



Plant Hug

Project report for Human Computer
Interaction course at Politecnico di
Torino

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Sommario

Intro.....	3
Problem overview.....	3
Needfinding.....	4
Domain description	4
First round of interviews	4
Methodology and procedure.....	4
Interview #1 with Sofia.....	4
Interview #2 with Vincenzo	5
Interview #3 with Luisa.....	6
Interview #4 with Antonio.....	6
Initial synthesis	7
Possible needs	7
Chosen needs	7
Domain description	7
Second round of interviews.....	7
Interview to Filippo.....	7
Contextual inquiry with Vanessa	10
Synthesis.....	11
Brainstorm of user needs	11
Deep needs.....	13
Solutions.....	13
Tasks and storyboard.....	15
Tasks.....	15
Storyboard	15
Low-fidelity prototype.....	16
Modalities of exploration	16
Prototypes.....	17
Desktop application.....	17
Mobile application.....	18
Prototypes high level flow	19
Desktop application.....	19
Mobile application.....	20
Selection rationale.....	20
Pros and cons.....	20

Final choice.....	21
Medium fidelity prototype.....	22
Previous sketches revision.....	22
Tools and work organization.....	22
Screens and comments.....	22
Simple task.....	22
Moderate task.....	23
Complex task.....	24
Conclusion and link.....	24
Heuristic Evaluation.....	25
Discussion on severity 3 or 4 violations with proposed solutions.....	25
Conclusions.....	29
High-fidelity prototype.....	30
Description and Link.....	30
Structure of the application.....	30
Significant screens with explanations.....	31
Comments.....	32
Conclusions.....	34

Intro

Project name: Plant hub

Value proposition: Helping people who owns plants in their daily, weekly or monthly care of their plants.

Group name: Giancono

Members:

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- Pietro Gancitano, s303880
- Kevin Cardinale, s305035

We are four students of Computer Engineering at Politecnico di Torino and a group of friends that have already teamed up together in the past, hence we know the benefits in our exchanges and different approaches to problem solving. Given that, we chose to work again together on this project, confident on what we can do.

Problem overview

After a long process presented in this report we ended up developing the prototype of a mobile application that let users interact with each other, benefiting from others experiences, and keep track of their own plants in order to improve the quality of given care, while also receiving suggestions for plants they may like.

Needfinding

Domain description

When choosing the theme for our project, we thought about medicine, psychology and then nature. We decided to pursue the path of plant care, since animal care is usually more covered. In fact, we took a look at existing apps and websites, and they had a huge potential for improvements. The choice of this theme was probably influenced also by the love that some of us has for plants.

First round of interviews

After choosing the theme, we were able to start with the interviews. Since there are many people having plants at home, it was easy to find possible respondents. The first two interviews concern two normal users in our close circles that use plants either for aesthetics or for cooking. A third interview was conducted with a student of Scuola di Agraria in Grugliasco. He is our extreme user. The fourth and last interview was conducted with a domain expert, working in the field. All the participants agreed to make us use their recordings and photos.

Methodology and procedure

All interviews were performed in Italian, as we all could speak and understand it. We will, when necessary, report them in Italian to give you the “raw” content, and then translate them. Questions were written and decided together, even if some modifications were made along the way to capture different angles or drop them altogether when we were content with what we had gathered at that point. The reasoning behind our choices will be given after, along with a brief description of the interviewee.

We always started with some generic questions (e.g., “How are you?”, “How can we call you?”, “Do you like being in contact with nature?”) to make people comfortable. Then, we went with more specific ones.

Here is the list of question that we used for the interviews.

- Have you ever had plants? Which ones, how many, and why?
- How often do you use your plants for cooking in a week?
- What do you like about succulents?
- How much time do you devote to their care in a week/month?
- What are some upsides and downsides in owning plants according to you?
- What would have you liked to know before owning your first plant?
- How emotionally affected would you be if a plant died?
- Do you like the idea of giving a plant as a present to someone?
- What's your opinion on fake plants?
- Which colours do you think of when speaking about plants?
- How good do you think your knowledge of plants is from 0 (newbie) to 5 (expert)?
- What are 3 things you like the most about owning plants?
- What are the 3 major struggles you encountered in taking care of a plant?
- Have you ever used auxiliary devices to take care of plants?
- What is your opinion on informative material you can find online about taking care of a plant?
- What would you advise to a newbie?

Interview #1 with Sofia

Consent Sofia is a student of “Processi Territoriali” at Università di Bologna. She was in Turin to visit some friends of us, and, while talking about university, she immediately showed interest in our project, telling us she would be happy to participate in the interview process.

The interview was conducted the on 10th of October in our friends’ apartment by Pietro and Kevin, Pietro was asking the questions and Kevin was recording and taking notes.

We started off with some simple general questions about which type of plants she owns or owned and how much she cared for them. Given that she owned Succulents and Edible Plants, we asked questions about why she liked these types of plants and how often she used edible plants for her diet. After that, we asked if she had any troubles with her plants and other general questions to understand how a normal user sees and perceive our domain of interest, e.g., “Which colours come up to your mind when thinking about plants?”, “Do you like fake plants?”, etc.

We concluded the interview by asking if she had used applications or devices to take care of her plants and her advises for novice plant owners, before thanking for her participation and time and taking leave. We think it may be useful to report this quote from Sofia interview.

"Se non sei esperto a volte è difficile capire che cosa hanno, e anche se riesci a volte non puoi fare molto per curarle."

If you're not an expert sometimes it's difficult to understand what is going on with them and, even if you do, sometimes there is nothing you can do to heal them.

We also asked which are the three major obstacles in owning and taking care of a plant, and she answered:

*"Le applicazioni, le trovo molto dispersive."
Apps, because I find them very dispersive.*

So, she doesn't always know where to find the information she needs, even trying different applications and websites. She also said she often ended up asking friends or experts she knew, leading us to think that maybe it would be helpful to let users communicate with each other.

The most important concept driven from Sofia interview is the need to give non-dispersive information from reliable sources, making easy finding the knowledge that non-expert users need.

Interview #2 with Vincenzo

[Consent](#) Vincenzo studies Botanica at Università di Roma. His father was a florist, so he grew up surrounded by plants, learning everything about them, developing a burning passion for them. Selling flowers and bouquets (roses and orchids mainly) with him first, and studying the subject then, he matured a lot of experience. In this case the interviewer was Kevin, while Pietro recorded it and took notes.

Given his studies and his experience, he believes to be an expert, rating himself with a 4.5 out of 5 on a self-assessment scale. At the same time, he claims he never stops learning. Based on that, we started focusing more on practical and domain-specific aspects with our questions. He owns houseplants, kitchen plants and small cacti. Each category of plants he owns is different, so he must deal with them accordingly. These plants are mostly kept in the garden, but some are also kept on the balcony or inside. He isn't alone in taking care of them: his parents do that on his behalf when he's away from home for long periods.

After the interview we understood that, even if he's more detached than a normal user, if any plant were to die (especially if it is a gift) he would be sad. According to him, fake plants are not a good replacement for their real counterparts, as they convey sadness. Those statements make us believe that it's important to engage with users in an emotional way, keeping in mind their bond with their plants.

He said he takes care of his plants about 2 to 3 hours a week. He also uses plants in many of his recipes, that being for him one of the great advantages of always having plants on hand. He also owns house plants for ornamental purposes in his home, to "give his living environment some colour" that wouldn't be there otherwise. Those are use cases we are willing to explore.

He states that it is challenging to fight insect infestations (aphids and mealybugs) as they are very common. Another very common problem is surely over-watering and wrong exposure to sun.

All in all, he believes that applications or tools designed specifically for the correct growth of a plant can certainly be helpful if supported by correct data and useful information, such as ideal soil moisture, soil type, sun exposure. With this we can have a more precise idea on which information should be immediately available to users.

Although in Vincenzo's opinion a plant is not a suitable gift for everyone (as the required level of commitment can be underestimated), he thinks that ecological beliefs and the concept itself of caring for a living being can be compelling reasons to buy a plant.

Vincenzo has never used any auxiliary devices, but he read a few books at a younger age. He still feels like informative supports of any kind can be useful, but information on the net can be misleading or, worse, conflicting.

Interview #3 with Luisa

Consent Luisa works at a bakery in Ragusa, and she's a food enthusiast. We could talk to her thanks to her daughter. In fact, we asked to a group of friends and acquaintances if they knew someone who had plants not only for aesthetics but also to cook, because we wanted to consider different use scenarios to gain various feedbacks. She can be considered as a normal user. The interview was conducted using a video chat (WhatsApp) because of the distance. We obtained her consent before going further, so that Riccardo could ask her questions while Luca could record and take notes of her answers.

We started off with some simple general questions about which type of plants she owns or owned and how much she cared for them. Departing from succulents, we put our focus on aromatic plants and their use in her (and her family's) diet. We did that also since she thought of plants as a gift mainly for people who want to eat healthy. We then asked her satisfaction with what she does now and how.

Here we present some interesting quotes from her interview.

"Mi è dispiaciuto quando una pianta è morta (rosmarino), ma provo grande soddisfazione ogni volta che mangio qualcosa di buono cucinato col mio peperoncino!"

I got sad when a plant died (rosemary), but I gain huge satisfaction every time I eat something delicious using my peppers!

It's clear that there's an emotional response and a sense of achievement linked to plant care.

"Non mi piacciono le piante finte. Sono solo plastica, non mi piace il loro impatto estetico e non mi fanno di niente, non ne vedo lo scopo".

I don't like fake plants. They're plastic, they're not aesthetic nor they give me any positive vibes, I don't see their purpose.

"Dicono che alcune piante non dovrebbero stare con altre, ma sono solo detti, tramandati dai nonni, e non riesco a trovare niente di concreto al riguardo su internet. Vorrei che qualcuno mi dicesse chiaramente cosa fare e cosa non fare."

They say some plants don't get along well with others, but that's just acquired knowledge from grandparents and you can't find anything about it on internet. I would like someone to speak to me clearly on what and what not to do.

From this interview we understood that users do not need cold numbers and encyclopaedic notions, they need to have access to concrete, down-to-heart advice, maybe even from peers. They do not have the time nor the will to fill the gap between theory and practice.

Interview #4 with Antonio

Consent Antonio is attending a master's degree in Agraria at University of Turin. We could reach him thanks to a friend of us living in Grugliasco, which asked for help on a Telegram group on our account. The semi-structured interview was conducted using a video chat (WhatsApp) for practical reasons. The interviewer was Luca, while Riccardo was taking notes about the answers.

We started off with some targeted questions, and he provided interesting insights on plants and technical issues in the agriculture field. Then, we ended with some simple general questions to obtain a well-rounded interview.

Here are some quotes extracted from this interview.

"Pensare che il bio sia meglio del convenzionale è un errore. Spesso non funziona e non ci sono evidenze su una maggiore qualità. [...] La giusta dose di fertilizzante è importante. [...] Bisogna dare importanza all'agrosistema."

You shouldn't take for granted that organic food is better. There's no evidence for that. [...] The right amount of fertilizing is crucial. [...] The agrosystem is often overlooked."

From this we can understand that there are some specific needs regarding agriculture that may be interesting to cover.

"Non penso che le persone dovrebbero usare in cucina le proprie piante, oltre a quelle aromatiche, si corrono rischi. I prodotti nei supermercati sono molto sicuri."

"I don't think people should use their plants in cooking other than aromatic ones. That's risky. In supermarkets products are safe"

We need to attention this since it differs from what others perceived and we may have to think twice before making it a pillar of our solution.

After this interview we understood that there are some specific needs that may be interesting to cover and that none of the interviewed before brought up in this way. Also, some perceptions may be less popular than anticipated.

