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Project full title: **Digital Education Modules 4 Participatory Planning**

OPT-G2: PARTICIPATORY GIS FOR PLANNING

1. Short description

This module focuses on introducing students to the concept of Participatory GIS (PGIS) and its application in spatial planning. It integrates interdisciplinary perspectives from geography, social sciences, and environmental studies to foster a comprehensive understanding of PGIS. The module explores foundational principles, practical approaches, and digital tools, equipping learners with the knowledge and skills to effectively engage in participatory spatial planning processes.

Aims

1. To familiarize students with the concept and significance of Public Participatory GIS (PPGIS) in the context of spatial planning.
2. To develop an understanding of how PPGIS merges geographical, social, and environmental disciplines for a holistic planning approach.
3. To introduce students to the fundamental principles and methodologies associated with PPGIS.
4. To enable students to identify, evaluate, and apply appropriate digital tools for effective participatory planning using PPGIS techniques.

2. Keywords

PPGIS; Public Participatory GIS; GIS; Spatial Planning; Digital Tools; Software; Spatial Data

3. Content

3.1. Definition and concept of the Public Particiatory GIS

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Public Participatory Geographic Information Systems (PPGIS) originate from Geographic Information Systems (GIS). GIS is a technology that allows for the collection of spatial data from various sources, enriched with descriptive attributes in a database. It enables the operator - the user - to interactively transform data into useful information using analytical functions, which in turn facilitates the creation of informational products (Figure 1) (Tomlinson, 2007).

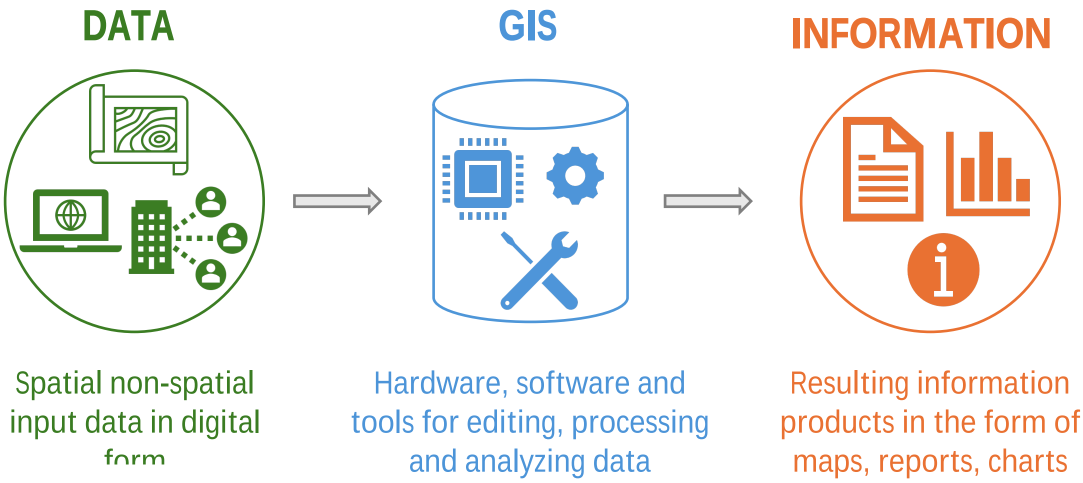

Figure 1: Geographic Information System (GIS) model (source: Tomlinson, 2007)

Initially, GIS was seen as a technique to reduce costs and accelerate the process of map creation. Over time, its capabilities and areas of application have expanded significantly, and the current form of GIS is the result of the integration of many disciplines, all of which share the common feature of using computers to create maps, store, and analyse spatial data (Goodchild, 2010; Tomlinson, 2007).

The history of GIS began in the 1960s. In 1963, the CGIS (Canadian Geographic Information System) project was initiated in Canada under the direction of R. Tomlinson - the first national GIS, containing data on natural resources. The development of this technology was supported by remote sensing and the placement of satellites, such as Landsat (from 1972), as well as the development of computer software. In 1981, ESRI released ArcInfo, one of the first spatial analysis systems, which is still being developed today as ArcGIS Pro (Duckham et al., 2003; Goodchild, 2010; Longley et al., 2015).

