THE CONCEPT OF USING GIS IN THE INVENTORY OF ARCHITECTURAL AND LANDSCAPE UNITS

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Abstract:

The paper presents a concept of using GIS in the inventory of architectural and landscape units for the territory of Poland.
Architectural and landscape units are identified based on topography, land cover and historical characteristics. The mosaic of these units is a record of the state of a landscape. To each architectural and landscape unit a specific form of protection is attributed.
National Heritage Board of Poland started work on building the infrastructure for spatial information about the monuments. One of the basic elements of this infrastructure was to develop and implement a geographic information system for architectural and landscape units. It was realized under the program for protection of Polish cultural landscape.
The work included: development of a database structure for architectural and landscape units, geometrization of raster maps, digitization of unit outlines, development of the data visualization standards, establishment of the schedule for implementation of the conceptual data structure model (SQL) and conceptual model of the data structure (UML).
The main problem during the realization of the project was the analog source material, which needed proper processing.
The use of GIS has enabled the replacement of analogue material collected in the National Heritage Board of Poland by a unified - spatial and descriptive - database for the whole territory of Poland.

1. INTRODUCTION

1.1 GIS

A geographic information system (GIS) is a system for capturing, storing, managing, processing and displaying the data spatially referenced to the surface of the Earth. Generally speaking, the complete geographic information system requires, first of all, hardware, software and data as well as a set of procedures for data management and analysis. It also demands personnel who are able to plan, implement and use a system as well as meaningfully interpret the collected data.

The essence of GIS functioning rests in its ability to integrate data from diverse sources in diverse formats into a single cohesive database of geographical information. Such a database contains information on geographical locations on the surface of the Earth or natural phenomena, allows recognizing relationships between them and includes information on their attributes and characteristics. Because of the advanced functions of the data analysis and displaying, the information, collected though GIS methods, enables a better knowledge and comprehension of the relationships and laws which govern the real world. Therefore, a GIS system can simultaneously serve as a depository of spatial information and as a collection of functions necessary to interpret and manipulate the data. A GIS must be distinguished from other information systems

chiefly based on its use of technology that allows a complex analysis of spatial data and related attributes which results in a presentation of this analysis in a cartographic form, in other words, in a form of maps [4].

The development of a GIS involves transferring the elements of the real world onto a computer monitor by means of models and symbols which can be interpreted by an information system. This multiphase process requires familiarity with the processes and phenomena of the real world. A functional GIS requires:

- development of a conceptual model, i.e. defining the scope of spatial and topical data and the method of their presentation;
- development of a logical model, i.e. identification of a fragment of the real world and its description by means of a set of commands understood by a computer;
- development of a physical model, i.e. working directly with the architecture of the database';
- implementation, i.e. collection and analysis of the data, and finally, the presentation of results.results, principal conclusions and references.

1.2 The architectural and landscape units

The National Heritage Board of Poland started work on building the infrastructure for spatial information about the monuments. One of the basic elements of this infrastructure was to develop and implement a geographic information system for architectural and landscape units. It was realized under the program for protection of Polish cultural landscape.

Architectural and landscape units (JARK) are identified based on topography, land cover and historical characteristics. The mosaic of these units is a record of the state of a landscape. To each architectural and landscape unit a specific form of protection is attributed [2,3].

To evaluate the distinguished units they are divided into three categories: natural, cultural and mixed.

2. METHODOLOGY OF THE GEOGRAPHIC INFORMATION SYSTEM INTENDED FOR THE ARCHITECTURAL AND LANDSCAPE UNITS

2.1 Preparation of the source materials

The main problem during the realization of the project was the analog source material, which needed proper processing. Scanned maps of provinces with the outlines of architectural and landscape units, as on Figure 1, were of very low quality and were geometrically distorted. For this reason each map sheet required suitable transformation [1].

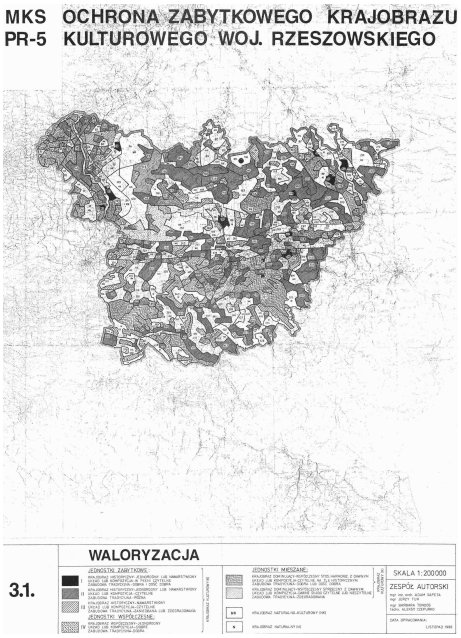

Figure 1: Example of the source materials – the scanned analog map

The table below (Table 1) presents a list of transformations applied, the number of control points and the RMS errors for chosen study area (root-mean-square error (RMS) is a measure of the differences between values predicted by a transformation model and the values actually observed).

Table1: The list of transformations

Map sheet name	Number of control points	Transformation	RMS error [m]
Sieradz	59	projective	40
Koszalin	36	projective	180
	62	polynomial 2 degree	206
	99	polynomial 2 degree	102
Krakow	47	polynomial 2 degree	157
Szczecin	15	affine	180
Rzeszow	16	affine	154
Poznan	60	polynomial 3 degree	216
Wałbrzych	14	affine	137

The architectural and landscape unit features were stored in tables but on paper, not in a digital form. The tables had different ranges of attributes and different symbols for various areas. This required to define the scope of the common attributes and common symbolisation for all areas. Numerical values for each attribute were also defined.