Initial synthesis

Possible needs

In summary we found out that for different type of users there are different needs, for normal users there is the need to gain the knowledge of both the process of irrigation of the plant (when and how much) and the main diseases that can afflict the plant (fungi/insects are the most common).

Another thing we need to take in mind is that for non-experts information on the internet is a little dispersive and sometimes disinformation is spread through rumours that can be detrimental to the life of a plant. The extreme user made us think of very different problems and needs, like the lack of funding for agriculturists and the average lack of education on the sector, he considers the use of fertilizers necessary for the correct growth of the plant as well as correct irrigation, respect of the right temperature range for each plant and respecting the agroecosystem. Again, he thinks that information on the net can be misleading since not every source is reliable.

Our expert user confirmed that the needs of a generic user are the one described above, the more you are expert the less you will need the use of applications or devices, he gave us knowledge of the most bought plants and info about which problems his client had and asked help for, that are pretty coherent with what we extracted from interviewing normal users.

For normal users it would be more effective having non-dispersive information from reliable sources, also this may be true for professionals with low knowledge, e.g. farmers.

Chosen needs

In the end the main needs seem to be:

- Identification of the plant and its characteristics (irrigation, range of temperature, soil and seasonality).
- Identification of diseases that are afflicting a plant and information on how to fight them.
- Correct use of fertilizers.

Domain description

In our next steps we will try to go deeper about these topics and how much they are known and needed for a non-expert user.

Second round of interviews

We then were able to start the second round of interviews. These were also conducted in Italian. The first was an actual interview with another normal user, while the second was a contextual inquiry that let us assist to a user taking care of her plants in her house.

Interview to Filippo

The interviewed is Filippo Castellarin. He is a colleague, suggested to us by a common friend who knows he owns various type of plants in his apartment. He is a student in Polytechnic University of Turin, enrolled at the first year in the software course of Computer Engineering. He lives in Turin in his own apartment without roommates and there he keeps different plants of various dimensions both inside and on the balcony. We conducted the interview in the outside space of the Polytechnic, that was a good place either for us and him

during a free hour between lessons. During the interview Luca was the interviewer while Kevin, as observer, was taking notes and recording it. Before the interview obviously we asked for consent and made Filippo sign the consent form. The interview was taken in Italian since it is the first language for all the three people involved. We did not need any specific material for this interview but a PC and a smartphone, the latter used for recording the interview while the former used by Kevin for taking notes. On another PC Luca had the list of questions written previously by the four of us basing on the initial user needs emerged from the first round of interviews. The questions represented a trace for the interview that was conducted as semi-structured, letting Luca have the possibility to add or modify questions in order to extract more useful insights whenever possible.



The following is the list of questions used for this interview. Before them there was a short discussion (not recorded) for introducing each other, introducing our purpose and explaining what we aim to obtain with our interview and how we were going to use collected data. The recording was started only after that when we had already obtained Filippo's [Consensus](#).

- Do you have plants at home?
- Do you think they have an impact on your house aesthetics?
- What do you think about having plant? It's a positive or negative thing?
- How many plants do you possess? Which type of plant are they?
- What do you think about taking care of them? In your opinion it is enjoyable or dislikable?
- How do you take care of them?
- How much time in a day or in a week do you think you spend in taking care of them? (Although this question implies a memory effort from Filippo we decided to keep it since we think the time spent in taking care of plants may be an important piece of information for our project and we didn't have any other way to verify it)

- How do you decide how much water you give to them?
- What are your sources of information in understanding how much water a plant does need? If any.
- Have plant infestations ever occurred to any of your plants?
- How did you manage that situation?
- What were the effects of your behaviour?
- Do you know any other potentially harmful insects? And not harmful?
- How would you feel about receiving more information about insects you may or may not find in your plants?
- What would be in your opinion the most comfortable way to receive them?
- Have you ever repotted a plant?
- How do you understand if you should repot a plant?
- When was the last time you did it? Can you explain me how you did it and how it went?
- Did everything go smoothly or were there any problems during this procedure?
- How do you choose what type of soil to use for your plants?
- How would you feel about receiving more information about soil types specifically needed by your plants?
- What would be in your opinion the most comfortable way to receive them?
- Regarding dimensions and materials, what types of vases do you use for your plants?
- How would you feel about receiving more information about specific vases that your plants may need?
- What would be in your opinion the most comfortable way to receive them?
- How do you decide when to buy a new plant and which?
- What do you mean when you say: “the most attractive one”?
- How satisfied are you with your plants in a scale from 0 to 5?
- How would you describe the effort you put in taking care of them corresponding to the idea you may had before having plants?
- What in your opinion may be the cause for these plants dying?
- Would have been useful or not to have information about water needs of your plants?

After these questions there was also a short interaction to thank Filippo for his participation before taking leave.

From this interview we better understood that people who take care of plants often trust their previous knowledge and this may be good or bad basing on the situation. Filippo told us that he was successful in taking care of most of his plants, but it also emerged there were also some plants that died. He was not sure what the cause was, but he said that probably the problem was watering them. This led us to think that probably people would be relieved to receive precise reminders of when to water a plant based on the specific need of that plant.

“Le piante hanno un fabbisogno di acqua diverso a seconda del tipo, [il fabbisogno] è difficile da misurare.”

Plants have different water needs depending on their type, it's hard to measure these needs.

More in general, Filippo focused mainly on water needs of plants, he showed few interests for the type of soil and a little more, but still few, on the type of vase. He said that for a small hobby like his one, he prefers to just buy whatever he can find at the supermarket that is fine for most plants. He also proved a little concern for possibly harmful insects. He experienced an infestation of cochineal and successfully managed it. But he was not well aware of other possible infestation. Probably people with plants would find helpful to somehow receive information about infestation or maybe directly ask to someone in order to understand whether some insects can be harmful or not.

“Ognuno sceglie per sé se vuole delle piante oppure no; quindi, se uno prende delle piante vuol dire che ne ha bisogno o che gli piacciono.”

People choose themselves whether to buy plants or not; then, if one buy a plant, either he needs it or he likes it.

We also noticed from his answers that people like him choose their plants mainly for their aesthetics and on how easy it is to take care of them. The fact that Filippo possess different plants of the same type (various cacti) led us to think that some users may appreciate suggestions on new plants to buy that are similar (for aesthetics or water needs) on the already possessed one.

Contextual inquiry with Vanessa



After Filippo's interview we also wanted to conduct a contextual inquiry and we had the opportunity to meet Vanessa Terranova. She is a biology student at University of Turin, studying for her master degree. She is colleague of a friend. She has a great love for plants and she owns some in her house in Turin. She let us meet her in her house and we observed that she keeps various plants both in her room and in the kitchen (common space). Vanessa is an immediate user that uses experience and empirical methods to take care of her plants. The interview was conducted by Pietro while Riccardo was recording and taking notes and photos.

Before starting the inquiry, we spent some time to introduce each other, explaining to Vanessa our purpose and how we expected to proceed. We explained to her that we wanted to collect some data like photos and registration and we made sure she was ok with this before asking her to firm a [Consensus](#).

- Do you like being in contact with nature?
- What do you think about plants?
- How do you know when to give water to plants?
- How do you know which vase to use?
- Have you ever dealt with insects that were dangerous for your plants well-being?
- What can you tell us on how you behaved?
- Have you ever encountered also plant fungi?
- How did you solve your problems?
- You mentioned repotting. When do you do it?
- Which kind of soil did you use to do it?
- Can you explain us how to do repotting?
- Which are the risks of it?
- How do you decide which plant are you going to buy next?
- How much effort do you put in taking care of plants comparing to the expectation you had when you bought them?



During or after the question we were also able to see Vanessa dealing with her daily/weekly caring of her plants and gained precious information from this. When we finished with the inquiry we thanked Vanessa for her time and hospitality.

"Una pianta che ha bisogno d'acqua lo fa notare rinsecchendosi, una cosa che può aiutare è infilare il dito nella terra"

If a plant needs water, it will dry up; putting your finger in the soil may help [understanding the water need]

"Ho scoperto alcune cose tramite internet, ma la maggior parte chiedendo a persone esperte nel settore"

I discovered something online, but most I asked to experts

"Non sapevo quanto fosse delicata una pianta rispetto all'esposizione solare e soprattutto le malattie che la potessero affliggere"

I didn't know how much a plant can suffer from light exposure and possible plant illnesses

Vanessa's experience made us better understand that for most users it is important to learn from other users experience. In fact for example she showed us that in some situations for understanding whether or not a plant needs water she put a finger in soil to verify the humidity. That is an empiricist method that it is not easy to find although someone who knows it tell you so. This led us to think that people with plant may find useful the possibility to give and receive advice from other plant possessors. This may be valid either in common or extraordinary situations, from a simple repotting (explained to us by Vanessa) to a unexplainable problem.

Synthesis

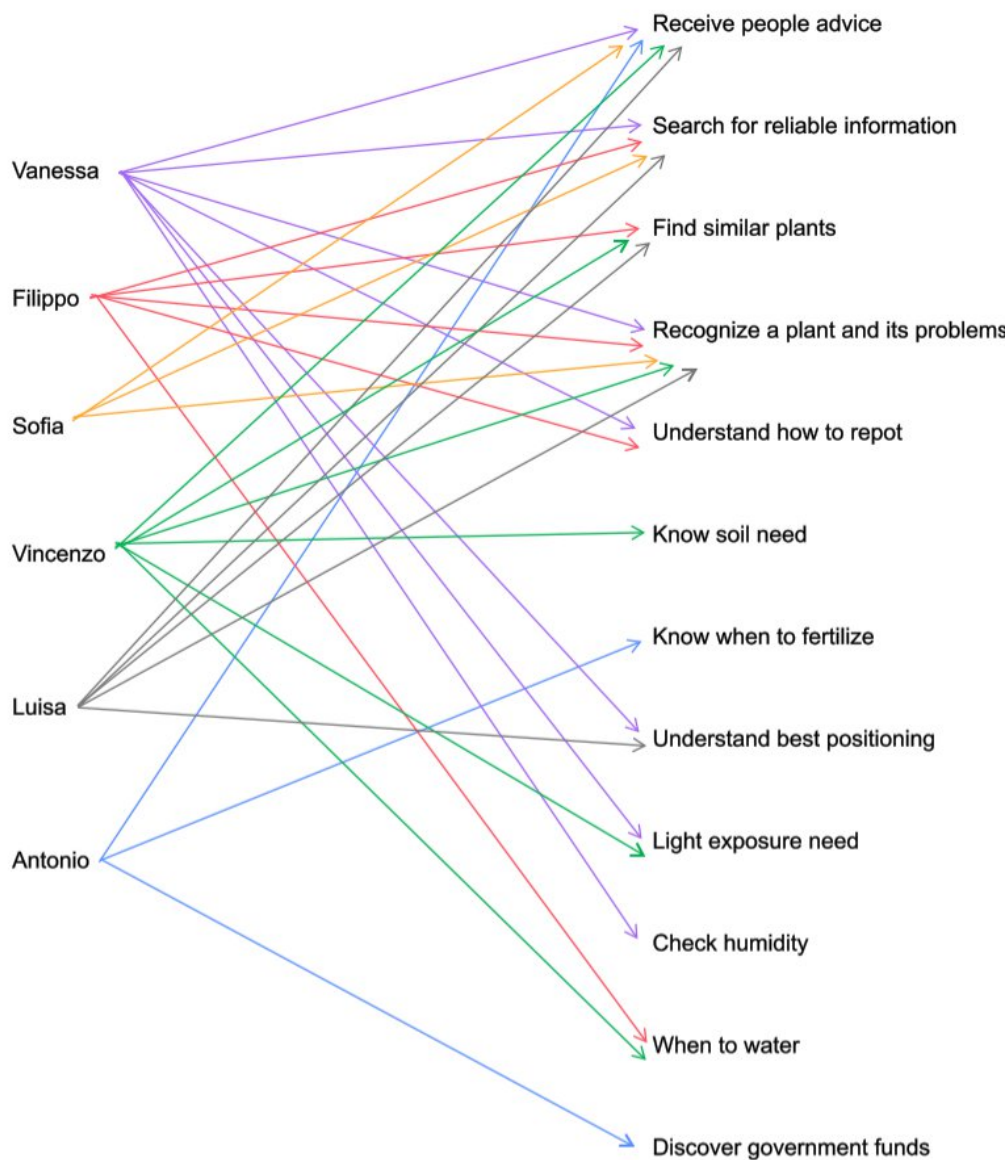
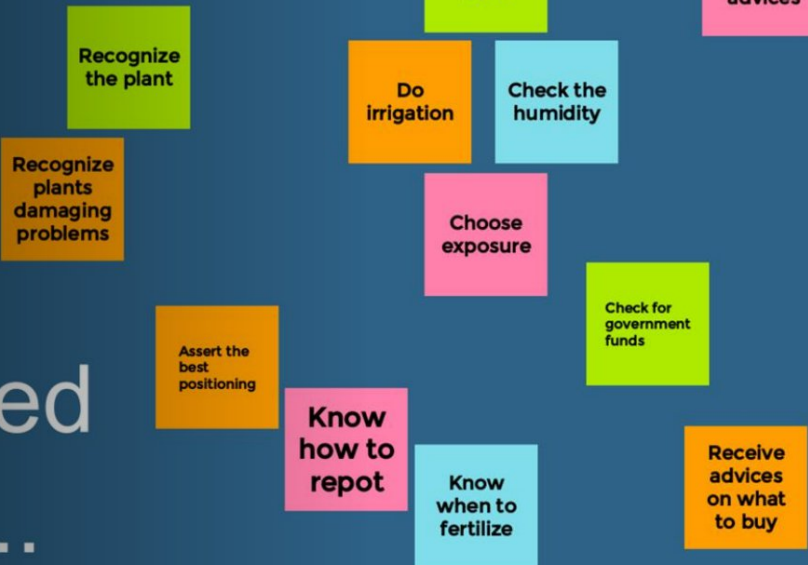
Brainstorm of user needs

