Garden City – A Virtual City for Undergraduates

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ABSTRACT

The Department of Civil and Environmental Engineering at Rowan University (CEE-RU), with support from NSF and Rowan, will adopt “Sooner City”, a virtual city developed by the School of Civil Engineering and Environmental Science (CEES-OU) at the University of Oklahoma. To be named “Garden City” at Rowan, the virtual city will provide continuity for students in the undergraduate degree program. Undergraduates will go to the Garden City website to obtain data and design criteria for homework and projects, and to access photos. They will also be able to place their designs in their own personalized version of the city, allowing them to record their accomplishments. Finally, the Garden City website will provide a central location for course webpages, tutorials, etc. Faculty will use Garden City to demonstrate the context (i.e., human communities) of many civil engineering projects. The purpose of this paper is to provide greater detail on the Garden City project.

INTRODUCTION

The following text is the Project Summary of “Sooner City - Design Across the Curriculum”, NSF grant # 9872505 (CEES 1998). It is included here to provide a brief summary of the Sooner City project.

The School of Civil Engineering and Environmental Science (CEES) at the University of Oklahoma (OU) is embarking on a curriculum reform project entitled Sooner City. The project is in response to the call for more design in the curriculum, a call being made by the engineering accrediting agency, by practitioners who are dissatisfied with the design skills of graduates, and by faculty who want to promote higher-level thinking skills and improve retention.

For the project, incoming freshman will be given a plat of undeveloped land that, by the time they graduate, will be turned into a blueprint for certain segments of the city (time constraints prevent the design of an entire city). Design tasks include all facets of the traditional civil engineering program, such as site planning and layout, sewer and water infrastructure, water supply, wastewater treatment, buildings, transportation systems, channel design, floodplain analysis, and geotechnical work. A common, four-year design project unifies the curriculum and allows material learned in early courses to carry forward, unlike the “traditional” paradigm wherein courses frequently stand as independent entities with no apparent connection. Also, the project allows students to develop a professional design portfolio that can be presented to perspective employers, be
used as a valuable reference for future design tasks, or be used as part of CEES’s outcomes-based assessment. Furthermore, Sooner City provides a natural forum for incorporating other pedagogical reform initiatives, such as just-in-time learning, collaborative learning, and laptop computing.

The primary goal of the project is to produce graduates who can consistently think at a higher level, and who are thus capable of handling open-ended design projects that require creativity, exploring alternative solutions, self-analysis, and awareness of economic, social, and political issues. The extent to which we meet this goal is being assessed through formative and summative evaluations by an external reviewer.

The project is unique in that it threads a common design theme throughout the curriculum, yet does so in a flexible, cost-effective manner that requires no change in the traditional sequencing of courses. Because it does not require major institutional support, nor lock faculty into a fixed syllabus, we expect the reform effort will be attractive to many institutions (with an obvious name change for the city) and be portable to other disciplines. Reform details will be disseminated via the Web and CDROM, and through traditional outlets such as conferences, journal articles, and local and national media.

Key elements of Sooner City, exactly as presented in the OU proposal, are given below (CEES 1998)

- It is comprehensive. The design project starts in the freshman year and continues for the entire undergraduate civil engineering curriculum.
- It is novel. We are not aware of any curriculum reform project that utilizes a common, four-year design theme. Sooner City builds on our own successes, and those of other institutions, with respect to integrated projects, yet it does so in a more economical manner.
- It is flexible. The project does not lock an individual instructor or course into one track, nor does it preclude transfer or advanced placement students. Furthermore, it provides a natural forum for proven pedagogical methods, such as collaborative learning.
- It is highly portable. Other institutions can readily adopt the methodology, and the associated educational materials, because it requires little change in the structure of the curriculum. This will also promote the longevity of the program.
- It addresses a national need. The engineering accrediting agency, ABET, now promotes, among other issues, more design, active, collaborative learning, and outcomes-based assessment.

Sooner City has already been recognized as educational reform worthy of widespread adoption. NSF has showcased the project for two consecutive years in the NSF Project Showcase at the ASEE national conference. Invitations have also been received to present Sooner City at the ASCE national conference (1998) and an NSF CAREER Workshop (1998). The project has been described in ASEE Prism (Bert 1998) and Engineering Times (Siegel 1999).

Garden City will rest firmly on the foundations of Sooner City. Where possible and appropriate, elements within the Sooner City web-site will remain intact, as the primary objective is the
adaptation of Sooner City. An installation/customization wizard is under development at Rowan, which will help new users create their own Civil City (a name for the portable version of Sooner City). For example, the institution could select a new name for Sooner City and link their own courses to Garden City. The adaptation program can also be configured to allow users to select existing projects or design criteria/codes from Sooner City or add their own.