In its early stages, GIS was dedicated to specialized users, such as surveyors, geographers, and cartographers. These systems were closed, operated on local networks, and required advanced knowledge. However, by the late 1980s and early 1990s, a broader potential for GIS use was recognized, focusing attention on its social role, research methods, and the issue of marginalizing certain social groups in accessing this technology. The 1990s saw a breakthrough with the emergence of personal computers and GIS software aimed at a broader user base. GIS began to be used not only for spatial data analysis but also for integrating the knowledge and experiences of residents, which initiated the development of concepts focused on the social aspects of planning. In the mid-1990s, alternative GIS approaches emerged in the U.S., such as bottom-up GIS (BUGIS), group-based GIS, and collaborative GIS. The goal of these solutions was to include the perspectives of local communities in spatial planning processes. At the same time, the development of the internet enabled the popularization of participatory geographic information systems (PPGIS), opening a new era in the history of GIS, centred on user needs and the construction of a geoinformational society (Duckham et al., 2003; Dunn, 2007; Elwood, 2010).

Simultaneously, decision support systems (Planning Support Systems, PSS) were developed, combining GIS with analytical models in the context of planning. The concepts of Participatory GIS (PGIS) and Public Participation GIS (PPGIS) also emerged. The PPGIS concept was defined in mid-1990s and aimed to support the participation of local communities in planning and spatial decision-making processes.

The fundamental assumptions of PPGIS include:

- Ensuring equal access to data and information for all members of the community.
- Empowering communities by providing relevant data and tools that support their needs.
- Maintaining a high level of trust and transparency in public actions to ensure that processes are legitimate and conducted responsibly.

PPGIS combined spatial analysis technologies with principles of participatory democracy, supporting active community participation in spatial planning and management of their environment (Brown & Kyttä, 2014; Obermeyer, 1998).

The 2000s marked the beginning of the Web 2.0 era, characterized by the ability for users to create content (user-generated content). The development of this technology contributed to the emergence of online geographic information services (geoweb), which became accessible to a wide audience. As a result, the production of spatial data ceased to be the domain of only government institutions and commercial entities. The intuitiveness and widespread availability of geoweb services are key elements of their potential in increasing civic engagement in spatial planning processes, particularly within the context of PPGIS. Solutions developed in the Web 2.0 era, based on geographic information systems (GIS), enabled even individuals without professional training to use online maps (Kahila-Tani, Kyttä 2009, Poplin 2012, Johnson et al. 2015).

In the initial studies on PPGIS, simple methods were used, such as paper maps on which participants added information using pens or stickers. Over time, digital mapping based on computers (desktop-based) was introduced. The next stage was the use of the internet (web-based GIS) and applications based on online maps (geoweb), which allowed users to actively submit data and information (Brown & Kyttä, 2014; Ganapati, 2010; Johnson et al., 2015).

Currently, participatory geographic information systems (PPGIS) are part of the trend known as geoparticipation, which involves using geographic information systems to support participatory mapping. Geoparticipation emerged from a critical approach to expert use of GIS in the 1980s and early 1990s. It assumes that residents should not only be passive recipients of planning processes but also active creators. This highlights the role of residents as decision-makers in spatial governance.

PPGIS can be understood as a set of methods and tools based on geographic information systems that support the realization of social participation processes. Their goal is to enable broader public involvement in planning and decision-making processes through information and communication technologies. In the literature, PPGIS is defined by three key aspects:

- The use of GIS tools by society.
- The socialization of spatial planning processes.
- The application of GIS in decision-making processes related to spatial governance.

In summary, participatory geographic information systems are a set of tools and methods that enable public engagement in decision-making processes related to spatial governance, thereby supporting the idea of more democratic spatial planning (Brown & Kyttä, 2014; Dunn, 2007; Kahila-Tani et al., 2016).

It is important to distinguish PPGIS from related concepts, such as PGIS (Participatory GIS), which focuses on education, community engagement, and strengthening local communities. PGIS is primarily a grassroots initiative supported by NGOs or VGI (Volunteered Geographic Information), which involves the creation, collection, and dissemination of geographical data voluntarily provided by interested users (Brown & Kyttä, 2014; Longley et al., 2015).

3.2. Examples of digital Public Participatory GIS digital tools

OpenStreetMap (OSM) is a website that utilizes an open geographic database, which is continuously updated and maintained by a community of volunteers through open collaboration. Contributors collect data through surveys, tracing aerial or satellite imagery, and importing information from other freely licensed geodata sources (https://wiki.openstreetmap.org, last accessed 17/12/2024). OpenStreetMap is licensed under the Open Database License, making it freely accessible for use in creating electronic maps, supporting turn-by-turn navigation, aiding humanitarian efforts, and facilitating data visualization. The platform uses its own topology to store geographical features, which can then be exported into other GIS file formats. The OpenStreetMap website serves as an online map, geodata search engine, and editor. It allowes individuals and communities to actively engage in mapping, contribute local knowledge, and participate in decision-making processes that affect their environments. By harnessing the collective power of volunteers and local communities, OSM fosters a more democratic and inclusive approach to geographic information and spatial decision-making. It enables individuals and communities to actively contribute to the creation and enhancement of geographic data. OSM is an open, collaborative tool that allows users to create, edit, and share detailed maps and spatial data for free, making it an ideal platform for participatory mapping projects.

