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User interface redesign and usability test for the 360ViSi node-based video editor

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Bachelor's Thesis | Abstract

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User interface redesign and usability test for the 360ViSi node-based video editor

There is an urgent situation in healthcare education where there is a shortage of resources and facilities to organize practical training. To relieve that situation, engineers from European universities have been developing a tool to digitally organize practical training. This tool is the 360ViSi node-based video editor. It uses interactive 360° video simulation to create scenarios where nursing students can safely practise their skills. However, the editor had a very complex user interface.

The aim of this thesis was to design a new user friendly interface for the 360ViSi node editor. The new user interface design especially took into account iconography and colour usage and how they impact on usability. After the user interface was designed, a usability test with the System Usability Scale questionnaire was conducted on both interfaces to determine which design had better usability.

The usability test results showed a significant difference between the old (SUS = 53,4) and new (SUS = 65,3) interfaces. Therefore, this thesis concludes that using icons and colours in the user interface design of a 360° video node-based editor provides a noticeable usability improvement.

Keywords:

usability, user interface, usability testing, iconography, interface colour palette

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Käyttöliittymän uudelleen suunnittelu ja käytettävyystestaus 360ViSi videoeditorille

Terveydenhoitoalan koulutuksessa on akuutti pula resursseista ja tiloista, joita tarvitaan harjoittelun järjestämiseen. Tilanteen helpottamiseksi eurooppalaisissa yliopistoissa on kehitetty työkalua harjoittelun digitalisoimiseksi. Tämä työkalu on 360ViSi, videoeditori, joka hyödyntää interaktiivista 360° videosimulaatiota. Editorilla voi luoda skenaarioita, joiden avulla terveysalan opiskelijat voivat turvallisesti harjoittaa taitojaan. Editorin käyttöliittymä oli kuitenkin monimutkainen ja vaikeakäyttöinen.

Tämän opinnäytetyön tarkoituksena oli suunnitella uusi käyttäjäystävällisempi käyttöliittymä 360ViSi videoeditorille. Uuden käyttöliittymän suunnittelussa huomioitiin erityisesti ikonografian ja värien käytön vaikutus käytettävyyteen. Kun käyttöliittymä oli valmis, suoritettiin käytettävyystesti, jossa käytettiin SUS (System Usability Scale) kyselyä molempien käyttöliittymien käytettävyyden arvioimiseksi.

Käytettävyystestin tulokset osoittivat merkittävän eron vanhan (SUS = 53,4) ja uuden (SUS = 65,3) käyttöliittymän välillä. Tulosten perusteella voidaan todeta, että ikonien ja värien käyttö käyttöliittymäsuunnittelussa paransi huomattavasti 360ViSi videoeditorin käytettävyyttä.

Asiasanat:

käytettävyys, käyttöliittymä, käytettävyystestaus, ikonografia, liittymän väripaletti

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List of abbreviations

ATM	Automated teller machine, cash machine
CLI	Command-line interface
GUI	Graphical user interface
HCI	Human-computer interaction
SUS	System usability scale
UI	User interface
UX	User experience

1 Introduction

There is an increasing need for workers in healthcare field. However, their education requires a great number of resources because the education includes a great amount of practical training. Using digital training tools for practical training would benefit many universities across the world by saving resources that are needed to organize the practical training.

A number of European universities have been developing together a product that makes digital training possible. The 360ViSi node-based video editor utilizes interactive 360° videos to create simulations for different training scenarios.

However, users of the current 360ViSi node editor have reported that it is very complicated and difficult to use. The aim of this thesis is to design a new user interface for the node editor, and then conduct a usability test to determine how iconography and colour usage impacts a node-based video editor interface usability. The goal is to design a user interface that is easier to use than the current interface.

Usually video editors have similar user interface which has library and timeline. Research shows that there are no other existing video editors for 360° video so this 360ViSi node-based video editor is novel. The objective of this thesis is to create an improved version of this quite unique video editor and give empirical evidence that iconography and colour palette can influence the usability of a 360° video node-based editor.

This thesis consists of three parts. The first part (Chapter 2) contains the literature review about usability, user interface, user experience, iconography and colour usage. The second part (Chapter 3) includes the designing process of the new UI for the 360ViSi node editor. The third part (Chapters 4-6) includes the usability test and discussion about its results.

