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A Comparative Study Between User Interface and User Experience

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Abstract

We have often heard of User Experience (UX) and User Interface (UI) when dealing with product design. These two terms are used interchangeably for people who use the web and mobile applications. User Experience and User interface are essential components of any product, more so software applications. The user interface is the place where the interactions with the system happen. The various tasks which can be done through the user interface include making a purchase online, downloading an application and sending a message. There are several user interfaces like the command-line interface, voice-enabled user interface and the graphical user interface. The main user interface design methods are prototyping and simulation. UI designers or developers create a prototype that is based on the system requirements. User experience is used to define the experience a person gets when they interact with a product. User experience focuses on developing products that are easy to use and understand. The objectives of this research paper are to study the various technologies that are already available that are used to develop User Interfaces and understand how User Interfaces and User Experience are related and also determine how the User Interface affects User experience for a given application and the search the various ways through which the users can be involved in improving the user experience for both mobile applications and web applications. The research questions are “How does User Interface affect user experience for a given application? How are User Interface and User Experience related?” The paper also discusses the various User Experience Models and Frameworks like accessibility, availability, creativity, and many others. It will also include methods used in data collection and analysis. Additionally, it will discuss the various system requirements like functional and non-functional requirements.

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Project Team.

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CHAPTER 1:

GENERAL INTRODUCTION

1.1 Introduction:

We have often heard of the term User Experience (UX) and User Interface UI when it comes to product design. Even though these terms are not new, it is common for people who use web applications and mobile applications to use these terms interchangeably. User Experience and User Interface are one of the essential components of a software. User interface is the place where the interactions between the users and the machine happens. (Jiang & Wang, 2020). The UI allows users to effectively operate a computer or machine in order to complete a given task or achieve a certain goal. The various tasks which can be done on a user interface include making a purchase online, downloading an app, or even sending a message. User Interfaces are made up of input devices which are used to control the computer from the user end like a keyboard, joystick or a mouse and output devices which provide feedback to users like monitors, printers and audio speakers. (Greenfeld & Lamont, 2018) The input and output devices work together to help users fully control the machine they are using. There are several types of use interfaces. The most famous user interfaces are command line interface, voice-enabled user interface and the graphical user interface. The command line interface was the main interface which people used to interact with computers back in the 1970s. The command line worked by the user typing a command and the computer responding with a printed output or displaying a message on the monitor. The graphical user interface (GUI) allows users to interact with digital products through the use of visual elements. Using GUI allows the user to go through a series of pages and screens which contain static and active elements like buttons. The main user interface design methods were prototyping and simulation. UI designers or developers create a prototype which is based on the system requirements.

On the other hand, User Experience refers to the experience a person gets when they interact with a product. User experience focuses on developing products that are easy to use and understand. The first step when trying to understand the best user experience is conducting research. The UX designers should understand the target audience, and they should understand what is needed from the product which is being designed. (Xanthopoulos & Xinogalos, 2013) UX designers often create personas which will help the users see the goals, limitations of intended users and their desires.

Development of poor interfaces can easily make users stop using an application because it does not favor them. It is important for developers to develop applications by putting their minds

to the experience the target users will get. User Interface and User experience should always go hand to hand because the design of an application greatly determines how the user experiences. (Dharmayant & Wibawa, 2018) A good design for any system or application will attract more users, which in return will help generate more revenue for the organization owning the application. A bad design will discourage users from using the application because a bad design will result in a poor user experience. The research project aims to conduct a comparative study between User-Interface & User-Experience, the common thing and how the UI Design may affect the UX. As the world keeps improving in all fields, UI design is not. (Shahzad, 2011). Designers today should create a full streamlined experience users find easy and pleasurable.

1.2 Problem statement and motivation:

Designers and developers have been building user interfaces since 1970 and during this time, computer-based user experience and design were not prioritized during that time, and it was just about what you could do with the limited amount of processing power and monochromatic screen. The main aim of early UX designers was to try and make everything work. As time went on, hardware started to evolve and the design abilities grew too and there was rapid progress in user interface design and experience.

The evolvement of technology led to the introduction of more realistic images, richer texture, fluid interactions and details and more consumers started to get wowed as the UX continued to be more vivid. UX designers started to take too far as technology also changed, whereby something that was at one point charming became corny. Over the years, user interfaces have been made responsive, and they can easily adapt to any device they application run on. This has helped improve user experience for various application. Also, frameworks have been developed that allow developers to design and develop applications according to given guidelines. In the past, an application was could run on a desktop could not run properly on a laptop or mobile phone.

However, a responsive design has not yet solved the problem, although it has helped in making some progress in achieving a perfect user experience. A responsive design helps designers or web applications to be divided into elements that react to the size and configuration of a given device. For example, a menu can widen on a desktop and then shrink on a smartphone allowing

only essential elements to be viewed. Responsive design has led to its own problems because various devices display application differently, whereby an Apple device can display a web application awkwardly and then an android device display it nicely. Over the years UI and UX have become interdependent whereby one aspect affects the other. In this research, we are going to focus on the various aspects of UI and UX and how the changes in technology keep affecting user design and user experience.

The motivations for doing this research include the rapid change in technology whereby new technologies are being developed and applied in the development of different applications, be it web application or mobile application. Technology keeps on changing, the same as the UI and UX. For example, a user interface that was so appealing in the past few years may be obsolete now. Another motivation for doing this research is to determine how user preferences or experiences have changed over time due to rapid change and development in technology over the years. Another factor which motivated us to do this research is to determine whether there is an application has been developed whose UI and UX can be rate at 100%

1.3 Project objectives:

1. Study the technologies that are already available that are used to develop User interfaces and understand how User Interface and User Experience are related.
2. Determine how user interface affects user experience for a given application and search the various ways users can be involved in improving user experience for both mobile applications and web applications.
3. To design a new proposed solution to the problems that are being faced designers of applications.
4. To develop new software tool that rate UI and UX for web page or app.

1.4 Criteria:

*Therefore, there are some standards must have in the website design:

We rate it (from 0 to 10) Depends on design elements, text, links, visual, user interaction.

1- **Intuitively:** User-friendly design so they don't get lost or confused.

2- **Comfortable**: Eliminate all elements that are not helping your users.

3- **Reduce cognitive load**: Avoid making users think/work too hard to use your product.

4- **Consistent**: The same colors, fonts, and icons should be present throughout the product.

∗According to adobe.

1.5 Limitations of the project:

The development of any application requires thorough research so that all user requirements are met. The system should ensure that every user's needs are met so that they can have a better user experience. Since it is difficult to meet all the user expectations regarding user interface and user experience, this project has its own limitations stated below:

The project is limited to conducting research on the most famous digital platforms which have high user traffic. The reason why it is limited to applications that have high traffic is because this will make it easy for us to screen the various feedbacks provided by the various user, and it is easy to locate those feedbacks online.

The second limitation of the project is that only a selected section of users will be interviewed, hence we will not include the views of every user regarding their user experience when using the applications, we will conduct research on.

The third limitation of this research is that it will not include research information across the globe, and it will be regionally biased, although the majority of the applications that I intend to perform a comparative analysis on are used globally.

1.6 Research questions:

The research question that will be answered in this research paper is:

1. How user interface affects user experience for a given application?
2. How User Interface and User Experience are related?
3. What is the technologies that are already available that are used to develop User interfaces?
4. What are the various ways users can be involved in improving user experience for both mobile applications and web applications?
5. Are there any problems that are being faced to designers of applications?

1.7 Schedules:

Below is the schedule on how we will conduct our research. As stated above, the research will be about conducting a comparative analysis between user interface and user experience. For the scheduling of paper work, I have related a Gantt chart (Timeline) for each week based on different phases. Following is a screenshot of the Gantt chart.

PROJECT NAME	PROJECT DURATION	PROJECT START DATE	PROJECT END DATE
Comparative Study	69	Aug 24, 2021	Nov 01, 2021

Week#	Task ID	Task Description	# of Days	Start Date	End Date
Week1-2	1	Selecting Topic	6	Aug 24, 2021	Aug 30, 2021
	2	Preliminary Readings	6	Aug 31, 2021	Sep 06, 2021
Week 3-5	3	Researching Sources	6	Sep 07, 2021	Sep 13, 2021
	4	Evaluating Resource	6	Sep 14, 2021	Sep 20, 2021
	5	Analyzing Results & Thesi	6	Sep 21, 2021	Sep 27, 2021
Week 6	6	Designing of Paper	4	Sep 28, 2021	Oct 02, 2021
Week 7-9	7	Writing First Draft	20	Oct 03, 2021	Oct 23, 2021
	8	Writing Final Draft	4	Oct 24, 2021	Oct 28, 2021
Week 10	9	Final Touches of Paper	3	Oct 29, 2021	Nov 01, 2021

