# How to Develop the Delivery Components of a Hybrid CAD Tool

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## Abstract

Over the last few years, there has been considerable interest in using the Internet to enhance the traditional engineering and technology courses[1,2]. The reason for this interest is that there are a number of advantages of Internet educational delivery systems over the more traditional approaches[3]. Many faculty members are expanding their traditional delivery methods (lecture, laboratory, face-to-face discussion) to include educational options ranging from web-based course supplement to the complete delivery of courses online[4,5]. The choices that faculty may consider range from simply posting a syllabus to creating web-based content to enhance classroom instruction to exclusive online delivery.

While the primary focus of web-based delivery has been in the development of standalone web-based distance education courses, more faculty members are beginning to use the web to supplement and enhance classroom instruction, creating "hybrid courses"[1,4,6]. The author has chosen to supplement a traditional face-to-face on-campus CAD (Computer Aided Design) course with an online supplement using WebCT. These WebCT-based CAD materials were developed in Fall 2002 and were initially implemented in Fall 2002 and Spring 2003. The materials were used in a junior level 'CAD for Technology' course. The following modules are currently available in the WebCT system.

- Course syllabus and information
- Lecture materials and extra study materials
- Discussions, chat, and e-mail
- Calendar, tips and gradebook
- Tests, labs, practice quizzes, and homework
- Supplements

This paper reports the step-by-step WebCT-based CAD development in Fall 2002, and implementations (lecture, lab, discussion, and examination) in Spring 2003.

**'CAD for Technology' Course Background**

Starting in the Fall semester of 2000, the 'CAD for Technology' course curriculum was enhanced with web-based exercises and projects[7]. By the Spring semester of 2003, a complete WebCT supplement was developed for the course and beginning in the Fall of the same year, the entire course was delivered through WebCT. Throughout the Spring 2003 semester, no course materials were committed to paper. The syllabus, handouts, course chapters, tests, unannounced-quizzes, homeworks, lab assignments, lab reports, and presentations were presented, delivered, or submitted via WebCT.

This junior level design course material covers industrial AutoCAD design practices. Its pre-requisite is the 'Fundamentals of Technical Drafting' offered in the student's freshman year. In the 'CAD for Technology' course, students involve themselves in many industrial design projects and part design laboratories.

**What is 'WebCT'?**

WebCT (Web Course Tools) was developed at the University of British Columbia, in Canada, and provides an environment for developing and delivering web-based educational activities and materials. It permits instructors to make tests, discussions, lecture materials, and sample solutions available via the web. Some course work such as homework, lab reports, and team projects, can also be submitted and controlled via WebCT (http://www.webct.com/). It is a requirement to have a University WebCT access code to fully access this website. More detailed information is available at the WebCT homepage mentioned above.

**WebCT Development for WebCT-based 'CAD for Technology'**

The WebCT-based CAD for Technology course site has been created by the author based on the text 'Discovering AutoCAD 2002' by Mark Dix and Paul Riley[8]. The homepage has twelve major links, and is shown in Figure 1. Each link is described below.

Syllabus     Course Chapters     Softwares & Downloads

Assignments     CAD Glossary     Content Study Tools

Support Materials     Information     Calendar

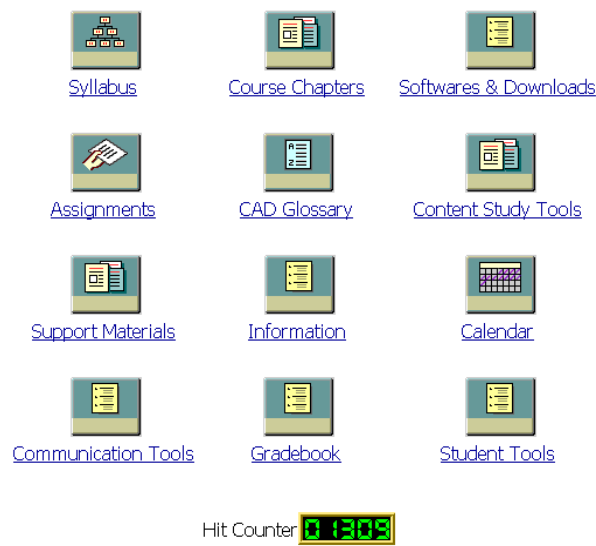Communication Tools     Gradebook     Student Tools

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Figure 1: Twelve major WebCT Links created for 'CAD for Technology'

I. Syllabus

The syllabus link connects student to a full syllabus for the course. The WebCT syllabus clearly states that nothing will be committed to paper. Paper copies of the syllabus have not been provided since the Spring 2003.

