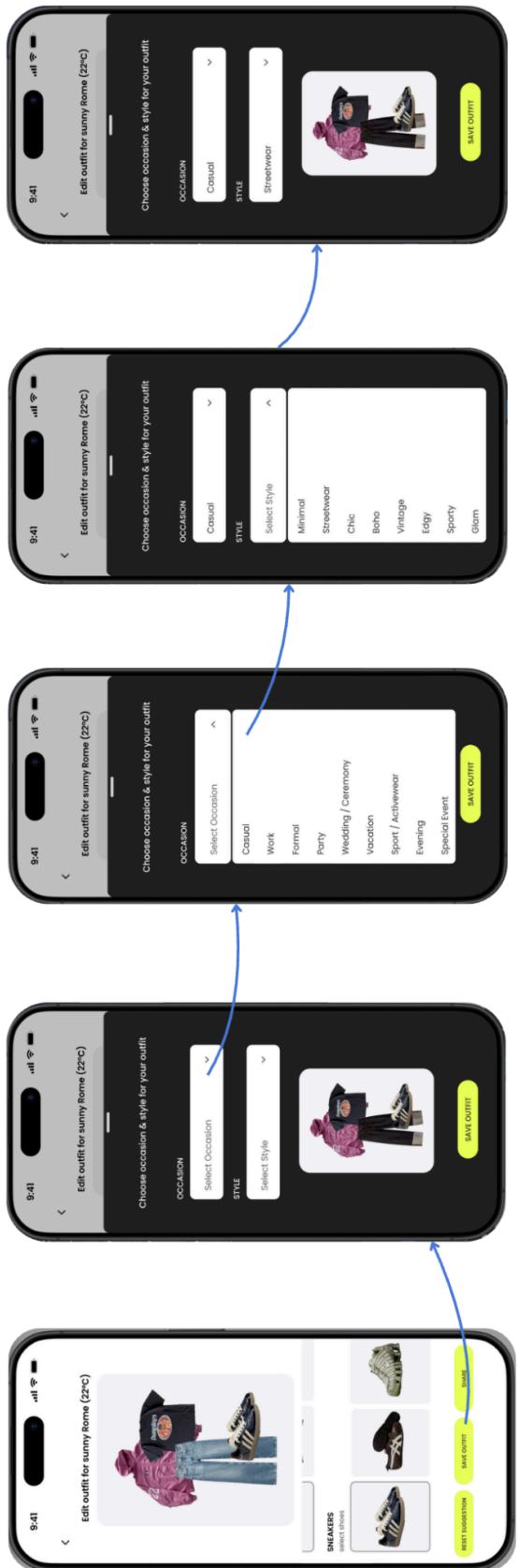


Edit suggested outfit

Editing outfit

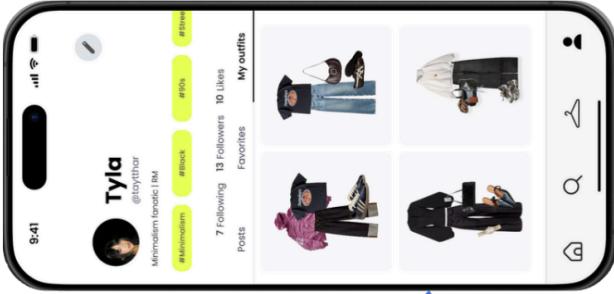
Reset to suggested outfit

Edit mode
In **edit mode**, users can replace individual garments from their wardrobe, with the option to reset and restore the original suggestion.

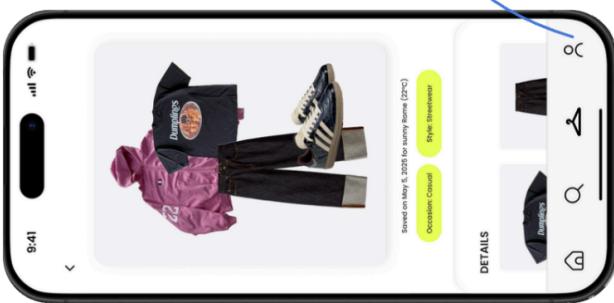


Saving an outfit

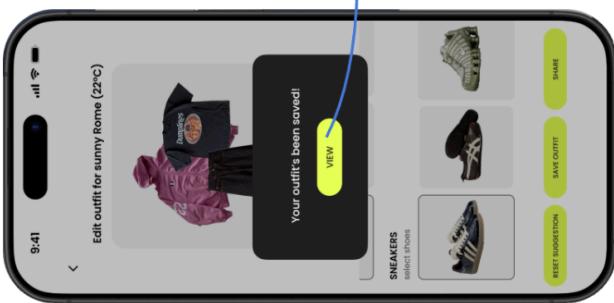
After selecting the garments, users choose the outfit's occasion and style to tag it. Once the tags are selected, the outfit can be **saved**.



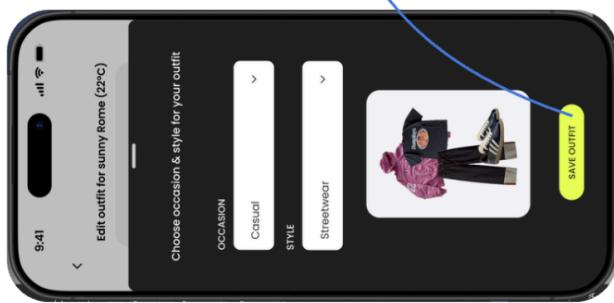
User profile - My outfits
updated with the newly saved outfit



View outfit saved



Outfit saved



Save edited outfit

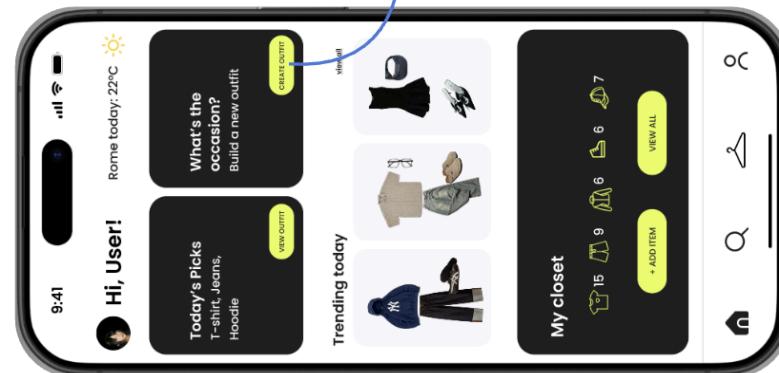
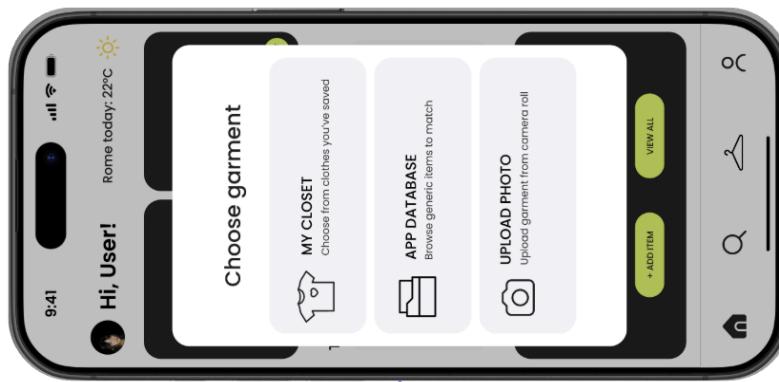
Once the outfit is saved, the user is notified and can choose to view it.
The outfit view displays its details and tags, and the user's profile is updated with the new outfit in the "My Outfits" section.

Outfit builder feature

From the homepage, users can select the **outfit builder function**: instead of generating a full outfit based only on the weather, this feature allows users to input where they're going, at what time, and for which occasion and style.

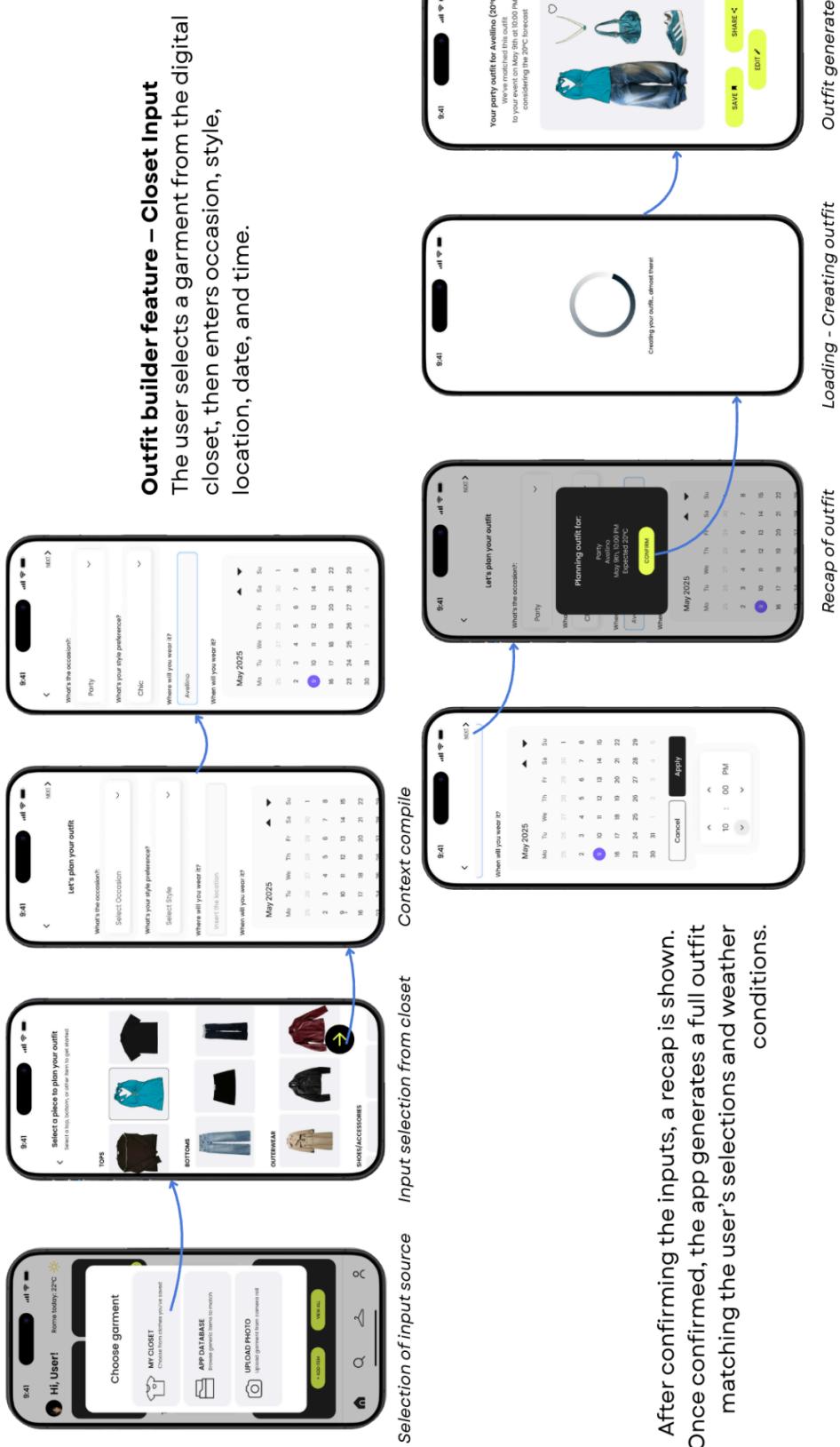
Based on these inputs and one selected garment, the app **automatically generates** a full outfit that matches the event, time, location, style, and weather conditions.