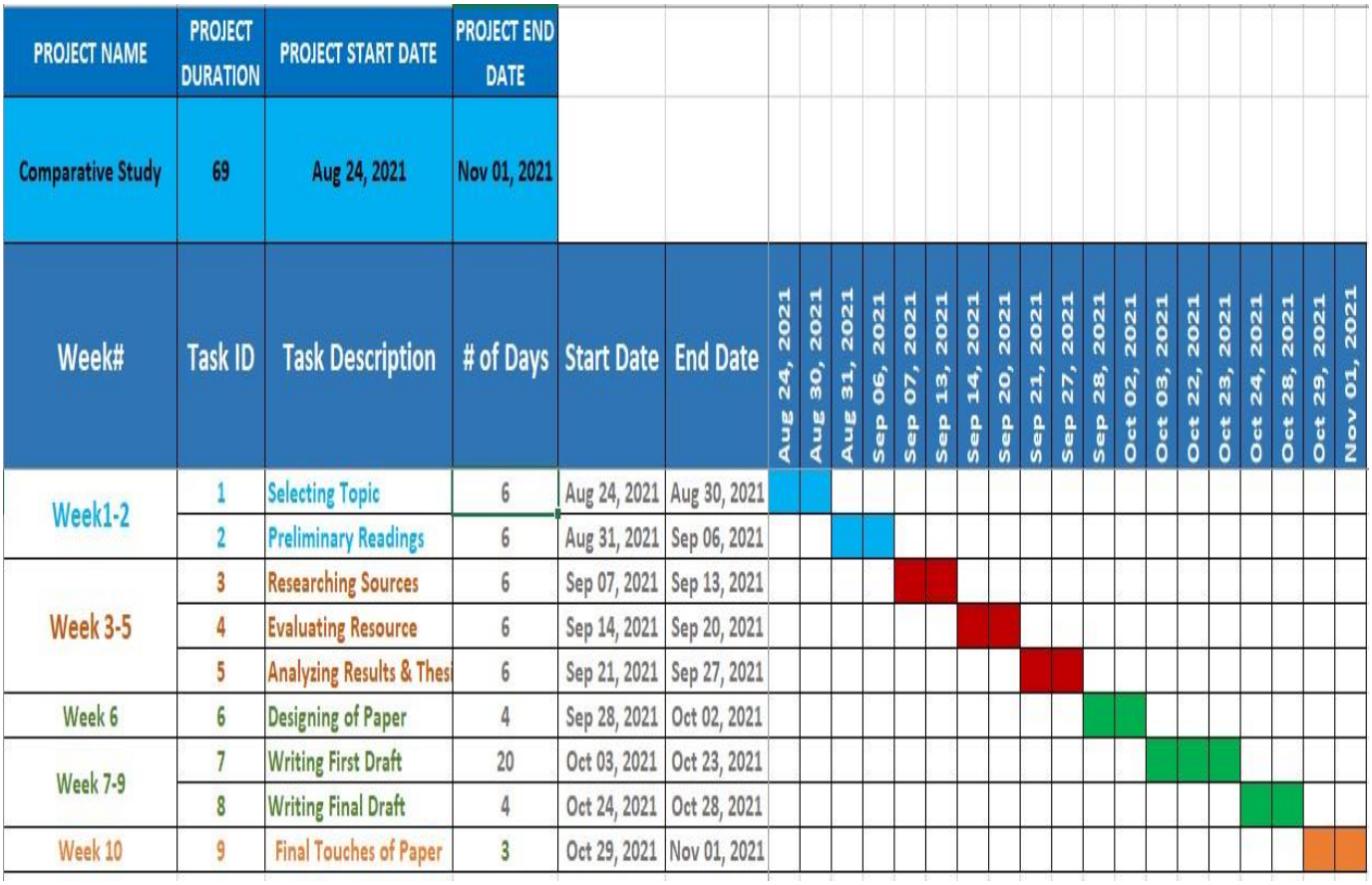


Figure 1:Gantt chart (Timeline) for CS 498

Table 1 of tasks for CS 499:

PROJECT NAME	PROJECT DURATION	PROJECT START DATE	PROJECT END DATE		
Comparative Study		Jan 24,2022	May 14,2022		
Week#	Task ID	Task Description	# Of Days	Start Date	End Date
Week 1	1	Planning	6	Jan 24,2022	Jan 30,2022
Week2	2	Making Coding	8	Jan 31,2022	Feb 07,2022
Week 3	3	Making Coding	9	Feb 08,2022	Feb 17,2022
Week 4	4	Making Coding	7	Feb 18,2022	Feb 25,2022
Week 5	5	Making Database	8	Feb 26,2022	Mar 06,2022
Week 6	6	Making Database	8	Mar 07,2022	Mar 15,2022
Week 7-9	7	Making Database	7	Mar 16,2022	Mar 23,2022
	8	Testing	7	Mar 24,2022	Mar 31,2022
Week 10	9	Fixes Errors	6	Apr 01,2022	Apr 07,2022
Week 11	10	Fixes Errors	8	Apr 08,2022	Apr 16,2022
Week 12	11	Writing First Draft	9	Apr 17,2022	Apr 26,2022
Week 13	12	Writing Final Draft	8	Apr 27,2022	May 05,2022
Week 14	13	Final Touches of Paper	8	May 06,2022	May 14,2022

1.8 Report structure:

Below will be the structure of the research report:

1. **Chapter 1: Introduction**
    - 1.1. Introduction
    - 1.2. Problem statement & motivation
    - 1.3. Project Objectives
    - 1.4. Limitations of the Project
    - 1.5. Research Question

1.6. Schedules
1.7. Conclusion chapter 1

2. **Chapter 2: Literature Review**
   2.1.Introduction
   2.2.Background Study
   2.3.Research methodology
   2.4.Related work
   2.5.Proposed solution
   2.6.Conclusion

3. **Chapter 3: System Analysis**
   3.1.Introduction
   3.2.Requirement Specification
   3.3.Functional Requirements
   3.4.Non-Functional Requirements
   3.5.User requirements
   3.6.Project modeling
   3.7.Chapter conclusion
4. **Chapter 4:** Implementation and Testing
   4.1.Introduction
   4.2.Technical study
   4.3.Hardware environment
   4.4.Software environment
   4.5.Implementation
   4.6.Database
   4.7.Technical architecture of the application
   4.8.Final Interfaces of the application
   4.9.Testing
   4.10. Testing method
   4.11. Results
   4.12. Conclusion

5. Chapter conclusion

And References.

1.9 Conclusion:

As discussed from above, user interface and user experience go hand in hand, and one affects the other in a certain way. Doing the research based on UI and UX will open a lot of insights regarding these two important aspects of digital products. The research will also focus on interacting with real world, data which help in having better conclusions in conducting the comparative analysis of the two aspects.

Chapter 2: Literature Review

2.1. Introduction

User experience and user interface have become key aspects in the design of products and services in the recent past. Businesses and organization that apply UX design activities in developing their products have achieved several potential advantages like reduced development cost and product support cost. The application of both UX and UI in product development also helps improve customer satisfaction. Recently, both user experience and user interface have gained a greater attention among several researchers in the academic world and industry. Due to the importance of these two aspects, several frameworks and models have developed and proposed to aid in the design and assess UX and UI of various interactive systems. Both frameworks and models guide on how the design of those applications can be improved and can help in determining the quality of those interactive systems. UX and UI are very subjective, context dependent and dynamic because they both evolve during the interaction process with the system.

Various factors collectively influence UI and UX, and they proof that these two are difficult to define, measure, model and validate them. It is important to include the management aspect into the UX process that can help to overwhelming the issues of complexity, vagueness and diversity. User interface and use experience acts as a bridge between users and the applications they are using. The user interface is the most important part because this is the one user use to interact in the system. More than 50% of a system's code it focused on the user interface. The defects of the user interface and the complexities have a great effect on the usability of the system. The development of UX and UI need to be done diligently and should aim at meeting the needs of the targeted users, and it should not make it difficult for users to understand the usage of a system. The aim of this literature review is to provide an overview of user experience prototyping and answer questions like how UX and UI affect the usability of web applications? How does UX and UI compare? How have UI and UX evolved over the years? Answering these questions will help design practitioners and product developers choose the best model and framework they can use in the development of both web applications and mobile applications. (Dudley, J. J., & Kristensson, P. O. 2018). The literature review is divided into four parts: background, research methodology, related work, and proposed methodology.

2.2. Background

There is a notion that UX and IU have been commonly accepted in the field of Human Computer Interaction (HCI) but there lacks an established definition of what they really are because there has not been a proper scope of what UI and UX should cover for a given product or application. The International Organization for Standardization defines UX as the user's perception and response which results after using a given system or a given product, and UI as the design of the interface which the user users to interact with the system. For a good system, users are likely to like the experience they had when using the system, and a good interface should provide easier usability for the users. These two aspects when perfected and involved in system development they result to the development of a perfect system which all user will have complaints when using. User experience design the majority of the interactions that contribute to user experience is done through the user interface. However, the design of user experience entails more than just the UI design. The complexity of how the user experience is demonstrated helps in coming up with different options and possibilities of product design. Instead of designing the user experience, it is possible to influence the experiences users have or use the experience of users when using a system in coming up with a better system that meet the expectations of the user regarding both the user experience and user interface.

"Human-centered design ISO indicates that the use of human-centered design help improves user experience" According to MacNamara, W. (2017). There are several user-centered design models that have been proposed like Contextual Design, Goal-Directed and Elements. All the above models are in terms with the ISO (2010) framework regarding human centered design and its major principles. The principles include:

- The design of a product or application is based on the proper understanding of its users, environment and task that are performed using the system and users should be involved throughout the design and development process of the product.

- the design of a product is driven and outlined through a user centered evaluation.

- The process is iterative.

- The design of the user interface should address the entire user experience.

- The design team should include various skills and perspectives so as to be able to include various user, tasks performed and the environment where it is being used.

Before sending the product to the market, it is important to first develop a prototype, which is then broadly studied if it meets the HCI ISO standards. Creating prototypes of will help in incorporating the various needs of a user as they are suggested. However, not all suggestion should be accepted because some users will give suggestions that meet only their needs. The role of prototypes in product development is discussed broadly in the HCI.ISO (2010) where it defines a prototype for interactive systems as a representative of all or some of the modules of an interactive web application or mobile application. Some people argue that prototype have two fundamental aspects, which are:

1. Filters for exploring a design space to help support the final decision regarding the best design of the system.
2. It is also a manifestation of several design ideas. The strength of the prototype lies in its incompleteness. An incomplete prototype reveals some of the qualities of the intended design of the product. The prototype helps filter the qualities a designer is most interested in during the design process of the product.

There are several tools which can be used in developing a prototype of a given system. The tools include art supplies, presentation software, graphics editing software, HTML software, programming language, and a prototyping software. Low fidelity tools are good and easy to use in developing early designs, and they help in promoting collaborative-sketching of the intended product. The low-fidelity tools are better than high-fidelity tools in generating user feedback regarding a system because users can be mistaken high-fidelity products are the final products, hence, they are not the suitable ones for collecting feedback from users. Hence, we can conclude that prototyping plays an important role in getting user feedback regarding both user experience and user interface of a given product.

2.3. Research methodology

Theoretical method

In conducting the research, we searched for relevant literature in various online research databases like google scholar, semantic scholar and in various search databases. we searched in these databases to locate the most relevant books and articles that were relevant and those that were peer reviewed. During the search we could find old theses which we deemed relevant to our area of study. Secondly, we performed a search in google search to identify important articles and books which we could not locate in google scholar and semantic scholar databases.

The criteria for our search were:

- No blogs were considered.
- Peer-reviewed articles were being considered.
- Books that were written by certified writers were being considered.

Research method (Empirical method)

To collect real data regarding the comparison between UX and UI, I used the survey method whereby I visited various web applications that allowed used to provide their feedback regarding what they could improve on to make the user experience and design of the user interface. I used sampling criteria because we only chose feedback from those users who had provided feedback that was related to our research criteria.

Research Purpose

The purpose of these research is to conduct a comparative analysis between the User interface and the user experience as they are related to the design principles of both web applications and mobile applications and how the two influence the stay of a user on that website. Based on the survey that was conducted on various web applications and mobile applications and information collected from various peer-reviewed articles and published books. We used this information to prove our research questions with valid facts and data.

The connection between empirical methods and research questions

With the use of the empirical method in data collection, it will help in gathering of data on what people think about user interface design and user experience. The data collected will help in coming proper conclusions regarding the two essentials of both mobile and web applications. The research took into consideration both positive and negative feedbacks provided by the users regarding UX and UI for the websites that were visited. Collecting proper data as indicated above will be an important aspect because it will help in properly answering our research questions.

2.4. Related work

From the theoretical research conducted, I was able to get some important articles and published books that allowed me to extract related information about the UI and UX of web applications. To begin within, I am going to discuss about the principles that should be taken into consideration when designing a web application with great User experience and user interface. Below are the various principles:

Accessibility

Accessibility means that the developed system is able to accommodate several users as possible with needing modifications. This principle helps in increasing the number of people using the system for a particular service. The principle takes into consideration other aspects like operability, perceptibility and simplicity.