**DESIGN OF A PORTABLE CIVIL CITY**

Sooner City, still under development, currently exists as a system of web pages. The main features are the Photo Gallery, Data Map, Criteria/Codes, and Design Projects. The Photo Gallery contains pictures relevant to Civil Engineering and can be used to make slides shows. The Data Map is currently an image containing some links to data students need containing some links to data students need to complete some projects. Similarly, Criteria/codes are design criteria and design codes students need to complete some projects. Some Design Projects are simple exercises described by text file. Others use executable files that allow students to design and simulate engineering product. Unfortunately, Sooner City has not been optimized for portability. For example, projects often reside in OU course web pages. OU logos and University-specific information abounds.

This section is used to present a proposed format for Civil City, the portable version of Sooner City. The following conventions are used:

- Underlined text indicates a link.
- Italics indicate text supplied by the city web master (WM).
- Text boxes are used for comments.
- All caps text is related to the Master City initiative.

The main web pages of Civil City are given in Table 1. The databases used to create and manage these web pages are given in Table 2. The city WM uses the databases to quickly create a custom city on a local server. For example, the WM can customize the city name, add incorporate the local institution’s courses, select from existing projects and criteria/codes and create new ones. Examples of two web page templates are given in Figure 1 and 2. Figure 1 is the main web page. It contains links to the other main web pages. Figure 2 is the Project page. In class, students would be assigned projects. They would access these projects using the project page. They would access data and critieria/codes via the respective pages. They would also apply their designs to their personal city on the web-site, allowing them to record their design efforts.
<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homepage</td>
<td>Contains links to the other main web pages, a brief description of Civil City, and an area where the local user can present news.</td>
</tr>
<tr>
<td>Course Page</td>
<td>Contains list of courses associated with the city (with links to course web pages) and brief descriptions (optional)</td>
</tr>
<tr>
<td>Project Page</td>
<td>Contains list of projects associated with the city (with links to project web pages or executables) and brief descriptions (optional)</td>
</tr>
<tr>
<td>Criteria/Code Page</td>
<td>Contains list of criteria/codes students use to complete projects (with links to criteria/code web pages) and brief descriptions (optional)</td>
</tr>
<tr>
<td>Data Page</td>
<td>Provides access to data used by students to complete projects. Exact format to be determined by OU.</td>
</tr>
<tr>
<td>Photo Gallery Page</td>
<td>Provides access to photos used by professors and students alike. Also provides mechanism for user to submit or add pictures to the Photo Gallery.</td>
</tr>
<tr>
<td>Custom Pages</td>
<td>Created by local user.</td>
</tr>
<tr>
<td>Plug ins</td>
<td>Contains links used to download plug ins needed for Civil City</td>
</tr>
<tr>
<td>Contact</td>
<td>Contains contact information for the city</td>
</tr>
<tr>
<td>About Civil City Page</td>
<td>Contains information about the development of Sooner City, Garden City, and the local city.</td>
</tr>
<tr>
<td>Help page</td>
<td>Contains information that helps users navigate within the city.</td>
</tr>
<tr>
<td><strong>Name</strong></td>
<td><strong>Contains Information used to:</strong></td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Management</td>
<td>Account information and controls user access to databases.</td>
</tr>
<tr>
<td>Mainpage</td>
<td>Create the homepage, the help page, and the About Civil Cities page.</td>
</tr>
<tr>
<td>Homepage</td>
<td>Name City; Replace Civil City logo picture behind Civil City name at top of web pages; Add custom links to link list on home page. Create a custom links page using a Civil City template; Add news to home page; Add Contact information; Add institution specific information to the “About Civil City” page; and Modify the help page.</td>
</tr>
<tr>
<td>Courses</td>
<td>Create Course page (Course name, ID, web address…).</td>
</tr>
<tr>
<td>Projects</td>
<td>Create Project page (Project name, ID, web address…). Database interface also used to put new projects in the City.</td>
</tr>
<tr>
<td>Criteria/Codes</td>
<td>Create Criteria/code page (Criteria/code name, ID, web address…). Database interface also used to put new Criteria/code in the City. Criteria/code are design criteria and design codes. Students use them to guide the design of projects.</td>
</tr>
<tr>
<td>Data</td>
<td>Create data and map (used to access data) page. May also be used to manage student project files.</td>
</tr>
<tr>
<td>Photo</td>
<td>Create Photo Gallery page. Database interface also used to submit or add new photo to the photo gallery.</td>
</tr>
</tbody>
</table>
Civil City is a virtual city on the web. Many civil and environmental engineering projects serve communities. Civil City provides students with a community context for projects they design throughout their undergraduate coursework. Use the links on the left to navigate.

**What is Civil City?**

Civil City is a virtual city on the web. Many civil and environmental engineering projects serve communities. Civil City provides students with a community context for projects they design throughout their undergraduate coursework. Use the links on the left to navigate.

**What’s new in Civil City?**

The WM posts news here.

These are links to other main web pages in the city. The WM can add custom links to custom pages. The WM can also remove the predefined links, except “About Civil City”. For example, an institution might have its own course page. The WM could remove the predefined Course link (thus removing the link and the page within Civil City) and add a custom link to the preexisting course page. Templates will be provided to help the WM create custom pages that follow the Civil City format.

