

Analysis of Human Factors in Software Application Design for Effective User Experience

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Abstract—Human computer interaction is concerned about the physical and mental activities between computers and humans. In terms of HCI perspective, one of the main problems that web developers, software developers, and hardware developers encounter in software design stage is a lack of experimental researches on the human factors. Mainly, developers are focused on the quantities and contents of the applications, but they are underestimating the importance of user experience and capabilities. There has been a research on the usability. However, there is still a gap in the design area called human factors which particularly needs careful consideration and findings. Thus, this research primarily investigates on how to understand and uncover the human factors in any application or software design. At this time, there are no accurate and particular models and methods on identifying and analyzing the human factors, therefore, we present new design model as our empirical research model called “Intensive Prototype Model” in order to enhance and facilitate the design process. We also propose unique and relative analysis methods: user-centered design, online survey, distributed survey and so on which they can assist the designer on identifying human factors regarding to application and software design. Finally, we discuss the key principles of this research to support the early stage of application design and to anticipate the human needs and requirements in computer interaction.

I. INTRODUCTION

With a rapidly fascinating web site contents, developments, interactions and designs user friendly applications, the need for appreciating human factors is appearing. In order to deal with human factors entirely in any application or software design was a hot ongoing research across different aspects and areas. In the past, the research of the usability was effectively and widely done by many researchers to improve the quality of the design [1,2,3]. Human computer design (interface) is an intermediary in a communication between

people and computers. On other words, human computer design (interface) is a platform of ongoing information flow and feedback between human and computers. Efficiency of the communication, information flow and feedback between people and computers depends on the effectiveness of good structure, the readable contents and the motivated tasks in any software application [4].

The acknowledgement of the human needs and requirements in the design and deployment of quality and user-centered design can ensure the success of the interactions between human and application. A human factor is potentially playing a significant role in success of product quality and reliability and poorly designed human computer interfaces can lead to many unexpected problems. Neglecting the importance of the human factors can leave a huge impact on the success of the products and cause people to quit or leave the intervention in the application or quitting using the products besides causing frustration to human.

One example of human computer design errors that liable many people to death is Therac25. Therac25 is an accident that occurred in United State and Canada between June 1985 and January 1987. The Therac25 machines cause death to seven persons by overdosing the patients. Due to lack of coherent structure and readable and proper procedure in the system interface, the person pressed the wrong button which caused the accident to occur [5]. On the other hands, the goal of studying the human factors is to quickly utilize human needs and requirements as a main source in designing any software applications and in providing applications or software that is free-errors, user friendly and motivated. Thus, an understanding the needs and requirements of human is necessary to gain benefits in enhancing the software design and in meeting people expectation and experience individually and organizationally. Human factors need to be addressed in the early stage of any application and software design. Many software and application designers concern about the contents and load the human with noisy contents without fully paying

attention to the flexibility of the design, the interaction and communication back and forth between human and computers. We will discuss issues that developers and designer should address during the development of any software or applications design. There are plenty of questions and issues which application and software designers need to take into account during the development of applications: who is the user? What does the user expect from pressing particular link or button? Does user concern about the contents or the clarity of the content? What does user expect from the design pattern that is used for common task? Does user's expectation and experience meet across different user level? What color does user like and dislike? What kind of data entry does user like? Does user like insertion or selection data entry etc?

The brief answer for the entire above questions and issues is that there is a lack of conducting research on human factors and misunderstanding of what need to be done in the software design. Particularly, there are several significant considerations: firstly, good understanding of the human behavior when interacting with web application or software, Secondly, applying all the design technologies is beneficial to the advancement of traditional industries and the development of new businesses through creative collaborations and attractive web application and software design between industries and human and thirdly, consideration of the negative feedback from the human when interacting with the softwares or applications before launching the actual application or software helps to resolve drawbacks of the system , enhance the design and facilitates the interaction and design process as well.

We propose Intensive Prototype Model as our experimental research model. We use this model as it intensively involves the human in most of the stages of the web application or software design and development. We will use the user expertise in the stages of the design where necessary. It uses to explicate the positive and negative attitude toward coherent and legible designs. We are convinced that this model can be applied successfully in any application or software design and development. Human can give a positive feedback when they can fully enjoy the ease and the flexibility of the design, the legibility of the contents, the ease of the navigation in any applications. The design of application or any software need to be studied carefully because any applications or software applications need to be delivered to the user with free-errors, user friendly, coherent, legible contents and structure, since the user interface is the essential component in

communication between human and computers. Application and software companies need to carefully study the human capability in order to make it up to their standard and meet the their satisfaction, because individuals or users do not want to use application that has functional errors, full of unnecessary contents, incoherent structure, unreadable contents. Moreover, designers need to make application more desirable, not too much colourful and full of media contents. In order to make an easy, usable, user friendly application and motivational, first of all, the designers need to make forms more attractive, user-friendly and easy data entry which more into selection rather than typing because designing interactive forms is really a big challenge. Second of all, designers need to provide easy navigation between in the application which user can easily recognize. Third of all, designers need to involve the user in the application development or design in order to achieve better user friendly applications.

