GIS IN TOURISM

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Abstract: GIS can be used in tourism as a decision making instrument regarding sustainable planning, impact evaluation and visitor flow management. Tourism has always been considered a suitable environment to expand the horizons of human interests. [1] It is a major factor in the development and exploration of historical, natural and cultural heritage of nations. Therefore, it indirectly serves to improve cultural understanding by both residents and foreigners. Internal tourism creates an understanding and appreciation for local attractions, and consequently improves sustainable tourism.

Keywords: GIS, tourism, map

1. Introduction

GIS is an ansamble of personal, equipment, software, methods and norms, aimed towards collecting, validating, storing, analysing and visualizing geographical data[2] . GIS is a computer based instrument used for mapping and analysing existing objects and earth based events[3]. GIS technology combines common database operations such as integration and statistical analysis with the particular visualization and geographic analysis benefits offered by maps. These qualities differentiates GIS from other informational systems, making it available to a wide and diverse public or private companies in order to explain certain events, predicting outcomes and planning strategies.

Tourism can be defined as a set of activities (for leisure, business, religious, health and personal purposes) engaged in by persons ,temporarily away (maximum of one year) from their usual environment, excluding the pursuit of remuneration from within the place visited or long-term change of residence[4].

GIS facilitates tourism development by providing information regarding a area's current state and any changes in time, that can be used in service improvement and for identifying new suitable tourist attractions.

2. GIS design and implementation in tourism

The essential component of a GIS is represented by the geographic data feed system.

Fig. 1. GIS components

In order to improve access to an information through classification, labelling and individual organization of activities or data, models and representations of the environment were developed. Therefore, to highlight relevant research entities and the relationships between them, a variety of presentation methods are used to convey spatial or descriptive information.

This information is automatically processed by an electronic computer. Geographical (spatial) data represent a certain entity in space, through four key elements:
  – position – usually expressed through spatial coordinates or postal address;
  – attributes – geographic entitty characteristics (names, altitudes, diameteres, soil type, etc.);
  – spatial relations – the relative position to other entities, an important characteristic in analysis, which introduces the notion known as GIS as topography;
  – time – the moment in which the data was registered.

Geographical (spatial) data can have different roles within the system:
  – supplies material for GIS modeling and analysis;
  – provides the geographic database;
  – helps with the search process and information extraction;
  – supplies the background for result presentation;

Transforming observations of the real world into a set of useful data for GIS, by establishing the necessary concepts and procedures, can be done only by using models. In general, a model can be represented through a hypothesis, a theory, a mathematical

relation or a database.

A model is an idealised or simplified representation of reality.[5]

Based on the concept model, information necessary for its development is determined. The main holder of information is the entity, that real world object or phenomenon which cannot be divided into objects and phenomena of the same kind. An entity is characterized by its affiliation to a certain class, through its attributes and spatial relations to other entities. Spatial relations between geographical entities can be numerous, complex, objective or subjective. For practical reasons, the model does not register all the spatial relations observed, sometimes deliberately omitting the most obvious relations.

The abstraction enables real-world understanding of the process and ,in the same time, enables the planning and necessary interventions. A passive model involves automating the existing process, without adding anything new. In the case of a reagent model, spatial entities and information are processed for analysis in order to find solutions or identify new ways of perfectioning the model.

An important quality of models is their dynamic nature. By using models information is accumulated and adapted. The spatial model's dynamic nature is transmitted to the application, which, in turn, is open to change and improvement.

In principle, the implementation and exploitation of GIS is conducted in the following stages:

Requirements definition: Implies a detailed study of user requirements. Following this study, quantitative and qualitative characteristics (precision, structure, representation scales) of the final results are set and volume data is estimated.

- Setting system functions: Being aware of the requirements it is necessary to specify the function which the system has to realize in order to achieve it's objectives.
- Database design: It is esential to define the represented entities and their characteristics, also the coordinate system that is being used.
- Selecting and procuring equipment and software: Of the various possibilities of implementing GIS (full or partial realization by own means, purchasing an existing one, etc.), the one which provides all or most necessary functions for maximum efficiency should be chosen.
- Customizing software to satisfy specifict requirements of the application: In a specific case of a particular application (surveying, traffic monitoring, urbanism studies, etc) it is necessary for all general GIS functions to be adapted to match the specific requirements. Modules and procedures should be customized as to be easily accessed by any user with basic knowledge in the application's field of study.
- Uploading the database: It consists of the actual realization of the digital map by supplying data and it regularly represents the phase in which the largest amount of resources is solicited.
- GIS exploitation: Unlike previous phases, it is permanent and is conducted in three main directions:
  a. Updating takes into account the dynamic nature of spatial data which should reflect the changes in the territory.
  b. Analysis is the most important possibility offered by GIS through it's ability to process spatial data based on different modules.
  c. Obtaining various raports represents one of the major advanteges of using GIS and it's main purpose. Basically, these reports can be represented graphically and/or in a table.