Key Features of OpenStreetMap as a PPGIS Tool:

1. **Open and Free Access:** OpenStreetMap is an open-source platform, meaning that anyone can access, view, and edit the map data without any cost. This promotes

equality and inclusivity by allowing all users, regardless of their technical background, to contribute their local knowledge to the map.

2. **Crowdsourced Data:** OSM relies on contributions from a diverse, global community of mappers, who input geographical information based on personal knowledge or observations. This crowdsourcing model helps capture local, often underrepresented, details such as smaller paths, public services, or community features, enriching the map's accuracy and diversity.

3. **Real-Time Collaboration:** Users can edit OSM in real-time, allowing the maps to be continuously updated. This feature supports dynamic contributions, enabling local communities to respond quickly to changing conditions–like adding newly built infrastructure, marking temporary hazards, or tracking environmental changes.

4. **Local Context and Knowledge Integration:** OSM allows local residents and communities to contribute detailed, context-sensitive data based on their lived experiences. This feature is particularly valuable for urban planning, community development, and environmental monitoring, where local insights often provide critical information that global maps might miss.

5. **Global Reach with Local Focus:** OSM is a global platform, but it is designed in such a way that local communities can focus on mapping their specific areas of interest. This combination of global infrastructure with localized control makes OSM a powerful tool for both worldwide and grassroots-level mapping projects.

6. **Customizable Tags and Data Categories:** OSM supports the use of customizable tags, allowing users to map and categorize data specific to their needs. Whether for environmental monitoring, mapping community assets, or tracking infrastructure changes, these customizable features enable the creation of specialized maps that reflect the unique concerns and priorities of different communities.

Google My Maps allows communities to engage in spatial data collection, share local knowledge, and participate actively in planning and decision-making processes. Its accessibility, ease of use, and collaborative features make it a valuable tool for fostering inclusive, community-driven mapping efforts. It allows individuals and communities to create, share, and collaborate on custom maps using spatial data. It empowers users, regardless of their technical expertise, to contribute to geographic data collection and visualization, fostering greater public participation in mapping and decision-making processes (https://www.google.com/maps/about/mymaps/, last accessed 17/12/2024).

Key Features of Google My Maps as a PPGIS Tool:

1. **User-Friendly Interface**: Google My Maps offers an intuitive platform that allows users to easily create and customize maps by adding markers, lines, routes and shapes, but also text annotations. This simplicity makes it accessible for a wide range of users, including community members, local organizations, and other non-experts.

2. **Collaborative Mapping**: Google My Maps enables multiple users to collaborate on a single map, allowing for crowd-sourced contributions. Community members can add locations, comments, and observations, turning the map into a shared space of local knowledge and experience. This aligns with the participatory aspect of PPGIS, where input is collected from a diverse group of stakeholders.

3. **Integration of Local Knowledge**: By enabling users to add and edit map features such as geographic locations, routes, and relevant contextual information (e.g., photos, descriptions, and videos), Google My Maps facilitates the incorporation of local knowledge. This enhances the map's relevance and accuracy for community-driven projects such as urban planning, disaster response, and local resource management.

4. **Access to Data and Information**: Users can add different layers of information to the map, such as data points, boundaries, and spatial markers, which can represent everything from environmental features to infrastructure. This capacity to integrate multiple data sources supports broader public engagement and transparency, a core principle of PPGIS.

5. **Ease of Sharing**: Maps created with Google My Maps can be shared with others through email, social media or embedded on websites. This feature allows for wider dissemination of community-generated data, facilitating outreach and collaboration among a broader audience, which is essential for participatory decision-making.

6. **Integration with other tools:** Google My Maps is integrated with other Google tools, such as Google Earth, Google Drive, and Google Sheets, enhancing the utility of the platform for data collection, analysis, and sharing. it is also possible to export spatial data from Google My Maps to other data formats such as *.kml or *.kmz. and share them with other types of GIS software.

