Manual-free software for a technical instrument

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Abstract

In workplaces, a lot of knowledge is lost when colleagues change positions. What was once obvious to one person can be incomprehensible to the next. This problem has been encountered by Probation Labs Sweden AB with their biochemical instrument, Labbot. Labbot facilitates researchers in automating their protein analysis. It works like a multi-tool where users can perform one or several tasks in a row.

Users often do not use the manual to operate the instrument. Instead, they rely on information from colleagues or the internet. This leads to a game of "Chinese whispers," where specific facts for a unique problem eventually become misconstrued as laws for other employees. As a result, there is a demand for software that includes the knowledge from the manual but also parameters that allow researchers to use the instrument in a personal way.

This thesis explores the potential of a manual-free software for Labbot. By studying how users interact with the software, the company, and competitors. Concepts and solutions to this problem are developed. The project uses Alan Cooper's Goal-Directed Design Process, which begins with an understanding of the company's visions and ends with a prototype that matches their needs.

The result is a prototype of how the home screen can look for Labbot's software, including the goals and concepts developed during the process. The main focus for further development of this system is how information should be stored and displayed in a simple and interactive way. This ensures that all users can find their way and feel in control when creating procedures.

Keywords: technical instrument, manual-free, software, information sharing, tacit knowledge.

Sammanfattning

På arbetsplatser går mycket kunskap förlorad när kollegor byter arbetsplats eller position. Det som har varit självklart för dem är oförståeligt för nästa person. Detta problem har företaget Probation Labs stött på med sitt instrument Labbot. Labbot är ett biokemiskt instrument som underlättar för forskare att lära känna sina proteiner på en automatiserad nivå. Man kan se Labbot som ett multiverktyg där man kan använda ett eller flera verktyg i rad.

Problemet som har identifierats är att användare inte använder manualen för att använda instrumentet utan i stället tar in fakta från kollegor eller internet. Situationen som uppstår är att arbetsplatsen blir som en visklek där specifika fakta för ett unikt problem till sist blir som en lag för de andra anställda. Detta skapar efterfrågan på en mjukvara som inkluderar kunskapen som finns i manualen, men också parametrar som underlättar för forskare att använda instrumentet på ett personligt sätt.

I detta examensarbete utforskas potentialen i en manualfri mjukvara till detta tekniska instrument. Med informationen som fås genom hur användarna interagerar med mjukvaran, företaget och konkurrenter. Utvecklas koncept och lösningar till detta problem. Projektet är utfört utifrån Alan Coopers metod Goal-Directed Design Process, som inleds med förståelse för företagets visioner och slutar med en prototyp som matchar deras behov.

Det slutgiltiga resultatet är en prototyp av hur hemskrämen kan se ut för Labbots mjukvara. Som inkluderar mål och koncept som tagits fram under processens gång. Främsta fokus för vidare utveckling av detta system är hur information ska lagras och synas på ett enkelt och interaktivt sätt. Där alla användare hittar sig fram och känner att de har full kontroll i skapandet av procedurer.

Nyckelord: tekniskt instrument, manualfri, mjukvara, informationsdelning, tyst kunskap.

Acknowledgments

Thank you to everyone who contributed during the interviews, for your commitment and flexibility. This project would not have been possible without you.

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Lund, June 2023

Ebba Holm

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1 Introduction

1.1 Background

In a world where people are aging and in need of medication, it is crucial to provide researchers with the best equipment to succeed in their work. With a suitable instrument, researchers can quickly make life-saving discoveries.

Researchers are purchasing expensive instruments that include highly specialized techniques. These instruments present users with challenges, as it can be difficult to understand the concepts behind creating an experiment. In these cases, it is important to have both explicit knowledge, which is information that is available in text, and tacit knowledge, which is information that is known by users but cannot be easily transferred in text. Transferring tacit knowledge between colleagues can be a challenge. Researchers often find it difficult to communicate tacit knowledge because it is too complex to put into words. Therefore, outstanding software would be one that includes as much tacit knowledge as possible (Shull, 2002).

Research has shown that relying solely on manuals for explicit knowledge may not be an effective strategy. Only 25% of software users read the manuals, and educated users are even less likely to use them (Blackler, et al., 2016). Instead, users expect software's to be intuitive and easy to use. If the software does not meet this expectation, users' resort to trial and error to figure out how to use the product. This approach can result in underutilization of the software and it not reaching its full potential.

Despite a history of difficult user interfaces, researchers are actively working to address this issue. The culture surrounding modern instruments is changing and evolving, and researchers are investigating ways to make software more user-friendly and intuitive.

Gaffney (2021) notes, a significant amount of knowledge is lost when experts retire, and structural knowledge is often not documented during employee turnover. This can result in a loss of critical information that is essential for providing effective healthcare. Similarly, in the academic field, post-doctoral students typically spend two years in a lab, while PhD students spend four years. Due to the short-term of academic contracts, there is often a high rate of employee turnover, which can lead to a loss of structural knowledge and impact research outcomes (Bajuk, 2021).

Considering these challenges, it is important for organizations to take proactive steps to address issues related to knowledge management and employee turnover.

This may involve developing comprehensive knowledge management strategies, investing in training programs for employees, and leveraging technology to capture and preserve critical knowledge. By taking these steps, organizations can help ensure that they are able to retain critical knowledge and expertise and continue to provide high-quality services to their clients and customers.

At Lund University the programs are designed to be a pre-stage before switching to a new workplace. With that high rotation of colleagues and students, there is often a knowledge gap the same as mentioned as tacit knowledge. It´s easy for parameters to become facts (Törnqvist, 2023).

In Laboratories trust is key. With trust comes better performance from coworkers and positive relationships to financial performance, labor productivity and product or service quality (Brown, et al., 2015). When the instruments are complex, special approaches become facts to everyone. This is a feeling many in this workplace have felt. You are led blindly by your colleague, and the manual for the software is not easily accessible. Therefore, it is important that the software leads you in the right direction and helps you find information.

As designer you need to understand the perspective of designing for health and well-being, and to design in a meaningful and sustainable way. To understand the full system, it´s important to understand all parts and the needs that are identified (Boeijen, et al., 2020, p. 19). Finding a balance between complicated manuals and simple software can make it easier for users to access information. This reduces the irritation of searching for information.

Do we really need to have a manual?

1.2 Purpose

The aim of this thesis is to explore the possibility of developing software that does not require a manual. The project will involve identifying the problem and conceptualizing potential solutions. The goal is to address the issue of lost knowledge and underutilized manuals in the workplace. Specifically, the objective is to determine whether it is feasible to create a manual-free software for technical instruments and how it would operate.

1.3 Case - Labbot

Probation Labs Sweden AB is a company that enables scientists to pioneer new frontiers in analyzing protein changes within the biochemical industry. For the purposes of this thesis, we will refer to them as Probation Labs. They are a start-up closely affiliated with academic researchers, created to enable scientists to pioneer new frontiers by enabling difficult experiments within biochemical research and related industries. An issue the founder encountered while working at Lund's University. The company currently has three employees.

Probation Labs has developed an instrument called Labbot, which is pictured in Figure 1.1. The “silver pencil” in the pictures is the pump. The company comprises three distinct elements: the instrument, software that is connected to the instrument, and a software tool known as Data Viewer. Data Viewer comprises all information from the software and presents it in a more visual format.

Currently, it takes a lengthy introduction to start up a new Labbot instrument for customers. By identifying the software components that can help Labbot grow and what elements are considered "typical Labbot," the company can expand its customer base.

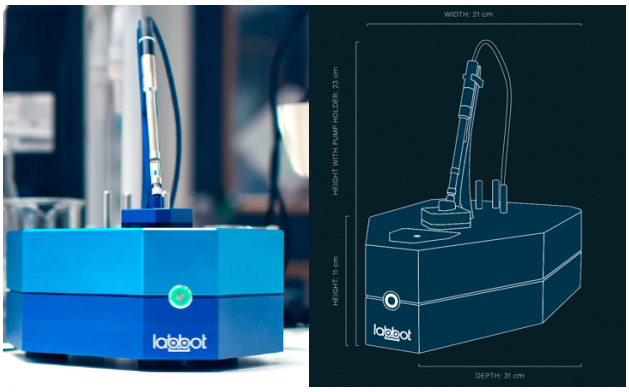

Figure 1.1 Picture and drawing of the instrument.

Labbot is an instrument with several different techniques and has visions of being the only instrument you need when getting to know your protein. With several different techniques comes complex software that gives the user a lot of freedom to design as wanted, see Chapter 2 for more information regarding the instrument. The company is in a situation where they have an instrument that is up to date and software that was made at the beginning of development. Labbot has 20 instruments on the market, the instruments are from different generations, used by academic researchers and commercial research and development labs.

The goal is to answer: can it be easier for users to understand the software, and could that be made with a manual-free software for this technical instrument?

1.3.1 Users

The users are highly educated academic scientists in biochemistry, biophysics and physical chemistry. It´s the team leader that purchases the instrument and after that used by PhD students, lab technicians, and post-doctoral researchers.

Some of the scientists Labbot is working together with:

- Prof. Sara Linse Snogerup, research towards understanding Alzheimer's and eventually finding a cure.
- Prof. Alexander Büll, leading researcher. in protein phase separation, a phenomenon that is important for better understanding and combating cancer.
- Prof. Cedric Dicko, researching towards developing synthetic silk, which can be important for both medical applications and within the textile and materials industries.

With 20 instruments on the market, and assuming on average five users per instrument, there should currently be approximately 100 active Labbot users.

1.4 Limitations

The project aims to find a solution for creating software that does not require a manual. This solution is specifically limited to the industry of academic researchers and will not be tested on persons with different backgrounds or education. There is not a broad target group to investigate whether this solution would work for all cases of software.

During the interviews, I will observe how academic researchers operate in this specific knowledge experiment, which is not their exact profession. This will primarily be done to understand the industry and will enable knowledge to develop the next generation of software.

Due to a time-limited period of 20 weeks, only a particular experiment will be examined, and not the entire software. Some goals and openings that have been communicated to the company are not written in this report, as it does not include knowledge about creating manual-free software.

It should be noted that Labbot has another software called the Data Viewer, which will not be included in this project, because of time limitations.

During the exploration of the company, most of the information has been gathered from the company itself in order to understand different technologies and other instruments. This is to gain insight into how these techniques are being used.

1.5 Structure of essay

With the use of the complex instrument and a variety of methods, the essay is structured to be read as a step-by-step process in chronological order. This design was implemented to facilitate the reader's comprehension of the case and to clarify the use of different methods. The project's overview would be difficult to comprehend if the design process phases were presented in a different order. Therefore, this essay has a unique structure compared to typical essays.

2 The instrument: Labbot

2.1 Why use Labbot?

Labbot is constructed so you only need one instrument, instead of several instruments doing specific things. You can compare it to a multi tool, either use one of the functions or all of them after each other. The same goes for Labbot, all techniques can be combined in different procedures in the software or just use one of them. These different techniques are good to use when you want to get to know your protein. See how the protein reacts to different temperatures, lights or other substances. This will give the scientist an overview of how the protein is behaving and can create conclusions or further development fields.

2.2 What it can do

Labbot can either do manual experiments or a full procedure. The manual settings are done to investigate how the substance in the cuvette is reacting, with quick measurements. It has a pump that injects syringes during a procedure. This is necessary when you want to find out how a substance is reacting to another. The Labbot has included a stirring function, so when injecting with the syringe it's stirring at the same time.

These results are important if you want to have knowledge when creating full procedures. See Table 2., for explanations of some technologies in the instrument. Only technologies that are relevant to this project are presented.

Table 2.1. Technologies in instrument (Törnqvist, 2023)

	Technologies in instrument
Procedure	A procedure is when you set up parameters and actions in a specific order and let it run per automation.
Ultraviolet-visible Spectroscopy *Manual mode*	The measurement procedure of absorbance, absorbance is how molecules absorb light. Depending on the absorbance, you will know much concentration of a certain substance is in the cuvette and how it reacts with different the light. It is measured in either the Ultraviolet (UV) or the visible (VIS) range of light. Before making the procedure, do a blank measurement. A blank measurement is a reference measurement of the buffer that the sample is dissolved in. It is used as a control to ensure that any measured changes are a result of the sample itself, rather than any other factors.
Fluorometer *Manual mode*	Fluorometer is the procedure the instrument does to decide the fluorescence. Fluorescence is when a substance is exposed by a specific wavelength and after the procedure transmits another wavelength. By understanding where the transmitted light comes from, you can decide the molecules in the cuvette. It consists of the light and detection of the transmitted light. In this manual mode you need to decide the excitation filter, the filter decide which range of light you are allowing in the cuvette.
pH-meter *Equipment*	This is an equipment that are attached to the cuvette, to decide which pH the substance has at each step during the procedure. It´s not connected to control the pH, only to detect how the pH changes over time. pH is important to detect since it is a measurement of how acidic it is. (Called "meter" in the software.)
pH Titration *Procedure*	pH is important to measure since proteins and other substances can behave very differently at different pH values. pH titration is a procedure that injects another substance through the pump in to the cuvette, with the *pH-meter* attached to make measurement. You can combine a *pH Titration* with the *fluorescence* and *absorbance*, and at the same time measure the pH. This makes it possible to follow how the state of a sample is affected by changes in pH.

To get a deeper understanding of how the software is communicating with other systems a context diagram is used as a visualization tool. The context diagram is used to understand how the software interacts with all other external parts, see Figure 2.1 (University of Waterloo, n.d.).

Users are also interacting with the instrument, pH-meter and Data Viewer. During this project, the goal is to build a bridge between the users and the developers.

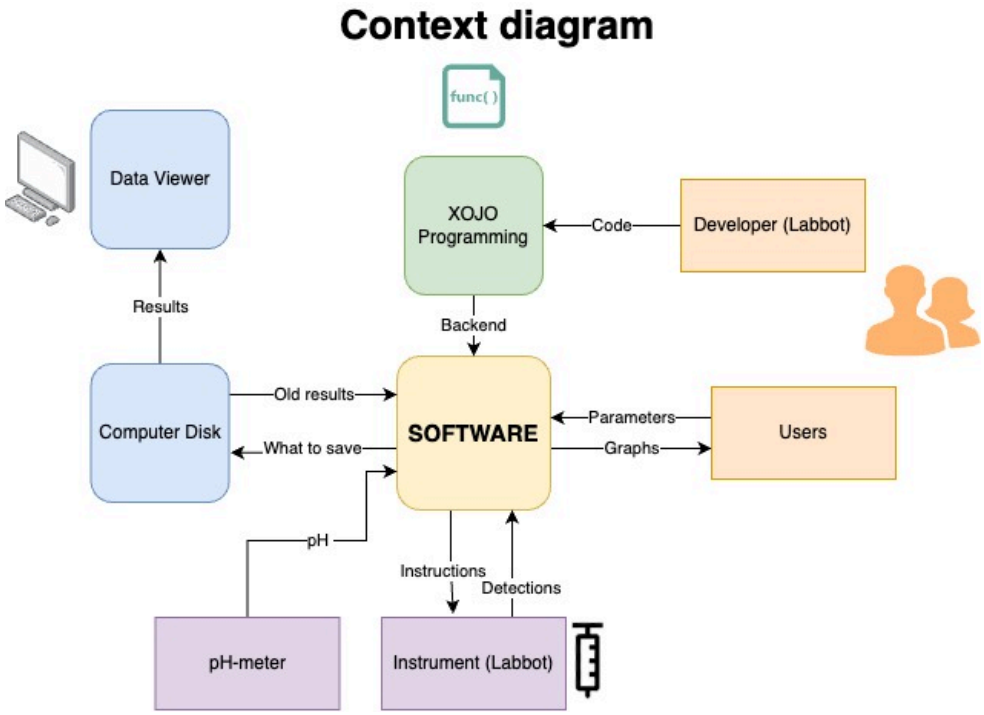

Figure 2.1 Context Diagram

2.3 How to use it

After the Labbot is connected, Figure 2.2 are showing what the home screen looks like. On the right side of the screen, you have all manual settings. You can test the temperature, stirring, meter and the pump. The manual mode settings are different windows, in Appendix A.1 all windows for the software are shown.

