Course Description

It has been estimated that more than 80% of the data on the Internet has a geographical component. Online mapping services, such as MapQuest, Google Map and Microsoft Virtual Earth, have had significant impacts on our daily lives over the past decade. In this project-based course, students are grouped into teams to work on projects related to managing and processing geographical information over the Web. The capstone course will last two semesters. In the first semester, we will study key technologies related to Web-based Geographical Information Systems (Web-GIS), such as data representation modeling of geographical data, indexing and query processing in spatial databases, geospatial Web services and browser-based visualization of geographical data. The second semester will focus on modeling and implementation of real-world problems.

Suggested Project Topics

1. MTA New York City Transit has published bus route maps in its five boroughs in PDF format together with timetables. Develop a Web-based system that allows users to visualize the bus routes interactively in a way similar to Google Map. In addition, the system will allow users to query the timetable for each bus stop interactively. The feature currently is not available in Google Map.
2. NYC bike map is available online at http://www.nycbikemaps.com/maps/nyc-bike-map/ which is based on Google Map. Design and implement a Web-based system that allows biking lovers to preview the intersections along their selected paths using Google Street View API.
3. Assuming you are coming to NYC and you would like to find a place to live. You have a couple of criteria including rental prices, walking distance to public transportation network and distance to the school that you are attending as well as distance to nearest park. Write SQL queries against the underlying spatial database storing all the relevant information, rank your potential choices and develop a system to visualize your favorites over the Web to share with your family and friends.
4. You can help scientists monitor global environments by converting raw satellite images that are publicly available into datasets that can be visualized in Google Earth (in 3D). The project requires programming satellite data server(s) to provide
Open Geospatial Consortium (OGC) Web map services and a KML server to generate dynamic KML documents out of the services that can be accepted by Google Earth.

Programming

Commercial and open source spatial databases and Web-enabled GIS support spatial queries based on extended Structured Query Language (SQL) and APIs in different programming languages are provided. Students are free to choose their favorite programming languages (C++, Java, Python, PHP) and Web-application frameworks (pure HTML, Ajax, Flex, Silverlight). For each of the approved projects, more details on the relevant technologies and further references will be introduced to the members of the project group.

Course Objectives

This course will introduce students to a new field of managing and processing geographical data in a Web environment, which is not only technically challenging but also practically useful. Through working on large projects of considerable technical depth, students are expected to expose themselves to the forefront of research and development in the field. Furthermore, students have a chance to apply their software engineering knowledge in a large project full of technical challenges. By the end of the course, students will:

- Understand the concepts, principles, technologies and best practices in Web-GIS through lecturing.
- Receive valuable hands-on experience in research and applications through large group projects.
- Gain deeper insights into the design and implementation of real world software engineering.
- Be better prepared for the career opportunities in GIS and Web-based programming.