

User Interface and User Experience: A Review on Evaluation, Design and Research Methodology for Mobile Applications

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Abstract—The usefulness of mobile phones has expanded significantly in the latest years permitting customers to carry out extra tasks in a mobile context. User Interface and User Experience play an essential position withinside the improvement of mobile applications nowadays. Specially to design the interface for aged people's usage. It allows to optimize the design and enhance it to be user-friendly. User Interface (UI) and User Experience (UX) elaborates a set of concepts, the workflow of design thinking and usability principles. The Graphical User Interface (GUI) of mobile phones are based on a certain set of principles, evaluation and research methodology.

This research paper sums up various concepts of UI/UX such as evaluation, design, usability principles and also some common usability issues in the mobile applications of certain sectors.

Index Terms— Usability, UI/UX, user interface, user experience, mobile application, mobile design, design evaluation, testing methods, elderly users, young users.

I. INTRODUCTION

In recent years, mobile technology has been a very useful platform to consume information for users. Everyday chores have now been widely distributed into mobile applications. From ordering breakfast in the morning to getting a cab at your doorstep. An important feature of Human-Computer Interaction (HCI) is the first-hand evaluation of User Interface (UI) via human participation testing. UI evaluation requires the participation of an assistant/partner to assess the practical benefits of the UI intended users. The usability of smartphones is still a great challenge. Utilization is a notable element in the design of human-computer interfaces. This paper is organized as follows. Section 2 explained a literature review of UI/UX. Section 3 briefly describes UI vs UX, designing the user interface, designing user experience, usability principles and user interface testing methods and some common usability issues in major sectors. Section 4 describes designing for different age groups. Section 5 there is a case study of a system developed that extensively shows a simple user interface in one of the major sectors.

II. LITERATURE SURVEY

As per the set of papers studied to understand the user interface and user experience of mobile applications. According to a couple of research papers: User Interface refers to the concept of bringing together interaction

designs, visual design and information architecture. User Experience according to these papers is to improve user satisfaction, deep understanding of users, overall experience related to the emotions/thoughts, reactions and behaviour that the user goes through while using the system [13]. It can be noted that one of the research papers on the user interface of smartphones for elderly users by Raywadee Sakdulyatham et al. As a conclusion, they derive that new UIs can save the time that the elderly use to achieve most of their activities [3]. Another paper on HCI design and Age groups by Monnisa Nash concludes that regardless of age, all users prefer a system of higher usability rather than attractive decisions. Furthermore, it is stated that young people value the time efficiency a system of higher usability provides [4]. Older people value the accuracy a system with higher usability provides. However, there were different methodologies for review, design user interface, design user experience and usability issues discussed were considered to make an overall review benefiting as a standard form of these [2,3,4,6,8,10,11].

III. DESCRIPTION

A. User Interface vs User

User Experience design is about identifying and solving user problems; User interface design is all about creating intuitive, aesthetic and interactive interfaces. User Experience design often comes first in product development, followed by the user interface. The below chart demonstrates a few points that differentiate UI and UX.

TABLE I. USER INTERFACE VS USER EXPERIENCE

User Interface	User Experience
Understanding of UX design process and research	Competitor analysis
Implementation with developer(s)	Analysis and iteration
Branding and graphic development	Content development
Design research	Product structure and strategy
User Analysis	User analysis and user research
Interactive and animation	Coordinating with UI designers

B. Designing User Experience

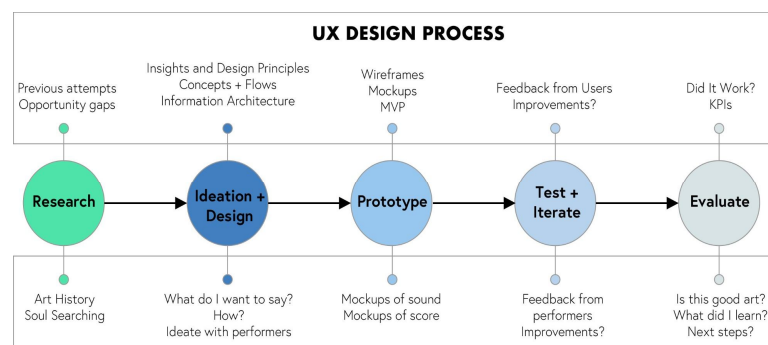


Fig 1. Design UX process

1. Research

The major process and initial process of User experience are to research the opportunity gaps in the current market of your product.

2. Ideation + Design

During the ideation process designers think of creative ideas to fill the gaps analysed during the research process and try to solve them by giving an appropriate design solution.

3. Prototype

Prototyping is an experimental process in which a design team transforms an idea into a concrete form from paper to digital. The team creates prototypes of various fidelity to capture and test the design concept with the user.