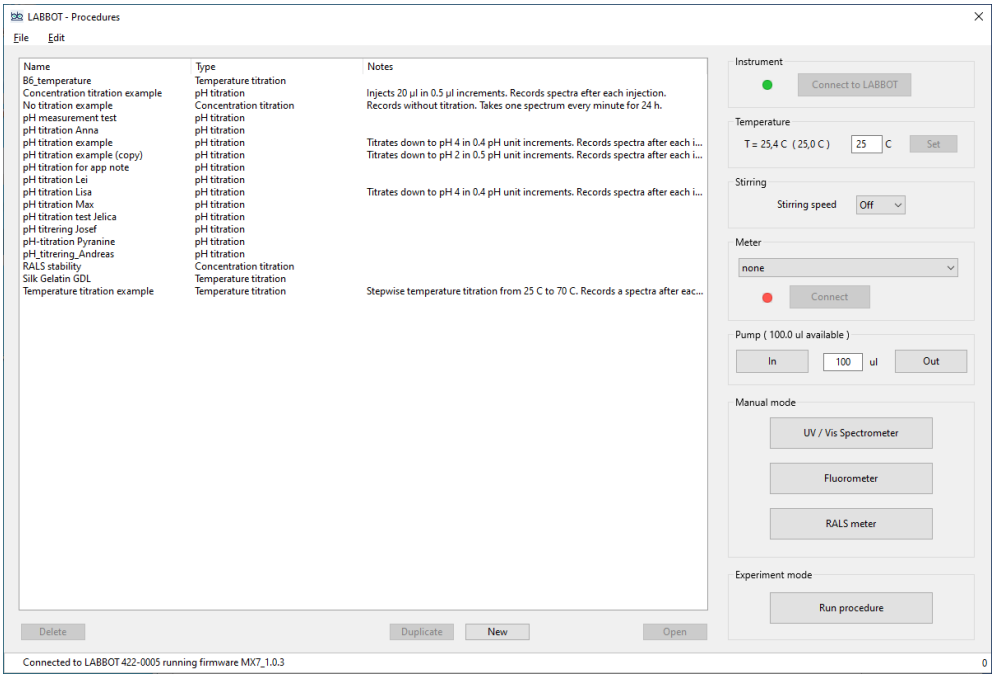

Figure 2.2 Picture of the home screen.

With procedures you can either decide to duplicate procedures in the list, open a procedure in the list or make a new one. A procedure is a sequence of different techniques as automation. This is to ease for the scientist, you can see how a substance are reacting over a long time. The aim of the project is to find out how users are feeling when creating their own procedure and which functions, Probation Labs are using. Labbot connected to the software is shown in Figure 2.3.

Figure 2.3 Pictures of the instrument in its environment.

2.4 Analysis of Labbot

Labbot is an instrument with a lot of different techniques. Which brings with many decisions of parameters. The company has focused a lot to give the user freedom to design, but with the freedom has a diffusion of navigation arrived. You don´t know where you are in the process, and it feels almost like a gamble when pressing buttons that you don´t know where it leads to. The next step will be to understand the company's vision more and after that investigate the users. The question remains if it´s possible to create a manual-free software.

3 Process and Method

3.1 Goal-Directed Design Process

Goal-directed design process is chosen during this project. It´s important for the project that the results isn´t generated by trial and error, it must have documentation from the start on what is happening and a clear structure. As said in 1.3, their equipment can be life dependent in the research field. The project has focus on the users, this process is generated depending on user goals. Therefore, this phase must come on early in the project. When Dubberly is describing Alan Coopers method in the article it´s important that there are several coworkers with different knowledge, see Figure 3.1 Bridge between knowledge (Dubberly, 2001).

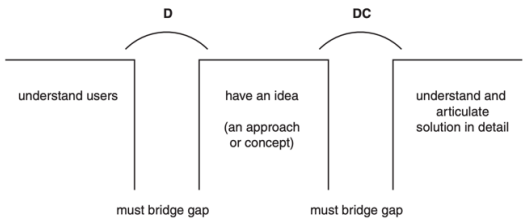

Figure 3.1 Bridge between knowledge (Dubberly, 2001)

The different steps of the process are shown in Figure 3.2, where the boxed steps are done. With knowledge from other courses, all steps feel comfortable. For example, interviews, concept generation, and personas, have been been a common method in courses through my education. Steps that are not included for example milestones, product plans and sales channels – because they are already known by the company.

When dealing with a complex project, it is important to choose the right approach and make informed decisions about what to deliver at each step. The method described here provides clear instructions for when to move on to the next step, while also giving you the freedom to adapt the steps to your needs and goals. As a developer, you retain control over the project, while still being able to follow a guide and design each step accordingly.

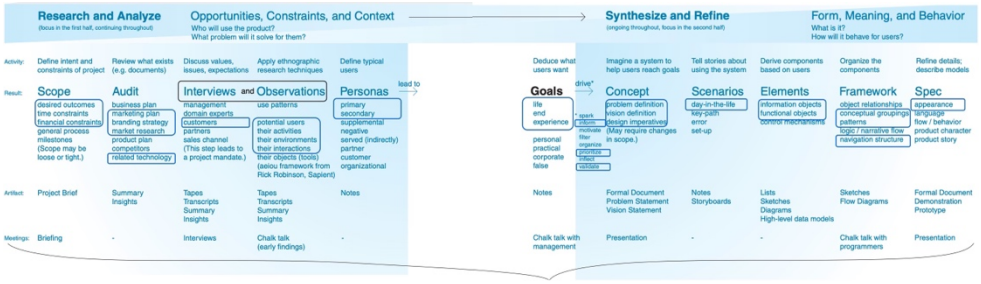

Figure 3.2 Goal-Directed Design Process (Dubberly, 2001)

Goal-directed design process is made to understand users and depending on their behavior and needs create a product (Qubstudio, u.d.). Labbot are right now in a situation where they know what they can do and want to do. But don´t have overview of what the customers are feeling, see Chapter 1.3. By using this process, they can guarantee that what they think is necessary also is necessary for the users.

Since this is a not very known method, it´s compared to the double diamond process. To see how the methods overlap and how they differ. To better understand why it´s used. The Double Diamond process is built on four different steps: discover, define develop and deliver (Sharp, et al., 2019, pp. 38-50). It´s built on user-centered design, and the first step is to discover requirements from users and define what the project is about, depending on the discovery phase. These steps are not defined on what you do, only a guideline, and then depending on the project you choose what the sub-steps to achieve a full discovery concludes. Why goal-directed is a better fit in this case because it has clear goals in each step what to deliver and how to do it. Since it´s a complex project, finding out which methods below each step is too time-consuming and can also result that some parts have been left out. The goal-directed design process is also user-centered but is more dependent on the persona and doesn´t have a full focus on requirements.

Even though both methods could be done in the same way. Since the double diamond doesn´t have to decide which methods they are using. Using the goal-directed design method is preferred. Goal-directed is a good fit when you need to discover a new field. In this project, there is a clear desired outcome from the company, and they need to understand their users and their needs. The focus is not to discover as much as possible.

4 Scope

The goal is to summarize the project brief together with the company. Understand what opportunities they have and what constraints there are with the project (Dubberly, 2001).

The scope is conducted through a day with Labbot. Were they worked as a focus group, answering and discussing questions. A focus group is made to get a deeper understanding for the company and give the company a chance to reflect on what they want to achieve with this project. Since they all have different responsibility, it's important that they can discuss together and fill in each other's answers, things can come to mind when hearing someone else answer a question (Ericson, et al., 2015, p. 87).

Attending from the company is the Senior Management, Software Programmer, and Product Management/Specialist. They need to provide me as a software designer with these bullet points (Dubberly, 2001) (accepted by the company):

- (Compensation)
- Stable environment
- Vision of the company
- Vision of product
- Authority of product
- Goals
- Resources
- Arbitration
- Tech opportunities
- Tech constraints

During the day we had the Labbot installed and had an open discussion over these questions:

- How do you usually use the software?
- What is Labbot?
- What do you want to achieve?
- What is the goal for you with this project?
- What constraints do you have when developing the software?

4.1 Desired Outcomes

A desired outcome is what the company wants to achieve with the project. All results have been gathered from the workshop and the introduction I got from them. The desired outcome will be compared to the background to understand how they can be combined.

The desired outcome is to systematically gather information about the users' workflows, needs and wishes. This will be done through interviews with users and on-site studies when using the instrument. The results of the investigations will be the basis for choices when designing the next generation of the software. Without this kind of systematic compilation, the company risks making design choices that do not meet the actual needs of our users, or that miss the needs of a particular user group.

Understand how the user interacts with the software and where the friction points are. Find solutions to the parts where the software isn´t interacting as expected with the user. Validate the friction points to Probation Labs own expectation and understand how the picture of the software either differs or is as expected. All points that differ will be improvement suggestions to create a confident and new design. See all desired outcomes in Table 4.1.

It is important for the company that Labbot is perceived as transparent. When using the software, the design illustrates to the user what is happening. There is no hiding of code or parameters. It´s easy to find information and to share information.

"Our goal is to automate and combine proven biophysical techniques in a new way" (Törnqvist, 2023).

Table 4.1 Desired outcome from Probation Labs

	Desired outcome from Probation Labs
Software	- Giving the users a freedom to create their own logic behind the system. - Understand how far the experiment has run. - Add more information without confusing users. - Accessible help and support functions. - More flexible. - More intuitive. - Decide which functions should be included and not to be included. - New features that help during experiments.

4.2 Constraints

A constraint is something that limits me as a developer when doing the project. Restrictions exist from the company. Their vision is to create the software in-house, which means that I need to create solutions that can be made by them. If someone else is to create the new software, they must be very aware of the instrument and that is expensive. They are therefore doing all programming by themselves. Probation Labs want to keep their programming service they have right now, which is XOJO.

The instrument is used by many different IT infrastructures, the development platform should not be dependent on the quality or update of the computer. Users have secret information in settings with very different IT infrastructures, so it should not connect online, without asking the user.

The limitation of users is that they have a lot of different purposes for the instrument, in some cases, users have secrets.

This project has a limitation to one type of procedure. See Table 4.2 for the constraints listed.

Table 4.2 Constraints from company and users

	Constraints
Company	Time. XOJO – programming.
Users	Offline mode. Different users. Different IT infrastructures. One type of procedure during the observation.

4.2.1 Financial Constraints

Financial limitations are mainly linked to the time it will take to program the solution. When the company itself will program, the goal is not to have to include any external party for the implementation.

4.3 Analysis

Probation Labs are a startup, and they now want to switch focus from the instrument to the software. With time limitations it can be hard to make a solution that is too difficult to implement. If the implementation phase is too difficult for them, it will be hard to keep deadline in development and bring on a lot of customer support if it doesn´t work. Therefore it´s better for the project to find openings and solutions and keep good contact with the company, so they can accept solutions and see if it´s possible to make. From this chapter, I bring with me a background of what is possible to make and need to understand more about the service XOJO. The next chapter will investigate how other companies are making their software and how XOJO works.

5 Audit

The goal of this step is to understand the market and with that information get insights into what Labbot wants and how other companies are working with the same problem (Dubberly, 2001).

In this chapter, background research is carried out on other companies that use similar techniques. The information is used to construct needs that can be used as a comparison later in the project. In order to determine constraints from the programming, an investigation is made of what the used technology (XOJO) can do.

To further get input on how Labbot right now wants to work as a company and be visible to the users, an overview is made of what their marketing and branding strategy looks like right now from the user's point of view. To get an understanding of how they want the software to radiate. This is then supplemented with a graphic profile to get all the information about how it looks. This part is also complemented by interviews with companies about what their graphic vision is.

5.1 Market Research

During the market search, the goal is to find companies that offer similar product to Labbot. These companies are objectively observed through their websites on their products, assuming that what they choose to show, reflects the need they see in users. Observing how their graphic profile is reflected throughout the software. This is to get an understanding of what other companies do to indicate to the user that the software is theirs.

The companies selected are from internet searches including technical words from Table 2.. Alternatives were shown for the company, which then they selected from these. The companies studied have a modern look and are:

- Fidabio
- NanoTempertech
- UnchainedLabs

By formulating needs based on what the other companies have in their software. The needs can be compared to Probation Labs goals. To be able to decide on the vision of Labbot and what other companies have found for the needs of their users. Conclusions will be drawn objectively from what they show on their website. All pictures from the companies are gathered from their website, not the real software.

To compare the software, these questions are answered. Questions are based on what information is needed to complement the company's view of the market. Also concerns that have arisen during the interview with the company. To see how other companies are working on these points. Primarily, the understanding will lie in coming up with what they want to showcase, then assume that those points are important to their users.

- How do they use the interactive design?
- Does it display their logo and use their profile colors?
- What do they really want to showcase with their website/software?

5.1.1 Fidabio

Comparing Fidabio to Labbot, both can detect Fluorescence and the results are shown with plots and real-time monitoring (FidaBiosystems, 2022).

Figure 5.1 Pictures from Fidabios webpage (FidaBiosystems (a), n.d.).

FidaBio's software features a clear headline, making it easy to identify the current page by filling it in with an orange color, see Figure 5.1. During experiments, the software displays the number of remaining steps and provides information about the phase the samples are going through. FidaBio is transparent with its parameters, displaying a lot of information on the screen to demonstrate the ease of use.

The software allows you to simplify graphs, save options, and view a graph that displays the chosen data and its appearance. To gain a better understanding of how FidaBio's software works, it was tested without answers.

Some headlines on their webpage:

- Being "The power of 1st principle”
- Transparent data read-out

- No need for superuser training
- The process has a built-in quality control.

Fidabio utilizes social media to post video clips and links them to their website. It appears that they prioritize staying current with interaction design, which can sometimes be overwhelming. Providing software training may help alleviate this confusion (FidaBiosystems (b), n.d.).

5.1.2 Nano Temper

Figure 5.2 Pictures from Nano Temper webpage (NanoTemper, n.d.).

The software features large buttons at the start, providing users with the option to explore the instrument's functions or to begin a new measurement, see Figure 5.2. If the user chooses to start a new measurement, the app provides a graphical guide on how to enter the necessary sample data. Once the experiment has begun, the app displays progress indicators and details on the instrument's operations. The user is then presented with options to either generate new results or save their current progress. Additionally, the app suggests the use of references as "tags" to help identify the user's attempts and offers customizable visualization options such as bar charts, lists, or graphs. Rather than introducing new windows to the screen, the app includes back buttons for easy navigation.

