International Journal of Information, Control and Computer Sciences
ISSN: 2517-9942
Vol:8, No:10, 2014

Survey to Assess the Feasibility of Executing the Web-Based Collaboration Process Using WBCS

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***Abstract*—**The importance of the formal specification in the software life cycle is barely concealing to anyone. Formal specifications use mathematical notation to describe the properties of information system precisely, without unduly constraining the way in how these properties are achieved. Having a correct and quality software specification is not easy task. This study concerns with how a group of rectifiers can communicate with each other and work to prepare and produce a correct formal software specification. WBCS has been implemented based mainly in the proposed supported cooperative work model and a survey conducted on the existing Web-based collaborative writing tools. This paper aims to assess the feasibility of executing the web-based collaboration process using WBCS. The purpose of conducting this test is to test the system as a whole for functionality and fitness for use based on the evaluation test plan.

***Keywords*—**Formal methods, Formal specifications, collaborative writing, Usability testing.

I. Introduction

FORMALmethods are one of the routes to much better software writing. Formal Methods help to reinforce the importance of a proper engineering approach to software development, as they relate both to the requirements specification and to the subsequent coding stage [1].

Every stage in the development of a software system is a kind of specifications. Software specifications will become the major reference document when the work shared through the software life cycle [2].

We believe in software development life cycle, the collaboration on producing a formal specification document of the software would save time overall and deliver a better result.

This study concerns with how a group of rectifiers can communicate with each other and work to prepare and produce a correct formal software specification.

To address these matter, we come into view of a theoretical framework that categorized into two; collaborative issues and formal specification issues. The overall issues are shown in Fig. 1.

Both issues are taken into consideration when we propose the solution of the subject that is a web-based model of Computer Supported Cooperative Work (CSCW) for preparing and writing formal software specifications document [3].

The proposed model provides software developers with a web environment that supports them to collaborate and to help them to produce correct formal software specifications[4].The model introduces a new technique to produce a formal specification called SNL2Z [5].

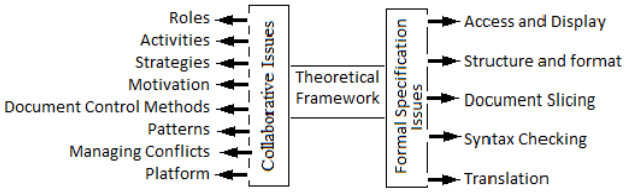

Fig. 1 Issues in CSCW for formal specification

II. The Evaluation Method

The majority of evaluation occurs in the form of user testing, which takes place after implementation and user testing is essential [6]. The main focus in usability testing for the WBCS is on studying the user interface and the support that it provides for the user to efficiently perform and conduct performance collaboration improvements.

The validity of WBCS prototype system is assessed to answer the principle question “have we built the right system?” if we justify that the needs and the requirements of the user are being fulfilled. The second question to be answered by the tests is “Have we built it right?”. If we have built the right system and the system was built right, we can justify the prototype system as an advantage.

An empirical test has been carried out for the usability and validity of the WBCS prototype system. The test was arranged in a laboratory environment. A multiple method approach of observation and questionnaire is used at the laboratory test. The formulation of the questionnaire specifically testing usability is based on the literature [7],[8]. The data base is tested for redundancy by checking that each fact is stored ones to improve update consistency and new data to be added without affecting existing programs and finally terms used can be easily understand.

III. Participants

Our study involved sixteen of participants. They are undergraduate students at the Faculty of Information Science and Technology (FTSM), University Kebangsaan Malaysia (UKM). They are well accustomed to use computers in their daily working routines. The participants have a technical background and all of them have experience using the Web and are familiar with other Web-based discussion tools. The participants have completed at least one course in Formal Method through their study and they are familiar with the

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formal specifications and Z notions. The participants were randomly assigned to four groups of four students.

IV. Case Study

A university wants to computerize its internal telephone directory. The database must keep a record of all the staff who are currently member of the university (as only they can have telephone extensions). The database must cope with the possibility that one person may be reached at several extensions and with the possibility that several people might have to share an extension.

V. Data Collection

In the study, two main types of data have been collected. The first type includes observations from the interaction between users (objective data). These data include the corrections that the users wrote, the comments that they produced, the reports that the system produced, and the log files that our system kept.

The other main type of collected data came from the survey we have carried out with users (subjective data). Most of the data collected for the study of our system was objective data.

VI. Objective Data Results

We was interested in observing the way users collaborated, particularly when they were using system facilities to write their comments on others correction. These comments were linked to a particular correction. All these corrections were saved. However, we were not interested in the content of the corrections. For example, we have not evaluated the quality of these corrections nor how the users themselves evaluated the corrections. Instead, we have focused on the evaluation and commenting process of these corrections.

VII. Subjective Data

The subjective data was collected just after the group had completed the collaborative task. The method we used to collect subjective data was a survey. Users who supplied subjective data were filled out a questionnaire. The questionnaire was filled by those participants who were involved in the evaluation test.

The questionnaire is divided into seven sections: background information about the participant (7 questions), Satisfaction with WBCS prototype system (8 questions), the ease of use of the WBCS prototype system (5 questions), the screen design and layout of WBCS prototype system (3 questions), Operations of WBCS prototype system (12 questions), the learnability and interaction flexibility of WBCS prototype system (5 questions), the difficulties and comments (5 questions).

The users are required to use five-point likert scale ratings in the questionnaire as indicated in Table I.

Participants have to fill out a questionnaire of subjective rating about the prototype system and effectiveness as a whole. As expected, the user's approaches to learning very widely. Some users are able to complete the tasks quickly, while others take time.

