GeoS4S Module Community and Participatory GIS

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Abstract
Community and Participatory GIS (CP-GIS) is an approach that involves groups and communities in the process of creating geospatial information systems to address their own local problems. CP-GIS often involves working with stakeholders from remote, impoverished or marginalized groups who lack the technological resources and the expertise to use traditional GIS. This teaching module employs case studies and interactive exercises to introduce the philosophy, values, methods and tools used in CP-GIS. Its high-level goal is to prepare the student for leading or contributing to real world CP-GIS projects. The current paper summarizes the learning objectives, lesson content, learning activities and evaluation scheme for this module.

Key Words: Community GIS, Participatory GIS, Free and Open Source, Open Standards, Volunteered Geographic Information (VGI)

1. Introduction

Traditional GIS depends on assumptions about the availability of funding, infrastructure and expertise, which may not be satisfied in some settings. CP-GIS offers an alternative approach to support successful GIS implementation even in these challenging environments. The key concept in CP-GIS is that the community should own, guide and control the development and use of the system. Graduate education in geoinformation science tends to emphasize the logical, analytical and technical aspects of the discipline. This module will help GIS practitioners recognize and deal with situations where the traditional, formal, technology-centered approach to GIS implementation will very likely fail.

1.1 Module Description

Geospatial technology has advanced dramatically over the past two decades. With this explosion of analytical and storage capability, most GIS courses and textbooks focus on technical topics: data acquisition, geospatial data representations, algorithms, models, visualization and so on. Building a new GIS tends to be presented as first and foremost a question of identifying and deploying the right technology. This module introduces an alternative approach, focused on the needs of the user community and the constraints of the environment. The course roughly follows the typical stages in a CP-GIS project: problem elicitation, data acquisition, system development and deployment, evaluation and preparation for sustainable use. Some lessons focus on tools and techniques for facilitating communication and acquiring information. Others provide experience with software components that can be used to assemble an inexpensive, community-oriented geospatial information system.

There are no textbooks for CP-GIS. The bulk of the information available about CP-GIS is captured in case studies, some of which are relatively informal. For this reason, this module requires more extensive reading than many of the other GeoS4S modules. Toward the end of the module, the lessons present a detailed case study of a CP-GIS project from Thailand, which students are required to analyze and critique.

1.2 Learning Outcomes

- Explain the differences between traditional GIS and CP-GIS.
- Summarize the values that underlie CP-GIS and explain how violating these values can undermine the success of CP-GIS.
- Identify decision criteria for undertaking a CP-GIS approach to a problem.
- Choose and apply problem elicitation and exploration techniques appropriate for a particular CP-GIS situation.
- Identify and apply technological tools (software, data gathering techniques) appropriate for CP-GIS.

- Given a specific problem scenario where GIS has been proposed: a) evaluate whether a CP-GIS approach is appropriate and justify that judgment; b) if the evaluation is positive, create a detailed plan for implementing CP-GIS in the scenario, including hardware, software, data design and acquisition, as well development and maintenance processes

2. Module Structure

2.1 Module Overview

This module consists of 15 lessons with slides and accompanying notes, plus required and optional reading assignments, practice exercises, hands-on interactive and individual assignments, and self-assessment quizzes. The overall student effort is estimated at 150 to 170 hours, and the module is intended to provide credit equivalent to 6 ECTS. The module materials are designed to be used flexibly, in either a traditional classroom setting or for on-line self-study. The module is organized into five sub-modules as described in section 4; the sub-module presentation order can be revised depending on the background and goals of the students.

2.2 Summary of Lesson Content

This section briefly presents the content and goals of each lesson.

- *Lesson 1: What is Community and Participatory GIS?* - This lesson compares and contrasts CP-GIS and traditional GIS, discusses situational factors that argue for using a CP-GIS approach, and explains the values that underlie CP-GIS. It also summarizes the history of CP-GIS and how it has been impacted by recent technological changes.
- *Lesson 2: Overview of the CP-GIS Process* - This lesson describes the typical stages in a CP-GIS project, then analyzes a case study, identifying each stage.
- *Lesson 3: Obstacles to CP-GIS Success* - This lesson identifies the factors that can cause CP-GIS projects to fail. It also highlights how personal biases and assumptions can negatively impact CP-GIS.
- *Lesson 4: Understanding Stakeholders' Problems* - This lesson discusses the goals of the problem elicitation process as well as identifying the types of problems where CP-GIS may (or may not) have an impact. It also considers environmental and social factors that can influence problem elicitation.
- *Lesson 5: Scenario Analysis and Focus Groups* - This lesson explains two structured discussion techniques that can be applied for problem elicitation, scenario analysis ("use case analysis") and focus groups, and allows students to practice using them.
- *Lesson 6: SWOT Analysis* - This lesson explains SWOT analysis including how it can be used in CP-GIS, and gives students the opportunity to apply this technique in a role-playing situation.
- *Lesson 7: Map-based Problem Elicitation* -This lesson explains and gives examples of how existing or newly-created maps can be used to elicit problem information in CP-GIS. It also discusses obstacles and issues with map-based problem elicitation.
- *Lesson 8: Data Acquisition in CP-GIS* - This lesson presents different methods for gathering geographic and non-geographic data in CP-GIS and discusses the trade-offs involved in choosing different techniques.
- *Lesson 9: VGI - Volunteered Geographic Information* - This lesson explains and give examples of VGI, including a discussion of Open Street Map. It also considers the pros and cons for using VGI in a CP-GIS project.
- *Lesson 10: Technical Tools for CP-GIS: Data storage and analysis* - This pivotal lesson provides an overview of web application architecture. It explains how OGC, W3C and de facto standards enable CP-GIS and why free and open source software is important for CP-GIS. It then describes the features and benefits of two representative open source tools used for data storage and analysis, PostGIS and GeoServer.
- *Lesson 11: Technical Tools for CP-GIS: Display and interaction* - In this lesson, students learn about the basic concepts of client-side web interaction using JavaScript. The lesson describes and compares some free tools for data display and interaction in CP-GIS. Students then create a very simple geodata visualization using one or more of these tools.
- *Lesson 12: Software in the Local Language* - This lesson considers why software internationalization (I18N) is important for CP-GIS, explains important concepts underlying I18N, and outlines a design strategy for I18N in a web or desktop GIS context.
- *Lesson 13: Amphawa Case Study Part 1* - This lesson presents the geographic and social context for the Amphawa Explorer project and requires students to evaluate whether a CP-GIS approach is appropriate.

