A Digital Workbook Tool to Support Asynchronous Collaboration

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Abstract. In our Computer Science Department at Universidad de Chile –as in many other departments around the world- every day more and more students are using TabletPCs as a substitute for their traditional notebooks. In many situations, these students need to interact with instructors, assistants and their partners in both synchronous and asynchronous way in order to carry out the tasks involved in their courses. In this context, a problem occurs when students try to share their digital annotations. This proposal of project intends to develop a digital workbook tool that runs on a TabletPCs and supports the student’s asynchronous work. The digital workbook will use the services provided by OneNote 2007 and it will extend the Conference XP platform in order to integrate the asynchronous work into such tool. The digital workbook will work in both ways, connected to a Conference XP archiver and connected to another peer (TabletPC). Using this tool the students can share and synchronize their annotations with other student’s annotations, and they can work in a collaborative way, which can improve their learning.

1. Institutions details

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2. Principal investigator

Luis A. Guerrero (luguerre@dcc.uchile.cl). Assistant Professor at the CS Department (Universidad de Chile), currently he is in charge of two courses of the software engineering area. His research areas include Computer-Supported Cooperative Work (CSCW) and Computer-Supported Collaborative Learning (CSCL). His current research activities are focused on the use of collaborative mobile devices (PDAs, smart phones and notebooks) to support educative scenarios. He has participated and led several research and development projects in Chile (see more details in http://www.dcc.uchile.cl/luguerre).
3. Co-investigators

Sergio F. Ochoa (sochoa@dcc.uchile.cl). Assistant Professor at the CS Department (Universidad de Chile), currently he is in charge of three courses of the software engineering area. His research areas are Computer-Supported Collaborative Work/Learning and Software Engineering. His current research activities are focused on the use of collaborative mobile workspaces running on TabletPCs, PDAs and notebooks, which are used in ad-hoc work scenarios. He has participated and led several research and development projects in Chile, Argentina and USA (more details in http://www.dcc.uchile.cl/sochoa). He has a vast professional experience leading consulting and development teams, mainly on Microsoft platforms.

Cesar Collazos (ccollazo@unicauca.edu.co). Professor at the Systems Department (Universidad del Cauca, Colombia), coordinator of the group of investigation IDIS (Research and Development in Software Engineering). His research areas includes Computer-Supported Cooperative Work (CSCW), Computer-Supported Collaborative Learning (CSCL), Human-Computer Interaction, and Educational Software. He has participated in several research projects. More details in http://atenea.unicauca.edu.co/~ccollazo.

4. Possible collaborators:

Andrés Neyem (aneyem@dcc.uchile.cl): PhD candidate at the CS Department (Universidad de Chile) and Teaching Assistant in the course CC51A-Software Engineering. His research areas include Computer-Supported Collaborative Work/Learning and Mobile Computing. Currently he is designing and implementing a software platform to facilitate the development of collaborative mobile applications running on small computing mobile devices and Tablet PCs. Such work is part of his PhD thesis. Andrés has a strong professional experience related to Microsoft technologies and tools including Microsoft .NET/COM+, Windows Mobile, Tablet PC Platform SDK, Smart Devices Programming and Visual Studio 2005. Andrés will be in charge of the architecture design and development process of the proposed digital workbook.

Gabriel Bravo (gabravo@dcc.uchile.cl). He is a Software systems engineer and student of the Computer Science Master program at the CS Department (Universidad de Chile). Currently he is starting to work in his master thesis on the proposed digital workbook. Gabriel was the main developer of MOCET (Mobile Collaboration Evaluation Technique) and he is an expert programmer in C# and .Net Platform. He has been developing software applications for several Chilean software companies since 2000 by using Microsoft technologies.
Francisco Castro (fcastro@dcc.cuhile.cl). He is a software engineer with a large experience in service-oriented computing and networking. Currently he is starting the master thesis and he is implementing additional functionalities for SOMU platform, such as the support for: WS-Security, WS-Discovery, WS-Attachments, and routing on MANETs.

Gonzalo Vitta (mavillar@dcc.uchile.cl). He is a CS Master student at the CS Department (Universidad de Chile). Currently he is starting to work his Master thesis extending the SOMU platform to be used in educational scenarios. His research areas include Computer-Supported Collaborative Learning and Educational Technology.

Manuel is an advanced programmer in C# and .Net Platform specialist in service-oriented computing.

Leonardo Oporto (loporto@dcc.uchile.cl). He is a Master degree student at the Computer Science Department from Universidad de Chile. He has a large experience in object oriented technologies. His research areas include Educational Technology.

5. Problem Statement (sharing annotations layers)

Students and instructors can make annotations on a presentation (or any other type of document) using different tools running on a Tablet PC. Some of these tools are: Conference XP Client, Classroom Presenter or ReMarkable Texts. However, such tools are not able manage the annotations as an independent information layer, that can be shared or integrated with annotations made by other students. For example, a student “A” who was not able to attend today’s lesson, could request and integrate the annotations done by three of his/her partners “B”, “C” and “D” during the presentation in order to improve his/her understanding of a specific issues. All of them are using a digital workbook able to share objects and keeps the link among them (e.g. slides and annotations, or paragraph and annotations).

