An example for synchronized usage of different applications in the classroom

Georg Turban
Department of Computer Science
Darmstadt University of Technology
Germany
turban@informatik.tu-darmstadt.de

Max Mühlhäuser
Department of Computer Science
Darmstadt University of Technology
Germany
max@informatik.tu-darmstadt.de

Abstract

In the given publication an example for synchronized usage of different applications in the classroom is presented. To create a vivid environment for PowerPoint-lead lectures, we combine different interactive displays and force separation of phases of creating new content and augmentation of existing content. We deal with synchronization issues that occur while presented content is stored for later retrieval and content is delivered from different applications.

We extend a common presentation environment by a projector and an interactive whiteboard to support a large auditorium. Our setup is economical in terms of development costs. A small application was developed for the interactive whiteboard. The discussion of the presented scenario is based on an evaluation in a class with over 100 computer science students.

1. Introduction

In the last years, computer systems and in particular notebooks became a widespread aid in higher education. Currently, interactive input devices like Tablet PCs and interactive whiteboards are getting more popular.

The corresponding software for these devices is specialized for handling, mediating and augmenting multimedia content. Several of those applications are also widely used to present and modify multimedia data during lectures but sometimes discussed controversially in this context [1]. Applications like Microsoft's PowerPoint are able to support both static and dynamic content. Contents in form of text, diagram, audio or video can be integrated straightforward and used uniformly [2]. The digital representation also has many other advantages. Presented content can be converted easily into web-friendly formats and delivered to a broad mass.

Using such a manifold application on a single device is quite comfortable for the lecturer. On the one hand the alternating usage of different devices can be vitalizing for students, but on the other hand they may be interfered with a lecturer who juggles between too many applications and devices.

The scenario that we expect to be more vivid but still easy to handle extends a common presentation scenario and will be presented in the following chapter while the remaining of the paper is organized as follows: Chapter 3 presents our approach to enhance a traditional PowerPoint-presentation by introducing an interactive whiteboard in addition to the independent software TinyWB. Chapter 4 serves to present selected technical aspects regarding the synchronization of multimedia content. Finally, we present selected but comprehensive results from examinations to assist our discussion in chapter 5 and finish with a summary of our work.

2. Extending a common presentation

We expect to enhance a PowerPoint-laid lecture by introducing an interactive whiteboard with a different intention to the classroom. We developed an application for interactive whiteboards that enables us to highlight the users interactivity while he creates new content in contrast to the presentation of (augmented) prepared content using a PowerPoint-like system.

Furthermore the application at the interactive whiteboard can be used by students during the tutorial or to illustrate their questions during a lecture.

Although PowerPoint can be used on interactive whiteboards and supports basic annotation facilities we miss certain aspects:
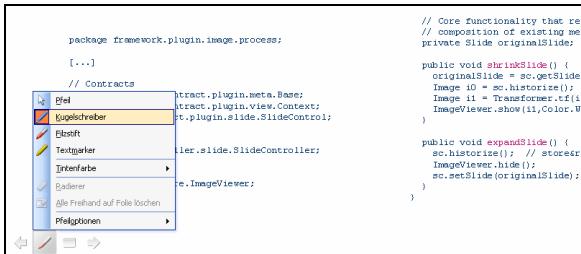
Figure 1: Annotating a slide via PowerPoint

- the control is circumstantial (see figure 1)
- the drawings contain no temporal information
- hand drawings can be stored resp. to a slide, but an empty slide can not be created on the fly

Our common presentation scenario relies on the presentation system for lecturers that is described in [3]. It enhances PowerPoint and overcomes the presented missed aspects.

Because of former experiences we decided not to use the application that is usually used by our lecturers, but offered the students to use the application for the interactive whiteboard. Moreover we expect several other advantages while using this additional application on a different device. Since the content is displayed on a separate projector, it usually remains visible for a longer time. The turns between devices should make the lecture generally more vivid.

3. Experimental setup

The setup presented in figure 2 consists of following hard- and software components: Three projectors, an interactive whiteboard (SMART Board [4]) and an interactive pen display (Wacom Cintiq 21UX [5]) are connected to a computer system that is able to serve four independent displays.

The presentation environment to the right of the dotted red line is controlled by the presentation system *Presenter* [3]. In this scenario its purpose is basically to provide the lecturer with a possibility to augment PowerPoint slides and therefore only roughly described. While current slides are displayed on the middle projector, an existing function is used to present former slides on the one to the right [6].

The projector to the left shows exactly the same content like the interactive whiteboard, since both of them are connected to a single VGA-output of the computer system using a common VGA-splitter.