2 Literature review

User experience (UX) consists of four elements: value, usability, adoptability and desirability. Value is the most important aspect of the UX. The product must meet with user's needs to be valuable. Adoptability includes the product's accessibility, credibility and attractiveness. Adoptability determines a user's will to start using the product. Desirability covers the emotional side of the user experience. Visual design has a significant role in desirability but the most important thing in desirability is that the product is fun and engaging. (Guo 2012.) User experience is often confused with usability. Usability impacts on UX but it is not the whole experience.

2.1 Definitions of usability

Usability is a quality attribute that determines user interface's ease of use (Nielsen 2012). There are five components usability is defined by: learnability, efficiency, memorability, error, and satisfaction.

Learnability measures how easy the system is to use for users using it for the first time and how easily goals can be accomplished. Efficiency means how quickly goals can be accomplished after the system has been learned. Memorability indicates how well users can remember functionalities of the system after not using it for a while and then continuing to use the system. Errors measure the system's error rate and how well user recovers from the errors. The severity of the errors is also investigated. Satisfaction indicates the pleasantness of the system and how satisfied the user is after achieving their goals. (Nielsen 2012.)

These five components are used to define usability, but usability is only one component of system acceptability. System acceptability includes other quality

attributes alongside usability such as utility (Figure1). System's usefulness is defined by system's utility and usability together. (Nielsen 2012.)

Figure 1. Quality attributes of system acceptability. (Nielsen 1993, 25)

2.2 Why usability is important

Usability is one of the most important aspects of a product. If a system has poor usability, no one wants to use it. When usability is at a good level, the user is satisfied and stays loyal to the system. Good usability also saves users time and helps the user to achieve goals. If usability is designed carefully, the need of training and customer support is decreased. Well-designed usability also improves user experience. (Nigam 2014.)

2.3 What is usability testing

Usability testing is a process which aims to gather information to make a product or a system more profitable. There are various testing methods, but they usually have the same goal. Test participants evaluate how the product, or system meets usability criteria. After the test data has been analysed, the

design could be improved to serve better in its purpose. This will improve user satisfaction levels and prevent frustration. (Rubin & Chisnell 2011.)

A test plan is an essential part in usability testing. It determines what is tested, who are testing, why testing occurs, how testing happens and where and when the testing is about to take place. (Rubin & Chisnell 2011.)

2.4 Usability heuristics

Jakob Nielsen has listed 10 principles for UI design to help designers to achieve better usability for their products. These are called usability heuristics. They are not specific guidelines, but they are a good basis for UI design. The first of these heuristics is visibility of system status. The user should be given feedback by the system about its current state. The second principle is a match between the system and the real world. This means the system should communicate with the user in an understandable way. The third heuristic is user control and freedom. Users should be able to undo their mistakes and recover from any errors. The fourth heuristic is called consistency and standards. The system should not be abnormal, but rather meet user expectations. The fifth principle is error prevention. The system should be designed in a way that it leaves a minimal amount of room for users to make mistakes. The sixth heuristic is called recognition rather than recall. User should not be forced to memorize information, but the information should be visible. The seventh heuristic is flexibility and efficiency of use. There should be different ways to use the system so both novice and experienced users can use the system efficiently. The eighth principle is aesthetic and minimalist design. There should not be any irrelevant information visible in the UI design because that would reduce the attention from the applicable information. The ninth heuristic is called recognize, diagnose and recover from errors. Errors should be announced to the user in a way that is familiar to the user and the user should be helped to recover from mistakes by offering a solution. The last of Nielsen's heuristics is help and documentation. The system should provide support to users to achieve their goals. (Nielsen 2020.)

These 10 usability heuristics can be found and tested through the user interface of a system.

2.5 What is a user interface

A user interface allows communication and interaction between a human and a machine. The term human-computer interaction (HCI) is often used in this context. User interfaces can be digital, such as online shopping sites, or physical, such as a remote control or an ATM. There are also different types of digital UI's such as graphical user interface (GUI), command-line interface (CLI) and menu-driven user interface. (Churchville 2021.)

When considering Nielsen's (2012) 10 usability heuristics regarding digital user interfaces, one cannot ignore that, among several design facets, iconography and colour design would play a prominent role in the overall perception of system usability. This thesis focuses on these two design elements to determine whether they can be isolated to impact the usability of a video editing system.

