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COLLABORATIVE MIND MAP TOOL TO FACILITATE REQUIREMENT ELICITATION

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ABSTRACT. Requirements elicitation is a crucial task in any software development process. It is notable as a major contributor to the project failure. To minimize and subsequently improve the process, folding Mind Map concept in the elicitation process and implementing it collaboratively is being proposed in this study. The aim of the study is to study the impact of the Mind Map and groupware in facilitating requirements elicitation. A prototype based on *PowerMeeting* is developed to illustrate the idea of mind map groupware called Collaborative Mind Map Tool (CMMT) which to be analyzed its impact towards requirement elicitation process.

Keywords: requirements elicitation, folding Mind Map, Collaborative Mind Map Tool (CMMT)

INTRODUCTION

Requirements elicitation is a process of identifying the requirements of the problem to be resolved by gathering, uncovering and understanding the needs of stakeholders. It involves the process of extracting and understanding the needs of stakeholders, and defining the application domain and problem context with explicit and precise descriptions. Requirements are obtained from the stakeholders as the primary resources, careful analysis of the organization, the application domain and business process where the system will be deployed (Kotonya, et al., 1998). Obviously those activities require intensive communication, collaboration and cooperation between stakeholders and requirement engineers. During this process, it is essential to capture the "right" understanding of the problem and interpret it correctly in agreeing representation. It has well been recognized that requirements elicitation is the most crucial and important aspect in any software development prior to analysis and specification stage.

Despite its crucial process, it is notable that requirement gathering is a major contributor to the failure in any software development project (Macaulay, 1996; Bohem, 1981; Rahman, 2004). Studies indicate that among the main problems in the requirements elicitation process are: gaps in communication and understanding, inadequacy of management; lack of knowledge and skilled people in approaching the requirement process; and process with wrong techniques and methods (Al-Rawas, et al.,1996; Weigers, 2003; Tsumaki, et al., 2005).

To overcome the situations, a Mind Map, which is a thinking "tool" that reflects how the information is stored and retrieved in a more organized and systematic way inside a human brain, will be bring into the requirement elicitation. Mind Map is a technique which uses graphical illustration in expressing thoughts and idea based on the concept of Radiant Thinking- a natural function of human mind (Buzan, et al., 1995). The subject of attention is placed in a central image, and radiates the ideas from the central image and hierarchically expands and associates the branches and its sub-branches with keywords. Information is categorized and classified, and subject is layout in a "snapshot" and organized way.

Furthermore, incorporating objects which are more stimulating than words such as shapes, images and colors in Research done by Ralph Haber, and later by R.S. Nickerson, have proven that images are more stimulating than words and thus generate more creative ideas and encourage better memorization. The Mind Map is used widely by many individuals and organizations and can be applied in most activities or situations, i.e. in decision making, analysis, problem solving, to-do list, note taking, brainstorming, presentation or even to write down simple notes.

Exploitation of Mind Map will generally multiply individual personal creative capabilities when collaborate in a group (Buzan, et al., 1995). Psychologically, group mind map encourages information sharing and teamwork (Morris, et al., 1998). It generates the sense of contribution which then encourages the team members to commit on job execution by viewing and understanding ultimate objective of the subject matter. This is essential criterion in teamwork to have same vision and mission (Hughes, 2008).

Greater exploitation can be achieved when incorporates the group mind map into groupware. Groupware is a technology that supports systematic and structured group collaboration (RAMA, et al., 2006). Generally, groupware is categorized into two primary dimensions of perspectives; the time and the space. The time illustrates the collaboration happens at same time (synchronous) or different time (asynchronous), whereas the space view on the perspective of where the collaboration is executed; whether it is in the same place (co-located) or different place (none co-located).

There are many significant advantages of groupware compared to a single user system, i.e. 1) To facilitate communication; make it faster, clearer and more persuasive 2) As a mechanism to transfer and share knowledge 3) To help in motivating individual to perform better 4) To collaborate a group of people of the same interest 5) A way to form structured group coordination and proactive collaboration 6) To save time and cost.

However, building groupware system is considered to be more challenging compared to individual system due to distinguish features in groupware system such as 1) presentation of groupware- high level of usability criteria; easy to learn, easy to use, error tolerant and subjectively pleasant, 2) collaboration and communication mechanism-classify the private and sharing information and maintain the consistency of the data throughout the instance, 3) work coordination- a defined process to be followed to encourage work accomplishment 4) openness- easily be integrated with other applications 5) group composition- management and control of the accessibility of groupware participants (Wells, 1996; Volksen, 1992)

COLLABARATIVE MIND MAP TOOL (CMMT) IN FACILATATING REQUIREMENT ELICITATION

Many studies have been done to find ways in improving requirement elicitation mainly due to the cognizance of the requirement engineering as one of the crucial factors contributing to the success of a software project. The process is more about people, communication and collaboration. A few studies and attempts to use Mind Map tool in various phase of software development process has been encountered (Eric T. Blue, 2006). However, very little usage of Mind Map in requirement activities as compared to project management activities. One convincing example that practically uses Mind Map in requirement elicitation is by Kenji Hiranabe. In his article, he has outlined few benefits and illustrated the example with specific template in using Mind Map in requirement process. He also provides a way on how to map mind map into UML diagrams using JUDE-a design and communication tool (Hiranabe, 2007; Change Vision, Inc, 2006).

