

SSCI 591 (35729), Web GIS

Syllabus

Units: 4

Term — Day — Time: Fall, 2017, Online

Location: Online

Instructor: Jennifer Swift, Ph.D.

Office: AHF B57D

Regular Office Hours: Monday and Thursday 1:00-2:00 p.m. PT. Also available most days and times by appointment via email.

Contact Info: jswift@usc.edu, 213-740-5841
<https://bluejeans.com/3809089594>

Library Help: Sherry Mosley

Office: VKC B40C

Office Hours: By appointment.

Contact Info: smosley@usc.edu, 213-740-8810 (office)

IT Help: Richard Tsung

Office: AHF 146

Office Hours: By appointment.

Contact Info: ctsung@usc.edu, 213-821-4415 (office)

Course Scope and Purpose

Today, acquiring programming concepts and skills underlying construction and implementation of high-quality Web GIS applications is a critical asset to both academic and professional portfolios. Learning to program innovative web-based mapping applications facilitates sharing and dissemination of your work, and at the same time vastly expands your overall application development skillset. Familiarity with web scripting languages and how these are utilized to implement Web GIS applications provides in-depth insight into how many government and commercial organizations, as well as individuals, develop these tools. The main goal of this course is to help you become comfortable with coding web-based applications that appeal to a broad or specialized audience, and that can be readily shared with a crowd.

This course will provide you with the most up-to-date software tools and information necessary for developing customized Web GIS applications according to current industry standards. It is assumed that students taking this course are new to web scripting and application development, and have no prior programming experience. Essential practical, as well as theoretical concepts of Web GIS, are covered. You will learn to develop Web GIS applications through popular open source and proprietary GIS and related development tools such as Google Maps, Esri ArcGIS Server, ArcGIS.com and other cloud-based technologies and using various Application Programming Interfaces (APIs). You will also learn the fundamentals of Web GIS system architecture as well as advanced programming topics including web mashups and distributed geospatial web services. Experience using Web 2.0 technologies that focus on user-generated content, geoportals for finding and accessing geospatial information, and web mapping interoperability in terms of utilizing open source universal data standards is also provided. In addition, the essentials of user experience and user interface design (UX/UI) are covered, including their importance in e-business and e-government web mapping interests.

This particular class is an elective class for the Geographic Information Science & Technology M.S. and Graduate Certificate Programs and is an elective course in the Spatial Informatics M.S. Program.

Learning Outcomes

When you have completed this course, you will be able to:

- Recognize different web scripting languages commonly used in Web GIS application development, and use several of these technologies to extend open source and proprietary GIS software functionality.
- Critically evaluate the benefits and challenges of developing Web GIS applications using different software technologies and system architectures, including local infrastructure versus cloud-based computing.
- Explain how Web GIS technologies are applicable to academia, e-business, and e-government.

- Develop and implement innovative Web GIS projects, geospatial web services, mashups, Volunteered Geographic Information (VGI) and Public Participation GIS (PPGIS) applications.
- Identify web map application design problems and solutions in order to make end user experiences and interfaces easy to use and aesthetically pleasing.
- Solve application development challenges, such as debugging scripts and integrating disparate code modules together into single applications.
- Conceptualize, design, implement and write up the results of a unique Web GIS application based on individual interests and goals in the final course project.

Prerequisite(s): None

Co-Requisite (s): None

Concurrent Enrollment: None

Recommended Preparation: SSCI 581: Concepts for Spatial Thinking

Course Structure

This is a graduate level course, so you should expect this class to be intellectually challenging. As graduate students, you are expected to engage with the information you are learning and to explore the heady cauldron of ideas, opinion, and analysis that describe our collective effort to thoroughly interrogate the subject at hand. Learning arises from active engagement with the knowledge found in our reading materials and with one another. As in any graduate class, the instructor's role is that of a guide who keeps you on this path of discovery, and you will find that you will learn much from your fellow classmates. The challenge for the instructor is to replicate such an academic experience within the milieu of "online learning."

All course materials will be organized through Blackboard. The main theoretical concepts will be provided through text readings and self-directed research you will do in the published literature and on the web and through hands-on experimentation with various tools and technologies.