II. Course Chapters

The "Course Chapters" link allows students to access to a variety of course related materials for each lecture and lab practice. Figure 2 shows the available chapters in the WebCT-based 'CAD for Technology'. These links offer a hands-on, activity-based approach for the use of AutoCAD2002 as a drafting and design tool. It is complete with techniques, tips, shortcuts, and insights designed to increase student efficiency. Topics and tasks are carefully grouped to lead students logically through the AutoCAD command set, with the level of difficulty increasing progressively as skills are acquired through experience and practice. High quality working drawings include a wide range of applications that focus on mechanical drawings but also include architectural, civil, and electrical drawings. Each chapter is also supported by an extended AutoCAD project. The objective of the course is to educate students so that they flawlessly and efficiently produce industrial design projects.

**Table of Contents**

1. Chapter 1: Lines
2. Chapter 2: Circles and Drawing Aids
3. Chapter 3: Layers, Colors, and Linetypes
4. Chapter 4: Template Drawings
5. Chapter 5: Arcs and Polar Arrays
6. Chapter 6: Object Snap
7. Chapter 7: Text
8. Chapter 8: Dimensions
9. Chapter 9: Polylines
10. Chapter 10: Blocks, Insert, and Design Center
11. Chapter 11: Isometric Drawing
12. Chapter 12: Wireframe Models
13. Chapter 13: Toolbars Review
14. Chapter 14: Solid Models

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Figure 2: Course Chapters in WebCT-based 'CAD for Technology'

III. Assignments

The "Quizzes and Surveys" tool in WebCT lets students take online tests and evaluations. Students can take timed online quizzes and surveys in class on a given day. A clock on the quiz page counts down the number of minutes assigned to the quiz once the student has begun. Students can also submit assignments and lab reports online using the assignment drop-box tool. The instructor can then grade and give feedback on these assignments and reports. Once completed and the score recorded, the grade is made available to the student along with the instructor's comments. Some WebCT quizzes prepared for the course are shown in Figure 3. Tests and projects designed on AutoCAD are submitted via WebCT. Assignments have not been committed to paper since Spring 2003.

The Survey feature is nearly identical to the Quiz feature, except that the Survey feature is used primarily to obtain student feedback on WebCT-based CAD course. The results of the course survey in Spring 2003 revealed that students found the WebCT-based CAD 'very good' overall.

| | | | |
|---|---|---|---|
| HW #1: Switch Plate | From: January 22, 2003 6:00pm<br>Due: January 30, 2003 9:00am | / 100 | Unavailable |
| HW #2: TRF Gating Fixture | From: February 4, 2003 9:00am<br>Due: February 6, 2003 9:00am | / 100 | Unavailable |
| HW #3: Dials | From: February 6, 2003 9:00am<br>Due: February 13, 2003 9:00am | / 100 | Unavailable |
| PQ1: Flanged Bushing | From: February 18, 2003 9:00am<br>Due: February 18, 2003 10:30am | / 100 | Unavailable |
| Test1 | From: February 20, 2003 9:05am<br>Due: February 20, 2003 10:35am | / 100 | Unavailable |
| HW #4: Base Assembly | From: March 18, 2003 10:00am<br>Due: March 27, 2003 9:00am | / 100 | Unavailable |
| PQ2: Base | From: March 20, 2003 9:00am<br>Due: March 20, 2003 10:40am | / 100 | Unavailable |
| Test#2: AIT Gating Block | From: March 25, 2003 9:10am<br>Due: March 25, 2003 10:55am | / 100 | Unavailable |
| HW#5: Sketching Exercise48 | From: April 3, 2003 4:00pm<br>Due: April 10, 2003 10:00am | / 100 | Unavailable |
| Test #3 | From: April 29, 2003 10:00am<br>Due: April 29, 2003 11:10am | / 100 | Unavailable |

Figure 3: WebCT assignments prepared for 'CAD for Technology'

IV. CAD Glossary

The "Glossary" link lets students become familiar with standard CAD terminology. Students can search for definitions of CAD terms and keywords used in the course. Presently, it contains 310 definitions. Most of the AutoCAD functions and terms related to design processes are available. Students found the CAD Glossary to be a versatile and helpful tool.