4. Test + Iterate

Test and iterate is a methodology in designing user experience where the application is tested on users and changed continuously at different stages of the designing process are based on feedback by users. This helps to eliminate user issues.

5. Evaluate

Evaluate methodology in designing user experience helps to evaluate whether it worked? What did you learn from this? And to evaluate yourself and your work.

C. Designing User Interface

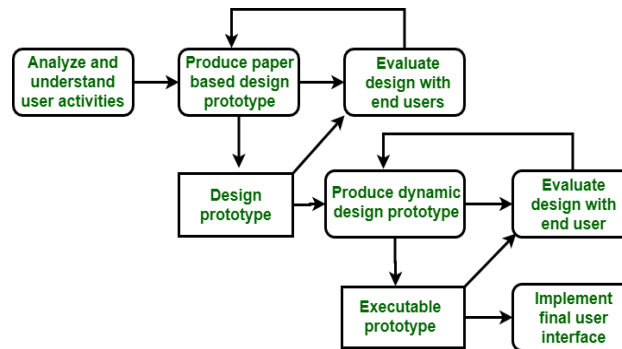


Fig 2. Procedure to design user interface

1. Analyze and understand user activity

To design an effective UI Designer has to analyze the user activity or interaction with a computer application and understand it to make an interactive user interface.

2. Produce a Paper-based design prototype

Paper-based prototype helps to do trial and error for designing UI initially once a proper set of changes is done the prototype would be sent to dynamic Prototyping.

3. Design prototype

The paper-based prototype is changed into a design using visual effects and colour combinations.

4. Produce a dynamic design prototype

Product dynamic design prototype helps to construct the interface of the product before sending it for development.

5. Executable prototype

Executive and prototype are the one design that is executable and demonstrates how the product works when developed.

6. Evaluate design with the end-user

After every prototyping process, the design is sent to the end-user to evaluate and list down the changes that are required accordingly.

7. Implement final user interface

Implement the final user interface is to implement a user interface that has been through all the prototyping process and is evaluated by the end-user which is implemented through the development process.

D. Usability Principles

Usability principles help to improve the interface usability and ensures that the User experience is more focused. It suggests stability of interface by avoiding sudden changes of you when there is the least need of it. Some Major usability principles are:

- Visibility
- Ease
- Efficiency
- Enjoyment

E. Usability Issues

Usability issue is an uncomfortable thing in your product that is causing and desirable outcome for users. Table 2 below demonstrates some common usability issues in major sector applications [14].

TABLE II. USABILITY ISSUE IN MAJOR SECTORS

Major Sector	Usability Issue
Education	Flexibility, Minimal Action, user-friendly, convenience learnability, affordance
Health	Visibility, mobile platform, user needs, satisfaction, flexibility
Tourism	Accessibility, Accuracy, navigation and graphic issues, coverage, orientation clues.

IV. DESIGNING FOR DIFFERENT AGE GROUPS

Children and teenagers often gain experience using digital media or mobile applications through school assignments and recreation. Consider how these socially familiar users can contribute to your application. Making a user interface user-friendly for the young generation means using more interesting content for marketing. These users want quick and efficient answers to customer satisfaction.

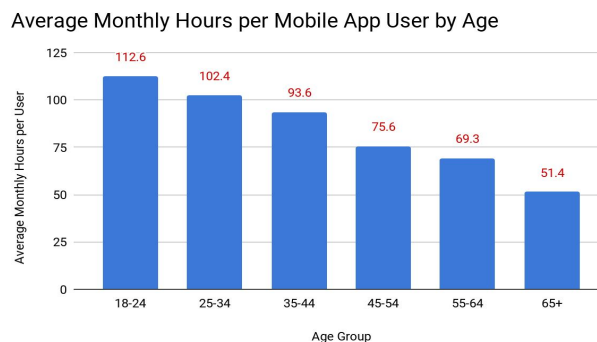


Fig 4. Mobile app usage by different age groups according to 2021
[Src: <https://www.simform.com/blog/the-state-of-mobile-app-usage/>]

As elderly users, have at least moderate experience using digital media. Designing an application for adults is generally simple. Unlike younger users, adults are much less drawn to animation and sound Unlike young users, they place less importance on research and learning and more on getting answers to words as quickly as possible [2,3,4,6,8,10,11].

V. RESEARCH METHODOLOGY

Research methodology involves continuously questioning and gathering evidence – a process that uses findings and insights from human research to create intuitive, person-centred experiences. There are two important methods in research methodology:

1. Quantitative research methods

Qualitative Research Methods are effective reasserts of inspiration. They deliver the voice of the patron without delay into the layout process and solutions to important questions on the dreams and behaviours that answers can support.

