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HELPING END USERS DESIGN BETTER UIS

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Academic year 2021–2022

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Abstract

User applications are crucial for users in many aspects of life; understanding the design and development strategies that can help the creation of accessible applications is crucial. Their main objective is to make sure that everyone may access the interactive applications. The purpose of this thesis is to help and facilitate user interface designers who have less or no prior knowledge of designing innovative and creative user interfaces. It has been observed over the past many years that the outlook and interface design of an application is something critical and significant when it comes to user interface designing. The design of an application is the most important part to look upon as it matters and gives designers a huge impact. An attractive, creative and innovative user interface will always give users an amazing experience and build their interest in using, developing and designing applications. If the user interfaces (UIs) are designed with the required customised requirements it will enhance the interest of the users and give them a clear understanding of using particular applications. Moreover, innovative and creative user interfaces help users to have smooth user-friendly experiences while using applications. On the other hand, the applications which are poorly designed and have no interactive or creative UI designs are not likely to be used by the users as they are hard to understand and use. However, this also blurs the purpose of the user application and results in poor user experience. In addition to this, badly or poorly designed user interfaces result in time consuming use of applications which loosen the interest of the user in the application and thus results in unclear understanding of the application. In the modern era of innovative technology, it has been challenging to design interactive user interfaces as every technology has its limitations. At the same time, a large number of UI designers who have less or no designing skills but they want to design interactive and innovative UI designs; therefore, it becomes challenging for them to fulfil their requirements of creating attractive UIs according to user interface design principles. However, this has a huge impact on the success of design applications. Therefore, in order to solve this problem we have proposed a solution where a user who has programming skills but has no design skills can design applications in an attractive and innovative manner. The proposed solution will help these UI designers to build their applications as per the user requirements based on UI design principles. The proposed solution provides recommendations to the designer which helps them to design and improve their UIs; the proposed solution gives recommendations to the designers with the help of which they continuously keep on updating and enhancing their user interfaces designs. However, we have used a sidebar feature in an already designed authoring tool; where the sidebar contains all

the recommendations for the UI designer. Moreover, the proposed recommendations are controllable by the designer and they can view it as per their need and requirement. Last but not the least, after designing the proposed recommendation system we have conducted a survey the details has been explained in Chapter 5 the results of the survey gave us satisfactory results as the result shows that providing proposed solution to the designer was a good success as it helped them and provided them with fruitful improvements while designing their UIs. Furthermore, this thesis has been divided into 6 major sections; where Section 1 gives an introduction about the existing problem. Section 2 gives an overview of related and existing research articles and studies. Section 3 highlights the design of the proposed solution and Section 4 illustrates the implementation part of the proposed solution. Further to these, in Section 5 we evaluate the results from the survey conducted and analyze them. Lastly, Section 6 gives concluding remarks about the overall proposed solution following the details about future extension to this proposed work.

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1

Introduction

We have seen an increase in the number of smart devices over the last several decades, including tablets and smartphones to wearable technology such as smartwatches, smartglasses and smartbands. Despite the fact that individuals are increasingly eager to design their own user interfaces as per their own design requirements and customisation, it remains difficult to enable these customised user interfaces. As a result, several studies have been conducted to investigate various ways of prompting the UI recommendations for UI designers in order to help them in designing their customised user interfaces. However, it has been observed that designing such customised user interfaces is a challenge for designers till date as most of the users are not from a technical design background. As a result, they face various challenges while designing their custom UIs for their applications.

Furthermore, because users' wants are impossible to predict due to their complex and evolving nature (along with technical improvements), developers are unable to meet the various and constantly changing user needs. As a result, we are seeing the emergence of end-user development solutions that enable so-called end users with no programming skills to create interfaces. We are going to design and propose a solution to this problem that will help users to design their own customised UIs with the help of provided recom-

mendations. Our proposed system will provide users with several different recommendations, which will later be used by the non-programmers to design their attractive and interesting customised UIs as per the requirements.

1.1 Problem Statement

The design and user interface development has become increasingly difficult as technology has evolved. Designers must consider new types of devices (such as tablets or smartwatches) and smart things (such as smart lights or smart thermostats) that are part of the Internet of Things (IoT). In addition to these technologies, designers must consider the needs of users, which are complex, divergent, and frequently evolve over time. As a result, in order to meet these evolving needs, we want to take an EUD approach that ensures people can design their own customised UIs as per their own customised requirements. However, given that end users do not have the same capabilities as UI designers and may not want to spend too much time on the design of their application, this poses a number of challenges. As a result, we propose to assist end users in designing their UIs by making recommendations on how to improve their designs.

1.2 Research Methodology

This research thesis was created using the design science research methodology (DSRM) in information system [23]. Design science research is a qualitative research approach in which the development process is the main point of interest, producing data on both the methodology used to create an artefact and the design itself. Below is the given research methodology; Figure 1.1 gives a graphical representation of the research methodology that has been selected to design this research work. The DSRM process model, which contains six actions, is built on earlier design science research concepts. The first step is to identify and motivate the problem, which is explained in this chapter. The next action entails defining the goals of a solution, which is explained in the Chapter 4. The third step is design and development, which is followed by demonstration, assessment, and communication. The details of this can be clearly seen in Chapter 5 of our proposed research work.

1.2.1 Problem Identification and Motivation

The fundamental issue, as described in the preceding section, is that there are many novice UI designers who have tailored criteria to build their UIs but

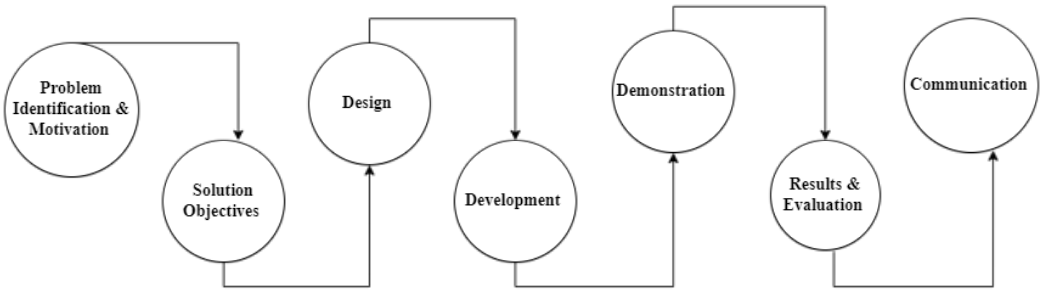

Figure 1.1: Research methodology

have no or little prior understanding of design, resulting in not-so-good-looking UIs. Aside from the lack of a single solution that allows designers to create their own user interfaces with their customised requirements, present solutions are limited in terms of adaptability, customisation, and ease of use. To address these issues, we looked at current research work in the design of UI recommendations, which aim to empower end users and novice designers to construct and customise their UI applications based on their needs. We were able to establish the need for an EUD solution that allows users more control over their UIs. To further simplify the development process.

Moreover, we have extended an eSPACE authoring tool in order to design our proposed solution for the UI designers. The recommendations have been integrated with UI design in the design view module of the eSPACE tool.

1.2.2 Solution Objectives

With the aims outlined below, we want to tackle the previously mentioned challenge by eventually facilitating end users with a practical solution that enables them to better manage and build their UIs.

Objective 1: Analyse and Explore the UI Design Process

- **Objective 1.1:** Encompasses a UI design environment to facilitate the UI design process for end users.
- **Objective 1.2:** Use case scenarios to generate design requirements for the UI designers.
- **Objective 1.3:** Extend a UI design environment based on the analysis made for Objective 1.1.

Objective 2: Providing Arbitrary Notions

- **Objective 2.1:** Requirements will be collected from the users in order to develop the required UI design recommendations.
- **Objective 2.2:** Providing users with user friendly and easy to understand recommendations in order to design their UIs without prior knowledge of UI design.

Objective 3: Design Specifications

Once we have our proposed solution, one of the most essential goals is to discover the appropriate abstractions to make it accessible to the end users. We were able to determine the demand for an EUD solution that allows users more control over their user interfaces.

While we offered a synopsis of our goals, they are inspired and elaborated upon throughout this dissertation.

1.2.3 Design and Development

We extended the eSPACE authoring tool to achieve our research objectives. Therefore, we used JavaScript and Spring Boot to build interactive and user-friendly design recommendations to assist them in designing UIs with the provided recommendations at their leisure and according to their needs.

1.2.4 Demonstration

We illustrate the value and usability of our various study artefacts in a variety of ways. In later Chapter 3, we reveal the capability of our proposed solution through a variety of showcases to demonstrate its strength. The same is true for all the utilities of each component.

1.2.5 Result and Evaluation

We assessed our research objects using multiple methodologies based on the type of artefact, as needed by the chosen DSRM. It should be noted that the demonstration process served as an appraisal of the artefact for some of the objects. We have compared different functionalities with the obtained design requirements (DRs); the result of this comparison gives us how our recommendations perfectly satisfy UI designers' needs. This allows us to assess the accuracy of our paradigm and methodology.

We have conducted a survey with 13 participants to check how our recommendations perfectly satisfy UI designers' needs. The survey collects data about how useful these design recommendations are while creating a design. Moreover, we have also scheduled interviews with the participants to learn how these recommendations are helpful to them. In addition to this, we have used MRC (Microsoft Reaction Card) and PSSUQ (Post-Study System Usability Questionnaire) for collecting feedback from users via questionnaires that were asked to be filled in during the evaluation process.

However, the analysis of results collected from interviews and surveys is discussed later in Chapters 5.

1.2.6 Communication

The DSRM concludes with communication, which consists of communicating this research endeavour and its associated artefacts to the research field. Our methodology, design and artefacts are included in this dissertation. Furthermore, we reviewed a number of research articles in the domains of user interface recommendations and requirements, and these studies supplied us with ideas, alternative perspectives and knowledge about the status of relevant work in this domain. Moreover, we present our work during the thesis defence in front of the jury.

1.3 Thesis Structure

The rest of the thesis is structured as shown in Figure 1.2. Chapter 1 of the research thesis gives an introduction and overview of the proposed research work. Next, in Chapter 2, the background of this research work has been explained in detail with the support of a review of the related studies and literature that have been studied for gathering information related to existing solutions for the stated problem. In addition to this Chapter 3, highlights the design part of the proposed research work, where tools and technologies that have been used for designing and implementing the proposed solution are discussed.

Moreover, the chapter also highlights the functional and non-functional requirements of the proposed research work. Furthermore, Chapter 4, i.e. implementation, gives details about the implementation of the proposed solution, whereas the chapter also discusses details about the proposed recommendation and how it is implemented. Last but not the least, Chapter 5 evaluates the results gathered with the help of usecases, scenarios and a user

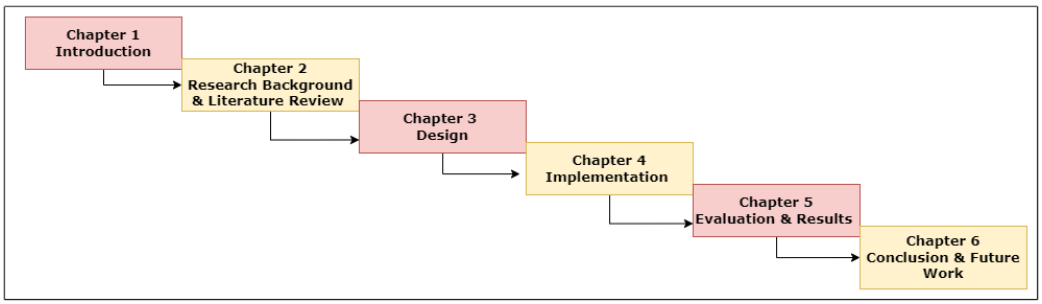

Figure 1.2: Thesis structure and organisation

study. This is followed by Chapter 6, where one can read the concluding remarks of this research work and details about future work.

2

Research Background

This chapter discusses the idea of end-user development as well as the evolution of user interfaces. We begin with a brief historical review, highlighting how user interfaces, also their users, have developed through time. The relevance of end-user development and its function in current society has been introduced and reviewed. We end with a discussion of the inferred needs for an augmented UI design environment based on our review of relevant work.

2.1 History of User Interfaces

UIs have existed for decades, evolving alongside technology and humans. User interfaces did not always exist as they do today, and our interactions with computer systems have developed throughout time. The first user interface debuted in the mid-twentieth century with the introduction of the first industrial machines, which required humans to input a programme using a punch-card mechanism. The information was encoded on perforated paper cards, which were then fed into the device, which automatically read each card in order. The research was transitioning away from assisting programmers as users and toward assisting programmers in developing better interfaces for non-programming end users [11]. People who owned their own

computers had the freedom to change the programme settings without impacting other users' computing environments [1].

Furthermore, users got the chance to explore special programming tools created to meet their needs thanks to advancements in hardware, graphics cards, and GUI usability. The earliest EUD programming environments that allowed users to create first-order functional programmes using formulas were spreadsheet systems like Excel [14]. Consumers were learning how to use their PCs, and in turn, PCs were having an impact on how mobile technology appeared. The next stage was to make computers more portable after increasing screen size, CPU speed, and memory capacity. The first laptop created to meet market demands was the Apple PowerBook, which debuted in 1991. In 2000, less than ten years later, SoftBank introduced the first camera phone. From there, mobile phone development accelerated. Their user interfaces make use of desktop GUI components including Windows, Icons, Menus, and Pointers (WIMP). However, a number of unified metaphors were used because of restrictions on both space and input devices.

The incorporation of mobile devices into our daily lives has led to HCI research focusing on the interaction of individuals with diverse device configurations and ecologies [3]. The purpose of UI recommendations is to facilitate the creation of individualised, distinctive, and inventive UI designs by developers and end users. User interfaces have come a very long way and continue to evolve with the use of speech and gesture interaction. Some writers consider NUIs to be the future age [7]. These interfaces are frequently undetectable, causing the user to respond and feel naturally based on the circumstances, which should lead to competent practice.

2.2 End-User Development

As the evolution of user interfaces has demonstrated, computer users have progressed from professional to non-expert users, sometimes referred to as end users. End users have acquired increasing influence over their UIs and apps over time, progressing from basic personalisation and modification to the creation of new features and applications. In the realm of EUD, several solutions are present to achieve this. Furthermore, the emergence of new types of smart devices and things over time has made it challenging to establish suitable end-user solutions to regulate all of these smart gadgets.