5.1.3 Unchained Labs

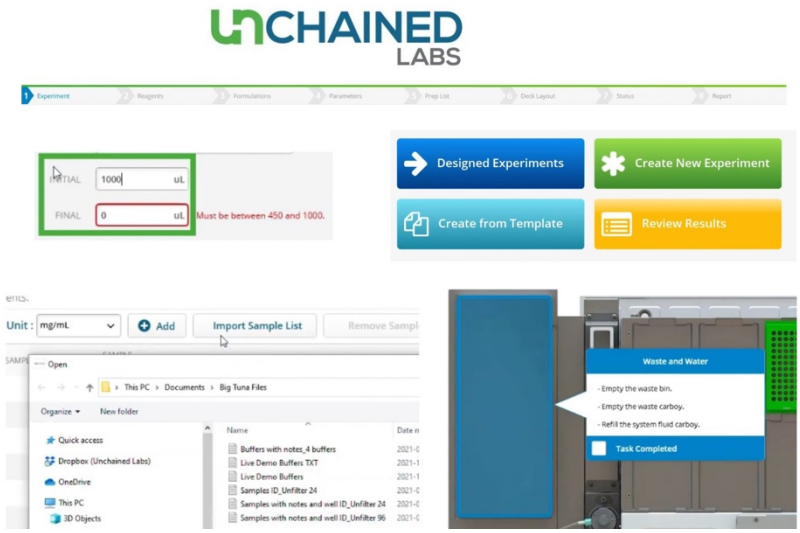

Figure 5.3 Pictures from UnChained Labs webpage (UnChained, n.d.).

Unchained Labs has a well-defined structure that may seem overwhelming at first glance due to the abundance of headlines, see Figure 5.3. To begin, the user selects the purpose of the program. Metaphors are also available to aid in experiment design, such as importing samples throughout the journey or adding new ones, which eliminates the need to input raw data for every sample used. Instructions are clearly presented with instrument pictures and step-by-step guidance. Additionally, a reward system is in place where users can click "Task completed" to receive a reward.

Identified needs will be compared to a comparative analysis to provide a critique on personal observations.

5.2 Summarize Market Research

This report highlights the findings from my market research on Labbot's competitors. Like Labbot, these companies value transparency and prioritize user-friendliness by avoiding the need for superuser training. I have identified areas in which these companies distinguish themselves from Labbot.

To enhance user experience, these companies color-code their software interfaces and utilize logos as symbols. For instance, NanoTemper employs a running and twisting "o" in its logo to visually represent the procedure. Additionally, these

companies offer clear indicators of progress, such as confirmation marks and bolded headlines.

Furthermore, these companies provide graphical representations of the procedure performed on the instrument, facilitating easy comparison with the actual process. They also use symbols and allow users to personalize the procedure with naming and labeling tests. They have a single-window approach to streamline the interface.

Besides the software, the companies have also developed more videos and guidelines on their webpages on how to use their software. See Table 5.1 for all needs that the market research has contributed with.

Table 5.1 Needs from Market Research.

	Needs from Market Research
Software	Can operate offline. Includes pictures for instructions. Indicates on time-laps. Has only one window. Can import sample lists from hardware. Has its own templates. Is color-coded. Can stop the experiment any time.
Company	Produce video tutorials including how to optimize the procedure. User training.

The research is done by me and that is a critical part since I haven´t had anyone to discuss and compare observations.

5.3 Related Technology

Labbot currently uses XOJO as a programming tool, which is an IDE (integrated development environment) that allows the user to choose how much programming they want to do. XOJO supports Desktops, Web, Console, iOS, Android, and Raspberry Pi (XOJO, u.d.). In Labbot, XOJO is used as desktop software without the need for an internet connection or other tools.

Research was conducted on XOJO's functions to determine which ones could be used in a future implementation. The suitability of features is determined by their ability to work offline and be compatible with all computers. The potential opportunities are summarized in Table 5.2. An overview of the functions and how the window looks when building websites is shown Figure 5.4.

Table 5.2 XOJO possibilities (XOJO, 2021).

	Specificities
Software can:	Have implemented PDF-files. Export data to an Excel® XLSX file.

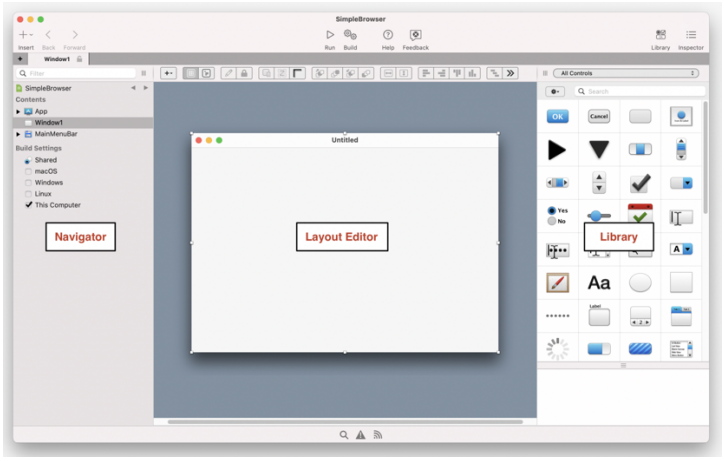

Figure 5.4 Building window for XOJO (XOJO (a), u.d.).

5.4 Marketing and Branding Strategy

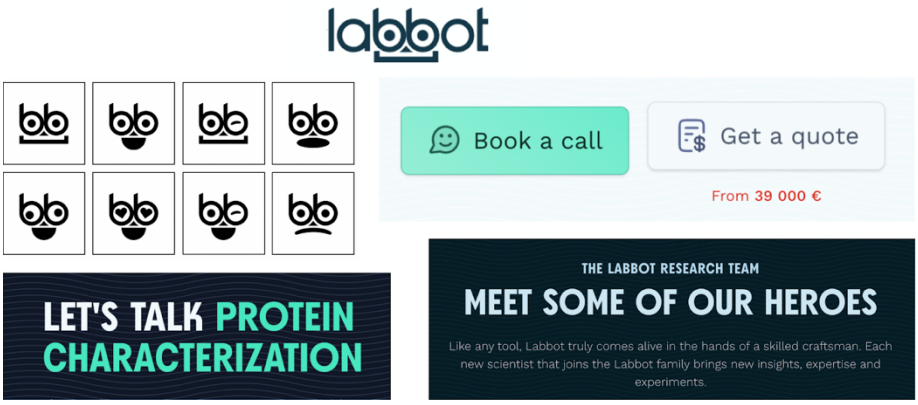

Figure 5.5 Pictures from Labbots webpage and intern pictures (Probation Labs, u.d.).

Figure 5.5 is from Labbot's latest website release. When comparing it to their current software, there are no shared colors, icons, or fonts. The website represents their desired appearance now, but the software has not been updated to match its current graphical profile.

After conversing with the company, I have identified the qualities that Labbot's software should embody. This will help me to have a clear understanding of the desired software functions. The company has approved the conclusions that were drawn. "We don't want to keep any secrets" - (Törnqvist, 2023).

Labbot is currently in a phase of expansion and wishes to provide customers with a comprehensive experience. They are adopting a more playful model and want to emphasize their friendly approach. They are also highly focused on ensuring smooth communication and user experience - one that is easy to understand and navigate.

After conducting interviews with the company, there are several words that I believe are crucial. These words can help guide my creative process in generating concepts and ideas. These words are shown below in Table 5.3.

Table 5.3 Keywords.

	Words
Labbot keywords:	Transparent Control Customized Hero

5.5 Conclusions

By giving users control over their procedures, they are also able to understand what is happening. This means not only accepting the steps, but also comprehending why and how they are performing them. Customization offers users more freedom to tailor procedures to their needs and adapt functions accordingly. Labbot identifies its users as researchers who seek to comprehend every aspect of their experiments.

From this chapter I bring with me that labbots vision of what they want to do is correct according to the market research. They want to be able to operate the software offline, they want to be more transparent and also understand what they need to bring with them in the next software. Also, to include their graphical profile into the software. Which all of the other companies already do. The market research can therefore serve as inspiration in the later stage of development. In the next step of interviews and observations, I bring with me from this step that I want to understand more how the other companies functions can be implemented in Labbots software. Understand how different type of users uses different functions. To make the software fit anyone.

6 Interviews and Observations

The method was chosen based on the target audience, consisting of scientists, PhD students and post-doctoral students who possess advanced knowledge. During test interviews, it was clear that the candidates were eager to provide accurate and comprehensive answers. Using open-ended questions followed by observations allowed for a clear understanding of the study's objectives. The observations were influenced by the candidate's awareness that the researcher sought to evaluate their use of the manual, among other factors. See Figure 6.1 for an overview of the elements and where they will be included.

The interview guide was developed with the aim of creating personas and establishing goals for concept development. As such, the interview is divided into three parts. Each part is divided as separate and contributes with different knowledge.

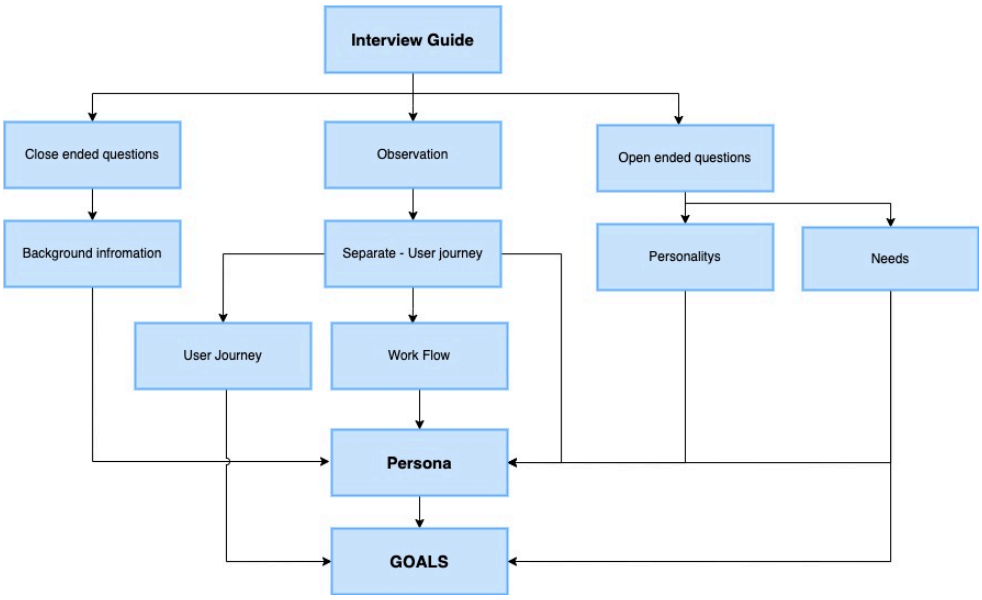

Figure 6.1 Flow from interview to goals

These are the subgroups into which people are divided:

- Users, used Labbot 5 times or more.
- Beginner, used Labbot less than 5 times
- New, never used Labbot

The interview had 12 candidates, four users, four beginners and four new users. They are working at Lund University on different projects, companies and research groups.

6.1 Close ended questions,

Close-ended questions are used when you know what they can be in advance and it´s usually only one response (Sharp, et al., 2019, p. 272).

These responses form the basis of the person's background knowledge, as well as an understanding of how much assistance they will require during the experiment. The questions asked to provide insight into the individual's profession, frequency of instrument use, and length of experience with it, all of which are necessary to draw appropriate comparisons during analysis and to provide the optimal conditions for experiment success. See Table 6.1 for some answers from the questions.

Table 6.1 Closes-ended questions.

Answers from the close-ended questions					
How long time have you used Labbot?	1 week	-	Since release	-	Only introduction
What is your position?	Post-doctoral	PhD student	Professor	PhD student	Post-doctoral
How often do you use Labbot?	2 times a week	-	Every week	-	-
How would you describe this environment?	“As usual”	“Feels good”	“Have been in this environment before”	-	“Looks like my work environment”

6.2 Observation

An observation is conducted to understand how the candidates interact with the software and to determine their goals, as well as to gain insight into how they work with the instrument in a controlled environment (Sharp, et al., 2019, p. 287). The results of the observation are gathered through individual summaries, which are then combined into a User Journey. A User Journey is a visual explanation of how the

person interacted with the software at each step, including their feelings during the observation, in order to better understand their experience and identify opportunities for development (Ericson, et al., 2015, pp. 98-99).

The candidate is given one task and then provided with various resources, such as the ability to ask questions, send emails, refer to manuals, or search the internet. The task involves performing a pH titration and analyzing fluorescence and absorbance (see Table 2. for an explanation). It is emphasized that this is not a test, but rather a learning opportunity, as the interviewer is less knowledgeable about the subject matter. The purpose is to observe how candidates approach problem-solving situations, rather than to test their knowledge.

During test interviews, the candidate felt that they were being assessed for each parameter, which created a stressful environment. To avoid this, it is clearly communicated to candidates that the interview is not an escape room or a test and that they are not expected to present a result. This was done before each interview to ensure that candidates understood the purpose of the exercise.

The interview is recorded to capture the user's journey and emotions, with varying workflows. The user flow (Figure 6.2) demonstrates that there are multiple paths a candidate can take, and a workflow diagram has been created to illustrate these options. The workflow diagram is useful for showcasing the different variations in the workflow, and it highlights significant differences in candidate approaches. The bolded line is the most common way the candidates took. The different headline windows are presented in Appendix A.1.

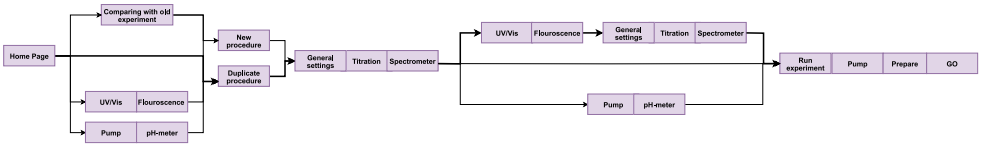

Figure 6.2 Picture of Workflow.

6.2.1 User Journey

User Journey is a mapping function where all the windows are presented as headlines. The User journey is used as a tool for deciding where functions are working and where they aren't. All personal User Journeys are gathered in Appendix B.2. All personal thoughts and feelings were summarized and then a User Journey with the most common workflow was made, see Figure 6.4.

To see an overview of the software together with the feelings from the observations, see Figure 6.3.

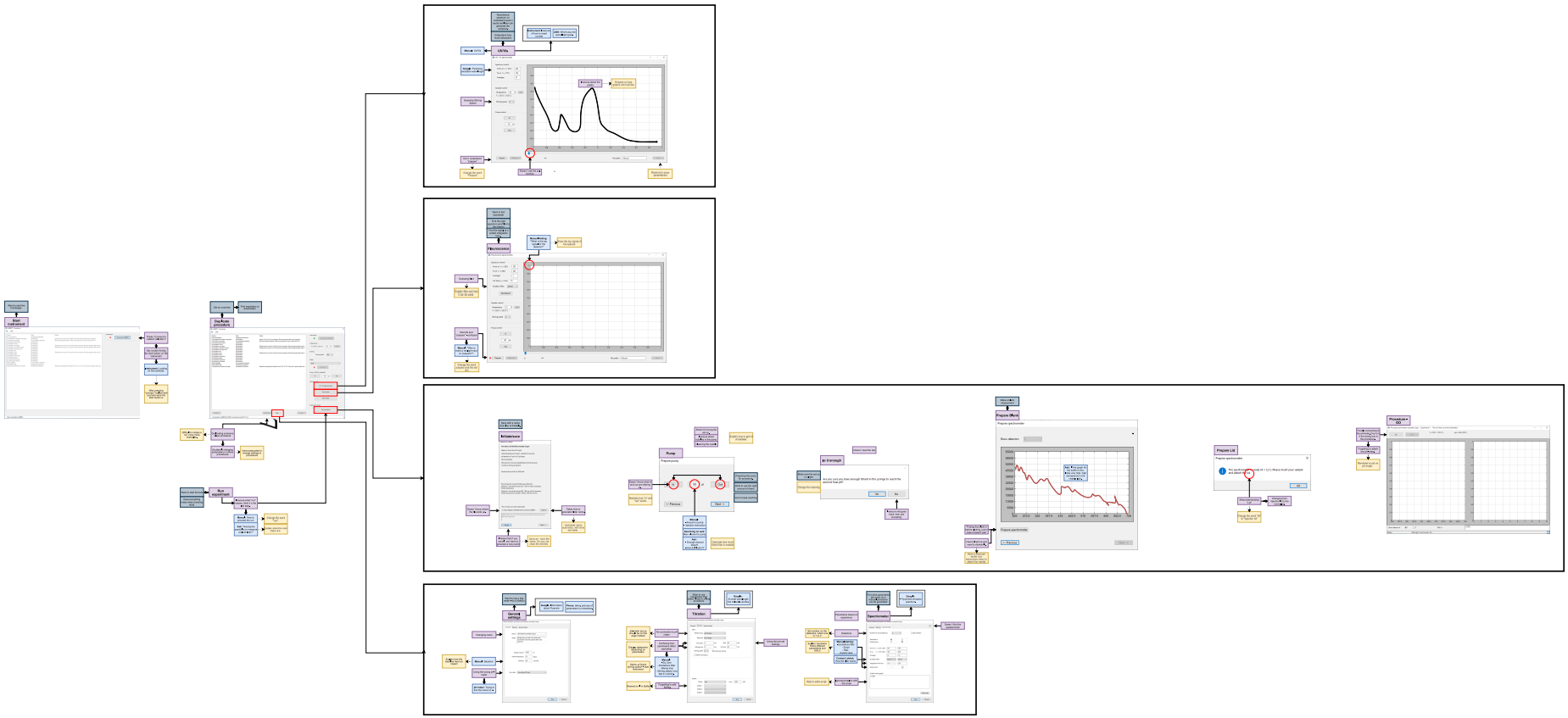

Figure 6.3 User Journey on the software (overview).