II. RELATED WORK

Continues efforts and researches have been ongoing to identify and to examine the human factors regarding to web site and software application design. Many researchers have done some valuable research on how to make an interactive, user-friendly web site or software applications [6]. John Lovett with David Daniels, Lauren Jesuitus, Emily Murphy, and Forrester [7] conducted a research on studying the software design expenses which companies are paying for. In the research they did not mention the methodology to study the human factors and how to design an interactive web site that is easy to use and navigate through a web page when a user interacting with a web site. they say that the lack of studying the importance of the usability, many companies spend \$2 million per year on site or software redesign, without knowing if redesign made easier to use, and this is because of individuals do not meet the software or the web application is user-friendly as they expected

Gavriel Salvendy, Micheal J.Smith [8] they study the usability and the human factors in the automation design, they also have invested on the usability research and human factors in automation design and they identified that usability is a necessary condition for survival. If a web site is difficult to use, people leave. If the homepage fails to clearly state what a company offers and what users can do on the site, people leave. If users get lost on a web site, they leave. If a web site's information is hard to read or doesn't answer users' key questions, they leave. There's no such thing as a user reading a web site manual or otherwise spending much time trying to figure out an

interface. There are plenty of other web sites available; leaving is the first line of defense when users encounter a difficulty. They also said that it is worthy to invest on studying the human factor which can help to a better usability. More Recently Mark Hurts [9], founder of Creative Good, his report has meant to focus on online user and the result was that 39 per cent of test shoppers failed in their buying attempts because sites were too difficult to navigate. Additionally, 56 per cent of search attempts failed.

They all discussed, argued and examined the usability of design, flexibility, and user-friendliness and so on. However, designing and building application that is user-friendly, readable and understandable from a designer perspective but from users point view it could be the other way around. So we emphasize on this research to study and take human factors into consideration for instance, cultural, capabilities, language and so on and so forth. Utilizing and exploiting human needs, experience and requirements from different perspectives and desires can increase the curve of the profitability of the business strategy and enhance the application designs. Human factors principles have not been analysed, utilized and internationalized individually or organizationally

III. Intensive Prototype Model

We propose Intensive Prototyping Model (IPM) which is a modified version of previous work. In comparison to previous work in [10,11], they did not exploit users' feedback intensively like in our propose model. Drawback of previous work may generally delay the developers at some steps of the design due to lack of users' feedbacks. Some of software engineer may wonder why we need to include the user feedback in every stage of the software design. Simply, user needs system that is free-error and easy to interact. In order to do so, we need a user to feed us with opinions and comments to avoid any unwanted and undesirable features. The following steps explain the structure of our purpose model in Figure 1:

- Software designer (developer) needs to gather all the user's requirements then developer proceeds to next step.
- If user's requirements have been entirely met and user was satisfied, then developer needs to proceed to next stage else developer needs to go back to the previous

stage and cover the missing things from a user's feedback.

- Iterative procedure repeats crossing the entire process of the design as in Figure 1.