V. Content Study Tools

A number of supplemental readings, study tools, and solutions are available through this link. Some examples of the materials available are solutions to part design lab practices, additional readings on design tips and different industrial practices.

VI. Software and Downloads

It is important that the user be able to open and read a variety of file formats (e.g. pdf, ppt, doc, prt, sld, etc). To help student's view most CAD related documents, a number of helpful software downloads are provided in this section, as can be seen in Figure 4.

VII. Support Materials

Many course related materials were included in this section. Instructor notes from the 'Fundamentals of Technical Drafting' course were also placed into this link.
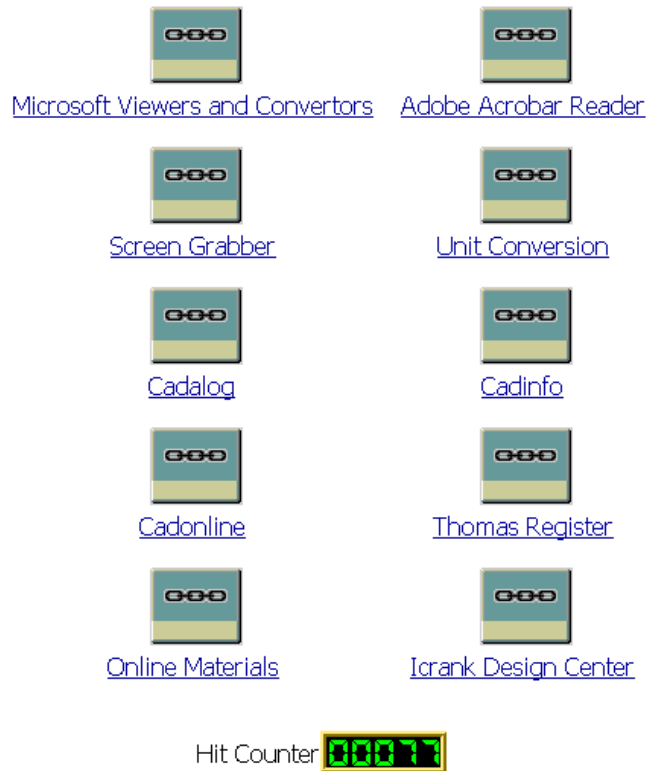
Figure 4: Software and Downloads available in WebCT-based 'CAD for Technology'

VIII. Information

General information related to course was added into this section, i.e. University Information, Course Instructor, Department, CAD Courses offered, and Industrial Technology information.

IX. Calendar

The "Course Calendar" feature lets the instructor maintain a course calendar that students can access at any time. All upcoming activities are placed in the calendar to remind students about important dates and events for the entire semester (i.e. lab schedule, report due dates, exam dates, etc.). Placing this calendar information on the course WebCT site helped increase the students' preparedness for course events and to plan ahead efficiently.

X. Communication Tools

The "Communication Tools" link lets students and design teams communicate with faculty and other students in the course using either synchronous (live) chat and whiteboard facilities or asynchronous (time-delayed) e-mail and discussion groups. Figure 5 shows the available communication tools in WebCT-based CAD course. These features provide forums for faculty-student information exchange extending the traditional office hours into virtual space.

Figure 5: Communication Tools available in WebCT-based 'CAD for Technology'

*Discussion*

The "Discussion" function allows students to engage in online discussions with a small group of students, the whole class, the instructor or off-campus individuals and groups. Messages can include file attachments and web site references. Discussions can be searched for content, sender, date sent, and other search criteria. In addition to the entire class discussion group, specific discussion groups for the lab teams were also formed to increase the efficiency and effectiveness of communication for the lab assignments.