The course will unfold on a weekly basis. Each week will be focused on a particular aspect of Web GIS. In order to encourage collaboration, for some assignments, the class will be divided into small groups to work on programming assignments. Students will share and test each other's work in brief online discussion threads. Students are encouraged to share questions and problems in discussion forums, to be explored in that congenial setting. The aim is to encourage deep-learning by active participation. You will finish the course by completing a Web GIS project on a topic of your choice on your own.

This is a four credit, one semester course. Students should expect to spend 10-15 hours per week completing the work in this course.

Technological and Communication Requirements

ArcGIS is provided online via the SSI Server, and ArcGIS Server is also provided for this course; hence, you do not need to install Esri software on your own computer.

Instead, every student must meet the following technology requirements:

- A computer with a fast Internet connection.
- A functional webcam and a microphone for use whenever a presentation or meeting is scheduled.
- An up-to-date web browser to access the SSI Server

SSI Server and Tech Support – For some assignments, this course utilizes the SSI Server which is a virtual desktop giving access to many different professional software. If you are unable to connect to the server or experience any type of technical issue, send an email using your USC account to SSI Tech Support at spatial_support@dornsife.usc.edu, (note underscore) making sure to copy (cc) me on the email.

Communications – This is a distance learning course, so most of our interactions will be asynchronous (not at the same time). All materials to be handed in will be submitted via Blackboard. It is each student's responsibility to stay informed about what is going on in our course. In addition to email about time-sensitive topics, any important announcements will be posted on the Announcement page in Blackboard. Be sure to check these each time you log onto Blackboard.

I will send via email through Blackboard any notices that are time sensitive. Please be sure that you read as soon as possible all email sent from Blackboard or from me. Do not ignore course email until the day before assignments are due. Also double check to be sure that email sent from the USC blackboard account does not go into your junk mail!

While I am usually on-line all day and will probably respond to emails from students very quickly, I will endeavor to respond to all email within 24 hours of receipt, aiming for no more than 72 hours delay. In the rare case when I expect to be off-line for more than 72 hours, I will post an announcement on the Blackboard site.

Discussion forums – On the Blackboard site, I will post a series of discussion threads relevant to various sections of the course. Discussions provide a key means for student-to-student discussion and collaboration that can replicate the face-to-face contact you may have experienced in traditional classrooms. Here, students can provide support to each other while working on their assignments, sharing hints and helpful tips, as you would in a classroom laboratory. Please post your questions about assignments there, as you would ask them publically in the classroom. I monitor the discussion threads and offer comments when necessary, but more importantly, consider the discussion board a key way to connect with your classmates and share your discoveries.

Required Readings and Supplementary Materials

There are two required textbooks (Fu & Sun 2011 and Fu 2016). These can be purchased from the USC bookstore or online outlets such as Amazon.

- Fu, Pinde, and Jiulin Sun. 2011. *Web GIS: Principles and Applications*. Redlands, CA: Esri Press, 296 pp. ISBN 9781589482456
- Fu, Pinde. 2016. *Getting to Know Web GIS*. 2nd ed., Redlands, CA: Esri Press, 350 pp. ISBN 1589484630.

These books will be supplemented with Course Notes and a mixture of readings from academic journals, professional reports, and authoritative websites.

- Elwood, Sarah, Michael F. Goodchild, and Daniel Z. Sui. 2012. Researching volunteered geographic information: Spatial data, geographic research, and new social practice. *Annals of the Association of American Geographers* 102(3): 571-590.
- Goodchild, Michael F. 2008. Spatial accuracy 2.0. In *Proceedings of the 8th International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences*, edited by Michael F. Goodchild and Jingxiong Zhang, 1-7. Edgbaston, UK: World Academic Press. Retrieved from <http://www.geog.ucsb.edu/~good/papers/453.pdf>
- Jones, Christopher B., and Ross S. Purves. 2008. Web-based GIS. In *The Handbook of Geographical Information Science*, edited by John P. Wilson and A. Stewart Fotheringham, 559-580. Oxford, UK: Wiley-Blackwell.
- Lin, Wen. 2013. When Web 2.0 meets public participation GIS (PPGIS): VGI and spaces of participatory mapping in China. In *Crowdsourcing Geographic Knowledge: Volunteered Geographic Information (VGI) in Theory and Practice*, edited by Daniel Z. Sui, Sarah Elwood and Michael F. Goodchild, 83-103. New York, NY: Springer.
- Peng, Zhong-Ren, and Ming-Hsiang Tsou. 2003. Internet GIS: Distributed Geographic Information Services for the Internet and Wireless Network. New York, NY: John Wiley & Sons. (Ch. 10 only).
- Holman, Justin. 2012. Spatial Career Guide: 5 Key Skills for Future GIS Software Developers. Retrieved from <http://www.justinholman.com/2012/03/29/spatial-career-guide-5-key-skills-for-future-gis-software-developers/>
- Roth, Robert. 2015. Interactivity and Cartography: A Contemporary Perspective on User Interface and User Experience Design from Geospatial Professionals. *Cartographica* 50(2): 94-115.
- Wang, Shaowen. 2016. CyberGIS and spatial data science. *GeoJournal* 81(6): 965-968.
- Zhao, Peisheng, Theodore Forester, and Peng Yue. 2012. The geoprocessing web. *Computers & Geosciences* 47:3-12.