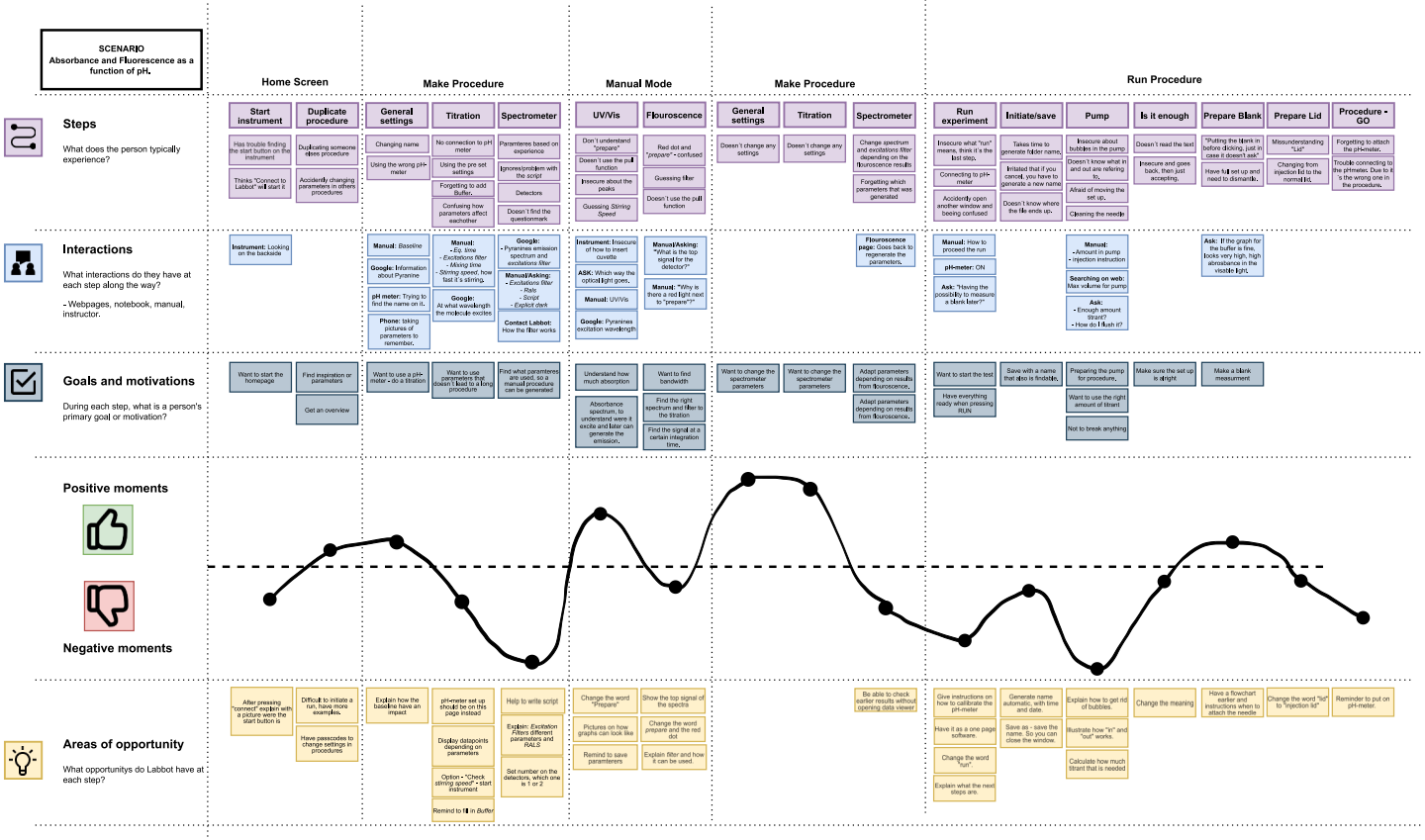

Figure 6.3 Picture of User Journey, visualization of User Journey on the software see Appendix B.2 (overview).

6.3 Open-ended questions

Open-ended questions are made to explore how the observation are matching with the questions. An also to understand how the users otherwise and in this case are working (Sharp, et al., 2019, p. 272). Since they first did a procedure, they have experience of the software and its functions. During the questions, the goal is to get the candidates to reflect on their attempts.

These questions are conducted from both marketing and branding strategy, also from market research. During these steps, different needs and goals of the company have been summed together. These questions are remaining after the steps during the process:

- **How do you know the test has succeeded?**
  - To understand how candidates validate their results.
- **How do you usually take in new information?**
  - Which functions are they using in the observation and how they differ from what they say that they are doing.
- **What do you think Labbot will use in their next software?**
  - To get their creativation on and reflect on how other companies are managing their software's.
- **When are you using a calculator?**
  - Understand when the software can help.
- **When do you lose time?**
  - When they are feeling that they are wasting time on something that could be done in another way.
- **When do you read the Manual?**
  - To see if the observation is like the question.
- **In what cases do you use Labbot?**
  - Get an overview of what another observation procedure could be.

All answers are gathered below headlines that I have created, see Figure 6.4. They are categorized and the ones that are bolded with a frame, are commonly answered and the ones I bring with me in the next step.

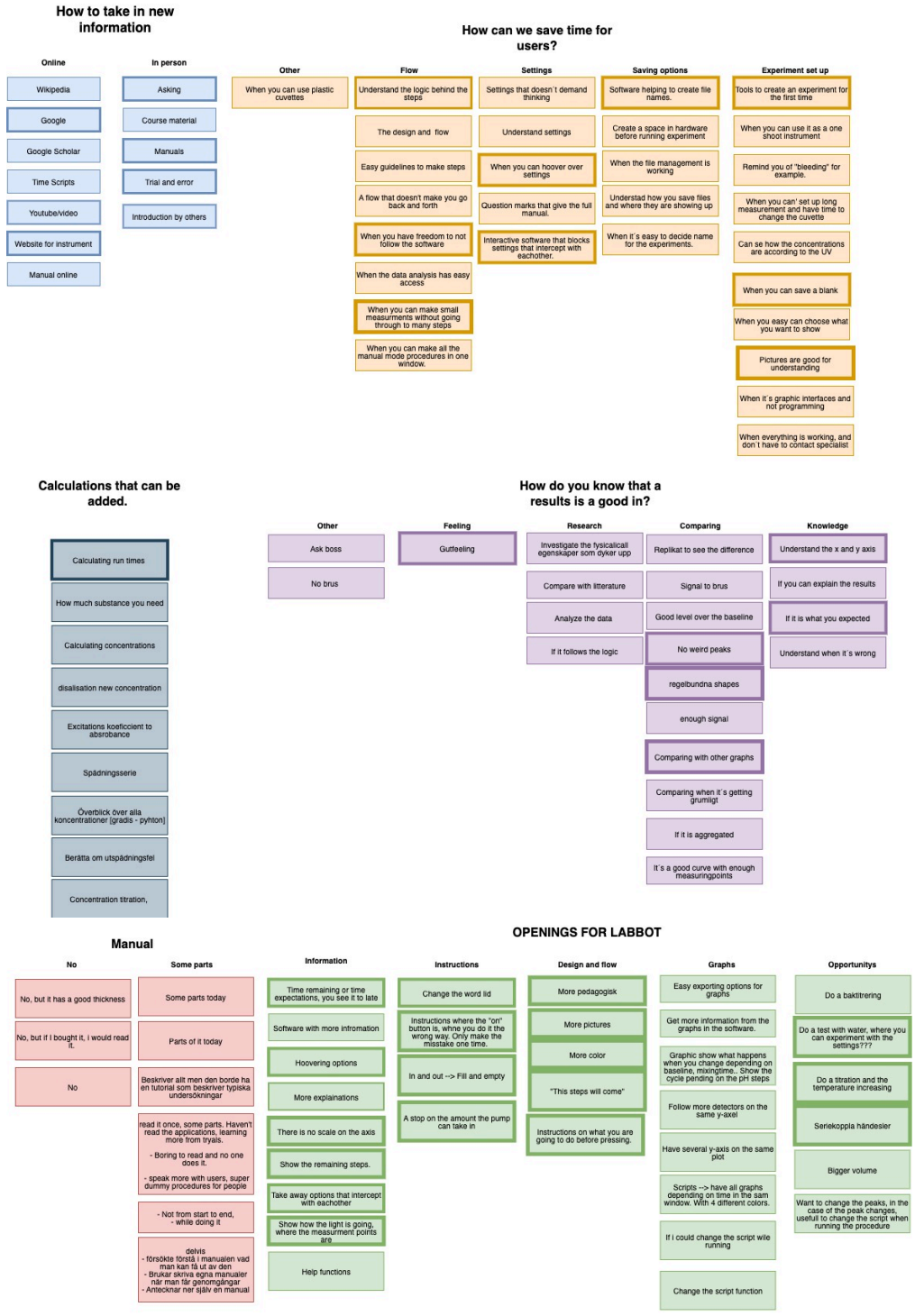

Figure 6.4 Summerized answers from questions.

6.4 Analysis

It´s important to make a deep analysis of the observation since this is the part that is the background to personas and all decisions furthermore.

Aim to find behavior and cognitive dissonance experienced by participants in an experimental setting. The study focuses on individuals from Lund University and investigates the participants' engagement with challenging tasks, their adherence to safety protocols, their interaction with instructional manuals, and the presence of a potential discrepancy between their verbal statements and observed actions. Through rigorous observation and analysis, this research sheds light on the intricate dynamics between participants' self-perception, task performance, and the influence of external factors.

The Feeling of an Escape Room: Stressors and Perceived Difficulty

Participants describe their experience as akin to being in an escape room, highlighting the stress-inducing nature of the tasks. This perception adds an element of challenge and urgency to their engagement.

Adherence to Safety Protocols

Participants exhibit behavior that deviates from their typical actions due to the awareness that potential dangers would be intervened by me. This is seen in the recorded tapes where the candidates often look at me and ask “is this right?” or “can I do this?”.

The difference between Stated Reading Intentions and Actual Engagement

Although participants mention their intention to read instructional manuals when seeking guidance, their behavior during the experiment does not align with these assertions.

Summarizing Goals and Needs as Requirements

Participants' goals and needs are consolidated into a set of requirements for comparative analysis with previous studies. This approach facilitates a comprehensive understanding of participants' motivations and expectations.

Exclusive Selection of Candidates from Lund University

The study specifically includes participants from Lund University to ensure a consistent sample and mitigate potential confounding variables associated with a broader participant pool.

Conclusion

The findings from this study shed light on the cognitive dissonance experienced by participants in an experimental setting, revealing the impact of perceived difficulty, safety concerns, engagement with instructional materials, and the interplay between verbal assertions and observed behavior. These insights contribute to my understanding of human behavior in constrained and observed environments, offering valuable implications for future research and experimental design.

6.5 Observation installing

During the projects, different observations had been done on other Universities, to understand if the same feelings are seen there. When Probation Labs are there as sellers. The observation was made during the onboarding of the instrument. First Probation Labs application specialist held a presentation, after that a procedure was made in front of the buyers to demonstrate. Meantime was I an observer writing down when they asked questions.

This was done to investigate how an implementation goes to, where the buyers have purchased one and have their onboarding. What people are wondering about, also do an analysis together with the company and produce a guideline before, during, and after the onboarding of the instrument.

Questions asked by the buyers:

- What is the highest value?
- What range is it?
- Which filter should we use?
- Is the instrument okay to move?
- Can we touch this?
- Can we get some test procedures?
- How do you move the pump?

What is taken away from this workshop and installation is that the software right now has too little information. And it is difficult to know which areas you can choose parameters in. The main need that is included is how information about each silage parameter should look. The second item that was raised after the analysis is that which is dealt with under each heading.

7 Personas

Creating a fictive person, that represents the users. This is of use when you don´t want to base your concepts on statistics or data. It also increases the feelings for the person and more understanding of their needs (Ericson, et al., 2015, pp. 94-95).

In order to create personas, all parts of the interview must be considered. Figure 7.1 shows the information gathered from both closed questions, individual user journeys, and open-ended answers. When placing different candidates together with similar feelings over the interview, there was no correlation. The conclusion showed that there was no correlation between different roles and experiences. For example, a person who was using the instrument for the first time shared their opinion with a decision-making researcher, which was not necessarily the opinion of the company.

In academia, people often like to divide employees into hierarchies based on their roles rather than their personalities, but this can make analysis complicated, especially when trying to avoid hierarchical divisions. Typically, a professor buys the instrument and then their students use it. Each with their own unique approach and workflow. This highlights that some users may want to jump back and forth between different steps, while others prefer to quickly get an idea. Furthermore, the open-ended questions revealed that many users have different attitudes towards how they absorb new information. Overall, the interview can be summarized by dividing the participants into different personas based on their roles, but also recognizing that hierarchical position does not necessarily determine the type of user.