Operability is a sub-principle of accessibility who main objective is to ensure that the developed system is usable by everyone, regardless of the physical abilities. Operability can be achieved through minimizing repetitive actions and reduced physical efforts in using the system. For instance, making the buttons of a system bigger to make them more accessible and ensures better positioning. This principle is important because it makes it easier for many people to be able to use the application, hence, improving the user experience because the various elements of the system are accessible and simple to use.

Another sub-principle of accessibility is simplicity. This sub-principle is hard to achieve because it is often bound with several other principles; however, it is not absolutely impossible because there are web applications that have achieved simplicity with:

- a simple user interface.

- Main functions showing first on the application.
- Putting in place an obvious visual hierarchy.
- Providing defaults on text fields and dropdowns.
- Making the most used services or actions simpler.
- Being consistent with the design.
- Removing all the unnecessary elements from the interface.

The sub-principle of simplicity refers to a simple website that is usable, understandable by all users regardless of their experience. It is important to include this to maintain simplicity for an application because it helps improve the user experience, and they will be willing to come back and use the system in the future.

The third sub-principle of accessibility is aesthetically pleasing which means that a good application should be visually appealing through the use of various graphic design principles like having a contrast between screen elements, creating groupings of related functionalities, aligning elements and groups well, and using colors and graphics effectively and simply. Aesthetically pleasing is an important principle that is affected by other principles like simplicity. For example, if users visit a web application and find it not to be aesthetically pleasing, this can greatly reduce their chances of the user coming back to the system.

Availability

Availability refers to making the functionality of the web application to be always available to the user without any restrictions that can prevent a user from using the system. By the statement of Liposinovic, M. (2020), Availability is an important aspect when it comes to user experience because a system that gives the users the defined functionality gives them a good user experience. One thing which should be considered when implementing availability into an application is not outputting everything to the same screen, but it is advisable to distribute the various outputs into different pages so that the flow of information will be easily followed by the user.

Other principles that should be taken into consideration are clarity, consistency, control, safety of the system, efficiency, familiarity, flexibility, and obviousness.

User Experience Models and Frameworks

There are several UX and UI models that are reported in literature that explain the various aspects of user experience and user interface. Majority of those models recognize the significance usability has on user experience. These models seek to complement on functional analysis of the user interface of a given system by taking into consideration the sensual, emotional, cultural and social aspects of people when they interact with technology related products.

With regard to user interaction design, there is a great difference between user experience goals and usability goals, whereby UX goals are mainly concerned with the user experience with an interactive system from the user's side instead of accessing how useful a system is from the product's perspective. The interaction design model consists of six usability goals which are efficiency, effective of use, good utility level, easy to learn, and easy to learn. The user experience goals of this model include:

- Creativity
- Helpful
- Motivating
- Emotionally fulfilling
- Aesthetically pleasing

The origins of UX and UI can be observed from two distinct views which are pragmatic quality and hedonic quality whereby the fulfilling of the intended goals is the main driver of experiences and in the view that pragmatic quality helps facilitate the achievement of the intended goals. UX in this aspect is defined as an evaluative feeling of a user using a given system.

Although several researchers on the aspect of UX and UI have discussed about the various dimensions, none of those researchers have come up with a structured organization which will help in the understanding of the aspects related to UX and UI, its dimensions, and their measurement criteria. Some researchers have stated clearly that their developed frameworks are not yet fine-grained enough, hence it is important to divide the aspects of UX and UI into several unambiguous pieces.

2.5. Proposed solution

There are several problems which UI and UX designers experience when trying to come up with the best design which will meet the required user interface and at the same time help achieve high user experience. Below are some of the proposed solutions to the problems that are being faced to designers of applications.

First, during the discovery process, it is important to identify all the challenging aspects of the user interface then come up with a wireframe of the various parts of the system since it will fit the most common UX practices like mapping out of the various types of users and their process through the system. Addressing the above challenges will not help in improving the design process, but it will help in estimating the time required to develop the system.

Also, it is important to identity the level of complexity that is involved with user interaction in the earlier stages of the project. Doing this in the earlier stages of development can have several benefits, like the developers will understand where they should work on to ensure the user interface and user experience of the program are both positive to the users.

The development of user interfaces and user experience should be users based, whereby the developers should use the feedback from users before developing the final product. Using this approach will prevent future major changes to the project.

2.6. Conclusion

User interface design and user experience are emerging research areas that help extend usability of an application, and these two areas are still immature. The absence of a proper theoretical framework which defines and interlinks the aspects of UX and UI and lack of measurement methods has resulted in disagreement among several software developers and practitioners when it comes to defining the UX and UI concepts. In this literature review, I have analyzed the various principles which helps improve both user experience and user interface of a given system. I also discussed the available framework that have been developed to define the various aspects of UX and UI and interlink them. We have also found out from the literature review that the two aspects: user experience and user interface are interlinked, and you cannot separate one from the other. For example, if an application has a good user interface, the user experience will be good too and vice versa. I also identified how the various principles that govern UX and UI are interlinked, whereby one principle is closely influenced by another. The development of any application requires thorough research so that all user requirements are met. The system should ensure that every user's needs are met so that they can have a better user experience. Since it is

difficult to meet all the user expectations regarding user interface and user experience. As stated earlier, development of poor interfaces can easily make users stop using an application because it does not favor them. It is important for developers to develop applications by putting their minds to the experience the target users will get. User Interface and User experience should always go hand in hand because the design of an application greatly determines how the user experiences. Research on this topic is till on going and there are several aspects that are yet to be identified which can affect user experience when they are using a certain system.

CHAPTER 3: SYSTEM ANALYSIS

3.1. Introduction

Getting to understand the user requirements is an important part of system design, and it is key in the success of interactive systems. It is widely known and understood that successful applications and products greatly depend on understanding the needs and requirements of users. User-centered design starts with the understanding of the needs and requirements of the user. Understanding user requirements can have several benefits like increased productivity, reduction in support and training, and improved user satisfaction. The main problem analysts of user interfaces and user experience face is they are unable to address the complex organizational situations for the various stakeholders; users and designers often think along the traditional lines when reflecting on the current system rather than becoming more innovative in the development of their products. The analysts are also users who do not know in advance what they might need from future systems. Also, developers do rapid development cycles, which reduces the time available for doing user requirement analysis.

3.2. Requirement Specification

The first step in requirement specification for the UI/UX process is requirement gathering. This is considered the base of the project and the opening step in the development of any product. Requirement gathering brings together all the involved parties. Several types of requirements can be taken into consideration during the requirement gathering process. This part of the research will discuss the various requirements gathered in the user interface design and user experience. Those requirements include functional requirements, non-functional requirements, and user requirements.

3.2.1. Functional requirements

Functional requirements specify the various software functionalities that should be implemented to help users do their tasks successfully, hence satisfying the business requirements. These requirements state what the system should do, and they are stated using the “shall “statement. The functional requirement for the analysis of both the user interface and the user experience should include business rules, transaction corrections, administrative functions,

authentication process, audit tracking, external interfaces, the reporting requirement of the system, its historical data, and regulatory requirements.

Ones all the features of the system have been identified, the developers should describe how each module of the system should work so that the users can understand the workflow and the steps which they should take when using the application. All the features of the system should work as they are described to the users so that they can meet the initial expectation of the users and help them have a great user experience.

The user interface should be made easy to learn and very easy to remember. Devices that are used infrequently should have an easy-to-use interface. Usability requirements include efficiency of use and intuitiveness and low perceived workload.

Table 2 of Functional Requirement:

Functional Requirement	Description
Selection	Users should be able to for make selection for element in the web page what they want to select.
Pause selection	Users should be able to Pause select of element when they want.
Export	Users should be able to export .doc file that consist of what in current progress.
Settings	Users should be able to change the overlay color and heuristics set.
View progress	Users should be able to save and see all the progress they do.

3.2.2. Non-function requirements

They refer to constraints that a system should have. Non-functional requirement defines quality characteristics. Most of the non-functional requirements end with “ity“. Examples include scalability of the system, capacity, availability, reliability, recoverability, maintainability, serviceability, security, environmental, data integrity, interoperability and performance.

The performance of a system is used to define how fast software or its modules respond to certain user actions when a certain workload is done on the system. In most scenarios, the metric used to

measure this property is how the user waits before the action is completed, given the number of users using the system at that particular time.

Portability and compatibility are some of the main non-functional requirements which define how a system and its elements may be launched on different environments. It usually includes hardware, software, and other platform specifications. Portability indicates how well the system functionalities can be accessed when interacting with it on a different environment. At the same time, compatibility defines how a system can co-exist with other systems in the same environment. For instance, software installed on a given operating system should be compatible with the OS's firewall or antivirus protection. These two greatly affect the user experience of a system.

Table 3 of Non-Functional Requirement:

Non-Functional Requirement	description
Usability	The extension is easy and clear to use.
Availability	The users can access your extension to install from and Google and the extension is available 100% for the user and is used 24/7 hrs.
Security	The extension and its data must be protected against attacks.
Performance	The extension response time should be at most in 5 seconds.
Maintainability	The extension should have update add new features, properties and fix errors.

3.2.3. User requirements

User requirements for the system will be identified using interviews with the users, conducting workshops, through scenarios and use cases, focus groups and scenarios. User requirements are almost the same as a non-functional requirement. They include the ease of use of the system if the system can accomplish what the user needs, the reliability of the system, customer experience, behavioral requirements, backup, and restoration. It is great to clarify well the user requirements to the developers, define the scope of the project very well; it is great to involve users during the entire process of developing the product so that in case of any change in user requirements, the users will be informed about the same. All the stakeholders should review the

user requirements once they have been compiled to see if there are some user requirements that should be added or excluded.

It is also important to develop a system that is able to develop a system that allows users to give feedback regarding their user experience and user experience, since this will give the developers the opportunity to get user feedback and develop the system according to the user requirements. Having a feedback system helps the organization to develop more user-oriented UIs, which will result in the long run.

To meet user requirements, manuals and documents should be made available for users to refer to wherever they experience challenges when using the system. It is important to visualize the available documents that are involved in the construction and design. There are two steps through which UI design be documented, first when the UI is being designed and visualized to the stakeholders and second when the UI design is in the implementation stage.

3.2.3.1. Actors and Use case

The use case diagram below shows the possible interactions the user will have with the system when interacting with the user interface and user experience.