After we finished with interviews and inquiry, we brainstormed a list of user needs starting from each interviews. At this point the list of possible needs changed a bit from the one resulted from the first round of interviews. Here is the list, followed by the picture of our brainstorm of needs on jamboard and the scheme where they are linked to the respective interviews.

- Receive people advice
- Search for reliable information
- Found similar plants to buy
- Recognize a plant and its problem
- Understand how to repot
- Know soil need
- Know when to fertilize
- Understand best positioning
- Light exposure need
- Check humidity
- When to water
- Discover government funds

We used
Google
Jamboard

Users need
a way to...



Deep needs

From the initial brainstormed list of user needs we extracted three main needs that in our opinion were the best ones to focus on for various reasons.

1. Users need a way to recognize a plant with its description and main needs.
2. Users need a way to give and receive advice from/to other users.
3. Users need the possibility to discover new plants that they might like.

Although none of the interviewed directly mentioned the need for recognizing a plant, all of them talked about various plants possible needs. We noticed that it is not easy to always know the precise plant someone owns, in fact it often happens that one knows the type or family of a plant without knowing the exact plant. For example many people just think “I have a cactus”. But there are cacti with totally different needs so it surely could help letting users know what is the plant they possess and what are the needs of that specific plant. With plant needs here we refer to various different needs grouped together, i.e. light, water, soil, vase, repotting, fertilizer, etc. Obviously, we intend to give higher priority to the needs that people mentioned more frequently, like water and sun.

In many cases information found online are not enough to solve problems with plants. Users often find useful empirical methods or solutions born from common knowledge. When information is not enough, or maybe not available, users may solve their problems by asking to other experienced users. Moreover, it is not to underestimate the fact that plant enthusiasts are willing to give advice to less experienced users for the sake of plant. This may create some sort of community.

The last needs regard the fact that all users told us that almost all the plants they possess are of the same type. Usually if people have plants may like the idea of having new plants and they surely will search for plant similar to the one they already possess, basing on the results of the interviews. Receiving advice of new possible plants may make people enthusiast about it.

Solutions

For the first deep user need we thought about these solutions:

1. Ask to an expert (maybe a florist).
2. Insert plant info in a form manually.
3. Recognize a plant by its photo.
4. Find a plant by its name (if known).
5. Consult a list of plants and try to recognize it.

The solution we thought was the most effective in our case is the third. It is very similar to the second one, but it is more efficient and faster, requiring less knowledge and time by users. The first solution is hard to adopt since we cannot be sure a florist or another expert will reply to users. Moreover users can find simpler to just ask in person to florist near their house. Finding a plant by its name is not always feasible since, as said before, there are lot of cases in which people do not know the exact plant name, that is the problem for which we are searching a solution. The possibility of consulting a list of plants is unfeasible to the huge dimension of it.

We thought about these possible solutions for the second deep user need.

1. A new sort of social network with friend requests and instant messaging.
2. A forum-like app with threads and asynchronous chats.
3. The possibility to obtain mail/phone contact of other users.
4. Link to extern social/forum/website with similar conversations.
5. Dedicated telegram group accessible through a link.

We started by focusing mainly on the first two solutions. We thought that the third one may be controversial due to privacy problem and decided to avoid it to preserve users. The fourth and fifth solutions implies link to external platforms. This may be a problem for various reasons. Using socials like Facebook implies that users must have an account and the ability to navigate through multiple apps. Regarding telegram, while it is easier to create and use an account, we had to consider that there are still few people (relatively to total population) that use it. For the first two solutions we preferred the first one. A forum may be more immediate not needing to send friend requests. Moreover, for users would be much more helpful to have the possibility to read already present threads where they can already find solutions to their problem without having to wait for someone to respond to their answers.

For the third need we brainstormed these possible solutions:

1. Showing a list of plants of a specific family/type.
2. Asking to other users for new ideas.
3. Florist advertisements.
4. Randomly showing plants to users until he found one he likes.
5. Providing dedicated suggestions based on the plants already owned by a user.

As already assessed before, it is not feasible to provide a list of plants. Although in this case it would be limited, for users may represent an overload of information and may not provide any value. The possibility to ask for other users is not quite good because each user has different taste and it would probably happen that users receive suggestions that they do not like. Anyway since for the second need we decided to create a forum-like section as solution, a user may always use that section to ask suggestions too if he wants to do so. Florist advertisements probably can represent a nuisance for most users. Advertisements tend to be invasive and disturb the normal usage by users. We risk that, rather than providing a positive environment, it would make users stop using the app. The random selection of plants would be good for giving new ideas but these would have not a correlation to the plants already possessed that is not what users need. The last solution is probably perfect. By using an AI algorithm, we can obtain perfect suggestions dedicated to each user, supposed that users insert their plants in the app somehow.

Tasks and storyboard

Tasks

To better understand the most useful functionalities of our system we decided to define three tasks with different levels of difficulty:

1. Simple task, characterized by few simple sub-steps to be completed.
2. Moderate task, characterized by a little more fields/information needed from the user.
3. Complex task, characterized by many steps, the possibility to connect with other paths of the system.

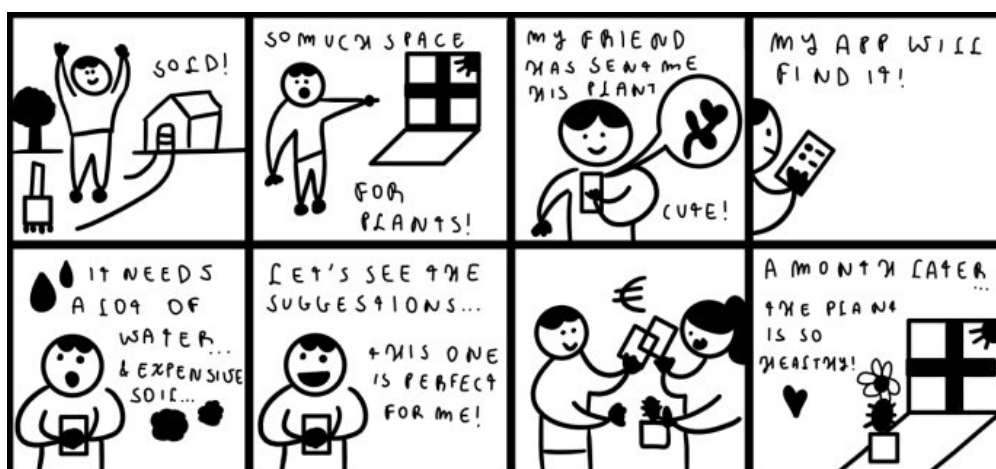
From these we obtained the following tasks:

1. Simple task.
Action: Recognizing a plant
Goal: Getting useful information about the maintenance of the plant, including watering frequencies, problems that can occur, repotting period, etc.
2. Moderate task.
Action: Receiving suggestions about plants to buy.
Goal: Suggesting a plant that meets the user needs in terms of money, effort and aesthetic.
3. Complex task.
Action: Interaction with peers.
Goal: Getting information in a natural language, explained by peers, on specific needs, or just interact with other enthusiasts.

All these tasks span from obtaining simple static informations, to exchanging informations with other peers around the world. These choices in our analysis are rather coherent due the fact that in this way the main focus of our system can be defined in a few words without any explanations: get informations and learn skills about plants.

Storyboard

The main goal of the next step is to have a visual representation of the use context of our system exploiting a list of sketches. In this way it can be easier to visualize and better understand a possible scenario in which our system can be used.



In our specific case, a user buys a new house and has a lot of space for plants. He received a photo of a plant and since he doesn't know which plant it is he uses the system to (task #1) recognize it and gain informations. Then, using the recommendations (task #2), he decides to buy another plant that better reflects his needs based on some criterias.

We choose this storyboard because it represents well the context and how the user should feel while using the app, showing the positive emotions that a possible use of it can infuse on people and a concrete improvement in everyday life. This storyboard perfectly fits the core idea of this project and meets the user needs we previously have found out.

Two of the three defined tasks are explored in our storyboard, so the third scenario is not contextualized. A possible extension of the sketch could show a possible issue of the user in the usage of some tools for the already bought plant, asking for informations to other user and possibly receiving a solution.