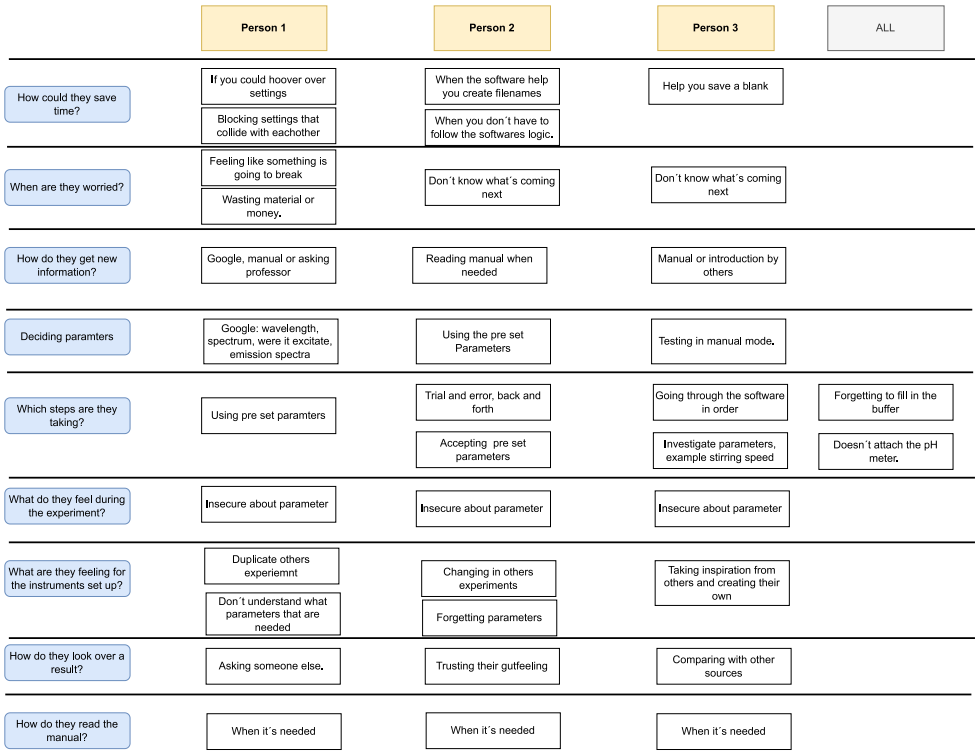

Figure 7.1 Creation of personas

All of this is then summarized in personas, see Chapter 7.1, 7.2, 7.3. Also including quotes from the interviews, description and summary of user journeys. The persons are completely without showing specific education, role at the research group. A decision was made to not make anyone of them the primary users, since they all are important to please.

7.1 Persona – Lisa

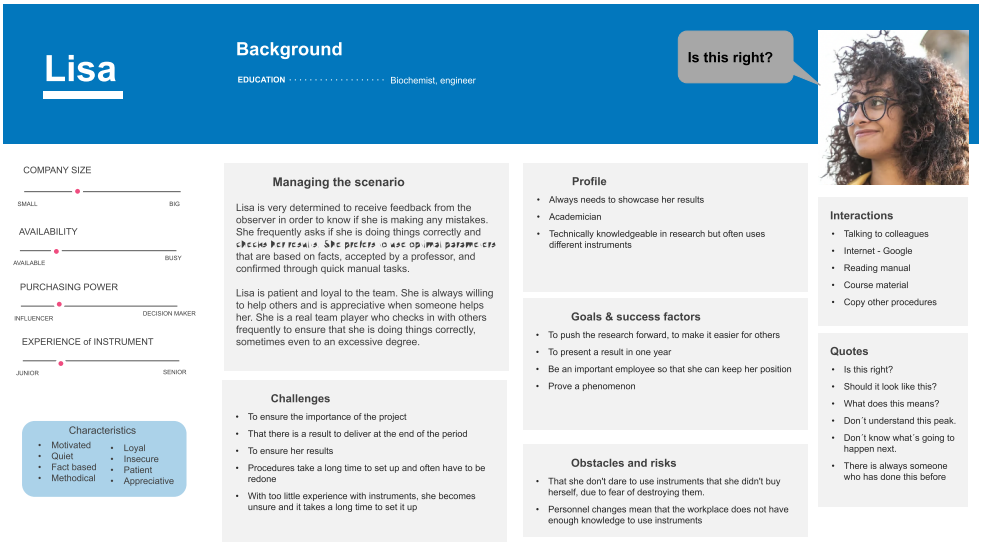

Figure 7.2 Persona Lisa

7.2 Persona – Karin

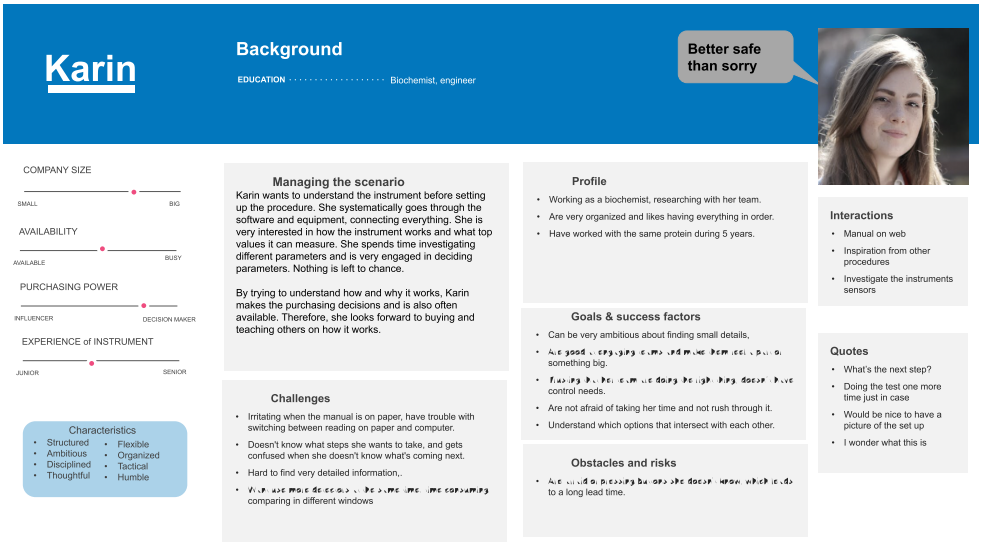

Figure 7.3 Persona Karin.

7.3 Persona – Rolf

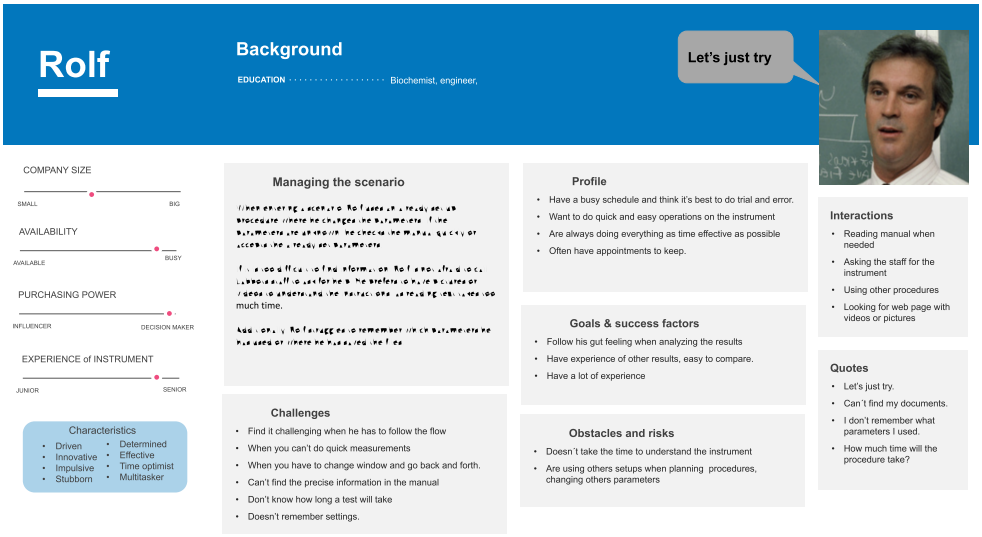

Figure 7.4 Persona Rolf.

7.4 Verification of Personas

After creating personas, they were brought into the office to determine which type of person the company communicated with most frequently. The result, after two weeks, was that all personas were represented. This is important for the company because, for example, an email response can be constructed in many ways depending on the personality type of the recipient. The company already extensively uses these personas when communicating with customers, and therefore they are considered reliable until further development.

8 Goals

This chapter's goal is to decide what the users want and set up goals, defining the start-to-end experience for users (Dubberly, 2001). Generated goals by combining all needs and opportunities from the user journey. Group them under individual headings, combining them with the goals from open-ended questions. And then summarizing the needs as goals, see Appendix B3 for the grouping.

With the question – can you create a manual-free software, this means that some of the goals will not be in focus. Without the goals that you start from are those that are linked directly to the question. And that the company receives a summary document where everything is listed. Where more general things are summarized.

To get an idea of each goal, I have made a valuation based on the profiles of the personas, see Table 8.1 for rating. Have not put valuation in personas, after consulting with the company, all these people are equally important. The verification of the personas in the previous chapter results is that any of the personas can be the decision-maker at a company.

Rate from 1-5

1. Not important at all
2. Of little importance
3. Off average importance
4. Very important
5. Essential

Table 8.1 Goals rated against personas.

GOAL	*Lisa*	*Karin*	*Rolf*	*Score*
Understand the logic behind the flow	3	5	5	13
Explain the graphs	5	4	3	12
Guiding illustrations	4	3	2	9
Access to information in the software	5	5	5	15
Remind the user of parameters and setups	4	4	4	12
Take away options the intercept with another	4	4	2	10
Passcodes on procedures*	3	5	4	12
Have detailed test procedures	5	3	4	12
Generates filenames*	3	4	4	11
Freedom during setup	2	3	5	10
Save a Blank*	3	3	3	9

* These goals are not necessary to make a manual-free software. They are of importance to the company.

8.1 Conflict Resolution Diagram

A conflict resolution diagram is made to understand both sides and find when conflicts arise. To make a win-win situation, in this project is when both the company and the users are pleased. This method is good to use when there are underlying needs from both sides but still have the same shared goal (Amran, 2023).

When all goals are compared against the company's requirements and desired outcomes, there are conflicts that arise, see Figure 8.1. This is because the feeling that wants to be achieved generates resistance to a goal. This makes a fear of conflict so that you can see who is resisting each other. Has also added the consensus between needs, so it´s easy to understand when they align.

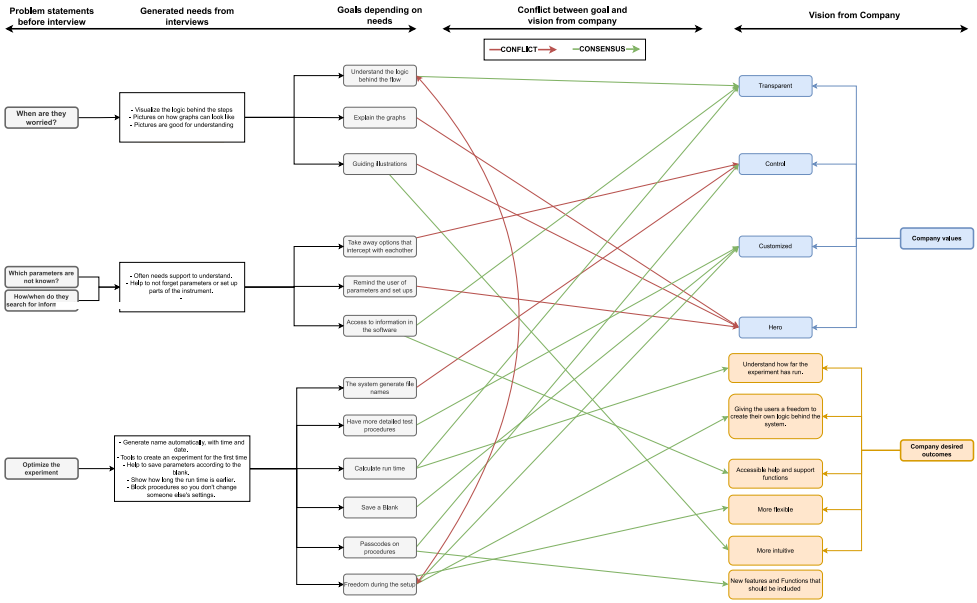

Figure 8.1 Conflict and consensus diagram (see diagram with only conflicts in Appendix B.1),

For those goals that have conflicts requirements will be set so that this does not become a problem during implementation. See Table 8.2 for a template to use when the goals are used in the future.

Table 8.2 Goals with the requirements.

Goal		*Requirement*	
Understand the logic behind the flow.		Easy to cancel a procedure.	
Explain the graphs.		Voluntary explanation.	
Guiding illustrations.		Possible to turn off.	
Access to information in the software.		Access to information in the software.	
Remind the user of parameters and setups.		Possible to turn off.	
Take away options that intercept with another.		Possible to add in intercepting options.	
Passcodes on procedures.		Passcodes on procedures.	
Have detailed test procedures.		Have detailed test procedures.	
Generates filenames.		Optional filenames.	
Freedom during setup.		Keep manual mode.	
Save a blank.		Save a blank.	

9 Concept

Different concepts that I think Labbot should work against and develop. This step of the process is an imagination of how a system can look. It could be a formal document, problem statement or vision statement (Dubberly, 2001). I have made a vision, of how I think the software should behave.

The new software: "TE4MW0RK"

When you walk into a laboratory, it's almost like walking into a car exhibition. All the instruments are lined up, from old ones to newly released ones, and each computer screen is connected to a specific instrument. It almost becomes a design competition, as well as a competition on how user-friendly the software is. For Labbot, the perfect combination would be to make the software have the same graphical profile as the instrument while focusing on the personas and making decisions based on their needs. If the software looks better, it will provide a better experience from the start when you initiate a run.

The focus should be on streamlining the software to make it easier for project groups that use it, allowing teams to coordinate procedures and provide transparency on the computer where others can use but not change their procedures. In the future, it should have an internet connection to easily access templates and send results to the team leader.

Creating a community for the team to have a notebook where they can write questions and the next person can answer or add to the conversation would be beneficial. Adding a task manager where you can save different bullet points and add results to the tasks would also make it easier for a teammate to continue a procedure or follow the streamlined steps taken by coworkers to come to a conclusion. This is also helpful for sharing tactical knowledge. Having an easy procedure streamlined allows you to see how the person resonated.

The most important part is to have easy access to information, as no one reads the manual before starting a procedure. The access should be easy and straightforward.

The next step in the process will be to see how the concept would look in different scenarios.

10 Scenarios

Scenarios are telling a story, where the users are in a specific scenario. My scenarios are describing a scenario in the future where the personas are using the new software together with Labbot. Scenarios communicates how the concepts are visualized in a developed solution (Ericson, et al., 2015, p. 141).

10.1 Lisa

Gets a task to help a colleague with a new area. Because she is so "good" at just det topic. This puts Lisa in a situation where she doesn't want to ask too much because she's supposed to be the expert. She has no one to ask about but of course, wants to help anyway. Therefore, Lisa can use a ready-made template, where you can easily ask your question and get a guide on how to do it. See the illustration of Lisa in Figure 10.1.

Figure 10.1 Scenario for Lisa.

10.2 Karin

Has been given a major assignment by a company many people know. It requires a lot of time and Karin has a hard deadline. This means that she must distribute responsibilities but also work quickly. Something that makes it difficult for Karin is that she has performance anxiety, and each part takes too long, as she has a hard time accepting and wants to double-check everything.

What helps Karin through this is that she can easily get instructions in each window and explanations about which parameters to use. Also, send easy instructions to others.

10.3 Rolf

Rolf has got a big opportunity for a project. He´s feelings are, that of course can he make this happen. He doesn´t have time to listen to his team leader and just wants to get it down. Without any frustration or overwhelming is he using Labbot and doesn´t see what the problem is. Because Labbot has all the knowledge in the software. There is no need to be frustrated. The software is helping without him thinking of it, “How hard can it be?”. See Figure 10.2 for the scenario.

Figure 10.2 Scenario for Rolf.

11 Elements

The aim of this chapter is to produce different sketches and lists, these illustrations are made depending on the user's goals. The different objects are both informational and functional (Dubberly, 2001). To develop these elements, different types of brainstorming are used. The brainstorming is divided into three different parts, See all parts explanation below each chapter:

11.1 Brainstorming: elements depending on goals.

11.3 Low-fidelity prototype: prototypes with elements included in different flows,

11.2 Speedstorming on computer: exploring over the internet.

11.1 Brainstorming

Brainstorming is good when you want to generate a lot of different ideas. You can make brainstorming in many ways. I have chosen to brainstorm around different words and goals. To able myself and think how each of the goals would look like in a software. I built up in different schematics where the essential parts were chip, rest and reflect over what did I do last. Circulate these, find the predictable principles and further develop them.