As well, for several of the assignments in this course, you will conduct online library research to find articles that apply specific techniques in an application area of your choice.

In addition, five Lynda.com courses are supplied with this course.

- Williamson, James. 2014. HTML Essential Training.
- Chellman, Joe. 2016. JavaScript for Web Designers.
- Marini, Joe. 2015. JQuery Essential Training.
- Williamson, James. 2012. CSS: Styling Navigation.
- Nodder, Chris. 2017. UX Design Techniques: Overview.

Description and Assessment of Assignments

Your grade in this course will be determined on the basis of several different assessments:

Resume Assignment – 1 worth 2 points. We require all current students to post and maintain a public resume, short biography and recent photo on our shared SSI Student Community Blackboard site. Please prepare your resume in the SSI template which will be provided to you. Unless you opt out, your resume will be included in the Spatial Sciences Institute Graduate Programs Resume Book. This resume book is compiled annually and, along with our web presence, is used to promote our programs, and more importantly, your skills, experience and professional aspirations.

Reading Assignments – 5 worth a total of 10 points. These will focus on the text and other assigned readings. Their objective is to help you evaluate and integrate the information you have acquired from the course readings. Some of these will involve discussions and collaborative work, most will be individual efforts. Others will stimulate in-depth investigation into the ontology and semantics of core geospatial datasets integrated into programming assignments.

Discussions – 4 worth a total of 4 points. Structured discussions will focus on combinations of theory and practice. You will post new message and replies to messages posted by your classmates (i.e. two per forum) at specified times throughout the semester.

Practicums and Charrette – 4 worth a total of 4 points. These meetings (live via BlueJeans™ or other online collaboration platform) will consist of 3 online practicum seminars, and one charrette focused on interdisciplinary collaboration and research activities that address a wicked problem facing the world's mega cities.

Programming Assignments – 7 worth a total of 35 points. In order to demonstrate that you understand the basic concepts and skills learned in the class, you will complete seven assignments that involve the use of web scripting languages and Web GIS software. Once you have completed each assignment, you will turn in a copy of some digital output from the final part of the assignment such as a .jpg at the final step, and/or some combination of a few brief text answers, the script itself or hyperlinks to your original working web pages and web-based mapping applications resulting from your code.

Final Project

To integrate your learning of all the material covered in the course, you will design, undertake and report on individually chosen Web GIS project that will be the context of discussion in several of the assignments. The six components of the Final Project are:

Proposal - 4 points. One individual meeting (live via BlueJeans™) and a brief written description of the Web GIS application you would like to build and how you plan to do it.

Technology & Data Report - 5 points. A written report describing the software tools you have chosen to implement and the spatial and non-spatial data you will utilize in your project.

Application Implementation - 15 points. The Web GIS application will consist of a unique, live website with an interactive web map, including any data required in your application. The application must work as described in your Final Project Report.

Final Project Report - 10 points. A written report on your project methodology, data and application development outcomes, including how to install and run your application.

Videos – 6 points. You will create two demo videos that describe and demonstrates the full functionality of your Web GIS application project. The first will cover your presentation, and the second will be a live demonstration of your application.

Presentation - 5 points. A presentation and live demonstration of your Web GIS application (live via BlueJeans™), open to all students in the course.

