Enabling the Legally Blind in Classroom Note-Taking

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ABSTRACT
Classroom note-taking has been shown to be beneficial, even if the student never reviews his/her own notes. Students that are legally blind are thus at a disadvantage because they face significant barriers to note-taking in the classroom. This presentation demonstrates a working prototype of the CUbiC Note Taker, which is a highly portable device that allows students who are legally blind to take their own notes in class without any special in-classroom accommodations, and without requiring lecturers to adapt their presentation in any way.

Categories and Subject Descriptors
H.1.2 [Models and Principles] User/Machine Systems; I.4.1 [Image Processing and Computer Vision] Digitization and Image Capture K.3.1 [Computers in Education] Computer Uses in Education

General Terms
Design, Experimentation, Human Factors

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Note-Taker, note-taking, lecture notes, automatic note-taking

1. INTRODUCTION
Students who are legally blind are unable to see chalkboards, whiteboards and overhead projector presentations without aids. Typically these students have access to various handheld or head-mounted aids - both digital and optical in nature. In the US, they also have access to human note-takers. In addition, there also exist various forms of automatic lecture recording systems such as [1], ranging from fixed-position camera systems that record everything, to digital whiteboard systems [2] that encode what is written on a board.

Despite all of this, legally blind students are still at a disadvantage. Reliance on human note-takers takes the legally blind student out of the process of classroom assimilation and interaction, and does not necessarily record what is most important to the student. While the PhotoNote [3] system is arguably the best lecture-recording system for the legally blind, it is an expensive addition to the classroom infrastructure (especially on an institutional scale) and, like most lecture recording systems, requires the student to review the content after the lecture.

Finally, due to the high magnification that is needed, portable vision aids such as [4, 5] (such as monoculars) provide users with a very limited field of view. This makes the constant transition from board-to-notes-to-board time consuming.

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Note-taking has been shown to be a beneficial process, even if the student never reviews the notes [6]. The CUbiC Note-Taker is a proposed solution to the above problems. It is an integrated system that aims to provide legally blind students with a practical means of taking notes in the classroom. The Note-Taker is cost effective and portable, requires no supporting classroom infrastructure, and no lecture adaptation.

2. THE HARDWARE and SOFTWARE

Figure 1: The Note-Taker in use

Figure 1 shows the CUbiC Note Taker as it is configured and used in a classroom. It is comprised of a servo-operated pan/tilt mechanism (Eagletron PowerPod), a consumer camcorder (Sony TRV-22), and a 13-inch Tablet PC with a 1280x768 screen (Gateway CX210X). Upon arriving in the classroom, the student quick-clamps the pan/tilt mechanism to the desk, installs the camera onto the pan/tilt mechanism, and then connects both the pan/tilt mechanism and the camera to the Tablet PC through USB cables, to produce the configuration shown in Figure 1. With practice, this set-up process takes about a minute, and can be done while the Tablet PC is booting up. The whole system is battery-operated, and runs for five hours before requiring battery exchange or recharge.

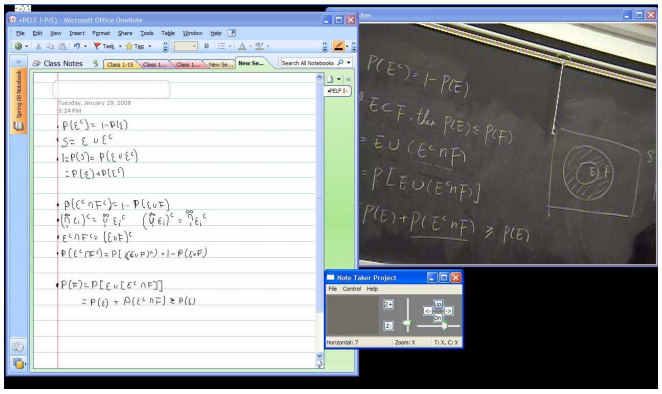

Figure 2: The Note-Taker Graphical User Interface

Figure 2 shows the Note Taker graphical user interface, which consists of three floating windows that can be positioned by the user. During lectures, the student views a live video camera feed of the front of the classroom (typically displaying a board, or a projected slide) in the video window, and takes notes by writing with a stylus into the adjacent digital notepad window. The digital notepad window is typically positioned in proximity to the camera control panel, which contains up/down/left/right buttons that allow the student to aim the camera, and zoom in or out as needed. Optionally, the student can choose to record both audio and video while taking handwritten notes. During the lecture the student can use any amount of optical zoom, and can aim the camera at the professor, the board, or a projection screen at the front of the class, without ever taking his/her eyes off the display surface of the Tablet PC. This allows the legally blind student to view both his/her notes and the board simultaneously. Since both are visible on the same screen, the student need only shift his/her gaze, much like a fully sighted student does between paper and board.

3. The presentation

The demonstration presents a working prototype of the CUbiC Note Taker. During the demonstration the audience is shown how the Note Taker can be quickly set up on a table top, how its video camera can then be aimed and zoomed, how it allows a student to take classroom notes on the surface of the Tablet PC, and how video and audio recording can be accomplished during the lecture. Those attending the demonstration (including those with visual impairments) are encouraged to try using the device.

As a result of this demonstration, attendees are able to see that the Note Taker is highly portable, is easily assembled and disassembled, does not require any supporting classroom infrastructure, does not require lecturers to change their presentations in any way, and provides legally blind students with real-time access to all aspects of classroom presentations, such as overheads, chalkboards, and whiteboards.

4. Conclusion

While the technical features of the CUbiC Note Taker can be described, the Note Taker prototype must be demonstrated to be fully appreciated - especially to people with visual disabilities, such as low vision or legal blindness, and to researchers who are involved in the development of assistive technologies for these people. This demonstration provides an ideal opportunity to show the Note Taker's functionality, and to allow people to gain "hands on" experience with it. The Note Taker demonstration is conducted by a student who is himself legally blind, and who has had considerable "in class" experience with its use. The development of the Note Taker and its user interface is an on-ongoing project, and demonstrations give potential users an opportunity to comment on its functionality, and to contribute ideas toward future enhancements.

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