Esri ArcGIS Online (with StoryMaps) is a cloud-based mapping and analysis platform developed by Esri that allows users to create, share, and analyse geographic information. It provides tools for visualizing spatial data, collaborating on projects, and conducting spatial analysis. With ArcGIS Online, users can easily access a wide range of ready-to-use maps, apps, and data layers, as well as create custom interactive maps and apps. It supports collaboration among individuals, teams, and organizations, enabling real-time sharing of data and insights. The platform is designed for users of all skill levels, from beginners to advanced GIS professionals, and is used in various fields such as urban planning, environmental monitoring, and disaster response**.** ArcGIS Online can be access through web browsers and mobile devices but also directly through other components of ArcGIS, including ArcGIS apps. With an extension of **Esri Story Maps** ArcGIS Online allows users to combine maps, multimedia (photos, videos, text, etc.), and geographic data into interactive, narrative-driven stories. Story Maps web-based application that allow to share maps in the context of narrative text and other multimedia content. It provides a compelling way for communities to share their experiences, concerns, and ideas about their local spaces, making it an effective tool for participatory planning (https://doc.arcgis.com/en/arcgis-online/get-started/what-is-agol.htm, last accessed 17/12/2024).

Key Features of ArcGIS Online as a PPGIS Tool:

1. **Interactive Web Maps and Apps**: ArcGIS Online allows users to create and share interactive maps and applications that the public can easily access. These maps can be used to gather feedback on urban planning, environmental issues, and other

community projects, enabling citizens to contribute their knowledge and data directly on the map.

2. **Crowdsourcing Capabilities**: With tools like GeoForm and Survey123, ArcGIS Online facilitates crowdsourced data collection. This allows citizens to submit geographic information such as photos, location data, and descriptions of local issues or assets. These tools can be used to report problems like potholes or pollution, helping communities participate in monitoring and improving their environment.

3. **Real-Time Collaboration and Sharing**: ArcGIS Online supports real-time collaboration among community members, government agencies, and other stakeholders. Maps and data can be easily shared with the public or specific groups, allowing for transparent and collaborative decision-making. This enhances civic engagement by giving everyone a voice in the process.

4. **Customizable Dashboards**: The platform offers customizable dashboards that allow users to visualize and analyse data in real time. These dashboards can display key metrics, trends, and geographical patterns, making it easier for the public to understand the impact of community initiatives and for decision-makers to monitor progress and make informed choices.

5. **Public Participation and Feedback Tools**: ArcGIS Online offers tools for gathering feedback, such as Story Maps and Web AppBuilder. Story Maps combine narrative text with interactive maps to provide a compelling way to engage the public in planning processes, while Web AppBuilder allows users to create customized apps for submitting feedback and exploring geographic data.

6. **Access to Basemaps and Spatial Data**: ArcGIS Online provides access to a wide variety of basemaps and spatial datasets that users can incorporate into their own maps and projects. Public participation is enhanced by the ability to use relevant local data, such as demographics, infrastructure, and environmental data, ensuring that decisions are informed by comprehensive, up-to-date information.

QGIS is a multiplatform, free and open source geospatial software (GIS). The QGIS project is part of the open source Geospatial Foundation (OSGeo). QGIS enables managing geographic data, creating your own data, including the use of GPS coordinates, performing spatial analyses and creating maps (https://www.qgis.org/, last accessed 17/12/2024). The software functionality can be extended by using additional plugins. The program provides the possibility of integration with other OSGeo projects, including PostGIS, MapServer, GDAL / OGR. QGIS is developed by a group of volunteer programmers. The system is available under the GNU GPL license in 39 language versions. QGIS enables collecting and processing spatial data (e.g., creating, selecting, identifying, editing, browsing, managing), as well as displaying, analysing, and sharing multiple formats, including publishing map compositions on the Internet.

Key Features of QGIS as a PPGIS Tool:

1. **Open-Source and Customizable:** QGIS is an open-source GIS platform, which means it is freely available for anyone to use, modify, and distribute. Users can tailor QGIS to their specific needs, whether for community mapping, environmental monitoring, or urban planning. It makes QGIS accessible to a wide range of users, including community organizations, NGOs, and citizens. This fosters inclusivity and

ensures that everyone, regardless of budget, can participate in the mapping and planning processes.

2. **Mobile Data Collection with QField**: This mobile application is specifically designed for field data collection and works seamlessly with QGIS. It enables users to collect geospatial data directly in the field using smartphones or tablets, with support for GPS tracking, offline capabilities, and real-time updates (https://qfield.org/, last accessed 17/12/2024).

3. **Web Mapping with QGIS Cloud:** QGIS Cloud allows users to publish their QGIS maps and projects on the web, creating interactive maps that can be accessed by anyone with an internet connection. Users can share maps, add layers, and provide access to spatial data without needing specialized GIS software. It provides an accessible platform for the public to interact with maps and geographic data. This fosters transparency in decision-making, allowing residents to view, comment, and provide feedback on plans, making them active participants in the planning process ((https://qgiscloud.com/, last accessed 17/12/2024).

4. **Spatial Analysis Tools**: QGIS offers a wide array of spatial analysis tools, such as buffering, overlay analysis, and proximity analysis, which help users understand spatial relationships and patterns in the data. Those tools allow to evaluate the potential impacts of planning decisions.