*Electronic Mail*

The electronic mail facility allows one-to-one message transfer among course participants. Messages can be searched by sender, content and date of sending.

*Chat Rooms*

The "Chat Room" feature lets students engage in online chat with course participants inside or outside the classroom. The chat tool can be used in conjunction with the whiteboard tool to create small drawings viewable by the entire group. Most of the chat rooms are exclusive to students in that course, but there is also one general chat room that allows communication among students in any course on the same WebCT server. Four of the chat rooms are accessible by the instructor, in case he or she wishes to monitor or moderate the exchanges taking place there.

The difference between the Chat and Discussion tools is that Chat requires the students to be online and remain online for a reply (i.e. it is 'live' communication), discussion groups allow students to post questions and logon at a later time to see the group replies.

*Whiteboard*

The WebCT whiteboard allows for real-time communication among course participants using a graphical drawing interface. A user draws on his whiteboard and all other users see what he or

she has drawn. The instructor can allow whiteboards to be saved and reloaded. The whiteboard tool can be used in conjunction with the Chat function.

XI. Gradebook

This tool allows the course students to see their grades and some grading statistics on-line. Gradebook has two features:

*My Grades*

Each student can view his or her own scores as entered by the instructor. The student also has access to minimum, maximum and average scores for each course component (at the discretion of the instructor). Students also have access to the comments and grades for each on-line quiz written and marked by the course instructor.

*My Progress*

This tool is a quantitative visual indicator for the course students to see how much of the on-line activities they have completed in the semester. It serves as a motivational tool for students.

XII. Student Tools

The "Student Tools" link has three elements for the 'CAD for Technology' students. They are Student Homepages, Student Tips, and Student Presentations as can be seen in Figure 6. More versatile information on course students and their presentations were placed in this link.
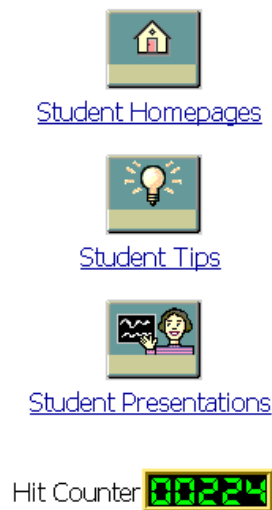
Student Homepages

Student Tips

Student Presentations

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Figure 6: Student Tools link in WebCT-based 'CAD for Technology'

*Student Homepages*

Course students can create their own homepage for viewing by others in the same course. Students are provided with an authoring interface much like that of the course designer's.

Students can add his drawings, images, text, and links to their homepage without knowing html. The homepage can be called up from a number of locations, including the homepage listing, e-mail, the conferencing system, student management and student progress tracking sections.

*Student Tips*

The instructor uses this tool to communicate with the students outside the classroom and allows for communication that supplements office hours. Suggestions and hints for student homework, labs, and reports are given to students. Some of the important upcoming activities are also announced with Student Tips. Students use these tips and reminders in their labs, homeworks, and presentations.

*Student Presentations*

Individual students or student groups can use the WebCT presentation tool to make in-class presentations. The course designer can give authoring privileges to a single student, a group of students, or to the entire class. Students with authoring privileges can upload their design projects to their area for view by all course participants. This tool is useful for displaying course projects, student work, student newsletters and more.

## Conclusions

WebCT has been extensively used in many technology courses and its advantages have been reported in various publications[9,10,11]. In contrast, there is no Advanced Industrial CAD course offered via WebCT as reported by WebCT[12]. This pioneering development transforms the traditional hands-on CAD instruction into an online hybrid WebCT implementation. In teaching the WebCT-based CAD course during the Spring semester of 2003, WebCT provided a convenient and versatile environment for the instructor and the students to interact. This new development effectively enhanced the instructor's teaching and lab practices, and increased the students' course comprehension and retention. Details about the various specific WebCT tools in 'CAD for Technology' and the manner in which these tools were utilized in delivering the course have shown the usefulness and effectiveness of online course delivery. In summary, this development maintains a cutting edge technological tool in classroom and design labs, making students more technology conscious and up-to-date. It also helps the instructor to easily create a web environment through which he or she can effectively interact with the registered CAD students. This hybrid CAD tool eliminates the amount of floppy disk, zip disk, and paper-based homework test, pop-quiz, and lab report submissions. Grading also becomes much easier. Paper-based submissions, floppy-disk/zip-disk compatibility and reliability issues faced before are eliminated. Electronic submissions allow instructor to be able to grade student works within a much shorter time frame, allowing timely feedback to the students on their progress. The graded work can then be stored and traced easily.