When student “A” meets with “B”, the first one requests the annotations that “B” did into each presentation slide. Provably, if the students are on a garden at the campus without access to an archiver, their digital workbooks implement a Mobile Ad-hoc NET (MANET) on-the-fly in order to share objects among them. Then, when student “A” meets with “B” and “C”, he/she repeats the process. As a consequence, student “A” has the current instructor presentation which now includes the annotations made by students “B”, “C” and “D”.

The same functionality can be used to support asynchronous teamwork, where the team members carry out their activities in a distributed and independent way and then, they have synchronous meets to integrate their contributions. The results of the team work could be submitted to a Conference XP archiver by using the digital
workbook functionalities to interact with a Conference XP archiver. Finally, the instructor rates the submitted work and the results can be downloaded by the team members from the archiver, or it can be shared among them.

6. Proposal Description

The main goal of this research proposal is to develop a digital workbook able to run on TabletPCs, which allows engineering instructors and students to share several kinds of objects. These objects can be, for example, a Word document, or an annotation included inside a document. These objects will have an XML representation and they can be synchronized by using XML Synch protocol implemented in SOMU (Service-oriented Mobile Units) [Neyem, 2006].

The digital workbook that embed the shared objects will be able to form a MANET on-the-fly and support the users interactions in such communication way. In addition, special functionality will be developed to integrate this digital workbook to the Conference XP Platform. It will be used not only to support traditional (synchronous and face-to-face) instruction, but also e-Learning and b-Learning. The PI is currently in charge of exploring solutions to support these instructional scenarios for the Engineering School of the University of Chile.

Using the digital workbook we will understand the challenges, opportunities and limitations to use TabletPCs and the proposed tool in engineering educational scenarios. The PI and their collaborators have previous experiences on this area and we want to continue exploring this scenario studying the impact it has on the student’s education. Last year we developed an application tool named MOCET (Mobile Collaboration Evaluation Technique) which was used in two software engineering courses to support the evaluation processes carried out by students using TabletPCs (see Figure 1 and 2).

The obtained results were really good and they were reported in a scientific article (see [Ochoa, 2007]). The technical solution we propose for the digital workbook will mix two of our previous work. The annotations support will be reused from MOCET and the support for data sharing, interactions on MANETs, and data synchronization will be reused from SOMU (Service-oriented Mobile Units) [Neyem, 2006].
7. Expected Outcomes

The most important project outcome is the digital workbook tool that will be designed to support the asynchronous collaborative work in educational institutions. This solution will be integrated to the Conference XP platform by allowing both instructors and student to interact in synchronous and asynchronous way. This initiative is a proof-of-concept that could be extended by the Engineering School if the obtained results are good enough. In addition, at least one article will be submitted to an important conference in the area, which will report the main results of the project. The experimentation with the digital workbook will allow us to understand the challenges, opportunities and limitations to use TabletPCs and the proposed tool in Engineering educational scenarios. This tool not only includes the traditional instruction scenario (synchronous and face-to-face work), but also e-Learning and b-Learning.
8. **Project Plan: Schedule**

The project is planned as an iterative process consisting of four stages and four milestones. The stages and milestones are the following ones:

**Stage 0** (month 1): Project kick-off, detailed planning and initial task assignments.

**Stage 1** (months 2 to 5): Adaptation of MOCEET tool and SOMU platform for working together. Design and implementation (first version) of the *digital workbook* tool. Design of a scientific experiment to validate the proposed initial solution. Writing of an article presenting the design features of the digital workbook and submit it to a prestigious international conference.

**Milestone 1 (month 5): First version of the digital workbook tool.**

**Stage 2** (month 6): Experimentation in two courses at Universidad de Chile, and analysis of the experimental results. Identification of strengths and weaknesses for using the digital workbook. Identification of design aspects which requiring reengineering.

**Stage 3** (months 7 to 8): To improve the design and implementation of the *digital workbook*. Design of a scientific experiment to validate the second proposal (second version). Starting writing an article reporting the results of the digital workbook application.

**Milestone 2 (month 8): Second version of the digital workbook tool.**

**Stage 4** (months 9 to 10): Experimentation in two courses at Universidad de Chile and analysis of the experimental results. Identification of the digital workbook strengths and weaknesses. Identification of design aspects that require modifications. Finishing the writing of the second article reporting the results of the *digital workbook* application and submitting it to a prestigious international conference.

**Stage 5** (month 11): Adjust the *digital workbook*. Documentation of the tool’s features through technical reports that allow us to continue this initiative in the future. During this stage the PI will attend to the MSR Faculty Summit to present the contributions of this research project.

**Milestone 3 (month 12): Third version of the digital workbook tool.**
**Milestone 4 (month 12): Two papers presented (or accepted) in two prestigious international conferences.**

9. **Technologies to be used for developing.** Technologies and tools involved in this project are the following ones: Tablet PC Platform SDK, Visual Studio 2005 (in order to take full advantage of custom managed code applications in C#, Windows XP and .NET Framework/Compaq Framework).

10. **Dissemination and Evaluation.** The findings of this research initiative will be reported in at least two papers to be presented in prestigious international conferences of the area, such as: CRIWG, CSCL, ECSCL, CSCW, CSCWD or HIC. In addition, the findings will be presented in local workshops, invited talks and research meetings. Software products developed by this proposal will be made electronically available to the general public, licensed under the open source model.

11. **Other Support**

The Department will provide desktop PCs, servers, printers and physical space to carry out the development process. It will also provide 10 Tablet PCs (7 HP Compaq tc4200 and 3 HP Compaq tc4400) to support the development and experimentation processes.