IMPORTANCE OF REQUIREMENT GATHERING AND USER INVOLVEMENT IN DESIGNING A SOFTWARE PRODUCT:

A CASE STUDY OF A SMALL SCALE PROJECT

Mehr Yahya Durrani[1], Armughan Ali[1], Haya Majid[1], Sajid Farid[2]
mehr.pk@gmail.com, armi123@gmail.com
[1] COMSATS Institute of IT, Attock
[2] Bahria University, Islamabad

ABSTRACT**:** *Software Engineering is a discipline which is related to the development of software products. Unlike other engineering products the output of software engineering is not a tangible product. However, just like other engineering disciplines Software engineering has a concrete set up of steps which, if properly applied, result in a good output obtained from a raw input. Software Industry today worth hundreds of billions of dollars. Countries such as India and China are the main beneficiaries of software industry, and their software exports are in billions of dollars.Many companies either have offices in these countries or having offshore companies which operate and develop software for many US and European clients. Pakistan being the neighbor country of India and China can also have a greater share of this industry, however, software Industry is in relative infancy in Pakistan. One of the major reasons is a lack of practical work in universities and higher education institution where students start believing that software engineering is just theoretical foundation and has no application in product development. This paper provides details of a case study carried out on a small scale project at Islamabad, Pakistan. The focus of the study was to investigate whether the software engineering practices taught are actually implementable or not? The study reveals that there is a need to incorporate practical training at the university level so that the gap between the theory and practice can be bridged and university graduates can understand the applicability of software engineering concepts.*

1. INTRODUCTION

Global Software Development is an outsourcing technique in which client organization hand over its software project to a vendor organization for development. The major reason for outsourcing a software product is cost effective. Many US and Western organizations have their offshore offices at countries where labor cost is low and thus saving millions of dollars in development cost. Similarly, various companies established in these countries which interact with client companies in US and European markets and develop software for them. India and China are two such countries which have taken the lead in GSD and as such considered as Software giants. Pakistan is a South Asian country which neighbors both India and China. The dynamics and cultures are almost identical to that of India, but the software industry in Pakistan is still in early stages. There are many reasons for this state of the software industry in Pakistan, which include lack of the Government's interest, poor infrastructure, scarcity of well-trained labor and lack of professional practices to name a few. However, during the last decade, its importance is realized and both Government and people started to see software industry an important area which was overlooked. This saw a growth in this area and the software exports reached at the level of 1 Billion US$. It is a meager amount when compared to the exports of India and China, whose exports are in the range of hundreds of billion dollars.

The major problem which is faced by Pakistani software industry is the unavailability of well trained and skilled manpower which understand the software development process. Although Pakistan is producing thousands of computer science graduates every year, but among them, very few are capable enough to work in Industry. Experiences with universities and higher education institutions in Pakistan show that the graduates think that programming is the only activity necessary for software development and the rest of the activities they studied at their schools are useless and merely a theoretical foundation. They fail to realize that sound software engineering practices and their understanding is the only way forward in making a career in the software industry. The primary aim of this research is to emphasize on the importance of Requirement gathering and Planning phase of Software Development Life Cycle (SDLC) which is necessary for developing a successful software product. The study is focused on a small scale project "3D-GIT" developed for cancer patients, especially children suffering from this disease. The study shows that HCI principles of involving users in the design phase is of extreme importance for developing a successful usable product.

Rest of the paper is organized in different sections. Section 2 provides a brief overview of SDLC. Section 3 given information of "3-D GIT" whereas in Section 4 provides the methodology adopted by the developers of this project. Section 5 discusses the results while Section 6 concludes the findings of the research.

2. System Development Life Cycle (SDLC)

SDLC is a classical model in software engineering, which describes the steps involved during the development of a complete software product. Various stages of SDLC leads to models for different processes and in each process there are different set of activities for achieving a certain task. The role of SDLC is to provide a certain set of activities to different persons involved in a software project. Different phases of SDLC are; Analysis (which includes requirements and design), Coding, Testing, Deployment and Maintenance. It is also important to understand that all these processes are iterative and outcome of one aspect affects the other one. A successful software project is more of an evolutionary product which tries to improve itself in each iteration.

The focus of this research is on Analysis phase where requirements gathering and designing of the product takes place. Various activities and tasks are part of this phase, which include defining of project goals, project deliverables,

project schedule and supporting plans. This phase lays the overall foundation on which the whole product operates and thus any problem in this phase will affect the complete product.