Also want to gather a lot of quantitative ideas instead of finding the exact right idea the first time (Ericson, et al., 2015, p. 125). The brainstorming should be 3-7 persons, since I am alone. I have made some modifications to the method. I have different questions in a box and take out one question at a time, work with the question for 5 minutes. Take a break to clear my mind and then comes back to the same question after some reflection.

The first questions were, “How can information and flow look like?”. Both text and drawings are used to convey messages, see Figure 11.1.

Figure 11.1 Concept to information and flow.

Each goal is examined in detail through a series of questions. These steps were mainly represented by mind maps and words, which helped determine when and how the goals are working within the software. See Figure 11.2 for an overview of the mind maps and notes. After analyzing the mind maps, I continued to work with the ideas. For example, I created a mind map with drawings for the pump when it was suggested that there should be a guiding illustration for the instrument, see Figure 11.3.

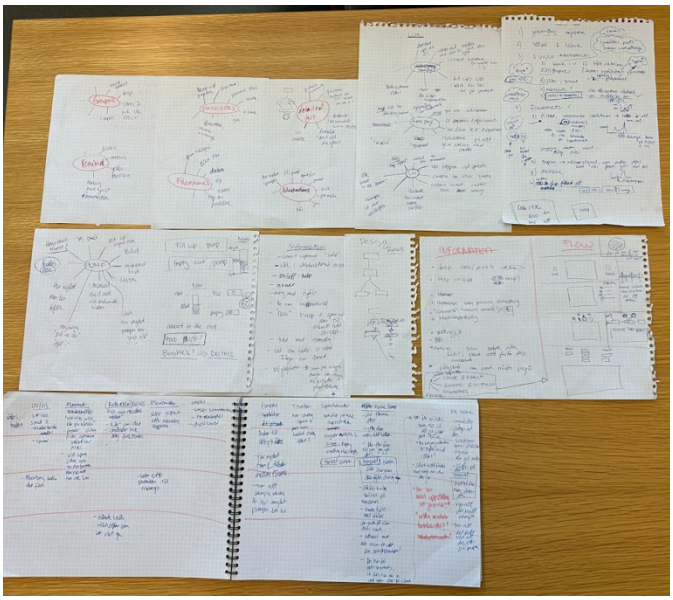

Figure 11.2 Overview to specific brainstorming.

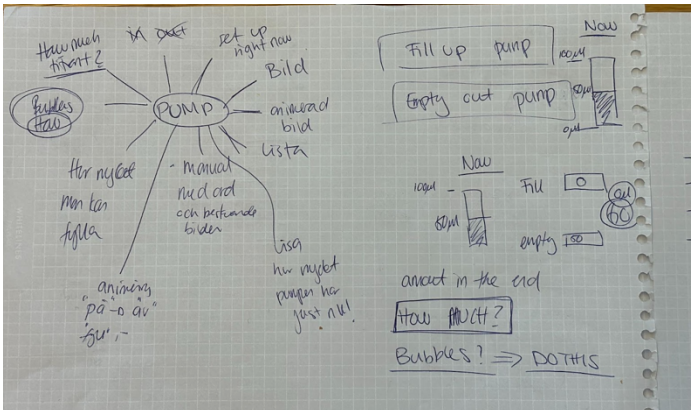

Figure 11.3 Brainstorm to pump concept.

11.2 Speedstorming on computer

Speedstroming can be compared to speed-dating, it´s a very quick interaction where different subjects are being worked through. It´s good to make speedstorming when you have different subjects to investigate in. When doing speedstorm there is no time for deep conclusions, it´s made to get inspiration (Ericson, et al., 2015, p. 135). The search words for the speedstorming is information, applications, XOJO design, flow and structure. Each word has been a speedstorm for 5 minutes.

11.2.1 Text Structure

Found picture of how authors are writing. It interested me because many of the symbols that were used, has been the same as when I have pictured the software. See Figure 11.4.

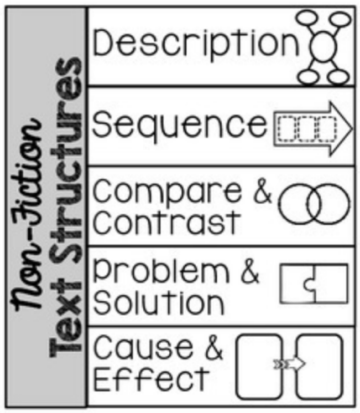

Figure 11.4 Brainstorm - text structure (Dunckelman, n.d.).

After deeper investigation and thinking. I started to only focus on the words as requirements for the software. If all these types were requirements, how would the software look and work? These are the things that come to mind when comparing the types to the personas:

*Cause and Effec*t: Show all people what their settings will do. Mainly visually with times and what the procedure looks like. depending on which parameters you choose how much extra time will the procedure take. For example, when adding a bigger range of parameter or a procedure that has a big temperature difference. How much extra time will the procedure take?

Compare and Contrast: If some guiding illustrations can visualize how it can look like, it´s easy to compare and also sees different contrast to its own. Helps Lisa to not ask and compare her results against course material or ask others. Helps Rolf to retrieve information from other sources, without having to do the research himself.

Description: Could be visualized as a glossary, where all descriptions are found. During the interviews, it was clear that you only search for help in the manual when you need to find something. A glossary or index is known as easy information. Helps Lisa to understand what parameters mean but also Karin to really understand and not have to double check information.

Sequence: To have very visible structure, will give the users an understanding of how and when the next step will come. This helps Karin and Rolf, so that they are aware of how to plan their procedure.

Problem and Solution: The first page should include this, where everyone who comes in and has a question can easily get a solution. Regardless of whether it wants to be solved yourself or if you want a template for a procedure. The most important

requirement I would say. Because this is why you buy the instrument. When you have a problem and want to find a solution.

11.2.2 Apple application

Found a very intuitive and easy-to-use software at Apple, see Figure 11.5. It's easy to use the templates and have different headlines on the side. You can choose to either make an empty document or use someone else's. There were also opportunities to add personal templates, which would be great for Labbot, to include more personalized features so the software fits the company and users who are buying it.

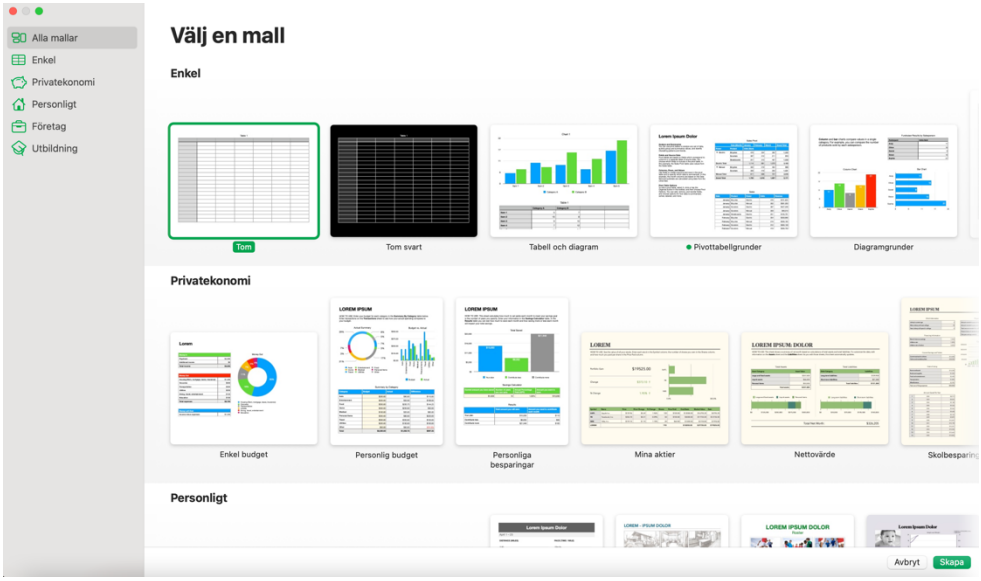

Figure 11.5 Brainstorm - Apple software (Apple, 2023).

11.2.3 XOJO design

When browsing on XOJOs different designs that have been made on their platform. The winner of the best “Best Cross-Platform App” (XOJO, 2019), has many of the features that can be good to add in for Labbot, see Figure 11.6. Both the running time illustration, colors, different users' procedures, symbols and search function.

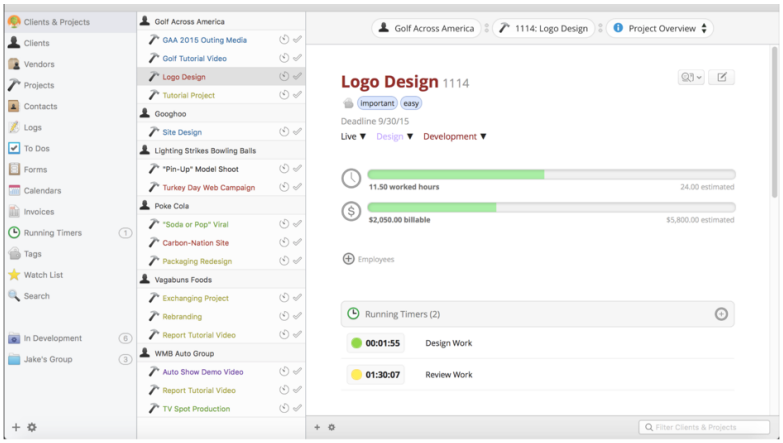

Figure 11.6 XOJO Award winner 2019, Best Cross-Platform App (XOJO, 2019).

11.3 Low-fidelity prototype

To summarize all different findings and ideas in sketches, a low-fidelity prototype is made, see drawings in Figure 11.7 (Sharp, et al., 2019, p. 426). It has inspiration from the previous chapters when finding new ideas. For example:

- Different headings in the XOJO design.
- Choice of procedure as the Apple software.
- The glossary that is inspiration from the text structure.
- Education, that is generated from how information should be spread and to not lose tacit knowledge.

Deeper discussion will be held in Chapter 13 Spec.

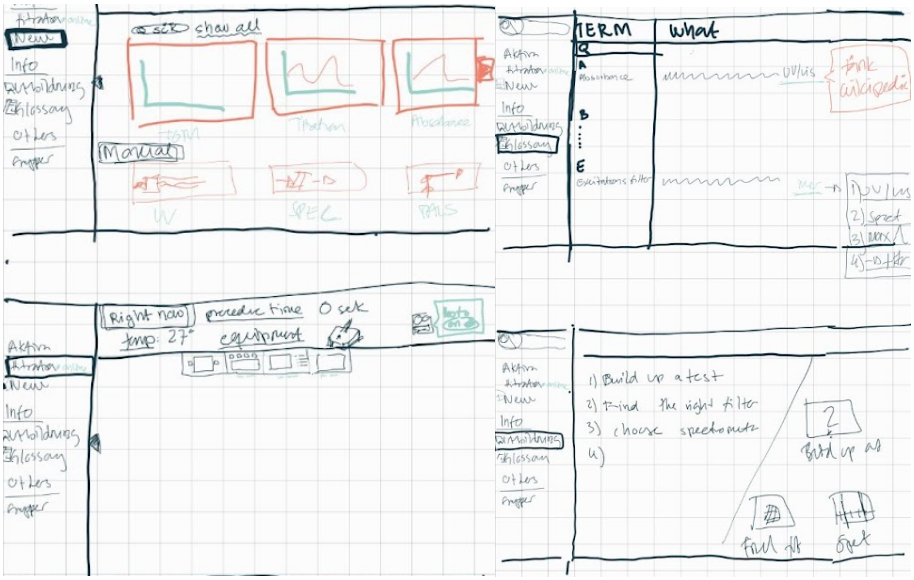

Figure 11.7 Low-fidelity prototype of the software.

With all these different ideas I wanted to go through the Software they have right now and see where the different concepts and elements would be included. See Figure 11.8.

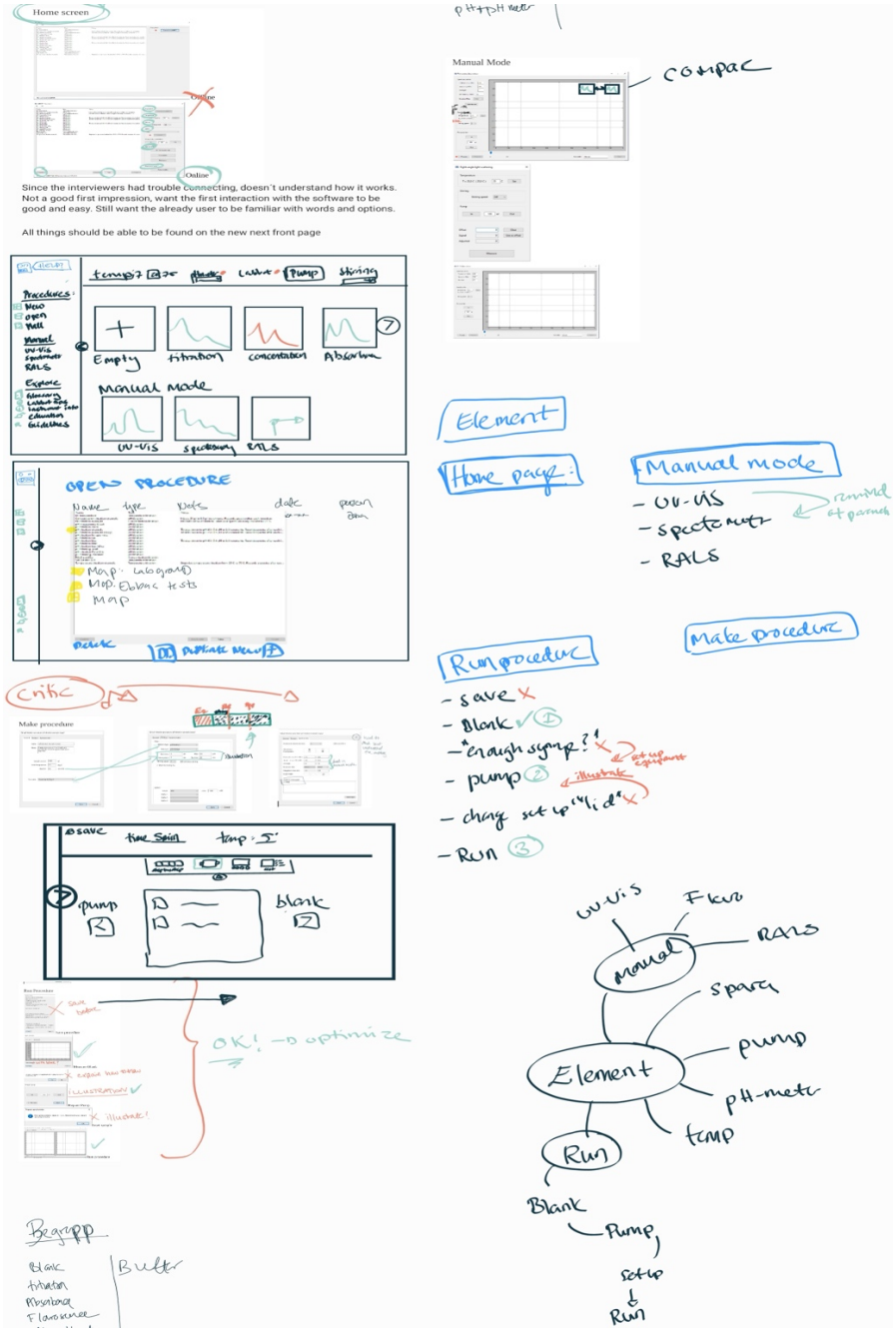

Figure 11.8 Overview of Labbots Software, with ideas.