Creating a Geodatabase

A geodatabase is a relational database that stores and manages geographical data, organised in more than one table, associated by common areas.

"Spatial data, such as in shapefiles, can have many formats. A geodatabase is a collection of maps and database tables stored in a relational database management system. In the future, more GIS systems will use geodatabases because most organizations work with database packages and prefer them to file-based systems such as shapefiles."[6]

There are 2 types of geodatebases: Personal Geodatabase and File Geodatabase.

In the window that opens, we must specify:
- **Input features** - the input vector is selected, in this case landuse.shp;

- **Output location** - it represents the location of the Geodatabase;

- **Output Feature Class** - here we chose the name under which the file will appear in the geodatabase;

The display order of the layers in the map is the one from the Table Of Contents. Thus, the first layer from the list will be displayed on top of the rest, and the last (as a rule, the ortho photo image) will be displayed below all the other layers.

Choosing object display:

An object is displayed as point (symbol), line or polygon. We can also set the percentage of desired transparency.

Setting the spatial reference

A spatial reference (also called spatial bookmark) identifies a specific location of a geographical area, which we want to save and then later reference. In this way, while exploring different areas of the map, we can easily go back to the studied area by accessing the spatial reference.

Creating a hyperlink

To view images from various places of interest from the GIS map, there is the option of creating hyperlinks. To add a hyperlink to a web page, select Link to URL and write address.

Data interrogation

The GIS map database is composed of a series of tables with records, which we can view, modify, execute queries on them in order to perform various charts and reports. To view the tables, right-click on the table of contents on the layer we want to show the table. Choose **Open attribute table** to open the attribute table of the layer.

Finding items by searching an SQL expressions

If we want to select an object from the map it helps finding them as quickly and efficiently as possible. A handy way to search is to use SQL Expressions.

Case Study

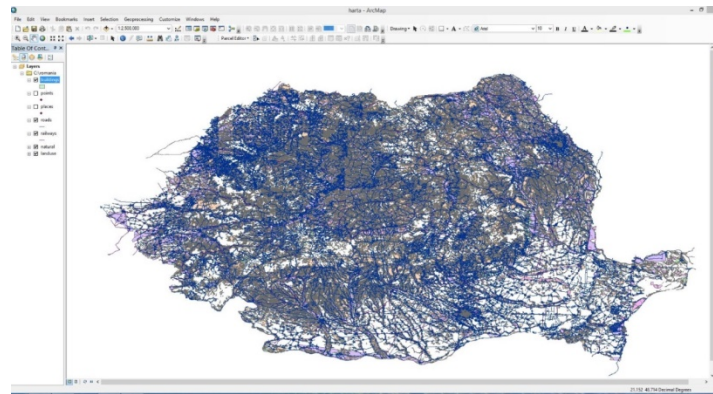To achieve this, as initial data we used a digital map of Romania obtained at: http://download.geofabrik.de/europe/romania.html.

Fig. 2. Digital Map of Romania opened in ArcGIS

The map is made in the geographical projection system GCS (Geographic Coordinate System) WGS (World Geodetic System) 1984 and it was brought into the national project plan (Stereo 1970) through the project tool (Data Management) (fig. 2).

"A map projection is a mathematical formula for representing the curved surface of the earth on a flat map. No flat representation of the earth can be completely accurate, so different projections have been developed, each suited to particular purposes. Map projections differ in the way they handle area, shape, distance, and direction. No projection can preserve all of these properties, although some combinations can be preserved, such as area and direction. As a map maker, you can decide which property is most important to your needs and choose a projection that preserves that property."[7]

Case Study 1 - selecting buildings bound for art galleries, tourist attractions and museums at a maximum distance of 1500 m from the fountain in front of the Unirii shopping centre.

To achieve this query one should take the following steps:

