MULTIMEDIA TOUR OF A WASTEWATER TREATMENT PLANT

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Summary: This paper describes the operation and development of a CD-ROM based multimedia tour of a wastewater plant which will be used as a teaching tool in an introductory water and wastewater treatment course in the Civil Engineering Department at the University of Tennessee, Knoxville. In the CD-ROM software, the student clicks on 3-D icons representing the various treatment processes of a typical activated sludge wastewater treatment plant. Upon clicking a process, the student can view slides and video clips with audio that show the actual treatment units along with written annotation. The software also includes a glossary of terms.

Introduction: Undergraduate Civil Engineering students at the University of Tennessee take an introductory course in water and wastewater treatment and take a field trip to see treatment facilities first hand. For practical reasons, only one trip to a wastewater plant is taken in the course and comes after the students have learned about wastewater treatment. Often the field trip is crowded and many students can not hear what the host is saying. Desirably, the students would be able to see pictures and video of real facilities and receive narration while they are learning about wastewater treatment and then be able to review what they've seen after the trip. This paper describes the development of such a "virtual field trip" of a wastewater plant. Because the software is approximately 380 MB in size, it is written on a CD-ROM.

Operation of the software: The opening screen is shown in figure 1. The inset photo on the lower right of figure 1 is a video of a chlorination basin weir with sound which plays during the opening screen. By clicking the continue button, the user brings up the overall navigation screen shown in figure 2 which is diagram of a typical activated sludge treatment plant. The student clicks on one of the unit process icons to display a short description of that unit process. For example, clicking on the aeration tank icon reveals figure 3 which is a short description of aeration tanks. The student can click on any of the highlighted terms, e.g., MLSS, to see a definition or discussion of that term. Navigation buttons at the bottom of the figure allow the student to see the next or previous process in the treatment train. The student can also click on the "PHOTOS & VIDEOS" icon to see a list of photos and videos of aeration tanks as shown in figure 4. Two of the Knoxville Utilities Board's (KUB) wastewater plants were used as examples for the photos and videos. The student clicks on one of the listed photos or videos to see examples of actual equipment or processes. For example, figure 5 shows a surface aerator. Each photo or video uses text to describe important features of the equipment or process. On several screens, there is also a glossary icon that brings up a scrolling list of terms. Clicking on a term shows a short definition or discussion of the term. An overall program flowchart is shown in the appendix.