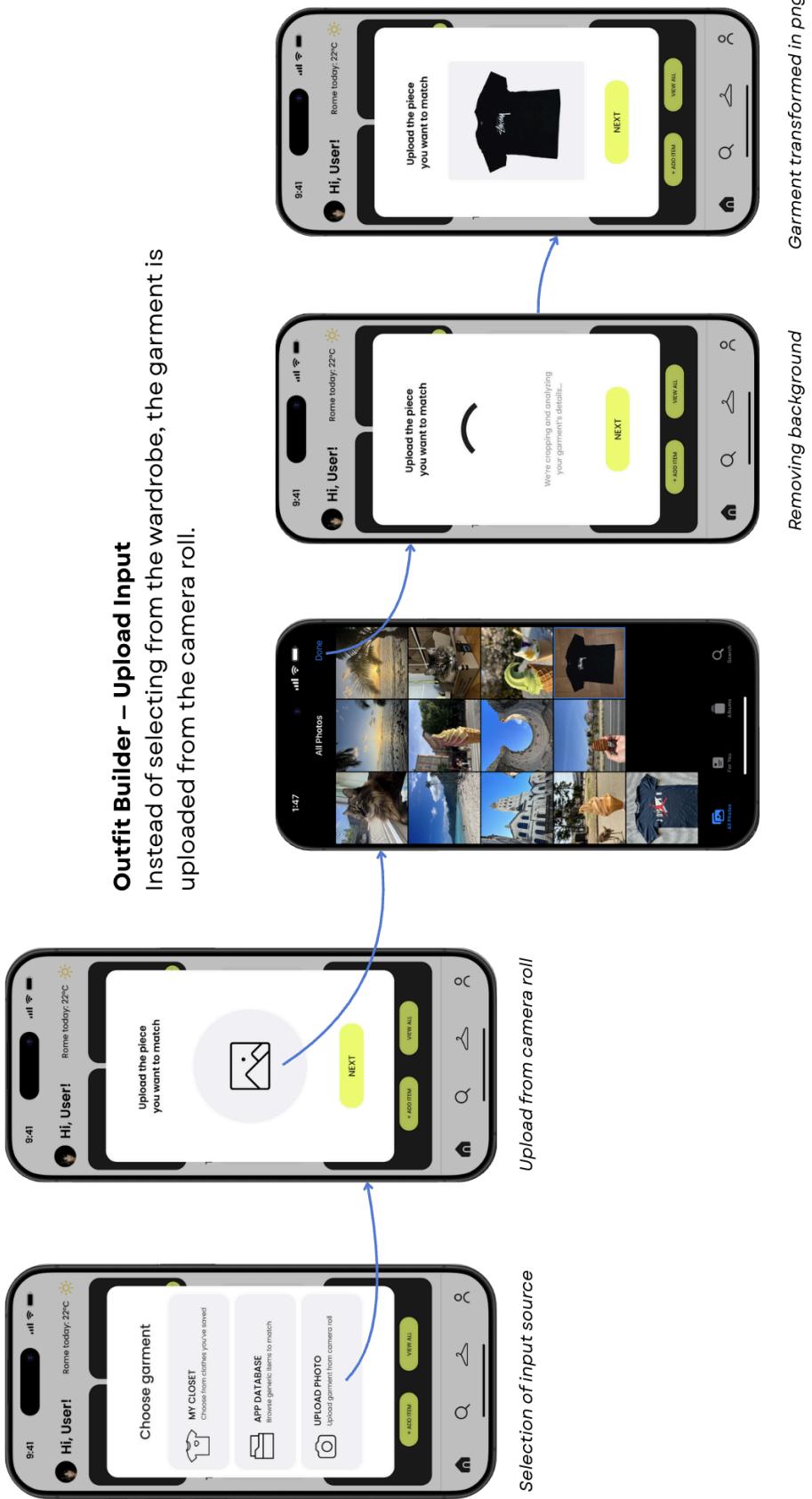
The starting garment can be selected from the user's **digital wardrobe, uploaded from the camera roll**, or chosen from the app's **database**.



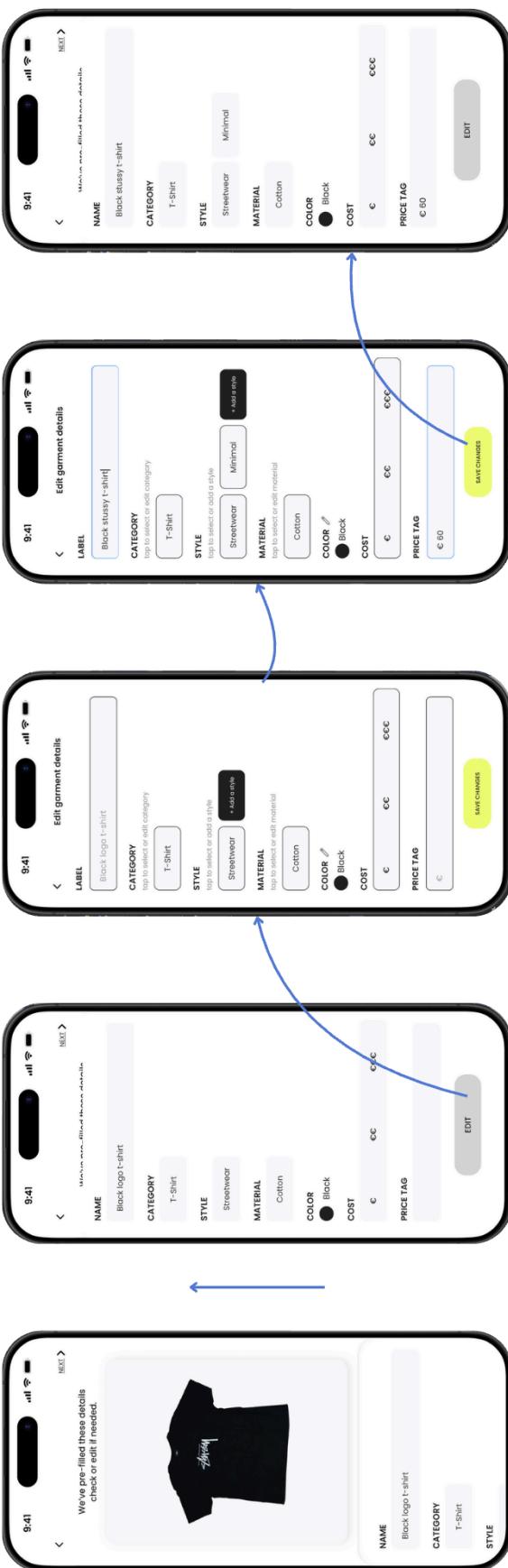
Selection of input source

Home Page





The app removes the background and automatically detects key attributes (name, color, material). The user can review and edit the generated information.