5. **Collaboration and Real-Time Updates with inSafe Plugin**: The inSAFE plugin is designed for collaborative mapping, allowing multiple users to contribute data in real-time. It is particularly useful for emergency management, but it also supports collaborative community mapping, enabling participants to update and share spatial data as projects progress. The inSafe plugin facilitates active collaboration between community members, government officials, and NGOs. By enabling real-time updates and data sharing, it enhances community engagement and ensures that all relevant parties have access to the most current information (https://plugins.qgis.org/plugins/inasafe/, last accessed 17/12/2024).

6. **Data Sharing and Exporting:** QGIS supports various data formats, such as GeoJSON, KML, shapefiles, and integrates with cloud services like GeoServer and QGIS Cloud. Users can export and share data in different formats, ensuring broad accessibility. The ability to share spatial data in multiple formats ensures that community contributions can be easily integrated into other systems and accessed by various stakeholders, such as local governments, urban planners, and other participants in the planning process. This promotes transparency and broadens participation.

3.3. Spatial data for Public Participatory GIS

Spatial data is at the core of Public Participatory GIS (PPGIS), providing the geographic context needed to make decisions and engage the public. In PPGIS, spatial data combines official data sets with community-provided information to provide a more inclusive representation of geographic phenomena. The types and sources spatial data in PPGIS are as follows:

3.4. Types of Spatial Data Used in PPGIS

Base data refers to the basic layers that provide the necessary context for participatory mapping projects. These data layers form the basic structure on which more detailed and specific information is added. They help participants to gain a clear sense of the geographical space they are working with, enabling accurate interpretation and integration of additional data. Access to such data is provided by EU Directive 2007/2/EC of 14 March 2007 INSPIRE.

Examples of base data include:

- **Administrative units/borders**, dividing areas where Member States have and/or exercise jurisdictional rights, for local, regional and national governance, separated by administrative boundaries.
- **Transport networks**, including roads, railways, and other infrastructure, essential for navigation and mobility-related projects.
- **Hydrography**, including marine areas and all other water bodies and items related to them, including river basins and sub-basins.
- **Land cover**, Physical and biological cover of the earth's surface including artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands, water bodies.
- **Elevation**, Digital elevation models for land, ice and ocean surface. Includes terrestrial elevation, bathymetry and shoreline.
- **Protected sites**, Area designated or managed within a framework of international, Community and Member States' legislation to achieve specific conservation objectives.

The base data is available in the INSPIRE Geoportal at Community level but also in the national geoportals of the Member States. The INSPIRE Geoportal acts as the central European gateway to geospatial data provided by EU Member States and EFTA countries under the INSPIRE Directive. It offers a variety of essential functionalities, such as monitoring the availability of datasets within its scope, discovering relevant datasets through detailed metadata descriptions, and accessing selected datasets via visualization or download services. The metadata used in the Geoportal is regularly updated, sourced directly from the discovery services of EU Member States and EFTA countries (https://inspire-geoportal.ec.europa.eu/srv/eng/catalog.search#/home, last accessed 17/12/2024)

Community-contributed data refers to the information collected by local stakeholders, citizens, or community groups, often through direct involvement and engagement with their environment. This data is vital for capturing the lived experiences, needs, and insights of the people who are most familiar with the area being mapped. It allows for a more localized, detailed, and inclusive approach to mapping, where the community actively shapes the data collection process.

Examples of community-contributed data include:

- **Locations of resources**, such as water sources, forests, or other important natural assets that the community relies on for sustenance and well-being.
- **Social infrastructure**, including essential facilities like schools, health centers, and community centers that support the daily lives of residents.

- **Community-identified problem areas**, such as flood zones, illegal dumpsites, or areas with inadequate infrastructure, which can help prioritize interventions or highlight risks.

Collection of this type of data is often facilitated by various tools that allow community members to easily contribute geographic information, including platforms like **OpenStreetMap** .

Demographic and socioeconomic data refers to information about human populations and their characteristics, which is often tied to geographic locations. This type of data is crucial for understanding the social and economic conditions of a community, as well as identifying disparities and needs for intervention. It plays a key role in planning and development, helping policymakers and local stakeholders make informed decisions that promote equity and improve quality of life.

Examples of demographic and socioeconomic data include:

- **Population density and distribution**, which provide insights into where people live and the concentration of populations in certain areas. This data is vital for infrastructure planning, resource allocation, and public service delivery.
- **Income levels, education rates, and access to services**, which help identify areas of economic hardship and social inequality. Understanding these factors allows for targeted interventions to improve living standards, education, and healthcare in underserved communities.