2.6 Iconography in UI design

Icons are meant to visually represent objects, actions or ideas. A user usually assumes the meaning of an icon based on their previous experience. For example the commonly used heart-icon often refers to actions "like" or "add to favourites". However there are no standards regarding icon usage, so a text label is often needed to clarify the meaning of an icon. Text labels should be visible at all times. When using icons in UI design, doing research beforehand is necessary. Icons that are used should be simple and preferably familiar from other products or designs. If new icons that do not exist in other designs are made, they should be designed to be easily recognized and remembered. (Harley 2014.)

2.7 Colour usage in UI design

The second UI design principle this thesis investigates is colour usage. Colours invoke emotions, attract users and help in communication. Also, culture has an impact on how different users relate to different colours. For example, colour palettes with red are usually associated with emotions like warmth and comfort but it can also mean anger and hostility. Cold colours, including various shades of blue, usually refer to trust and confidence. For this reason, many restaurant chains use red in their logos and many technology companies use blue (Figure 2). Orange arouses excitement and yellow represents joy and happiness. Green symbolizes calmness and renewal. White is traditionally the colour of purity and black indicates mystery or death. Purple is often associated with wealth and royalty. (Vaniukov n. d.)

Figure 2. Colour usage in company logos.

There are two main rules regarding colour usage in UI design. The first rule is called the golden ratio or the 6:3:1 rule. (Vaniukov n. d.) It means that interface colours should be in balance. A primary colour that is neutral should be used in 60% of UI design, 30% should be a secondary colour that contrasts the main colour and the remaining 10% should be the accent colour that comports with the two other colours. (Jeph 2020.)

The second rule is to use a maximum of three primary colours. It prevents the design from being disordered. With these two rules combined, the UI design should be well balanced and pleasant to use. (Vaniukov n. d.)

In addition to the rules above, there are a few more things to consider when using colours in UI design. One of those things is accessibility. The UI should be designed in a way that people who are colour blind would also be able to use it. There are some checkers like WebAIM that help to design accessible UI's. (Vaniukov n. d.)

Interactive colours is also something to keep in mind when designing UI. Buttons with similar functions should have identical colours so the user can associate a specific colour to a specific function. (Vaniukov n. d.)

3 Design process

The design process started with testing the original design and examining what were the most complex parts that needed the greatest changes (Figure 3). The editor was lacking any instructions for the user, so its learnability was poor. Also, the memorability needed improvement because it took a lot of time remembering all the functionalities after not using the editor for a while. The editor had some errors as well, but the focus was to improve learnability and memorability components.