The core of the activity at Analysis phase is to understand the requirements of the users of the product and to come up with a design which is easily acceptable to the users. Though seem simple this is a huge task as the understanding the proper requirements described by various users, having different background and skills, is not an easy task. Similarly, as the literature in the field of HCI advocates that the user should be a part of the design team so that one can come up with a good and usable design is one of the most difficult tasks. Activities and sub activities at this level include one on one interviews, group interviews, questionnaires, Joint Application Development team, use cases, prototyping and brainstorming, etc. For proper designing story boarding is an important technique which help the user in understanding the design of software products.

During the course of this research it is realized that for a successful software product the involvement of the user is necessary to design an effective product. If the user is involved in designing phase, then the chances of acceptability of the final product increase manifold. The crux of this research is to give insight into this phase and show its importance so that the university graduates realize that other parts of SDLC are as important to the development as the programming phase. Though they are taught at their schools that programming is just a part of a product, unfortunately, they believe programming is a complete product and other stages are mere sub activities which are time consuming which only slow down product development and hence they easily ignore analysis phase.

3. Related Work

Requirement Analysis is an important area which has gained importance since the early days of Software Engineering (RE). Requirement Engineering is the sub domain of software engineering which deals with identifying the requirement and translating it in to a good design.

A software product can only be successful if it can fulfill the needs of the users [1]. Requirement Engineering is considered as a creative process which enables software engineers to incorporate relevant models and theories in to a product [2]. Considering the importance of RE a methodology is proposed in [3] which organizes requirements in four layers. Creativity in RE is discussed in detail in [4]. The translation of fuzzy requirements in to quality requirements is the focus in [5]. The focus of [6] was on the development of scenarios for better understanding of Requirements which will lead to a better design. Conversion of requirements into technical specification is discussed in length in [7]. Problems in current practices in RE and new directions are described in [8]. Many researchers in the field of RE believe that the problems of Requirement engineering arise due to inconsistency, ambiguous requirements and incomplete requirements [9, 10]. All in all there is a need for creative thinking so that not only the needs of users can be incorporated , but with new creative thinking design can also be improved which would provide a chance of better usability and acceptability [2].

3D GIT Project

3D Graphical Image Therapy (3D GIT) Project is a fully funded ICT R&D research project funded by Govt. of Pakistan. The aim of this project was to design a product which helps in healing of brain tumors in patients especially children. As such the cognitive behavioral effects on children was an important task. The goal of the project was to help the children in overcoming their psychological problems associated with the illness. The developers of the project used their creative imagination and came up with a product which showed promising result.

Developers of 3D GIT believed that all the steps in SDLC have significant importance and thus they thought to develop a product which is usable and have value for its customers which in this case were children of age 4-12. Keeping in view the users they decided to develop a 3D game for the said purpose. Mental imagery is involved in routine activities of every human. Using this imagery and coupled it with animations the developers intended to develop a game for the children.

The challenge faced by the developers of 3D GIT was the same as faced by the other developers of a product i.e. develop a product which is highly usable. This involve various stages such know your user, the context of the interaction, design a product as per users' requirement, involve him/her in its designing phase. However, the task was more difficult as in this case the intended users were children, which had no idea about software development, they were unaware about the needs, involving them in designing was another difficult task. Most importantly the intended users were suffering from a chronic disease which made this task more daunting and at times emotional aspects were also crept in during development. The developers had to be imaginative and creative to develop a product. Moreover, since they had to be emotionally involved with the kids so that they cooperate with them and become friendly to their practices. They were required to develop an illusion of the physical world so that children's brain can get involved in the game and it may think himself as part of the game.

All in all the success of the project was dependent on Requirement gathering and Analysis phase. The developers are of the view that the coding and testing phases were easy to implement, but the initial phases of requirement and analysis were difficult and had the extreme importance in this project.

4. METHODOLOGY OF 3D GIT PROJECT

The developers were given 18 months' time to complete the product. However, the same was extended to 24 months in order to introduce android version of the game. The team involved in the project decided to meet Psychiatrists and Psychologists to get insight into the working of the human brain. At the same time they also decided to visit certain schools and hospitals to meet children and ask them questions, etc. so that design not only include cognitive aspect learned from the psychiatrists but also include inputs from children. Meeting children was an important activity as it enabled them to take users on-board on developing a

product for them. Further, through visiting schools and hospitals they intended to achieve the task of Ethnography which is of great importance in the field of Usability.

After meeting the psychiatrists and psychologist the development team was able to understand the cognitive details related to the therapy, what type of imaginary world children build in their minds so that they become psychologically strong to face the disease.