Grading Breakdown

The table below summarizes the course assessments and their point distribution:

| Assessment | Number | Points Each | Total Points |
|------------------------------|--------|-------------|--------------|
| Weekly Assignments | | | |
| Student Resume | 1 | 2 | 2 |
| Reading Assignments | 5 | 2 | 10 |
| Discussions | 4 | 1 | 4 |
| Practicums | 4 | 1 | 4 |
| Programming Assignments | 7 | 5 | 35 |
| Project Components | | | |
| - Proposal | 1 | 4 | 4 |
| - Data & Technology Report | 1 | 5 | 5 |
| - Application Implementation | 1 | 15 | 15 |
| - Final Report | 1 | 10 | 10 |
| - Videos | 2 | 3 | 6 |
| - Presentation | 1 | 5 | 5 |
| Total | 28 | - | 100 |

Assignment Submission Policy

Unless otherwise noted, assignments must be submitted via Blackboard by the due dates specified in the Course Schedule below and on the assignment instructions.

Unless otherwise noted, all Assignments are *due by 11:59 pm PT on Mondays or Thursdays*, while Practicums will be held between 2pm – 6pm PT on *Tuesdays* as indicated in the Course Schedule. Project components have different due dates as indicated on the Course Schedule below. Your attention to on-time assignment submission is essential if I am to meet my goal to return comments on your submitted assignments before the next one is due. Sometimes this is impossible, so I will post a notice on anticipated delays if needed.

Strict penalties apply for late assignments as follows:

- All assignments will be penalized 2 points up to FOUR days late. No points will be given for submissions more than FOUR days late. Note that all assignments worth 2 points will receive 0 points if submitted late.
- Additionally, no written work will be accepted for grading after 5 pm PT on the last day of class.

Course Schedule

| | Topics/Daily Activities | Readings and Assignments | Deliverables/Due Dates |
|---|---|---|---|
| Week 1 8/21 | Introduction: Introduction to the course | Fu & Sun (2011) Ch.1 Jones & Purves (2008) Wang (2016) Resume Assignment Programming Assignment 1 | Introductions: Monday, 8/21 Resume Assignment: Thursday, 8/24 |
| Week 2 8/28 | Web Page Basics – Part 1: The basics of internet scripting languages, and creating basic web pages using HTML5 and Javascript | Williamson (2014) Chellman (2016) Reading Assignment 1 Programming Assignment 2 – Part 1 | Practicum 1: Tuesday, 8/29 Programming Assignment 1: Thursday, 8/31 |
| Week 3 9/5* *Monday, 9/4 is a university holiday | Web Page Basics – Part 2: Styling web pages & introduction to user experience (UX) & user interface (UI) concepts | Marini (2015) Williamson (2012) Nodder (2017) Discussion 1 Programming Assignment 2 – Part 2 | Reading Assignment 1: Tuesday, 9/5 Programming Assignment 2 – Part 1: Thursday, 9/7 |
| Week 4 9/11 | Web Mapping Basics – Part 1: Introduction to the Google Maps API and the uses of various web scripting languages | Fu & Sun (2011) Ch.2 Peng and Tsou (2003) Reading Assignment 2 Programming Assignment 3 – Part 1 | Discussion 1: Monday, 9/11 Programming Assignment 2 – Part 2: Thursday, 9/14 |
| Week 5 9/18 | Web Mapping Basics – Part 2: Creating web maps embedded in web pages using Google Maps API: Static & Real-Time Data Display, Services and Libraries | Discussion 2 Programming Assignment 3 – Part 2 | Reading Assignment 2: Monday, 9/18 Programming Assignment 3 – Part 1: Thursday, 9/21 |

