
Investigators:
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What do you intend to do?
This education project aims at developing a web-based interactive simulation environment to introduce hydrological concepts in engineering and science curriculum. This project builds upon the preliminary work done at a project supported by Google Summer of Code 2013 program. This project will integrate new web-based technologies and developments in teaching hydrological concepts in a game-style fun and engaging educational simulation environment. The platform will have two simulation options to support virtual and augmented reality technologies. Dr. Demir is offering 'Information Systems for Resource Management' course in Fall 2013 which is cross-listed in 4 departments (IE:3129, ME:3129, CEE:3129, ECE:3129, GEOG:3129). The proposed simulation environment will be integrated to the curriculum, and provide an interactive learning environment and hands-on experience in hydrological concepts for students from various engineering and science backgrounds.

How will it improve student learning?
Students will be interactively getting hands-on experience in hydrological concepts, management actions, and effects of flooding in actual communities in Iowa. This will raise the student's interest in environmental curriculum. Integration of real-time data resources make it easy for students to work with actual data. Rich visualizations and animations will attract students, and game-style performance evaluations will provide a competition environment for better management actions via in-game scores for saving land and reducing damage of floods with proper action. The platform will also integrate gesture based technologies to allow students to interact with the platform using their hands and body movement. The proposed project will assist instructors as an interactive simulation environment in supporting their curriculum.

Benefits of the proposed project are listed below:

- New hydrological and environment concepts can be easily integrated into the online learning environment
- Student will be able to get hand-on experience on flooding with actual data and communities in Iowa
- Web-based platform will make it easy for any instructor to integrate the platform to their curriculum using a web-browser
- Students will learn how hydrological systems work and how they are connected to each other
- Game-style performance measures and high-scores list will engage students in competing for better flood mitigation scenarios historical and actual events
- Rich visualizations and animations will allow students to observe hydrological concepts and their effects in real-time
- Online training platform will serve as a 24/7 hydrology lab for students to access from their home, and reduce the load or need for teaching assistants
The platform will be integrated to the curriculum of the course, ‘Information Systems for Resource Management’, which is cross-listed in 4 departments (Civil and Environmental Engineering, Mechanical and Industrial Engineering, Geography, and Electrical and Computer Engineering). The proposed project can be used to enhance the teaching effectiveness of any course with hydrological concepts. We expect to have a large audience from various engineering and science courses to utilize the platform for their teaching and research purposes. The project will be deployed to the courses in Fall 2014.

The success of the project will be assessed through quizzes, and feedback from the students and TAs. Training will be provided to TAs during the orientation. An additional outcome will be the student’s evaluations of the learning platform (e.g., what worked or not, what needs improvement, etc.). We will also conduct surveys for the student’s engagement and satisfaction with the platform.

List of possible courses that can benefit from the platform:

- Hydrology (CEE:4119) - Capacity: 30
- Graduate Seminar: Hydraulics Hydrology & Water Resources (CEE:5093) 40
- Integrated Watershed Analysis (GEOS:3390) - Capacity: 25
- Water Resource Design (CEE:437) - Capacity: 96
- Hydrometeorology (CEE:4378) - Capacity: 20

Total Enrollment Capacity: 234

What resources will you need?

IIHR Hydrosience and Engineering computational and data resources will be used to support the development of the system. IIHR has strong server and databases resources and staff to support the database development and data integration. An undergraduate student will work with Dr. Demir on the design and development of the platform. The platform will be optimized for accessing with tablets, and will be tested initially on iOS and Android platforms. Application to Apple and Google Developer Program and an OSx computer is required to deploy application to iOS platform. The platform will further expand its capabilities using gesture based interaction technologies like Microsoft Kinect, and various motion tracking hardware and software.

Rough estimate of costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>6-month salary for a senior undergraduate student for programming:</td>
<td>$7,500</td>
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<tr>
<td>Mac computer for the development of the iOS application for tablets:</td>
<td>$2,000</td>
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<tr>
<td>Tablet devices (iOS, Android) for deployment and testing of tablet application:</td>
<td>$1,000</td>
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<tr>
<td>Experimental hardware for hands-free interaction capabilities:</td>
<td>$1,500</td>
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