



## Department of Geography and Geoinformation Science

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# GGG 692

## Web-based GIS

### 1. General Information

|                        |   |
|------------------------|---|
| <b>Instructor:</b>     | Dr. Dieter Pfoser   |
| <b>Where:</b>          | Wednesday 4:30-7:10pm, Exp 2103   |
| <b>When:</b>           | Spring 2023   |
| <b>Course website:</b> | Blackboard + MS Teams   |
| <b>Credits:</b>        | 3.0   |
| <b>Office Hours:</b>   | Wednesday 3-4pm and reachable on the course MS Teams channel (all students will be invited) |

### 2. Course Objectives

Managing, analyzing and communicating geospatial data is at the core of an emerging Billion-Dollar industry. This course will provide the students with the knowledge to build Web mapping applications on top of a database and so communicate and interact with the data using nothing more than a Web browser. The course will cover a variety of open-source software packages for web mapping and will provide pointers to commercial solutions where appropriate. To communicate findings in reports and presentations, we have to carefully weave our content into an interesting narrative that tells compelling stories to our audiences. As such, we also discuss data visualization and storytelling techniques to enrich the visual appearance of our Web application. In the context of a project-based approach, we will leverage open-source intelligence techniques to collect data and investigate a current issues using a data-driven approach.

The specific goals are

- To design, develop, and implement custom web mapping applications using open standards and open-source software.
- To enable students to develop a good understanding of the principles and techniques of spatial databases incl. to perform common various types of queries and spatial analyses.
- To be mindful of data visualization and storytelling techniques and enable students to improve their user interface design and presentation skills using a project-based approach.

### 3. Learning Outcomes

By the end of the course each student will be able to:

1. Articulate and effectively communicate concepts and ideas related to Spatial Data Management and Web Mapping to experts, non-experts, and other professionals in a work environment.
2. Have a broad knowledgebase on fundamentals, theory and techniques of Spatial Data Management in the context of Web Mapping applications.
3. Have the ability to appropriately apply the knowledge acquired in the course for various hypothetical and real-world data processing tasks.
4. Given a problem or task, be able to effectively analyze it, identify key elements and potential difficulties, and define a strategy for successfully addressing it.
5. Perform a critical review of the potential, effectiveness, and reliability of specific solutions.

#### 4. **Textbooks**

*Required reading:*

- **Introduction to Web Mapping**, Michael Dorman, continuously updated version, <https://geobgu.xyz/web-mapping2/>.
- **Selected readings** incl. tutorials and other sources will be distributed via the course website - Web mapping and programming

*Additional reading (not required, but interesting):*

- **Storytelling with Data: A Data Visualization Guide for Business Professionals**. C. Nussbaumer-Knafllic.
  - [Amazon Link](#)
  - GMU Library link (login required) [https://wrlc-gm.primo.exlibrisgroup.com/permalink/01WRLC\\_GML/19u1omk/cdi\\_askewsholts\\_vlebooks\\_9781119002062](https://wrlc-gm.primo.exlibrisgroup.com/permalink/01WRLC_GML/19u1omk/cdi_askewsholts_vlebooks_9781119002062)
- **OSINT Techniques: Resources for Uncovering Online Information**. Michael Bazzell
  - [Amazon Link](#)
- **Database System Concepts**. Abraham Silberschatz, Henry Korth, S. Sudarshan. McGraw-Hill Science/Engineering/Math; 6 edition (January 27, 2010). Any edition is fine for the course, since we will only use a few basic chapters - order as used book!
  - GMU Library link <http://magik.gmu.edu/cgi-bin/Pwebrecon.cgi?BBID=1252251>

#### 5. **Technology Requirements**

##### **Hardware**

- Activities and assignments in this course will regularly use the Blackboard learning system, available at <https://mymason.gmu.edu>. Students are required to have regular, reliable access to a computer with an updated operating system (recommended: Windows 10 or Mac OSX 10.13 or higher) and a stable broadband Internet connection (cable modem, DSL, satellite broadband, etc., with a consistent 1.5 Mbps [megabits per second] download speed or higher. You can check your speed settings using the speed test at [fast.com](http://fast.com).)
- Activities and assignments in this course will regularly use web-conferencing software (Blackboard Collaborate / Zoom). In addition to the requirements above, students are required to have a device with a functional camera and microphone. In an emergency, students can connect through a telephone call, but video connection is the expected norm.