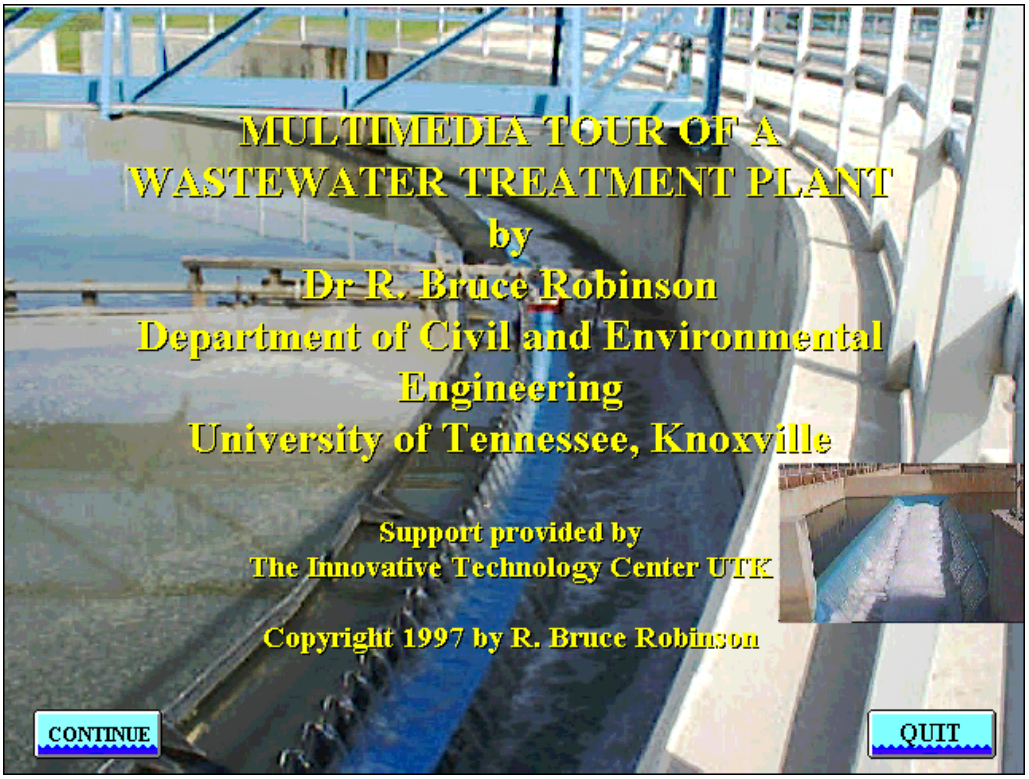

Figure 1. Opening screen view (clicking the continue button leads to figure 2)

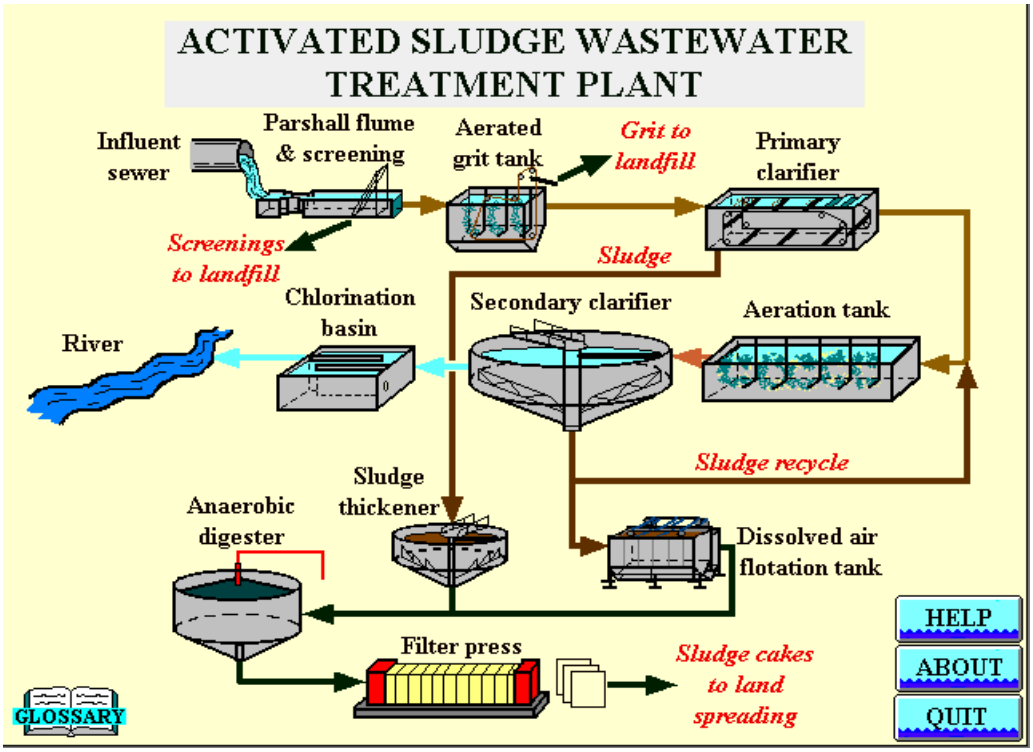

Figure 2. Main navigation screen (clicking the aeration tank icon leads to figure 3)