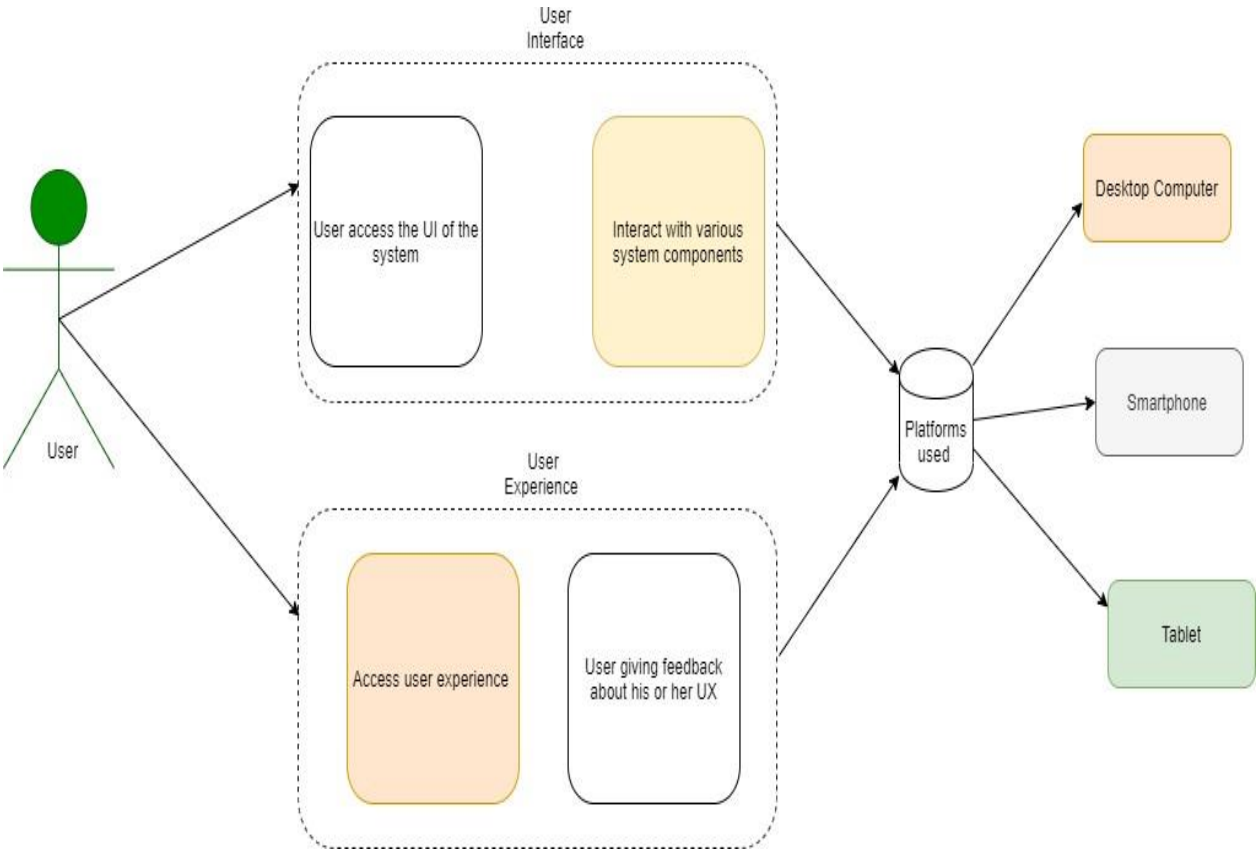


Figure 2 : Use case diagram

3.3. Static modelling (class Diagram)

The class diagram shows how various components of the user interface interact while the user is using the system. It also shows the actions which happen during user interactions and the feedback the user expects to get from the application.

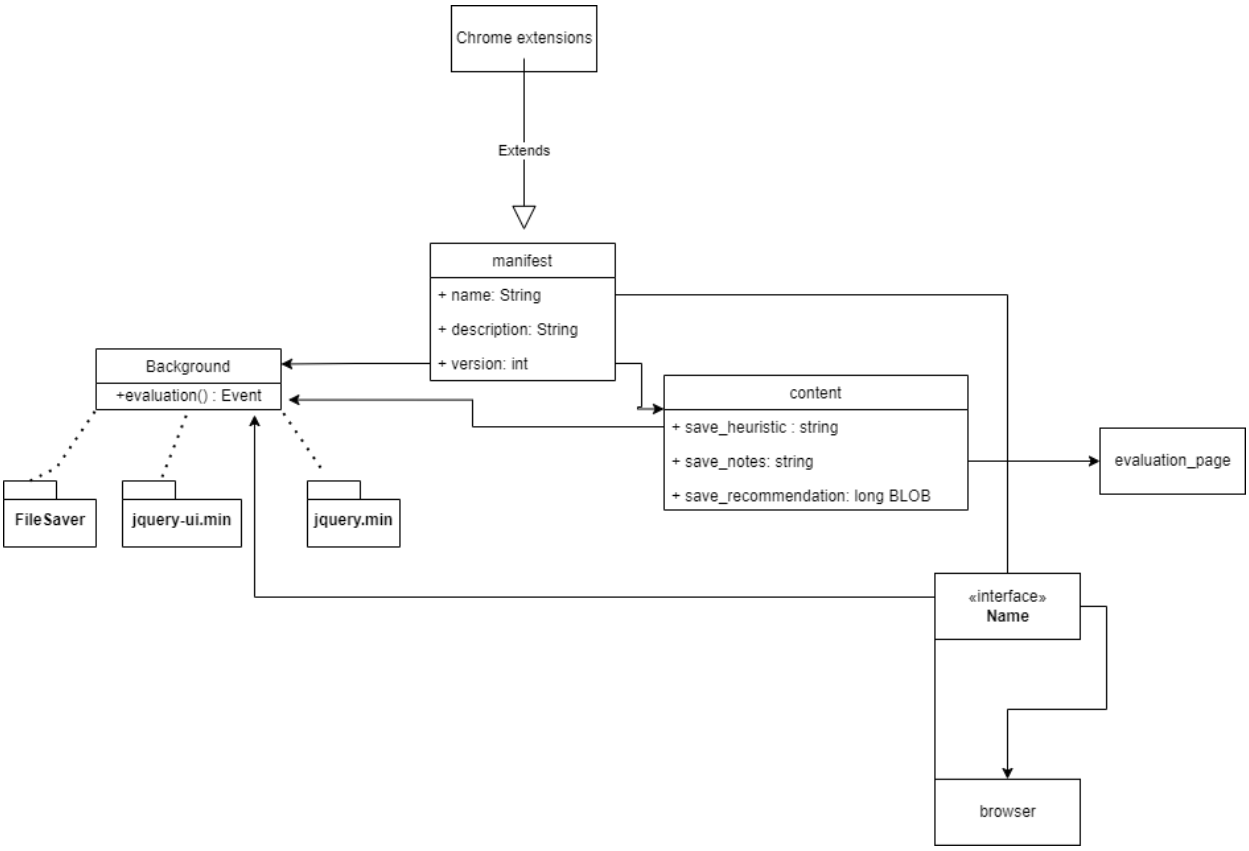


Figure 3 : Class diagram

3.4. Dynamic modelling

The activity diagram below depicts the behavior of the system wherever the user interacts with it. The diagram also shows the control of flow from the beginning to the finishing point. And decision points when the user is interacting with the system.

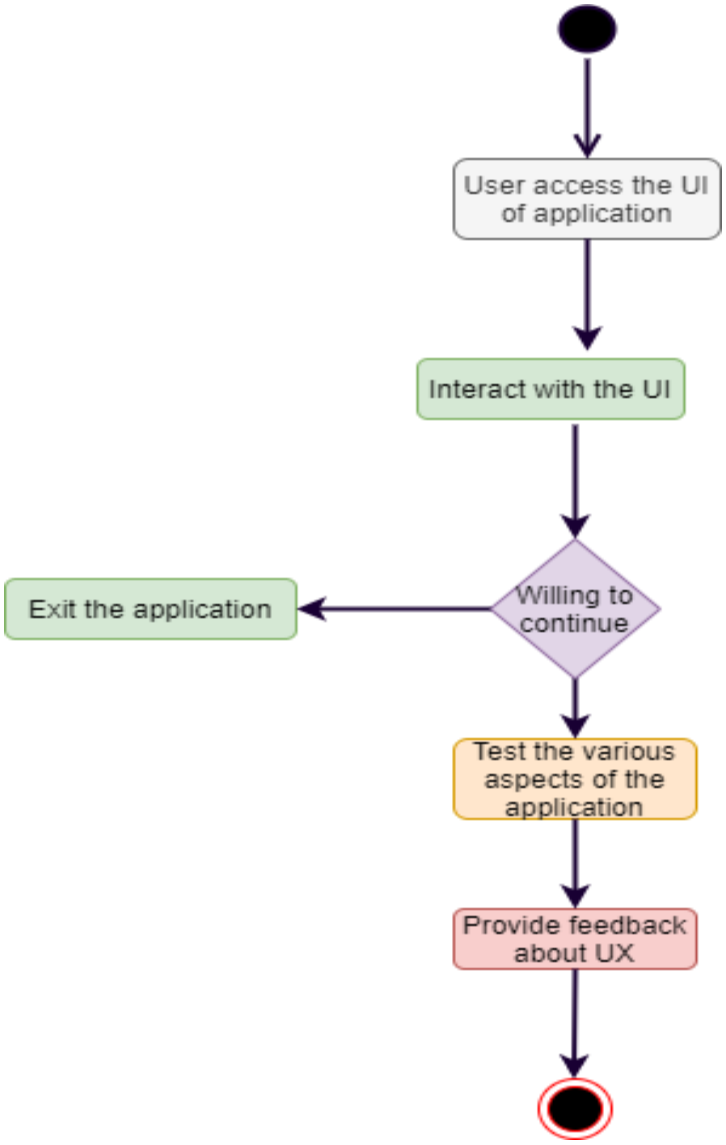


Figure 4 : Activity diagram

3.5. Conclusion:

Requirement specification is important for any system. In our case, we are defining the various requirements that will make the user experience and user interface to be appealing to the user. Understanding the user requirement, functional requirements and non-functional requirements of any system is important because they will greatly determine how well the system or application is loved by the users. As shown above, various diagrams have been designed which shows have the UI and UX come into place when designing a web application or mobile application. I also identified how the various principles that govern UX and UI are interlinked, whereby one principle is closely influenced by another and included that in the design of the various diagrams under requirement specification. The development of any application requires thorough research so that all user requirements are met. The system should ensure that every user's needs are met so that they can have a better user experience. Since it is difficult to meet all the user expectations regarding user interface and user experience. As stated earlier, the development of poor interfaces can easily make users stop using an application because it does not favor them. It is important for developers to develop applications by putting their minds to the experience the target users will get. User Interface and User experience should always go hand to hand because the design of an application greatly determines how the user experiences.

CHAPTER 4: IMPLEMENTATION AND TESTING

4.1 Introduction:

When developing a chrome extension, the development team should recognize that users are an important part of the team and during the development process, multi-disciplinary design team members can come up with useful ideas from a different point of view. Clarifying UI requirements can help the entire development team to understand what the system should work or look like. UI and Usability design and implementation can be divided into two separate styles which are process-oriented and product-oriented. The first thing one should take into consideration when developing the system is understanding the context of use. This step is essential towards understanding the various physical, task social, environmental aspects of various users. It is important to conduct system analysis to help understand the context of use before the system is implemented.