Low-fidelity prototype

Modalities of exploration

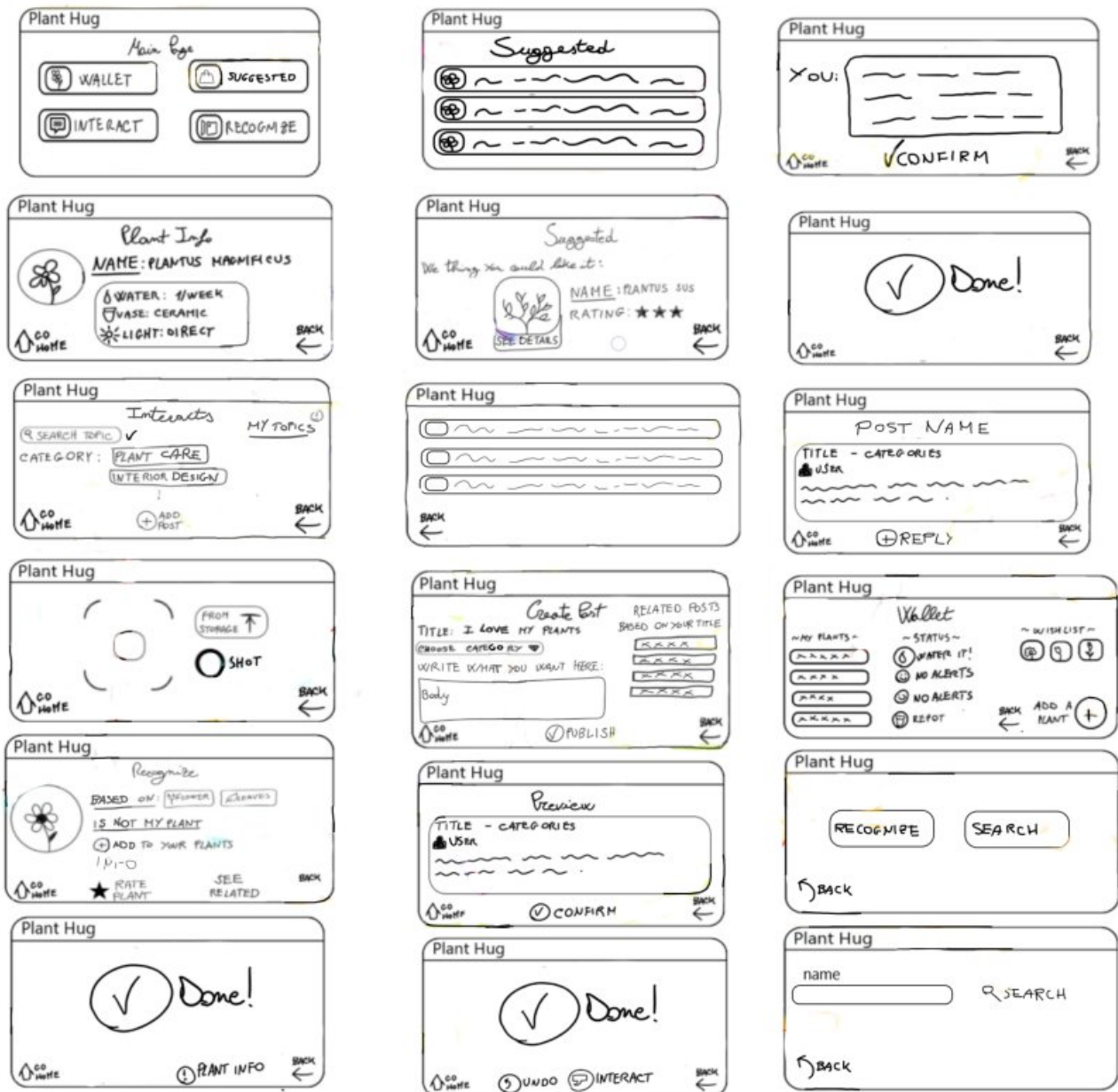
For our application we brainstormed about the modalities we wanted to explore. First of all we knew that users need to take a picture of the plant (task #1) or load it from somewhere else, so it is clear that modalities like speech-based or AR/VR applications were not suitable for our case. We considered an app for smartwatches but also that would not be optimal due to the low level of screen size adaptations.

In the end, since our application must be accessible by all kinds of users, experts and non-experts, in a comfortable and fast way and on a large scale, we decided to explore two modals: mobile and desktop applications.

Prototypes

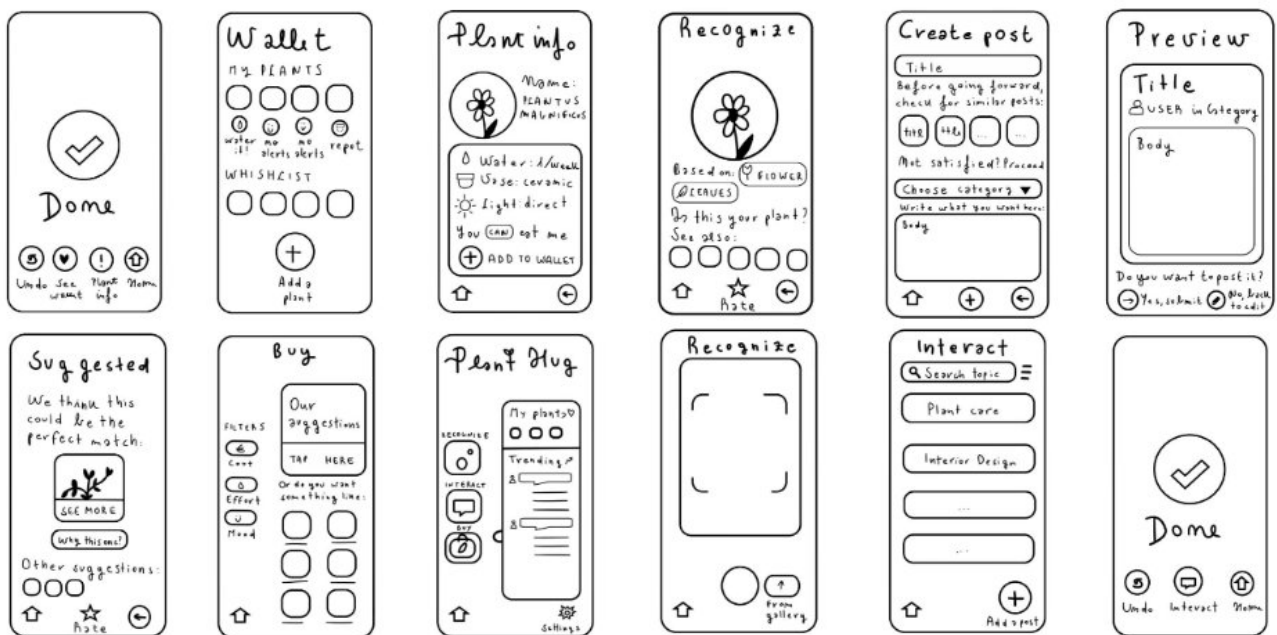
Below the two low-level prototypes

Desktop application



The storyboard user would use the prototype in this way: he would click Recognize and take a photo of the plant or load it from his device. By that the application would recognize the plant and show on screen the important informations. Then, he uses the Suggested functionality to find another plant to buy. This show how possibly task #1 and task #2 may intertwine with themselves in order to give a better experience to the user. For task #2 there is the Interact functionality that will lead to a page where you can search for a thread inside the categories or by using the search bar or even create a new thread with personal questions, doubts, comments, thoughts. [Here](#) you can find the prototype to have a better view of it.

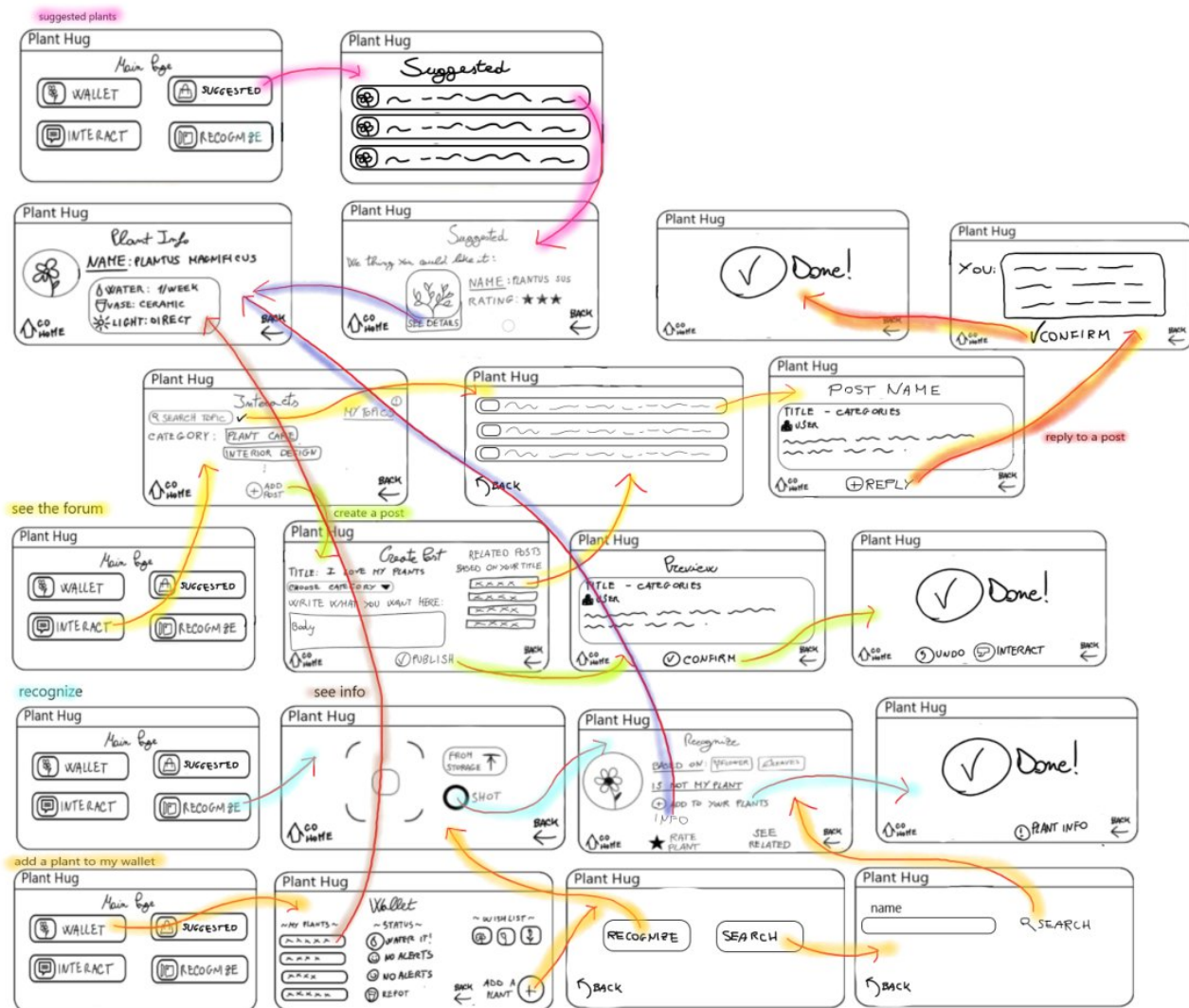
Mobile application



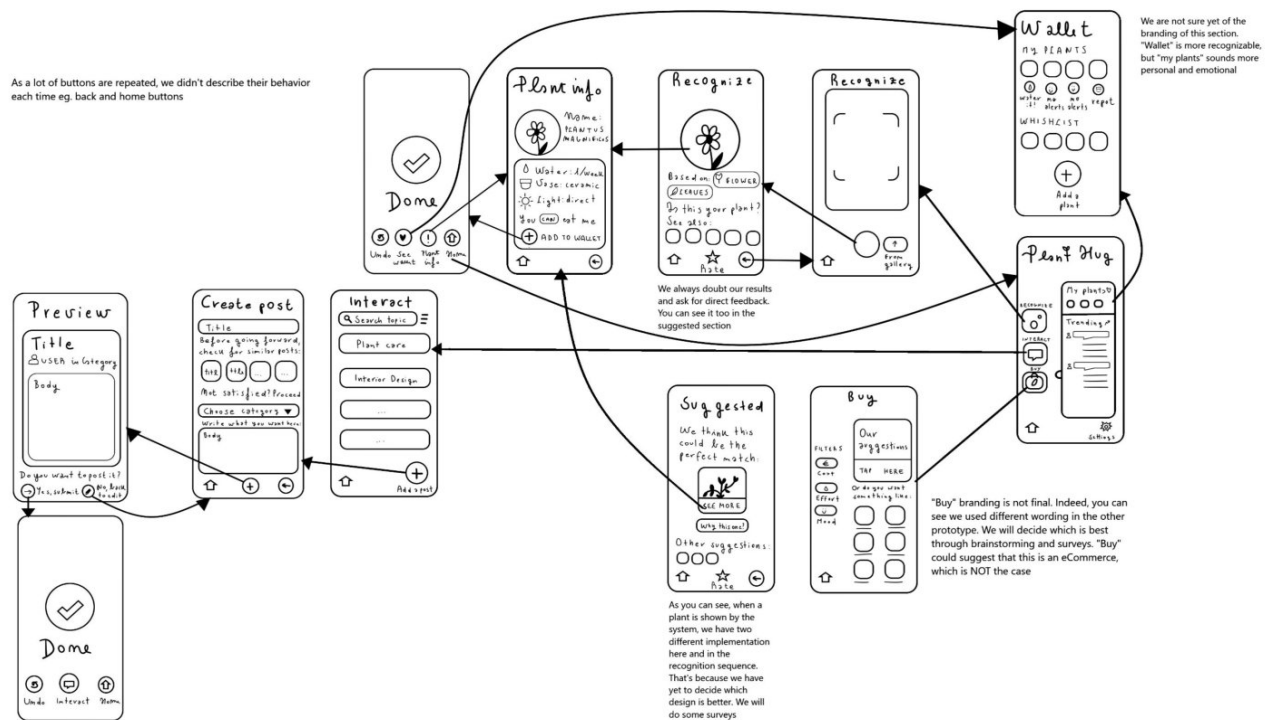
Above we can see the high-level flow of our prototype #2. In the center we have the main page of our application where the user, by clicking with his finger on the relative icon, can access functionalities. Through this, he can access specific pages relative to our tasks for recognizing a plant (camera icon), interacting with other users by using a forum (dialogue box icon) and receiving plant recommendations (shopping bag icon). This prototype perfectly fits what we see in the storyboard, the user does everything easily by using the smartphone's built in devices. [Here](#) you can find the prototype to have a better view of it.

