

Tools for Online Instruction

Dr. John W. Lipscomb Jr., PE¹

Abstract

Classroom instruction has traditionally used the blackboard and chalk. Online instruction uses a computer display as the blackboard with many types of “chalk” including text, still images, video, and sound. This article presents the author’s development and use of hardware and software to capture lecture images with added audio for the online Construction Engineering Technology program at the University of Southern Mississippi. Developing online material can be very time consuming and efficiencies should be sought. A “webcam clipboard” was designed and fabricated to project images and capture images during classroom presentations or in the office. A compressed audio file describing the images was recorded later. The captured images and audio were then uploaded to the online software where they are available to enrolled students anytime. The result is an audio-visual online presentation that is an effective teaching tool and is dial-up Internet compatible.

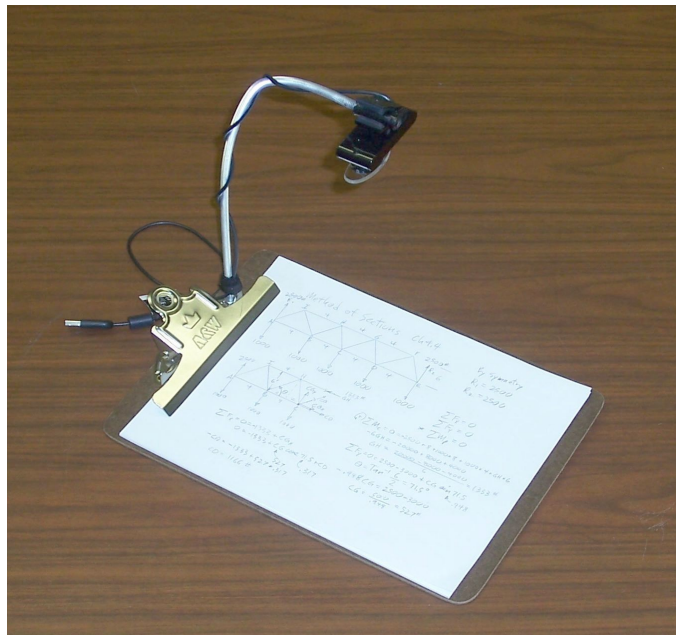
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INTRODUCTION

This paper describes a method of saving traditional “blackboard and chalk” lectures for student access on the Internet. During a lecture, text and diagrams were written on the “webcam clipboard” shown below, were projected for student view, and sequential images were captured with a laptop computer. Continuous audio recorded during the lecture created overly long files. Audio errors and interruptions were also a problem. A concise audio explanation of the sequential images recorded later in private was more satisfactory. The author used WebCT [1] to provide secure Internet access to the images and audio descriptions. Experimentation involved four different webcams and their software for this application. The best webcam and software was found to be the Logitech Quick Cam for Notebooks Pro. [2]

WEBCAM CLIPBOARD CONSTRUCTION

The following describes the process of constructing the webcam clipboard (~\$125). Purchase (1) one Logitech Quick Cam for Notebooks Pro webcam, (2) one stiff, letter size, clipboard (with a two-rivet clip mount), (3) one ¼ inch diameter all-thread rod at least 18 inches long, (4) three ¼ inch flat washers, (5) four ¼ inch nuts, (6) one pair of 2.50 small lens reading glasses, and (7) Loctite gel epoxy. A one foot piece of electrical or duct tape is also needed. Place the clipboard on your work area in front of



¹ University of Southern Mississippi, 118 College Drive, Hattiesburg, MS 30406, J.Lipscomb@USM.edu

you with the clip to the left. Using a 1/4-inch twist drill, drill out the far rivet. Cut the threaded rod to 18 inches if necessary. Install one nut onto the uncut end of the threaded rod screwed to 3/8 inch from the end. Insert the rod into the drilled hole. Add a washer and nut to the bottom. Adjust and lightly tighten the two nuts so that the rod is even with the bottom of the nut. Place a sheet of paper on the clipboard and draw two diagonal lines across the usable area of the paper (not behind the clip). Cut out a cardboard right triangle with one side 12 inches long for a gage. Bend the rod using gloves and tools to position the center of a 1-inch straight portion of the end of the rod 12 inches above the marked spot using the triangle and the image above as a guide. The nuts can be loosened and retightened to facilitate bending and positioning. The 1-inch long webcam mounting portion of the rod should be parallel with the long dimension of the clipboard and parallel to the surface of the clipboard. Cut off any extra rod length. To provide a better grip for the webcam, wrap tape on the threaded rod centered over the marked spot to about 3/8 inch diameter. With the clip on the left, mount the webcam on the tape with the wire-side of the webcam away. Wrap the wire around the rod and clamp it to the bottom of the rod with the provided Velcro fastener. A rubber band may be wrapped around the webcam clamp for a tighter mount. Hang the clipboard upside down on the edge of the worktable and weighted so it will not fall off. On the back of the clipboard, draw a pencil line across the length of the clipboard from the nut parallel to the long edges. Mix a small amount of epoxy and glue two washers and two nuts centered on the pencil line, one near the edge and one centered to stabilize the clipboard. While the clipboard is upside down, use one drop of epoxy gel on the webcam microphone hole to attach the concave side of a small reading glass 2.50 lens. Let the epoxy cure for at least 4 hours before movement. This completes construction of the webcam clipboard.