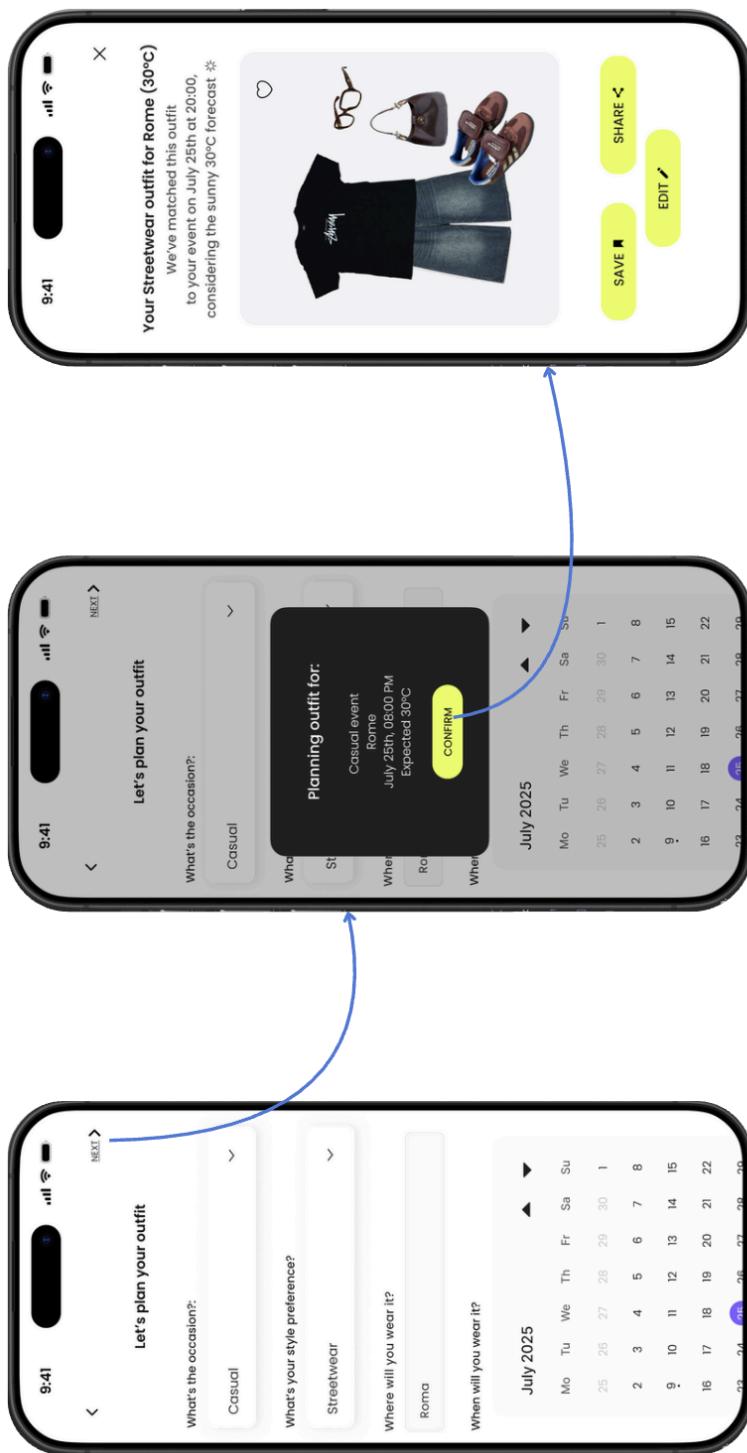


View of uploaded garment

Edit of garment details

Save garment details changes

Garment details edited

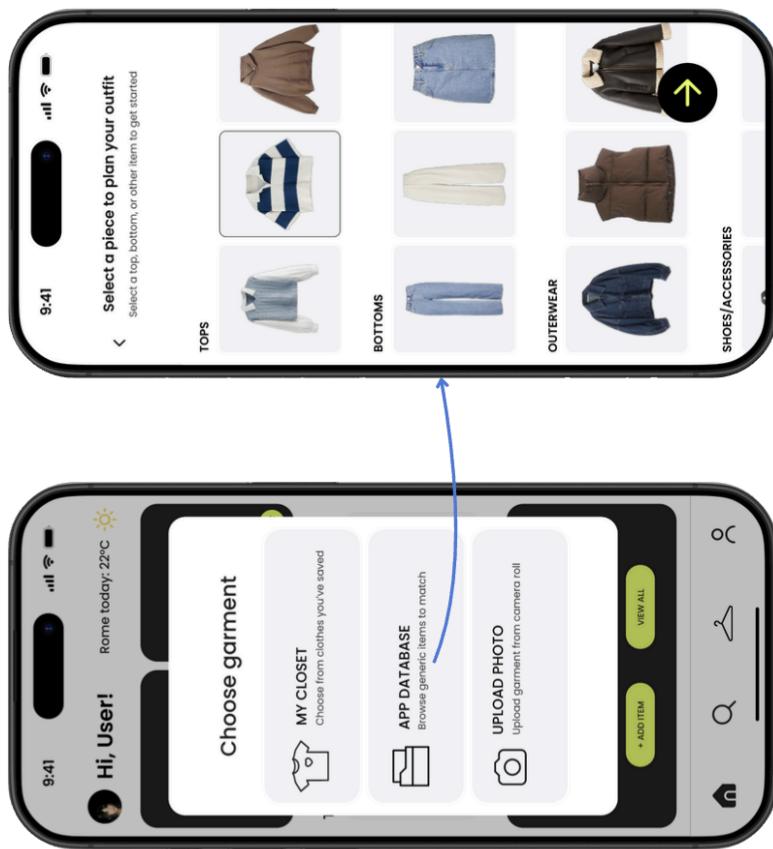


Context compile

Recap of outfit

Outfit generated

Then proceed by entering occasion, style, location, date, and time to generate the outfit.



Selection of input source

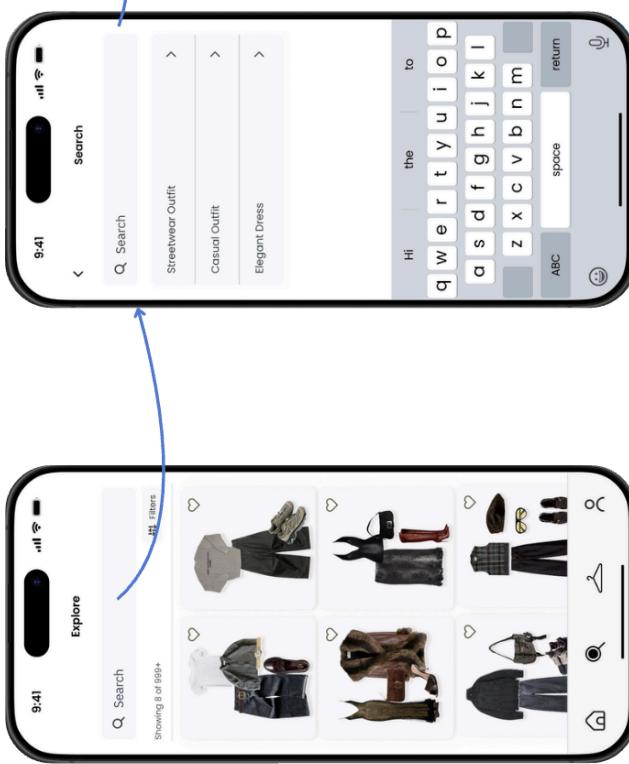
Input selection from app's database

Outfit Builder – Database Input
 Lastly, the user can select a garment from the app's database, which offers various generic items.

This option is useful for inspiration or when the garment is not available in the user's closet or photo gallery.

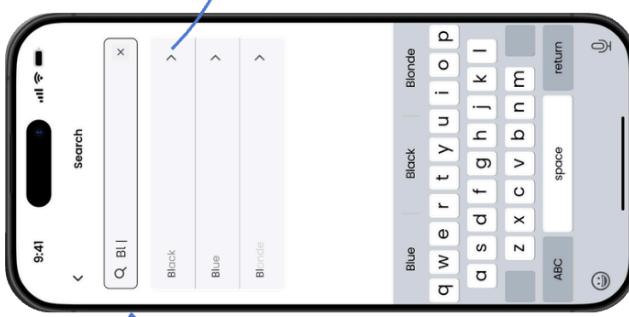
Community – Explore & Search

In the Explore page, users can **browse** posts from the community, with priority given to accounts they follow.