Authors in a research article [12], presented one of the first solutions focused at empowering end users. According to the creators, WebSplitter is a concept that enables a website to be spread across several users and displays. WebSplitter may also be used to separate different devices' views of an online slideshow presentation. The presenter, for example, can use a PDA to browse their slides, while students can use their own gadgets, like laptops, to follow the presentation. To govern access privileges, an XML metadata data file is used, which allows different users to see a web page layout in different ways. By establishing mapping rules in this file, an individual may determine which XML attributes or web elements for each XML tag should be distributed to particular user classes or devices. Once the system is running, the user cannot change the various web page views that were created based on the rule file, which is a significant drawback. Most contemporary UI distribution methods provide consumers more control over the deployment of applications.

Another research study suggested the MashupEditor [10], for EUD of web mashups constructed from pre-existing web components a few years later. The editor employs the copy-paste paradigm to connect many web components, such as an input form, google maps, and a weather feature. Once connected, the weather component displays the city's temperature, and the name typed in the input field appears on the map component. To make the MashupEditor environment work on a range of devices, web technologies are leveraged.

Authors in a research study [4], provided another solution based on web technology, which allows end users to generate mashups. The study develops a UI-centric technique for producing mashups on various platforms. By displaying real-time modifications to the mashup application, the suggested environment adheres to the *What You See Is What You Get* paradigm. In comparison to the MashupEditor, the drag-and-drop paradigm is used to link UI components. The authors employed a model-driven method in which each user's activity on their compositions is turned into descriptive models that describe the mashup's logic [5]. These models are dynamically interpreted to instantiate the appropriate apps on the fly, allowing users to try out their mashing compositions interactively. However, the mashup may be used as a separate piece of software on many devices. Model-driven and model-based techniques are used to make UIs from declarative models to simplify the UI development process, but these approaches tend to favour designers and developers over end users [28, 18]. There are a few outliers, such as the system and tool described in the research paper [22], which is built on the

MARIA language [21], enables end users to tailor desktop-to-mobile adaption via a mapping table. However, the technology [22], only allows for minimal adjustments and does not allow for changes to UI components.

2.3 User Interface Design Tools for Guiding End Users

The purpose of this section is to describe the literature review studied and analysed to develop and propose solutions for the helping end users design user-friendly and most appropriate user interfaces (UIs) as per the required business and other needs of users. This chapter explains the reference to several different research studies related to guidelines for design recommendations and end-user development in terms of UIs and the current ongoing research in this field of recommendations for end users. Furthermore, this section provides details about the gaps between previous and current research work. User interface design has gotten increasingly complex as a result of the development of new sorts of electronic devices and the introduction of the Internet of Things. Designers of user interfaces (UIs) often struggle to keep up with changing user demands and preferences. To overcome these challenges, we intend to assist end users in creating their own user interfaces. End-user UI design, on the other hand, is a huge difficulty since end users frequently lack the requisite design abilities. It is frequently stated that developers should begin with the client experience and work their way back to technology, rather than the other way around. Norman's primary concept is that equipment, items, computers, and interfaces should be useful, easy to use, and intuitive. According to his thesis, two gulfs must be avoided: the execution gulf and the assessment gulf [10]. That is, after all, the absolute truth.

In 2010, Meskens et al. [19], published a research article and in that particular research work, the authors stated that designers must deal with a variety of design tools and user interface toolkits while developing apps for diverse computer platforms. Incompatibilities between various design tools and toolkits make it difficult to maintain consistency in multi-device user interfaces. Moreover, the authors of this research article [19], in 2010 introduced Jelly, which is an exile design environment that supports a wide range of computing devices and toolkits. The solution provided in this research article [19], reduces the cost of building multi-device user interfaces reduced switching between design tools and tool support for keeping uniform user interfaces across platforms and toolkits. The challenge of how to programme

the world around us emerges in a future where hundreds of smart networked devices will be implanted in our everyday environs. A web-based integrated development environment with an abstraction layer may intertwine the capabilities of accessible smart things to create a collective orchestration of smart behaviour [16].

Furthermore, in 2016, another study by Henninge [13], has been published, illustrating that for usability knowledge and practises to expand, there is an increasing demand for tools to spread the field's acquired understanding. Usability guidelines are one approach for conveying usability expertise. Another developing field is usability patterns. Moreover, this article [13], describes a method for combining these strategies in a case-based architecture and employing a methodology to assist an organisation in capturing, adapting, and refining usability resources from project experiences. To express the criteria under which a specific usability resource is relevant, the technique leverages a rule-based tool. The features of the application under development are collected and used to match usability resources to the project so that the design process can be driven. Design reviews, on the other hand, are used to collect feedback and ensure that the repository remains a valuable source of knowledge for designing meaningful and useful software systems.

In addition to these mentioned research articles, another research study has been published in the same year i.e. 2016 by Todi et al. [30]. In this study, the unique idea of incorporating real-time design optimisation into a sketching tool was investigated. Although optimisation approaches may address highly complicated design issues, their emphasis on specific objectives and a single optimum is incompatible with sketching processes. Furthermore, Sketchplorer [30], is a multi-touch sketching app with a real-time layout optimiser. It deduces the designer's role as looking for both local improvements to the present design and global (radical) alternatives. Moreover, these ideas push the designer toward better useful and appealing layouts by using predictive models of sensorimotor performance and perception without overriding the designer or requiring considerable involvement.

Another research article by Koch et al. [15], in 2019 has been published; according to the author of this research article, design ideation is a critical creative activity in the field of design. However, due of its quick expansion and exploratory character, it is difficult to support computationally. In the study [15], cooperative contextual bandits (CCB) were introduced as a machine-learning technique to support interactive ideation. A CCB may be taught to adjust their exploration and exploitation methods and to make suggestions for domain-relevant contributions. The authors have created a CCB

for an immersive ideation tool that explores and uses inspirational resources alongside the designer while also suggesting motivating and situationally appropriate products. Last but not least, it also explains recommendations to facilitate reflection. However, authors in their research article [15], also made a significant point, stating that the CCB technique has potential for ideation processes where adaptable and steerable help is desired, but designers must maintain complete control of the result.

In 2015, O'Donovan et al. [20], published Designscape; In their compiled research work, they have stated that for inexperienced users, creating graphic designs might be difficult. In terms of their problem statement, the research article [20], proposes and introduces DesignScape, a system that assists the design process by providing interactive layout ideas, such as adjustments in the position, scale, and alignment of objects. Moreover, the method employs two sorts of ideas that are unique but complementary: refinement proposals, which enhance the present layout, and brainstorming suggestions, which modify the design. On the other hand, the authors have looked into two different interfaces for dealing with suggestions. First, they have provided a suggestive interface in which recommendations may be previewed and approved. Second, they have created an adaptive interface in which pieces move on their own to better arrangement. Last but not least, they have compared both interfaces to a baseline without suggestions and found that both interfaces create considerably superior layouts for rookie designers, as judged by other novices.

In the year 2007, Quiroz et al. [24], addressed an interactive evolutionary method to evolve user interfaces in the XUL interface specification in order to address the problem of user fatigue. In order to affect the evolution of interfaces, the interactive genetic algorithm combines a set of quantifiable user interface design requirements with arbitrary user input. The study's [24], primary purpose is to give a tool to the user interface designers for exploring advancement and innovativeness in the design space of UIs, as well as to make it simpler for end-users to further personalise their user interface without programming experience. Furthermore, in this study [24], An interactive genetic algorithm's population of user interface requirements is represented as individuals, and fitness is determined by weighing user input and user interface design standards. Furthermore, the study [24], shows how to lessen user fatigue in interactive genetic algorithms by limiting the designer's need for user input by only requiring them to choose two user interfaces from a display of ten, and/or by only requiring them to do so once every 't' generations.

As designing user interfaces that work across different devices is becoming increasingly crucial, therefore, Lin and Landa, in which the group of authors have developed a prototype tool for web UIs that operate on PCs and mobile phones, as well as prompt-and-response style voice UIs, have proposed another research article [17], in 2008. Damask designers simplify their designs for a single device while incorporating design patterns to express higher-level concepts. Damask's patterns provide ready-to-use UI pieces that are optimised for each platform. Moreover, designers, to indicate which devices share UI components and which are exclusive to a single device, also use layers. In addition to this, Damask generates designs for the other devices based on the drawings and patterns, which the designers may then improve.

Furthermore, while studying all the above-mentioned research studies, we also studied another research article that will be published in 2020. In this research article authors Dayama et al. [6], have stated that when sketching and wireframing user interfaces, designers employ grid layouts to spatially organise user interfaces. However, their design, on the other hand, is mostly time-consuming physical labour. Moreover, this is difficult owing to the combinatorial explosion and complicated objectives such as alignment, balance, and position expectations. Moreover, this research [6], provides a unique optimisation technique for creating a variety of grid-based layouts. A rigorous yet effective grid generation method that ensures element packing, alignment, grouping, and preferential placement is offered by the mixed integer linear programming (MILP) model.

Software businesses are increasingly attempting to produce software that adapts to the needs of their customers. As a result, the emergence of component-based experiences that users may compound and adapt to meet their own needs is on the rise. However, the ability of users to discover the components they need is critical to the commercial viability of these apps. The authors García et al. [8], in 2019, offered a way of addressing the challenge of recommending the most appropriate component for each user at any given time by developing a recommendation system based on smart data analysis methods. Furthermore, the authors gathered interaction data and created a dataset to solve the challenge of changing a given dataset from a real component-based system to an optimum dataset for machine learning algorithms using feature engineering and feature selection approaches.

Aside from the technique advocated by the authors, other machine-learning techniques are employed to construct recommendation systems. A series of experiments were conducted to build recommendation models, with multiple machine learning methods applied to the optimised dataset to determine

which recommendation model has the highest accuracy. According to research [8], deploying a recommendation system that produces better results increases the chance of a component-based application's success in the market by allowing users to select the best appropriate component for themselves, improving their user experience and application engagement.

Furthermore, Zhigang et al. [31], in 2017 published research paper in which the authors presented a novel approach to object recognition in movies using a spatiotemporal saliency model. Unlike prior techniques that focused on exploiting or combining various saliency signals, the suggested method intends to leverage object signatures that can be detected by any object segmentation method. To create improved spatiotemporal saliency maps, authors [31], combine two separate saliency maps, which are derived using object suggestions of an appearance-dominated approach and a motion-dominated methodology, respectively. This enables the approach to detect significant items in films with high accuracy and resilience under a variety of demanding settings. To begin with, two types of potential foreground objects are extracted using enhanced appearance-based and modified motion-based segmentation techniques. Secondly, the authors have also devised a novel method for filtering the retrieved noisy object pixels and labelling foreground super pixels in each object signature channel using these acquired object signatures. Third, the research has used a foreground connectivity and saliency measure to generate two types of saliency maps, which are then combined using an adaptive fusion technique to produce the final spatiotemporal saliency maps for salient item recognition in a movie. However, the suggested method exceeds existing state-of-the-art approaches in both quantitative and qualitative tests on various hard video benchmarks.

There are several different types of trackers that have been proposed in the literature over the last two decades, with varying degrees of effectiveness. Therefore, in 2013, Smeulders et al. [29], proposed in their research article that a decent tracker should be able to cope with lighting changes, occlusion, clutter, camera motion, poor contrast, secularities, and at least six other factors in a large number of films. However, the goal of the research work [29], was to assess trackers on 315 video pieces, encompassing the elements in a methodical and experimental manner. The authors have shown how survival curves, Kaplan-Meier statistics, and Grubs tests may be used to objectively assess trackers. The F-score is equally effective as the object tracking accuracy (OTA) score in the evaluation practice. The examination of trackers in a wide range of situations gives impartial insight into their strengths and flaws.

In 2017, Jiajun et al. [32], designed a whole framework and addressed two issues in their research work. First, the authors devised an enhanced fisher model to optimise the direction bins, which reflect the key movement directions in a scenario. Second, they have employed a weighted sampling technique and surface fitting to tackle the shortage of sample problem throughout the learning process. The proposed method can produce results that are competitive with those of state-of-the-art methods, according to experiments carried out on actual surveillance films. Moreover, to detect accelerating events in surveillance settings, this research [32], provides a velocity-learning algorithm based on the directional Gaussian model. The suggested approach [32] takes into account the effects of projective transformation on predicting motion velocities in an image plane, making it practical and useful in real-world applications. However, the authors have also investigated the idea that the velocity in the picture plane fluctuates owing to changes in the direction of a moving item in a real-world plane travelling at a constant velocity. Tolerating the influence of projective transform on velocity modelling, the authors [32], have suggested learning the velocities determined at a certain place in multiple direction bins using this theory.

Video analysis and background modelling have been crucial in locating the foreground. In the year 2016, Zuofeng et al. [34], established another research article the authors introduced a unique background modelling strategy for foreground segmentation in this study [34]. The suggested technique is unique in that it combines a background update strategy at both the pixel and object levels in addition to the pixel-based adaptive segmentation method. Foreground detection issues can include updating a static or slow-moving object too quickly or only detecting a portion of the foreground due to the limitations of the current pixel-based adaptive segmentation method, which only updates the background at the pixel level and ignores physical changes to the object. Furthermore, to circumvent these flaws, the authors have divided the foreground pixels into two groups using a counter (illumination and object). The suggested technique retrieves a proper foreground object by regulating the update time of pixels corresponding to an object or an illumination zone. Extensive testing revealed that our system outperforms state-of-the-art foreground identification techniques, even when intermittent object motion is present. In the end, the authors have also examined the efficiency of the proposed technique [34], in a variety of scenarios is demonstrated to demonstrate that the suggested method is suitable for real-time applications.

In 2014, Sedky et al. [27], proposed another research article in which they purposed Spectral-360, a new physics-based change detection approach based on the dichromatic colour reflectance model, has been designed. This technique compares the full-spectrum reflectance to compute a consistent physics-based colour descriptor of the spectral reflectance of surfaces visible in the image from the camera output. of background and foreground pixels to segment the foreground from a static background. Moreover, this method uses explicit predictions about the mechanics that form pictures to detect changes, which is a novel approach to change detection. The presence of a dominating light and the use of diffuse-only reflection are the assumptions considered.

