USABILITY of Collaborative Web Surfing Systems in e-Research

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Abstract

Software's developed for the e-Research are generic in nature and are used in diverse application context. The Usability evaluation becomes more severe for that type of software's. In this paper, we focus on e-Research application based software on small scale to evaluate the quality assessment in accordance to the usability of the software. The graphical user interfaces are the main artifacts of the Usability evaluation, we proposed a model transformation method for the generation of executable user interfaces for the usability quality assessment of the software used in Collaborative environment for web surfing.

Keywords: *Usability, Collaborative Web Surfing, e-Research, Quality assurance, Model transformation, User Interfaces.*

1. Introduction

Now a day's e-Research is getting more attention from the researchers by exploring the new scientific possibilities [1]. Most promising example of e-Research is the usage of text corpora in Humanities. E-Research is gaining more importance in less technical research areas also. Hence, the software development for e-Research is more generic or simple to use. Having generality in the software leads to the flexibility and extensions to the exiting software used for e-research. It is more frequent that the users of the software are less technical and feedback from those users may base only criticism, or we can say that the software does not meet their expectations. Switching from one to another software is possible. User of the software always looks for the software which meets their requirements. Hence, we can say that either the usability or understandability has not been properly studied. The collaborative web surfing is also social network where researchers can surf together. The software's still did not get much attention of the research community because of their bad usability. Hence, the quality of the software decreases, which decrease in the usage of that particular software. In this paper, we focus on the usability of the e-Research software's used for web surfing in a collaborative environment.

The paper is structured as follows: In section 2, we determine types of software that are used for collaborative e-Research. In section 3 the concept of the usability and its practical approach is discussed. Model based approach for user interfaces generation is discussed in section 4. We conclude with an outlook on future research direction in this area in section 5.

2. Collaborative Software's in e-Research

According to Carstensen and Schmidt [2] the concept of collaborative software overlaps with computer supported cooperative work (CSCW) [3] for example groupware [4]. The groupware provides a way that how computer can support collaborative activities and their coordination. Most promising application such as email, calendar, text-chats, wiki and bookmarking belongs to the collaborative way of communication in a groupware. Some other applications are more general for example some social software's such as Twitter [5], Facebook [6] and Friendster [7, 8]. The use of collaborative software in the workspace creates the collaborative environment. A collaborative working environment provides a platform to the individuals and cooperative workers by supporting new class of e-Researchers, who work together beyond the geographical locations. There are three main categories of for working in a collaborative environment.

- **Communication:** It refers to unstructured interchange of information for example phone call.
- **Conferencing:** It refers to the interactive work towards shared information. This collaborative way of sharing goals or brain storming can be used in many applications to achieve common goal.

- **Coordination:** It refers to the complex but based on mutual dependent work to achieve common goal. In this case everyone is doing some thing different to achieve that goal.

The main objective of collaboration software used for e-Research to help and facilitates the e-researchers working together over geographic distances. The tools play important roles in communication, collaboration and process of problem solving in real time shared environment where one or more than one researchers are tried to achieve the common goal.
Recent development shows the application of e-Research Infrastructure is increasing globally distributed through Internet. These types of collaboration are now days built upon grid computing software's, which provide benefits to the researchers in shared environment. The grid computing software's help researches to the usage of advanced ICT tools for data analysis, large scale computing resource and high performance visualizations [9].

3. Usability and Its Practical Approach

Usability is used to evaluate the quality of the software that influences the handling of and the user's attitude towards a software product. Usability play important role to various aspects of the software for example decisive role for the selection of process when more than one alternative for same application are available [10].
Usability is based on context or it's a context sensitive. The usability used for one application can not be as good as used for another application [11]. The application context includes: Tasks execution, Environment and User. Usability of the software can be evaluated qualitatively or quantitatively that includes effectiveness, efficiency and error rate. These attributes are indirectly measured based on the observation of the people. Error rate can be calculated by counting number of mistake done by the user, during software usage. These mistakes can be of adding invalid entries, these types of mistakes falls into the qualitative measurement of usability. On other hand, quantitative measurements include satisfaction of the user and attractiveness of the software graphical interfaces. These can be obtained through questionnaire, interviews and surveys. ISO 9241-11 [12] is a standard for usability as shown in Figure 1. In which usability quality measure is divided into two sub tasks, Usability is influenced by application context and Usability is evaluated by measures. Figure 1 presents the application tasks in terms of Tasks, environment and user. Tasks are based on goals and steps taken by the user that particular task. Environment relates to the operating system problems and user relates to the knowledge, experience and other attributes related to the gender. Measure already discussed relates to the qualitative and quantitative measures.

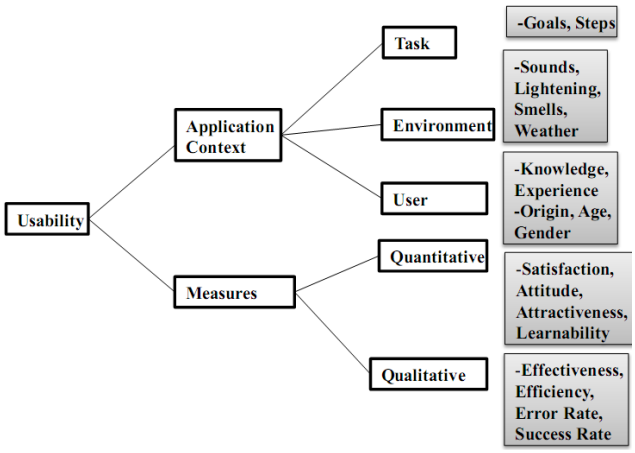

Fig. 1 ISO 9241- 11 Usability measures and its influence.