Prototypes high level flow

Desktop application



Mobile application



Selection rationale

Pros and cons

The choice of a proper prototype is as important as the choice of tasks, because good tasks without an appropriate system can not be exploited. For this reason after a brainstorming session we defined pros and cons for each prototype, just to have in particular a list of points of failures for each of them.

- Desktop application

Due to the homogeneity of desktop platforms, a desktop application could be easy to design, with optimized performances due to the high performance hardware of these devices. Otherwise due to the large storage space, the application could exploit the absence of the internet connection, storing a large database of plants. This last feature could be also a problem, because the task #3 cannot be exploited due to impossibility to interact with other users.

A point of failure of this kind of application could be the absence of cameras in the desktop device, unless for external webcams, needed to be able to recognize plants. It could be possible to use other file transfer strategies, but it is not optimal. Moreover an extra step could be necessary, due to a possible installation of the software. In the end the large screen size of the hardware may be dispersive for a not expert user.

- Mobile application

Statistically, everyone has a smartphone, so it is the easiest way to interact with this kind of application. Due to the high homogeneity in terms of smartphone app design, we think that the users might have a good interaction experience, in particular through the usage of touchscreen. No extra devices are required, due the presence of built-in cameras in almost all smartphones. In the end, a good notification mechanism can be exploited.

On the other hand, due to the high number of different devices, the design of the application could be difficult, also considering that deployment of mobile applications usually has higher cost, due, for instance, to the publication of the application in a store. Obviously an installation is required. Regarding the last point,

moreover, the application must be deployed for different Operative Systems, causing an extra cost.

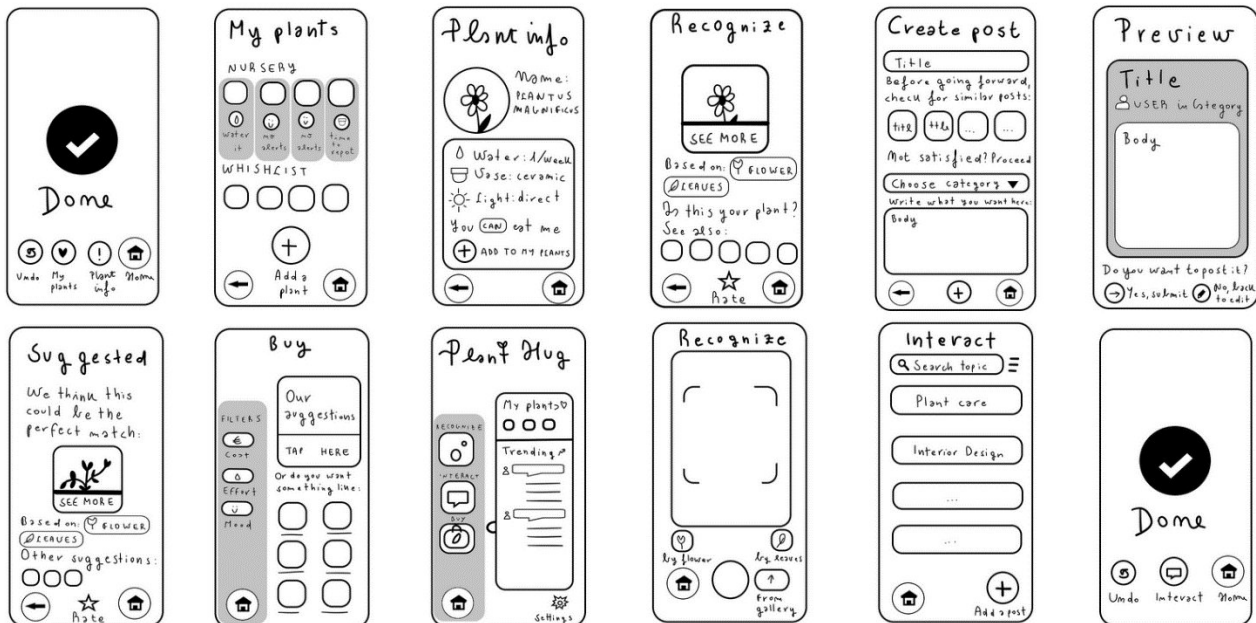
Final choice

In the end we chose the smartphone prototype, since we came to the conclusion that our application can be smarter and more practical thanks to smartphones' inbuilt features like camera and touch-screen. We also thought that in this way the application would be more accessible to everyone, since in this time and age everybody has a smartphone in their pocket and, as a consequence, a smartphone app would be more immediate to use respect to a desktop application.

Medium fidelity prototype

Previous sketches revision

After deciding to use a mobile-app prototype and obtaining feedback we revised our paper prototype to start implementing our high-fidelity prototype on that starting point.



In the revised paper prototype, we introduced, for suggestions, what is the suggestion based on and the possibility for the user to choose it, besides we fixed some design aspects that were inconsistent, we defined the elements we wanted to change and improve for our medium-fidelity prototype (like adding interactions via back buttons for example).

Tools and work organization

Next we started our work to create the medium-fidelity prototype. As recommended, we used figma to design it. First of all we had a meeting to decide how we wanted the prototype to look like and what process we wanted to follow. In the end we decided to divide the prototype in “chunks” (each chunk related to the task-like functionalities, that are Forum, Recognize, Suggestions and one extra about My Plants) that we assigned to each member. While working on his chunk, each one of us had to check others work by testing the interactions, applying heuristics and providing feedback.

Screens and comments

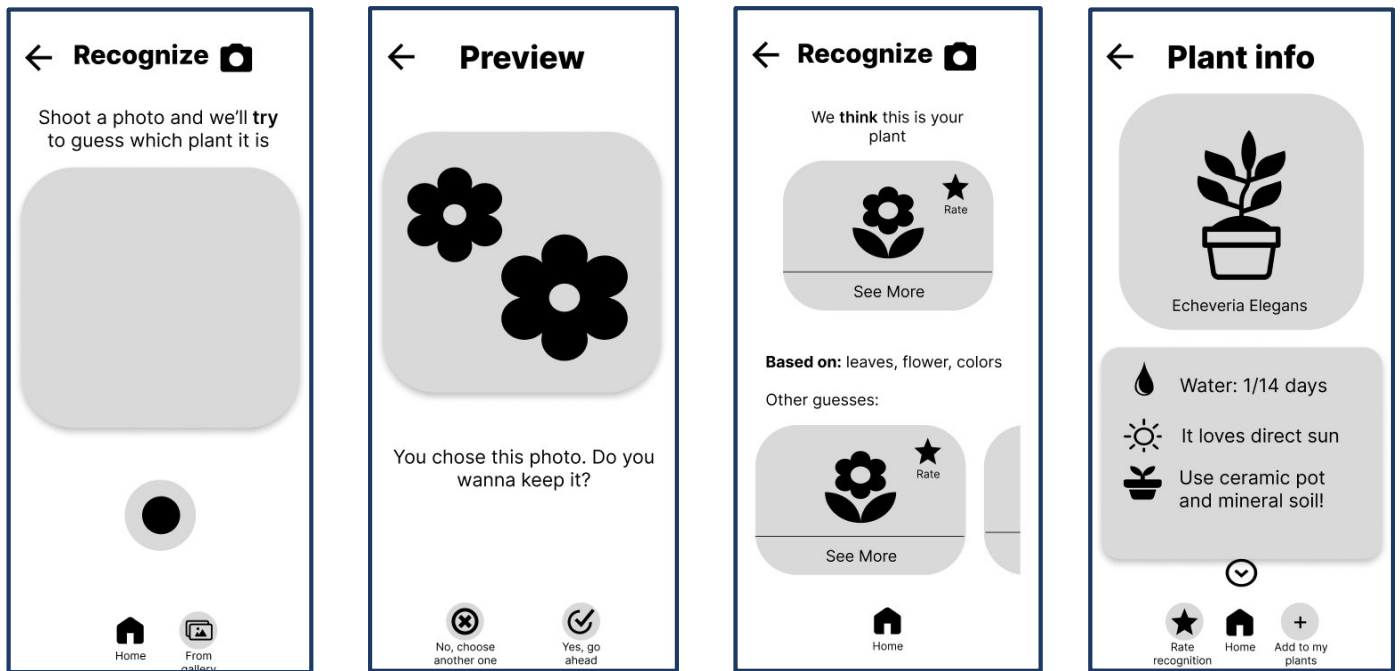
Of course in the medium we wanted to show the between the user and the the three tasks we defined steps.

Simple task

For the simple task we used user can load a photo from on the fly so that, through recognize it and give useful

fidelity prototype
interaction
application during
in the previous

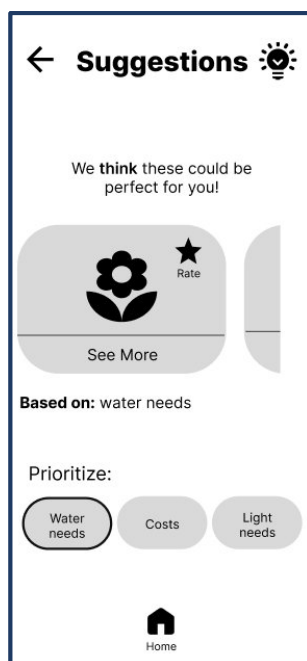
a page where the
gallery or take it
it, the system can
information.



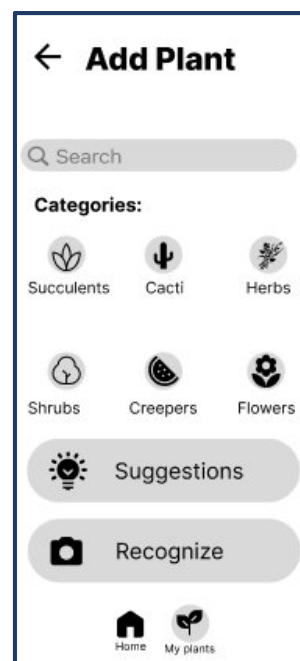
The user loads the photo and is redirected to preview page. There he can decide if he wants to take another photo or if it is fine with the current one. The system will then try to recognize the plant, giving a main guess and minor ones. The user can see more information about each plant by clicking on the “See More” button.

