APPLICATION OF GIS (GEOGRAPHICAL INFORMATION SYSTEM) IN WIDE-SPREAD PUBLISHING OF ENVIRONMENTAL DATABASE FOR INCREASING CONSCIOUSNESS OF CITIZEN

Dr. Eng. Beata Hejmanowska*; MSc. Eng. Ewa Glowienka**

1. Introduction

Internet is very quickly developing public domain. People start to use it more and more expecting really reliable information. A new services are developed: e-government,
e-education, e-commerce. We became information society and we wish easy access to the data.

Internet is a huge data base. The first computes were connected in the end of 60-ties. At the beginning only text information were exchanged. In 90-ties World Wide Web (www) was fund and also graphic data could be sent. It was really turn in Internet applications lasting today. Map is, without doubt, a graphical object and like many others graphical objects (pictures, drawing etc.) could be published as an "image". Ordinary image was very quickly not enough. People expected more functionality: possibility of length and area measurements on the image or read text information for the map objects. Text data connected with the object's map are known as a Geographical Information Systems (GIS). Thanks many projects GIS data are published in internet. Nowadays all GIS software allow www data publishing. Different technology are implemented but always it is Client/Server architecture. Server makes the access to the database and eventually analyses the Client complex questions and sends the answers.

GIS data www publishing could be range as following:

- Business - commercial firms publishing own information on the map,
- Governmental and non-governmental administration – surveying agency – officially designed to map production.

GIS has no scale but nevertheless is strongly connected to the maps, one can say even determined by map scale, especially in kind of text (attribute) data gathered in alphanumeric database. Generally GIS can be in regional (smaller then 1:10000) and local scale (larger then 1:10000).

Regional GIS is treated as a source of topographical map mostly used for regional spatial planning. Local GIS basing on cadastre maps gives citizen an important information when they would like to buy or sell real estate.

* Dr. Inz.-AGH University of Science and Tecnology -Krakòw –Poland.
** Mgr. Inz.-AGH University of Science and Tecnology -Krakòw – Poland.

In the paper two GIS database are described (Fig.1):
- Małopolska Region – regional level.
- Stalowa Wola District – local level.

The researches presented in the paper are also financed by AGH projects No 11.11.150.459.

Figura 1 - GIS database in Poland: Małopolska Region and Stalowa Wola District.

2. Data

2.1. Regional GIS - Atlas of Cracow province.

GIS database on regional level (Małopolska Region in Poland) was created thanks scientific, application grant of Polish Committee of Scientific Research No 9941994 C/2163: "Digital Atlas of Cracow Province as an element of Małopolska Land Information System". Undertaking realized in years: 1997-1999 by AGH University of Science and Technology, Jagiellonian University was financial supported firstly by the Surveyor General of Cracow Province and later, after administration reorganization - Marshal Office in Malopolska.

Two principal objectives were defined at the point of origin of the project. Intentionally, the Atlas is to be helpful for the spatial planning and environmental engineering - mainly for an environmental protection.

To fulfil expectations of potential users, the originators conducted an inquire through two parts questionnaire.
The first part concerned general topics as:
- Atlas as a set of maps or/and GIS database
- vector or/and raster type of GIS data
- interaction between Atlas and user's system, defined software or standard
- utilisation of Atlas for GIS analysing and decision support or visualisation and CAD edition
- user's software GIS and CAD type presently in use.

The second part was detailed and it specified thematic range of Atlas by means of typical map layers on the level of accuracy relevant to a topographic map in scale between 1:50k to 1:300k depending on kind of contents.
There were 25 different types of geoinformation concerning such fields as waters, DEM, housing, roads, forests, borders, geology, geomorphology, hydrology, climate, soils, agriculture, industry and build environment, transportation, telecommunication, health service, education, culture and art, tourism and recreation, and others.