4. Usability for Application Context User Interfaces

User Interfaces and back end are two types of layers used for most of the software's. The user-interfaces can be graphical as well as textual. In this paper only graphical user interfaces are discussed. The graphical user interfaces allow user to work with the software [13]. The back end provides the functionalities implemented for that user interface. The generic or specific software user interfaces can be modeled with three types of the models, these are: 1) User Interface frame work model, which identifies the basic elements of the user interfaces, 2) User Interface model that describes the specific interaction elements and their types and 3) functionality model that describes all functionalities available by specific or generic software.

5. Model Example for Collaborative Web Surfing Application

We have developed a collaborative web surfing application called NetSurf [14, 15]. Hence, in this section, we will discuss the practical applicability of usability to its two major component of NetSurf application:

- NetSurf Graphical user Interface (GUI): It provides an integrated environment with web browser to the user to access all functionalities of software.
- Repository at Back-end: in addition to other, it stores and achieves the keyword and their

corresponding URL that enforces the user management including access rights.

On back-end user is unaware of the functionality of the NetSurf in which how data is stored in the repository. The user can access to the GUI buttons, text and video messaging and file transfer functionalities. Each of the user access to the functionalities that are logically belongs together.

As a refinement of the user interface framework model, the user interface for collaborative NetSurf software is application specific software that defines the concrete interfaces of the elements in that context for example data transfer, which defines specific representation of the contents in the NetSurf. It also defines the specific buttons, labels, elements, chat and data transfer buttons and context menus. Furthermore the user interface model links the defined elements of the NetSurf to the appropriate function, in which data is added to the repository of the software. The functionality model can also define the combinations of the functionalities of the functional model to appear as one the functionality.

To assess quality of the software, rules and guidelines play important role. Guidelines are the best practices, which are gathered by the experts with their experience and practical knowledge. The guidelines may also vary from domain to domain. In quality engineering assessment based on usability is divided into three main categories [16].

1. The human behavior and psychology for the application used in the particular domain
2. Guidelines for the application used in particular domain
3. Usability evaluation based iterative user interface

From above quality assessment approach, the most effective assessment for the usability is conducted through iterative evaluation of user interface application. The advantage of this method is that it can be applied at any stage of the software varying from paper-based interface drafts up to final versions of the user interfaces.

However, quality engineering methods applied for the user interfaces or any other applications have two major methods for good usability products. These are expert oriented and user oriented methods. The experts methods are applied early stages of design and user oriented methods are applied in later stages. The disadvantage of expert oriented method is that it does not involve the end user only expertise of the developer is utilized. Hence, one can compare both types of the methods for quality engineering easily. User oriented used in later stages focusing on the functionality and quality of the product has some advantages over the expert method.

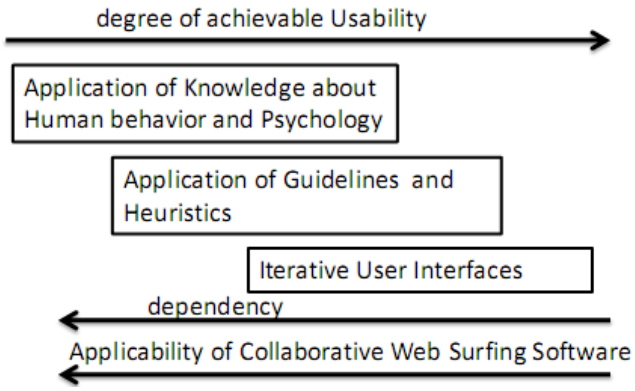

Fig. 2 Application of usability in a collaborative web surfing.

Following relationship is illustrated in the Figure 2, which defines the applicability of the usability for the generic software's. The boxes show the different categories of the usability engineering and arrows indicate the degree to be achieved by usability, dependency and applicability for the software application.

6. Model Transformation approach for User Interface Generations

Model based software development is an emerging topic these days. Model based approach can also be used to generate executable user interface model for any application [17, 18]. To use model transformation approach, we used Unified modeling language for the designing of user interfaces, with class diagrams.

Model transformation approach works in the following way [19]. The three types of the user interface model can be served as input models. To get executable user interface model, we need to apply transformation rules on the input models. These transformation rules are applied into XPand model to text transformation language [20]. The XPand language is based on the EMF models; hence the input UML model for user interface is EMF model [21]. The model transformation language is a part of the eclipse modeling project. The output executable model is basically source code for user interface that can be the part of the software. The source code is an executable and can be generated the Graphical user interface for the software. Figure 3 shows the model transformation approach in a generic way. In which Input model are user interface frame work model, user interface model and the functionality model to produce executable model based on the transformation routines.

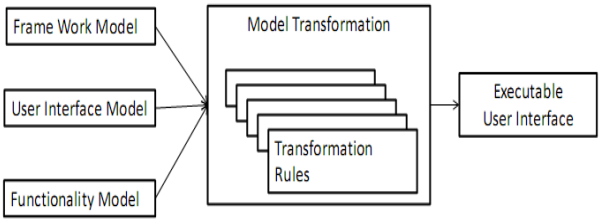

Fig. 3 Model Transformation approach for Executable user interfaces.

7. Conclusions

The same usability can not be achieved with the generic software because the usability is based on the application context. In this paper, we provide how usability can be applied on the application based software in the domain of web surfing. Different types of quality engineering approaches have been discussed based on the application context for the user interfaces which has direct impact on the Usability quality attribute and we have showed how model transformation approaches can be applied for executable user interface generation.

Furthermore, our application based software is very small for usability quality assessment. The approach can be applied to the large scale software application based on grid computing for example TextGrid [22]. We can compare their possible results for both applications to see how it is useful to create good quality user interface to improve the usability of the software.

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