##### **Software**

- A supported web browser (See [Blackboard Support](#) for supported web browsers)
- Blackboard Courses (Log into <http://mymason.gmu.edu>, select the Courses Tab)
- Blackboard Collaborate (Select Tools from the Blackboard Course Menu, then select "Blackboard Collaborate")
- Adobe Acrobat Reader ([free download](#))
- PDF Creator - An open source PDF printer ([free download](#))
- Microsoft Office ([purchase](#), also available at Citrix Virtual Computing Environment - <https://its.gmu.edu/service/citrix-virtual-lab/>)
- **Visual Studio Code** – free download at <https://code.visualstudio.com/>
- **Node JS** - <https://nodejs.org/en/download/>

##### **Tools**

Visit the following two Web pages and create accounts!

- **Codepen** – <https://codepen.io> - our Web-hosted Web programming tool
- **Cartodb** - <http://www.carto.com> - our Web-hosted database software (you can get a free account at Carto by signing up for the **GitHub Education pack** <https://education.github.com/students>)
- **MS Teams** – <https://its.gmu.edu/service/microsoft-teams/>

## 6. Format

- This in person course will be taught as a combination of lectures, topic/problem-oriented discussion (flipped classroom), and tutorials based on independent reading and class discussion.
- There will be a midterm and a course project (no final).
- The course will be project driven.
- Evaluation will be based on (i) participation in lectures, (ii) presentations, (iii) assignments, (iv) midterm and (v) the course project.

## 7. Course outline and schedule

This course will cover the following topics (please note that the topics and their order are subjected to change at the discretion of the instructor, any changes will be announced in class).

*The course topics and dates are subject to change.*

| Week of | Mod. # | Topic  | Presentations                   |
|---------|--------|--|---------------------------------|
| 1/25    | 1      | Introduction and overview of the course – project orientation, project topics, Web development |                                 |
| 2/1     | 2      | Javascript introduction, Codepen environment, Leaflet intro                                    |                                 |
| 2/8     | 3      | Leaflet, functionality, AJAX, GeoJSON  |                                 |
| 2/15    | 4      | Database integration and interactivity   |                                 |
| 2/22    | 5      | Data collection and data cleaning techniques   |                                 |
| 3/1     | 6      | Leaflet advanced features  | Project proposal, Presentations |
| 3/8     | 7      | Midterm - Mapbox GL  |                                 |
| 3/15    |        | Spring Break   |                                 |
| 3/22    | 8      | Data visualization and storytelling  | Presentations                   |
| 3/29    | 9      | VSCode   |                                 |
| 4/5     | 10     | Open-source intelligence   | Presentations                   |
| 4/12    | 11     | Full stack web application development   |                                 |
| 4/19    | 12     | Open-source intelligence (cont'd)  | Project updates                 |
| 4/26    | 13     | Project work   |                                 |
| 5/3     | 14     | Project presentations (online)   | Final projects due              |

Please check the [GMU Semester Calendar](#) for holidays, etc.

## 8. Grades

Each assignment and written exam will be given a numerical grade on a 0-100 scale. Some assignments may include bonus tasks. At the end of the term all the marks will be totaled as a weighted average according to the following weights:

|                        |     |
|------------------------|-----|
| Participation          | 10% |
| Assignments            | 20% |
| Midterm                | 20% |
| Assigned Presentations | 15% |
| Project                | 35% |

Please note that in general all assignments will not have the same weight. The weight of each individual assignment will be indicated on the assignment form. Final grades at the end of the course will be assigned using a **combination of absolute achievements and relative standing in the class.**

## 9. Exams

In class midterm exam. No final exam.

## 10. Assigned Presentations

Each student will present an assigned topic to the class and lead the ensuing discussion. Evaluation is based on the organization of the slide presentation, the clarity and comprehensibility of the talk as well as on the knowledge and depth of the presented material (as demonstrated during the presentation as well as during the discussion in class) and the provided supplemental material.

## 11. Project

The course will include one project addressing a Web mapping application and including data management aspects as well as communicating this data over the Web using the tools and techniques discussed in class. The project will include (i) a written report, (ii) a software demonstrator and (iii) an in-class presentation of the project results incl. a live demonstration.

The specific format and timing of the project will be discussed in class.

The project will be graded based on the following criteria.