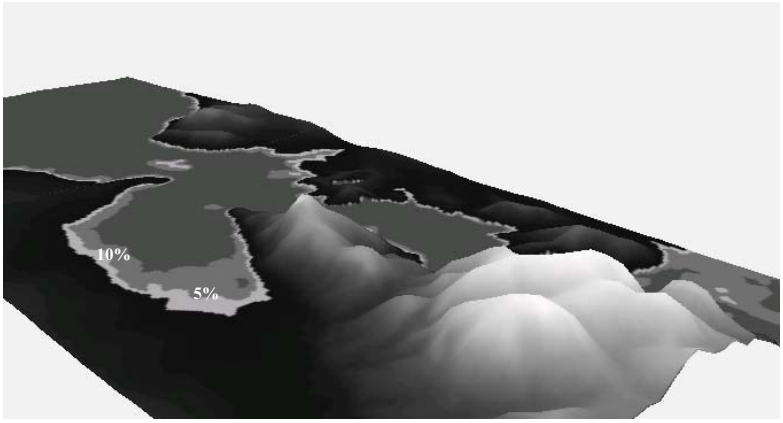

Figura 2 - Flood risk – Krakow, area of 5% and 10% of flood risk calculated on the base of DTM error.

2.2. Geographical Information System (GIS) for Stalowa Wola District

GIS database on local level was created in years: 2001-2002 by AGH - University of Science and Technology thanks local administration financial support and scientific, application grant of Polish Committee of Scientific Research Nr 10T12001200C/5075: "Land Information System in Stalowa Wola in administration usage aspect".
The region of Stalowa Wola is situated in the south-east Poland (Fig.1), about 200 km in the east direction from Cracow. The main goal of the project was to create and implement Geographical Information System (GIS) in Stalowa Wola District in the aspect of using it by local government. Primarily GIS was

dedicated for Stalowa Wola District Office – Faculties: Surveying and Environmental Protection.

Creating GIS on local level in Poland meets some problems:

- Graphical and alphanumeric part of cadastre, even if in digital form, are usually gathered in separate software; it is historical consequence when only alphanumerical data were collected in digital form,
- Cadastre coordinate system is still old (so called 1965, basing on old Russian coordinate system and Krassowsky ellipsoid), but regional cartographic data are already in new (obligatory) coordinate system – WGS84.

Data integration was the main goal of the project. Thanks the project:

- Cadastre graphical data were collected: in the city from surveying, for the land districts from cadastre maps,
- Graphical and alphanumeric data were integrated on the one software platform,
- Ortophotomap corresponding 1:2000 scale was prepared,
- Regional cartographic data were integrated with the cadastre data.

Environmental aspect was specially developed. The data included environmental parameters of the region: concentrations of air pollutants such as carbon and sulphur dioxide, dust etc; and detailed information about sources of emission:

- industrial plants,
- rubbish and industrial dumps,
- sewage-treatment plants,
- natural resources and other.

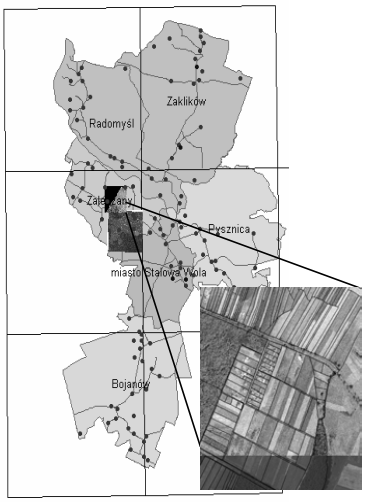

Figura 3 - Local GIS – Stalowa Wola District – data integration (cadastre, ortophotomaps: 1: 2000 and 1:10000, environmental data base – ex. pollution emitters).

Moreover, the topographical maps and orthophotomaps of Stalowa Wola region were used as element of the GIS:

- topo in scale 1:50000, 1: 25000
- ortho in scale 1: 10000

Orthophotomaps were received from Surveyor General of Rzeszow Province.

