

StuPad: Integrating Student Notes with Class Lectures

Khai N. Truong and Gregory D. Abowd

GVU Center & College of Computing

Georgia Institute of Technology

Atlanta, Georgia 30332-0280

+1 404 894 7512

{khai, abowd}@cc.gatech.edu

ABSTRACT

A classroom environment contains both private (student-generated) and public (teacher-generated) streams of information. This paper discusses a system, StuPad, that integrates publicly available streams of information, such as a lecture presented by an instructor, with notes captured by individual students. We discuss the motivation for StuPad within the Classroom 2000 project and present a prototype to support capture and access/review activities.

Keywords

Ubiquitous computing, capture and access application, computer aided note-taking, educational application.

INTRODUCTION

The classroom lecture is a shared experience between the instructor and the students. Typically, the instructor lectures on some subject matter, and the students record much of the instructor's presentation. Unfortunately, the student's goal to record accurately the events of the lecture may interfere with the goal of understanding the content of the lecture. We want to support a more effective student note-taking practice through the use of enhanced technology.

In a Classroom 2000 environment, the ZenPad system provides the service of capturing the public streams — everything that the instructor presents, writes and says [1]. After each lecture, students may access this collection of notes over the web. Handwritten notes by the instructor become indices into audio (and video) recording of the lecture. Because ZenPad captures these streams of information, students are relieved from the burden of copying down everything that the instructor says and writes during class. Instead students have the opportunity to participate in the lecture. Although initial results of studies indicate that Classroom 2000 has the overall effect of influencing students to take less notes in class, it is misleading to think that students should no longer take

notes. On the contrary, students are now encouraged to take summary notes that capture the essence of the lectured material in their own words.

While students are now encouraged to take notes that are personally meaningful to them, traditional paper-based notes do not integrate easily with the parts of the lecture that have been captured. Paper notes alone may not carry with them enough of the lecture context, especially since students already rely on the automatically captured notes of Classroom 2000. Furthermore, the private, paper-based notes cannot be used to index into the captured, public streams. As a result, the students have expressed a desire to be able to integrate and synchronize their private notes with captured materials from Classroom 2000, motivating the addition of the student note-taking system, StuPad (Student notePad) to Classroom 2000.

THE STUPAD PROTOTYPE

StuPad is built with different interfaces for the capture phase during a lecture and the access/review phase that occurs after a lecture. By separating the capture interface and the access/review interface, StuPad demonstrates how interfaces can be designed to best support the kinds of user activities and interactions that are specific to each phase of the lecture experience.

The Capture Interface

In designing StuPad, shown in Figure 1, we focused on building a system that would allow students to continue to take notes in a manner as familiar to the traditional pen-and-paper interface as possible. We put pens in the hands of the student and provided networked computers that include pen-based video display tablets (from Mutoh) to run StuPad. While it is true that the intrinsic ease of use of paper cannot easily be replaced, we attempted to simulate the properties of paper in the system (such as the ability to flip between pages). The justification for using the system we have chosen versus other pen-based systems (including pen-and-paper) lies in its added benefits.

There are existing paper-based solutions that synchronize private notes with the audio from a live experience, such as the Audio Notebook [3]. However, the user must still personally copy the notes off the board quickly enough to synchronize what the instructor has written on the board

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with the audio being captured. NotePals integrates student and lecture notes, but the integration is rather coarse-grained and occurs only after the lecture is completed [2].

StuPad offers students two separate streams for note-taking. One is a private, blank notebook, and the other is the lecture stream that shows the presentation being given by the lecture (prepared presentation and handwritten notes created using ZenPad). Students can write in the free-form private notebook or add their own annotations onto their copy of the instructor's slides. These two streams are kept separate and can be individually navigated through use of thumbnail-image scrollbars, as shown in Figure 1.