- Selecting the reference point, for example the fountain in front of Unirii Shopping Centre;
- The result of the query is saved as a separate file, type *.shp, named atractii_unirii.shp and then graphically represented by destination (fig. 3);
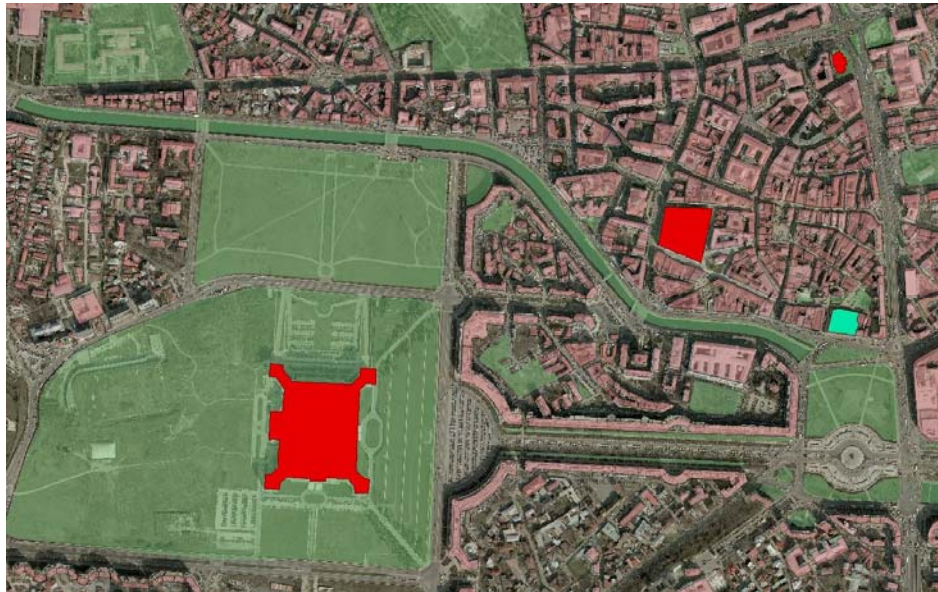
Fig. 3. Selecting buildings bound as art galleries, tourist attractions and museums, located within a 1500m range from the fountain in front of Unirii Shopping Centre

All of these steps were obtained with the help of a modelbuilder (fig. 4).

"Modelbuilder is an application available in ArcView that you can use to document your geoprocessing workflows. With Modelbuilder, you construct model diagrams from the data and geoprocessing tools needed for you analysis or workflow. Once the model is built, you can run it once or save it and run again using different input data parameters."[8]
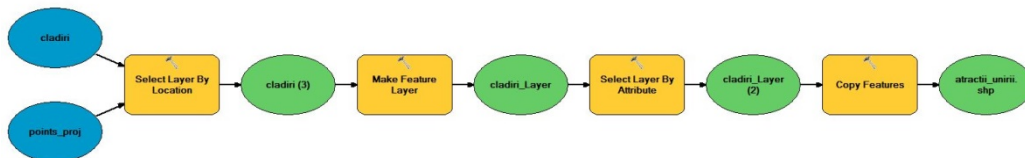

Fig. 4. A modelbuilder for the selection of buildings bound as art galleries, tourist attractions and museums within a 1500m range from the fountain in front of Unirii Shopping Centre.

Study case 2 - Selecting buildings bound as restaurants, bars, coffee shops and fast food within a maximum 500m range from a park

In the database buildings do not have a destination field, but there are points within them which have such a field. Because of this first the attributes of the point must be attributed to the buildings. This can be made through multiple steps in the modelbuilder .

"A spatial join is a join that you perform between the attribute tables of two themes using Shape fields in these tables as the basis for the join"[9]

In order to realize a selection of buildings bound as restaurants, bars, coffee shops and fast food within a maximum 500m range from a park a new modelbuilder is created (fig. 5).
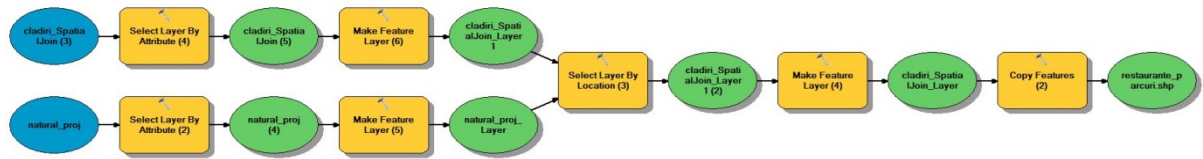

Fig. 5. A modelbuilder for the selection of buildings bound as restaurants, bars, coffee shops nd fast food within a maximum 500m range from a park

The final result of the modelbuiler is the selection of buildings bound as restaurants, bars, coffee shops and fast food within a maximum 500m range from a park.

Fig. 6. The selection of buildings that have as their destination a restaurant, bar, coffee shop and fast food and is located at a distance of 500 m from the Izvor Park.

3. Conclusion

As Farsari and Prastacos (2004)[10] reported, most applications of GIS in tourism relate to identifying suitable areas for developing tourism activities in the future (land suitability analysis) while the use of GIS in already developed (mature) tourist destinations has been avoided. They suggested that there are a number of ways in which GIS can benefit the study of tourism and implementation of sustainable practices in destination areas.

Successful implementation of GIS promotes importance of information over technology.

GIS has been successfully used in tourism for collecting, analysing, modelling and visual representation of tourist data. GIS is also used to bring the geographical data(spatial and non spatial) into digital maps.

The query of tourism data and GIS data is still a big challenge for the tourism industry today.

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