Explore page

Explore page - search bar

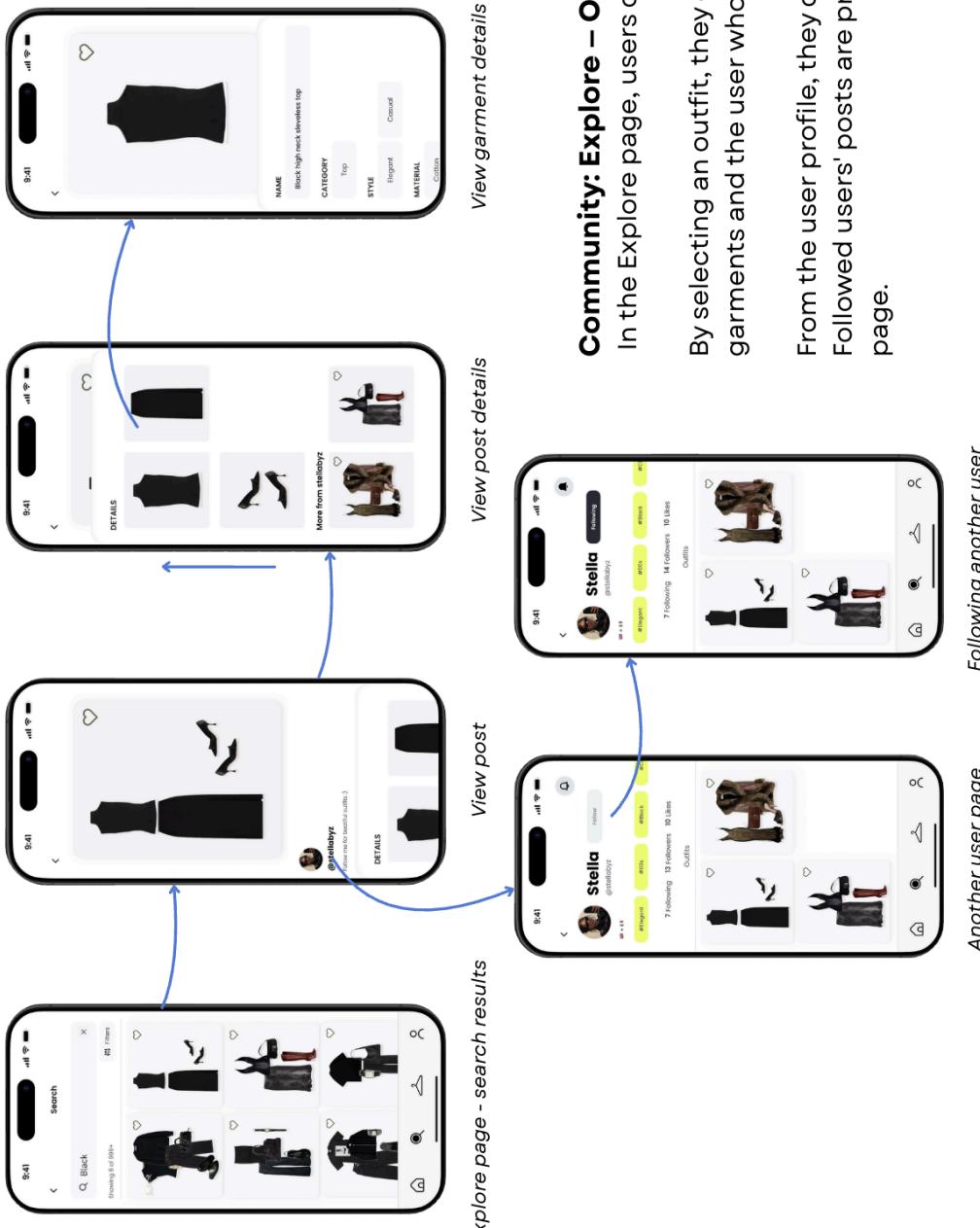


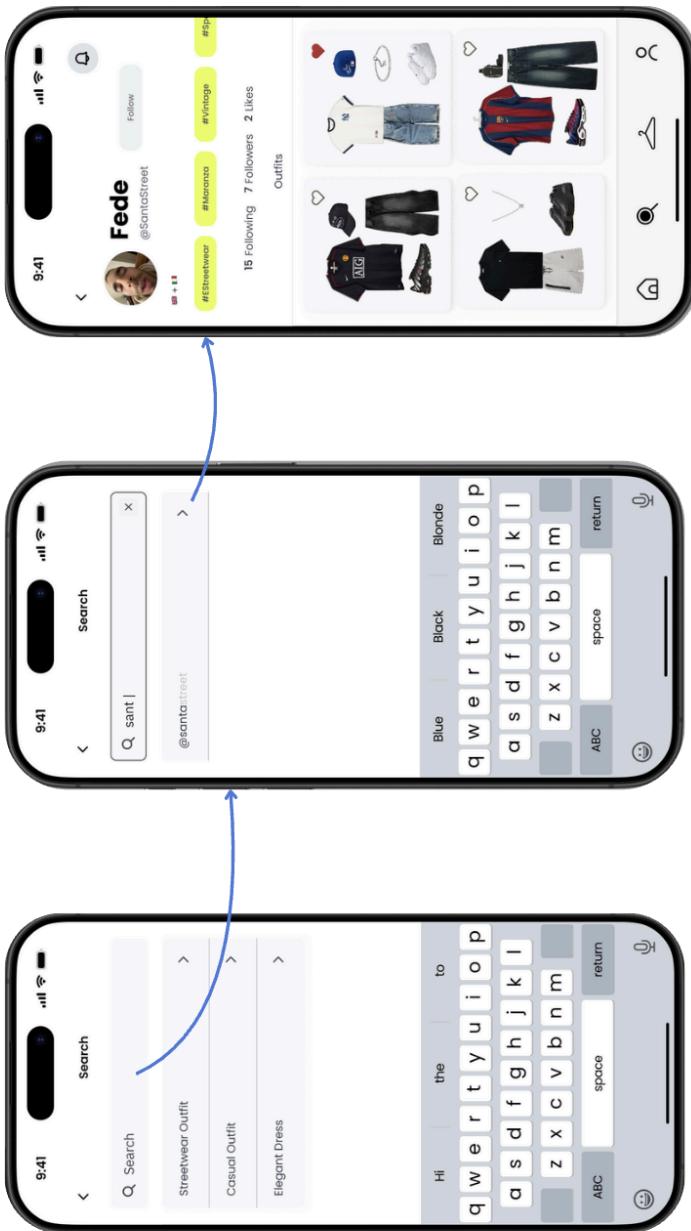
Explore page - insertion of keyword



Explore page - search results

A search bar allows users to enter **keywords** to filter and view outfits matching the search, such as colors or styles.



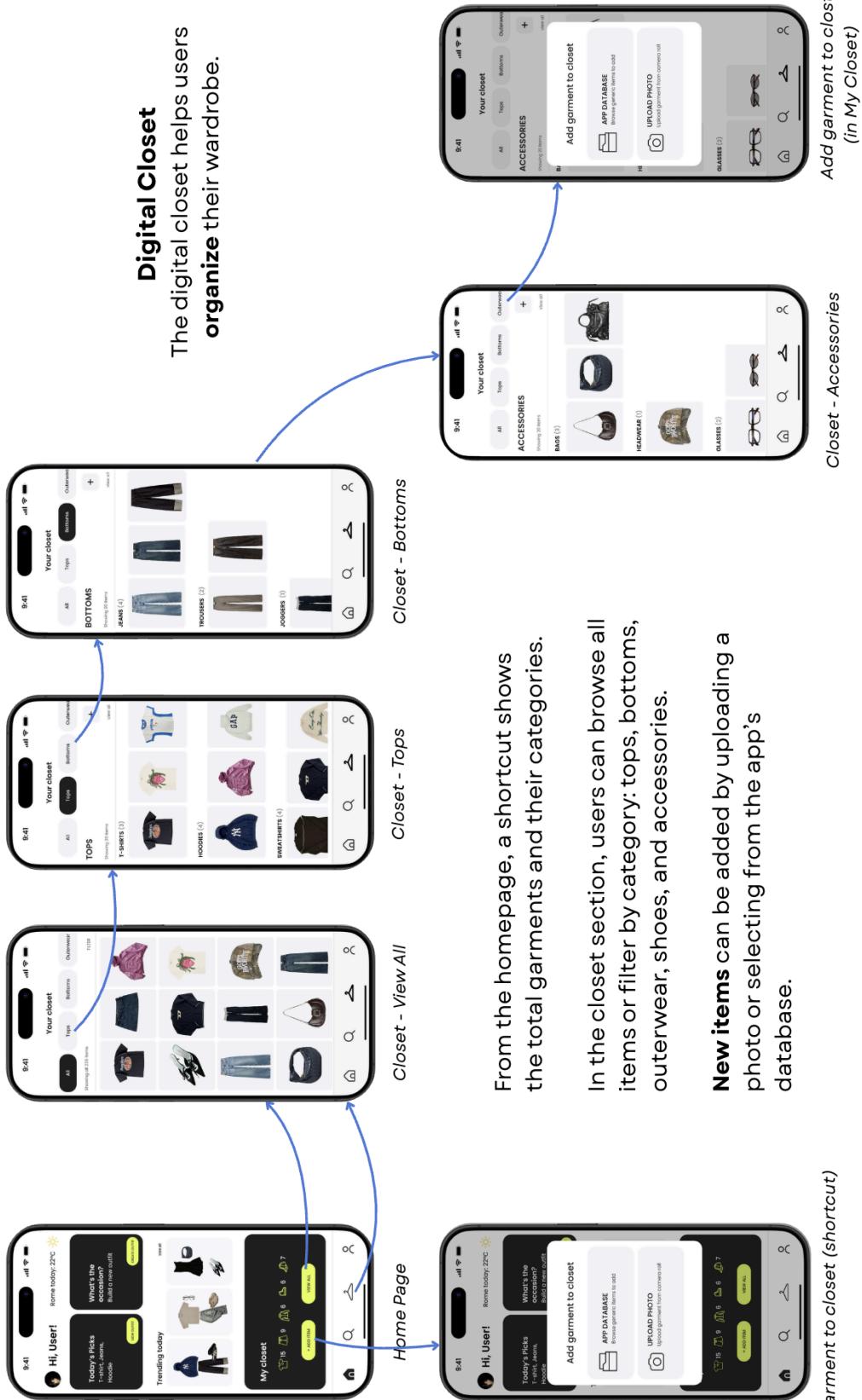


Explore page - search bar

Explore page - searching for another user's username
Another user page

Community – User Search

From the Explore page, users can also search for other users by entering their usernames. Selecting a result opens the corresponding user profile.



6. Expert-Based Evaluation

Expert-Based Evaluation is a usability evaluation method in which usability experts, rather than end-users, review a system or interface to identify potential usability issues. These experts rely on their knowledge of usability principles, design heuristics, and cognitive psychology to anticipate problems that real users might encounter during interaction with the system. Unlike user-based testing, expert-based evaluation does not require involving actual users and can be conducted early in the design process. Common expert-based techniques include **Heuristic Evaluation** (checking against usability principles) and **Cognitive Walkthrough** (simulating the user's problem-solving steps).

1. Definition of Heuristic Evaluation

A **heuristic evaluation** is a usability inspection method used to detect user interface problems by examining how well a system complies with recognized usability principles, known as **heuristics**. It is typically performed by usability experts, who systematically analyze the interface to identify potential issues that may affect the user experience, even before any user testing is conducted.

These evaluation methods are now widely taught and practiced in the new media sector, where UIs are often designed in a short space of time on a budget that may restrict the amount of money available to provide for other types of interface testing.

The primary goal is to identify problems related to **efficiency, learnability, error prevention, and user satisfaction**, allowing designers to make informed adjustments. This approach was formalized by **Jakob Nielsen**, a leading expert in usability, who developed the methodology after years of consulting and academic work in human-computer interaction.

The most widely used heuristics come from Nielsen's book Usability Engineering, which defines ten usability principles that serve as a guideline for evaluating and improving interface design.

1. Visibility of system status:

The system should always keep users informed about what is going on.

2. Match between system and the real world:

Use familiar language and concepts that align with real-world conventions.

3. User control and freedom:

Users should be able to undo and redo actions easily.

4. Consistency and standards:

Follow platform conventions and maintain consistency in wording, design, and behavior.

5. Error prevention:

Design systems to prevent errors before they occur.

6. Recognition rather than recall:
Minimize memory load by keeping options and information visible.
7. Flexibility and efficiency of use:
Allow users to customize actions or use shortcuts to speed up interaction.
8. Aesthetic and minimalist design:
Show only essential information and avoid unnecessary clutter.
9. Help users recognize, diagnose, and recover from errors:
Use clear, human-readable error messages that suggest solutions.
10. Help and documentation:
Provide easily accessible help and instructions when needed, even if the system is simple.