3. Technology

The Atlas database was prepared with use of MGE Intergraph. To utilise the database fully it is necessary to have MGE software package consisting of Base Administrator, Nucleus, Base Mapper, Terrain Analyst (Modeller), Grid Analyst, I/RAS C (Image Analyst). The basic tool to build GIS for Stalowa Wola District was software package GeoMedia, which allows working on graphical and descriptive data saved in various file formats. However, the software can be also use for the Atlas data review, edition, up-date and modification.

3.1. Geomedia and Geomedia Professional [1]

The software package GeoMedia is designed for specialists who work with GIS projects. The interface created with usability in mind has the look and feel of a standard Windows application. The GeoMedia software provides tools for capture, edit and maintenace spatial data. GeoMedia's data server technology provides integration of the graphical and descrptive data. It is also possible direct access to all major GIS/CAD data formats and to standard relational databases. The potential user can work with data of: MGE, Microsoft Access, MicroStation, AutoCad, MapInfo, ArcView, ArcInfo, Oracle 9™ Object Model, SQL Server and FRAMME™. GeoMedia's data server enables analysis across disparate data sources - projection and transformation of the data is made on-the-fly.

GeoMedia Professional are built on GeoMedia's flexibility and supply tool for collecting and modifying data and speeding implementation of GIS databases. GeoMedia Professional enables to make live connections to GIS data in multiple data warehouses simultaneously without any translation or conversion. It is possble to work always with current information because the user has real-time access to data, queries and thematic maps and any changes are automatically updated in the data warehouse.

3.2. GeoMedia WebMap

GeoMedia WebMap is a Web-based map visualization and analysis tool that provides real-time links to GIS data warehouses. Simple interface navigate the user through large quantities of information. One can query a database and required information is dispaly on a map or click on the map feature and see

1 http://www.intergraph.com/

selected database information about that chosen map feature in a attribute table. Each feature in the map is linked to its attribute information, enabling the user to see a report about that feature. Moreover the combine data from different sources can be display in a one map. GeoMedia WebMap's technology is based on GeoMedia software so enables to access and analyze data without translation or conversion as well. The user has the possibility to access the required data anywhere, anytime by the Intranet or Internet in its native format and perform queries on live data to get the answers. GeoMedia WebMap's tools allows Internet browsers to view either raster or vector data. The user can choose an ActiveX control or a Java applet to render vector data. With a simple click on a map feature, GeoMedia WebMap provides associated information about that feature from the current data in the respective local or distributed database. The process is dynamic – users can bring published maps make changes, and the Web application reflect these changes instantly on the displayed map. Any number of completely individual vector or raster maps can be generated to cope different user requirements.

4. Results

GIS database gathered thanks the projects are published in Internet on AGH server (http://www.fotogrametria.agh.edu.pl/GIS), Fig. 4. Following data are available:

- Cadastre – user and password are needed, (Fig. 5),
- Environmental protection (Fig. 6, Fig. 7),
- Atlas of Maloploska Province - user and password are needed, (Fig. 8)
- Ortophotomaps of Stalowa Wola Region (Fig. 9).

Presented below examples are prepared according research projects. In Malopolska Region professional local server is also working: http://www.wrotamalopolski.pl. There are "Mapy-GIS-GPS" module with interesting GIS database publishing: vector and raster, Fig. 9.

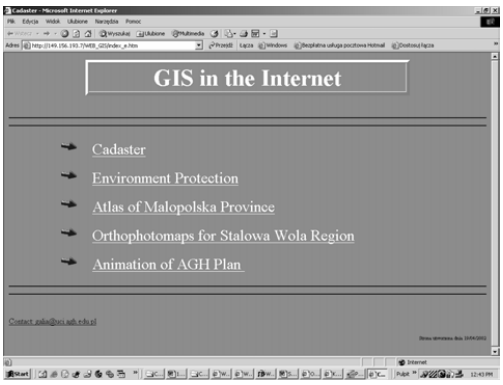

Figura 4 - Main page Web GIS (fotogrametria.agh.edu.pl/GIS)