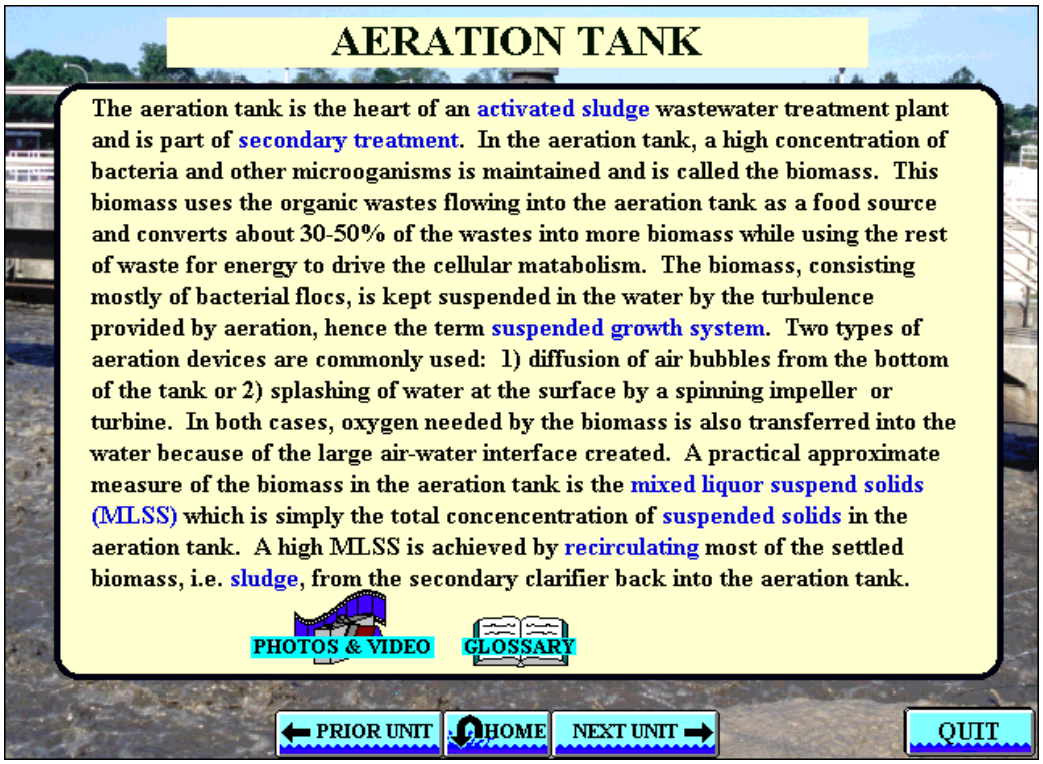

Figure 3. Description of aeration tanks (clicking the photos & video icon leads to figure 4)

Figure 4. List of photos and videos for aeration tanks (clicking surface aerator hot text leads to figure 5)