As part of the evaluation process, each usability issue identified is typically assigned a **severity rating**. This rating helps prioritize problems based on their impact on the user experience, how frequently they occur, and how difficult they are to overcome. Severity levels usually range from 0 (**not a problem**) to 4 (**usability catastrophe**), enabling designers to focus on the most critical issues first.

2. Heuristic Evaluation

The evaluation of **Prototype 0** was conducted through a **heuristic evaluation** performed by our professors, **Valeria Mirabella** and **Venkata Srikanth Varma Datla**, who applied Jakob Nielsen's usability heuristics to analyze the interface and interactions of our early prototype.

Below is their detailed heuristic evaluation of our project, based on the functionality and user flows implemented in **Prototype 0**.

Frame	Heuristic violated	Severity	Comment
Onboarding Screen	Recognition Rather than Recall	2	Offer users a summary of the onboarding process when they first open the app.
Login/Registration Interface	Help Users Recognize, Diagnose, and Recover from Errors	3	During the registration and login processes, when users input their username and password, there are currently no tooltips or error-handling mechanisms available. Implementing real-time feedback and suggestions can significantly improve usability and reduce frustration.
User Profile	Help and Documentation	2	No explanation of the hashtag system or how style preferences affect recommendations. New users may not understand the impact of profile customization.
Suggested Outfit Interface	Error Prevention	2	There is no confirmation required before overwriting suggested outfits.

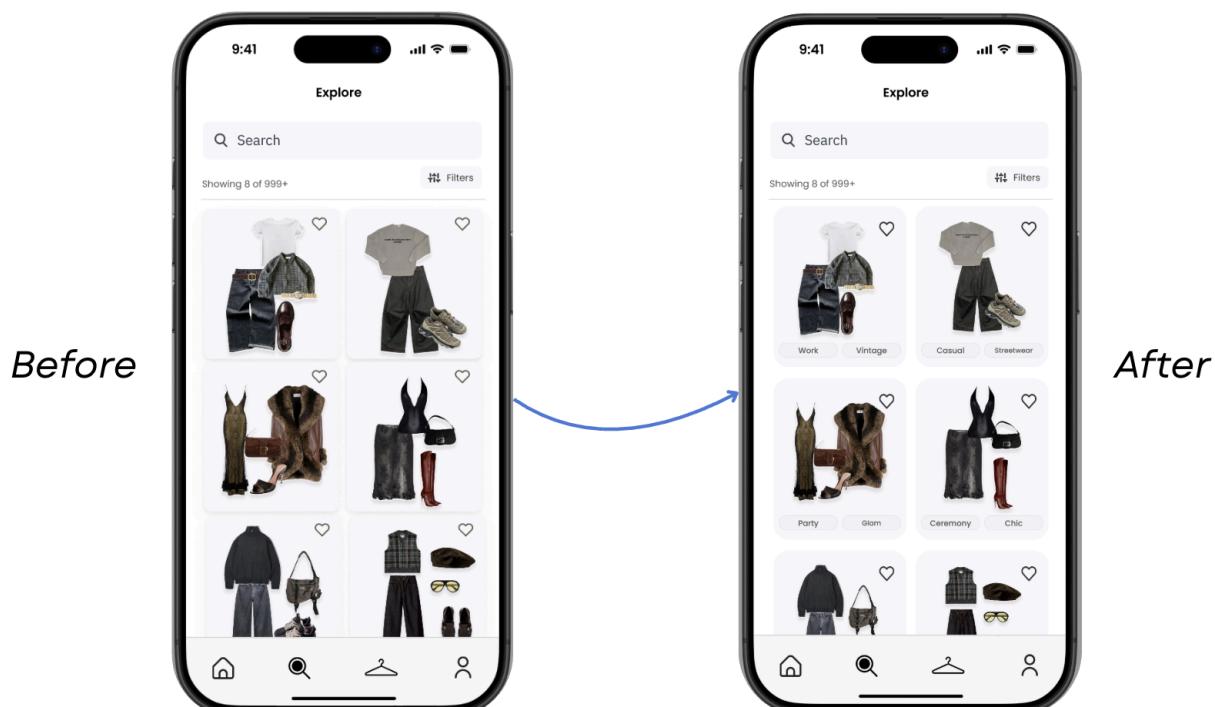
Posting an Outfit to the Community	User Control and Freedom	2	There is no visible “Cancel” button on the post details form, so users must rely on the system's back arrow, which may not be clear to everyone.
Editing Garment Details	User Control and Freedom	3	There is no “Cancel” button available while editing outfits. Users must navigate back through several screens to exit the editing mode.
Outfit Builder Interfaces	Error Prevention	4	No real-time validation for mandatory fields allows users to save an outfit without specifying details such as occasion or style. This can result in unusable suggestions later.
Community Explore	Recognition Rather than Recall	3	Outfit cards do not include tags for occasions or weather. As a result, users must open each post to understand the context.

3. Correction of detected defects and Prototype 1 (HE)

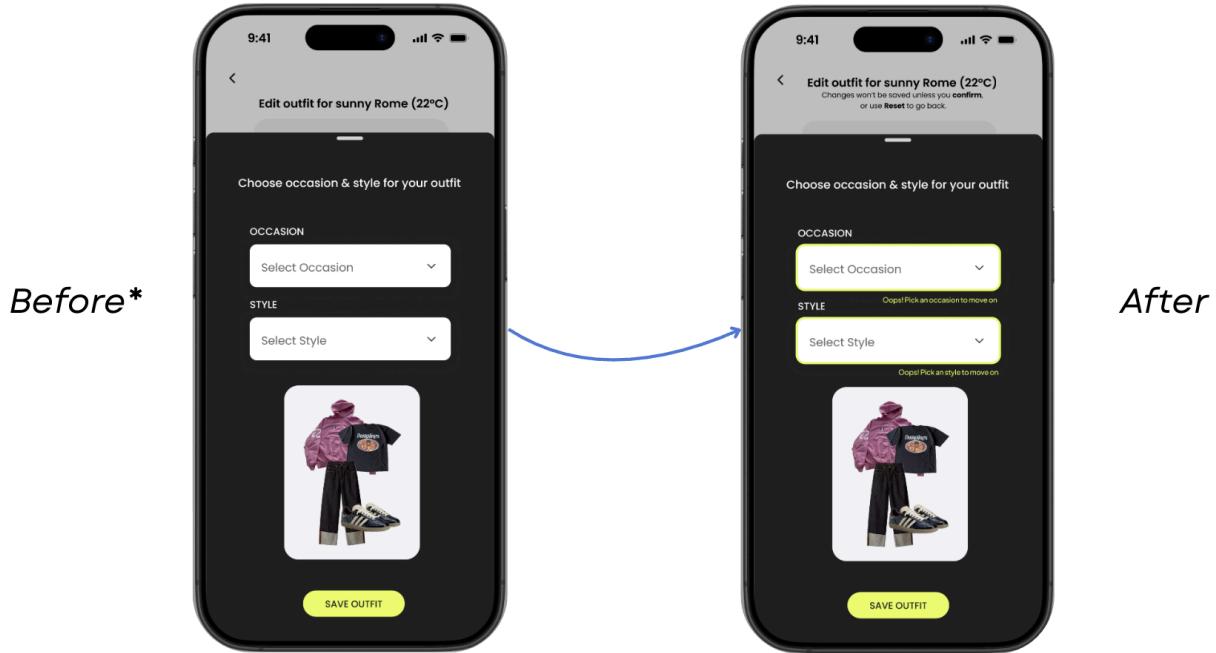
After receiving the heuristic evaluation, we analyzed the identified issues and implemented the necessary improvements. As a result, **Prototype 1** was developed, incorporating the suggested corrections to enhance usability and overall user experience.

The main changes introduced in Prototype 1 include:

- “Outfit cards do not include tags for occasions or weather. As a result, users must open each post to understand the context”

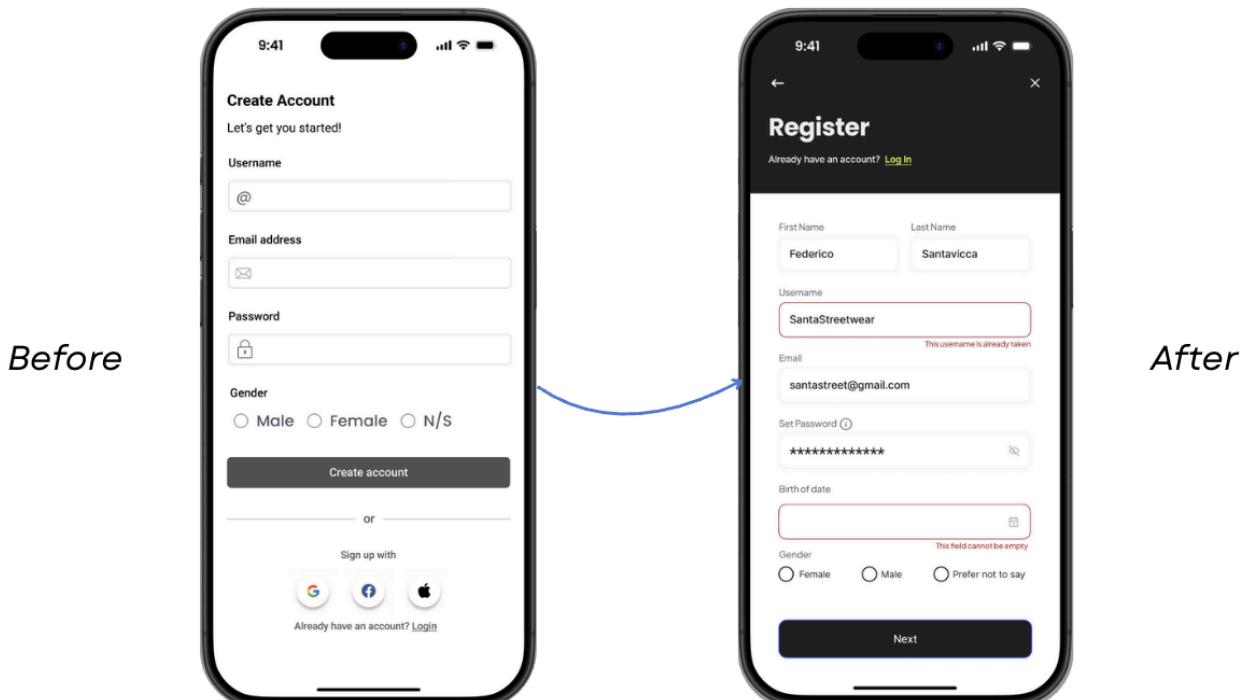


- “No real-time validation for mandatory fields allows users to save an outfit without specifying details such as occasion or style. This can result in unusable suggestions later”



*You can save an outfit without select an occasion and a style

- “During the registration and login processes, when users input their username and password, there are currently no tooltips or error-handling mechanisms available. Implementing real-time feedback and suggestions can significantly improve usability and reduce frustration”



4. Definition of Cognitive Walkthrough

Cognitive Walkthrough is a usability inspection method used to evaluate how easily a new or inexperienced user can complete specific tasks within an interactive system. It focuses on **task-specific interactions**, making it particularly effective for identifying issues related to **learnability**, that is, how intuitively a user can learn to use the interface through action rather than instruction.