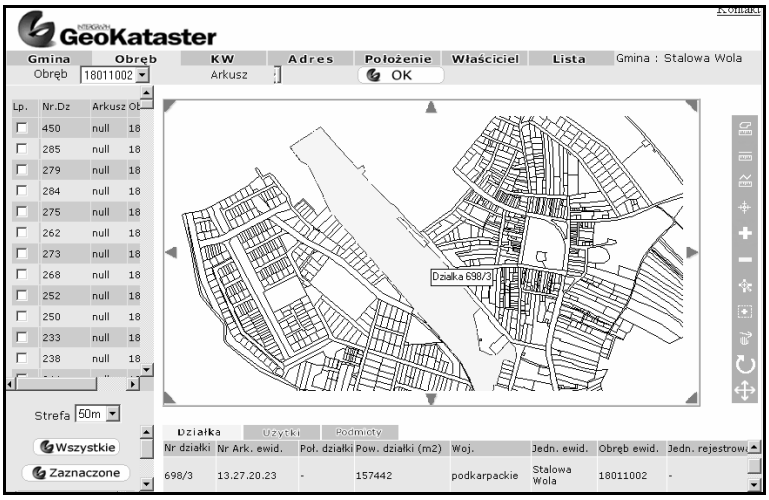

Figura 5 - Cadastre data

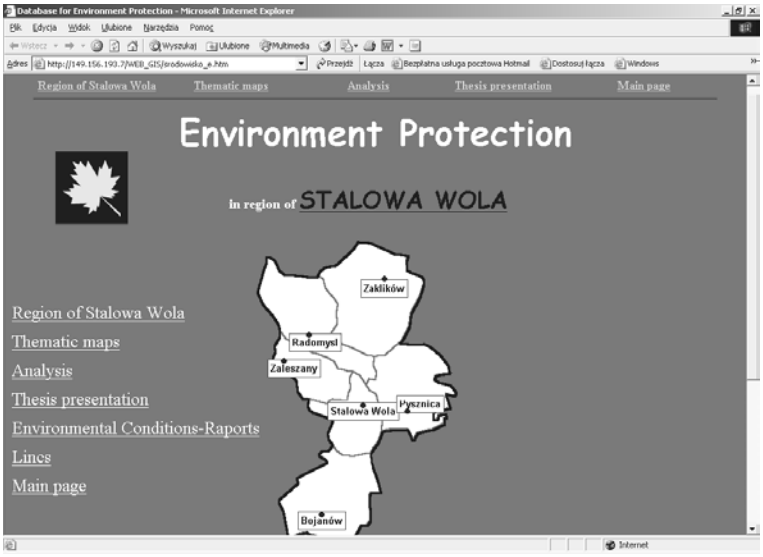

Figura 6 - Environmental data publishing

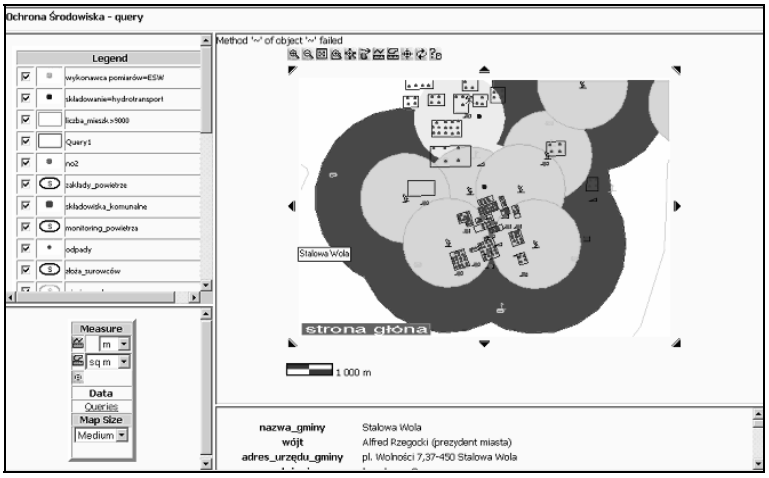

Figura 7 - An example of GIS analysis available through the Internet, distance analysis from municipal waste dump.