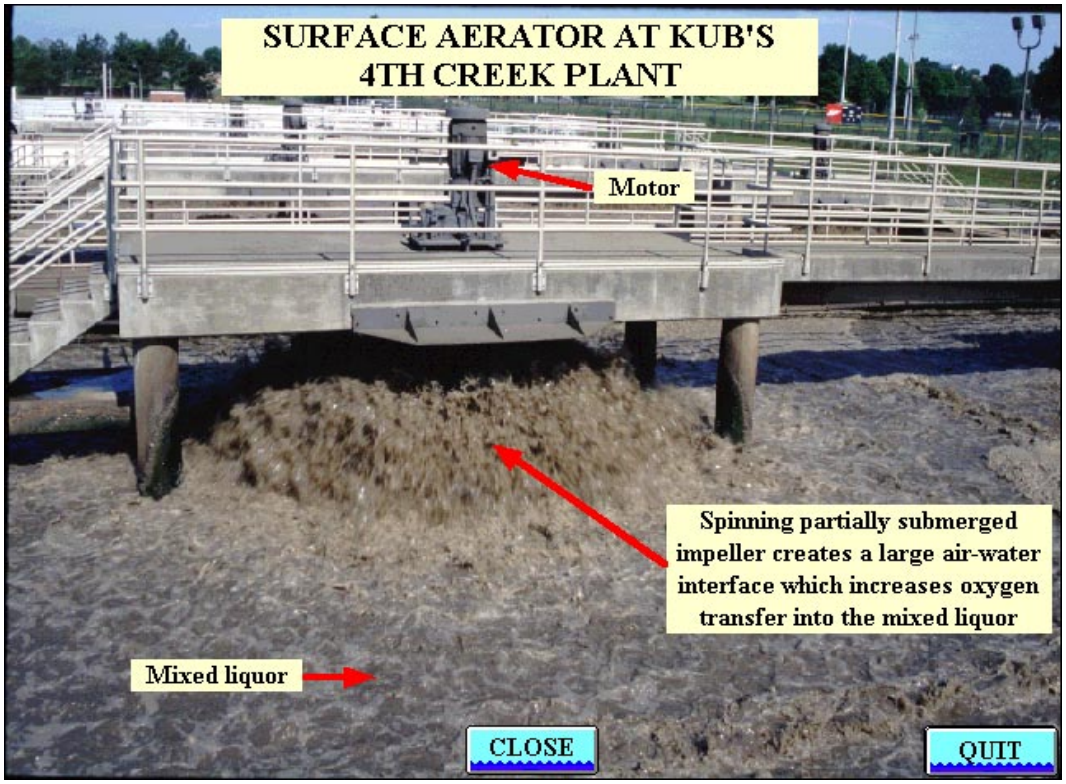

Figure 5. Surface aerator photo

Development of the software: It is interesting to evaluate the resources required to develop this multi-media software. For this project, the author's time for various tasks is estimated in table 1.

Table 1. Time spent on various tasks

TASK	WORKER	HOURS
Administrative (reports, budget, etc.)	Author	20
Planning project (story board, etc.)	Author	30
Investigation of equipment/software and purchase equipment/software	Author	35
Attending seminars on multimedia development	Author	15
Learning Authorware 3.5 software package	Author	25
Background learning about multimedia	Author	10
Taking slides and video in field	Author	20
Scanning slides and capturing video	Author	70
Authorware programming	Author	130

Creating CD-ROM's	Author	15
Taking slides and video at KUB wastewater plants	Jennie Ducker, CE student	45
Develop unit process icons for main navigational screen	Jennie Ducker, CE student	15
TOTAL TIME	---	420

Several pieces of hardware and software were purchased to develop the software as listed in table 2. A sound card was also necessary but was already available on the computer.

Table 2. Hardware and software purchased for project

ITEM	**PURPOSE**	Cost
100 megabyte Iomega Zip Drive	store and transfer the large video and graphics files	$150
Sony Hi-8 video camera	capture high resolution video	$400
HP SureStore CD-Writer 6020	write the CD-ROM's	$565
Non-commercial version of Authorware 3.5	create the navigational software	$460
Fast FPS-60 Video Capture Card	capture video	$390
Books on multimedia	-------	$100
35mm slide film & development	-------	$50
Zip drive diskettes	store large files	$84
CD-ROM labeler and writeable CD-ROMs	-------	$175
TOTAL COST	-------	$2374

Acquired skills: Several skills needed to be acquired including:

- Becoming familiar with the basics of multimedia software development,
- Using Macromedia's Authorware software which was used for the navigational software,
- Creating icons using a variety of techniques,
- Developing a story board for project planning,
- Using a digital camera,
- Scanning 35 mm slides and editing them with Adobe Photoshop,

- Capturing video and sound with video capture and sound cards and creating video and wave files using Adobe Premiere,
- Writing files to a CD-ROM with an HP SureStore CD-Writer 6000.

Lessons learned: Several things were a surprise in this project, even with forewarnings on some of them. The file sizes, especially for video and to a lesser degree graphics files were impressively large. The average video file for about 30 seconds of video was around 10 megabytes and the average for graphics or picture files was about 1 megabyte. The total size of all the project files is about 400 megabytes, most of which are video. A 100 megabyte Iomega Zip drive was found to be essential for transferring and backing up files. A larger mass storage device would have been better. The CD-Writer was good for occasional backing up of large files that were not being edited, but the long write time and the non-erasable nature made it impractical for routine backup. More trouble than anticipated was encountered in using the software across platforms. The directories and desktop settings, especially whether the desktop was set for 8 bit vs 24 bit color, had to be set carefully. Slide scanning turned out to be much easier than anticipated but the results were a little disappointing. It was not a case of "what-you-see-is-what-you-get." Although the original slides had very good color and brightness, the slides scanned into the computer much darker. This required using Adobe Photoshop to try to bring back the brightness, but the scanned images never had the quality of the original slides for interior shots. Video capture was found to be relatively easy, but deciding which settings to use was confusing and may not have been optimal. Also, a 486-66 MHZ machine was used for video editing but was borderline of what was needed. The computer took about 3-4 hours to convert a 1 minute video with captions into a video file. With a recently acquired 233 MHZ computer, the same video file creation took only 15 minutes. Adobe Premiere was used for video editing and was very user friendly. It was impressive how sensitive the Sony Hi-8 video camera was to low lighting and to sound. Several video shots could not be used because stray voices were captured, although some shots were salvaged by replacing the sound with similar sound footage. Indoor video shots indoors turned out very well. Finally, it was found necessary to be very meticulous in being consistent in format so that all similar screens in Authorware would have the same look.