**Figure 1: Homepage for Civil City**
For projects already in the Civil City database, the WM selects them from the project database to create the project page.

The WM also selects associated courses from the course database (created by the WM).

For custom projects, the WM must enter.

Figure 2: Project page for Civil City
RESULTS TO DATE

Currently, the Garden City project can be divided into three main areas of development: the installation wizard, the database setup, and the main web site interface. Each of these areas are under parallel development for smoother integration of the entire system. Below, each area is discussed in terms of its primary purpose, functionality, and current status.

Installation Wizard

The installation wizard is a crucial part of the entire Garden City project. Portability is the main motivation for the installation wizard, with the goal that this system should be easy to install, saving hardware limitations, on any other institution's server. The wizard will provide basic setup procedures allowing a user to customize every aspect of the web site. More importantly, the user will not be required to have any advanced knowledge of the code and/or programs used to develop the Garden City site. By simply copying all files to the system, initializing the database setup (see database setup section), and opening the "install.asp" page in a typical web browser, the user can begin to enter specific information pertaining to the institution where the Garden City system is being installed. The installation wizard guides the user through the setup step by step and stores the entered data into the database system. When the installation wizard setup is complete, the customized Garden City web site will then be available with all user-determined options resident on the particular institution's server. The option to return to the installation wizard and adjust or change settings at anytime will also be available. Access to the installation wizard is restricted to a site administrator who will be required to enter a password to make any changes to the system.

The installation wizard is designed in Microsoft (MS) Active Server Pages (ASP) format and will run on any MS Windows NT/2000 server system. The installation wizard works in conjunction with MS SQL Server 7.0 (see database setup section) to store all customized data as well as default data included in the Garden City system. While the user will be required to invoke and complete the installation wizard to install the Garden City system, default settings will be provided such that only basic information will be needed (i.e. institution name, virtual city name, email addresses, links, and other location specific information) to setup the system.

Currently, the installation wizard has reached the point described above. Basic installation of the site, with institution specific information and some customizations that allow the user options such as which links he or she may wish to include in the navigation menu (i.e. home, courses, projects, contacts, etc.) has been implemented. The next step for the installation wizard is to allow advanced customization of the database that will allow the user to actually change the site graphics and other design features.

Database Setup

The Garden City project relies on the systems ability to store and manage information in a database system. All location specific information used to customize the Garden City site, system information such as projects, courses, and building codes, and even user specific information will be managed in the system database.
Installation of the Garden City system will also require the installation of MS SQL Server 7.0 for database management. The site administrator will also be required to setup the MS ODBC32 driver that connects the web site to the database system. Instructions for this simple procedure will be included with the Garden City software.

Currently, SQL Server 7.0 is being used to correlate and store all information gathered from the installation process and user updates. Garden City allows authorized users, typically faculty, to add information to the system, such as course or project information. This type of data is organized and stored within the database setup and remains there until removed either by an authorized user or site administrator. While only authorized users will be allowed to add, remove or change data in the database system, all users will have the capability of viewing the data via the web site interface. No users, save the site administrator, will have direct access to the database via MS SQL Server 7.0 software. Authorized users must enter or change information via the web site interface provided as part of the Garden City web site (see web site interface section). The next step for the database setup is to implement a login and password system for authorized users, and a section where the site administrator can enter or remove authorized users. This part of the system will be required to track a user, once logged in, as he or she uses the database, so that parts of the site that require authorization will be made available to that authorized user.

Web Site Interface

In general, the web site interface, the bulk of which has been described previously in this report, provides general user access to the information in the Garden City system. While most of the site is written in HTML, it is driven by ASP code that draws data from the database system and displays the information in a typical web browser.

The web site interface is where both students and faculty will visit to seek information from the Garden City system. The interface setup and features are defined by the site administrator via the installation wizard. Currently, the web site interface layout and design is in a generic form (see DESIGN OF A PORTABLE CIVIL CITY section). In the future, via the installation wizard, the site administrator will be able to customize the design of the web site interface by adding custom graphics to the current layout.

CONCLUSIONS

At this point in the project, all portions of development are progressing favorably. The installation wizard has become the primary function of this project, with database and web support. Projections indicate that we should have a working model of this system by March 16, 2002, and will spend the next several months adding features and fine-tuning our work. The usefulness of the portability of this project cannot be understated, as this will allow for other institutions to quickly and easily set up their own such site.

ACKNOWLEDGEMENTS

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BIOGRAPHY

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Jess W. Everett is an Associate Professor of Civil and Environmental Engineering in the College of Engineering at Rowan University. He also serves as chair of the Landfilling and Composting committee of the Air and Waste Management Association. Dr. Everett is a registered Professional Civil Engineer in Oklahoma and is actively involved in environmental research and education. Dr. Everett received B.S.E., M.S., and Ph.D degrees in Civil and Environmental Engineering from Duke University in 1984, 1986, and 1991, respectively.

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