| | Topics/Daily Activities | Readings and Assignments | Deliverables/Due Dates |
|-------------------------|--|--|---|
| Week 6 9/25 | Geospatial Web Services – Part 1: Introduction to geospatial web services and VGI using Esri's ArcGIS.com and configurable apps to build web maps in a virtual environment | Fu & Sun (2011) Ch.3 Fu (2016) Ch.1,2,3 Zhao, Forester & Yue (2012) Reading Assignment 3 Programming Assignment 4 – Part 1 | Discussion 2: Monday, 9/25 Charrette: Wednesday, 9/27 Programming Assignment 3 – Part 2: Thursday, 9/28, Project Proposal Meeting: Friday, 9/29 |
| Week 7 10/2 | Geospatial Web Services – Part 2: Customizing configurable apps and widgets | Fu (2016) Ch.4,5 Discussion 3 Programming Assignment 4 – Part 2 | Reading Assignment 3: Monday, 10/2 Programming Assignment 4 – Part 1: Thursday, 10/5 |
| Week 8 10/9 | Geospatial Mashups: The basics of Web GIS mashups and geoprocessing services. Approaches for creating advanced applications using the Esri ArcGIS Server and the ArcGIS Server JavaScript API | Fu & Sun (2011) Ch.4 Fu (2016) Ch.6,7,10 Elwood, Goodchild, & Sui (2012) Lin (2013) Reading Assignment 4 Programming Assignment 5 | Discussion 3: Monday, 10/9 Programming Assignment 4 – Part 2: Thursday, 10/12 |
| Week 9 10/16 | Geoportals & NSDI: Introduction to Geoportals, NSDI and spatial geodatabases using Esri ArcGIS Server. Advances in creating 3D Web scenes. | Fu & Sun (2011) Ch.6&7 Fu (2016) Ch.9 Goodchild (2008) Final Project Proposal Programming Assignment 6 | Reading Assignment 4: Monday, 10/16 Programming Assignment 5, Thursday, 10/19 |
| Week 10 10/23 | Web GIS Applications In the Cloud: Developing Web GIS applications in a commercial cloud environment. Critical assessment of the benefits and challenges of cloud vs. local virtual environments | Fu & Sun (2011) Ch.8 Programming Assignment 7 | Final Project Proposal: Monday, 10/23 Practicum 2: Tuesday, 10/24 Programming Assignment 6: Thursday, 10/26 |
| Week 11 10/30 | Web GIS Applications: User Experience/User Interface (UX/UI): Fundamental Principles of Web Application Design | Roth (2015) Reading Assignment 5 Data & Technology Report | Programming Assignment 7: Thursday, 11/2 |
| Week 12 11/6 | The Future of Web GIS: Evaluating current open source and proprietary technologies that support Web GIS and how these might shape the future of Web GIS application development | Fu & Sun (2011) Ch.9,10 Holman (2012) Discussion 4 | Reading Assignment 5: Monday, 11/6 Practicum 3: Tuesday, 11/7 Data & Technology Report: Thursday, 11/9 |

| | Topics/Daily Activities | Readings and Assignments | Deliverables/Due Dates |
|--|---|--|---|
| Week 13 11/13 | Work on Final Project: Project Programming | Final Project Application Programming | Work on Final Project |
| Week 14 11/20 | Work on Final Project: Finalize Project Programming | Thanksgiving break (22-26) | Discussion 4: Monday, 11/20 Work on Final Project |
| Week 15 11/27 | Finishing up Final Project Finalize Report | Final Project Report | Final Project Application Implementation: Thursday 11/30 Final Project Report, Videos 1 and 2: Friday, 12/1 |
| Final Exam Week 12/6-12/13 | Final Project | Final project presentation, live demonstration, and videos of Web GIS application project | Final Project Presentations: Monday, 12/11-Tuesday, 12/12 All work must be submitted by 5:00 pm on Friday, 12/1, the last day of class. |

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <https://policy.usc.edu/student/scampus/part-b/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>. **Academic**

Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” <https://policy.usc.edu/scampus-part-b/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Support Systems

Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

<https://engemannshc.usc.edu/counseling/>

National Suicide Prevention Lifeline - 1-800-273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. <http://www.suicidepreventionlifeline.org>

Relationship & Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. <https://engemannshc.usc.edu/rsvp/>

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: <http://sarc.usc.edu/>

Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class.

<https://equity.usc.edu/>

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. <https://studentaffairs.usc.edu/bias-assessment-response-support/>

Student Support & Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. <https://studentaffairs.usc.edu/ssa/>

Diversity at USC – <https://diversity.usc.edu/>

Tabs for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students

Resources for Online Students

The Course Blackboard page and the GIST Community Blackboard page have many resources available for distance students enrolled in our graduate programs. In addition, all registered students can access electronic library resources through the link <https://libraries.usc.edu/>. Also, the USC Libraries have many important resources available for distance students through the link: <https://libraries.usc.edu/faculty-students/distance-learners>. This includes instructional videos, remote access to university resources, and other key contact information for distance students.