- User Interviews
- Focus groups
- Diary Studies
- Literature Review
- Participatory Design
- Remote Walkthrough

2. Qualitative research methods

Quantitative research is a method that researchers use to test theories about people's attitudes and behaviours against statistical and numerical evidence.

- Behavioural analysis
- User Surveys
- Intercept surveys
- Click tracking
- Eye tracking
- A/B testing

The below screenshot of a mobile application developed by me during my final year of Masters elaborates simple User Interface with minimal colour contrast. From Fig 5 to Fig 9, the system was designed to reduce the hustle of creating number of WhatsApp groups for a particular batch. The designing was minimal as the core feature of the app was to help professors of our institution to post messages and students can access all the messages in one dashboard, which can also be viewed category wise. The project was followed with research methodologies mentioned as above. A group of user containing students and faculty was formed to conduct an extensive usability test. And also, the usability testing used are mentioned in below Table III [Refers 1].

TABLE III. USABILITY TESTING METHODS AND RESULTS

Usability Test Methods	Results
Heuristic Review	During Heuristic review we listed down the changes according to the survey group experience as they mentioned some gaps in UI design during the usability testing
Guerrilla Usability	A quick, and low-cost testing was done during the development process with a group of friends.
Perspective Based UI Inspection	Some parts were iterated as the perspective of users differ from one to another.
Cognitive Walkthrough	Core feature feasibility was tested during the cognitive walkthrough where
Pluralistic Walkthrough	The early concept was taken in account to produce early designs where we could also see what are other expectations from different users.



Fig 5. Categories appearing in Admin app

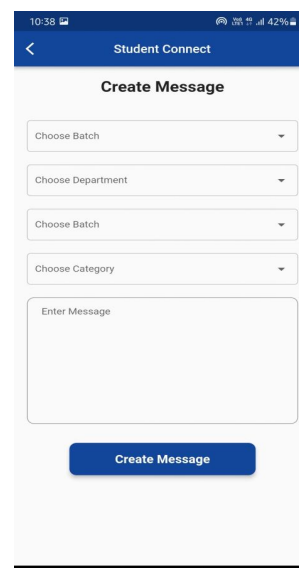


Fig 6. Creating a message by Admin

The purpose of developing this system was to have a quick and low- cost interactive application to eliminate the creation of numerous WhatsApp groups. In this application Admin (Faculty) would create a message in which he would select a category and batch to send the message. Admin would also be able to create a batch wherein a unique code will be auto generated and will be given to students. Students would use this code during the registration process. Students would be notified about the message and can also view the message sin one dashboard and also in different categories. So the name of application was given as “VIRTUAL NOTICE BOARD”.



Fig 7. Batch Details in Admin app

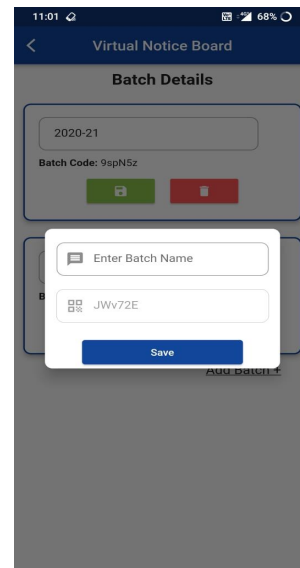


Fig 8. Creating a batch by Admin

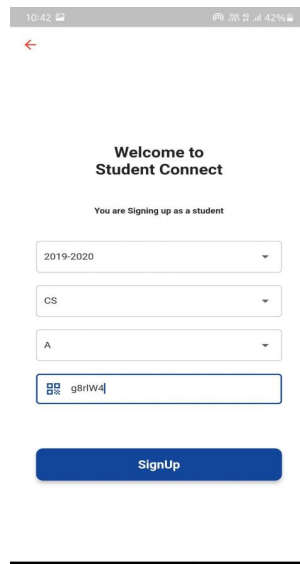


Fig 9. Student registering in student app using batch code

VI. CONCLUSION

In general, it can be concluded that various methodologies can be used to design the User interface and User experience. The main goal is to understand the thin line between UI and UX. A different set of design procedures and design styles may be used to design user interfaces for different age groups. Different evaluation methods help to evaluate the user interface and iterator design accordingly to user feedback. Research methods like quality research methods and quantitative research methods help to enhance usability experience and usability interface. Usability principles help improve the usability interface in a more efficient way. Keeping in mind the limitations of Designing mobile interfaces and considering different methodologies and feedback one can design an effective Human-computer interface. The case study presented shows the minimal and simple user interface for sector of education where the user experience places important role as there is a set of different users for this system.

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