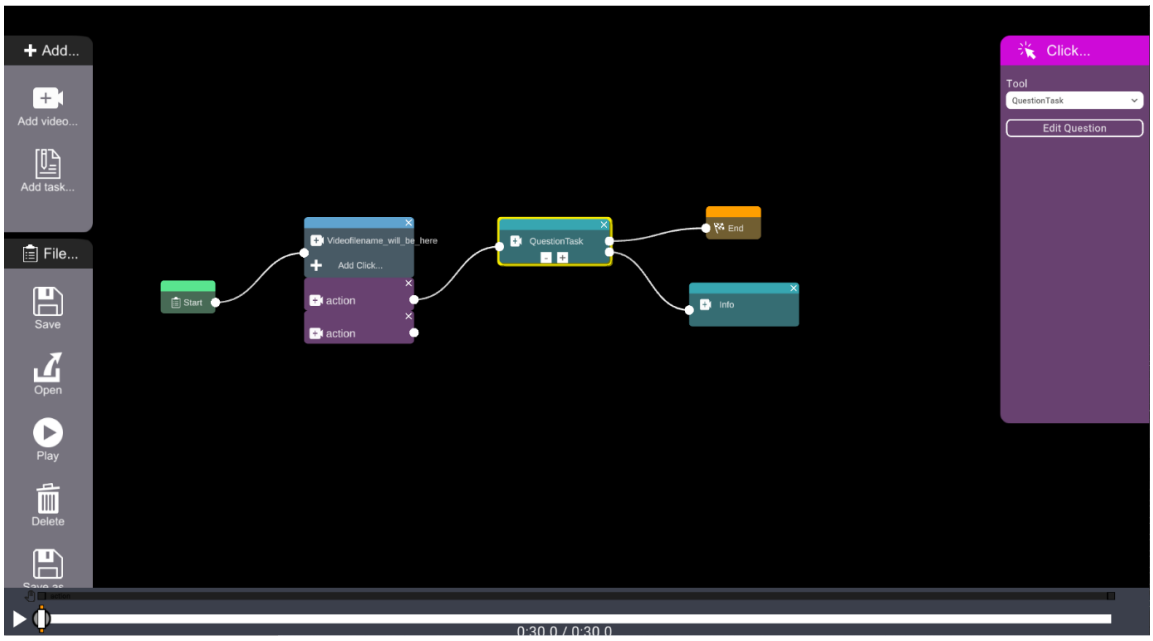

Figure 3. Original design of the editor.

From the very beginning it was clear that different nodes should have clearly different colours so they could be distinguished from each other. The first sketch of the design already started to incorporate the new colour scheme (Figure 4).

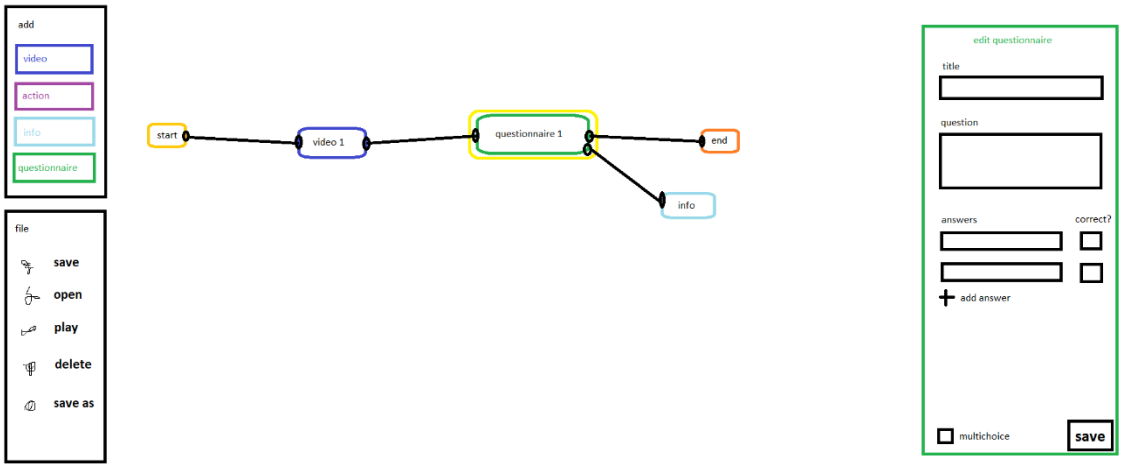

Figure 4. First sketch of the UI design.

In the new design, the representative node colour recurred in the ”Add”-menu and ”Edit”-windows (Figure 5). This strengthens specific colour association to a specific function and makes it easier to learn and remember.