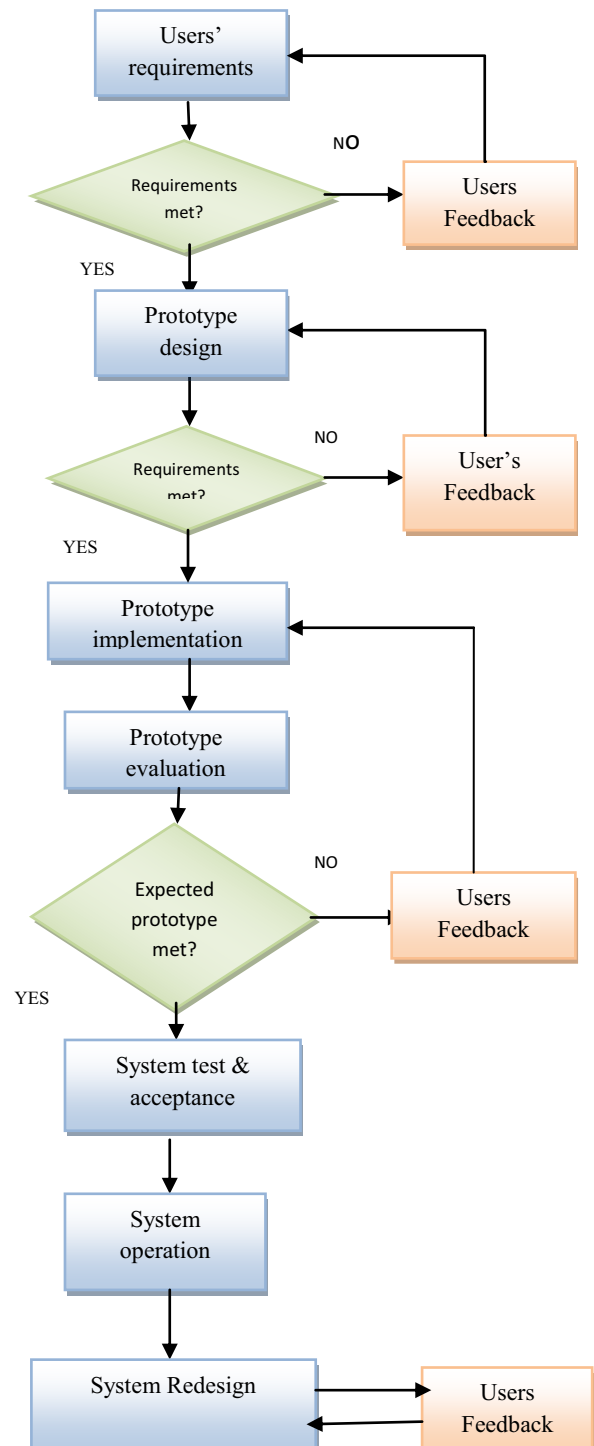


Figure 1 Structure of Intensive Prototype Model

IV. Analysis Methods

In order to capture and analyze the cognitive behaviour of the individual while

interacting with applications we need special protocol to capture the behaviour of the individuals that can help us to predict what specifically user expect from being interacting in the software applications, we have to find a way in which give us the cognitive perception about the skills of the users from different aspects and perspective, to understand and identify the cognitive and the physical behaviour of individuals in the interaction will make it more easier to design applications that is more motivational to individuals across different areas. We propose methods that assist to analyse and uncover human factors.

1) User feedback: involving the user in the early stage of any application or software design helps to uncover some of the drawbacks and unwanted features that individuals encounter while interacting with any applications.

2) Automated application agent: providing an automated agent in any application helps to discover the cognitive behaviour and the impact of users' navigation. This agent should be able to extract some of the obstacles that human face during the interaction. The agent must be able also to correspond to the individuals' reaction and experience in the application.

3) Task analysis: analyzing the task that is provided in the application which users are appearing to be immersed, it can be determined by the number of times users clicks on a particular tasks.

4) User action: by analyzing the users' action we can discover the user behaviour or preferences. User action can help in enhancing the application design. User action can be determined by the number of clicks and frequency of visits by identifying users IPs address.

5) User interest: this method can explore users' interest by registering in the application and recommend it to others. Joining the application can tell that a particular user has been attracted to the application, however, leaving the application without leaving any feedback or joining is unpleasant attitude toward the application from a user perspective, therefore, we can say that user faced problems or distracted either by finding the application is not interesting or by finding the application's content is not legible and has no coherent construction.

6) Online Survey: Online survey is published and distributed via internet to uncover the human capabilities and skill in the human computer interaction. It dramatically helps to discover the human factors globally and locally that provides

the designer with overview of the human perception.

7) Distributed Survey: It is a type of questionnaire or other format that can be distributed among users to uncover the users' experiences and abilities in computer interaction. This type of survey can extremely assist in discovering what people like and dislike in the design.

8) User-centred design: designers should target the users. They should know who they are designing for, what users need and so on.