One last surprise was the amount of development time needed. Developing multimedia software is very time intensive. The 360+ hours of development time for this project is consistent with comments from others. At the American Society for Engineering Education's annual conference in June, 1997. Antonio Trani from VPI suggested that it takes from 100 to 400 hours of development time for every hour of student use of a multimedia program. A visiting lecturer from Australia who develops commercial multimedia educational products estimated costs on the order of a couple hundred thousand dollars for their products.

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Biographical Information:

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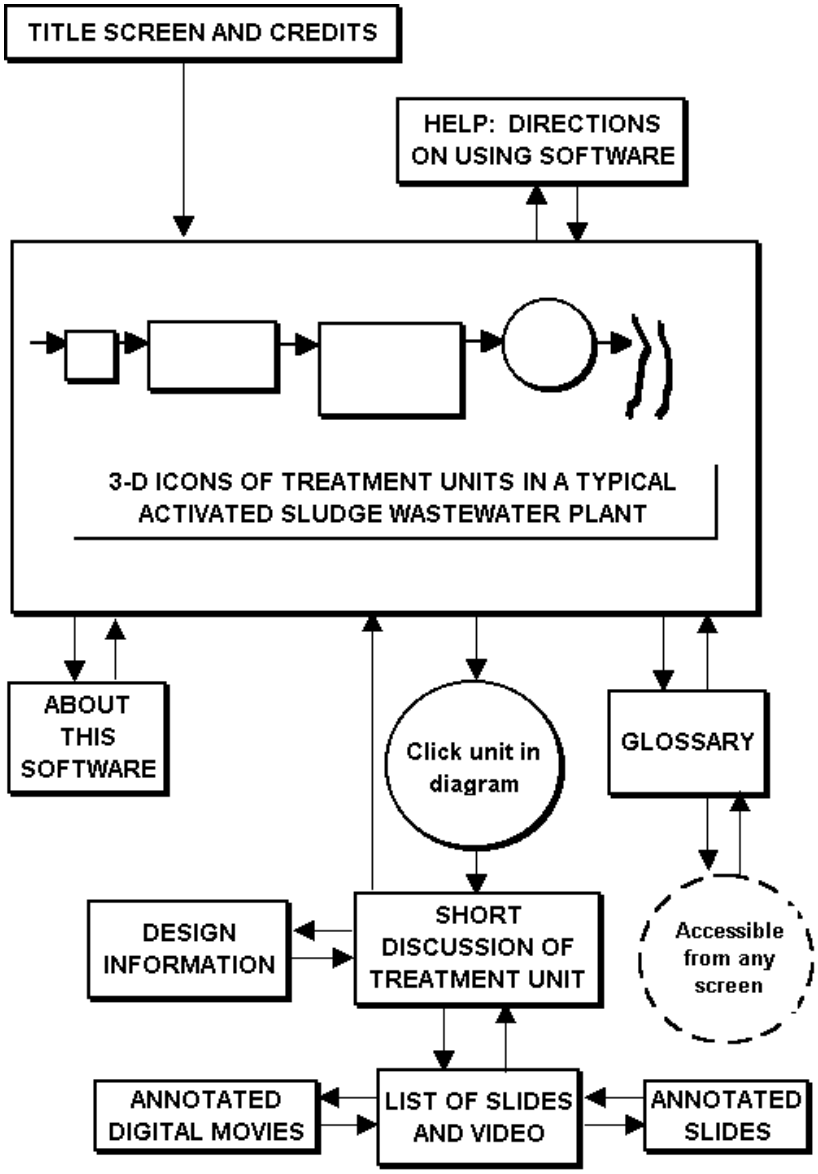
Knoxville. He received a B.S. in Civil Engineering from Iowa State University in 1973 and an M.S. and Ph.D. in Sanitary Engineering from Iowa State University in 1975 and 1979 respectively. He has authored over 60 papers and technical reports.

Appendix:



Flow chart of software