Unlike heuristic evaluation, which provides a broad assessment of the entire interface, the cognitive walkthrough is more focused and structured around concrete user goals and steps.

The process involves breaking down a task into a series of user actions and, for each action, asking four key questions:

1. **Is the effect of the action the same as the user's goal at that point?**
(Does the user understand that this subtask is needed to reach their goal?)
2. **Will users see that the action is available?**
3. **Once users find the correct action, will they know it is the one they need?**
4. **After the action is taken, will users understand the feedback they get?**

To perform a Cognitive Walkthrough, evaluators typically use a prototype of the system, a detailed task description, a complete list of necessary actions, and a clear definition of the intended user profile. Any negative answer to the four questions indicates a potential usability issue that should be documented and addressed.

5. Cognitive Walkthrough

The evaluation of **Prototype 0** was conducted through a **Cognitive Walkthrough** performed by our professors, **Valeria Mirabella** and **Venkata Srikanth Varma Datla**, who answered the four questions for each Act-Resp in our prototype.

Below is the result of the cognitive walkthrough of the task "Posting a custom outfit to the community".

Act. 1: open the app;

Resp. 1: App opens, Login Page is displayed;

Q1. Is the effect of the action the same as the user's goal at that point? (Does the user understand that this subtask is needed to reach the goal?)	yes
Q2. Will users see the action is available?	yes
Q3. Once users find the correct action, will they know it is the one they need?	yes
Q4. After the action is taken, will users understand the feedback they get?	yes

Act. 2: Log in with credentials;

Resp. 2: Log in successful, user is redirected to the home page;

Q1. Is the effect of the action the same as the user's goal at that point? (Does the user understand that this subtask is needed to reach the goal?)	yes
Q2. Will users see the action is available?	yes
Q3. Once users find the correct action, will they know it is the one they need?	yes
Q4. After the action is taken, will users understand the feedback they get?	Partial. Show a confirmation message to the user as Login successful

Act. 3: Click “Create outfit” button;

Resp. 3: Outfit creation page opens with options to select the source;

Q1. Is the effect of the action the same as the user's goal at that point? (Does the user understand that this subtask is needed to reach the goal?)	yes
Q2. Will users see the action is available?	Maybe. The button placement and visual prominence may vary, potentially making it less discoverable.
Q3. Once users find the correct action, will they know it is the one they need?	yes
Q4. After the action is taken, will users understand the feedback they get?	yes

Act. 4: Select “Upload a photo”;

Resp. 4: Photo upload screen is displayed;

Q1. Is the effect of the action the same as the user's goal at that point? (Does the user understand that this subtask is needed to reach the goal?)	yes
Q2. Will users see the action is available?	yes
Q3. Once users find the correct action, will they know it is the one they need?	yes
Q4. After the action is taken, will users understand the feedback they get?	yes

Act. 5: Select a piece to upload;

Resp. 5: The selected item appears in the outfit builder;

Q1. Is the effect of the action the same as the user's goal at that point? (Does the user understand that this subtask is needed to reach the goal?)	yes
Q2. Will users see the action is available?	yes
Q3. Once users find the correct action, will they know it is the one they need?	yes
Q4. After the action is taken, will users understand the feedback they get?	yes

Act. 6: Plan the outfit (occasion, location, date, time);

Resp. 6: Planning data is saved and displayed as summary with the entire outfit;

Q1. Is the effect of the action the same as the user's goal at that point? (Does the user understand that this subtask is needed to reach the goal?)	Maybe. Users may not understand why contextual planning is necessary for outfit generation.
Q2. Will users see the action is available?	yes
Q3. Once users find the correct action, will they know it is the one they need?	yes
Q4. After the action is taken, will users understand the feedback they get?	yes

Act. 7: Click the “Share” button;

Resp. 7: The Share Page is displayed;

Q1. Is the effect of the action the same as the user's goal at that point? (Does the user understand that this subtask is needed to reach the goal?)	yes
Q2. Will users see the action is available?	yes
Q3. Once users find the correct action, will they know it is the one they need?	yes
Q4. After the action is taken, will users understand the feedback they get?	yes

Act. 8: Fill the informations fields (caption, style..) and post the outfit;

Resp. 8: The outfit is shared on the community;

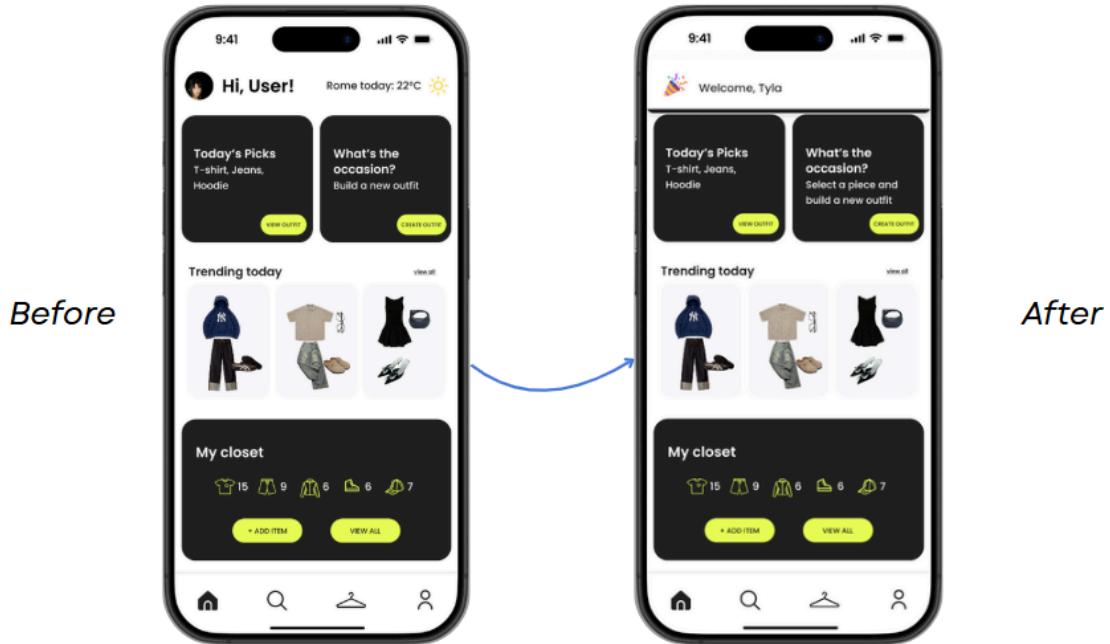
Q1. Is the effect of the action the same as the user's goal at that point? (Does the user understand that this subtask is needed to reach the goal?)	yes
Q2. Will users see the action is available?	Maybe. Required vs. optional fields may not be clearly distinguished.
Q3. Once users find the correct action, will they know it is the one they need?	yes
Q4. After the action is taken, will users understand the feedback they get?	Partial. Success confirmation may be unclear or missing.

6. Correction of detected defects and Prototype 1 (CW)

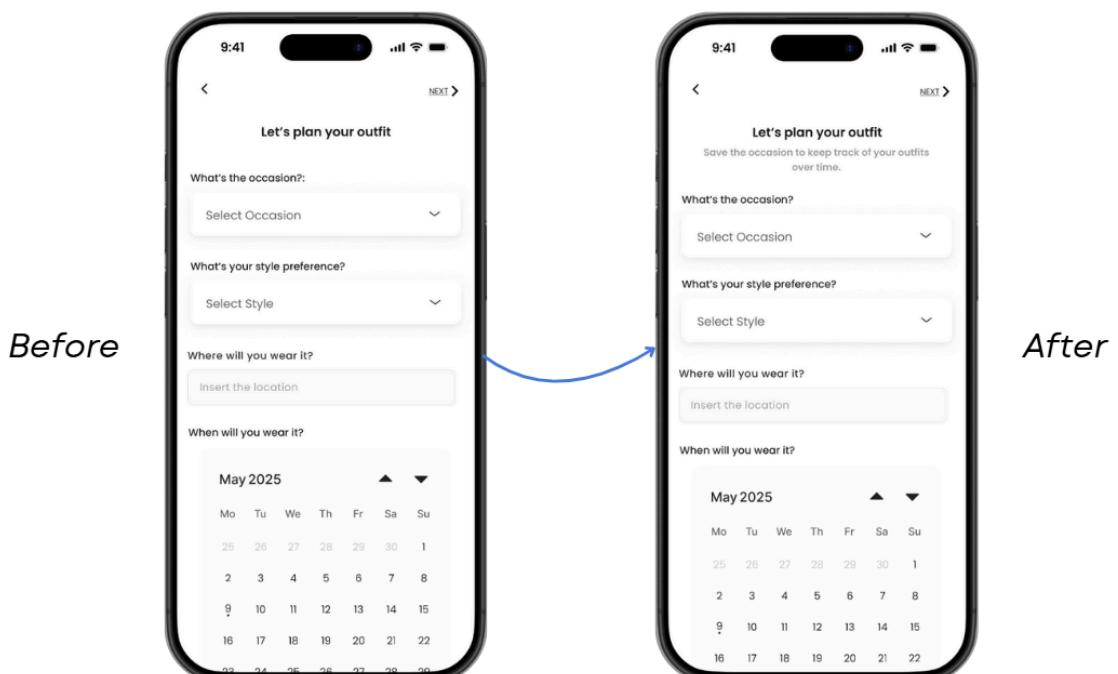
After receiving the Cognitive Walkthrough, we analyzed the identified issues and implemented the necessary improvements. As a result, we incorporated the suggested corrections into the corrections already made after the heuristic evaluation in **Prototype 1**.