WEBCAM CLIPBOARD OPERATION

Using the webcam clipboard is similar to writing on overhead transparencies. This can be done during a lecture or prepared in the office. After the Logitech webcam is plugged into the computer, the correct size of the webcam image for projection can be adjusted as follows. Open the Quick Cam software with the display resolution at 1024 x 768. Then click, Start, Settings, Control Panel, Display, Settings, change the Screen Resolution to 800 x 600, OK. The 640x480 image capture size is used for a small file size and for an appropriate Internet viewing size. Further adjustments are as follows. With the camera running, click Camera Settings at the bottom right of the webcam display, then Driver Settings, Device Settings, Default, Drag the Saturation slider full left, Advanced, Unclick Automatic Gain Control, Adjust Gain for light gray tint with no white spots, OK. The color saturation is changed to black and white because fluorescent and incandescent lights are not white. The camera zoom should be adjusted to 120%.

The best results have been obtained using a black erasable pen (PAPER MATE Eraser Mate) on ink-jet paper which erases best. Erasing mistakes on the image is time saving and necessary for classroom presentations. Errors that are found later can be fixed with the free software PhotoPlus 6 [3] by cloning an adjacent blank area over the mistake and adding text in a similar dark gray shade. The webcam clipboard is very versatile because anything placed on it can be projected and captured. This includes tables and diagrams from the textbook, photographs, and small objects. Straight edges and templates can be used to draw accurate diagrams.

The images are captured by clicking the "Take a Picture" button at the bottom of the Logitech display. Many sequential images should be captured because extra images can be deleted later. Images that were accidentally left out can be created by copying the next more complex image, renaming it, and erasing parts of the image using the image processor described below.

For each image capturing session, the Logitech webcam software starts over naming the image files with Picture 1.jpg. This is a problem because uploading the same name will overwrite earlier images. A batch of images may be renamed easily using the free software Irfanview [4] image viewer. Click File/ Batch Conversion /Rename. The name pattern abc\$N (where abc are any number of characters) can be used to identify the batch of images and \$N preserves the word "Picture" and the sequential numbering. The changed names should be saved to another folder to avoid writing over the original images. After the renamed images are checked and moved into the course folder, the originals in My Pictures/Temp (or other custom folder) should be deleted so that other images can be stored by the webcam without confusion.

AUDIO

After the sequential images have been captured and renamed, an audio description was recorded privately using an Olympus Digital Voice Recorder WS-100 [5]. This digital recorder uses the Windows Media Audio (wma) format that streams quickly and does not require downloading. This is a very important advantage over the mp3 format. To create a small file size and clear audio, the recording mode was adjusted to LP and the Mic to Lo. The images were viewed in sequence and each was described as in the lecture. When changing images, saying “next image”. This allows the students to open the next image and more easily keep up with the audio. Files can be blended and edited with the audio software described below. In many cases, starting over is easier than editing out audio errors. As in a lecture, small audio mistakes are ignored. This result is a compressed monaural audio file at an 8 kHz sample rate and a 16 bit sound depth. The wma format may also be recorded directly on computers using an auxiliary microphone. Many audio recorders with freeware licenses can be found with an Internet search. The Free Easy MP3 Sound Recorder 2.01 [6] records wma audio at a slightly larger sample rate but this can be converted to a smaller sample rate if desired. The combination of 640 by 480 jpg images and the compressed audio described above is compatible with dial-up Internet connections.

INTERNET PRESENTATION

After the images and audio files have been created, they are uploaded to WebCT. The wma audio file is uploaded first and placed at the top of the file list. Students must open the audio file first so they can listen to the image descriptions as they page forward through the images. Students must be instructed to configure the Windows Media Player properly so that it opens wma files, remains small, and stays on top. (See Appendix) WebCT automatically opens and displays jpg images adequately and a zoom feature is available for students to enlarge images. Paging may be reversed to view prior images if the audio is paused or the time slider is dragged backward to describe the correct image. Although, no mechanism was used to synchronize the image and audio automatically, students did not report problems with maintaining an image and audio match.

SOFTWARE TOOLS

Inexpensive software is available to facilitate manipulating the images and audio. An excellent free image viewer with basic image processing is Irfanview. [4] The plugins should also be downloaded and installed. If the image sequence appears out of order, the numbering system can be changed by clicking, Options, Sort directory files, (by name ascending, XP style). To erase portions of an image and add text, a more comprehensive free image processor, PhotoPlus 6 [3], may be used. PhotoPlus 6 allows cloning a blank area over an error to erase it. Recorded audio can also be edited to omit errors. Some audio editing software programs (not Audacity) can load, manipulate, and save in the wma format. For conventional editing, the Acoustics Labs Audio Editor [7] is quite good. However, it cannot write to a highly compressed wma file. To increase the compression, the 4Musics Converter [8] can be used.