Detecting foreground items in the context of dynamic background movements is difficult. In 2010, Mingjun et al. [33], have published, research article in their research they presents two novel methods to solve the problem by including the geographical and temporal contexts of each pixel into the codebook model. The local spatial dependence between adjoining pixels is included in the spatial context, whereas the previous detection result is included in the temporal context. The first approach used during research [33], incorporates just the geographical environment, resulting in a background representation that is more compact than the usual codebook. The second technique in the article [33], uses a Markov random field model to explicitly characterise the spatio-temporal environment, resulting in more accurate foreground detection. Moreover, extensive experiments are carried out on a variety of dynamic situations to compare the two suggested algorithms to each other and to the traditional codebook approach by the authors.

A research article [6], published in 2020 provides a unique optimisation technique for creating a variety of grid-based layouts. The MILP paradigm provides a rigorous approach that assures element packing, preferential placing, orientation and grouping. Previously, in 2019, a research article [8], concluded that all recommender systems produce reasonable results, with a reliability of up to 40%, with neural network models producing the best results, with an effectiveness of up to 80%. Further to this, another research article [15], in the same year 2019 another research introduces contextual bandits as a machine-learning strategy for assisting in interactive ideation. A CCB may be taught to suggest domain-relevant contributions and to modify their exploration and exploitation approaches. The authors created a CCB for an immersive ideation tool that proposes inspiring and situationally suitable items, as well as exploring and utilising inspirational materials alongside the designer.

In 2017, an article [32], was published in which the work of the authors provides a velocity learning approach for detecting speeding events in surveillance circumstances based on a directional Gaussian model. Two critical difficulties must be solved in order to facilitate the entire system. First, an updated fisher model was created to maximise the direction bins that reflect the key movement directions in a situation. Second, to address the issue of a shortage of samples during the learning phase, a weighted sampling method and surface fitting were used. Another research article [31], has been designed to create revised spatiotemporal saliency maps. The study integrates two separate saliency maps, which are derived using object this enables the approach to achieve high resilience and precision in recognising prominent items in films under a variety of challenging conditions.

In addition to this, another study [16], created a platform called meSchup, which offers an incredibly simple abstraction layer across heterogeneous devices and is backed by a web-based IDE. It is expected that meSchup can serve as the foundation for new applications; meSchup was created by integrating physical computing parts with user interface elements that are already present in a user's environment.

Moreover, authors in a study [34], employed a counter to divide the pixel value into two groups: illumination and object. By manipulating the update time of pixels pertaining to an object or an irradiation zone, the suggested technique retrieves the proper foreground object. Furthermore, other research [30], focused on the practice of sketching layouts, which involves a designer placing, colouring, organising, and defining objects on a canvas. Furthermore, it investigates "sketchploration", a unique notion for utilising interactive optimisation techniques in design tools, specifically for layout sketching.

An article [20], introduces DesignScape, a technology that assists in the design process by providing interactive layout recommendations. The writers created a suggestive interface in which recommendations can be previewed and approved. Second, the writers created an adaptable interface in which items migrate automatically to better arrangement. Another method has been introduced [27], In order to distinguish the surrounding landscape from a stationary background, the author uses image formation models to numerically estimate a physics-based colour descriptor of the reflectance values of surfaces visible in the image from the camera output.

Furthermore, in a research article [29], the performance of suggested trackers has generally been examined on less than 10 films or on special-purpose datasets. The authors goal in this work was to assess trackers systematically and empirically on 315 video pieces addressing the aforementioned features.

Additionally, the research [33], presents two novel solutions for this problem by upgrading the auto encoder model by including the geographical and temporal environment of each pixel. The spatial context includes the local spatial relationship between nearby pixels, whereas the temporal context includes the previous detection result.

Another article [19], introduces Jelly, a versatile design platform that can target a wide range of smart devices and toolkits. Jelly allows a designer to copy elements of an interface from one gadget to another and utilise linked editing to keep the multiple user interfaces in sync. Damask [17], uses design patterns and layers to handle the design of inter-user interfaces in a unique way. Design patterns make it easier to create cross-device user interface designs that are optimised for each target device by incorporating pre-built UI design pieces with significantly diverse interaction patterns depending on the device. Another study [24], shows how we can reduce human tiredness in interactive genetic algorithms by just asking the user to select two interface designs from a set of ten on the screen and only asking the user to select once.

Lastly, an article [13], describes a method for combining these strategies in a case-based architecture and employing a methodology to assist an organisation in capturing, adapting, and refining usability assets from project experiences. The method employs a rule-based tool to express the conditions under which a certain usability resource is relevant.

2.4 Discussion

Below is a summary of all the related research articles that have been studied for the proposed research work. Moreover, this section explains the gaps that have been observed while studying these articles with regard to the identified problem and its proposed solution. This comparison of the research has helped us to work on the design and implementation of the research work in a more efficient and appropriate manner.

A overview of all linked research articles that have been studied for the proposed research study is provided in Table 2.1 below.

System	Techniques	Description
2020 Grid [6].	MILP model	Interactive layout design with integer programming.
2019 García et al. [8].	Data analysis method	Component-based applications using machine learning techniques.
2019 May AI [15].	Contextual bandits	Design ideation with cooperative contextual bandits.
2017 Wen et al. [32].	Directional gaussian model	A gaussian model for automatic detection of speeding events.
2017 Tu et al. [31].	Spatiotemporal saliency model	Using different object characteristics to locate salient objects in video.
2017 meSchup [16].	Referencing by physical manipulation	A programming platform for interconnected smart things.
2016 Zhong et al. [34].	Pixel-based method	Adaptive background modelling method foreground segmentation.
2016 Sketchplore [30].	Predictive model of sensorimotor	Using a layout optimiser, sketch and explore.
2015 Donovan et al. [20].	Interactive layout design	Designscape layout suggestions.
2014 Spectral [27].	Image formation model	A physics-based method for detection change.
2013 Smeulders [29].	Tracking algorithm	Visual tracking an experimental survey.
2010 Wu et al. [33].	Dynamic background technique	codebook-based dynamic background subtraction in a spatiotemporal environment.
2010 Jelly [19].	Single multi device ui design technique	An environment for controlling device consistency across several platforms.
2008 Lin et al. [17].	Damask patterns	Early design and development of cross-device user interfaces using patterns and layers.
2007 Quiroz et al. [24].	XUL interfaces	Interactive evolution of XUL user interfaces.
2001 Henninger [13].	Case-based architecture	Technique for organisational learning that applies usability principles.

Table 2.1: Summary of studied related research studies

Figure 2.1 gives a pictorial image of the design requirements for the recommendations in end-user interface design found in research work.

Design Requirements	GRIDS	Antonio Jesús Fernández-García	Guide	May AI	Damask	DesignScape	Sketchplorer	Interactive Evolution
Recommendations shown in a sidebar	✓	✓	✗	✓	✓	✓	✓	✗
Recommendations shown in a graphical form	✓	✗	✗	✓	✗	✓	✓	✗
Feedback of recommendations	✗	✗	✓	✓	✗	✗	✗	✗
Overview of recommendations	✓	✗	✗	✓	✗	✗	✓	✗

Figure 2.1: Design specifications for recommendations in end-user interface design

3
Design

This chapter gives a detailed overview of design recommendations, considerations, and derived requirements (DR). Furthermore, it explains the tools and technologies that have been used to design our proposed recommendations.

User interface design has grown increasingly difficult for those with limited design expertise. Furthermore, many UI designers find it challenging to modify their UIs to meet changing user wants and preferences. We wish to assist end users in creating their own user interfaces to address these problems. However, because end users frequently lack the required design abilities, end-user UI design poses a significant difficulty.

We looked into the possibility of using design suggestions to respond to the inquiry, "How may end users be assisted during the UI design process?" Analyzing the best way for end users to receive recommendations regarding potential design enhancements is the first step in finding the solution to this question. In order to better understand how end users want to receive design advice, whether they trust user or machine-generated recommendations, and whether they are okay with their interactions being recorded and shared with others in order to enhance the recommendations, our key study question "How to support end users during the UI design process?" is answered by design recommendations and guidelines that have been designed with the

help of Design Requirements [26], which summarise the results of our survey. Because they are viewed as helpful and reliable, design recommendations are an effective technique to assist UI designers during the design process. A UI designer can establish a user interface design recommendation system based on the needs and expectations of the users to adhere to the suggested design.

3.1 Design Recommendations Considerations

Since we want to help end users during the UI design process, we looked at how to best give them design advice to achieve our research objectives. The consideration of how end users should best get advice regarding potential design enhancements is a starting step toward solving this topic. As a result, we considered a research article [26], in which the authors conducted a survey to determine how end-users want to receive design advice, whether they trust user or machine-generated recommendations, and whether they accept that their interactions are logged and shared to improve the recommendations. Based on the findings of the survey [26], the authors provide a set of design criteria for the integration of suggestions in end-user UI design tools. Below are the design criteria for the proposed recommendations:

- **Design Requirement 1 (DR1):** Recommendations should best be shown in a sidebar.
- **Design Requirement 2 (DR2):** Recommendations should be shown graphically.
- **Design Requirement 3(DR3):** Recommendations should cover simply improvements as well as creative aspects.
- **Design Requirement 4 (DR4):** The visibility of recommendations should be controllable.
- **Design Requirement 5 (DR5):** Explanations should be provided on-demand only.
- **Design Requirement 6 (DR6):** Users should be able to provide ratings/feedback on recommendations.
- **Design Requirement 7(DR7):** Users should be able to provide ratings/feedback on explanations.
- **Design Requirement 8(DR8):** An overview of received recommendations should be available.

- **Design Requirement 9(DR9):** Design templates should be offered as an optional starting point.
- **Design Requirement 10(DR10):** The source of recommendations should be selectable.

To what extent should end users be helped during the UI design process in order to improve their UIs? This is the question that these design criteria are intended to address. and we will use these standards to guide the creation of our solution. Five design guidelines and recommendations that were created with DRs' assistance [26], describe the findings of our survey.

A: DR1 Recommendations should be shown in a sidebar.

The recommendations will be displayed on the sidebar in order to give a clear overview of different recommendations which fulfil the design requirements (DR1). Moreover, users are already familiar with the side recommendation as they feel it is an appropriate manner to display and view recommendations [25].

B: DR4 The visibility of recommendations should be controllable.

According to the design requirements (DR4), the visibility of recommendations should be controllable. Therefore, Provide a mechanism so user control the visibility of the recommendation view [25].

C: DR5 Explanations should be provided on-demand only.

According to the design requirements (DR5), recommendations should be shown to the users as per their demands. Therefore, a recommendation has been designed where a button can be clicked to view/show the recommendation as per the UI designer's demand [25].

D: DR7 Users should be able to provide ratings on recommendations.

In order to fulfil the design requirement (DR7), the feedback icon has been designed to allow UI designers to submit their feedback on the basis of the recommendations they are using to create their attractive and innovative UIs [25].

E: DR8 An overview of received recommendations should be available.

According to the design requirement (DR8), the recommendations should be overview when necessary by the UI designers [25].

3.1.1 Derived Requirements

Below are some of the non-functional requirements of the proposed research solution of recommendations for designing UIs.

- **Portability** of a system can be determined when it can be used on an operating system other than the one on which it was built without requiring extensive rewriting. Furthermore, our proposed system should be designed in a portable manner, regardless of the system, so it can be easily used on any computer system.
- **Reliability** is predicated on the assumption that a system or service will execute its intended purpose successfully for a specified period of time or will operate without failure in a specific environment. Therefore, our proposed recommendation system should be designed keeping in mind the ability to provide reliability to users while they design their UIs using our recommendations.
- **Usability** is described as a system's capacity to provide an environment in which its users can do activities in a safe, effective, and efficient manner while having pleasure. Our proposed solution will provide users with a usable solution of recommendation while designing their required UIs.

3.2 eSPACE Authoring Tool

Nonetheless, end-user UI design is a significant difficulty since end users frequently lack the requisite design abilities. The research study [26], offers an end-user smart tool named eSPACE. The eSPACE authoring tool is based on the eSPACE framework, which facilitates the reuse of its components in other applications, either by reusing them in the original form or combining to create a newly reusable components. With the help of the given framework [26], the authors have demonstrated the versatility and extendibility of these components by allowing them to be connected together to move between them and construct new compositions, which is not enabled by many existing systems. End users may customize and use pre-existing components provided by developers to create new, occasionally unexpected functionality. By adopting an authoring technique rather than a programming one, end users can gradually add to the current collection of components.

3.2.1 User Interface Design View of Authoring Tool

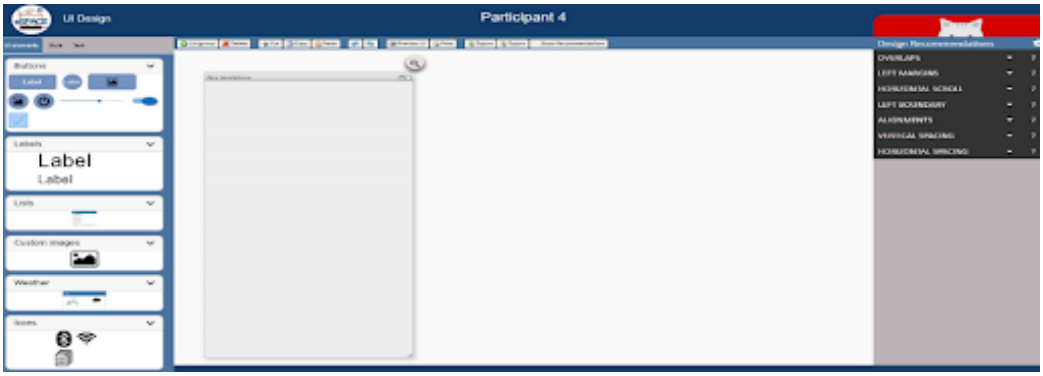

Figure 3.1: UI design recommendations

Figure 3.1 illustrates the interface of the designed controller app for the UI designers. We are working on the design of an experimental prototype user interface design tool (UID) for end users, which is complemented by several design guidelines for this research work. However, this prototype has been built according to the requirements arising from the analysis of several studies. Furthermore, end users should ideally evaluate the tool to determine whether the UID recommendations enable users to create better and more creative user interfaces.

3.3 Technology

The eSPACE authoring tool is implemented using Spring Boot, which uses Java-script for developing the front end of the recommendation system. On the other hand, JavaScript is a computer language that enables one to produce dynamically updated information, handle multimedia, animate visuals, and perform a variety of other things [9]. JavaScript is used to construct interactive web apps. As a result, in order to provide the greatest user experience while creating UI based on end-users needs, we employed Java-script with the Spring Boot framework to create all recommendations for this proposed research work.