Surveyed by Chucked Frey (2007) shows that collaboration is the most beneficial feature in Mind Map tool, and according to Nikos Drakos, a Gartner Inc. analyst, Mind Map will become more interesting and beneficial if it is move towards collaborative online (Gilhooly,

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Paper No.
067

2006). This indicates that collaborative Mind Map tool has potential significant impact to people and the process of software development in particular.

Requirement and Specification

Conceptually, the proposed CMMT hybrid the features from Mind Map theories and the distinguish features of groupware system; with the objective to improve the current problem facing in requirement elicitation.

The following are features proposed to be in CMMT:

Presentation of the tool: Inherited from the concept of Mind Map, the tool should tag with high level of usability. Conceptually, Mind Map is a simple and easy concept as it is based on how our brain works. Thus, the tool should be easy to integrate into practice and simple to use. Additionally, color, shapes and images will be used to trigger information which make the tool more attractive and motivate users to use it.

Communication mechanism: Radiant concept of mind map should articulate the information in a better way and present them in a more structure, clearer and more focus. With categorization and prioritization of information help to better understand the requirement and reduce ambiguity and inconsistency of requirements. Enriching the value of the tool, it should support both "synchronous" and "asynchronous" features. Having these features, existing requirement elicitation techniques (e.g. introspection, task analysis, brainstorming, laddering, requirements workshops, goal-based approach, scenarios, viewpoints and etc) can easily blend with mind map.

Collaboration mechanism: Information can be classified as private or sharing depending on the scenarios. A control mechanism is provided to manage the accessibility of information among the participants with centralize architecture to maintain data consistency. Nowadays, increasing in globalization has demanded multisite software development organizations (Damian, et al., 2003). Making the tool as a web based, it able to support distributed geographical requirement gathering activities which obviously save time and cost.

Work coordination: A floor control or session control is used to control the session and to ensure the process is executed in defined and structured manner. It also controls the accessibility of the participants in each elicitation session. This is to make the elicitation process more systematic, focus and efficient.

Requirement elicitation specific features: 1) Data Dictionary – A feature where crucial term or glossary can be defined. One of the problems in requirement elicitation is not sharing common understanding of concepts and terms. This ensures all crucial terms and concepts can be defined and agreed between stakeholders. 2) Record and Playback - A feature to record and replay each of the session. This can be used to further understand and review on the agreed requirements or decision. 3) Attachment Uploading – A feature where each requirement/information can be attached with supporting resources (e.g. organization plan, business process, legacy system manuals and etc.). This is to cater for which requirements may originate from different sources and formats. 4) Prioritization and Status updates – A feature where each requirement can be attached with priority number and status. This is to prioritize on the crucial requirements and to set the status of requirements (e.g. to revisit and decide on the specific requirement.). 5) Chat – A feature where users can discuss on any issues rose during the requirement elicitation session.

Implementation Strategy

The prototype of CMMT is built on top of *PowerMeeting* framework. *PowerMeeting,* a work-piece (on going research) by Dr. Weigang Wang (2008), is a web based synchronous groupware framework which offers flexible, customizable and extensible groupware development environment. It basically provides with basic collaborative functionalities such

Proceedings of the 3rd International Conference on Computing and Informatics, ICOCI 2011,8-9 June, 2011 Bandung, Indonesia

Paper No. 067

as floor session control, user management, transaction management, text messaging, voice chat, session control, and also other existing groupware plug-in tools such as calendar tool, pincardboard and presentation slides.

From a high level technical point of view, the *PowerMeeting* framework is modeled based on Model (Shared Model) – ViewController (MVC) architecture and transactional replicate architecture employed from CommonGround toolkit, to provide with the basic groupware services such as user management, session and group management, replication and transaction management and persistence management (Wang, 2008). The implementation is built using AJAX technologies offered by Google Web Toolkit (GWT). AJAX is used to gain the benefit of instantaneous and faster response time, asynchronous partial updates and other rich user experience characteristics.