CONCLUSIONS

It has been the authors experience over two semesters that the webcam clipboard images combined with descriptive compressed wma audio provide an efficient way of producing effective online instructional content. This content has been saved for future semesters. Two semesters of Internet content are currently available. Students were queried periodically in class, individually, and with formal student evaluations about their online experiences with the webcam images and recorded audio. Prior to the addition of the corrective lens, the main complaint involved the focus quality of the images. Increased contrast was achieved with a black erasable pen over a 0.7 mm #2 pencil. Student evaluations also indicated that the online images and audio were helpful to their understanding of the material. The images and audio for an example problem could be reviewed several times if necessary. The performance using a 56K modem dial-up Internet connection was checked. The images loaded more slowly (10 seconds) and the audio performance was similar. No difference was found in the student evaluations between high bandwidth and dial-up Internet connections.

APPENDIX

The following document has been used to help students configure the Windows Media Player so that images and sound may be experienced together.

VIEWING IMAGES WHILE LISTENING TO AUDIO

(Please Print This For Future Use)

1. The Audio and Image formats are chosen to accommodate Dial-Up connection to the Internet. The following should make listening and viewing easier for you. If you are using another platform than Windows, you are probably familiar with how you can accomplish the following.
2. Open Windows Media Player. If you do not have it, download it from <http://www.microsoft.com/windows/windowsmedia/default.mspx>. It is about one hour at 28.8 kb/s (slow dial-up connection)
3. Left click Tools => Options => "Keep the Player on top of other windows". Then click File Types and be sure that Windows Media Audio file (wma) is checked. Click OK. (If you have Apple Quick Time, Winamp, or other audio programs installed, you can uncheck wma in their Edit, Preferences, and File Types. These other audio players will still play wma files if you open them with that program. This will allow Windows Media Player to open wma files automatically. Otherwise, you must use whatever program opens the WebCT wma audio files.) You can operate Windows Media Player in Full mode or Skin mode. Click the little down arrow (or View) then click Full Mode or Skin Mode. You will need to use the time slider. To see the time slider in full mode, click the down arrow and click "Menu Bar Options" and "Show Menu Bar." Now your Windows Media Player should be configured for the online sound and images.
4. You can left click and drag Windows Media Player around your desktop by left click-hold the top portion and dragging. You can also change its size by clicking and dragging its sides and bottom. Do not make it too small to use the horizontal time slider and the volume slider. If you click on the tab in the task bar at the bottom of the page, you can toggle it on and off the desktop. To make room for the images, drag the Windows Media Player to the upper right corner of the desktop.
5. If you have difficulty with Windows Media Player, you can click help for help. Windows Media Player has very many features and it is free.
6. Now that you have Windows Media Player set up. You can listen to the audio files and page through the images by the following method.
7. Enter WebCT, Log on, click on the course, click course materials, and click examples. Each example is shown separately. Click on the example that you want to view.
8. You should open the wma audio file first. When the Windows Media Player opens, size it smaller, move it to the upper right, and listen to the audio. You should see the time slider moving. You can stop and start the audio by clicking > and ||. You can choose any part in the audio file by clicking and dragging the time slider left and right. You can click and drag the volume slider to choose a comfortable volume. Small, inexpensive ear buds can be used to listen privately.
9. You can use the little green arrows in the WebCT portion to page to the right and left to view different images in the sequence of images.
10. The best strategy is to start the audio at the beginning and page through the images to keep up with the audio. You can stop the audio to study an image more closely. You can move backward or forward through the audio and images.

REFERENCES

- [1] Blackboard Inc., 1899 L Street NW, 11th Floor Washington, DC 20036; www.blackboard.com
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- [3] PhotoPlus 6, free image processor is available from <http://www.freecerifsoftware.com/>
- [4] Irfanview, free image viewer is available from <http://www.irfanview.com>
- [5] Olympus Digital Voice Recorder WS-100 (~\$80),
http://www.olympusamerica.com/cpg_section/product.asp?product=1170
- [6] Free Easy MP3 Sound Recorder 2.01 is available from
http://www.soft32.com/download_187763.html
- [7] Acoustics Labs Audio Editor (~\$25) is available from <http://www.sharewareplaza.com>
- [8] 4Musics Converter (~\$25) is available from <http://www.4musics.com>

John W. Lipscomb, Jr., Ph.D., PE

Dr. Lipscomb holds the rank of Professor in the School of Construction at the University of Southern Mississippi. He received the B.S. degree in Electrical Engineering, and the B.S. and M.S. degrees in Mechanical Engineering from Louisiana State University, and the Ph.D. degree in Higher Education from the University of Mississippi. He is a registered professional engineer in Louisiana and Mississippi.