

# Design and Development of Usable User Interface by Utilizing User-Centered Approach

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## Abstract

*Human-computer interaction (HCI) is the study of how people interact with computer technology. Usability is the core component of human-computer interaction field. Usability feature are consider very late or at the end for software development process in practice which is very costly to make the system highly usable. So it is essential to consider usability aspects from the early of the development i.e. from planning, analysis and design steps. Highly usable interaction depends on usable interface design of software systems. This research is about how to design and develop usable user interface by utilizing user-centered approach. User is the most important component for usable user interface. User-center approach is a guideline how to involve users from the beginning to the end of the development process. I have used iteration and prototyping approach for this. This is an iterative approach i.e. Analysis, design, prototype, evaluation, redesign cycle and iteration continues until user fixes no problem on its interface.*

**Keywords:** Usability, user-centered approach, interface design, prototype, evaluation.

## 1. Introduction

Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them (Hewett et al., 2004). Usability plays an important role for software development in Human-Computer Interaction (HCI) field. The motivation for applying usability when developing software system is to increase user satisfaction, efficiency, productivity,

consequently. But my aim is to provide a usable user interface. For systems usability we must deal it with enter development process. Usability testing is not enough to present highly useful systems because it cannot fix the design problems. If developers apply usability testing or other software testing approach at the end of the development cycle, then it will be very late and costly to fix and solve the problem. Software designer and developer should think about usability from the early stages of the development process i.e. planning, analysis, design and so forth for highly usable system output (Feree et al., 2001). User is the most useful and important component to design and develop usable user interface because designers need to understand about the users of the system, their physical capabilities, their characteristics, users goals and tasks etc. So involving users from early stage i.e. planning, requirements, analysis and so forth is the key to design and develop usable user interface. User-centered approach facilitates to involve users at the early stage in the development process so that designers and developers getting to know the users and their requirements for usable user interface (Costabile, 2001). So my aim and objective of this research is to design and develop usable user interface by utilizing user-centered design principle.

## 2. User-centered design approach

For usable user interface design, we should follow an iterative design process. A user-centered design approach concept is very important to design usable user interface. The User-Centered Design (UCD) is an approach to improve the usability of interactive systems. UCD includes several methods, tools and steps to assists developers in addressing usability of designing interactive systems (Ruter- berg, 2003). UCD is a user based approach which puts the user first. Great strength of user-centered design is that it follows iterative process. It is not possible to go back and refine the work of previous steps without costing resources in

usual development cycle such as waterfall model (Paul, 2006). UCD process should perform iteratively from the earliest stage through to project completion until the product requirement has meet. For example, waterfall model is a system-centered model which has some drawback. In this model usability issues is not addressed. Also user is not involved to evaluate the product. The system is tested at the end of the development cycle which is too late to modify the design to meet the requirements. Also requirements are collected from customer rather than actual user. On the other hand requirements are limited to functional requirements. Requirements not address usability requirements such as easy to use, easy to learn, safety etc. So in Waterfall model usability issues are neglected. But User-Centered Design use to address usability issue as well for the final system (Costabile, 2001).

### 3. Usable interface design process

To design usable user interface, we can follow iterative design process as shown in following figure. First we should know the user requirements i.e. what actually user wants. After that need to analyze the tasks, then design the interface based on analysis. In design phase, we can apply various HCI rule and principle. Design should be conceptual design and physical design. After design, we can implement low-fidelity prototype or high-fidelity prototype and evaluate it with the user to fix problems. Then follow the iterative process and redesign the prototypes until user have no problem in evaluation. If we are happy with the interface design, then we can use this interface design to further software development phases such as for architectural design or coding. To apply user-centered approach for usability, we should involve actual users in every steps of the interface design process. This section we will discuss more details about the activities of the interface design process step by step.

#### 3.1 Requirements

To produce usable product, user should be the target audience. User requirements can be gathered in many ways such as surveys, interviews, focus groups, observations and derived data (Agarwal, 2003).

#### 3.2 Analysis

Task description used is very well known technique for many years to describe the task. There are common types of task description such as scenarios, use cases (Preece et al., 2007).