## Acknowledgements

**Bibliographical Information**

1.      Burgess, L. A. and Strong, S. D., Trends in Online Education: Case Study at Southwest Missouri State University. Journal of Industrial Technology, 19 (3), http://www.nait.org/jit/Articles/burgess041403.pdf, 2003.

2.      Clyburn, W. W. and Johnson W. C., A Status Report on the Use of Distance Learning in Industrial Technology. Journal of Industrial Technology, 17 (3), http://www.nait.org/jit/Articles/clyburn051601.pdf, 2001.

3.      Schmidt, E. K. and Gallegos, A., Distance Learning: Issues and Concerns of Distance Learners. Journal of Industrial Technology, 17 (3), http://www.nait.org/jit/Articles/schmidt041801.pdf, 2001.

4.      Smallwood, J. E. and Zargari, A., The Development and Delivery of a Distance Learning (DL) Course in Industrial Technology. Journal of Industrial Technology, 16 (3), http://www.nait.org/jit/Articles/small060600.pdf, 2000.

5.      Schmidt, K., The Web-Enhanced Classroom. Journal of Industrial Technology, 18 (2), http://www.nait.org/jit/Articles/schmidt011802.pdf, 2002.

6.      Reed, S. and Schweitzer, S., Developing Effective Course Websites to Supplement Traditional Classes. Proceedings of the 2002 American Society for Engineering Education Annual Conference, http://www.asee.org/conferences/caps/document2/2002-405_Paper.pdf, 2002.

7.      Dixriley (2002). AutoCAD Release 2002, http://www.prenhall.com/dixriley/

8.      Dix, M. and Riley, P., Discovering AutoCAD 2002, Prentice Hall, 2002.

9.      Pardue, S. and Darvennes, C., Dynamic and Resonating Use of WebCT. Proceedings of the 2002 American Society for Engineering Education Annual Conference, http://www.asee.org/conferences/caps/document2/2002-405_Paper.pdf, 2002.

10.     Carter, J. W., A Successful Model for Web-Based Engineering Technology Education. Proceedings of the 2002 American Society for Engineering Education Annual Conference, http://www.asee.org/conferences/caps/document2/2002-53_Paper.pdf, 2002.

11.     Lillevik, S. L. The Classroom: Online. Proceedings of the 2002 American Society for Engineering Education Annual Conference, http://www.asee.org/conferences/caps/document2/2002-326_Paper.pdf, 2002.

12.     http://www.webct.com/content/viewpage?name=content_showcase and http://www.webct.com/engineer/, 2003.

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Dr. Ismail Fidan is an Associate Professor in the MIT department, College of Engineering, Tennessee Tech University, Cookeville, TN. He has been at Tennessee Tech University since August 2000. Dr. Fidan received his PhD in Mechanical Engineering from Rensselaer Polytechnic Institute in 1996. He is a senior member of IEEE and SME, life member of TAS, and member of ASEE, NAIT, and ASME. Dr. Fidan also serves as an associate editor for the IEEE Transactions on Electronics Packaging Manufacturing and International Journal of Computer Applications in Technology. He has been ABET and NAIT manufacturing program evaluator since 2003. Dr. Fidan is the recipient of 2004 TTU Leighton E. Sissom Innovation and Creativity Award, 2003 SME Jiri Tlusty Outstanding Young Manufacturing Engineer Award, 2003 TTU Exemplary Course Project Award, 2002 Provost 'Utilization of Technology in Instruction' Award, 2002 Technology Award by The Institute for Technological Scholarship, and 2001 NAIT Outstanding Professor Award. His teaching and research interests are computer-integrated design and manufacturing, electronics manufacturing, rapid prototyping, and manufacturing processes.