The flexibility and collaborative features furnish by *PowerMeeting* framework has made the prototype implementation and deployment of CMMT easier. Figure 1, illustrates the CMMT on the *PowerMeeting* interface.
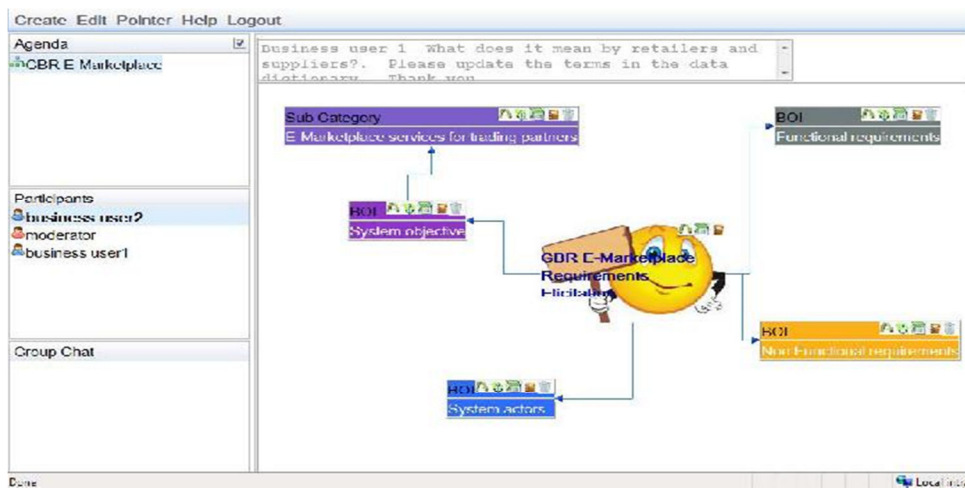

Figure 14: CMMT on *PowerMeeting*

Mind Map Tool Architecture

Mind Map tool is plugged-in into the *PowerMeeting* framework through the creation of Model/Shared Model objects and View-Controller objects. Model objects are used to hold and process the data and information in CMMT while the View-Controller objects hold the responsibilities to interpret the events initiated by the users, convey the instructions to the model for data processing or application specific processing and notify the view of any changes in the model object.
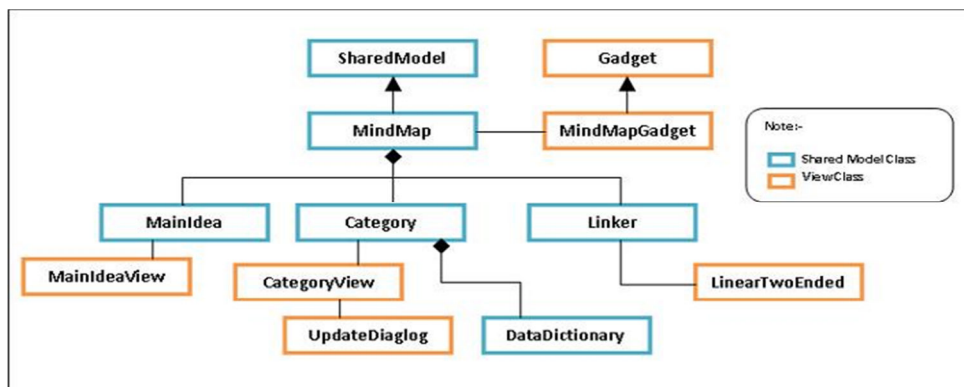
Below figure shows the object models of CMMT.

Figure 15: CMMT Object Model

Proceedings of the 3rd International Conference on Computing and Informatics, ICOCI 2011,8-9 June, 2011 Bandung, Indonesia

Paper No.

067

Model objects are defined mainly on the basis of mind map theory by which it has the central subject matter (MainIdea) and radiates the idea into branches (Category) through associations (Linker). CMMT model objects need to extend SharedModel object provided by the framework to inherit the services to handle replication and transaction. Having this, CMMT model object instances can be made available and shared by all users in real time.

Evaluation and Analysis

The prototype-CMMT was successfully built which furnishes with three basic essential elements outlined to be achieved i.e. features that supporting requirement elicitation activities, Mind Map concept, and collaboration. A scenario of a software project development is given to a small group of participants to be executed for evaluation. The selected participants are those who are already familiar with elicitation process but having minimal background knowledge on mind map. Having this focus group we aim to get more reliable insight on the impact of CMMT towards elicitation process.

Feedback and comments were gathered through questionnaire at the end of the elicitation activities. The goal are to capture responses on usefulness of CMMT in requirement elicitation, the effortlessness in using CMMT, the layout and the performance of CMMT. Scale of 1(Strongly Agree) to 5(Strongly Not Agree) were used in capturing the responses. As an addition, participants can also plainly comments on a free text space provided.

More than 70% of participants agree that CMMT overlays a structured way of capturing requirements resulting to better understanding of the gathered requirements. However, only 30 % of respondents agree that CMMT promotes group work and encourages more detailed requirements capturing. In terms of the layout, over 60% responses in the group agree that the CMMT layout is easy to use and learn yet they are not sure on the effectiveness of the layout to generate creativity and memorization. On the other hands, the response time of CMMT is generally bearable to the participants. Since it was only tested by a small group of people, this finding would not be a strong claim to support the hypothesis. However, the work presented has provided an insight for future works in collaborative groupware and requirement engineering field.

CONCLUSION AND FUTURE WORKS

Observing the result from the evaluation and analysis, we believe that CMMT has demonstrated its potential capabilities in supporting requirement elicitation process.

In future, CMMT prototype is to be tested and validated in real software development project situation in order to get an actual insight of CMMT in terms of the significance offered and the improvement towards elicitation process. Also, further refinement should focus on implementing all the proposed features and subsequently extending the feature list so that it can fit to other requirement engineering processes; i.e. requirement modeling and analysis, requirement validation and requirement management.

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Paper No.
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