Moderate task

For the Moderate task, we supposed (basing on the interviews) that a suggestion system must be connected to user’s data (what he likes, what plants already possess). So, for this task, not only we have pages for users to see personal suggestions (possibly choosing criteria), but we also needed pages where a user can insert his own plants.



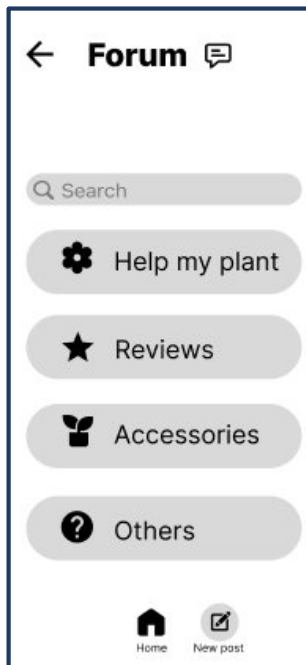
Suggestion Page



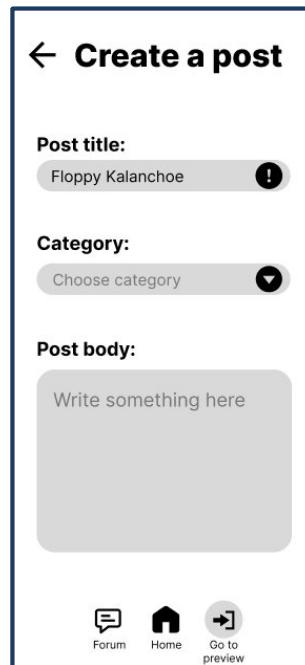
Recognize Page

Complex task

For the Complex task, we had already decided in the paper prototype that the solution was a forum-like section where each user can create threads and comment on other threads. This was replicated in this high-medium prototype.



Forum Page



Create Post Page



User replying to post

Conclusion and link

Figma represented a very useful tool for developing our application. Thanks to its interaction system, we could visualize in our medium-fidelity prototype how everything would be "interactive". We put lots of effort in modelling the prototype aiming at letting most users understand how the application works while using it. With respect to the paper prototype, harder to design since some variable behaviours were hard to replicate on paper, testing on the medium-level prototype was easier since it could be done not only in person but online too. You can see our medium fidelity prototype by clicking on this [link](#)

Heuristic Evaluation

After delivering the figma prototype, we received the heuristic evaluation. Our approach was to read it individually, then discuss together and decide what to fix and how. We all pretty much agreed that some ratings were a bit skewed with respect to our interpretation of the severity rating. For example, for us, some violations rated 3 probably were not major usability problems but just minor ones, that anyway we were willing to fix. Other violations, in our opinion, seemed to be forcing a wrong interpretation of Nielsen's heuristics or were related to project sections not directly connected to our tasks (so not entirely developed since not necessary in the prototype) defined in the README.

We found that some suggestions maybe were not so well thought. For example *"The loading screen while recognizing the plant can be too much maybe."*: by using figma you can see that the loading screen is very fast (as it would in the real application), this is coherent with standard conventions and guidelines for applications that involves AI. Another example is the suggestions linked to a notification system that, of course, can be fully implemented in a complete application with a server, but surely not in a medium fidelity prototype.

We have to admit that, furthermore, we obtained very useful insights on what we needed to fix and some suggestions about things we overlooked during the process.

Discussion on severity 3 or 4 violations with proposed solutions

Here we discuss and find solutions on each severity level 3 or 4 violation. We will highlight: in green the ones we agreed were actual violations and that we wanted to fix as soon as possible; in orange the violations that for us were in part correct, in part wrong; in red the ones we decided to ignore, maybe because we did not agree or thought were duplicated.

1. H1 Visibility of system status / Found by: E4, E3

Where: Add a plant - Undo

What: when I click on "undo" no feedback is provided

Why: the user should always be aware of the system status, with no feedback given the user might not understand whether the action was undone

Severity: 3

Discussion and Solution: Of course this is totally right, we overlooked it during the process, it will be implemented in the high-fidelity prototype by adding a popup, but this was actually not directly connected to our tasks.

2. H1 Visibility of system status / Found by: E3

Where: Forum - reply

What: when I click on "reply" no feedback is provided

Why: the user should always be aware of the system status, with no feedback given the user might not understand whether the action was undone

Severity: 3

Discussion and Solution: This again was overlooked. An alert will be used to make the user aware of the system status.

3. H1 Visibility of system status / Found by: E4

Where: Forum section

What: it's hard to understand if questions have answers

Why: no visual element is present to suggest the user that he can interact (e.g open) a question and see the answers

Severity: 3

Discussion and Solution: We thought that the thread box was enough but maybe it is not. We will add a "See post" button.

4. H1 Visibility of system status / Found by: E1, E2, E3

Where: overall application

What: there is no information about the "macro" section in which we are (Forum, Suggestions, Recognition).

Why: in the "Forum" section the word "Forum" is always written at the top of the page, in every page of the section, while in the other two it's written only in the initial ones, and then, proceeding with the possible actions the user may lose track of where he/she is, also because some screens like "Plant info" can be reached by many different ways.

Severity: 3

Discussion and Solution: Better titles for the sections will be used so that the user knows the macro section.

5. H2 Match between system and the real world / Found by: E1, E2, E4, E3

Where: Home page

What: The button's functionality for the 'My Plant' section is not understandable

Why: The user would expect a title in order to understand what the button is referring to

Severity: 3

Discussion and Solution: We missed the title/description on that button component so it will be added.

6. H3 User control and freedom / Found by: E2, E4

Where: Forum, My plants sections

What: Missing Remove/Edit button

Why: When I post a message, question or reply I can't edit/remove it. An "Add Plant" button is provided, but the user cannot remove a plant that is already in the list.

Severity: 3

Discussion and Solution: We meant to add them but we forgot, delete buttons will be there in the next step.

7. H4 Consistency and standards / Found by: E4

Where: help my plant

What: the user can create a new thread when he is viewing the list of categories, but he can't create a new thread when he has chosen a category (like "help my plant")

Why: the user is still able to create a thread, but in a different section of the app. Normally, we would expect to add a new thread directly in a category. However, no button to do this is displayed.

Severity: 3

Discussion and Solution: We missed a "Create thread" button. We will add it in a forum section.

8. H4 Consistency and standards / Found by: E1, E2

Where: navigation buttons in the bottom part of the application

What: the position of buttons in the navigation section changes often

Why: some icons have a gray background, others don't. Overall, the navigation bar changes often, with some buttons that change position, or missing "back" buttons. These are some examples:

- back button in "Threads" and "Return tu Thread" is positioned between two buttons, while in "Add plant" it is positioned to the right
- some buttons are used to go back, but their functionality is the same as the back button in the upper-left side of the application

Severity: 3

Discussion and Solution: We do not understand how misplaced back buttons (still present and working) or overlooked duplicated buttons can be a major usability problem. Of course we will fix these problems by removing duplicates and placing the buttons correctly.

9. H4 Consistency and standards / Found by: E1, E2, E4

Where: Forum - New Thread

What: If I click on "New Thread", in the next page I'm asked to create a post (and not a thread)

Why: a different terminology is used to refer to the same thing, this is inconsistent and might confuse the user

Severity: 3

Discussion and Solution: Again, we do not agree that using an inconsistent term (new thread and new post) can be a major usability problem, but we intend to fix this inconsistency.

10. H5 Error prevention / Found by: E1

Where: Create a post

What: If I click the back arrow while creating a post, the post is deleted with no warning

Why: when the user clicks the back arrow, he should be reminded that the post will be deleted, otherwise he might delete what he wrote, unintentionally

Severity: 3

Discussion and Solution: We agree, but this was due to the limitations of figma. We will indeed alert the user about it in the high-fidelity prototype.

11. H5 Error prevention / Found by: E1, E2

Where: Create a post - preview

What: When I click on "Post it" there is no warning about the fact that I'm going to publish a message

Why: The user might click on "Post it" button unintentionally, but there is no way to undo this action, and the fact that it is placed exactly where the "Go to preview" was placed in the previous screen make it even more easy to press by mistake

Severity: 3

Discussion and Solution: We do not agree. The preview is the confirmation of creating a post, why should we add another confirmation on that? A confirmation page before creating a post is already present.

11. H5 Error prevention / Found by: E2

Where: Creating a thread ("create a post" screen)

What: the user can create a new thread, but it could have an empty category or post body, and no error is shown

Why: if you have a form for the user, it should be checked because the user may leave some necessary fields empty (or fill it invalidly). The button should be disabled if the input is not valid

Severity: 3

Discussion and Solution: This is not considering at all the context of the medium-level prototype, that shows you what happens when the user tries to create a post by using pre-compiled screens (it is a medium level prototype, there are not actual functionalities coded) since there is no form here. In the high-level prototype there will be nothing faked, but actual user interaction will be implemented and so checks on validity done via code.

12. H6 Recognition rather than recall / Found by: E1, E3, E4

Where: Your plants status, Our suggestions

What: Plants are recognizable only through their image

Why: The user should be able to read the plant's name too, since the image that represents the plant is small and the user might not recognise the plant if he is not very skilled.

Severity: 3

Discussion and Solution: We agree this is a violation, but we do not agree on the severity rating. Names for plants will be added.

13. H6 Recognition rather than recall / Found by: E2

Where: In the reply screen

What: the user, in order to reply in a thread, should open another screen that doesn't allow them to see the previous messages.

Why: The user shouldn't use more memory than needed, it is necessary to allow him to view the chat while typing the reply message.

Severity: 3

Discussion and Solution: We were not sure on that since putting the reply part in the same screen makes it a bit cramped. We will do so anyway by trying to design it well.

14. H8 Aesthetic and minimalist design / Found by: E1

Where: Recognize

What: Space is not very well managed

Why: You could write what the user has to do. Even if it is easy to understand, it is better to make it clear. For example, you could write: "Point at the plant to recognize it and the system will show you the results". This is violating Human-AI Interaction guidelines 1 and 4

Severity: 3

Discussion and Solution: We will add some text for the user, but we feel that the part questioned is very immediate in terms of understanding (as they said too), so severity 3 feels exaggerated.

15. H9 Help users recognise, diagnose and recover from errors / Found by: E3, E4

Where: Recognize section

What: no feedback is provided about the quality of the photo taken by the user

Why: the system might fail in recognizing the plant if the photo is blurred or the lighting conditions are not good enough and the user should be aware of this

Severity: 4

Discussion and Solution: We agree that the user should be aware of that, but this is a medium level prototype where we show how the application behaves. We totally should have done another flow of events to show how it would behave when there is a bad photo, but the fact that we missed telling the user that it could lead to a bad classification is not an usability catastrophe, only something missing on the prototype. Feedback will be received by users in the high-fidelity prototype.

16. H10 Help and documentation / Found by: E4

Where: Homepage

What: it's hard to understand that the "my plants" button is a button and which section does it bring to

Why: this button has a different layout in comparison to the others in the bottom, plus no written hints are given about his function

Severity: 3

Discussion and Solution: This was a design choice. We do not feel that every single button in the application should look the same.

17. H10 Help and documentation / Found by: E4, E1

Where: Recognize section

What: no disclaimer is provided about the limitations of the AI

Why: the user is not informed that the plant recognition might fail or be wrong. The user should be aware of this, and should be also able to signal it in the app when it happens. It violates the Human-AI interaction guideline #2, too

Severity: 3

Discussion and Solution: This is similar to violation n. 15, You can find there the solution proposed.

Conclusions

We tried to consider every violation, even those with severity 1 and 2, for our high-fidelity prototype. We agreed on some of them and improved our prototype and ignored the ones we feel were wrong or just design choices.