TABLE I
Five-Point Likert Scale Ratings

No	Description			Scale
1	Very easy	Completely Satisfied	Strongly agree	5
2	Somewhat easy	Satisfied	Agree	4
3	Not sure	Not sure	Not sure	3
4	Difficult	Dissatisfied	Disagree	2
5	Very difficult	Completely Dissatisfied	Strongly disagree	1

VIII. Analysis and Discussion of Results

The first usability design walk through tests the effectiveness and usability of icons, menu titles, field labels, and methods of access for various levels of users with graphical user interface experience. Users are able to identify almost the correct meaning of all icons.

The usability test reveals that WBCS is easy to use and fast in completing the tasks. Table II shows the summary of the questionnaires and the statistical results.

The mean values for all eleven categories are above or close to four (agree), which is regarded as a satisfactory level.

A. Satisfaction

The questionnaire with its all items is employ to assess the subjective satisfaction of the users after testing the prototype system. The results reveal that WBCS is easy to use, learn, control, and fast in completing the tasks.

B. Usefulness of the WBCS

The users unanimously agree that the WBCS system is useful to the software developers by the facilities that it provides, and it will encourage them to write formal software specifications.

C. Screen Design and Layout

The template presentation format with the operation help the users perceive the overall structure of the WBCS.

D. Navigation

Navigation through the prototype system proves to be both easy and flexible. The meaning of the icons corresponds well with the users' expectations. Thus using the icons to browse the pieces of information provided is straightforward.

E. Consistency

The static presentations of the descriptive part, as well as the dynamic functioning of the user interface, are standardized and predictable in the prototype system. No inconsistencies are revealed the test.

F. Learnability

Every group of users has sat for the introduction of the WBCS. Within 30 minutes, practically, every user has learned the basic functionality of the prototype system. The fourteen users master the user interface of the system completely and two satisfactorily. The sixteen users agree that the WBCS at least partially widened their understanding of the formal specification concept.

TABLE II
SUMMARY OF QUESTIONNAIRES AND STATISTICAL RESULTS

No	Categories	Mean	Std. Deviation
1	Satisfaction (Overall Performances)	4.19	0.543392667
2	Usefulness of the WBCS	4.13	0.608243107
3	User Control	4.00	0.632455532
4	Ease of Use	4.49	0.5510347
5	Screen Design & Layout	3.94	0.680073525
6	Navigation	3.81	0.644455259
7	Consistency	4.13	0.336010753
8	Learnability	4.06	0.573730483
9	Correctness	3.94	0.61892206
10	Terminology	3.63	0.5
11	Operation & Efficiency of Use	4.14	0.547259354

G.Efficiency of Use

The tests show that the system provides the users with quick access to the available information as well as efficient instance for presenting information consistency.

Participants in the test bring with them Expectations about collaborative writing. These attitudes uncovered in the questionnaire present that 37.5% of the participants have strongly agreed that they do not prefer to work independently and they feel that working with other people is more helpful than working alone, while 62.5% of them have only agreed .

As for sharing their work through the WBCS prototype system, the most common advantage reported was the easy of using the prototype and accessibility to the information and comments in all the stages of the processes. 87.5% of the participants valued the fact that all the prototype system was easy to use with no difficultiesworking on it. One respondent wrote, "*It is easy to use; we just need to click some buttons or type in the needed information*".

Beside the ease of the use, some participants consider that the using of comments in the rectifying process in the WBCS prototype system has helped them to get the job done. One respondent wrote, "*It is easy to use and we can know what the error is, and other's comments are helping me to know my mistakes and to assist me do the correction*", anther one said, "*Comments and solutions from others have helped me to overcome the problems that I did not even know*."

Respondents after using the WBCS prototype system, they state that the system was helped them most in learning the process of writing formal specification. One of them expressed "*The system helped me to understand more clearly about Z specifications*," "*It helped me to learn and understand Z specification*," another user said. Some mentioned that by suing the prototype system they learn how work with others and correct their work, in this context a respondent has wrote, "*This is a good system where I can learn and correct my specification ... It is easy and better to work with others*"

Many of the views and valuable observations have been collected through this questionnaire; one of these important observations was to use this system as a learning tool for students. They believe that the using of the system and the different process that it uses, by students will increasetheir skills and abilities. One respondent wrote, "*Student should try these specification writing processes in WBCS to improve their skill.*"

A few disadvantages were also mentioned from some participants. Some of these disadvantages were related to the using of the WBCS prototype system, while some others were related to shortcoming in the facilities that the prototype offered. Some users got some confuse during the use of the system and they were complained from the difficulty of understanding the process. The reason for this is the neglecting of some students in the good preparation for the work on this system, where the user manuals were distributed to students in advance, but some students have not prepared well. Two users have mentioned to this problem and one of them wrote, "*I felt a bit confused when I was using the system,*" the other used stated, "*It is difficult to understand the flow of the operation.*"

One more complain have received from the users is regarding to the facilities of the WBCS prototype system. Some of the respondents indicated to some problems with the system and the solving of these problems should be taking in mind in any future upgrading of this WBCS. 50% mentioned that the system should provide the user with a help to write the Z symbols and not depend on the symbols booklet. One user has suggested that the WBCS should have information library and he wrote, "*WBCS is a good system ... It should have library for people to search about information while using this system.*"

IX. CONCLUSION

The main objective of carrying out of this test is to assess the feasibility of executing the web-based collaboration process using WBCS. The usability testing focuses primarily on assuring that the prototype system is easy to use and understand, and the navigation and windows layouts have to be reviewed that they are easy to understand and use.

We believe that the results of the usability testing were very encouraging and the ratio of 78% of the users confirmed that the system was easy to use and understand. In addition, the responses of some users, such as, "*After I have used this WBCS system, I felt very happy to use it,*" indicate that our system has got the satisfaction of users.

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