- **Academic merit** of your project
- **Quality of the written report.** The project results need to be communicated in a written report. Please remember that your report is a professional document, and should therefore be formatted and constructed accordingly. A template will be made available. Submission of a hardcopy of the report will be made in class; submission of a softcopy (in PDF) will be made through Blackboard.
- **Quality of the demonstrator** as assessed by the instructor and fellow students during the presentation of the project.
- **Quality of the presentations of the project results** as assessed by the instructor and fellow students. Students will be required to present their results in-class. The presentation will include a demonstration of the developed system.

## 12. Course website

The course has a Blackboard website. This website will provide you a single portal through which you may obtain lecture notes, retrieve assignment data and, review links to additional materials, and receive special announcements. Please notify ITU (and, if necessary, the instructor) if you encounter any problems accessing this website. We will also use MS Teams as a communication platform between students and instructor.

## 13. Course Materials and Student Privacy

All course materials posted to Blackboard or other course site are private to this class; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class.

- Video recordings — whether made by instructors or students — of class meetings that include audio, visual, or textual information from other students are private and must not be shared outside the class.
- Live video conference meetings (e.g. Collaborate or Zoom) that include audio, textual, or visual information from other students must be viewed privately and not shared with others in your household or recorded and shared outside the class.

## 14. Course Recordings

Meetings in this class might be recorded to provide necessary information for students that could not attend the class. Recordings will be stored on Blackboard and will only be accessible to students taking this course during this semester.

## 15. Campus Closure

If the campus closes or class is canceled due to weather or other concern, students should check Blackboard for updates on how to continue learning and information about any changes to events or assigned work.

## 16. Student Expectations:

- **Academic Integrity:** Students must be responsible for their own work, and students and faculty must take on the responsibility of dealing explicitly with violations. The tenet must be a foundation of our university culture. [See <http://academicintegrity.gmu.edu/distance/>].
- **Honor Code:** Students must adhere to the guidelines of the George Mason University Honor Code [See <http://oai.gmu.edu/the-mason-honor-code/>].
- **MasonLive/Email (GMU Email):** Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account. [See <https://masonlivelogin.gmu.edu>].
- **Patriot Pass:** Once you sign up for your Patriot Pass, your passwords will be synchronized, and you will use your Patriot Pass username and password to log in to the following systems: Blackboard, University Libraries, MasonLive, myMason, Patriot Web, Virtual Computing Lab, and WEMS. [See <https://password.gmu.edu/index.jsp>].
- **University Policies:** Students must follow the university policies. [See <http://universitypolicy.gmu.edu>]. Responsible Use of Computing - Students must follow the university policy for Responsible Use of Computing. [See <http://universitypolicy.gmu.edu/policies/responsible-use-of-computing>].
- **University Calendar:** Details regarding the current Academic Calendar. [See <http://registrar.gmu.edu/calendars/index.html>].
- **Students with Disabilities:** Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See <http://ods.gmu.edu>].
- Students are expected to follow courteous Internet etiquette at all times; see <http://www.albion.com/netiquette/corerules.html> for more information regarding these expectations.

## 17. Student Services:

- **University Libraries:** University Libraries provides resources for distance students. [See <http://library.gmu.edu/distance> and [http://infoguides.gmu.edu/distance\\_students](http://infoguides.gmu.edu/distance_students)].
- **Writing Center:** The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing. [See <http://writingcenter.gmu.edu>]. You can now sign up for an Online Writing Lab (OWL) session just like you sign up for a face-to-face session in the Writing Center, which means YOU set the date and time of the appointment! Learn more about the [Online Writing Lab \(OWL\)](#).
- **Counseling and Psychological Services:** The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See <http://caps.gmu.edu>].
- **Family Educational Rights and Privacy Act (FERPA):** The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the "Buckley Amendment," is a federal law that gives protection to student educational records and provides students with certain rights. [See <http://registrar.gmu.edu/privacy>].

## **18. COVID-19 considerations**

Students must follow the university's public health and safety precautions and procedures outlined on the university [Safe Return to Campus webpage](#).

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**Disclaimer:** Any typographical errors in this Course Outline are subject to change and will be announced in class. The date of the final examination is set by the Registrar and takes precedence over the final examination date reported by the instructor.

**Note:** Recording is permitted only with the prior written consent of the professor or if recording is part of an approved accommodation plan.