The best strategy to help you in gathering information regarding the best user context is through the use of surveys, analyzing tasks, observation, and interviewing. The second action to perform is specifying the user and organizational requirements. Designers and users need to put into consideration the attributes of UI requirements and the goals of every attribute. As it is known, UI metaphors are elements that are related to computers that help us to remember and enjoy the user interface. This means that the designers and developers should understand the needs of users and the objectives of the system. Data gathering is an essential step before the implementation

process begins as it will play an important role in helping the designers to select the best elements for creating the UI

4.2. Technical study

In the various chapters, we have discussed in detail the various aspects of the user interface and user experience. Some of the models developed during the analysis process are essential inputs when designing a good user interface that will provide a good user experience. The main aim of the requirement collection phase is to come up with specific requirements which will help in the implementation of the entire system while keeping in mind the user experience and user interface. It is important to specify precisely the software being developed without having to describe how it should be done. For the user interface to be responsive enough to the users and offer a good user experience, it is good for the chrome extension to run on a stable system which will ensure the system is always up and running.

Since a majority of systems are made up of different modules, it is important to ensure that the user interface is friendly to offer an easier understanding of the user interface and offer a good user experience to the users. The system user interface will be developed using a single software development lifecycle. The SDLC approach used for a given project will depend on the requirements of the project other factors. The development models can be described as development strategies that are used to achieve goals that help satisfy the requirements of a system while still abiding by the existing constraints.

4.2.1. Hardware environment

The hardware requirements for the development of the system are described below:

Table 4 of Hardware environment:

Description	Minimum
Processor	1.6GHz or a faster processor
Memory	4GB and above
Hard Disk	10GB of available HDD space
Video Card	DirectX 9 and higher
Resolution	1024 X 768 or higher

Having good hardware specifications where the chrome extension can run, help improve the user experience and can help in attracting more users to the application. Systems that run on hardware with higher specifications ensure that the various modules of the system work well and that users can receive the intended services with a lot of ease. The minimum processor speed will be 1.6GHZ to enable fast processing of requests, the minimum RAM capacity will be 4GB and above to ensure the smooth running of the system and the hard disk should have a minimum of 510GB of available space to allow space for installation of the system.

4.2.2. Software environment:

We will develop a chrome extension and the extensions are small software program packages that customize the browsing experience. They permit customers to tailor Chrome functionality and conduct to individual wishes or preferences. They are built on internet technology which include HTML, JavaScript, and CSS.

The software required to develop the system are as follows:

Build extension utilities	
Accessibility (a11y)	Make an extension accessible to people with disabilities.
Background Scripts	Detect and react when something interesting happens.
Internationalization	Work with language and locale.
Identity	Get OAuth2 access tokens.
Management	Manage extensions that are installed and running.
Message Passing	Communicate from a content script to its parent extension, or vice versa.
Options Pages	Let users customize an extension.
Permissions	Modify an extension's permissions.
Storage	Store and retrieve data.

Table 5 of build extension utilities

Table 6 of Software environment:

Description	Tools
Operating system	Windows 7 and above

Internet browser	chrome browser.
Language	HTML, JavaScript, CSS and PHP.
Server of database	Apache 2 or newer
Editor	Visual Studio code
Database	MySQL, phpMyAdmin, XAMPP

The software requirements which will ensure proper running of the system will include windows 7 operating system and above so that all the modules of the system are supported. The system will be able to run on the chrome browser. There are several servers where the database will run but the best server which will ensure the smooth running of the system is the Apache 2 or newer. The editor which will be used in developing the entire chrome extension will be Visual Studio Code.

4.3. Implementation:

Here, we will show the database of extension well as the technical architecture of our extension that recap all the tasks performed by the actors. Finally, we will show the interface of our extension.

4.3.1 Database:

"A database is an organized collection of structured information or data that is usually stored electronically in a computer system. A database is usually controlled by a database management system (DBMS)" (Oracle, 2021).

In this section, we created a database using “MySQL”, which contains a database named “db1”, and added a table named “saved_data”, which contains seven columns:

- save_id
- webpage_url
- save_heuristic
- save_rate_all
- save_notes

- save_recommendation
- save_screenshot

here we will present the database from MySQL:

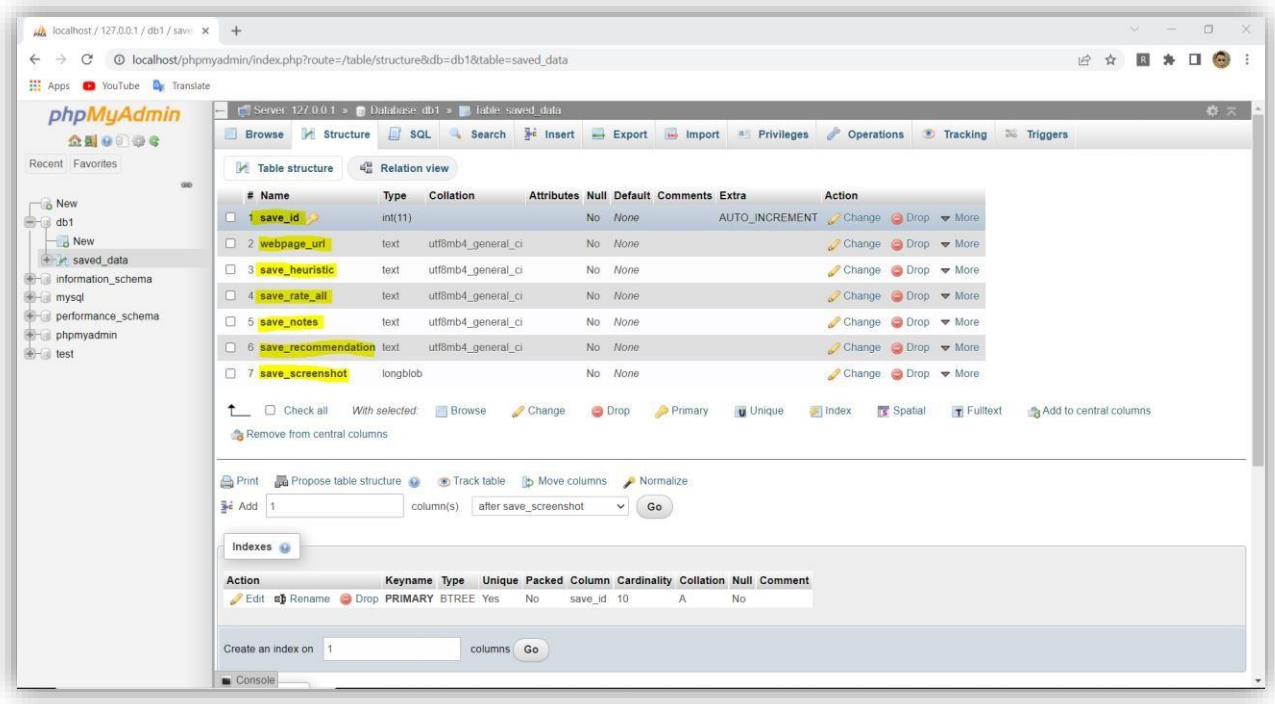


Figure 5:Database structure

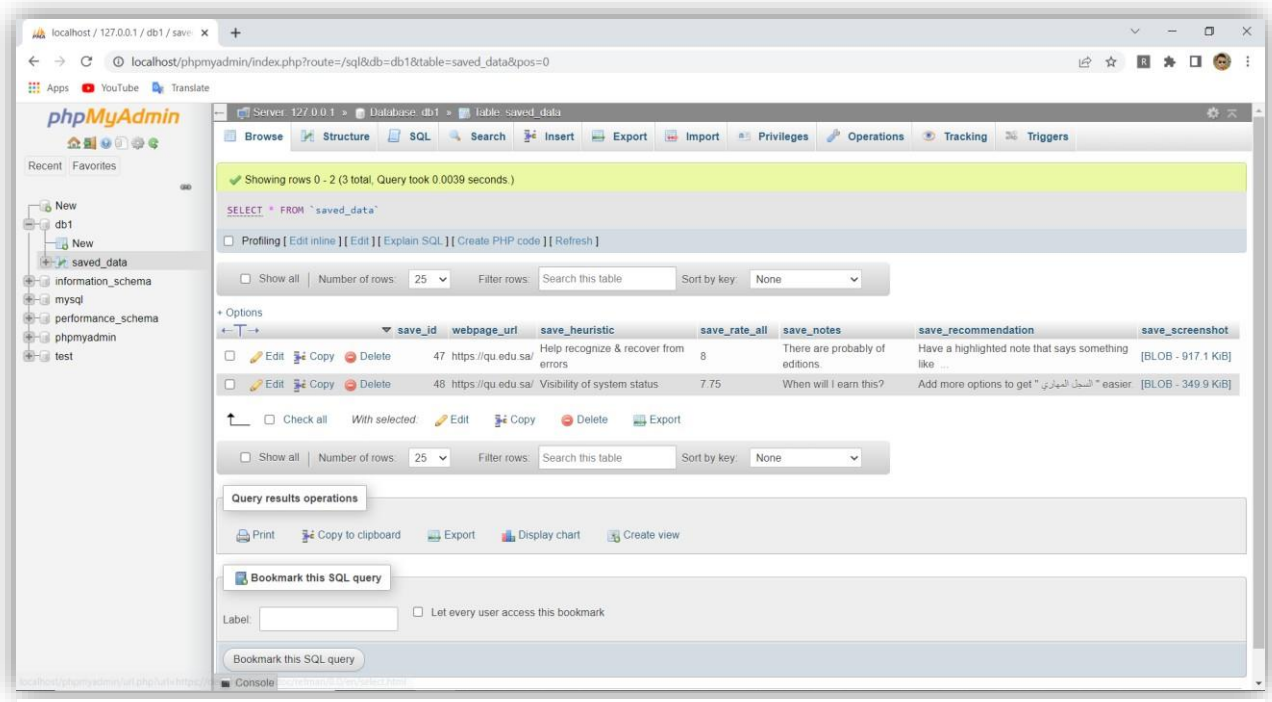


Figure 6 :Database information

4.3.2. Technical architecture of the application:

An extension architecture will depend on its functionality, but our extension will include multiple components:

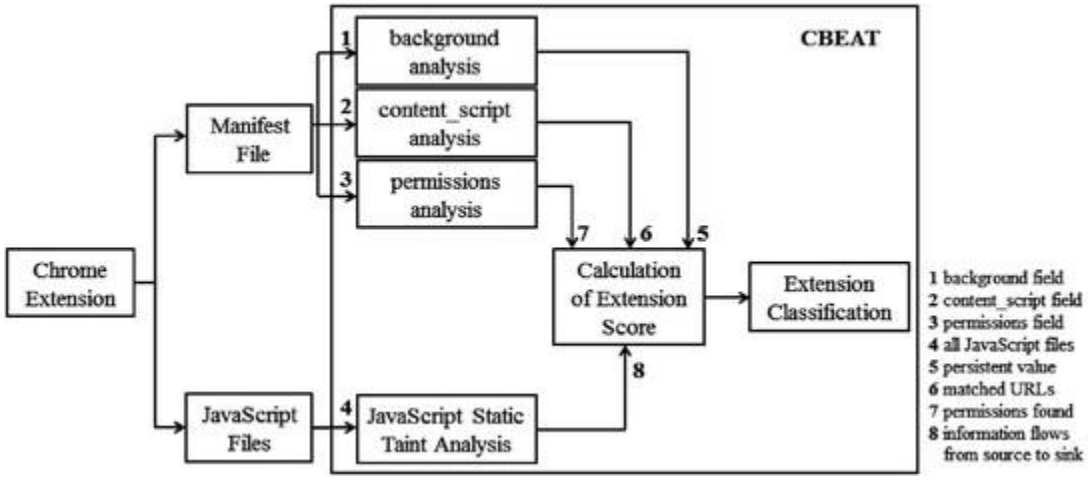


Figure 7:Extension architecture

Manifest:

The manifest file, named manifest.json, gives the browser information about the extension, such as the most important files and the capabilities the extension might use (name, description, version, permissions, content scripts, etc...).