Sources of demographic and socio-economic data often include census data collected by national statistical agencies, as well as community survey data, which provide more localised and detailed information. At the European Union level, statistical data are also provided by the statistical office of the European Union Eurostat (https://ec.europa.eu/eurostat/web/main/home, last accessed 17/12/2024)

Imagery and remote sensing data refer to visual information captured from satellite images or aerial photos, providing detailed geographic visuals that help in analysing and understanding the Earth's surface. This data is invaluable in participatory mapping efforts as it offers an up-to-date, accurate, and comprehensive view of areas that can be difficult to access or monitor directly.

Examples of imagery and remote sensing data include:

- **Satellite images**, allowing for the identification of infrastructure, buildings, roads, and land use patterns. This type of imagery is crucial for urban planning, disaster response, and environmental management.
- **Land cover classifications** derived from satellite sensors, such as those on **Landsat** or **Sentinel** satellites, which provide detailed information on vegetation, water bodies, forests, and other land features. These classifications help track changes in land use, monitor environmental degradation, or assess natural resource distribution.

Satellite data from the Sentinel mission can be obtained via the Copernicus Dataspace (https://dataspace.copernicus.eu/, last accessed 17/12/2024), which is the main source of information for users of this data. The platform provides full access to data from different Sentinel missions, such as Sentinel-1, Sentinel-2, Sentinel-3 and

Sentinel-5P. Users can download both raw and processed data, including multispectral imagery and radar data. Landsat data can be obtained through the USGS Earth Explorer platform, managed by the United States Geological Survey (USGS) (https://earthexplorer.usgs.gov/, last accessed 17/12/2024). This service provides data from all Landsat missions, from Landsat 1 to Landsat 9, covering decades of Earth observations. The platform allows easy data searching based on location, date range, and image type. Users can download multispectral scenes, images processed for analysis, such as NDVI (Non-Density Vegetation Index), and more.

Real-time or dynamic data refers to information that is continuously updated, providing immediate insights and enabling real-time decision-making. This type of data is crucial for dynamic environments where rapid changes occur, and timely responses are needed. In participatory mapping, real-time data enhances the relevance and accuracy of maps, particularly for time-sensitive situations.

Examples of real-time or dynamic data include:

- **Traffic conditions or congestion maps**, which provide live updates on road traffic, helping users to navigate efficiently or assisting in urban planning and infrastructure management.
- **Weather data and live disaster updates**, such as information on storms, wildfires, or flooding, which is critical for emergency response, evacuation planning, and public safety.

Real-time data sources include APIs that provide continuous streams of information, local IoT sensors that can monitor various conditions such as air quality or traffic flow, and crowdsourcing platforms that collect traffic data from users and provide real-time updates.

3.5. The functionality of digital Participatory GIS tools

The functionality of **digital Participatory GIS (PGIS) tools** enables communities and stakeholders to collaboratively gather, analyse, and visualize spatial data. Here are 10 descriptive points about the functionalities of PPGIS tools:

1. **Crowdsourcing Data** PPGIS tools enable community members to contribute spatial data through crowdsourcing platforms like OpenStreetMap. These platforms allow individuals to map local features such as roads, buildings, and points of interest, which can improve the accuracy and inclusiveness of mapping efforts.
2. **Mobile Data Collection** Tools like QGIS Field facilitate the collection of field data using mobile devices such as smartphones or tablets, even in offline settings. This enhances data accessibility, especially in areas with limited internet connectivity, empowering local stakeholders to gather and share information on-site.
3. **Interactive Map-Based Surveys** allow the creation of map-based surveys, enabling users to provide feedback on spatial plans and issues. These surveys gather public input while linking responses to specific geographic locations, helping stakeholders understand community perspectives in relation to place.
4. **Multimedia Integration** PPGIS tools support the attachment of multimedia, such as photos, videos, and audio, to georeferenced data points. This capability enriches spatial data by adding context, making it easier for users to convey complex information and experiences related to specific locations.