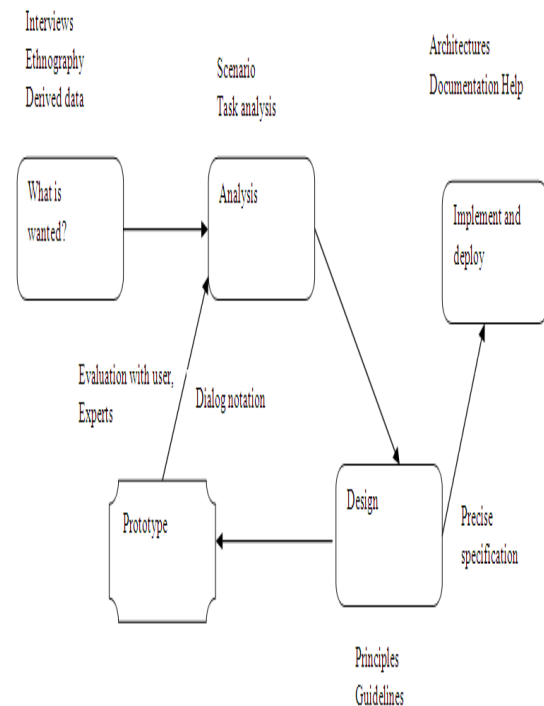


Figure: Interaction design

#### 3.3 Design

Design is the core activity of user interface design. It is divided into two parts such as conceptual design and physical design as describes below. We can use low-fidelity prototypes or flowchart for conceptual design. As a low-fidelity prototype, we can produce storyboard from scenario or card-based prototype from use case. We can use low-fidelity prototype such as paper-based prototype for physical design (Preece et al., 2007).

#### 3.4 Prototyping

Prototype is an important and very useful support to discuss the interface design idea with users and team members. Prototype can be categorized into two types such as low-fidelity prototypes and high-fidelity prototypes (Preece et al., 2007). Storyboarding, Prototyping with index cards, Paper mock-ups are some examples of Low-fidelity prototypes (Ferec et al., 2001). High-fidelity prototyping is an effective way for selling idea to people and to test the technical issues. It is fully interactive, user driven and complete functional prototype. Common high-fidelity prototyping tools such as Visual Studio.Net, Flash, Smalltalk, PowerPoint etc. Also it is helpful for usability testing (Preece et al., 2007).

### 3.5 Evaluation

Evaluation is essential part of a design process. It collects the information about users' experience when interacting with a prototype. Evaluation focuses on the usability of the systems i.e. how easy it is to use and the satisfaction level of user experience when interacting with the design. Three main evaluation approaches are usability testing, field studies, analytical evaluation (Preece et al., 2007).

### 4. Conclusion

My research aim is to design and develop a usable user interface. From this research I found that, user-centered approach is the best practice to design and develop a usable user interface. It emphasize that involve the real users throughout the design and development phase to understand and get users goals to produce a usable user interface. User can see the design and development process so that they are able to give their reflection. Developers are also able to know what the user expectation about the product is. So for usable user interface, I found that we should include people from the early stages of the development and do the whole process with the actual user to get user feedback. From my research I found that to produce usable user interface, interface process should be iterative because it is very difficult to solve the entire usability problem by following a non iterative process. Interface design process involves requirements analysis, tasks analysis, conceptual design, physical design, prototyping, evaluation, iteration and involving actual users in every step i.e. from start to end of the process. We can gather user requirements in many ways such as surveys, interviews, focus groups, observations and studying documents. To describe the task, task scenario is the best practice because it describe the task as a story so that user can understand and able to participate. Also task analysis is another way to analyze the task. For example Hierarchical Task Analysis (HTA) which breaks the tasks into subtasks and then into subtasks and so on. For conceptual design of the interface we can use flowcharts to conceptually structure the tasks flow. Also in conceptual design low-fidelity prototype such as producing storyboard from scenario or card-based prototype from use case is very much useful to get early user feedback. We can apply usability rules and principles in conceptual design and physical design. For physical design, we should consider various cognitive processes such as attention, perception, memory, learning, reading, listening, problem-solving, decision making etc. We can use low-fidelity prototype such as paper-based prototype or card-based prototype for physical design. To develop the prototype of the

interface, we can use the paper prototype or high-fidelity prototype to get user feedback. High-fidelity prototype is fully interactive and looks like the final product and it is also very much helpful for usability testing. For evaluation, we can do usability testing, field studies or heuristics evaluation to identify the usability levels for usable user interface. Usability testing investigates the level of usability of the interface and it is done in a controlled environment with user. Field studies are done with user in their working place with observation or questionnaires. For usable user interface, we should do heuristic evaluation. It is done by multiple experts and at least two passes should be done through the interface. From my research, I found that iteration and prototyping with user is the best way for usable interface design. After identifying the problems, we should go back to the analysis or design phase, redesign the interface to solve those problems as priority basis, implement new prototype and evaluate it again to fix new problems and it will continue until there is no problem to fix.

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