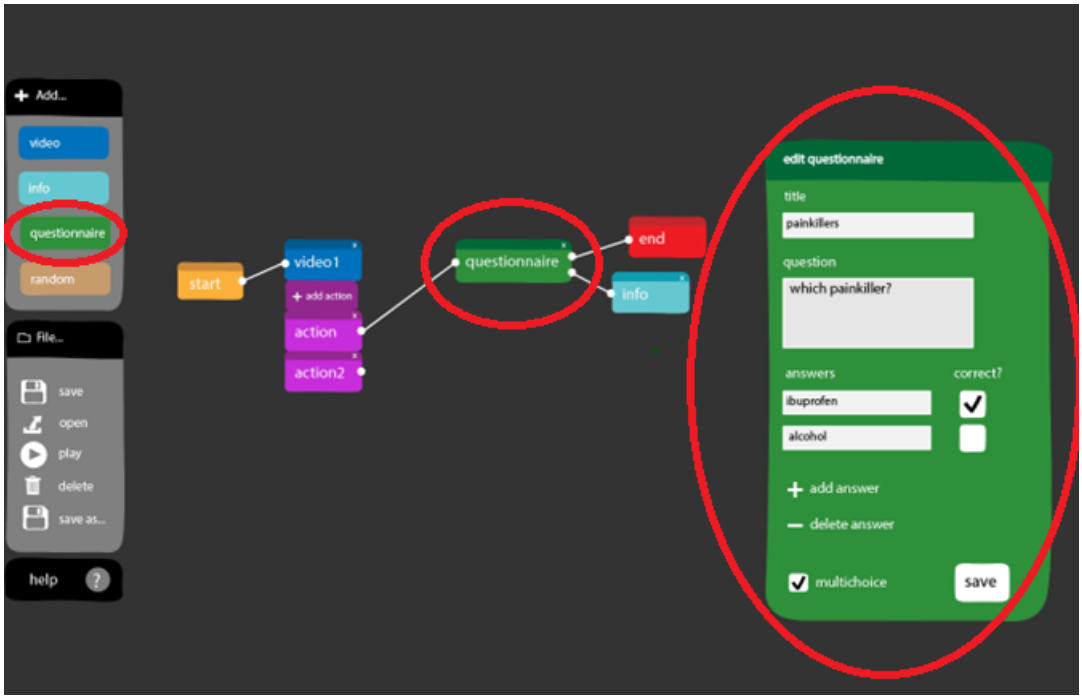

Figure 5. Representative colour recurring.

Learnability was also improved by adding a ”Help”-button and placing ”Hint”-buttons throughout the design (Figure 6). These instructions also prevent users from making errors.

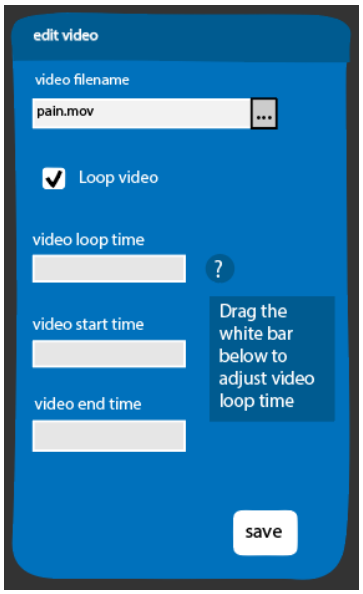

Figure 6. ”Hint”-button.

Another thing to improve learnability and memorability was adding icons to the design. Icons also had text labels to clarify their respective meanings (Figure 7).

Figure 7. Icons in the ”Add”-menu.

The overall visual representation of the editor was also enhanced. This elevates the editor’s desirability, which is an element of the user experience.

Unfortunately, everything that was planned in the design phase could not be implemented in the final version of the editor. For example, the ”Edit”-window was designed to be on the right side of the editor view but it ended up to be a whole new window in the middle of the view. However, most of the changes were executed as planned. It was assumed that this new version would be more successful in the testing than the original version.

4 Testing the new editor

Although an A/B test is typically a research method for user experience testing, this study applied it to measure the usability aspect of the original node editor UI design and the new node editor UI design. An A/B test suggests two variations to a prospective user group and determines which of the two variations the users prefer. The test can be done within groups or between groups, each with their pros and cons. This study applied the between groups design.

There were 17 nursing student participants who tested the two editor user interfaces. Eight students tested the original version, and nine students tested the new version. Each student completed the System Usability Scale (SUS) questionnaire (Appendix 1) immediately after testing the interface. The SUS questionnaire was designed by Brooke (1986) and is still widely considered a cost-effective way to quickly determine whether a computer system or application has a suitable usability level. The questionnaire comprises 10 Likert-style questions that test various perceptions on the usability of the system in question.

The participants were divided into two test groups and they were not informed about which version of the UI design they are testing. Their goal was to create a short simulation scenario using the node editor. Both groups were advised to create the same scenario. After the participants had created the scenario, they were asked to fill in the SUS questionnaire. The test results from both groups were compared to determine which version has the better usability.

5 Results

To correctly analyse the results, the raw SUS questionnaire data (Figure 8) must be transposed (Brooke, 1986). To do this, the odd numbered question scores must be reduced by one. Even numbered question scores must be deducted from five. Then the transposed values must be summed together and the sum multiplied by 2,5. The average SUS scores were calculated from both UI's. Figure 9 shows the transposed and calculated SUS scores.