12 Framework

12.1 Grouping Patterns

This step is made to understand how the different components are working and are organized together. It´s presented with sketches, where the conceptual groupings are made after the Figure 11.4. I have added a lot of different sketches, since this is the material Labbot can work towards and with, when they are developing the next software.

12.1.1 Sequence

The sequence is important, because one goal of the users is to understand how the flow Is working. If the sequences are easily presented. You will know what the next step will be. See Figure 12.1 for examples on how the flow and sequences could look like. The main thought behind the drawings is to illustrate for the user what the next step is. During implementation, I think it´s important to give the user a decision on which sequence illustration they want to choose. Comparing to a database on the computer, where you can decide how you want to show all documents on a computer.

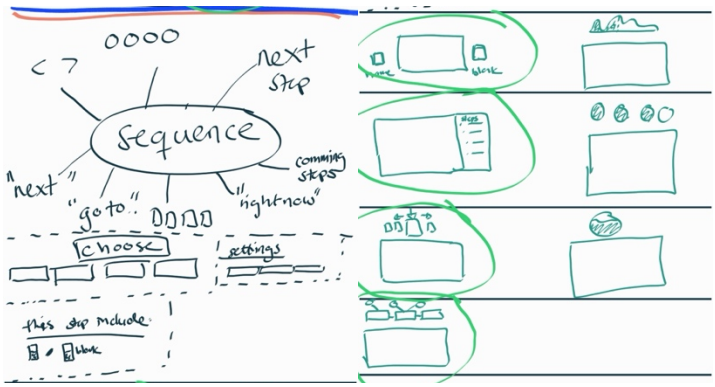

Figure 12.1 Sequence shown in design.

12.1.2 Description

The system needs a help function that provides descriptions to assist users. These descriptions should include how to use the stirring and pump components, as well as how to understand their functionality. Since this is explicit knowledge that can

be easily communicated, intuitive descriptions should be included. Additionally, a description of the procedure that the user has carried out can be connected to the goal of generating filenames, which can make the saving process quicker. Suggestions have been made on what to include, and these different suggestions can be seen.in Figure 12.2.

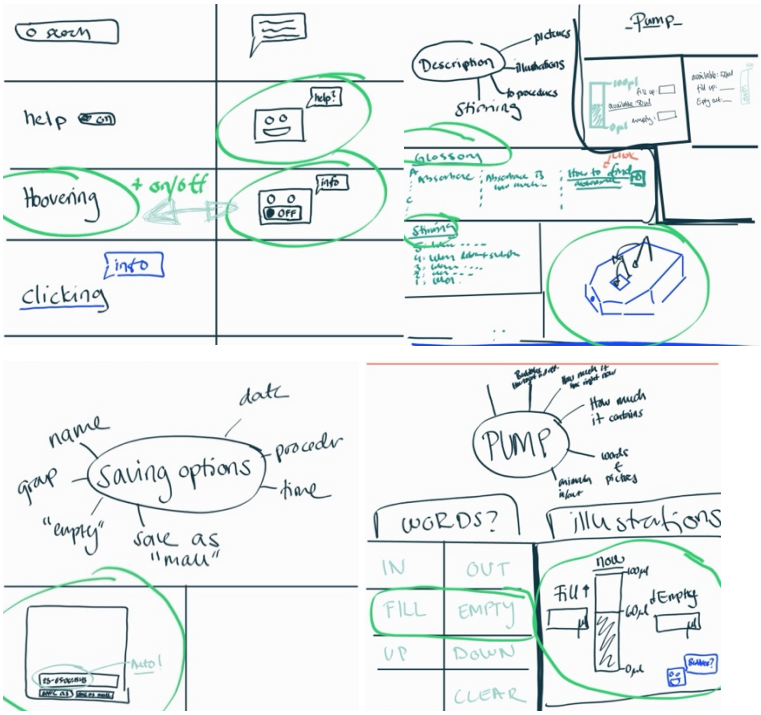

Figure 12.2 Description shown in design.

12.1.3 Cause and Effect

When setting up, it's difficult to understand how different parameters are affecting the procedure's running time. Compared to other companies in the market research, they show the running time. I think Labbot should accelerate in another direction and visually show where you are in the procedure. See Figure 12.3 for an illustration of the running time. Also, when changing parameters, the procedure would look different, and the illustration can change.

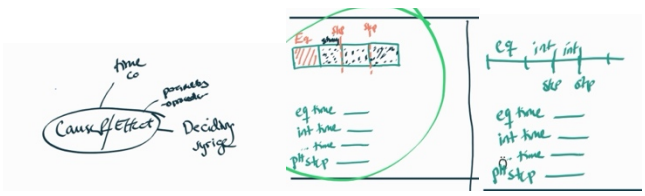

Figure 12.3 Cause and Effect shown in design.

12.1.4 Compare and Contrast

This section is important because, as seen in the observations, almost all candidates are duplicating another procedure. To get rid of the problem that users are duplicating and not reflecting on the other persons knowledge and tacit knowledge, more comparison options could be added to provide a contrast to their own decisions. This is an example of what the headline could be, and a symbol next to graphs, see Figure 12.4.

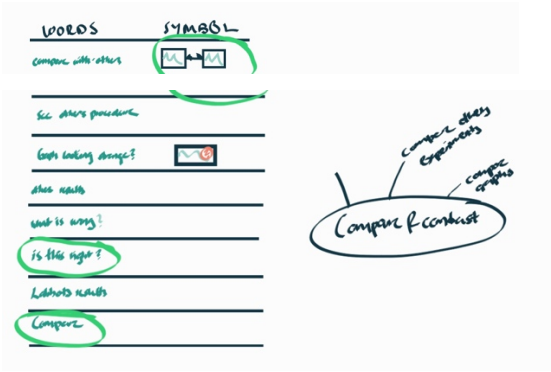

Figure 12.4 Compare and Contrast shown in design.

12.1.5 Problem and Solution

The users are entering the software with a problem and want to find a solution. Here are some different examples of how that could look like. The different solutions have inspiration from all the other sketches, since this is how the final product can look on the front page, see Figure 12.5 for sketches. You can easily find different solutions to your problem either by downloading a lab manual, creating a procedure as a story, having a few questions in the beginning, or giving options on different procedures.

Figure 12.5 Problem and Solution shown in design.

12.2 Navigation Structure

Merged all parts into drawings. Built together as different jigsaw puzzles. Where all parts fit together. That different flows are combined and what they could look like. These parts alternate until the ideas ran out, see Figure 12.6. Can't decide if it´s possible to change the flow, because the observation was made through one type of procedure. Instead of changing the flow, I think it should be easier to change the window and keep all settings. Without closing or needing to stop during a setup.

Figure 12.6 Elements in context.

13 Spec

This is the last step of the method, where the prototype is presented with a description (Dubberly, 2001). I have created the home page, and in that added Labbots logo, font, and color scheme. This is an example of how the software could look like, there are many other options that also would fit. I have created this front page according to the goals that have been set and with inspiration from the elements that I have generated. There are goals and elements that should be included in a design, but in other windows. Therefore, this prototype is only a redesign of the homepage. The home screen isn´t fully prototyped.

13.1 Prototype

See Figure 13.1 for the prototype that is a start to further development.

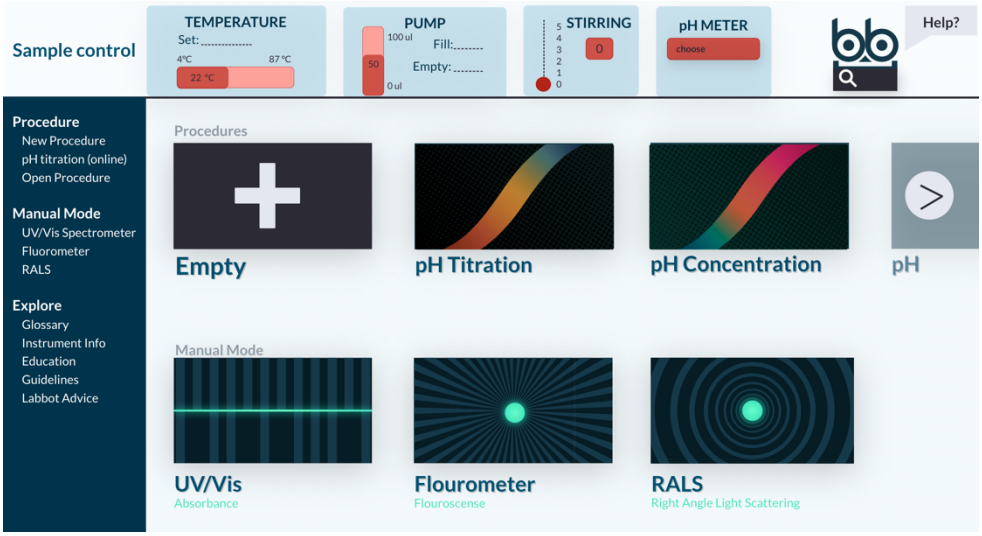

Figure 13.1 Prototype of Home Screen

14 Discussion

Working with a subject that is up to date and with the knowledge of that things that comes up during this process can lead to future development of medicine. Is a relevant field and a field to widen the competences. It´s interesting to understand how knowledge from my education is so important in another field. It has been interesting to understand a complex subject and develop.

Process

The project has been challenging due to its unique field outside of traditional mechanical engineering. One of the difficulties encountered was communicating with academic professionals who may not be familiar with the same engineering terminology. Additionally, separating the technical aspects from the design proved to be a challenging task. It was also necessary to filter out any technical information that was not relevant to the project's objectives, which proved challenging during candidate interviews. In order to overcome these challenges, it was important to work closely with technical specialists to discuss the relevant terms and knowledge gaps.

The project had a steep learning curve, as it was necessary to gain a deep understanding of the problem and the instrument's functionality. Although the technical aspects were not the focus during the project, they were essential during the initial stages of the project. Without a thorough understanding of the technical aspects, it would not have been possible to develop new ideas.

Ultimately, the goal was to create a high-fidelity prototype. However, the design process took longer than anticipated, and it became necessary to make the decision to proceed with sketches in order to meet the project deadline.

Method choices

The selection of methods has been effective. Unexpectedly, communicating with the team has been easy from the start. As they had not previously engaged in this type of development, the step-by-step process and phases were easy for them to follow and understand the workflow.

The personas have been an invaluable tool in the development process. They facilitate the separation of a person's job position from their personal identity. Personas are crucial because their personalities shine through when they are stressed or lack the energy to create a process.

During the market research, it would have been beneficial to conduct additional research on companies with designs similar to Labbot's. This would provide an understanding of how they work with similar designs and make them more user-friendly. Labbot has time constraints, so analyzing another company with the same opportunities would be interesting. The methods used are marked in the goal-directed design process. I hold a deeper discussion of the choices I made.

Context diagram

During the research and the first few weeks, it was challenging to comprehend a complex situation and how all the technical components interact with each other. A context diagram made it easy to present to the company and get their approval that we understood each other.

Workflow

After creating the personas, it was challenging to visualize how each member of the team would observe things differently. A workflow made it easier to present, so one does not have to go through every member's observation. This decision was made after all the observations were completed, and the user journey was established.

User journey

The user journey was added because the text did not fully illustrate the experience. After realizing that each interviewee's journey was considerably different from how the company would approach it, a user journey was deemed necessary. A blueprint could work as well, but the journey includes all aspects and emotions. It was easy for me to generate many possibilities that I used in further development.

Conflict diagram

The conflict diagram was created after the goals were set, as it was difficult to summarize them. This allowed me to understand when and how the company's values and the user's goals did not align. Scoring was done to determine the most important goals. All conflicts were then reviewed, and requirements were established to align them.

Bigger perspective

This tool provides academics with an opportunity to pioneer advancements in research. Even the best instrument in the world is worthless if it is not used properly. The goal of the project was to explore the feasibility of creating manual-free software as one potential solution to improve software usability. Taking a broader perspective of the academic environment, how can knowledge be retained within a

team amidst high employee turnover? After analyzing and observing the situation, I have identified the following measures:

- Write a brief article summarizing projects.
- Create documentation outlining procedures and justifying parameter decisions.
- Consolidate all information into a searchable PDF.

From an ethical standpoint, it is easy to access another researcher's procedure and replicate it for one's own purposes, potentially leading to misuse. There is also the risk of becoming overly reliant on test procedures without reflecting on their contents.

Furthermore, there is the possibility of the tool being misused for unintended purposes. As a developer, I am not responsible for such misuse.

Sources of error

- The project is made by one person. There is a risk of bias, even though it includes iterations when listening to interviews.
- The interviews were held closed in time to each other. There was no time to evaluate interviews between.
- The concept generation was done by one person, which didn´t make it as time officiant.
- The interviewees felt that they were in an escape room.
- There is a difference between what they do and what they say.

Labbot didn´t know what the problem definition was, when the project started. They had their own feeling of the software but no data on users feelings. The concrete desired outcome was made in the middle of the process. When finding and defining the problem definition, it´s important to understand the hierarchy of the problems (Boeijen, et al., 2020, p. 119).

For someone else?

How can all of this help someone else work with a complex system? When starting to develop in a new and complex field, it's important to first understand the case you're working on. Do research and get to know the company and their work environment. Sketch context diagrams and present to the company to ensure you are on the same page. It's important to understand each other.

Before starting, set clear goals and know when to continue. It's easy to get distracted when the issues are too technical and complex. Therefore, have a clear goal and direction together with the project managers. Choose a process and method

depending on what fits the team so everyone can be involved in the development. To deliver something that can be used, understand your constraints. Constraints and limitations are important to understand and work within. Don't try to go outside the box when there are clear limitations.

With clear communication and process, continue to work while trying to understand the project and come back to the company to get clarifications. When working on this complex project, it's easy to get involved with the company. It's important to think outside the box and expect the unexpected, such as the personas. When discussing users with the company, they had a clear vision of their users. However, when meeting them, there were differences.

Future development

The next stage in the process is to refine the details and create a prototype. Before finalizing the prototype, it's important to iterate on the observation step to gain insight into another procedure. As mentioned in the sources of error, the procedure has only been tested on one example, which suggests that interviews may make the next step easier. While the software may be working perfectly now, it's important to test more procedures and compare the results to ensure that they are similar.

If the results of the other procedures match, the next step in development is to incorporate the different elements into more design options. Low fidelity tests should be performed on users to determine their necessity and to see how intuitive the elements are.

It would be interesting to test the full prototype on someone who is new to the field, like my experience during my first weeks at Probation Labs.

14.1 Conclusions

The goal of the process was to determine the features and appearance of a new software. However, the creation of personas revealed a larger issue: the company struggles to understand its users because there is no consistent way in which the product is used. This leads to the development of diverse procedures. Unlike other tools that can be used in a standardized way, this instrument is intended to be a Swiss army knife with many different functions, making it difficult to prescribe a singular approach for users.