3.4 Design Recommendations

This section gives a detailed explanation of the design recommendations mapped with the design requirements (DR); where each recommendation

has been designed in order to fulfil the design requirement criteria. The details about how each DR has been fulfilled with the help of proposed design recommendations can be seen below in Table 4.1; where each DR has been mapped against proposed recommendations, giving an explanation of how DR's have been fulfilled using our proposed recommendations.

3.4.1 Avoid Overlapping Elements

This recommendation holds critical importance as if the elements of the UI design overlap each other, then it might create trouble for users to view elements that is why avoiding an overlap of elements in UI design has been considered an important design recommendation. Therefore, there should be no overlapping between any elements of the interface.

3.4.2 Avoid Elements Going Out of Left Margin

Another functionality of the proposed tool is the left margin. The left margin functionality will help designers to design innovative designs with improved designing skills; the left margin will help users to keep all the components at a reasonable distance.

3.4.3 Avoid Horizontal Scrolling

According to UI design standards, there should be no scroll bars in the UI design because scroll bars do not provide proper UI functionality.

3.4.4 Avoid Element Touching left Boundary

There should be no component touching the boundary. Therefore, we have designed recommendations to notify designers if any component, like buttons or etc., touches the boundary of the user interface.

3.4.5 Avoid Not Aligned Elements

Alignment is one of the core points of consideration. In order to create improved, creative, and innovative user interfaces, we are also offering recommendations for alignment after matching the y-axis and x-axis of the component.

3.4.6 Avoid Horizontal Close Elements

Horizontal spacing is also one of the major concerns while designing user interfaces; therefore, recommendations for both have been designed. According to the UI principle, no two components can be in the range of 15-x distance from each other.

3.4.7 Avoid Vertical Close Elements

Vertical spacing is also one of the major concerns while designing user interfaces; there should be some space between two elements so the user can clearly see each element.

3.4.8 Avoid Name Duplication

Having the same name for more than one element makes users confused. For that, we have to restrict users. For every element, there should be a unique name.

3.5 Proposed Architecture

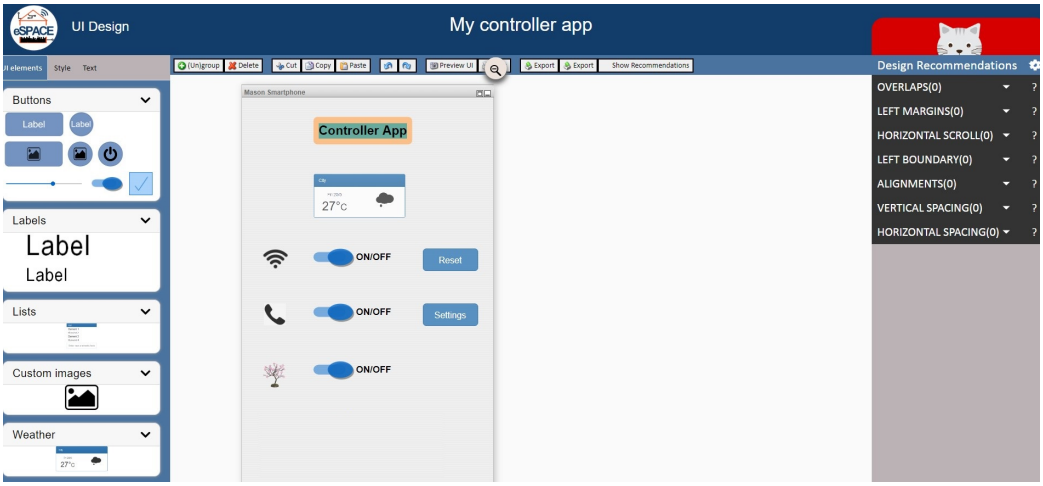

Figure 3.2: Ui design recommendations

Figure 3.2 illustrates the interface of the designed controller app for the UI designers. We are working on the design of an experimental prototype user interface design tool (UID) for end users, which is complemented by several design guidelines for this research work. However, this prototype has

been built according to the requirements arising from the analysis of several studies. Furthermore, end users should ideally evaluate the tool to determine whether the UID recommendations enable users to create better and more creative user interfaces.

4

Implementation

In this chapter, we discuss how our model meets all of the conditions outlined earlier in Chapters 2 and Chapter 3. As a result, we briefly discuss how our approach addresses each need. Furthermore, all of the specified functionalities have been implemented; this implementation is explained in detail in the next sections of the chapter.

4.1 Implemented Design Requirements

This section explains the proposed solution mapped with the design requirements (DR); where each condition has been designed to fulfil the design requirement criteria [25]. The details about how each DR has been fulfilled with the help of the proposed solution can be seen below in Table 4.1; where each design requirement has been mapped against the proposed solution, giving an explanation of how design requirements have been fulfilled using our proposed solution.

Design Requirements	Proposed Solution
Recommendations should best be shown in a sidebar.	Recommendations are displayed in the sidebar so that users can quickly view them.
The visibility of recommendations should be controllable.	The visibility of recommendations can be adjusted.
Explanations should be provided on-demand only.	Explanations are only given when requested.
Users should be able to provide ratings on explanations.	Users can rate the explanations by giving them stars.
An overview of received recommendations should be available.	An overview of received recommendations are given on sidebar.

Table 4.1: Implemented design requirements

4.2 Implemented Design Recommendations

4.2.1 Avoid Overlapping Elements

We create a recommendation such that if any of the UI design elements overlap, the user will receive a recommendation. For instance, if any of the UI interface's elements overlap any of the other UI elements. To put that into practice, the interface's elements are all rectangular in shape. Each element that is a part of the UI grid has x-axis and y-axis coordinates. We know the element's width and height. We can compute an element's top left and bottom right by using it. To determine whether any element on the canvas overlaps another element. Moreover, in the Figure 4.1, it can be clearly seen how we implement it. In addition to this, below illustrates the code for designing the subject recommendation.

- P1(Top left of element 1)
- Q1(Bottom Right element 1)
- P2(Top left of element 2)
- Q2(Bottom Right element 2)

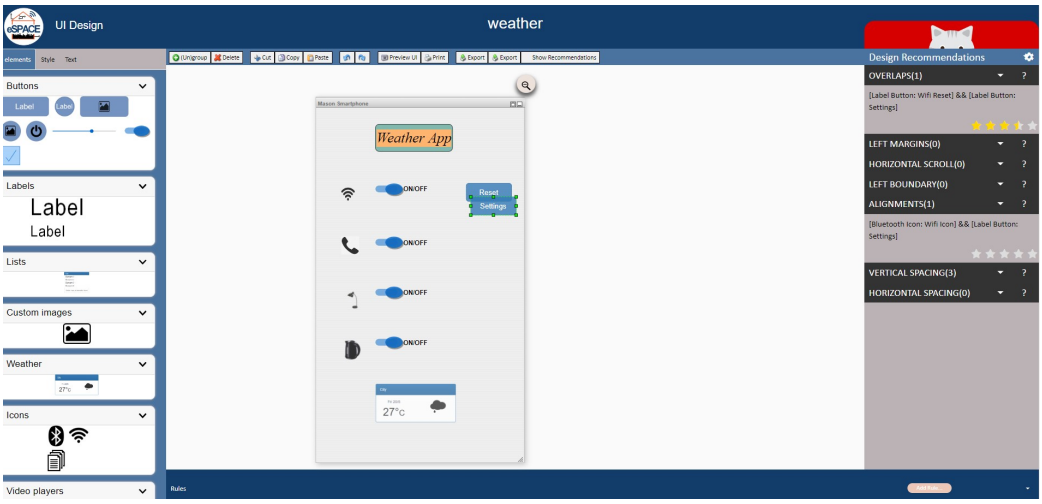

Figure 4.1: Overlapping components

```
function overlap( p1, q1, p2, q2) {

    // To verify that either rectangle is a line
    // Like : p1(-1,0) q1(1,1}) p2(0,-1) q2(0,1)

    // If rectangle is on the left side of other rectangle
    if (p2.x >= q1.x || p1.x >= q2.x) {
        return false;
    }

    // if one rectangle is higher than the other
    if (p1.y >= q2.y || p2.y  >= q1.y) {
        return false;
    }

    // the line cannot have positive overlap
    if (p1.x == q1.x || p2.y == q2.y ||
        p2.x == q2.x || p1.y == q1.y ) {
        return false;
    }

    return true;
}
```

Since most of our elements are rectangular in shape, the first thing we check is if the element is a line. Next, we will look at the y-axis, which indicates whether two items are overlapping if, their x-axes are not the same when they are inserted. It will return false if one element resides on canvas and is below the other element, or vice versa. It will also return false if one element is left side of another element, and we can see that check by using the if statement. If any of the statements that are depicted in the picture return false, it means that there is no overlap between the items, and if all of the assertions return true, it means that the two elements do overlap.

4.2.2 Avoid Elements Going Out of Left Margin

To provide recommendations if elements are going out of left margin we have 15x pixels set as the left margin value. Then, for each element, we will verify that its top left is higher than the margin value that we defined. If this check is successful, it signifies that the element does not touch the left margin. If it fails, then it will appear in the sidebar recommendations with the name of element. Figure 4.2 shows the recommendation design of avoiding elements that go out of the left margin.

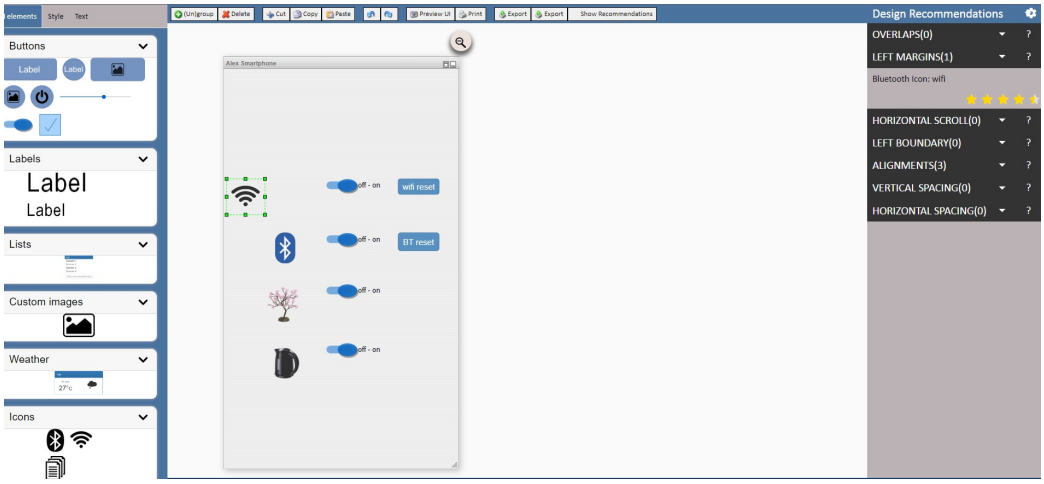

Figure 4.2: Elements going out of left margin

4.2.3 Avoid Horizontal Scrolling

We provide recommendation if any of the component horizontally reside out of the boundary for that we have 15x pixels set as the left margin value. Then, for each element, we will verify that its top left is higher than the margin value that we defined. If this check is successful, it signifies that the element does not touch the left margin. If it fails, the recommendation will appear in the sidebar recommendations. However, Figure 4.3 illustrates the user interface of a recommendation, and in addition to this, the logic implemented for designing the proposed recommendation can be seen in below.

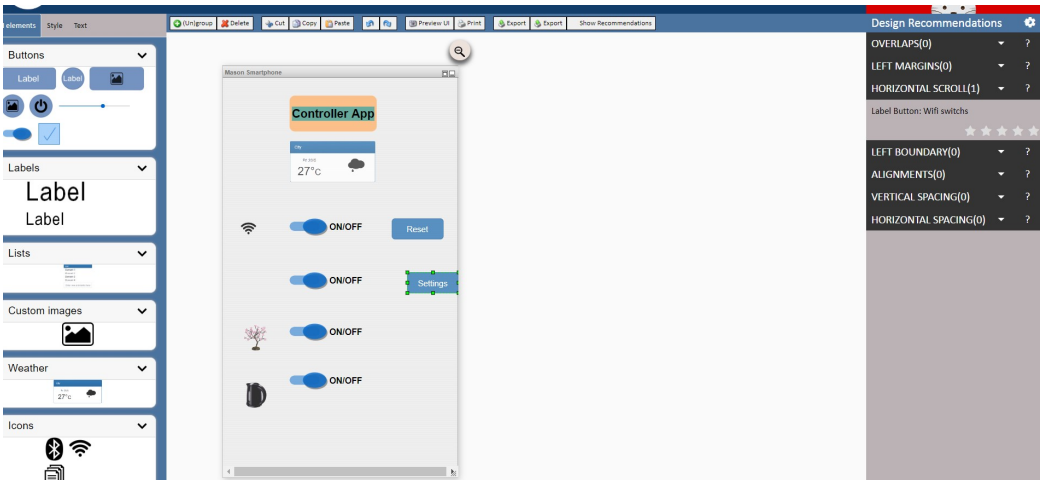

Figure 4.3: Horizontal scrolling

```
if(uielements[tp].left+uielements[tp].width>=$(".mxWindow").width())
            {
                $("#hor_scroll").append();
                hor_scroll++;
            }
```

4.2.4 Avoid Element Touching left Boundary

We make sure that every piece on the canvas fits within its boundaries. For that, we first determine the interface's x-axis, and then we determine whether all of the elements are included within the interface. To do that, we examine each component separately. In order to view the user interface of the subject recommendations, you can see Figure 4.4. Whereas, below illustrates the logic implemented to design a recommendation in order to help UI designers. For that we can check each component x-axis not less than zero that mean if component x-axis is less than zero,the component touches the boundary.

```
if(uielements[tp].left <0)
            {
                $("#left_bond").append();
                left_bond++;

            }
```

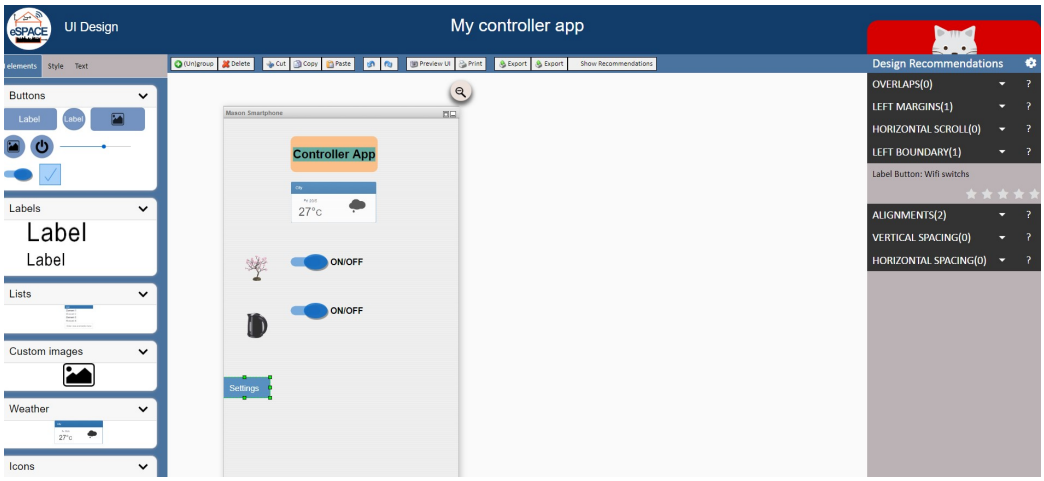

Figure 4.4: Element touching left boundary

4.2.5 Avoid Horizontal Close Elements

To avoid horizontal close element here should be at least a 15x pixels difference between adjacent items to prevent horizontally close elements. To determine whether there is a 15x pixels gap between each element and each other element on the canvas, we compared them. If not, a recommendation will be shown in the sidebar. Figure 4.5 gives a UI overview of the proposed recommendation.