We created the application *TinyWB* with a different purpose than *Presenter*. It has been designed in particular for interactive whiteboards and especially

- switching devices, applications and content types
- didactical separation
- transfer of content
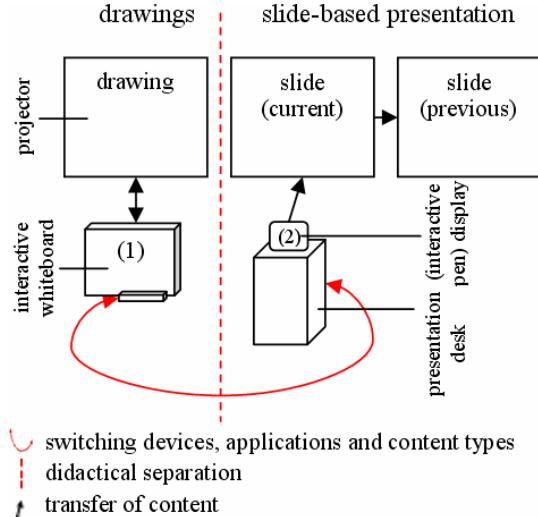
Figure 2: Experimental setup

supports the SMART Board. See figure 3 for a view of its user-interface that includes several tools.

TinyWB can be used without dedicated trainings and runs on any system that provides a current Java Runtime Environment. Devices like interactive whiteboards, interactive pen displays or Tablet PCs are recommended due to its drawing purpose. Running TinyWB under Microsoft's Windows allows using its special support for SMART Boards. TinyWBs design is simple and clearly follows the model-view-controller (MVC) design pattern. Please refer to figure 4 for its class diagram and figure 3 for a view of its tools. MVC allows us to keep the toolbars view and model in sync with the underlying model of the real hardware. The SMART Board for example is able to detect the currently used tool (basically it distinguishes between the sponge and pens and the pens colors) due
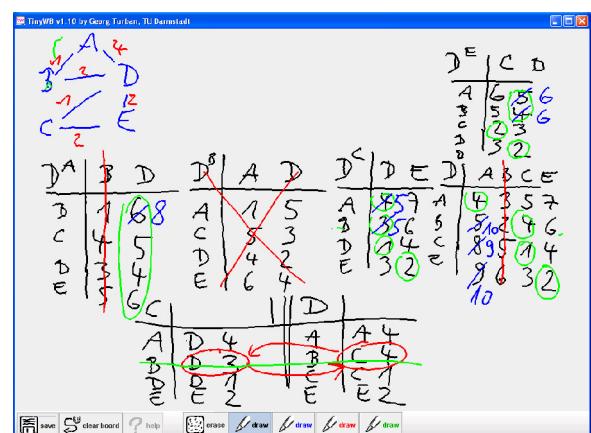
Figure 3: A student's illustration of a solution
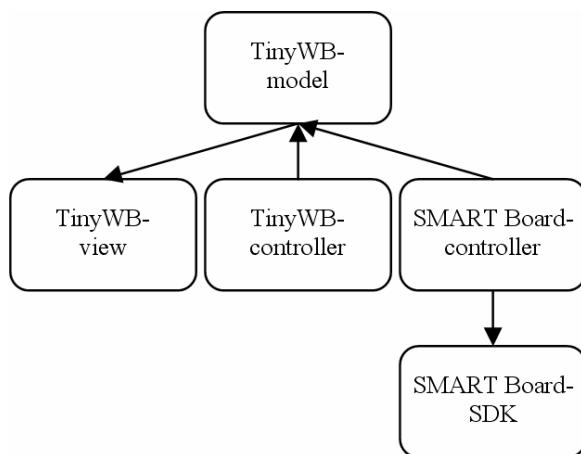
Figure 4: Class diagram

to sensors in the corresponding trays. This *SMART Board-controller* modifies our *TinyWB-model* and offers our lecturers and students an extremely intuitive usage.

Using different systems requires some kind of synchronization between their presented/created content, e.g., to support the students with a continuous and proper recording of the lecture. For synchronization purpose we created a database component that deals with the creation of continuous and synchronous storage of multimedia content and follows our concept presented in [7]. It is depicted in the next chapter that deals with the synchronized usage of our two applications.

4. Synchronization

The different phases and transitions during a lecture can be described by figure 5 that represents the state diagram of our scenario presented in chapter 3.

A common lecture that relies only on PowerPoint traverses the states *begin*, *PowerPoint* und *end*. The transition labeled with *2* summarizes different actions like *a slide transition*, *an animation step* or *the integration of an annotation*. During these transitions,
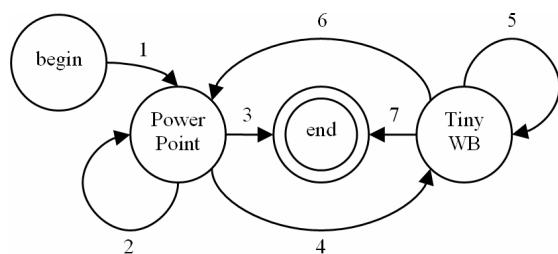
Figure 5: State diagram

a database component will be used to synchronize the content. A typical database call contains a parameter *granularity*, since the granularity of the transmitted content differs. For example, the integration of a single annotation begins when the stylus touches the drawing surface and ends when it is raised. The beginning and ending defines a period of time that is part of the interval during which the corresponding slide is presented. Displaying a slide ends with a slide transition (*2*) or closing the application (*3*). The temporal duration of latter two events is related to our definition of the *atomic* granularity.