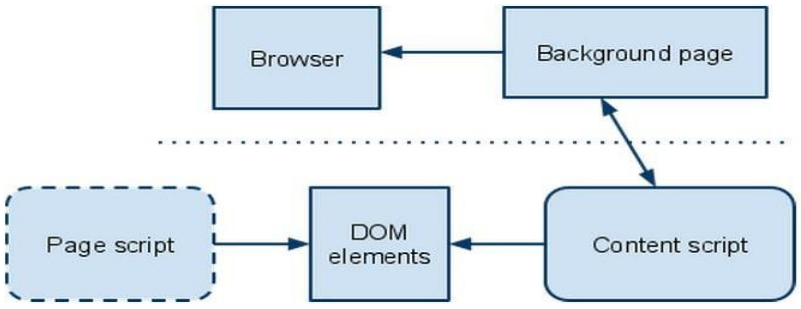
Background Script the "back-end" of our extension:

It is holding the main logic and contains listeners for browser events important to the extension; the background script acts as the extension's event handler. When an event occurs, the background script goes dormant, then it executes the logic instructed. Background scripts should only be loaded when they are required and unloaded when they are not required.

UI Elements: The extension UI needs to be useful and minimal. The UI needs to personalize or decorate the surfing revel without distracting it. Extension UI pages, consisting of a popup, can include everyday HTML pages with JavaScript. Extension UI pages, consisting of a popup, can include normal HTML pages with JavaScript logic. An extension of the use of a web page action and a popup can use the declarative content material API to set guidelines withinside the

Figure 8: describe Background work

background script for while the popup is to be had to users. When the conditions are met, the background script communicates with the popup to make its icon clickable to users.



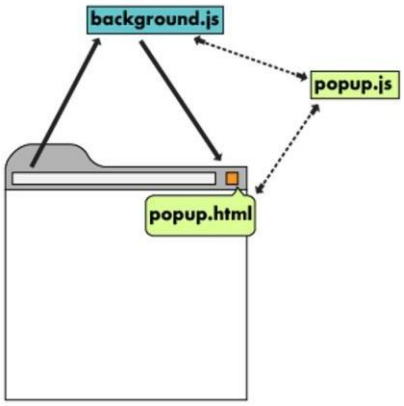


Figure 9: what are the UI Elements

Content Script:

JavaScript is contained in the content script, and it executes within a page that is loaded in the browser. In Content.js, users can read and modify the DOM of web pages they visit.

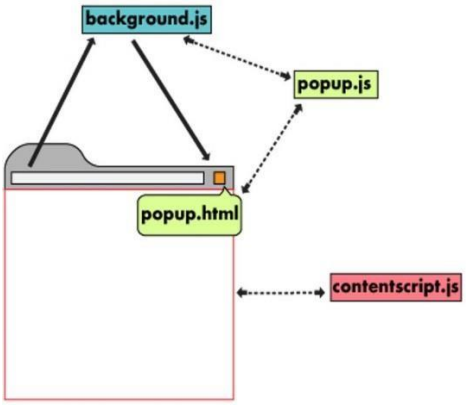


Figure 10:Content Script

4.3.3. Final Interfaces of the application:

In this section, we will present the design of some of the interfaces and how it's work to Improve your webpage's UI & UX.

Rate UI is a Chrome Extension that helps you identify usability issues through a heuristic evaluation, and evaluate the page based on criteria.

- **Main Interface:**

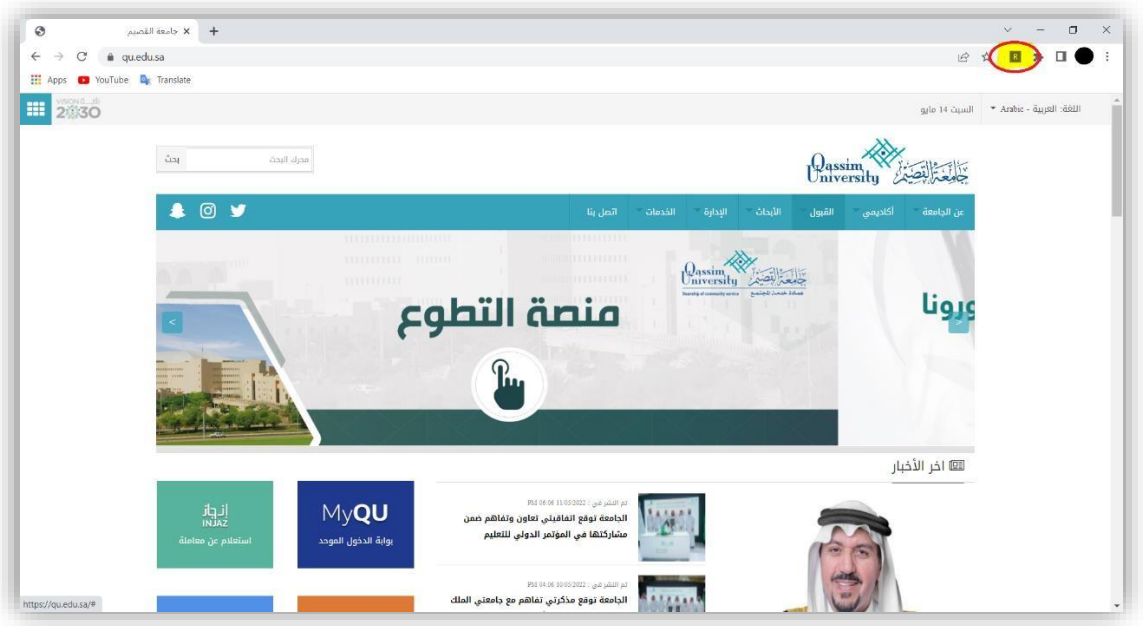


Figure 11: When the user opens whatever website he wants the user click on extension (Rate UI).

When the user opens any website he wants, the user can run the extension (Rate UI) to evaluate the page after the user opened the extension the interface shows the. The extension will open up Nielsen's Ten Heuristics in a side panel next to your webpage. When you click an item that does not comply with the heuristic, you can add notes, recommendations and a screenshot will be saved in current progress. finally, you can export your progress to a docx so that you can share information with your colleagues.

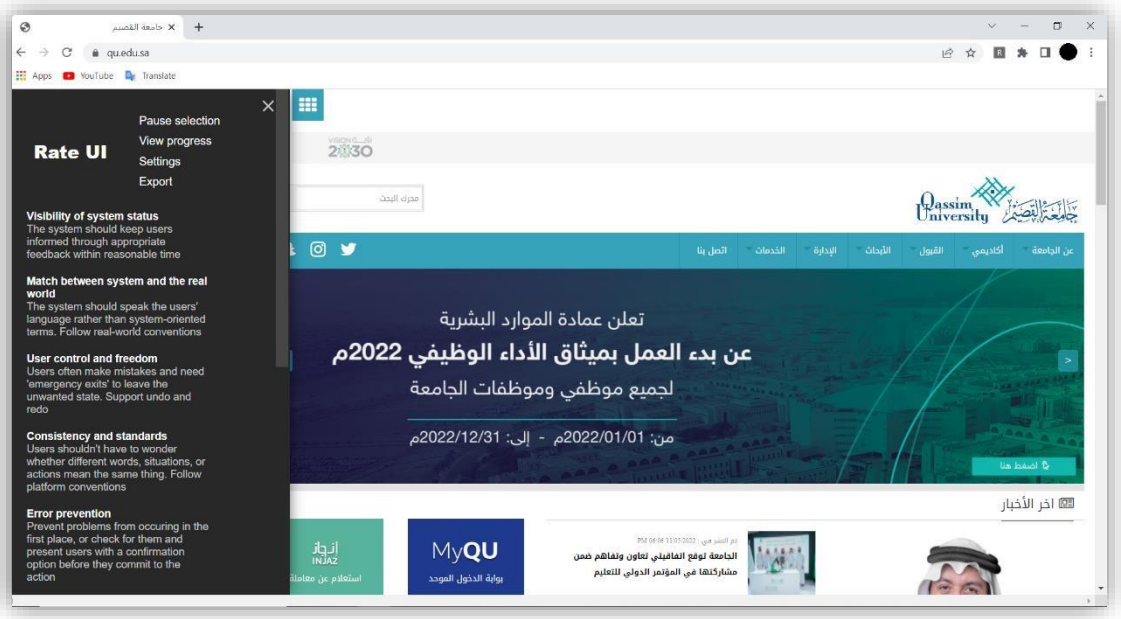


Figure 12: The main interface of extension.

(Rate UI) brings up a list of Nielsen's 10 heuristics to help the user make notes for issues

- When you identify an issue, click on the relevant an item.