High-fidelity prototype

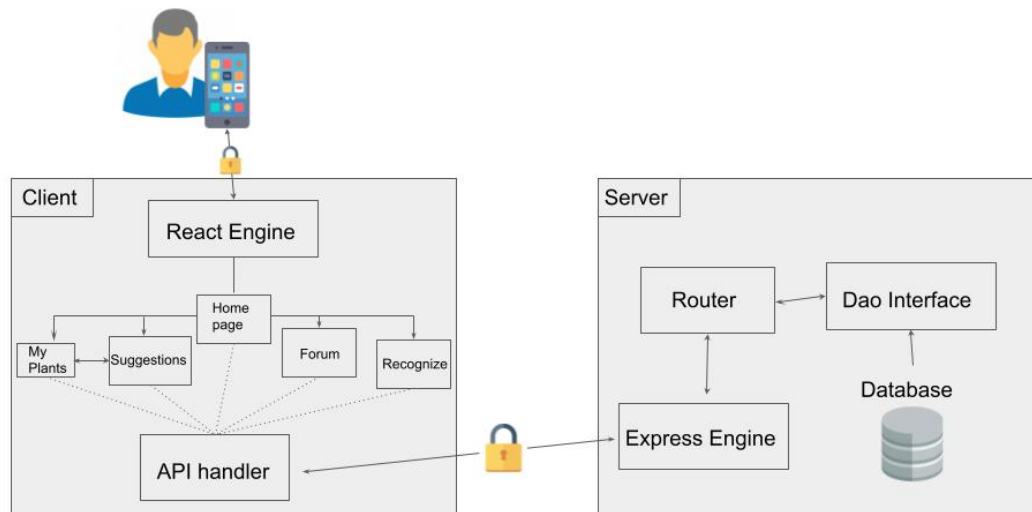
Description and Link

Next, we started working on the high-fidelity prototype. Given the experience of all the members of this group we decided to develop the prototype with the Node.js framework, using the React javascript library for building the user interface (client side) and Express JS for the server side.

The link to the prototype code can be found here: [Prototype Code](#).

Structure of the application

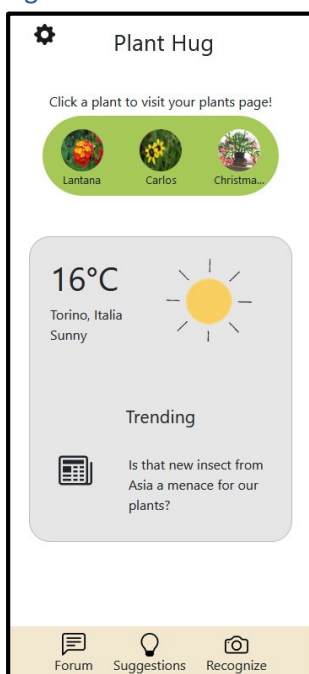
The software architecture is divided in two main blocks: client and server.



Some of the functionalities need to store persistent data (like an user adding a new plant to his/her collection or creating a post) or to receive persistent data because of that all the pre mentioned components are connected to a “API Handler” component which acts as intermediary with the server.

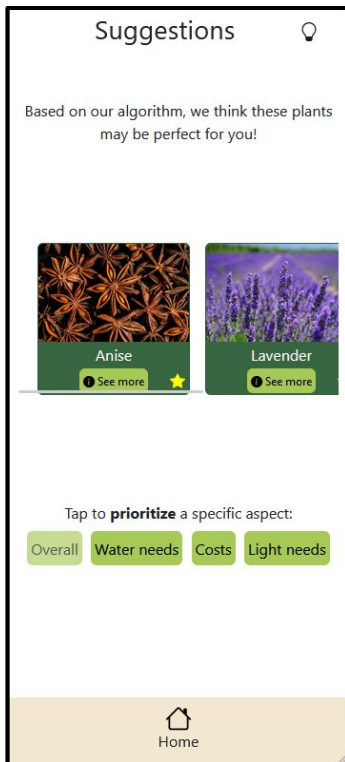
The server block is composed of the Router component that handles all the requests received from the client and uses the DAO interface component that implements the queries on the Database.

Significant screens with explanations



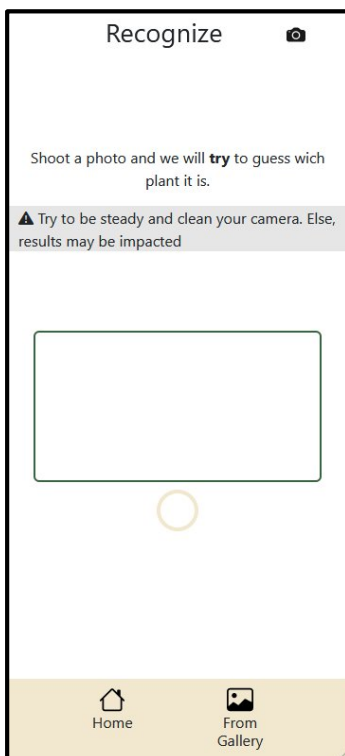
The Homepage is the first page of the application which the user interacts with. From here the user can navigate to any of the applications functionalities described by the components:

- Recognize, that includes all the pages and functionalities for task #1 (Recognizing a plant).
- Suggestions, this includes pages and functionalities related to task #2 (Giving suggestions to the user) and is directly related to My Plants, a block containing pages related to the user plant collection, since the suggestions are given according to the latter.
- Forum, that includes all the pages and functionalities about task #3 (Interaction with peers).

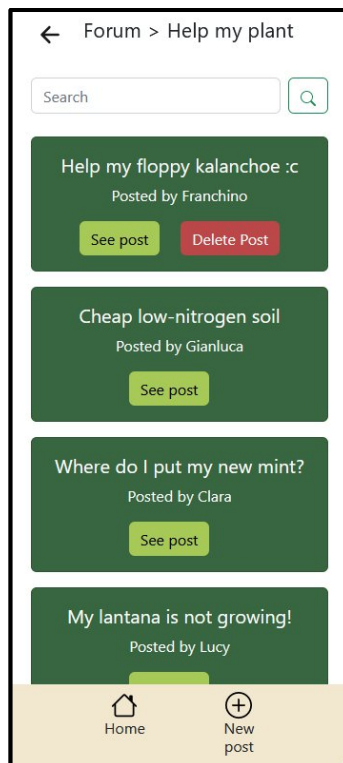
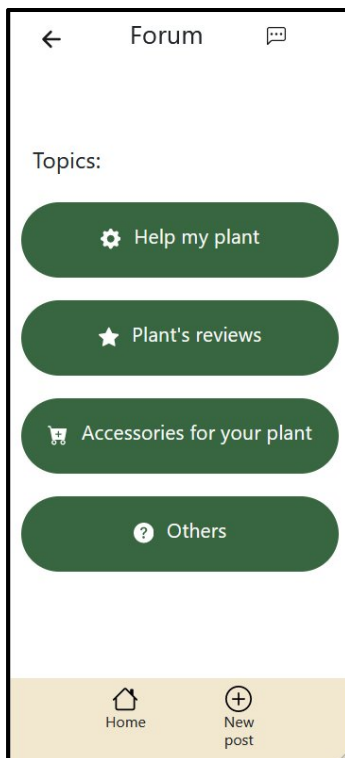


Suggestion page where the user can use our software advice to find new plants to buy. Here he can choose the criteria by which the suggestions are decided (Water needs, Costs, Light needs). By default, the suggestions are done considering all of them.

In this page the user can access more information about a plant by clicking on the relative “See more” button, this will redirect him to another page. User can also send feedback for the received suggestion by clicking on the star. The feedback would be used by the algorithm to improve the suggestions.



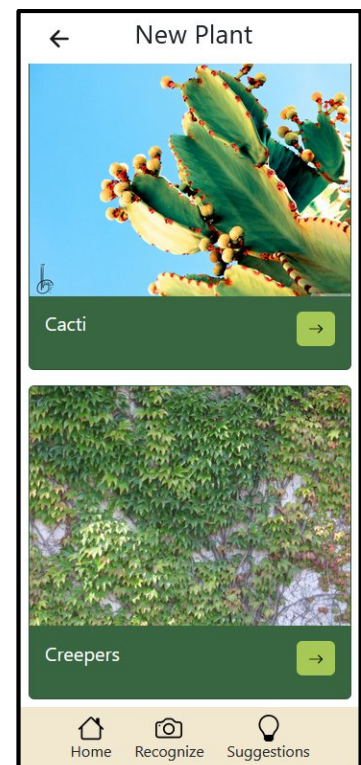
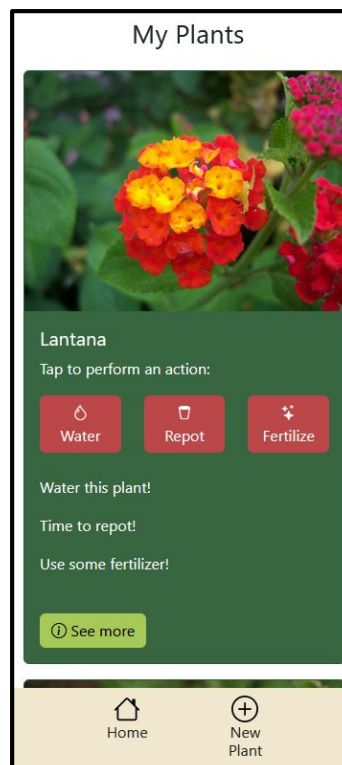
Recognize page where a user can recognize a plant by taking a photo or loading it from gallery.



In the Forum page the user can create a new post or consult already existing posts by entering in one of the Forum topics. There he can open a post to see the question and the replies and add a reply. If it is one of his posts he can delete it. The same is for his replies.

In the My Plants page the user can see his/her collection and perform some actions. By clicking on water, repot or fertilize, user can communicate to the application that the plant has been watered, repotted or fertilized. Red button is meant to capture attention of a user to tell him he maybe need to perform these actions. When the button is green the actions have been already performed and it is not needed to perform them now.

Through the “New Plant” button, the user can access another page containing a list of plant families/types. He can than click on one and see the plant of that type. By clicking on one plant “See more” button, user can look at more information about it and then add the new plants to his collection.



Comments

Some things were hard-coded since there is no authentication and user management. The posts/replies created are only for show and not actually connected to some user, so the delete functionalities are enabled

only for some names and for presentation purpose. Another limitation of our prototype is that the server is actually not deployed and only present for persistent data management. As a consequence, the notification system that would be implemented is not there. A completed app would tell you through notifications to water your plants! Same is valid for the Deep Learning algorithms that should be used for recognizing plants or suggesting them. This prototype only assumes they exist and work as intended. Also, our database is pre-populated by different (but limited) types of plants and some forum posts and replies.

Usability Testing

To conduct usability testing, we will use a merged approach, somewhere in between the Cooperative Evaluation and the Think Aloud method, with some variations. We will work with users who will use the software daily to identify potential problems and their solutions.

To conduct usability testing, based on our high-fidelity prototype, we used a merged approach. Our base is Participative evaluation, but it's more constrained because users can make questions during the process, but we won't. In that way, it's a little more similar to the Think Aloud method. There's also an additional variant, as we will add a form to fill, with closed-answer questions and an evaluation of each task following the Likert Scale.

Reasoning behind this choice:

- Cheap, as no special equipment is needed
- Easy, as it doesn't require training
- Robust, because it doesn't rely too much on facilitators
- Not biased as other methods, as it shows non-constrained use of the system (we don't give them any additional instructions)
- Natural, relaxed interaction
- The user is encouraged to point out potential issues
- Clarification is possible, more than using the Think Aloud method

We also know that talking could slow down the process, making us unable to measure time on task and that the situation is unnatural, but we decided they're payoffs we're willing to pay

Process:

In particular, we first identified the evaluation tasks the user will have to perform. Those are tasks that expect final users to perform in their daily usage of the app. We used the previously defined ones, decomposed them into sub-tasks, and refined them a bit to better include the key app functionalities.