- *Lesson 14: Amphawa Case Study Part 2* - This lesson describes the Amphawa project plan, process, final products and outcomes, and requires students to critique the project and evaluate its success.
- *Lesson 15: Long term sustainability of CP-GIS* - This concluding lesson discusses factors that affect the long term sustainability of CP-GIS: social, political, financial and technical.

3. Hands-on Sessions

The module provides a number of interactive and hands-on activities to supplement the lecture content, deepen students' understanding, and develop their practical skills. Many of these activities are part of the module evaluation scheme.

- SWOT Analysis (Lesson 6)
- Sketch Map data acquisition (Lesson 7)
- Using OpenJump in data acquisition and editing (Lesson 8)
- GeoServer familiarization (Lesson 10)
- JavaScript mapping with Leaflet and OpenLayers (Lesson 11)
- Software internationalization (Lesson 12)

This module does not assume any prior knowledge of specific software, although some of the activities will be easier if students have prior exposure to programming concepts.

4. Teaching and Learning System

The module is divided into five sub-modules, which use rather different learning methods.

Sub-module 1: (lessons 1-3) introduces definitions, concepts, philosophy and values for CP-GIS. Aside from studying the overview provided by lecture notes, students will read 6 short papers discussing the philosophy and practice of CP-GIS. This sub-module also offers a self-administered quiz to allow students to check their understanding.

Sub-module 2: (lessons 4-7) focuses on specific problem elicitation techniques. Learning activities will involve role-playing and/or practice of these techniques with actual stakeholder groups, if possible. One reading assignment is also included.

Sub-module 3: (lessons 8-9) considers data acquisition for CP-GIS systems. Students will read two case studies. They will also complete two hands-on assignments, one focusing on sketch maps, the other using open source GIS data editing software.

Sub-module 4: (lessons 10-12) introduces students to sample software tools that can be useful for creating spatial data bases and visualization platforms for CP-GIS. Students will complete hands-on assignments using some of these tools.

Sub-module 5: (lessons 13-15) presents a detailed case study of CP-GIS (Amphawa Explorer). Students will be required to analyze, evaluate and critique this case study in interactive, in class discussions.

During the time devoted to Sub-module 5, students will also work on a final project. For this project, they will write a paper that considers a specific real world problem where CP-GIS might be appropriate. This paper will present an argument as to whether CP-GIS is appropriate for this problem or not. If the student concludes that CP-GIS is appropriate, he or she will create a detailed plan for applying CP-GIS to the problem. If the student concludes CP-GIS is not appropriate, he or she will document the reasons for this decision, then present a plan for applying traditional GIS to the problem. As an alternative to having the instructor present a real world project scenario, the student may propose a scenario derived from his or her personal experience, culture and geography.

5. Evaluation System

Performance evaluation for this module involves two components: hands-on or interactive assignments (80%) and a written project assignment (20%). For the interactive, discussion-based assignments, the instructor will provide feedback and suggestions, but grading will be based on participation and apparent

effort and thought. The purpose of all assignments is to give students practice with specific tools and techniques, and to engage them in both analysis and synthesis. The written assignment will assess the degree to which students have internalized the concepts and techniques addressed by the module and can apply them to a specific case. In addition, the module provides five self-test quizzes to help students evaluate whether they understand the basic concepts of the preceding few lessons, and one hands-on exercise (Lesson 11) to prepare the student for the assignment.

6. Additional Notes

The sub-modules in this module are somewhat independent. Students who are using the module material for self-learning rather than for credit may not want to complete all modules. In particular, sub-module 4 could be skipped by people who do not have any computer background or interest. Sub-module 1 could serve as a standalone introduction to CP-GIS. Sub-module 5 would be a reasonable follow-up to sub-module 1 for people who play a supervisory or managerial role in CP-GIS projects but who are not involved in detailed design and implementation. If the module is being offered in an intensive workshop format rather than a normal classroom, it may be desirable to change the lesson order. Specifically, the case study lessons can be interpolated into sub-module 1, with Lesson 13 Part A after Lesson 1, Lesson 13 Part B after Lesson 2, and Lesson 14 after Lesson 3.

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