Geographical Information System that Stores the Data About Graffiti in the City of Lodz

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Географічна інформаційна система яка зберігає дані про графіті в місті Лодзь

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Abstract—The paper presents the Geographical Information System that was elaborated within the subject "Geographic Information Systems in Tourism" carried out in the Faculty of Geographical Sciences at the University of Lodz. The assumptions, functional and non-functional requirements for the system are presented, as well as the implementation details. This is probably the only such system in Poland.

Анотація—У статті представлена географічна інформаційна система, яка була розроблена на предметі "Географічні інформаційні системи в туризмі", який читається на факультеті географічних наук в Університеті Лодзі. У даній роботі представлені припущення, функціональні і нефункціональні вимоги до системи, а також деталі реалізації. Це, напевно, єдина така система в Польщі.

Keywords—GIS; graffiti in Lodz; OpenStreetMaps API

Ключові слова—Географічна інформаційна система; графіті в місті Лодзь; OpenStreetMaps API

I. INTRODUCTION

Geographic Information System is a computer system that allows the acquisition, storage, analysis and visualization of spatial information having a reference to the Earth's surface. GIS are widely used in geodesy and cartography, forestry and agriculture, public administration offices, in local government units, in the army, the real estate management, environmental protection, trade, transport, industry and tourism.

Data stored by the system can come from various sources, such as satellite and aerial images, Light Detection and Ranging (LIDAR) data, geodetic measurements, field measurements using GPS devices, digitized paper maps and acquiring existing data in the form of statistical yearbooks, records, measuring logs. GIS data can also be collected by Internet users. A good example here is Wikimapia project. An extremely important advantage of GIS is the ability to integrate data from different sources.

The main module of GIS is a database of spatial information. Before we can use the system, the necessary data must be placed in the individual database tables. At the moment, most of the Database Management Systems have extensions that enable the storage of spatial data. Examples include Oracle Spatial and Spatial Data for Microsoft SQL Server. Oracle Spatial gives more possibilities than spatial extensions of other Database Management Systems.

Within the subject "Geographic Information Systems in Tourism" carried out in the Faculty of Geographical Sciences at the University of Lodz it was decided to elaborate the system that stores the data about the graffiti in the city of Lodz. It would help to develop students' practical ability to acquire spatial information and develop their own GIS systems.

II. DESCRIPTION OF THE SYSTEM

To implement the system Java programming language was chosen. This allows fast creation of complex systems. Java provides quick access to object-relational Database Management Systems using the JDBC Application Programming Interface. In addition, the language has built-in support for exception handling that allows the unified error handling of the user input and information exchange with the database. The choice of Java has enabled the use of OpenStreetMap Application Programming Interface. OpenStreetMap API provides the data structures that give the possibility to place the geographical objects on the map easily. System uses Oracle DBMS to store its data.

The graffiti data for the system was obtained by the students. Students were divided into teams. Each team inventoried one area of the city.

The data was collected in the field using mobile devices and applications enabling the measurement of point coordinates in GPS. Each project team travelled the route determined by previously documented trail and found the graffiti on the walls of buildings. The information obtained included:

- photo of the graffiti,

- the coordinates of the place of the graffiti occurrence (coordinate system PUWG 1992),

- address of the building on which the graffiti is located,

- category and description of the graffiti.

To store the graffiti coordinates data system uses the Oracle Spatial extension. This extension includes SDO_GEOMETRY object data type. This type allows to store the data of spatial objects of different shapes in relational database tables. System uses points to store the coordinates of the places of the graffiti occurrences. In order to store the graffiti images data the object type ORDSYS.ORDImage is used. All data operations are implemented on the database side in the form of stored procedures. Java code simply calls various procedures using JDBC.

The project includes the implementation of the following system modules:

- adding data of each graffiti,

- displaying graffiti objects on the OpenStreetMap map in the form of icons,

- obtaining all information about individual graffiti including photographs of the graffiti,

- editing the data of individual graffiti,

- displaying the summary list of graffiti data.