Handling of another application like TinyWB is supported by simply adding a parameter to the database calls that identifies the currently used application. Therefore, a transition between different applications can be easily expressed by the transitions labeled *4* and *6*. They will be handled in analogy to the presented example of slide transitions within a single application (*2*). Open intervals will be closed in order to open new ones related to the focused content of the targeted application.

5. Discussion

We presented a scenario that consists of different hardware components and software applications and a simple concept for synchronizing the presented content of different software applications.

The feedback of our students regarding the described scenario was generally positive. Very interesting is that the aspect of introducing different devices and applications for different purposes was rated clearly positive. We delivered questionnaires after a lecture that implemented the described scenario and was attended by 105 students from which we got 80 questionnaires back with feedback.

The item "The conceptually separated presentation of prepared slides at the presentation desk and creation of sketches at the interactive whiteboard was … 1 = negative; …; 8 = positive." got 5.86 points on average with small variance. "The switches between the interactive whiteboard and the presentation desk were … 1 = negative; …; 8 = positive." got 5.70 points with larger variance than the previous item.

We asked the students for feedback to latter item and interpreted their 17 comments as follows:

Besides five neutral comments like "neither positively nor negatively influenced", we received three negative: "changing the pen slows down the lecture", "too long turn-around-time" and "place the desk and interactive whiteboard close to each other, otherwise the presentation is interrupted".

In total twelve positive comments have been submitted. Besides the comment "The combined techniques extend the lecturer's possibilities for presenting" there have been five comments that heavily approve the clearness of our approach like "processes can be visualized extremely well using the interactive whiteboard" or "thus the (prepared PowerPoint) slides stay free of annotation". A more exciting lecture and higher activation has been attested by six contributions like "changing the media makes the lecture more interesting (but please do not overdo)", "makes the lecture not so monotone", "more dynamic" or "is more vivid and especially good while drawing huge diagrams".

The presented approach for synchronizing the content allows us to introduce a database component with easy archiving and retrieval facilities. Distinguishing between content by their identified granularity allows us to correct temporal information while they are gathered and assign them clearly to other intervals of different granularity. So far, our experiences are quite positive. It seems that this is a suitable compromise between structured and simple handling of contents for our designated use.

The hierarchical structure of our repository enables us to easily iterate over content with a specific granularity and extract meaningful indices like discussed in [8]. An overview of all slides can be generated by limiting the retrieval of content to the corresponding depth of granularity and used for printing purpose. A realistic reproduction of the whole lecture is possible by including finer structures and removal of the depth limit during retrieval. This should be equivalent to approaches that linearly record all content and events. The discussed example of synchronization is scaleable and not limited to the synchronization of two applications.

6. Summary

Although it is quite comfortable and common to use a single application for presentation purpose, there are without doubt scenarios where it makes sense to combine different software systems. We presented such an example that consists of different applications and devices and allows creating a more vivid environment for lectures and received feedback of students that shows clearly that they preferred this kind of separation in the examined scenario that relies on two different applications and their purposes.

According to this example, we presented our approach for handling and synchronizing content delivered by the two applications. Storing the content

in a hierarchy has several benefits for us and turned out to be very easy to handle.

7. Acknowledgements

8. References

[1] Tom Creed, "PowerPoint, No! Cyberspace, Yes," The national teaching & learning forum, volume 6, number 4, James Rhem & Associates, Inc., 1997. ISSN 1057-2880.

[2] Microsoft Corporation, "Microsoft PowerPoint," http://www.microsoft.com, last visited on September 28th, 2006.

[3] Georg Turban, Henning Bär, "Anreicherung und Koordination von Vortragsmaterialien," In: Proceedings of the eLectures Workshop at DeLFI 2005. Ulrike Lucke, Kristin Nölting, Djamshid Tavangarian (Hrsg.). pp. 73-74, Logos Verlag, Berlin, 2005. ISBN 3-8325-1023-0.

[4] Smart Technologies Inc., "SMART Board interactive whiteboards," http://www.smarttech.com, last visited on September 28th, 2006.

[5] Wacom Technology, "Interactive pen displays," http://www.wacom.com/lcdtablets/index.cfm, last visited on September 28th, 2006.

[6] Georg Turban, Guido Rößling, and Christoph Trompler, "Bridging media breaks in presentations," In Proceedings of the 10th annual SIGCSE conference on Innovation and Technology in Computer Science Education, Caparica, Portugal, ACM Press, New York, USA, p. 377, 2005.

[7] Georg Turban, Max Mühlhäuser, "A category based concept for rapid development of ink-aware systems for computer-assisted education," In Proceedings of the 7th IEEE International Symposium on Multimedia, Irvine, California, USA, pp. 449-457, 2005.

[8] Peter Ziewer, "Navigational Indices and Full Text Search by Automated Analyses of Screen Recorded Data," In Proceedings of E-Learn 2004, Washington, DC, USA, 2004.