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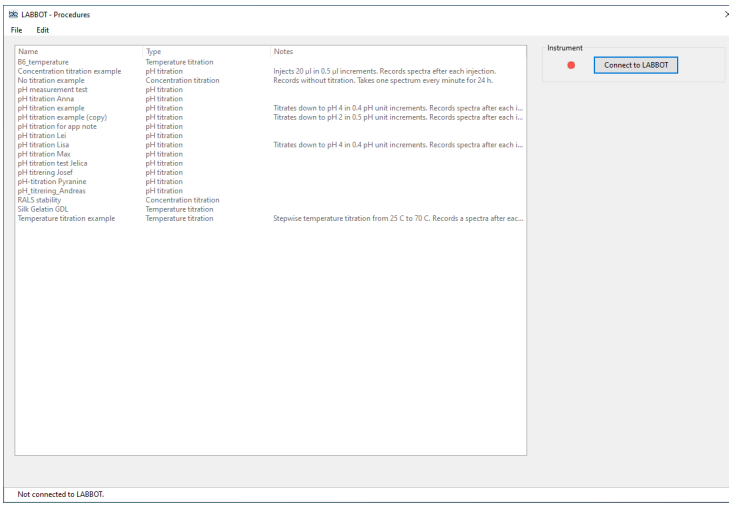
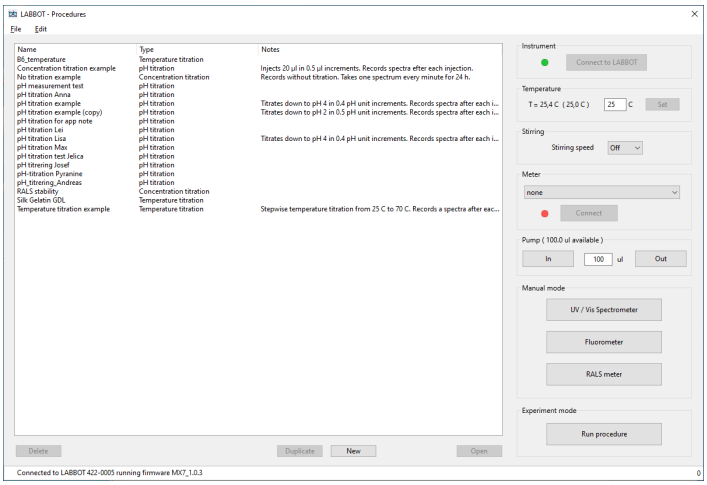
Appendix A Original Software

A.1 Home screen

A.1.1 Offline

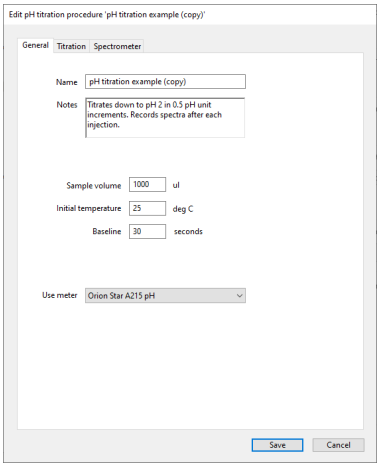


A.1.2 Online

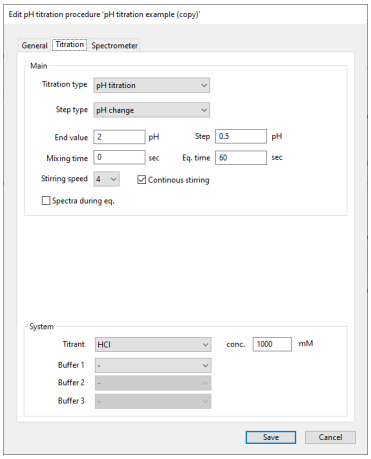


A.2 Make procedure

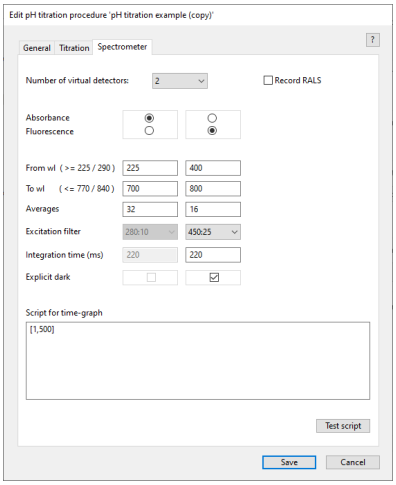
A.2.1 General settings



A.2.2 Titration

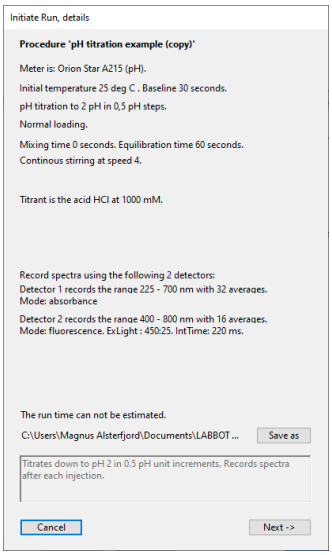


A.2.3 Spectrometer

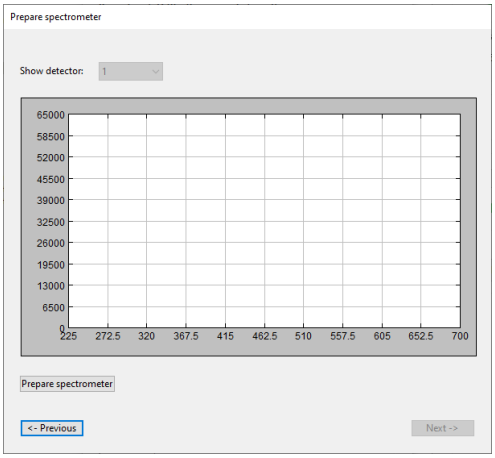


A.3 Run Procedure

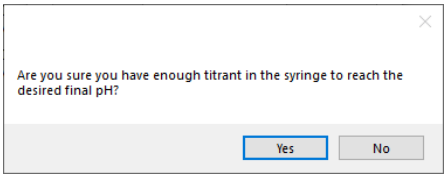
A.3.1 Save procedure



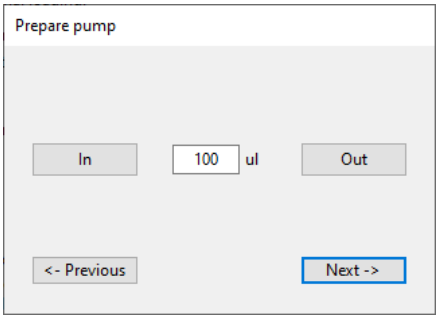
A.3.2 Measure Blank



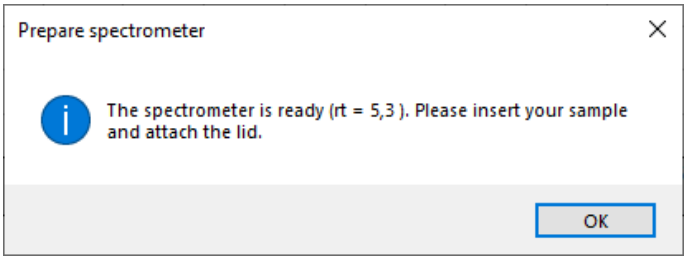
A.3.3 Enough titrant?



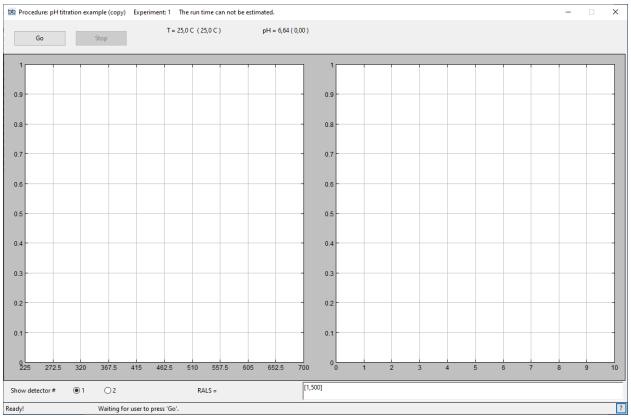
A.3.4 Prepare Pump



A.3.5 Insert sample

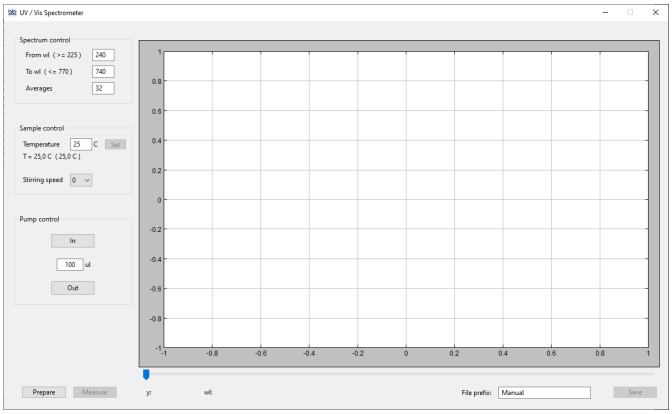


A.3.6 Run procedure

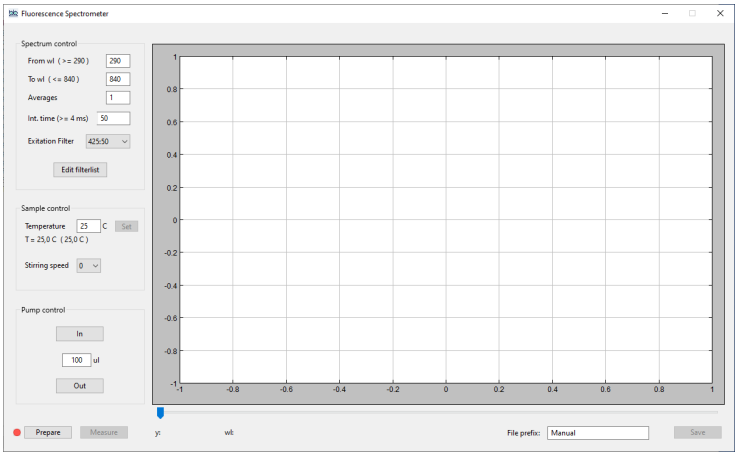


A.4 Manual Mode

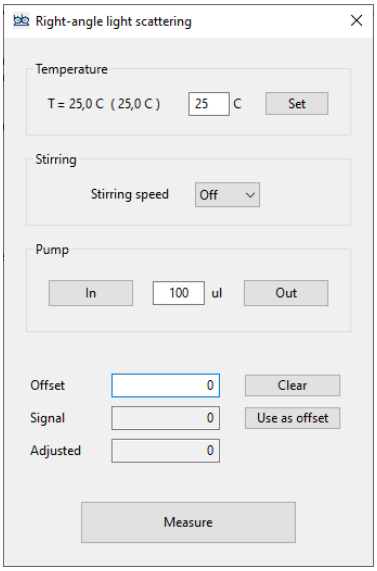
A.4.1 UV/Vis Spectrometer



A.4.2 Fluorescence Spectrometer

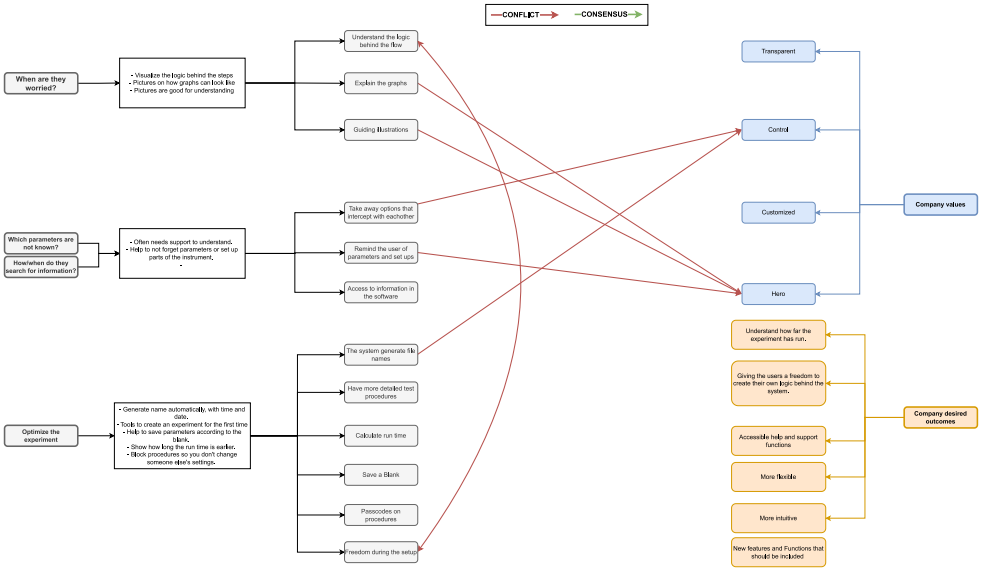


A.4.3 Right-angle light scattering

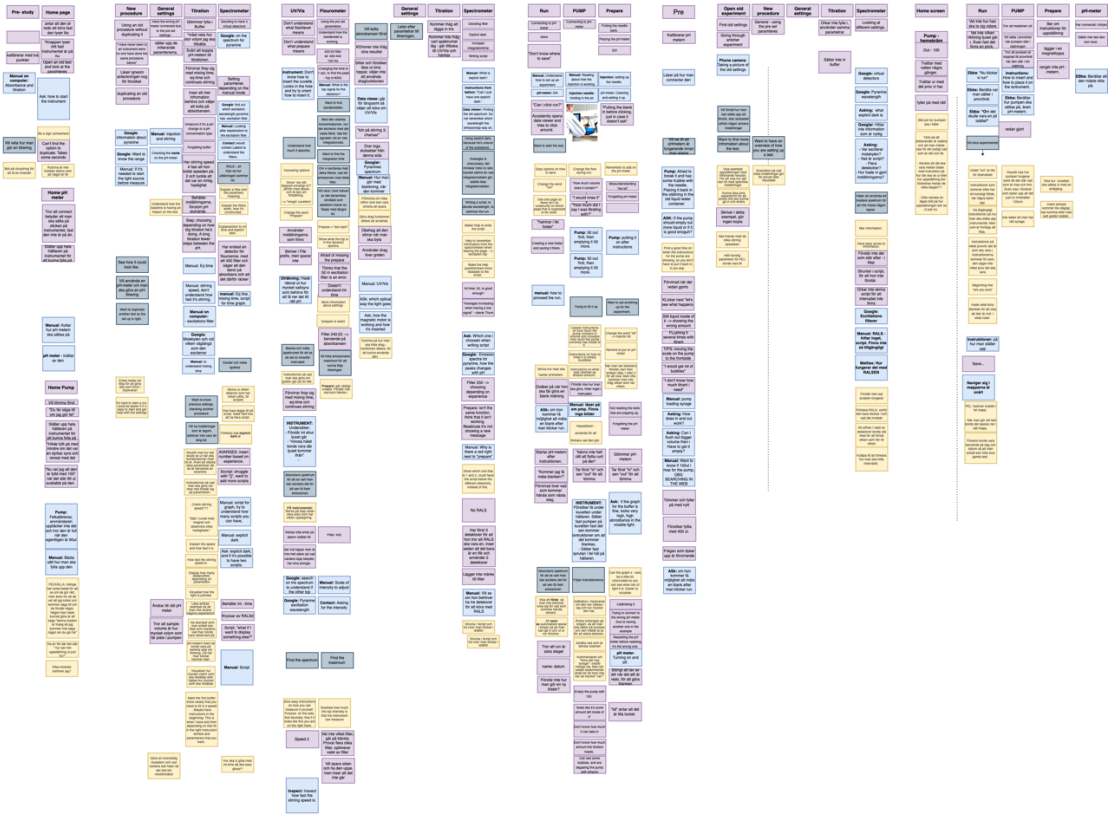


Appendix B Results from project

B.1 Diagram only conflicts



B.2 Graphical overview of all separate User journeys together



B.3 Goal summarizing