Figure 4.5: Horizontal close elements

4.2.6 Avoid Vertical Close Elements

There should be a minimum of a 15x pixels gap between other items to prevent vertically close elements. To determine whether there is a 15x pixels gap between each element and each other element on the canvas, we compared them. In order to have a clear understanding of the UI the required recommendation; you can view in a Figure 4.6.

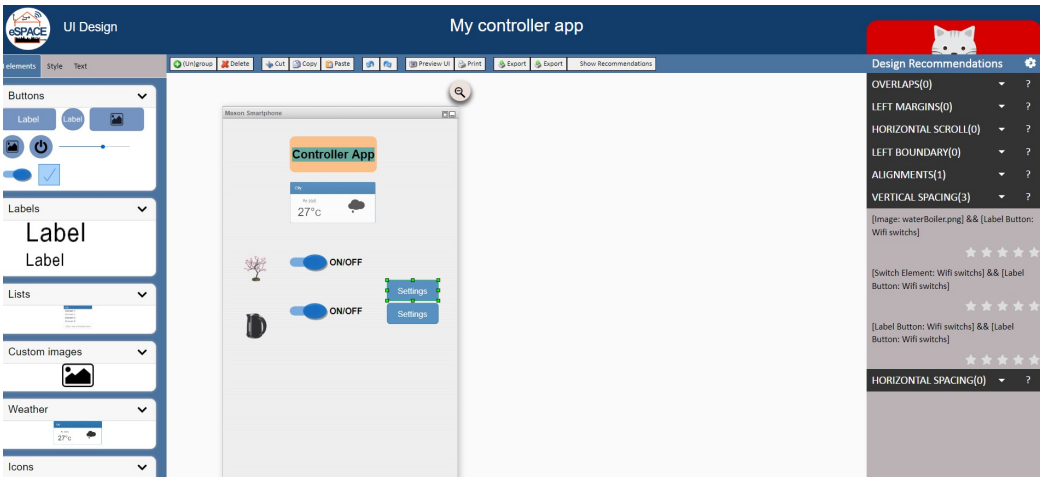

Figure 4.6: Vertical close elements

4.2.7 Avoid Non-aligned Elements

Figure 4.7 gives a pictorial representation of the proposed recommendation, we can check every component with other component with its top-right, top-left, bottom-left, bottom-right and in addition to this, below illustrates the programming logic designed to formulate the mentioned recommendation either they are aligned with other component or not.

```
if (overlap(p1, q1, p2, q2)) {}
else if(topright(p1, q1, p2, q2)){}
else if(topleft(p1, q1, p2, q2)){}
else if(bottomleft(p1, q1, p2, q2)){}
else if(bottomright(p1, q1, p2, q2)){}
else if(p1.x==p2.x){}
else if(p1.y==p2.y){}
else if(p1.x!=p2.x&&p1.y!=p2.y)
{
$("#comp_align").append();
 needtobealign++;
}
```

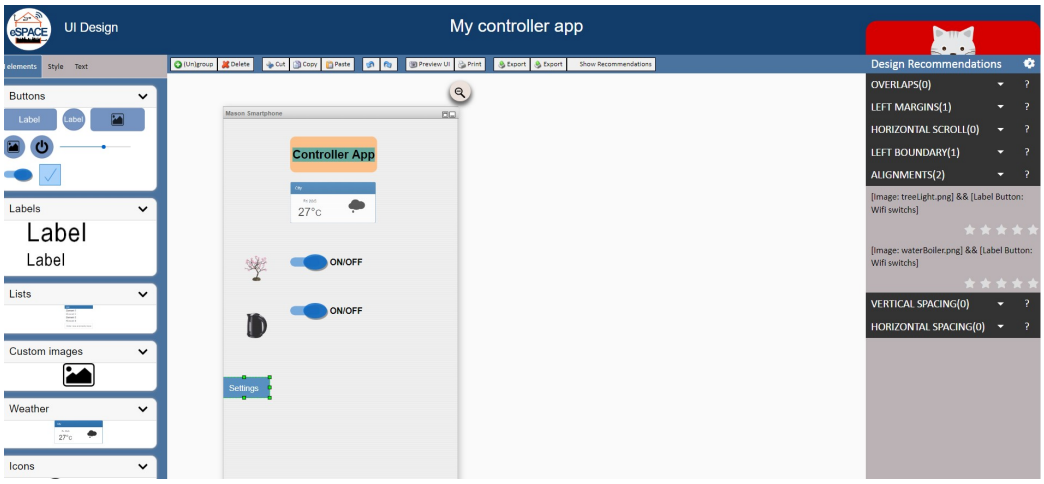

Figure 4.7:
Non-aligned elements

4.2.8 Avoid Name Duplication

To avoid name duplication, before adding an element to the database, we always check to see if there is an existing element with the same name. If one is found, a notice stating that the element name already exists is displayed. Last but not least, Figure 4.6 shows message will display component name already exists.

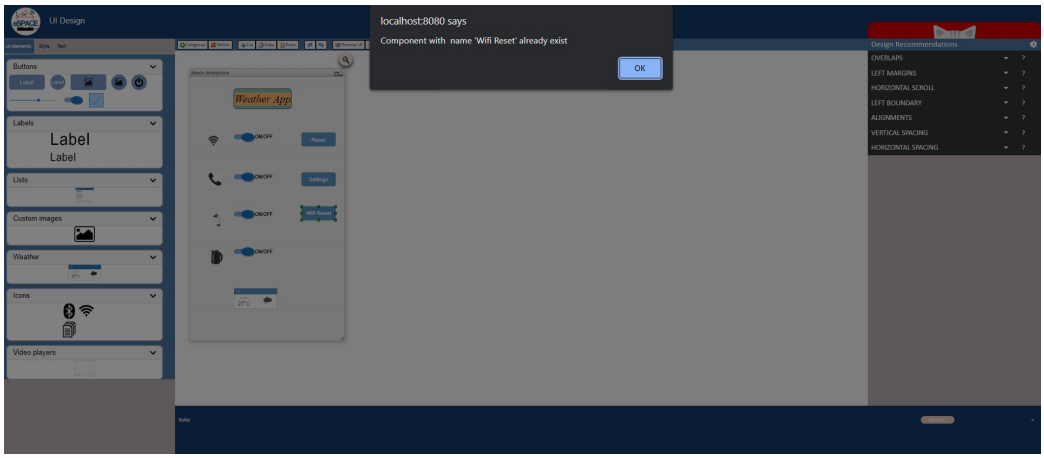

Figure 4.8: Name duplication elements

4.3 Discussion

Figure 4.9 below shows the interface used for our proposed research work. With the help of this tool, we have made recommendations in order to help users design their own UIs. These recommendations will help the UI creator verify whether the designed UI is correct according to the requirements or not.

Firstly, the user will not see any recommendations while creating the UI until someone presses the "show recommendation icon" on the interface. Furthermore, the recommendations can be seen on the sidebar.

Secondly, according to another design requirement, recommendations should be innovative and improved for the UI designers. Therefore, we have added the functionality that will notify if the user uses similar components overlapping each other; this will help designers to avoid overlapping components in their design. This will help UI designers to design their UI with more creativity and innovative ideas.

In order to create improved, creative, and appropriate user interfaces, we are also offering recommendations for alignment, scrolling, distances, margins, and boundaries for which the system will generate recommendations and notify designers to improve it. Lastly, users can also rate the recommendations made in order to help us improve.

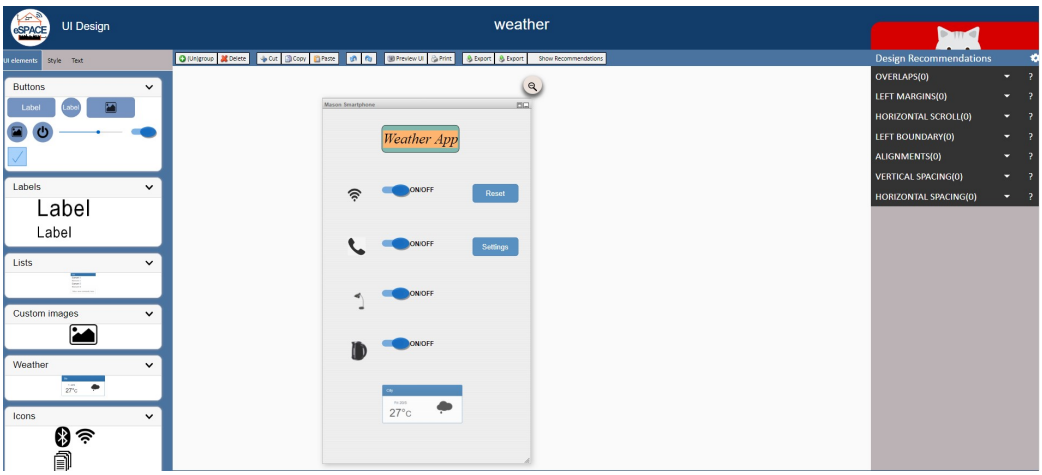

Figure 4.9: User interface of proposed research work

5

Evaluation

This chapter gives an overview of the conducted survey we performed in order to evaluate our solution, details of the survey questions, and an evaluation of the results are described as well. Moreover, this chapter also explains the tasks requested by the users to perform in order to collect results and analyse our proposed solution. In the last section of this chapter, three different scenarios provided to users for performing the survey tasks have been discussed.

Data was gathered throughout the study by taking notes from the participants, which were based on their responses to the post-survey questionnaire. In the remaining paragraphs of this section, we examine the users' final comments and put into practice our suggested solution to provide them with the great experience of developing UI in accordance with their own specifications. The next section of this chapter provides a detailed overview of the questionnaire that has been designed to collect all the responses from the users. Moreover, later in this chapter we will present and discuss all the survey results that have been collected in order to evaluate and analyse the requirements of the users. Last but not least, this chapter also gives an overview of the requirement scenarios that have been established while conducting the survey.

In addition to this, if we look for a broader picture of the survey, then there are three different tasks performed by the users using our tool, which has been hosted on our laptop at a local host. The tasks of the survey have been discussed below in this chapter. In task 1, the users have to make a UI interface. Secondly, in task 2, after designing a UI, users will come across several different recommendations; with the help of these recommendations' users can improve their UI designed applications. Thirdly, in the last task, users will create one more interface with the help of the proposed recommendations. After completing these tasks, users are asked to complete the survey form by filling in their personal information. Then, using Microsoft Reaction Card , users will select words from the given word list and place them in the relevant columns of their choice. Last but not least, based on tasks, i.e. designing UI with recommendations, designers will fill in the questionnaire given at the end of the survey.

5.1 Setup

The eSPACE tool was used in this user study in the same intelligent environment as that which was detailed in the preceeding chapter. Users were expected to do the user study in the prepared smart environment. Later on in this chapter's sessions, we go into greater detail on this.

5.2 Participants

Seven males and six females were recruited from our group of 13 individuals. We chose applicants with little to no programming experience because our target audience is non-programmers.

5.3 Protocols

Using the eSPACE technology, participants were required to complete a number of tasks. We deployed the application in our own computer systems and users were allowed to use our laptop for performing their tasks; Following the assignments with eSPACE, we wrapped up with a survey and a quick interview.

5.4 User Study Presentation

Each participant was given an explanation detailing the three activities they had to perform. Throughout the course of the study, the explanation was available to all the participants.

5.5 Tasks Execution

To evaluate the system, 13 participants participated. We assumed that the users are not familiar with UI design. These users were asked to perform 3 tasks shown in Appendix B with the use of eSPACE authoring tool. In task 1, users were asked to create UI design using drag and drop functionality provided by tool. In task 2, users were asked to improve the UI design by using our recommendation system. In task 3, users were asked to create UI design by taking recommendations from our recommendation system.

5.6 Questionnaire and Interview

We conducted surveys through questionnaires and interviews with 13 participants. First, we get personal information from participants through a post questionnaire by asking them their age, gender, qualifications, and specialisation. Next, we employed the Microsoft Reaction Card approach [2], which involves providing participants with a list of phrases that are shown in Appendix B.2.1 from which they must choose the ones that best characterise the tool they have used, in order to record the participants' initial impressions and the attractiveness of the authoring tool. Moreover, the word set includes terms that are negative, neutral, and positive. Depending on the words that best fit the design recommendation. We selected to have 40 words are shown in Appendix B.2.1 The evaluation process is the same as that was used by the author [26], in his survey; participants might choose five to ten of these terms, categorising them as either extremely relevant or simply relevant, with no more than five words allowed per category. For each participant, the word list was randomly chosen shown in Appendix B.2.1. In the end, a questionnaire asked participants about how simple they found each activity to be, which recommendations they preferred, and whether they had any suggestions to improve recommendations. In a brief interview, we asked participants to explain why they chose particular phrases from the response cards and put them in a particular category. The word list for each participant has been randomly chosen. The Post-Study System Usability Questionnaire (PSSUQ) was the next form that participants had to complete.