On the other hand meeting the children in schools and hospitals was an interesting experience. Here the focus of the team was to get the input of the children, which would help them in design of the final product. The important question here was how to design a human character and enemy characters. How to encourage children to fight the enemy characters, how to motivate them to take proper diet and how to motivate them to take their medicines. The design of the product was dependent on these questions and the team was expecting to get good input from children which would help them in making better design.

The children were asked to create sketches of the enemy characters. They created enemy characters using irregular shapes, multiple hands and dirty teeth. The children's choice of such characters may be due to the influence of television programs which normally depict the evil characters in such a way.

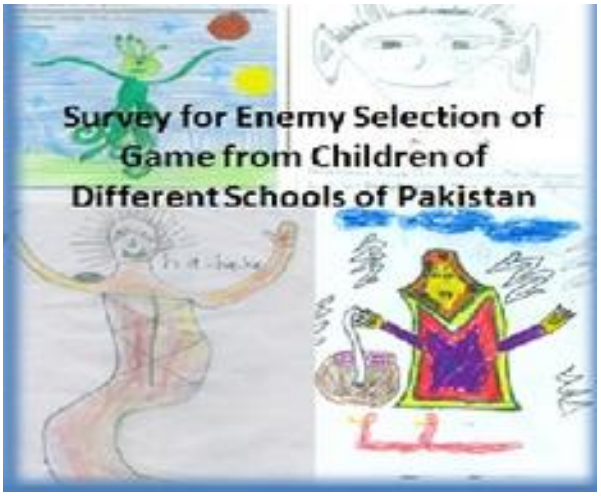

Figure 1 Sketches for Enemy Shapes

After getting through various enemy sketches it was decided to make enemy in round shape. The decision of round shape was taken partially due to the round shape of the tumor. Further, most of the kids sketched enemy in green color and so the enemy was colored as green. The final shape of enemy character is shown in figure 2.

Figure 2 Enemy shape

The next step was to identify the sort of weapons children want to use to kill their enemies. It was interesting to note that most of the kids chose Injection as their weapons. The reason behind choosing an injection as the pain they feel during injections and they wanted to transfer that to their enemies. Further, the developers wanted to give the message to the students that if they want to fight their enemies the main weapon is available in their bodies i.e. white blood cells which create their immune system and can overcome diseases easily.

5. RESULTS AND FURTHER DIRECTION

After the game was successfully designed and implemented it was deployed in different hospitals to identify the results of the game. Developing team was of the view that the game would be appreciated by the children and their involvement in the game will help in the healing from their disease. Interestingly, the team was not thinking about the cognitive outputs of the game. It turned out that the kids, which were playing the game were recovering speedily than the kids which were not using it. Because the kids were taking the injections and medicine on time as they have defeated their enemy with these weapons and they were taking the food on time as in the game they gain power after eating the fruits in the game.

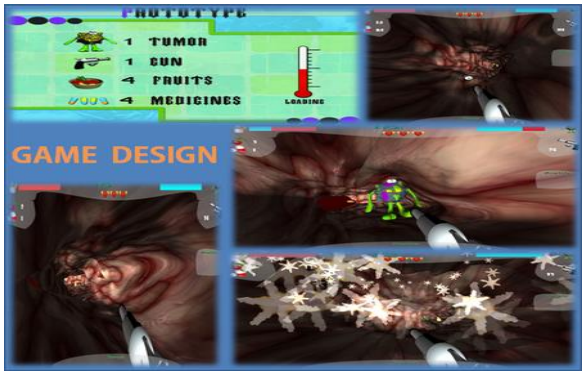

Figure 4 Images from Prototype

Quick healing of the children showed that the product achieved the desired goal. The success as stated earlier, lies in the proper analysis and designing phase. The game could have been developed in many ways like all the other games but is developed in accordance to the desire of the children which improved the chances of acceptability both aesthetically and cognitively.

The development team is planning to develop further versions of the game for more improved functionality. They also intend to develop similar products for other types of diseases as well, which will aid the patients to overcome the diseases quickly. 3D GIT team also plans to start a training program

for oncologists/ Psychologists in various hospitals of Pakistan on the implementation of this innovative gaming therapy.

6. CONCLUSION

It is necessary to provide practical knowledge to the students of Computer Sc. As the majority of them believe that the coding of a software project is the most important requirement of a successful product. By conducting the research, such as 3D GIT and incorporating it in the curricula the students would be able to grasp the importance of other phases of SDLC which will make them a better programmer.

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