The main changes introduced in Prototype 1 include:

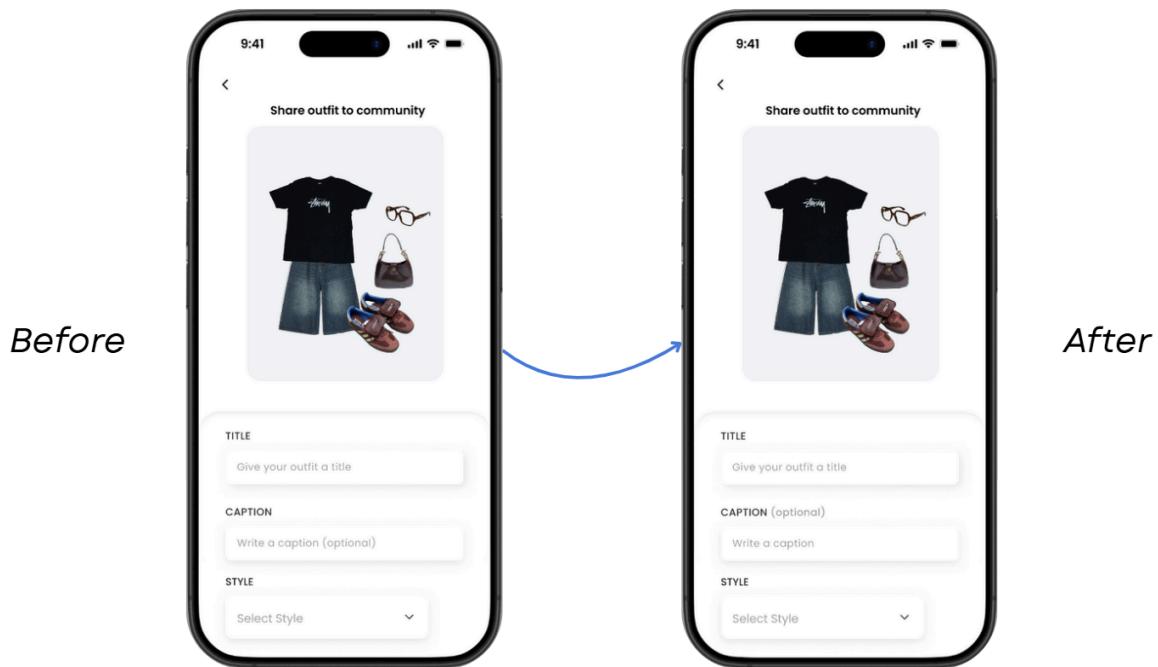
- “Partial. Show a confirmation message to the user as Login successful”



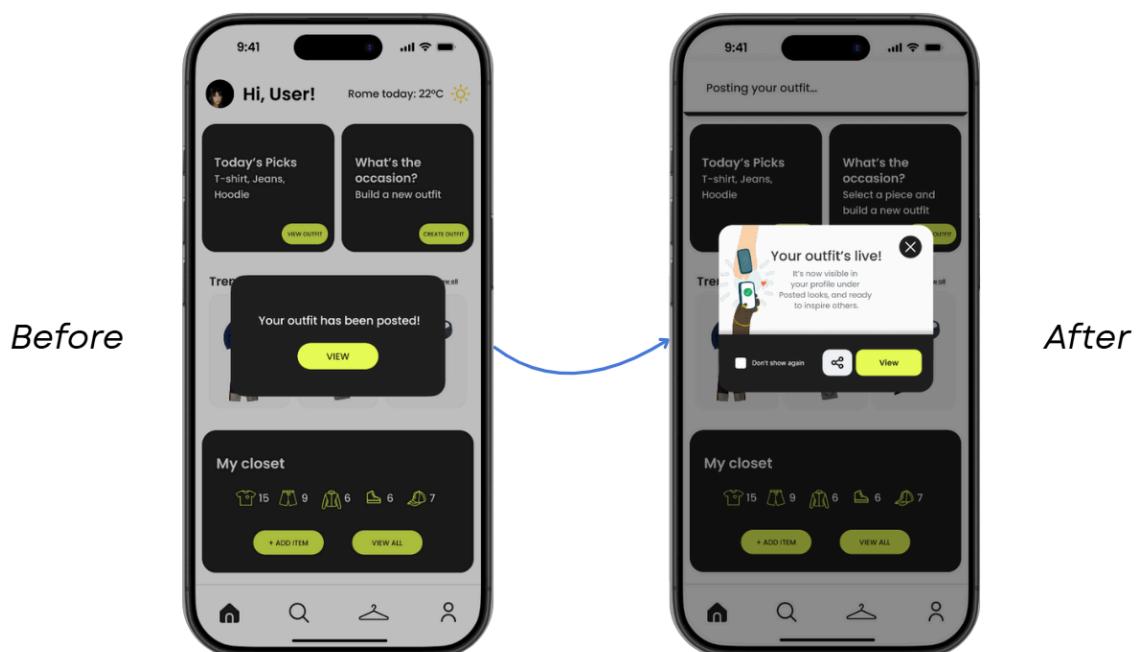
- “Maybe. Users may not understand why contextual planning is necessary for outfit generation.”



- “Maybe. Required vs. optional fields may not be clearly distinguished.”



- “Partial. Success confirmation may be unclear or missing.”



7. User-Based Evaluation

User-Based evaluation is a usability assessment method that involves real or representative users interacting with the system to perform specific tasks. The objective is to observe their behavior, identify usability issues, and understand how effectively the interface supports task completion.

Unlike Expert-Based methods, user-based evaluations are grounded in actual user experience and provide direct insight into how the design works in practice. This category includes techniques like **Think Aloud**, **Cooperative Evaluation**, and **Controlled Experiments**, which are covered in detail later.

Such evaluations are essential for validating design decisions and ensuring the product meets users' needs and expectations in real-world contexts.

1. Definition of Think Aloud

The **Think Aloud** method is a user-based evaluation technique in which participants are asked to perform a set of tasks while **verbalizing their thoughts**. This includes explaining what they are doing, why they are doing it, and what they believe is happening at each step. The goal is to gain direct insight into the user's reasoning process and mental model while interacting with the interface.

During the session, the evaluator observes and takes notes on both the user's actions and verbal comments. This method is particularly valuable because it reveals usability issues that might otherwise go unnoticed, especially in early prototypes.

Think Aloud is appreciated for its **simplicity and low cost**, it does not require complex setups or large samples, yet it provides rich qualitative feedback. However, it also has limitations: the data collected can be **highly subjective**, and the process of verbalizing may **alter the user's natural task behavior**, especially in more cognitively demanding situations.

To conduct a successful Think Aloud session, it's important to clearly explain to the participant that they are not being tested, and that their role is simply to express what they think as they use the system. The facilitator should avoid giving hints or assistance during the task and only intervene to prompt the user to "keep talking" when needed.

2. Think Aloud

To evaluate the usability of our application, we selected **two representative tasks** and asked a user to perform them using the **Think Aloud** method. During the session, the user was encouraged to verbalize their thoughts while interacting with the interface, expressing what they were doing, why they were doing it, and what they expected to happen next.

We carefully **observed and took notes** on both verbal comments and user behavior, documenting any difficulties, observations, or reactions. Based on these insights, we created detailed **analysis tables** for each task, highlighting the user experience step by step, including any usability issues encountered and possible improvements.

The two tasks tested were:

1. Saving an edited daily outfit in the wardrobe

	Related incidents	Priority	Description	Reason	Good or bad	Solution
Login and navigate to home	None	4	"Okay, I'm in. Looks like the daily outfit is right here on the home."	The user easily identified the daily outfit area after login.	Good	None
Click "View outfit" and then "Edit"	User looked for Daily outfit	2	"Let me check what this outfit looks like... but where? Oh, there. Good I can also edit it."	The Daily outfit button is not well displayed. The Edit button was found easily.	Bad	Button more visible
Modify outfit & plan it	None	4	"Wow, there are other clothes I can choose from... ok I have to plan the outfit."	The user immediately found new clothes to edit the daily outfit, and the reason for planning is well explained.	Good	None
Save and view the changed outfit	None	4	"Okk I have to save it... nice, now it's in my wardrobe!"	The user knows that he has saved the outfit thanks to the notification popup. The popup also shows the outfit in the closet.	Good	None