5.7 Results

We first go over the phrases that the participants felt best captured their use of the eSPACE authoring tool extended with our recommendations. Then we look over the answers from our questionnaires before summarising our study findings.

On the basis of the research questionnaire and survey conducted, it can be observed that maximum participants have submitted their inputs in favour of the provided recommendations, which shows that the provided recommendations to the users were helpful to them as they were used to design their customised UI application. However, out of 13 participants who took the survey, only 1 participant submitted that he was not comfortable with using the provided recommendations as he found those recommendations difficult and was not able to modify his UI application using the given recommendations.

Another participant filled out the questionnaire and suggested that the provided recommendations were a little confusing and that it was a little difficult to use such recommendations for improving his designed UI application.

However, 11 out of 13 participants responded in a positive manner, stating that the provided recommendations for UI applications were easy to understand, user friendly, simple, and helpful for improving designed UIs.

The overall results of the survey show that the participants (users) of the survey were satisfied as a whole and were quite happy to use the recommendations to improve their UIs.

5.8 Microsoft Reaction Cards

The word cloud in the Figure 5.1 shows a selection of response cards created by participants at the end of our study. The size of a term indicates how often our participants selected it. Additionally, a term that is considered highly relevant is given more weight than a word that is considered relevant.

Figure 5.1: Wordcloud representation of word

The most often used term is "*Helpful*", 8 participants choose the card that had the word helpful on it, when we asked why they choose this word, they confidently responded that the recommendations were organised into various groups that were helpful for improving the UI design. That's why we decided on this word, also because it was simple to employ. The word "*Easy To Use*" and "*Reliable*", these two words are the second most popular word chosen by 7 participants. The word "*Flexible*", was chosen by 8 participants and they indicated that it provided a great deal of flexibility in terms of what they could do with the recommendations. Further choosing "*Difficult*", Participant 1 shown in Appendix C stated that in task 2 when improving UI based on recommendations, they initially struggled with the tool, aligning the components, but it was fine after a time. The word "*Creative*" was chosen by 6 participants since the technology allowed you to make your own apps. Additionally, 4 participants selected the word "*Exciting*", and 5 persons selected the term "*Advanced*", stating that the tool offered functions they were not accustomed to, leading them to think that tool was extremely sophisticated. Another participant wrote down satisfaction since they felt satisfied when making their own applications. With the help of the eSPACE tool, we could still learn more about how people behave and receive insightful feedback. We summarise the findings of our evaluation in this section. Overall, there was a lot of praise for our tool. Our word cloud's most frequently occurring terms were "*helpful*", "*Easy to use*", and "*Reliable*".

5.9 Questionnaire

The first part of the questionnaire was the post-study system usability questionnaire (PSSUQ). Although the purpose of this user study was to evaluate how users would use and interact with our tool, as well as to determine whether they could design UIs using it, we nonetheless provided them with this questionnaire to get a sense of their attitudes. The PSSUQ calculates an overall score based on the user's perceived tool satisfaction. It can also be divided into three subgroups consisting of the system usefulness (SYSUSE), information quality (INFOQUAL) and interface quality (INTERQUAL). Question 1 to 6 are assigned to system usefulness, questions 7 to 12 are assigned to information quality and questions 7 to 12 are assigned for interface qualilty. The average score of the overall score and these subgroups determine how satisfied the user feels with it; the lower the number, the better. Based on the response from our participants, the scores displayed in the Table 5.1 are calculated using tool provided by UIUX[1].

PSSUQ	**Average Score**
SYSUSE	1.42
INFOQUAL	1.56
INTERQUAL	1.67
Overall Score	1.40

Table 5.1: PSSUQ results

If we examine the PSSUQ results, we can find that the overall average score is 1.40 which is an indicator that the user is generally satisfied with the system. Participants regarded the system to be beneficial with a score of 1.56 for information quality and Interface Quality INTERQUAL score is 1.67. we can also infer that overall, our recommendation system did fairly well. It performs best in terms of system usefulness, then information quality, and finally interface quality. The best-rated questions are Question 1, Question 2, and Question 16 from the survey questionnaire. Questions 1 and 2 ask about how easy and simple the system is to use whereas Question 16 asks about general satisfaction with the system.

[1] `https://uiuxtrend.com/pssuq-calculator/`

5.10 Observation and Discussions

We conclude this chapter with examples that show the step-by-step process of how to use the tool. we show the summarised details of the evaluation chapter as a whole to explain our problem. What we observed and what outcomes did we get through our evaluation. Firstly, we put our problem in front of our participants and gave them different 3 tasks and asked them to make a better UI design. We chose 13 participants for this purpose to research the process related to our problem. Next, we asked them to make UI designs first without using our recommendations, and after that, we asked them to improve their UI design by using the recommendations which are shown on the sidebar participants did the same, which we ask for. Additionally, when they are done with this process, we survey these participants through different questionnaires and interviews, which are mentioned above in the results and task execution section. After taking the survey, we observed their working style and their perceptions of every task that they had done to make UI designs.

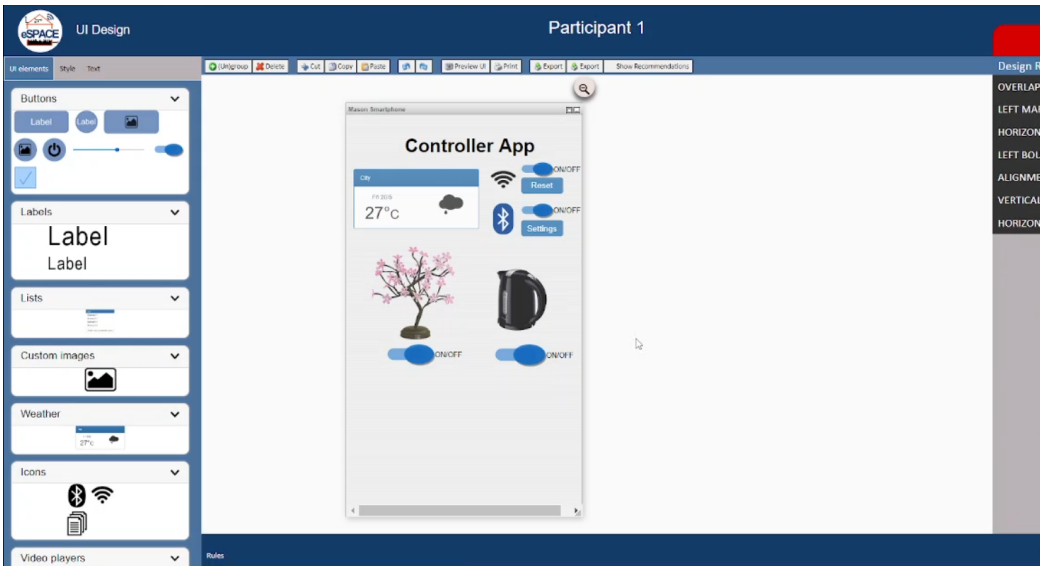

Figure 5.2: Designed UI prior to the recommendations

Moreover, Figure 5.2 shows the UI design by the participant who tried to design an interface without any recommendations provided to them. In contrast to this, Figure 5.3 shows how recommendations helped the designer to design the application in an appropriate manner. This illustrates that our recommendations provide motivation to UI designers as they seem effective and beneficial to the designers.

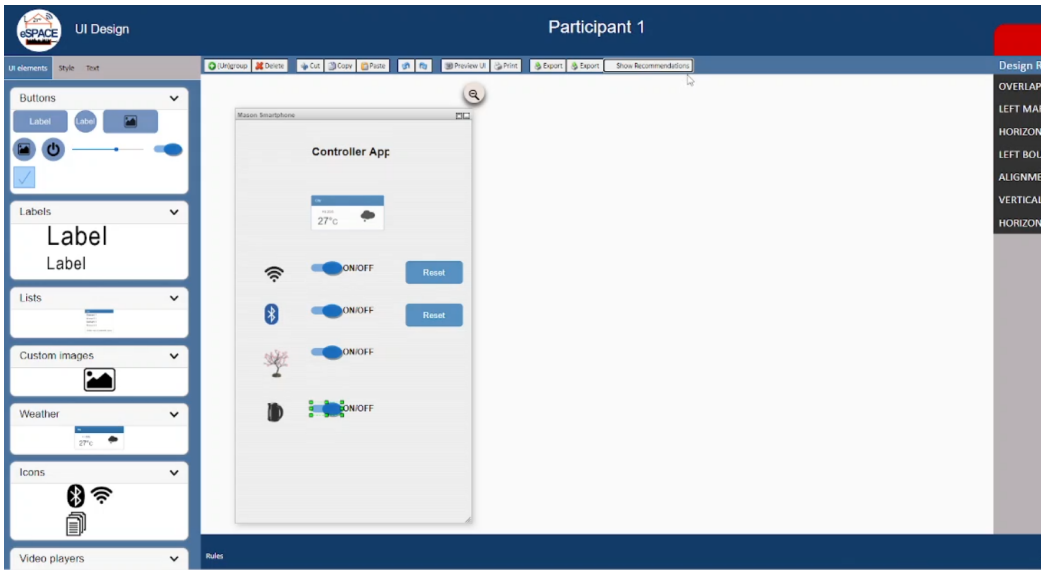

Figure 5.3: Designed UI after the proposed recommendations

6
Conclusion

We now have the chance to summarise the accomplishments that we have also highlighted in this dissertation. We then continue our discussion by considering the accomplishments of the proposed solution, followed by the recommendations for further research.

6.1 Discussion

The proposed solution of providing users with the interactive recommendations to help them design their innovative and creative user interface. It has been observed that designers with no prior knowledge of designing UIs facing several challenges while designing their customised user interfaces. However, UI design plays an important role when users want to design their required UIs; designing wrong or less interactive UIs results in poor performance of the user applications and leads to no user friendly results. On the basis of previous research studies, it has been observed that there are different solutions that can be used for providing an amazing experience of user recommendations to UI designers for developing their UIs. On demand recommendations, brainstorming suggestions, and recommendations in Microsoft PowerPoint are a few of the examples of providing recommendations

to the UI designers.

In addition to the research studies, we have designed a solution which provides UI designers with on demand recommendations so that they can control and view the required recommendations as per their design needs. All the recommendations are displayed on the sidebar of the interface, which can be viewed and hidden as per the demand of the UI designer. Further to this, on demand functionality of the users, the proposed solution also provides users with the ability to share their reviews and feedback with the help of a rating system incorporated into the proposed solution. Users can rate the proposed recommendations on a scale of 1-5 where 5 is the maximum rate and 1 is the minimum rate on the scale.

Along with the recommendations, the proposed solution provides an explanation of the recommendations, which explains why these recommendations are important and how they are useful for the UI designs.

Further to the design of the proposed solution, we have decided to conduct a survey for the purpose of evaluating proposed recommendations. The survey questions all the participants whether the proposed recommendations are helpful or not. However, the results in Chapter 5 show that the proposed recommendations were helpful and useful to all the UI designers for designing their customised and innovative UIs. Moreover, the results also showed that few participants stated that some of the recommendations were difficult and confusing to understand. However, these results gave us room to improve our recommendations in the future.

In addition to this, the survey results have been observed using MCR (Microsoft Reaction Card). According to the MCR, the most used word by the participants of the survey was "helpful", which gives clear results that the proposed recommendations are helpful to the users as per their requirements for designing UIs. Moreover, the results in Chapter 5 also show that the proposed solution is easy and simple to use and gives satisfactory outcomes to the UI designers as per their needs and requirements.

6.2 Future Work

On the basis of the design requirements (DR) discussed in Chapter 3 we have designed different recommendations that have been provided to users. However, due to some development constraints, we were not able to cater to all the design requirements. Therefore, design requirement “Recommendations should be shown graphically” can be considered as future work.

Firstly, the design requirement of showing recommendations graphically has not been implemented in our proposed research work. For the current system, the recommendations can only be seen in textual format on a sidebar. However, this can be enhanced by using graphics and the same recommendations can be displayed graphically on the side bar. As we have observed and studied from the previous related studies, understanding proposed recommendations in a graphical format will help designers to understand the recommendations in a more easy and user friendly manner. Further to this, we also have a plan to design these graphical recommendations in such a manner that once a designer clicks the component to receive recommendations, it shall highlight the component, explaining that the particular recommendation is related to the specific component; this will help the designers to understand the recommendation better.

Secondly, another area of improvement in the future is the feedback of the recommendation. However, we are providing the rating option in our proposed solution but the feedback option has not been enabled currently. Therefore, in the future we are looking forward to designing a functionality to collect feedback from the participants in order to keep on improving our recommendations. The feedback explanation of recommendations is important as it provides guidelines to users to enhance their innovative UIs; nevertheless, this also fulfils the design requirement DR7 of the research study [25]. Last but not least, this feedback from the designers will also help us in deciding our design criteria for the proposed recommendations.

Thirdly, it has been observed that it is important to know the source of the recommendation. Therefore, we are also considering that we should provide the information regarding the source of the recommendation so that the designer shall have complete information about the recommendation. In addition to this, selecting recommendations is also one of our major insights to be considered in the future. Therefore, we shall design an option that will provide users with the liberty to customise the recommendation according to their needs and requirements; this will help designers to view and use only the recommendations related to their requirements.

Last but not least, automating recommendation improvement is also one of the important factors to be considered in the future. However, we have planned to design a semi automated system for improving design recommendations. which will help users to resolve their design recommendations automatically as per the design requirements.

As we outlined in earlier sections, in order to create a pleasant customer experience, each of our ideas will require user feedback.

We would like to conclude this conversation with a famous quote from Steve Jobs:

"*Design is just not what it looks like and feels like; design is how it works*"

A

Appendix A

A.1 Post-Survey Questionnaire

User Study Informed Consent Form

Study administrator is: Hammad Ali

Participant is: _____

Participant number: _____

This is a study about Helping End Users Design Better User Interfaces. Our goal is to make the creation of user interfaces easier for end-users by giving them design recommendations. Your participation will help us achieve this goal.