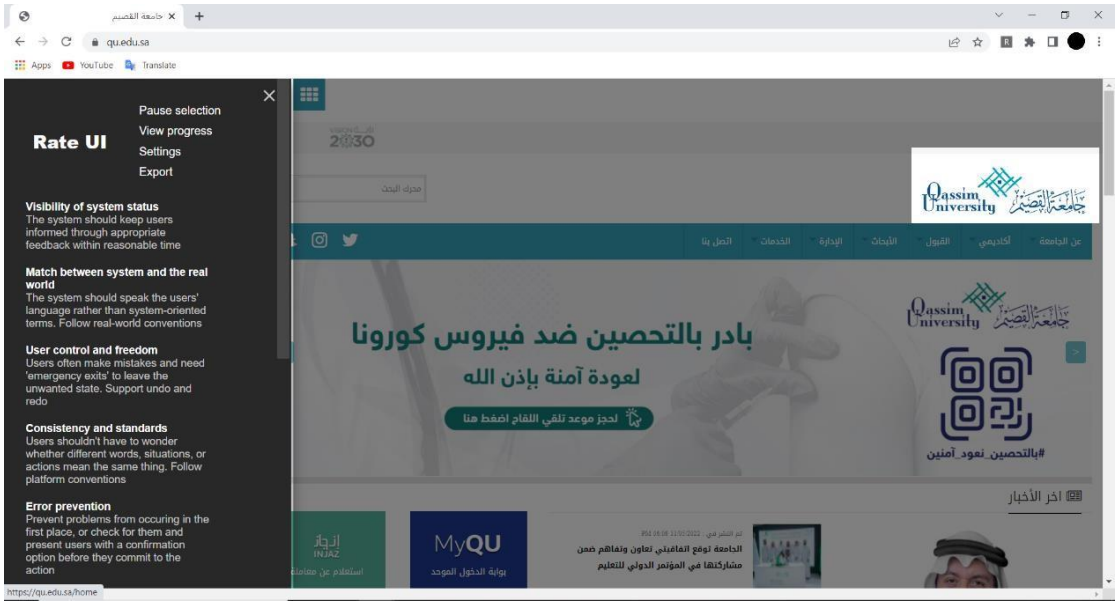


Figure 13: identify an issue

- Then give your opinion adding heuristic, notes, recommendation and rating the criteria. A screenshot of the User Interface will be saved in current progress

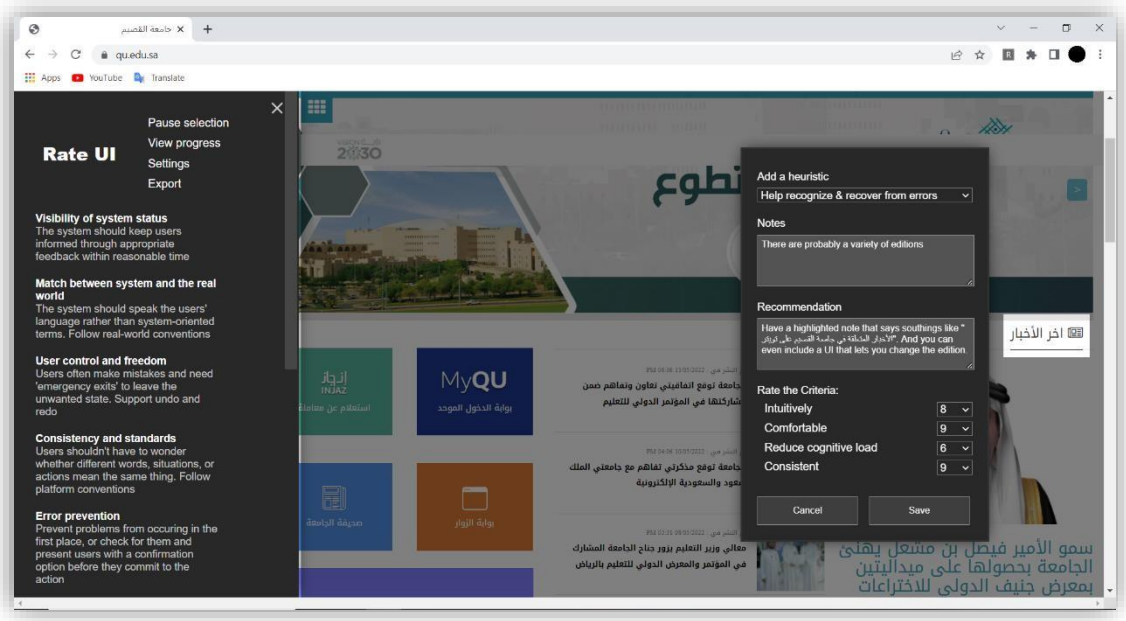


Figure 14: Annotate

- Pause Selection (Pause selection let the user continue browse the website

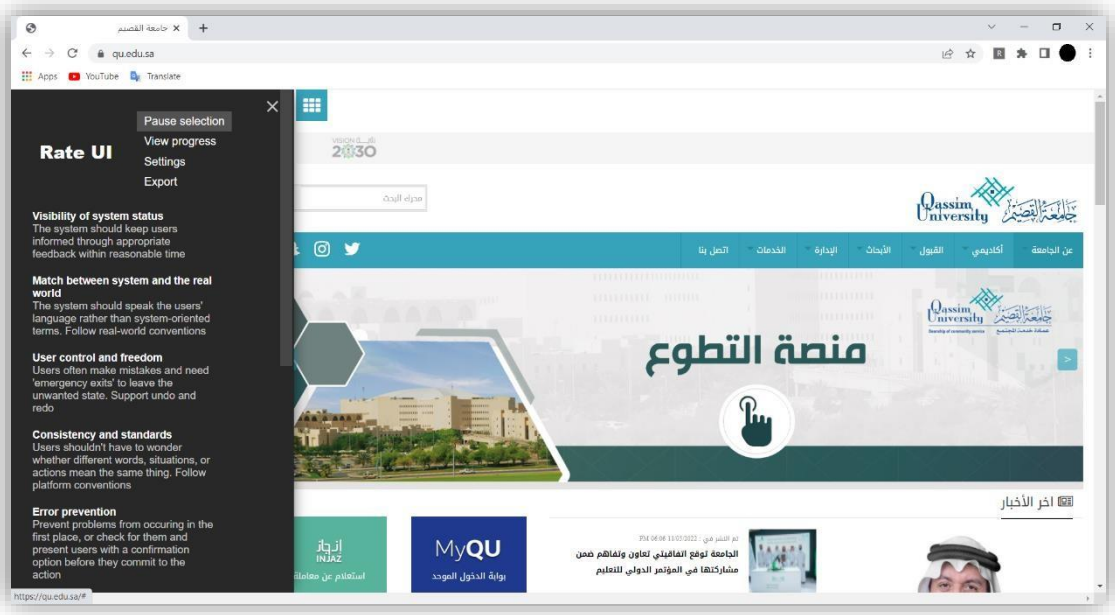


Figure 15: Pause Selection.

- View Progress (The user can see his progress of evaluation to keep him updated on his work).

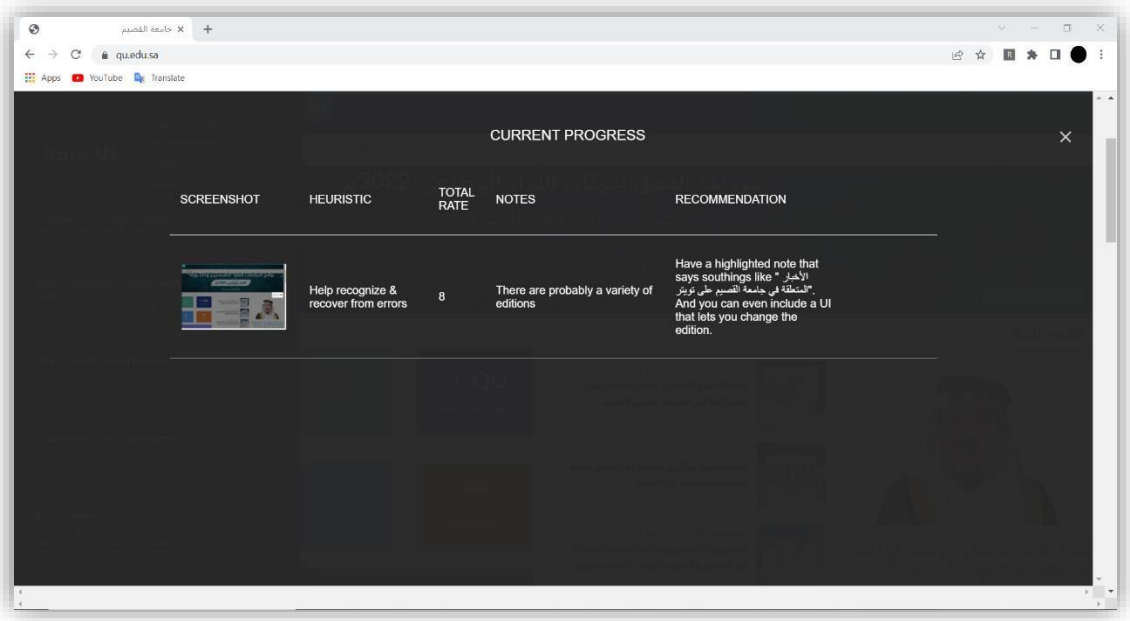


Figure 16: Current Progress

- Settings (settings contains two options, first option for overlay color let the user control of the overlay color of the page, second option heuristic set the option the user can set custom heuristic for what he need).