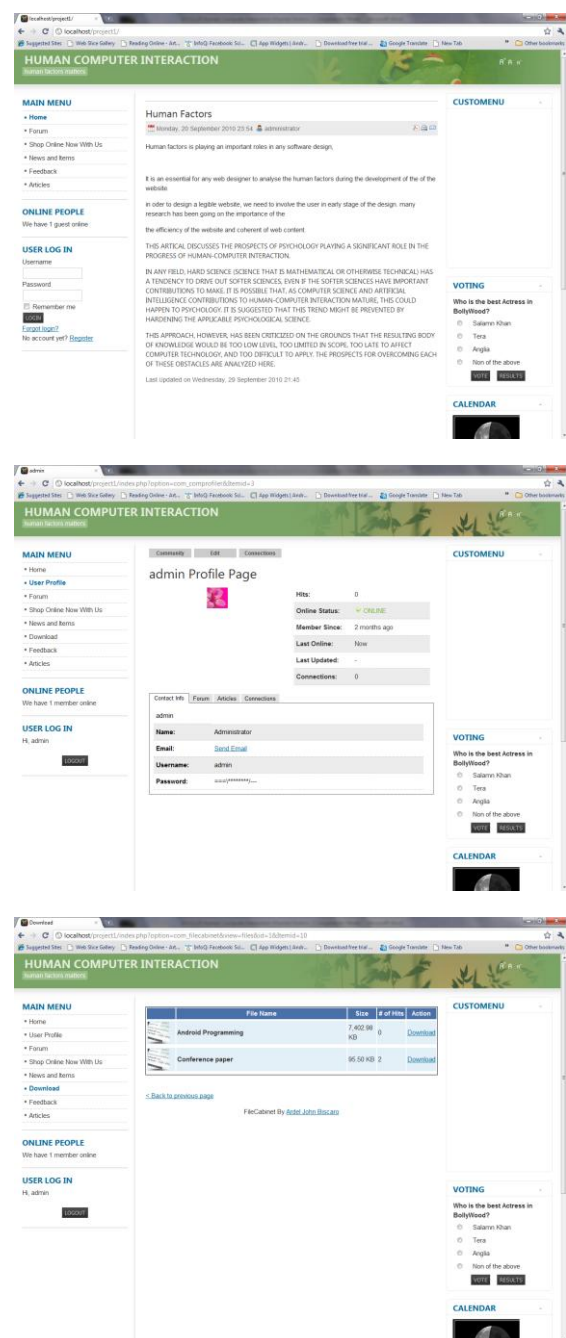


Figure 2 Screenshots of our sample web site

V. Research Experiment

We have designed and developed sample web site (Figure 2) as our experimental research to involve the users in the requirements stage which meant to collect the user requirements including functional requirement and design requirements. (For the screenshots of the web site, please visit <http://mysite123.zxq.net/website.html>.) The web site purpose was to serve users in online shopping, open discussion, download, and other features. We invited the users to help us clearly identify the requirements so that we can design according to the requirements. After collecting the requirement we show all the requirements to users in order to make sure that all the requirements have been collected, however, many users asked whether the site is multilingual or not, therefore, we took their main concern into consideration. After all the requirements have been reviewed by the users, then we initially started to design our prototype. We tried to design and make the content legible as possible as we can so that we can attract the users. After we finished the prototyping, we also show the user the prototype in order to avoid any unwanted features. We receive many feedbacks which assisted us in making some modifications and eliminate some of the unnecessary contents. However, we receive a criticized feedback from the users. As we go through the design and development process further, we received positive and negative feedbacks from users. Finally, we launched a web site that is user-friendly, coherent structure, legible content, motivational to the user and meet users' expectations. As result, the users were pleased with a design and they find it motivated. In Table 1 illustrates the users' opinions and perception about the web site that we build and develop as our experimental research; it shows a varying percentage of users' responses in term of features and functionalities. The subjects of the experiments was students from the university, they were graduate, and undergraduate students with different backgrounds. Our website does not have a domain yet, we used a local machine to build our experimental website.

Table 1: User responses and opinions

attribute feature	Worse	Accepted	Good	Excellent
User friendly	5%	6%	89%	
Ease of navigation		4 %	6%	90%

Clarity of contents		20%	80%	
Coherent structure	2%	22%	76%	
Motivated	7%	25%	68%	
Function	5%		79%	12%

VI. Conclusion

The choice of analysing the human factors can introduce some an expected features exposure to any application or software design. As the ongoing popularity of the web application and software applications continue to grow, there may be possibly a huge need for these human factors to be included in the design as part of the application and software design and success. As analysing the human factors is an essential issue for the quality of the software and the ease of the interaction between the computers and human, web application and software application designer need to take into an account these issues in order to design according to the user needs and requirements and eliminate as many distractions as possible and facilitate the interaction. Any software application design need to be more fascinated to human being and facilitate the tasks that is provided in the application. Designer needs to design beyond the user expectation to make application more motivational and attractive. In addition, the main objective of studying the human factors in human computer interaction is to produce usable and safe systems to the users, as well as functional systems. Most importantly, designer and developer should try to fulfil the user's requirements because human is the central character that we are looking for to please.

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