In this session, you will be working with the Espace prototype running in the web browser. We will ask you to perform tasks a typical user might do, described in the scenario that you will receive. The study administrator will sit in the same room, quietly observing and taking notes. This person will sit near you and help you if you are stuck or have questions.

All information collected in the session belongs to the VUB WISE lab and will be used for internal purposes. We will videotape and/or audiotape the session. We may publish our results from this and other sessions in our reports, but all such reports will be anonymized and will not include your name.

We are not testing you. We want to find out what aspects need improvements, so we can make it better. You may take breaks as needed and stop your participation in the study at any time.

Statement of Informed Consent

I have read the description of the study and of my rights as a participant. I voluntarily agree to participate in the study.

Print Name: _____

Signature: _____

Date: _____

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: “Helping End Users Designing Better UIs”

S.no	Personal information
1.	Gender ❑ Male ❑ Female ❑ Others
2.	Age group (in years) ❑ Below 25 ❑ 25-35 ❑ 36-45 ❑ > 45
3.	Qualification**:** ❑ Under Graduate ❑ Post Graduate ❑ Ph.D
4.	Specialization:

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)

`

B

Appendix B

Evaluation

B.1 Task Document

User Study

During this user study you will be given **three tasks** which you will complete using the eSPACE authoring tool. For the first two tasks you will be creating a user interface for an application meant to be used on a smartphone. For the last task you will be creating a user interface for an application meant to be used on a tablet. If you have questions about the tasks or the tool do not hesitate to ask!

Task 1

Imagine that you want to create an user interface for your smartphone. You can do this using the tool opened in the browser in front of you, simply by dragging and dropping user interface elements from the left sidebar to right.

The application you want to create is called “My controller app” and is composed of five different components. The first one is the **weather component** which shows the weather in Brussels. The second one is the **Wi-Fi component** which has two buttons: one for turning on and off the Wi-Fi, and the other for resetting it. Next, there is the **Bluetooth component** which has a button for turning on and off Bluetooth along with a button giving access to some Bluetooth options (e.g. changing the name of the Bluetooth device and other the default Bluetooth settings). The fourth component comprises control over a **study lamp** which has a button for turning it on and off. Last but not least, there is a component to control the water boiler kettle which has a button for turning on and off the kettle.

Task 2

After finishing the creation of your first user interface (task 1), click the “show recommendation" button. Once this button pressed, you will see some design recommendations in sidebar on the right. Try to use the design suggestions shown in the sidebar to improve the user interface you just created.

Task 3

Now that you are familiar with the use of design recommendations (see task 2), you want to create a second user interface, one for your tablet. This time you can make use of the design recommendations/suggestions while creating your application. The name of the application is: “My video app”. The user interface you want to create has again five components and is inspired by the YouTube interface. Therefore, the first component is the **video player** which simply shows the video you want to watch. Next, the second component comprises a **list of videos**, representing the video that have been watched, the one that is currently playing and the next one that will be played after that. This component also has some buttons to move forward or backward in the list of videos. The third component is the **title & info** component which holds the title of the video that is currently playing as well as some descriptive information. Next, there is the **comment section**, where users can leave a comment on the video they are watching. Lastly, there is a component to **leave a thumbs up or down** to the video.

B.2 Post-Survey Questionnaires

B.2.1 Microsoft Reaction Card

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	**Relevant**

Figure B.1: List of words

B.2.2 Usability Questionnaire

Strongly Agree **Strongly Disagree**

Sno	Performance Expectancy	1	2	3	4	5	6	7	N.A.
1.	Overall, I am satisfied with how easy it is to use this tool.								
2.	It was simple to use this tool.								
3.	I was able to complete the tasks and scenarios quickly using this tool.								
4.	I felt comfortable using this tool.								
5.	It was easy to learn to use this tool.								
6.	I believe I could become productive quickly using this tool.								
7.	The tool gave suggestions that clearly told me how to fix problems.								
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.								
9.	The information provided with this tool was clear.								
10.	It was easy to find the information I needed.								
11.	The information was effective in helping me complete the tasks and scenarios.								
12.	The organization of information on the tool screens was clear.								
13.	The interface of this tool was pleasant.								
14.	I liked using the interface of this tool.								
15.	This tool has all the functions and capabilities I expect it to have.								
16.	Overall, I am satisfied with this tool.								

B.2.3 Informative Questionnaire

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES | NO**
   a. If Yes, how did they help you?

   _____

   _____

   _____

   b. If No, why did they not help?

   _____

   _____

   _____

2. Did you use the recommendation rating system? **YES | NO**
   a. Do you think it is useful to have such a rating system?

   _____

   _____

   _____

3. Any suggestions for improvements?

   _____

   _____

   _____

Thanks For Your Participation

4

C

Appendix C

C.1 Participant Data

Participant 01

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☑ Male ☐ Female ☐ Others
2.	Age group (in years) ☐ Below 25 ☑ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☐ Under Graduate ☐ Post Graduate ☑ Ph.D
4.	Specialization: Computer Science.

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
				✓

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
	✓			

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Time Consuming	Aduane
Flexible	Difficult
Useful	Familiar
Helpful	Overwhelming
Simplistic	Innovative
Engaging	Confusing

Part 2 on 3

		Strongly Agree						Strongly Disagree	
Sno	**Performance Expectancy**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N.A.**
1.	Overall, I am satisfied with how easy it is to use this tool.	✓							
2.	It was simple to use this tool.		✓						
3.	I was able to complete the tasks and scenarios quickly using this tool.		✓						
4.	I felt comfortable using this tool.	✓							
5.	It was easy to learn to use this tool.	✓							
6.	I believe I could become productive quickly using this tool.		✓						
7.	The tool gave suggestions that clearly told me how to fix problems.	✓							
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.		✓						
9.	The information provided with this tool was clear.	✓							
10.	It was easy to find the information I needed.	✓							
11.	The information was effective in helping me complete the tasks and scenarios.	✓							
12.	The organization of information on the tool screens was clear.		✓						
13.	The interface of this tool was pleasant.		✓						
14.	I liked using the interface of this tool.		✓						
15.	This tool has all the functions and capabilities I expect it to have.	✓							
16.	Overall, I am satisfied with this tool.	✓							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES | NO**
   a. If Yes, how did they help you?

   Yes, the recommendations are helpful in designing interfaces.

   b. If No, why did they not help?

2. Did you use the recommendation rating system? **YES | NO**
   a. Do you think it is useful to have such a rating system?

   No, I did not use recommendation rating system.

3. Any suggestions for improvements?

   Canvas is not very smooth. If show recommendation ~~changes~~ predict different changes than it will be much better.

Thanks For Your Participation

Participant 02

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☑ Male ☐ Female ☐ Others
2.	Age group (in years) ☐ Below 25 ☑ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☐ Under Graduate ☑ Post Graduate ☐ Ph.D
4.	Specialization: Electro - Mechanical Engg. [Mechatronics]

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
			✓	

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
			✓	

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Innovative.	Attractive.
Useful.	Flexible.
Easy to use.	Straight Forward.
Comfortable	Trustworthy.
Exciting.	Consistent.

Part 2 on 3

Strongly Agree **Strongly Disagree**

Sno	Performance Expectancy	1	2	3	4	5	6	7	N.A.
1.	Overall, I am satisfied with how easy it is to use this tool.		✓						
2.	It was simple to use this tool.	✓							
3.	I was able to complete the tasks and scenarios quickly using this tool.		✓						
4.	I felt comfortable using this tool.			✓					
5.	It was easy to learn to use this tool.			✓					
6.	I believe I could become productive quickly using this tool.	✓							
7.	The tool gave suggestions that clearly told me how to fix problems.		✓						
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.		✓						
9.	The information provided with this tool was clear.		✓						
10.	It was easy to find the information I needed.	✓							
11.	The information was effective in helping me complete the tasks and scenarios.	✓							
12.	The organization of information on the tool screens was clear.		✓						
13.	The interface of this tool was pleasant.	✓							
14.	I liked using the interface of this tool.	✓							
15.	This tool has all the functions and capabilities I expect it to have.		✓						
16.	Overall, I am satisfied with this tool.	✓							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES | NO**
   a. If Yes, how did they help you?
   Information is quick suggestions and easy to understand.

   b. If No, why did they not help?

2. Did you use the recommendation rating system? **YES | NO**
   a. Do you think it is useful to have such a rating system?
   Yes.

3. Any suggestions for improvements?
   None.

Thanks For Your Participation

Participant 03

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☑ Male ☐ Female ☐ Others
2.	Age group (in years) ☐ Below 25 ☑ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☐ Under Graduate ☑ Post Graduate ☐ Ph.D
4.	Specialization: Business Management

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
				✓

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
				✓

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Innovative	Confusing
easy to use	Preticable
Satisfying	effective
Reliable	efficient
Flexible	Inspiring

Part 2 on 3

		Strongly Agree						Strongly Disagree	
Sno	**Performance Expectancy**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N.A.**
1.	Overall, I am satisfied with how easy it is to use this tool.	✓							
2.	It was simple to use this tool.	✓		✓					
3.	I was able to complete the tasks and scenarios quickly using this tool.			✓					
4.	I felt comfortable using this tool.	✓							
5.	It was easy to learn to use this tool.	✓							
6.	I believe I could become productive quickly using this tool.		✓						
7.	The tool gave suggestions that clearly told me how to fix problems.	✓							
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.			✓					
9.	The information provided with this tool was clear.	✓							
10.	It was easy to find the information I needed.	✓							
11.	The information was effective in helping me complete the tasks and scenarios.	✓							
12.	The organization of information on the tool screens was clear.	✓							
13.	The interface of this tool was pleasant.		✓						
14.	I liked using the interface of this tool.	✓							
15.	This tool has all the functions and capabilities I expect it to have.	✓							
16.	Overall, I am satisfied with this tool.	✓							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES | NO**
   a. If Yes, how did they help you?
   Yes It gave you suggestions and instructions which are very clear. With that its easy to design
   b. If No, why did they not help?

2. Did you use the recommendation rating system? **YES | NO**
   a. Do you think it is useful to have such a rating system?
   yes you can tell the developer which fuction needs more attention otherthan going through all the application.

3. Any suggestions for improvements?
   Alingment of elements takes time maybe it could be bit more easier

Thanks For Your Participation

Participant 04

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☐ Male ☒ Female ☐ Others
2.	Age group (in years) ☒ Below 25 ☐ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☒ Under Graduate ☐ Post Graduate ☐ Ph.D
4.	Specialization: SOCIAL SCIENCES

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
		X		

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
				X

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Reliable	Innovative
Helpful	Relevant
USEful	familiar
Effective	flexible
Creative	Comforlable.

Part 2 on 3

Strongly Agree **Strongly Disagree**

Sno	Performance Expectancy	1	2	3	4	5	6	7	N.A.
1.	Overall, I am satisfied with how easy it is to use this tool.	X							
2.	It was simple to use this tool.	X							
3.	I was able to complete the tasks and scenarios quickly using this tool.	X							
4.	I felt comfortable using this tool.	X							
5.	It was easy to learn to use this tool.	X							
6.	I believe I could become productive quickly using this tool.	X							
7.	The tool gave suggestions that clearly told me how to fix problems.	X							
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.	X							
9.	The information provided with this tool was clear.	X							
10.	It was easy to find the information I needed.		X						
11.	The information was effective in helping me complete the tasks and scenarios.		X						
12.	The organization of information on the tool screens was clear.	X							
13.	The interface of this tool was pleasant.	X							
14.	I liked using the interface of this tool.	X							
15.	This tool has all the functions and capabilities I expect it to have.	X							
16.	Overall, I am satisfied with this tool.	X							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES** | **NO**
   a. If Yes, how did they help you?

   The recommendations made it very accessible to design interfaces

   b. If No, why did they not help?

2. Did you use the recommendation rating system? **YES** | **NO**
   a. Do you think it is useful to have such a rating system?

   Yes, as it allows you to give feedback

3. Any suggestions for improvements?

Thanks For Your Participation

Participant 05

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☐ Male ☑ Female ☐ Others
2.	Age group (in years) ☐ Below 25 ☑ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☐ Under Graduate ☑ Post Graduate ☐ Ph.D
4.	Specialization: Civil Engineering

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
			✓	

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
			✓	

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Advanced	Innovative
Helpful	Relevant
useful	Reliable
Exciting	Creative
Simplistic	Easy to use

Part 2 on 3

Sno	Performance Expectancy	1 (Strongly Agree)	2	3	4	5	6	7 (Strongly Disagree)	N.A.
1.	Overall, I am satisfied with how easy it is to use this tool.	X							
2.	It was simple to use this tool.		X						
3.	I was able to complete the tasks and scenarios quickly using this tool.		X						
4.	I felt comfortable using this tool.		X						
5.	It was easy to learn to use this tool.	X							
6.	I believe I could become productive quickly using this tool.	X							
7.	The tool gave suggestions that clearly told me how to fix problems.		X						
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.	X							
9.	The information provided with this tool was clear.	X							
10.	It was easy to find the information I needed.		X						
11.	The information was effective in helping me complete the tasks and scenarios.	X							
12.	The organization of information on the tool screens was clear.	X							
13.	The interface of this tool was pleasant.	X							
14.	I liked using the interface of this tool.	X							
15.	This tool has all the functions and capabilities I expect it to have.		X						
16.	Overall, I am satisfied with this tool.	X							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES** | **NO**
   a. If Yes, how did they help you?

   _____

   _____

   _____

   b. If No, why did they not help?

   _____

   _____

   _____

2. Did you use the recommendation rating system? **YES** | **NO**
   a. Do you think it is useful to have such a rating system?

   _____

   _____

   _____

3. Any suggestions for improvements?

   _____

   _____

   _____

Thanks For Your Participation

Participant 06

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☐ Male ☑ Female ☐ Others
2.	Age group (in years) ☐ Below 25 ☑ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☐ Under Graduate ☑ Post Graduate ☐ Ph.D
4.	Specialization: Computer Science.