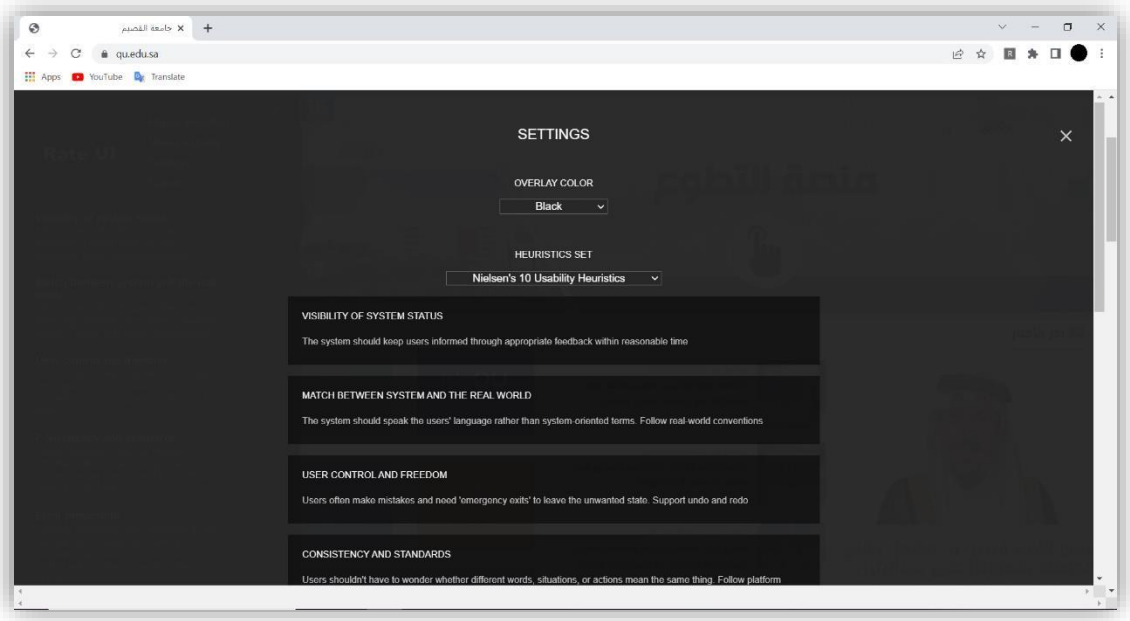


Figure 17: Settings

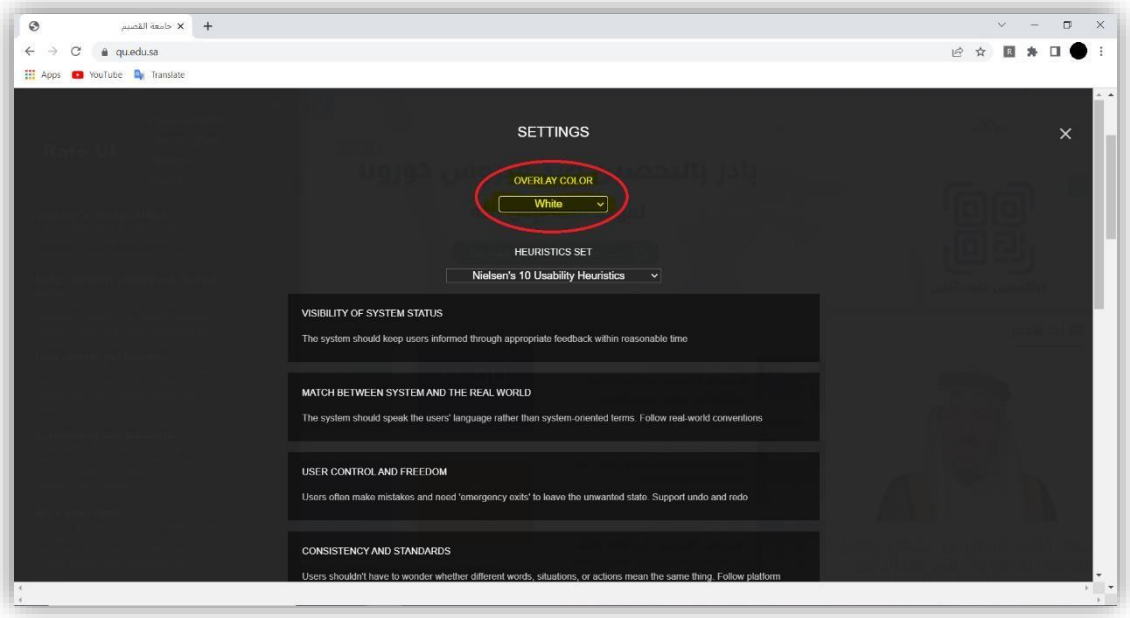


Figure 18: Change the overlay color.

- After change the color from black to white the user can use the white in dark websites.

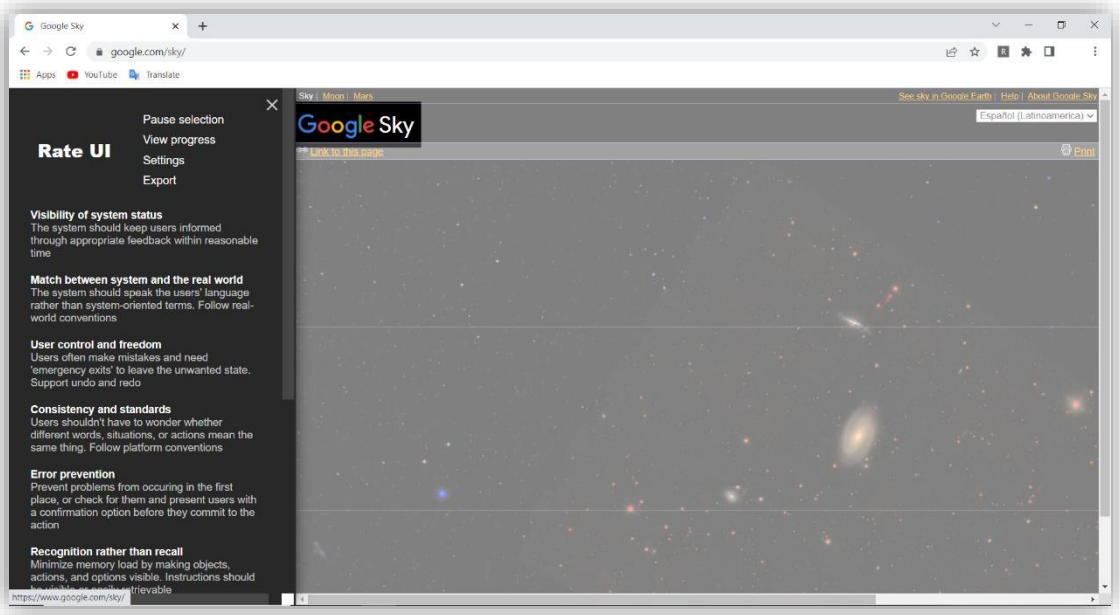


Figure 19: Overlay color white

- Export (The user can export the current progress to docx file and share it with his team).

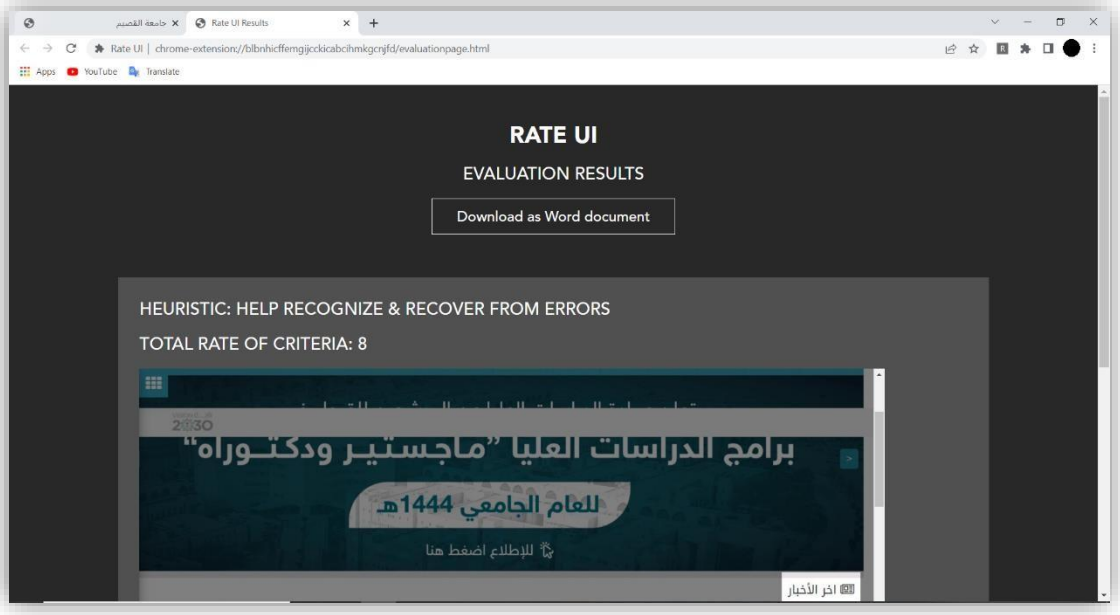


Figure 20: Export.

4.4. Testing:

We use testing to checks the Chrome extension against the functional and technical requirements of the end-users, also to make sure the Chrome extension fulfills all these requirements without errors that hinder the user's goals. The following table shows the test case that we used to test our Chrome extension features and the results of the test.

4.4.1. **Testing** method:

Table 7 of testing :

Feature/interface	**Test case**	**Result**	**Type of error**
Does the extension open	User opened the extension successfully	Pass	-
Identify	Pause identify	Pass	-
Add a heuristic	User can add a heuristic to annotate	Pass	-
Write notes	User can write notes	Pass	-
Write recommendation	User can write recommendation	Pass	-
Rate the Criteria	User can rate the Criteria	Pass	-
Delete progress	Allow project user to delete current progress	Pass	-
Save and cancel	Allow to save the progress and cancel it	Pass	-
View progress	Show the user progress that contains saved information	Pass	-
Settings	Display the Overlay color and Heuristic set	Pass	-
Overlay color	User can change the color	Pass	-
Heuristic set	User can custom the Heuristic	Pass	-
Export	Allow project user to export and download current progress files	Pass	-

4.4.2. Result:

This section deals with the evaluation of our chrome extension. The aim of the evaluation is to ascertain the degree of success in regard to the goals and outcomes of any such procedure that has been made to assess our extension, we made a questionnaire for some programmers who work on online software projects, and my colleagues.

the following table shows some questions and results of the questionnaire.

Table 8 of result:

Questions	**agree**
This chrome extension is smooth and easy to use	98%
I can move between options easily	100%
This extension promotes teamwork on Online Projects	100%
This extension facilitates communication with the project team	100%
This extension is rich in colors and comfortable on the eyes	95%
I can export the current progress to docx file	99%
This extension arranges the progress of the evaluation and displays them graphically	99%
Does the settings give what the user wants	92%

4.5. Conclusion:

So, as you saw previously, the action to perform is specifying the user and organizational requirements. Designers and users need to put into consideration the attributes of UI requirements and the goals of every attribute. with our extension you can give feedback for a website, and makes heuristic evaluations quick and easy. Also, in our website we include the feature that allow the user to add Annotate on specific element and make notes and recommendation with screenshot to save it in docx file by easily, all that by Identify on an item. The goal from this feature is to save user time and quick reviews to share with his team.

As said by the limitation of time and the surprising deadline, we assume that we did an excellent job in despite of the problems we experienced on development and testing. As we take time on catch to searching of details that we need, time to test the website, additionally how we handle the faults of one another and try to fix them.

Finally, in this chapter we presented the set of hardware and software used in the development of our extension. Also, we presented the architecture of our extension as well as some interface or out work and the problem that we faced in development. The next chapter present general conclusion of our report and future work.

General conclusion:

user interface and user experience go hand in hand, and one affects the other in a certain way. It is important for developers to develop applications by putting their minds to the experience the target users will get, and system should ensure that every user's needs are met so that they can have a better user experience.

We propose an extension framework that professionally serves UX and UI designer. It also determined the problems faced by developers who need consistency between user interface and user experience, summarized into the following points:

- A responsive design helps designers or web applications to be divided into elements that react to the size and configuration of a given device.
- inconsistency makes it difficult for your users to navigate and use your app.
- A common user experience mistakes is only thinking about the UI design. However, UI deals with user interactions with a page interface, UX is interested with how the overall design makes the user feel.

To deal with these problems, we did some research. As a result, to our research, paying attention to user interface and user experience is important, and for that we have created an extension to Run a heuristic evaluation on user's website that the user can evaluate the UX and UI of the website.

Future Work:

We have a powerful motivation to work on this type of project. Our idea may be acceptable by users, so we are going to spend more effort to make this project more efficient.

Working on this project improve your evaluate skills and the way how to find the information that we evaluate the website and make it better.

This extension improves ratings for favorite sites, also make the user's knowledge and ability to perceive designs, the user has a reaction to his evaluation of the sites. Moreover, we will improve the extension by adding more evaluation options. In addition, we will make more option for exporting the progress, and we will add more setting.

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Appendices:

Copies Of All Supervisor Meeting Reports

Code Examples

Other Documents