Then we identified and recruited users from the target population. For each one, we followed this process:

- As each user works with the system they verbalize the problems that they experienced and the evaluator makes notes. We will also let them ask questions, but not the opposite.

- A debriefing session is held at the end of the session so that any misunderstandings that might have occurred can be cleared up and checked for common understanding.
- We then make the user fill out the form.

Users:

Mariapia: she already uses some applications to manage her plants, so she's a target user. She's in her last year of high school but she will eventually study Scienze Biologiche at Università di Torino.

Sara: she studies Chimica at Università di Torino, and we got to know her at Comala through common friends. She doesn't have a plant yet, but she said she wants to buy some, and she would like a guide to do so.

Anna: she works as a Bartender in Turin and her parents always ask her to help with the plants that they filled their house with. She's not that into it, but she gladly helps them and would want to think less and do more, relying on a trustworthy source of information.

Fabio: he studies Tecniche Erboristiche at Università di Torino and he thinks he could be helpful in a community about plants. He's already using some forums but they're very old and not very user-friendly.

The tasks

1. Add a plant to your ones

- Through Suggestions
- Through New Plants

2. Recognize a plant

- Try shooting a photo
- Try uploading it from your gallery

3. Interact with users

- Add a post
- See existing posts
- Interact with an existing post
- Delete a reply

Sara:

Organization: Kevin conducted the test, while Luca took notes.

Results

Sara provided us with some really interesting cues on how our app is perceived by an actual user. Let's start with the positive comments:

- The actions to perform on plants are really intuitive
- Custom names for plants induced a very enthusiastic response. We are glad, as we tried to engage with users emotionally
- Also, the colors and the layout looked engaging and "akin to a game" to her
- She immediately went to "My Plants" after adding a plant, understanding she would find it there
- She immediately asked if she could receive suggestions based on the effort required: that's a key concept of our app, and it shows we correctly found real user needs
- She asked if she could actually download it, showing genuine interest in the application
- She really liked the Recognize function
- She said the "from gallery" is the de facto standard in all Android applications
- She said that she expected the app to go back to the Forum after posting, and that's relieving because we had some doubts about it
- She liked the homescreen with weather forecast because it's "Useful to take care of plants". That differs from others' feedback, so we could make it customizable (a list of customizable and rearrangeable widgets)

Let's now discuss the found issues:

- Notification are missing, she would like to be actively reminded of the actions provided (water, fertilize, repot)

We could provide a notification center and a push notification system

- She always tried to click on plant images instead of "See more"

We could make the whole card clickable

- The feedback feature went unnoticed

We could make it more prominent, maybe with a dedicated button and some text other than the star icon

- She understood red-colored actions were to be performed, but she asked nonetheless

We could maybe add a legend at top of the page

- She hesitated when looking for some icons on the navbar

Maybe we could highlight some actions or put them out of the navbar entirely

- She tried to click on the camera icon in the top-right corner instead of the right one

We could change the shoot button color, maybe it's too light

- She would've liked to see more plants on the homepage

We could make it scrollable sideways, to show all plants

- She asked in which order plants on the homepage were shown and said she would like to see the more needy ones first, the ones which needed immediate care

We explained right now they're just in a database-dependent order (primary key) but we could totally make them prioritized based on current needs. We could even introduce more options

- She was confused about the undo function in the add plant sequence, she didn't know what it was supposed to do and what to expect

We will just get rid of it, as others expressed doubts as well

Timing on each task:

Task number	Description	Time
1.1	Add a plant through suggestions	1m8s
1.2	Add a plant through New Plants	1m23s
2.1	Try recognizing a plant shooting a photo	33s
2.2	Try recognizing a plant uploading a photo from gallery	42s
3.1	Add a post to the forum	1m27s
3.2	See existing posts	8s
3.3	Reply to a post	20s
3.4	Delete a reply	48s

Anna:

Organization: Pietro conducted the test, while Riccardo took notes.

Anna really loved our prototype, giving us mostly positive comments and asked us a few questions about some implementations:

“Positive” comments:

- She loved the suggestions because it makes the application very playful and cute while teaching her of new existing species and giving ideas of what to buy.
- In general she loved how colorful the application was
- She loved the minimalistic design of the Forum calling it “very practical”
- She enjoyed being able to add new plants and use nicknames for the plants in her collection
- She considered the application very useful and she did immediately see how it could help a plant owner.
- She liked the meteo widget in the homepage.

“Negative” comments/found issues:

- Although she liked the meteo widget she said that she would have preferred it in another color, like light blue.

We will take in mind to explore different colors for the meteo widget.

- She didnt immediately understand how to go back from the popup “alert” when she tried to reply to a post in the forum

Maybe instead of asking the user to click anywhere in the page to continue we can add a button that is more visible.

- She was confused when using the Recognize function because it was trying to use her front camera instead of the back camera.

We explained that it was just for the prototype and in the complete application the back camera would be used but of course its counterintuitive.

In the end we made her compile our questionnaire and she told us “you really did a good job i felt like using a real application, even better then somes i have downloaded in my life”.

Timing on each task:

Task number	Description	Time
1.1	Add a plant through suggestions	1m
1.2	Add a plant through New Plants	1m41s
2.1	Try recognizing a plant shooting a photo	22s
2.2	Try recognizing a plant uploading a photo from gallery	27s
3.1	Add a post to the forum	58s
3.2	See existing posts	12s
3.3	Reply to a post	25s
3.4	Delete a reply	5s

Maria Pia:

Organization: Luca conducted the test, while Kevin took notes.

Maria Pia really appreciated our prototype, saying that this kind of app would be useful to her, given her clumsiness.

“Positive” comments:

- She appreciates the fact that when adding a new plant he receives feedback that the same plant is already present on his wallet.
- When creating a new post, she appreciated the functionality of displaying the preview to be sure of what she was publishing.

“Negative” comments/found issues:

- She did not immediately realise the usefulness of the suggested page, taking a few moments to fully understand what it was for.
- She would not expect the undo function at the end of the process of adding a plant to her wallet.
- She also did not appreciate the warning when deleting a reply to a post.
- She did not appreciate the confirmation notice after adding a reply to a post, he considers it unnecessary since he is aware of what he has done.
- She wondered why the search bar on the forum page was not working.
- She found a bug in the recognise page via photo from gallery, in fact you cannot go back after uploading the photo to the system and consequently you cannot re-upload another photo.
- She asks why the side menu on the home page does not work.

Other crucial points for improvement / revision of the prototype

- From the home page she does not understand how one can see the wallet with all his plants, she would appreciate a more obvious indication.
 - A possible solution to this problem could be a biggest text font, to make it more visible.
- She did not notice that adding the name of the plant was optional during the process of adding it to his wallet.
 - Again, the usage of a bigger text could be a solution.

Timing on each task:

Task number	Description	Time
1.1	Add a plant through suggestions	16s
1.2	Add a plant through New Plants	53s
2.1	Try recognizing a plant shooting a photo	35s
2.2	Try recognizing a plant uploading a photo from gallery	36s
3.1	Add a post to the forum	38s
3.2	See existing posts	26s
3.3	Reply to a post	22s
3.4	Delete a reply	40s

Fabio:

Organization: Riccardo conducted the test, while Pietro took notes.

Fabio appreciated most of the part of the proposed prototype and would be willing to download it.

“Positive” comments:

- He appreciated the presence of the back button to return to the previous functionality of the app.
- He particularly liked the choice of showing alternates similar to the plant recognised by the system in order to be sure of lowering the probability of error due to light conditions, location etc. that could affect the recognition of the photo.
- As soon as he added a plant to his wallet he immediately checked that the plant had been correctly added, showing a mastery of the software after only a few minutes of use.

“Negative” comments:

- He hesitated to use the 'go to preview' button when creating a post. He went on to say that he did not see the sense in using the colour red in the 'post it' button and that the correct choice would be green.
- When adding a plant, he found it difficult to understand whether the plant had been added to his wallet or not, and suggested improving the confirmation.
- After adding a plant, the 'undo' option is of dubious functionality, considering also that it is not immediately visible.
- Highlighted a problem with scrolling when adding a reply to a post.
- The keyboard in adding a reply is broken if there are many other replies.
- Noted that the search bar does not work anywhere.
- A problem was encountered with the camera when capturing a photo as only the front camera of the mobile phone can be used.
- After recognising a plant via the camera, he did not realise that the related plants were similar to the one he had just scanned (the suggested plants are picked randomly from the database)

Other crucial points for improvement / revision of the prototype

- At first glance, he did not quite understand how the page of a post was structured, taking a few moments to understand the hierarchy of resources on the page.
 - Maybe redefining the gerarchical interpretation of the color palet could be useful to solve this problem.
- During the recognise function when uploading a photo from the gallery, he found it difficult to find the button to open the gallery.
 - A possible solution to this problem could be the usage of a more evident color.
- He does not see the point of the weather widget on the main page of the application.
 - Giving to the used the possibility to customize the home page could be a possible solution to better adapt our application to large number of people

Timing on each task:

Task number	Description	Time
1.1	Add a plant through suggestions	46s
1.2	Add a plant through New Plants	1m
2.1	Try recognizing a plant shooting a photo	23s
2.2	Try recognizing a plant uploading a photo from gallery	37s
3.1	Add a post to the forum	1m
3.2	See existing posts	20s
3.3	Reply to a post	32s
3.4	Delete a reply	26s

Questionnaire:

At the end of the test each user compiled a questionnaire, this was to assess the usability of our prototype. We used The System Usability Scale (SUS) a simple ten-item scale giving a global view of subjective assessments of usability and then added additional questions about our defined tasks.

SUS yields a single number representing a composite measure of the overall usability of the system being studied and is considered a valuable evaluation tool.

The SUS score of our prototype was 87/100.

Results [here](#).

Conclusions

The first thing that comes to mind is how difficult is to actually design a functional and successful user interface. Before studying it, we thought of it as something minor, boiling down to personal preferences. But now, we know that is definitely not the case. There is a process that needs to be followed, a very well-structured and documented one and it is more about people than just code. That is a huge shift of perspective from any approach we adopted in previous years of our studies, and we will of course have it in our personal skillset and professional portfolio.

Our project theme was very fun to pursue. We all have some plants or some friends with plants, so it was like diving into a familiar domain, but with a purpose, a vision, building up in time. We talked to experts and learned some aspects we would not ever think of, and we got to see the little quirks, always different from person to person, of plant owners in the real world. People which we interviewed told us about their bond with nature, their daily struggles, and a passion that maybe they did not even realize it was that important to them, but it was. The emotional aspect of it was as important as the technical part, and we thought of a solution that, according to us, fits both.

Regarding the AI part, we noticed a somehow unexpected openness to the theme, probably due to the amazing development it experienced in these last years, showing how promising it is. We think this technology could really help users and improve their lives, but also, we noticed how important guidelines were: people constantly looked for feedback on the AI process, and they can find it in our solution. Also, filters to prioritize the suggestions process were a hit, giving them control over it.

Users' responses were overall heart-warming, as, apart from some little issues to iron out, the prototype was well perceived, praised, and appreciated for the very aspects we loved about it and carefully worked for. In particular, the simplicity and colourful, playful character of our solution was what we most felt proud of. Seeing it grow from sketches to something resembling an actual application was amazing.

Overall since we are students of different curriculums our timings for working on this project didn't quite match up but we did always divide and parallelize the work in a balanced way, keeping in touch daily and discussing what should be done and how, working in a group with other people gives you a broader and different vision which certainly helps for the development of something that is intended for an end user and not ourselves.