These materials were scanned and then converted to text and filed in Microsoft Excel (xls) files.

2.2 Developing the database

Coordinate system called "1992" was selected as a cartographic environment of the database. It is an official coordinate system used in Poland, based on Gauss-Kruger projection on the WGS 84 ellipsoid.

In the GeoMedia Professional software a database "*jarki.mdb*" for the architectural and landscape units was established. It is a database filed in the MicrosoftAccess format, which can be managed directly by a GIS software, in this case by the GeoMedia Professional.

On the basis of the georeferenced maps it was possible to vectorise the outlines of the architectural and landscape units. Each outline was annotated with a proper number according to the source materials.

The Tables 2 with descriptive information about architecture and landscape units for individual provinces, saved in xls format, were imported into the GeoMedia Professional software. This software joins the descriptive data with their geometric representations - the outlines of units, through the use of ID, common for both databases.

Table 2: Reference table of attributes (scope)

JARK outline features	**Attribute name in the system**
unique identifier	ID
voivodship name in the previous administrative division	Nazwa_Woj_St
country regionalization number	Rej_Kraj_NR
country regionalization name	Rej_Kraj_NAZWA
JARK number	JARK_NR
JARK name	Nazwa_Jedn_JARK
warehouse: historical units	Zasob_JH

warehouse: relief units	Zasob_JU
warehouse: land cover units	Zasob_JP
valorization taking into account units which are in character: historical (levels I-III), contemporary (level IV) and mixed (levels V-VI)	Waloryzacja
Guidelines relating to the type of protection	Wyt_Rodz_Ochr
Guidelines relating to the scope of protection	Wyt_Zakr_Ochr
Zonal plan including: cultural protected area, cultural park and conservation zones	Plan_Strefowy
remarks	Uwagi
IGiK remarks	Uwagi IGiK

For the vectorised architectural and landscape units the libraries of signatures were developed. These libraries contain symbol definitions (color, pattern, line width) applied to graphical representation of the JARKs on printed maps. They are stored in jarki_style.mdb file which is directly accessed in the GeoMedia Professional environment.

The work also included the development of the data visualization standards, the establishment of the schedule for implementation of the conceptual data structure model (SQL) and conceptual model of the data structure (UML).

3. CONCLUSIONS

The final result - complete and functional geographic information system for architectural and landscape units - allows to select and analyze data collected for the whole territory of Poland on the basis of:

- descriptive data (attributes) e.g. selection of architectural and landscape units with defined valorization degree
- spatial data (administrative units, selected region) e.g. selection of architectural and landscape units located in chosen districts or communities.

It is also possible to create advanced queries concerning one chosen attribute or few different unit properties. The most useful for the final users are simultaneous selections of descriptive and spatial data.

The use of GIS has enabled the replacement of analog materials collected in the National Heritage Board of Poland by a unified - spatial and descriptive - database for the whole territory of Poland. The process of transition from analog data to geographical information system is illustrated on Figure 2.

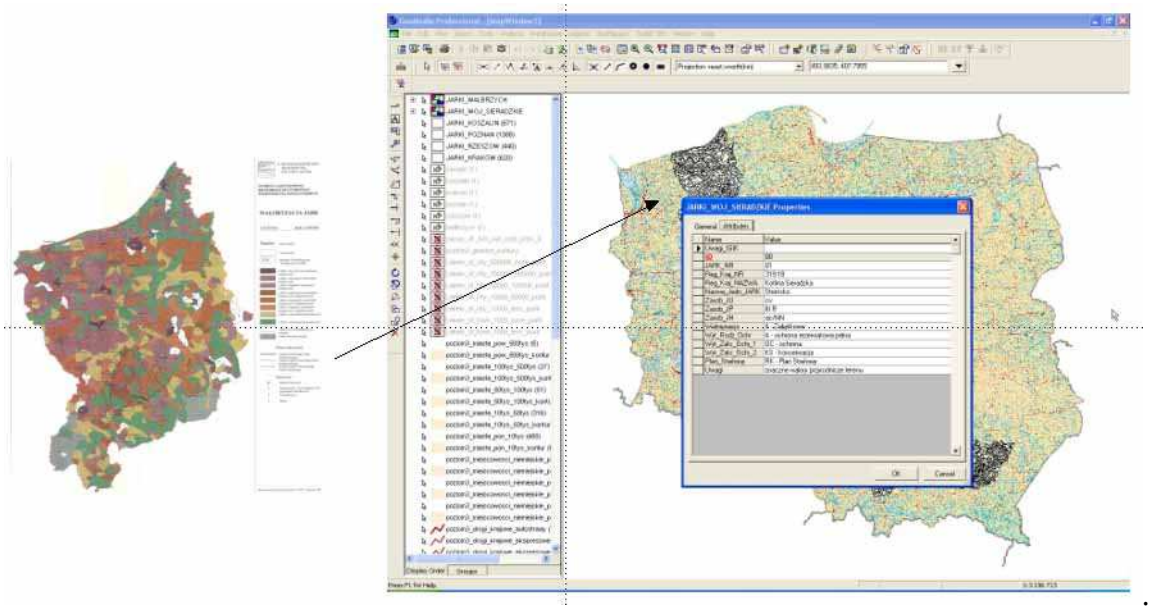

Figure 2: From analog map to the spatial database

4. REFERENCES

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