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
				✓

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
				✓

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Innovative	Simplistic
Creative	Advanced
Satisfying	Relevant
Familiar	Consistent
Helpful	Organized

Part 2 on 3

Sno	Performance Expectancy	1 (Strongly Agree)	2	3	4	5	6	7 (Strongly Disagree)	N.A.
1.	Overall, I am satisfied with how easy it is to use this tool.	✓							
2.	It was simple to use this tool.	✓							
3.	I was able to complete the tasks and scenarios quickly using this tool.	✓							
4.	I felt comfortable using this tool.	✓							
5.	It was easy to learn to use this tool.		✓						
6.	I believe I could become productive quickly using this tool.	✓							
7.	The tool gave suggestions that clearly told me how to fix problems.		✓						
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.		✓						
9.	The information provided with this tool was clear.		✓						
10.	It was easy to find the information I needed.	✓							
11.	The information was effective in helping me complete the tasks and scenarios.		✓						
12.	The organization of information on the tool screens was clear.	✓							
13.	The interface of this tool was pleasant.	✓							
14.	I liked using the interface of this tool.		✓						
15.	This tool has all the functions and capabilities I expect it to have.	✓							
16.	Overall, I am satisfied with this tool.	✓							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES** | **NO**

   a. If Yes, how did they help you?

   Recommendations Provided by tool help me to make better interface.

   b. If No, why did they not help?

2. Did you use the recommendation rating system? **YES** | **NO**

   a. Do you think it is useful to have such a rating system?

   Indeed, it is useful to give feedback.

3. Any suggestions for improvements?

Thanks For Your Participation

Participant 07

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☐ Male ☒ Female ☐ Others
2.	Age group (in years) ☒ Below 25 ☐ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☒ Under Graduate ☐ Post Graduate ☐ Ph.D
4.	Specialization: English and Dutch Literature

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
				x

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
				x

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant

Part 2 on 3

		Strongly Agree						Strongly Disagree	
Sno	**Performance Expectancy**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N.A.**
1.	Overall, I am satisfied with how easy it is to use this tool.	✓							
2.	It was simple to use this tool.	✓							
3.	I was able to complete the tasks and scenarios quickly using this tool.	✓							
4.	I felt comfortable using this tool.	✓							
5.	It was easy to learn to use this tool.	✓							
6.	I believe I could become productive quickly using this tool.	✓							
7.	The tool gave suggestions that clearly told me how to fix problems.	✓							
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.	✓							
9.	The information provided with this tool was clear.		✓						
10.	It was easy to find the information I needed.		✓						
11.	The information was effective in helping me complete the tasks and scenarios.	✓							
12.	The organization of information on the tool screens was clear.	✓							
13.	The interface of this tool was pleasant.			✓					
14.	I liked using the interface of this tool.		✓						
15.	This tool has all the functions and capabilities I expect it to have.	✓							
16.	Overall, I am satisfied with this tool.		✓						

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES | NO**
   a. If Yes, how did they help you?

   Yes, it helped me to allign the elements

   b. If No, why did they not help?

   /

2. Did you use the recommendation rating system? **YES | NO**
   a. Do you think it is useful to have such a rating system?

   Yes, it allowed to give me the needed feedback.

3. Any suggestions for improvements?

   The design could be more creative.

Thanks For Your Participation

Participant 08

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☐ Male ☑ Female ☐ Others
2.	Age group (in years) ☐ Below 25 ☑ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☑ Under Graduate ☐ Post Graduate ☐ Ph.D
4.	Specialization: Computer Science

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
				✓

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
				✓

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Relevant	Exciting
Comfortable	Inspiring
Satisfying	Easy to use
Straight forward	Organized
Creative	Advanced
helpful	Effective

Part 2 on 3

		Strongly Agree						Strongly Disagree	
Sno	**Performance Expectancy**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N.A.**
1.	Overall, I am satisfied with how easy it is to use this tool.	✓							
2.	It was simple to use this tool.	✓							
3.	I was able to complete the tasks and scenarios quickly using this tool.		✓						
4.	I felt comfortable using this tool.	✓							
5.	It was easy to learn to use this tool.	✓							
6.	I believe I could become productive quickly using this tool.	✓							
7.	The tool gave suggestions that clearly told me how to fix problems.	✓							
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.	✓							
9.	The information provided with this tool was clear.	✓							
10.	It was easy to find the information I needed.	✓							
11.	The information was effective in helping me complete the tasks and scenarios.	✓							
12.	The organization of information on the tool screens was clear.		✓						
13.	The interface of this tool was pleasant.		✓						
14.	I liked using the interface of this tool.		✓						
15.	This tool has all the functions and capabilities I expect it to have.	✓							
16.	Overall, I am satisfied with this tool.	✓							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES | NO**
   a. If Yes, how did they help you?

   Yes, by providing information about the alignments

   b. If No, why did they not help?

   N/A

2. Did you use the recommendation rating system? **YES | NO**
   a. Do you think it is useful to have such a rating system?

   Yes, it is helpful for further recommendations

3. Any suggestions for improvements?

   Good work!

Thanks For Your Participation

Participant 09

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☑ Male ☐ Female ☐ Others
2.	Age group (in years) ☐ Below 25 ☑ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☑ Under Graduate ☐ Post Graduate ☐ Ph.D
4.	Specialization: Computer Science

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
				✓

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
				✓

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Attractive	Predictable
Inspiring	Engaging
Effective	Advanced
Simplistic	Helpful
Satisfying	Reliable

Part 2 on 3

Sno	Performance Expectancy	1 (Strongly Agree)	2	3	4	5	6	7 (Strongly Disagree)	N.A.
1.	Overall, I am satisfied with how easy it is to use this tool.	✓							
2.	It was simple to use this tool.	✓	✓						
3.	I was able to complete the tasks and scenarios quickly using this tool.		✓						
4.	I felt comfortable using this tool.		✓						
5.	It was easy to learn to use this tool.	✓							
6.	I believe I could become productive quickly using this tool.		✓						
7.	The tool gave suggestions that clearly told me how to fix problems.		✓						
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.		✓						
9.	The information provided with this tool was clear.		✓						
10.	It was easy to find the information I needed.		✓						
11.	The information was effective in helping me complete the tasks and scenarios.		✓						
12.	The organization of information on the tool screens was clear.	✓							
13.	The interface of this tool was pleasant.		✓						
14.	I liked using the interface of this tool.	✓							
15.	This tool has all the functions and capabilities I expect it to have.		✓						
16.	Overall, I am satisfied with this tool.	✓							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES** | **NO**

   a. If Yes, how did they help you?

   Recommendations help me while making design and improving design

   b. If No, why did they not help?

2. Did you use the recommendation rating system? **YES** | **NO**

   a. Do you think it is useful to have such a rating system?

3. Any suggestions for improvements?

   NO.

Thanks For Your Participation

Participant 10

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☑ Male ☐ Female ☐ Others
2.	Age group (in years) ☐ Below 25 ☑ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☐ Under Graduate ☑ Post Graduate ☐ Ph.D
4.	Specialization: Energy Engineering (Masters)

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
		✓		

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
✓				

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Reliable	Effective
Engaging	forward
Satisfying	Organized.
Comfortable	Overwelming
Creative	Approachable
Consistent.	Complex

Part 2 on 3

		Strongly Agree						Strongly Disagree	
Sno	**Performance Expectancy**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N.A.**
1.	Overall, I am satisfied with how easy it is to use this tool.			✓					
2.	It was simple to use this tool.	✓							
3.	I was able to complete the tasks and scenarios quickly using this tool.			✓					
4.	I felt comfortable using this tool.		✓						
5.	It was easy to learn to use this tool.	✓							
6.	I believe I could become productive quickly using this tool.	✓							
7.	The tool gave suggestions that clearly told me how to fix problems.		✓						
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.			✓					
9.	The information provided with this tool was clear.		✓						
10.	It was easy to find the information I needed.				✓				
11.	The information was effective in helping me complete the tasks and scenarios.				✓				
12.	The organization of information on the tool screens was clear.	✓							
13.	The interface of this tool was pleasant.		✓						
14.	I liked using the interface of this tool.			✓					
15.	This tool has all the functions and capabilities I expect it to have.			✓					
16.	Overall, I am satisfied with this tool.	✓							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES | NO**
   a. If Yes, how did they help you?
   Yes, Its easy to use because of the user interface.
   b. If No, why did they not help?

2. Did you use the recommendation rating system? **YES | NO**
   a. Do you think it is useful to have such a rating system?
   Indeed!

3. Any suggestions for improvements?
   Its already nice to use!

Thanks For Your Participation

Participant 11

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☒ Male ☐ Female ☐ Others
2.	Age group (in years) ☒ Below 25 ☐ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☒ Under Graduate ☐ Post Graduate ☐ Ph.D
4.	Specialization:

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
				X

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
				X

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Effective	Familiar
Simplistic	Helpful
Easy to Use	Straight Forward
Approacable	Relevant
Organized	Reliable

Part 2 on 3

		Strongly Agree						Strongly Disagree	
Sno	**Performance Expectancy**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N.A.**
1.	Overall, I am satisfied with how easy it is to use this tool.	X							
2.	It was simple to use this tool.	X							
3.	I was able to complete the tasks and scenarios quickly using this tool.	X							
4.	I felt comfortable using this tool.	X							
5.	It was easy to learn to use this tool.		X						
6.	I believe I could become productive quickly using this tool.	X							
7.	The tool gave suggestions that clearly told me how to fix problems.	X							
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.	X							
9.	The information provided with this tool was clear.	X							
10.	It was easy to find the information I needed.	X							
11.	The information was effective in helping me complete the tasks and scenarios.		X						
12.	The organization of information on the tool screens was clear.	X							
13.	The interface of this tool was pleasant.		X						
14.	I liked using the interface of this tool.	X							
15.	This tool has all the functions and capabilities I expect it to have.		X						
16.	Overall, I am satisfied with this tool.	X							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES** | **NO**
   a. If Yes, how did they help you?

   It helped me to properly align the interface

   b. If No, why did they not help?

2. Did you use the recommendation rating system? **YES** | **NO**
   a. Do you think it is useful to have such a rating system?

3. Any suggestions for improvements?

Thanks For Your Participation

Participant 12

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☑ Male ☐ Female ☐ Others
2.	Age group (in years) ☐ Below 25 ☐ 25-35 ☑ 36-45 ☐ > 45
3.	Qualification: ☐ Under Graduate ☑ Post Graduate ☐ Ph.D
4.	Specialization: Electromechanical Engineering

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
			✓	

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
				✓

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Easy to use	Time-consuming
Flexible	Flexible
Unattractive	Engaging
Simplistic	Organised
Helpful	comfortable
Useful	Innovative.

Part 2 on 3

Sno	Performance Expectancy	1 (Strongly Agree)	2	3	4	5	6	7 (Strongly Disagree)	N.A.
1.	Overall, I am satisfied with how easy it is to use this tool.	✓							
2.	It was simple to use this tool.	✓							
3.	I was able to complete the tasks and scenarios quickly using this tool.	✓							
4.	I felt comfortable using this tool.	✓							
5.	It was easy to learn to use this tool.	✓							
6.	I believe I could become productive quickly using this tool.		✓						
7.	The tool gave suggestions that clearly told me how to fix problems.		✓						
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.		✓						
9.	The information provided with this tool was clear.		✓						
10.	It was easy to find the information I needed.		✓						
11.	The information was effective in helping me complete the tasks and scenarios.	✓							
12.	The organization of information on the tool screens was clear.		✓						
13.	The interface of this tool was pleasant.			✓					
14.	I liked using the interface of this tool.			✓					
15.	This tool has all the functions and capabilities I expect it to have.		✓						
16.	Overall, I am satisfied with this tool.			✓					

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES | NO**
   a. If Yes, how did they help you?
   Interface design was easy in terms of easy access to the tool.

   b. If No, why did they not help?

2. Did you use the recommendation rating system? **YES | NO**
   a. Do you think it is useful to have such a rating system?
   Yes

3. Any suggestions for improvements?
   Bit improvement not to the tools.

Thanks For Your Participation

Participant 13

Post-Survey Questionnaire

The following custom questionnaire was used to gain insight into the knowledge of people concerning the user study created in the context of the master thesis: "Helping End Users Designing Better UIs"

S.no	Personal information
1.	Gender ☐ Male ☒ Female ☐ Others
2.	Age group (in years) ☒ Below 25 ☐ 25-35 ☐ 36-45 ☐ > 45
3.	Qualification: ☒ Under Graduate ☐ Post Graduate ☐ Ph.D
4.	Specialization:

How good are you at using technology?

Very bad (1)	(2)	Neutral (3)	(4)	Very good (5)
				X

How comfortable or easy was this survey for you?

Very difficult (1)	(2)	Neutral (3)	(4)	Very Easy (5)
				X

Microsoft Reaction Card

Part 1 on 3

Look at the list of words. Choose the words that most accurately reflect your experience with the tool you just used. You have the option of choosing between 5 to 10 words. Put them into one of two categories: Highly Relevant or Relevant. (Each category has a maximum of five words)

Highly relevant	Relevant
Reliable	Easy to use
Creative	Attractive
Helpful	Trustworthy
Exciting	Engaging
useful	Slight Forward.

Part 2 on 3

Sno	Performance Expectancy	1 (Strongly Agree)	2	3	4	5	6	7 (Strongly Disagree)	N.A.
1.	Overall, I am satisfied with how easy it is to use this tool.	X							
2.	It was simple to use this tool.	X							
3.	I was able to complete the tasks and scenarios quickly using this tool.			X					
4.	I felt comfortable using this tool.		X						
5.	It was easy to learn to use this tool.		X						
6.	I believe I could become productive quickly using this tool.		X						
7.	The tool gave suggestions that clearly told me how to fix problems.		X						
8.	Whenever I made a mistake using the tool, I could recover easily and quickly.		X						
9.	The information provided with this tool was clear.		X						
10.	It was easy to find the information I needed.	X							
11.	The information was effective in helping me complete the tasks and scenarios.	X							
12.	The organization of information on the tool screens was clear.	X							
13.	The interface of this tool was pleasant.	X							
14.	I liked using the interface of this tool.		X						
15.	This tool has all the functions and capabilities I expect it to have.			X					
16.	Overall, I am satisfied with this tool.	X							

Part 3 on 3

Please Fill in the final set of questions as best as you can.

1. Did the design recommendations help you when designing the interfaces? **YES | NO**
   a. If Yes, how did they help you?

   Using recommendation I fixed my design error.

   b. If No, why did they not help?

2. Did you use the recommendation rating system? **YES | NO**
   a. Do you think it is useful to have such a rating system?

3. Any suggestions for improvements?

Thanks For Your Participation

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