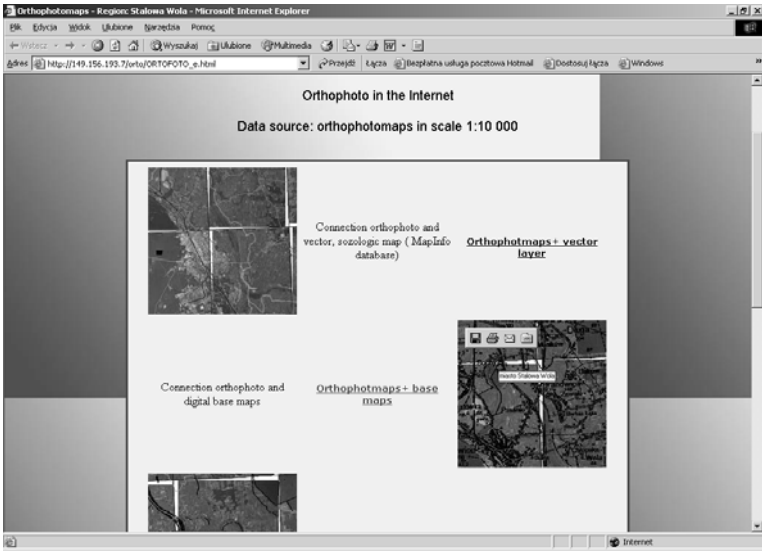

Figura 8 - Ortofotomaps in Internet

Figura 9 - Professional local GIS database publishing: http://www.wrotamalopolski.pl - "Mapy-GIS-GPS" module

5. Conclusions

Wide-spread access to GIS data open the new possibilities of interaction between people and environment. Firstly, citizen have right to know, possibly the most of all, risks concerning them. In the paper some examples are presented. One of it prepared on the base of regional GIS database refers the flood risk near Krakow (Fig.2). This information should be public domain, and Internet is the most suitable means to publish it.

Another example concerns environmental protection. In Poland rights to public access to the data about the environment is by law regulated. The access is guarantee in the regulation but in fact it is almost always only on the paper. In this case also Internet access would be the best way to publish the data (Fig.6, 7).

Last example concerns cadastral data, very important for business development, real estate market (Fig.5). However in this case another problem appears, namely regulation about personal data protection. Access to full cadastral data (personal data about the owners) have to be saved by password, but graphical data and some alphanumeric data might be wide-spread published.

References

Florek-Paszkowski R., Hejmanowska B., Pyka K., (2000), "Accessibility of the Digital Atlas of Krakow Province, Poland as a GIS data through intranet and internet", *Int. Archives of Photogrammetry and Remote sensing XVIII ISPRS Congress*, Amsterdam, Holland.

Hejmanowska B. (2002), "Land Information System in Stalowa Wola in administaration usage aspect", *Final report of the Polish Committee of Scientific Research project Nr 10T12001200C/5075.*

Trafas K., Pyka K. (1997), "The Future of the Regional Atlas: Computer or GIS Atlas", *Proceedings Vol. IV 18th ICA/ACI International Cartographic Conference, ICC 1997*, Stockholm 1997, page 2150-2157.

Pyka K. (1999), "Digital Atlas of Cracow Province as an element of Małopolska Land Information System", *Final report of the Polish Committee of Scientific Research project, No 9941994 C/2163.*

http://www.intergraph.com/

http://www.tatukgis.com/Home/home.aspx

http://en.terramapserver.com/

http://www.geoplace.com/gw/

http://www.grida.no/

http://www.usgs.gov/science.html#environment

Polish Regulation, "About the access to information about environment and its protection and about influence on environment evaluations", 9.11.2000.