5. **Collaborative Map Creation** platforms Google My Maps support collaborative map creation, allowing communities to co-design and update maps. Users can mark areas of interest, concerns, or resources, which fosters shared understanding and collective action in decision-making.
6. **Custom Data Layers** PPGIS tools enable users to add custom layers of data, visualizing issues such as environmental risks, infrastructure gaps, or other community concerns. This feature empowers users to tailor maps to specific needs, ensuring that the most relevant information is accessible for analysis.
7. **Real-Time Spatial Updates** Many PPGIS tools support real-time updates, ensuring that multiple users can simultaneously view and contribute to the same map. This real-time synchronization helps streamline collaborative work, enhancing decision-making processes with up-to-date data.
8. **Scenario Modeling for Decision Support** Tools like InaSAFE for QGIS allow users to simulate various scenarios, such as natural disasters or policy interventions, using local data. Scenario modeling helps decision-makers evaluate the potential outcomes of actions, enhancing preparedness and response strategies.
9. **Monitoring and Evaluation** PPGIS tools provide functionalities to monitor and track the progress of community projects and interventions over time. With features like before-and-after comparisons and geospatial data layers, users can assess the effectiveness of initiatives and identify areas needing improvement.
10. **Security and Privacy** PPGIS tools include security measures such as data anonymization, controlled access, and encryption to protect sensitive community data. Role-based access ensures that only authorized users can edit or view specific information, safeguarding the privacy and integrity of the collected data.

4. Classroom discussion topics / case studies

Take a closer look at the example of PPGIS (Public Participatory GIS) application in sustainable urban mobility planning (provided in this article:https://pressto.amu.edu.pl/index.php/rrpr/article/view/8572, last accessed 17/12/2024)
The case study serves as a basis for classroom discussions on the following topics:

- What specific methods and tools were utilized in the case study?
- How were these tools employed to collect and integrate community input?
- In what ways does PPGIS enhance inclusivity in urban mobility planning?
- Are you familiar with other examples of PPGIS applications in urban planning or related fields?

5. Assignments

Using QGIS and QGIS Cloud software, as well as any survey tool (for example Google Forms), create a geosurvey that allows you to assess the location of planned objects.

1. Create a QGIS project.
2. Create a new shapefile or GeoJSON file with point geometry.
3. Add an OpenStreetMap basemap to the QGIS project.

4. In the newly created file, mark two proposed locations for objects (e.g., bus stops) using points.
5. Add text fields to the attribute table, such as **„description"** and **„survey"**.
6. Create online surveys to assess the suitability of the proposed locations.
7. Share the surveys by copying the links.
8. In the attribute table:
- In the **description** field, add a description for each location.
- In the **survey** field, add the corresponding survey link for assessing each location.
9. Share the project using the QGIS Cloud plugin:
- Log in to your QGIS Cloud account via a browser.
- Display the map, copy the map link, and send it to a selected person to test the geosurvey functionality.

Summary of Learning

Q1: What is GIS, and what are its primary functions?
A: GIS (Geographic Information Systems) is a technology that collects spatial data from various sources, enriches it with descriptive attributes in a database, and allows users to transform the data into actionable information using analytical tools. It facilitates the creation of informational products such as maps.

Q2: What is PPGIS, and how does it differ from traditional GIS?
A: PPGIS (Public Participatory Geographic Information Systems) integrates GIS technology with participatory democracy principles, enabling community members to engage in spatial planning and decision-making processes. Unlike traditional GIS, which was expert-oriented, PPGIS aims to ensure equal access, empower communities, and maintain transparency.

Q3: How does QGIS facilitate community participation in spatial planning?
A: QGIS, an open-source geospatial software, enables community participation through its customizable tools and accessibility. Features such as mobile data collection via QField, web mapping with QGIS Cloud, and collaborative plugins like InSAFE support real-time updates and interaction. QGIS allows users to publish maps online, perform spatial analyses, and share data in various formats, ensuring broad engagement and transparency in planning and decision-making processes.

Q4: What types of spatial data are commonly used in PPGIS projects, and why are they important?
A: The main types of spatial data used in PPGIS projects include base data, community-contributed data, demographic and socioeconomic data, imagery and remote sensing data, and real-time or dynamic data.

Q5: What roles do multimedia and interactive surveys play in enhancing PPGIS functionality?

A: Multimedia integration allows users to attach photos, videos, and audio to georeferenced data points, adding context and depth to spatial information. Interactive map-based surveys, collect community feedback linked to specific locations, providing insights into public opinions and spatial issues.

Quiz

Q1: What was the primary purpose of Geographic Information Systems (GIS) when it was first developed?

A) To enable real-time spatial data updates.
B) To integrate community input in spatial planning.
C) To reduce costs and speed up map creation.
D) To facilitate multimedia integration in spatial data.
A: C

Q2: Which decade marked a breakthrough for GIS with the introduction of personal computers and software for a wider audience?

A) 1970s
B) 1980s
C) 1990s
D) 2000s
A: 1990s

Q3: What is the primary goal of Public Participatory Geographic Information Systems (PPGIS)?

A) To develop commercial mapping tools for specialized users.
B) To improve accessibility of spatial data for local governments.
C) To enable broader public involvement in spatial planning and decision-making.
D) To create highly technical simulations for urban planners.
A: C

Q4: How does PPGIS differ from PGIS (Participatory GIS)?