Graphical user interface of the system is developed using the Swing (the Java standard graphical components library), so that the user interface is standardized for different operating systems. At startup, the system detects the screen resolution of the output device and adjusts the size of the main window of the graphical user interface in such a way that the window took up the whole screen.

Fig. 1 shows the fragment of the main system window. Individual graffiti are placed on the map as icons. Placing the mouse cursor on the icon displays a thumbnail image of the graffiti. Double-left clicking the icon displays a pop-up menu that allows to display the window shown in Fig. 2. This window enables to change graffiti data. Fig. 3 shows the fragment of the system window displaying the summary list of graffiti data.

CONCLUSIONS

Operation of the system reveals a high deployment potential of the software and the modular design allows for easy software development and modification. It can be considered that the project was completed successfully.
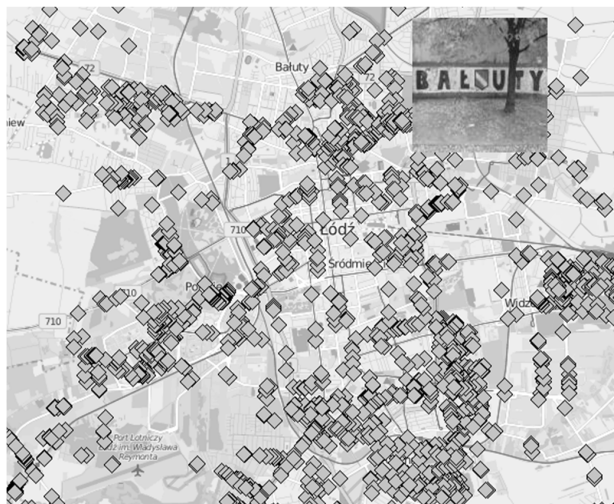

Fig. 1.   The fragment of the main system window presenting graffiti as icons on the map

Fig. 2.   The fragment of the system window presenting detail information of the graffiti

ID	Nr zdjecia	Adres	Nr dzialki	Kategoria	Opis
3439	obszar_15_124	Ignacego Paderew...	494/28	RTS/ŁKS	Nie ma możliwości st...
3440	obszar_7_51	Lutomierska 119	B45-183/49	ŁKS	Grafiti łks na budynku
3441	obszar_15_125	Ignacego Paderew...	206/46	RTS/ŁKS	Nie ma możliwości st...
3442	obszar_7_57	Konstantynowska 35	P15-598/2	ŁKS	GRAFFIT NA PŁOCIE
3443	obszar_15_126	Ignacego Paderew...	206/46	RTS/ŁKS	Nie ma możliwości st...
3444	obszar_7_52	Sprawiedliwa 23	B45-18/27	ŁKS	Grafiti łks na budynku
3447	obszar_7_53	Lutomierska 151C	B45-204/29	ŁKS	Grafiti łks na budynku
3448	obszar_15_128	Jarosławska 25	204/9	RTS/ŁKS	Nie ma możliwości st...
3449	obszar_7_54	Obornicka 6	B45-208/54	ŁKS	Grafiti łks na budynku
3450	obszar_7_55	Konstantynowska 45	P15-594	ŁKS	GRAFFIT NA BUDYN...
3451	obszar_15_129	Jarosławska 10	207/1	RTS/ŁKS	Nie ma możliwości st...
3452	obszar_7_56	Konstantynowska 35 ...	P15-598/2	ŁKS	Grafiti łks na budynku
3453	obszar_15_130	Jarosławska 25	204/38	RTS	Graffiti należące do ...
3456	obszar_15_131	Chocimska 19	237/9	ŁKS	Graffiti należące do z...
3463	obszar_7_91	Turoszewska 4a	B44-26/8	RTS/ŁKS	GRAFFIT NA BUDYN...
3464	obszar_15_132	Rymanowska 5	161/117	RTS/ŁKS	Nie ma możliwości st...
3465	obszar_15_133	Konstantego Ciołkow...	497/22	RTS	Graffiti należące do z...

Fig. 3.   The fragment of the system window presenting the summary list of graffiti data

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