		TEST GROUP A (old UI)								
Raw data										
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Participant 1	3	2	4	5	4	2	4	3	4	4
Participant 2	4	2	4	4	5	2	5	2	4	4
Participant 3	2	3	4	5	4	2	5	2	2	2
Participant 4	4	2	3	5	5	1	4	2	3	4
Participant 5	5	4	4	4	4	3	4	2	5	1
Participant 6	2	5	2	5	4	2	4	4	4	2
Participant 7	4	5	2	4	5	1	4	5	2	4
Participant 8	3	5	1	5	3	4	3	4	1	5

	TEST GROUP B (new UI)									
Raw data										
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Participant 1	4	4	4	5	4	2	5	4	4	2
Participant 2	3	2	2	5	3	4	1	5	1	4
Participant 3	2	2	2	5	3	2	5	4	1	5
Participant 4	5	2	4	4	5	2	5	2	2	4
Participant 5	5	2	4	3	5	2	4	2	4	2
Participant 6	5	1	5	4	5	1	4	1	3	3
Participant 7	4	2	4	5	4	2	5	2	4	2
Participant 8	5	2	5	1	5	1	5	1	5	1
Participant 9	5	2	4	3	5	1	5	4	2	2

Figure 8. Raw data.

Calculated											
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS score
Participant 1	2	3	3	0	3	3	3	2	3	1	57,5
Participant 2	3	3	3	1	4	3	4	3	3	1	70
Participant 3	1	2	3	0	3	3	4	3	1	3	57,5
Participant 4	3	3	2	0	4	4	3	3	2	1	62,5
Participant 5	4	1	3	1	3	2	3	3	4	4	70
Participant 6	1	0	1	0	3	3	3	1	3	3	45
Participant 7	3	0	1	1	4	4	3	0	1	1	45
Participant 8	2	0	0	0	2	1	2	1	0	0	20
										Average:	**53,4375**

Calculated											
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS score
Participant 1	3	1	3	0	3	3	4	1	3	3	60
Participant 2	2	3	1	0	2	1	0	0	0	1	25
Participant 3	1	3	1	0	2	3	4	1	0	0	37,5
Participant 4	4	3	3	1	4	3	4	3	1	1	67,5
Participant 5	4	3	3	2	4	3	3	3	3	3	77,5
Participant 6	4	4	4	1	4	4	3	4	2	2	80
Participant 7	3	3	3	0	3	3	4	3	3	3	70
Participant 8	4	3	4	4	4	4	4	4	4	4	97,5
Participant 9	4	3	3	2	4	4	4	1	1	3	72,5
										Average:	**65,2777778**

Figure 9. Calculated data.

The original UI design scored 53,4 in the usability test and the new UI design scored 65,3. This means that usability was improved by almost 12 points. In terms of grades, the usability improved by 2 grades (from D to C). That is, the original UI would be graded as D and the new UI would be graded as C (Figure 10).

SUS Score Range	Grade	Percentile Range
84.1 - 100	A +	96 - 100
80.8 - 84.0	A	90 - 95
78.9 - 80.7	A -	85 - 89
77.2 - 78.8	B +	80 - 84
74.1 - 77.1	B	70 - 79
72.6 - 74.0	B -	65 - 69
71.1 - 72.5	C +	60 - 64
65.0 - 71.0	C	41 - 59
62.7 - 64.9	C -	35 - 40
51.7 - 62.6	D	15 - 34
0.0 - 51.6	F	0 - 14

Figure 10. SUS score grades (Sauro & Lewis 2018.)

6 Conclusion

The thesis objective was to design a more user friendly user interface for the 360ViSi node-based editor to improve the system's usability that was previously quite poor. The original design was examined to identify the most complex parts that needed improvement. The suggested improvements focused especially on iconography and colour usage.

An A/B test design with the SUS questionnaire was conducted and the results showed that the new user interface design had a remarkable improvement in usability.

A finding that came out in the test results (in question 4 of the test form), is that most of the participants still felt they would need the support of a technical person to be able to use the system. This indicates that there should still be more guidance and support for the user in the system. This could be resolved through further rigorous usability research on the interface.

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Usability testing form

System Usability Scale

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	1	2	3	4	5
2. I found the system unnecessarily complex	1	2	3	4	5
3. I thought the system was easy to use	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	1	2	3	4	5
5. I found the various functions in this system were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this system	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
8. I found the system very cumbersome to use	1	2	3	4	5
9. I felt very confident using the system	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	1	2	3	4	5