2. Searching for new outfit ideas in the community and following a user:

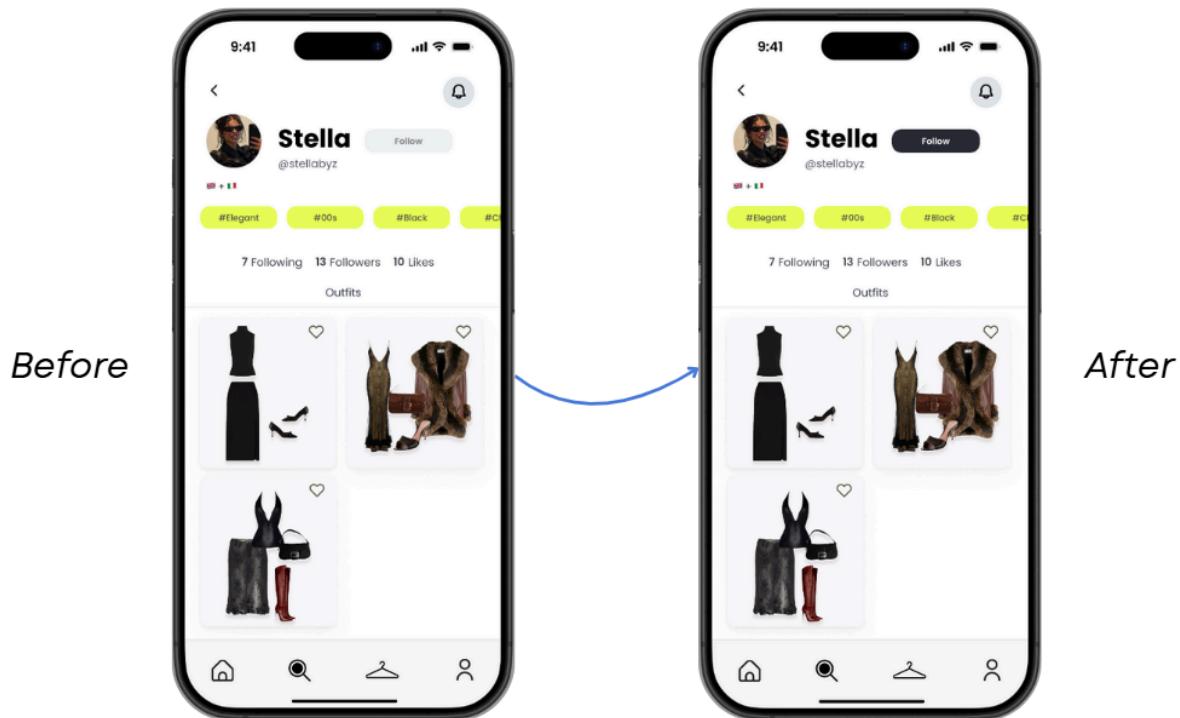
	Related incidents	Priority	Description	Reason	Good or bad	Solution
Login and access Home	None	4	"Alright, I'm in. Let's see what's new today."	User entered the app and landed on the home page without issues.	Good	None
Click Community and search using a Keyword	None	4	"This must be the place to find other people's outfits. Oh I can search some ideas."	The label 'Community' and the search bar were easily found.	Good	None
Select an outfit from results	None	4	"This one looks cool, let's check it out."	The results were displayed clearly and the user could choose easily.	Good	None
Click on username and follow the user	User looked for "Follow" button.	2	"Ok I click the username and see the profile.. I want to follow but I dont see the button.. oh there."	The "Follow" button is not visible enough.	Bad	Change color button.

These tables allowed us to assess both the clarity and efficiency of the user flow and to identify small improvements for future iterations of the design.

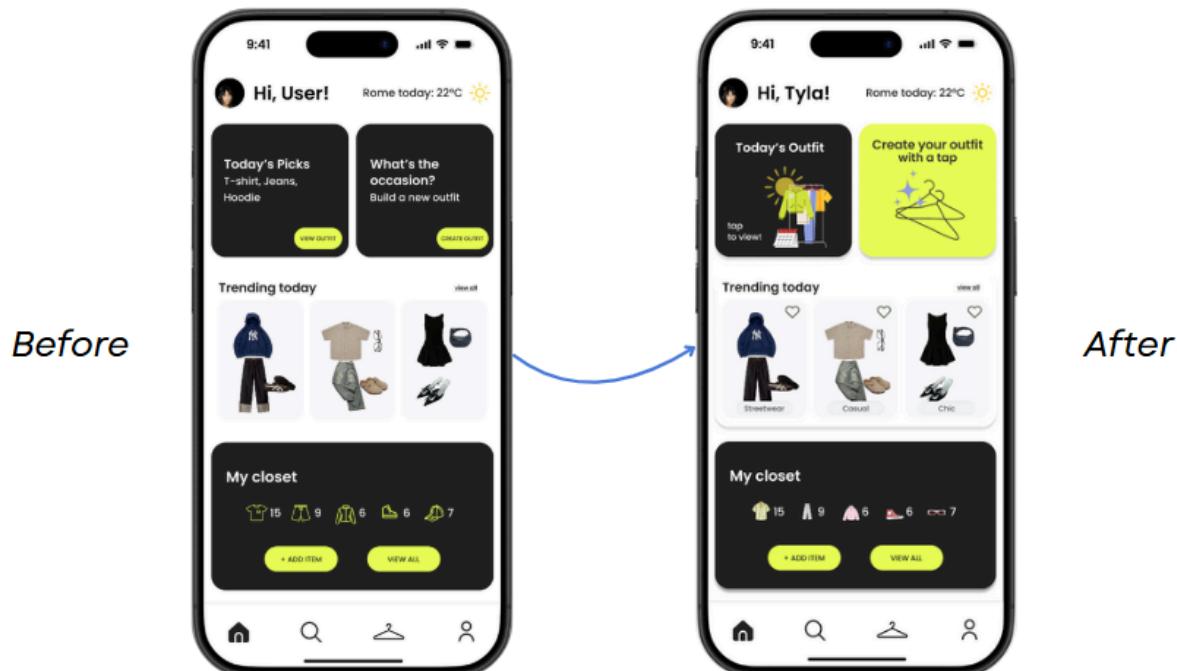
4. Correction of detected defects and Prototype 2

After completing the Think Aloud session and analyzing the results, we identified a few minor usability issues based on the user's feedback and behavior. In particular, we focused on the moments where users hesitated or had difficulty recognizing key interface elements.

As a result, we implemented targeted improvements to resolve these issues. We adjusted the visibility of the “Follow” button by changing its color to make it stand out more clearly in the user profile section...



...and we have changed the design of the home buttons to make them more visible and suitable for their functionality.



5. Definition of Controlled Experiment

A **controlled experiment** is a structured evaluation method used to determine the effect of a specific variable by systematically manipulating it while keeping all other factors constant. This allows researchers to isolate the impact of that one variable and observe its influence on measurable outcomes, known as **dependent variables**, for example, the time required to complete a task, the number of user errors, or the accuracy of user decisions.

To set up a controlled experiment, the first step is to clearly define a **hypothesis**: a prediction about how the independent variable will affect user behavior. Then, an experimental design is created, typically involving one or more **user tasks**, and participants are recruited to perform these tasks under different conditions. It's crucial that the participants reflect the target user group, and that the tasks simulate realistic scenarios to ensure the validity of the results.

Controlled experiments are particularly valued in usability studies because they allow for precise and objective comparisons between different interface designs or interaction conditions. The data collected is typically analyzed using statistical methods such as **ANOVA** (Analysis of Variance), which helps determine whether the differences observed between groups are statistically significant or could have occurred by chance. This type of analysis produces a value (F) that is compared with a critical threshold (F_{crit}): if F exceeds F_{crit} , it indicates that the variation between conditions is meaningful. In this way, controlled experiments provide quantitative evidence that supports design decisions with a high degree of reliability.

6. Controlled Experiment

To assess how users interact with icons in the bottom navigation bar, we conducted a controlled experiment comparing two different interface styles: one using **icons only** and the other combining **icons with labels**. The goal was to evaluate which design allowed users to complete a specific task more efficiently and accurately.

We used a **between-groups design**. Each participant was randomly assigned to one of the two interface versions and asked to complete the same task: **searching for new outfit ideas in the community and following a user**.

The **independent variable** was the interface style (Style 1 vs. Style 2), while the **dependent variables** were the **time taken** to complete the task (in seconds), and the **number of errors** made during the interaction (e.g., clicking the wrong element, getting lost, or asking for help).

We hypothesized that users would perform the task more quickly and with fewer errors using the interface with labels. The **null hypothesis** stated that there would be no significant difference in performance between the two styles.

The collected data was analyzed using **ANOVA** to determine whether the observed differences were statistically significant. This helped us validate our design assumptions with quantitative evidence.

We analyzed the data collected from the controlled experiment using one-way ANOVA:

- Results on the time spent

Style 1	Style 2	Analysis of variance: one factor					
		SUMMARY					
		Groups	Count	Sum	Average	Variance	
		Column 1	12	1378	114,8333	210,3333	
		Column 2	12	1482	123,5	216,2727	
		VARIANCE ANALYSIS					
		Origin of the vari	SQ	gdl	MQ	F	Significance va
		Between gro	450,6667	1	450,6667	2,1128	0,160189
		Within gro	4692,667	22	213,303		
		Total	5143,333	23			

- Results on the errors

Style 1	Style 2	Analysis of variance: one factor					
		SUMMARY					
		Groups	Count	Sum	Average	Variance	
		Column 1	12	15	1,25	1,113636	
		Column 2	12	22	1,833333	1,424242	
		VARIANCE ANALYSIS					
		Origin of the vari	SQ	gdl	MQ	F	Significance va
		Between gro	2,041667	1	2,041667	1,608955	0,217897
		Within gro	27,91667	22	1,268939		
		Total	29,95833	23			

These results suggest that adding text labels to icons does not lead to a measurable improvement.

8. Future Work

While the current version of our application offers a functional and intuitive interface for outfit planning and community interaction, several directions for future improvement and expansion have emerged. One promising development is the **integration of an AI-based assistant**, which could automatically suggest outfit combinations based on user preferences. This would enhance personalization and reduce decision fatigue for the user.

An important step is to **transition from a prototype to a fully deployable application**, allowing users to incorporate it into their daily lives. This would involve refining backend infrastructure, and possibly integrating the app with other platforms (e.g., calendar, shopping apps).

In addition, we plan to **expand user testing**, involving a wider and more diverse sample of participants. This would allow us to gather feedback from many others.

Finally, we aim to **enable real-time notifications** for updates such as new community posts, outfit suggestions, and interactions. This feature would help maintain user interest over time and foster a more dynamic and connected fashion-sharing experience.

These future steps will help transform the application into a smarter, more personalized tool for everyday outfit planning.