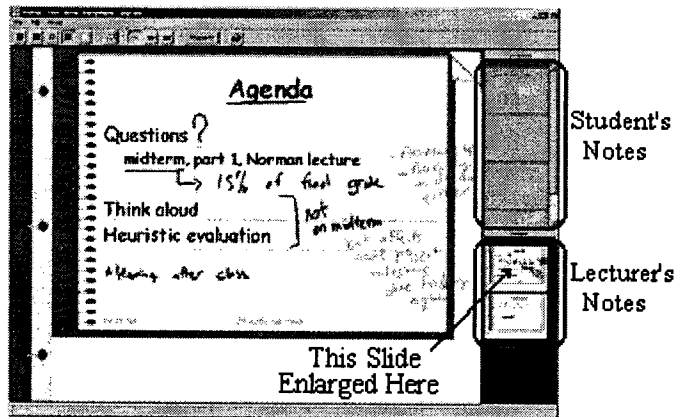


Figure 1. The Capture Interface

The Access Interface

The access interface (not shown) supports students reviewing their notes after class. During review, students are not expected to have a pen-based video display. Instead, a more traditional keyboard and mouse interface is provided. The main input is typed text and the mouse is used to request synchronization between student and teacher notes and audio or video.

While some interactions during the access phase may involve the modification of the notes, the majority of the interaction is expected to be the simple review of those notes. To best support this type of interaction, the access interface differs from the capture interface by allowing the students to view both their private notes and the instructor's notes simultaneously, splitting the screen into two viewing regions. StuPad enables the student to browse through both private and public notes, synchronizing one stream with the other. Full replay in synchronization with the audio or the video is provided through use of a master timeline.

RESEARCH CHALLENGES

StuPad will be a ubiquitous computing system subjected to real and everyday use, similar to ZenPad in Classroom 2000. Students will need to rely on the system when capturing notes during classes and when accessing notes

for review before we will be able to assess properly the impact on learning and note-taking. Hence, the reliability and robustness of the system must be addressed. Supporting a large population of users means supporting a wide variety of physical devices the users have available in order to be able to use the system. In addition, the unpredictable and sometime serendipitous nature of when and where students access their notes points to the need to make their captured notes universally accessible, while maintaining privacy concerns. Finally, allowing students to modify notes during access/review presents a time-stamping quandary that has been previously ignored by all other research into automated capture systems.

CONCLUSIONS AND FUTURE PLANS

Automated capture of the classroom experience has been a valuable service provided by Classroom 2000. The additional capability of StuPad to capture student notes that integrate with the lecturer's notes is anticipated to be an equally valuable service. Students in Classroom 2000 have requested this capability and our extensive formative evaluation and iterative design has resulted in a paper-like interface that is simple to use and more powerful than paper alone. Students will be even more encouraged to take the right kind of summary notes that are personally meaningful and can enhance their understanding of the live lecture.

The next step is to test the value of integrated electronic notes through authentic evaluation. After much initial testing and formative evaluation, we will introduce the StuPad system to the Classroom 2000 environment in the Winter of 1999. In the initial experiment, we will evaluate StuPad's impact on note-taking practices, note-reviewing, and overall effectiveness of the lecture experience for a set of students in one course.

ACKNOWLEDGEMENTS

We thank Ahmad Aslami, Brian McNamara, Steve Lin, and Margaret Li for their help in the initial development and formative evaluation of the prototype. Additional information on StuPad and Classroom 2000 can be found at <http://www.cc.gatech.edu/fce/c2000/stupad>.

REFERENCES

1. Abowd, G.D., et al. Investigating the capture, integration and access problem of ubiquitous computing in an education setting. *Proceedings of CHI'98*, ACM, New York, pp. 440-447.
2. Landay, J. et al. NotePals: Sharing and Synchronizing Handwritten Notes with Multimedia Documents. In *Handheld CSCW Workshop, CSCW '98*, Nov., 1998.
3. Stifelman, L.J. *The Audio Notebook*. Ph.D. Thesis, MIT Media Laboratory, September 1997.