A) PGIS focuses on grassroots community engagement, while PPGIS emphasizes decision-making and public participation.
B) PPGIS is only used by NGOs, while PGIS is used by governments.
C) PGIS incorporates Web 2.0 technologies, while PPGIS does not.
D) PPGIS is an older concept than PGIS.
A: A

Q5: What technological advancement in the 2000s significantly contributed to the growth of PPGIS?

A) The introduction of ArcGIS Pro.
B) The development of geoweb services and user-generated content.
C) The first satellite imaging by Landsat.
D) The creation of closed GIS systems for experts.

A: B

Q6: What is the primary data collection method used by OpenStreetMap contributors?

A) Importing data exclusively from government databases
B) Using only satellite imagery
C) Tracing imagery, and importing freely licensed data
D) Relying solely on automated systems

A: C

Q7: Which key feature of Google My Maps makes it accessible to users with varying technical expertise?

A) Integration with ArcGIS Pro.
B) User-friendly interface for creating and customizing maps.
C) Advanced spatial analysis tools.
D) High subscription costs for premium features.

A: B

Q8: What is an unique feature of Esri ArcGIS Online's Story Maps?

A) They allow real-time GPS tracking in the field.
B) They combine maps with multimedia and narrative text for community storytelling.
C) They are exclusively used for environmental monitoring.
D) They are only accessible to GIS professionals.

A: B

Q9: How does QGIS Cloud contribute to participatory mapping?

A) By providing access to basemaps for GIS professionals.
B) By enabling users to publish interactive maps on the web for broader public access.
C) By offering free access to proprietary GIS software.
D) By supporting only offline data collection.

A: B

Q10: What role does the QField app play in QGIS?

A) It is a plugin for spatial analysis on desktop computers.
B) It enables mobile data collection with GPS tracking and offline capabilities.
C) It allows users to create Story Maps for community engagement.
D) It integrates QGIS maps with ArcGIS Online.
A: B

Q11: What is the primary purpose of "base data" in Public Participatory GIS (PPGIS)?

A) To collect community-contributed data about local issues.
B) To provide foundational geographic context for participatory mapping projects.
C) To gather real-time data for urban traffic management.
D) To track demographic and socioeconomic changes over time.
A: B

Q12: What type of data allows communities to contribute insights directly about their environment, such as identifying problem areas like illegal dumpsites?

A) Imagery and remote sensing data.
B) Demographic and socioeconomic data.
C) Community-contributed data.
D) Real-time or dynamic data.
A: C

Q13: Which platform provides access to data from Sentinel missions, including multispectral imagery and radar data?

A) USGS Earth Explorer.
B) Copernicus Dataspace.
C) Landsat Viewer.
D) Sentinel Hub.
A: B

Q14: What does multimedia integration in PPGIS tools enable users to do?

A) Create 3D maps of geographic locations.
B) Attach photos, videos, and audio to georeferenced data points.
C) Automatically analyse survey results.
D) Add weather data to maps.
A: B

Q15: What is the benefit of linking survey responses to specific geographic locations in PPGIS?

A) It speeds up the map rendering process.
B) It provides insights into community opinions related to specific places.
C) It automates decision-making processes.
D) It increases the resolution of spatial imagery.
A: B

Q16: How do multimedia and surveys enhance the depth of spatial information in PPGIS?

A) By generating high-resolution satellite imagery.
B) By providing detailed textual descriptions of spatial data.
C) By adding context through photos, videos, and surveys linked to locations.
D) By automatically categorizing geographic features.
A: C

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7. Glossary

Geographic Information Systems (GIS) is a technology that collects, stores, analyses, and visualizes spatial data. It allows users to interact with geographic information using decision-support and mapping tools.

Public Participatory Geographic Information Systems (PPGIS) is an approach that integrates GIS technology with participatory democracy, enabling local communities to actively participate in spatial planning and decision-making processes.

Geoweb refers to web-based geographic information services that allow users to access, create, and share geographic information online.

Participatory GIS (PGIS) focuses on empowering local communities through education and engagement in the collection and use of geographic information. It is a grassroots initiative supported by non-governmental organizations.

Spatial data refers to any information that identifies the geographic location and characteristics of objects or phenomena. It forms the basis of GIS and PPGIS, enabling the visualization and analysis of geographic areas, resources, and human activities.

Geoparticipation is a concept that involves residents as active participants in spatial management and decision-making, rather than passive recipients.

Crowdsourced data refers to information collected voluntarily by a large group of people, often from diverse and global communities, contributing local knowledge and observations.

Volunteered Geographic Information (VGI) is the use of GIS tools to create, collect, and disseminate geographic data provided voluntarily by interested individuals.