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GEOINFORMATICS SERVICES USED IN PROMOTION, PROTECTION AND INVENTORY OF MONUMENTS IN POLAND BASED ON EXAMPLES OF STUDENTS' AND PATRONS' OF SCIENTIFIC SOCIETY KNGK GEOINFORMATICS

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Abstract

The current status in geoinformatic services dedicated for sightseeing branch in Poland have been introduced in the article. Data collection and its elaboration are described. Another topic is distribution and promotion of portals themselves and also promoting objects by constant extension of the offer and information sharing. The author also shows the possibility of using the services for tourists by people from tourist industry and scientists. As an example of newest technologies two ideas have been introduced: geoportal (Oil Trail) and virtual museum (Underground City Osówka and Benedictine Monastery in Jarosław). Both have been created by students and their patrons from scientific society "KNGK Geoinformatyka".

USŁUGI GEOINFORMATYCZNE WYKORZYSTYWANE W PROMOCJI, OCHRONIE I INWENTARYZACJI ZABYTKÓW W POLSCE NA PRZYKŁADZIE OPRACOWAŃ STUDENTÓW I OPIEKUNÓW KOŁA NAUKOWEGO KNGK GEOINFORMATYKA

Słowa kluczowe: geoinformatyka, zabytek, geoportal, wirtualny spacer

Abstrakt

W artykule przedstawiono aktualny stan usług geoinformatycznych w Polsce, dedykowanych dla obiektów zabytkowych. Omówiono zagadnienie pozyskiwania danych, a następnie ich opracowania. Kolejnym opisanym zagadnieniem jest dystrybucja i promocja samych portali, a także promocja obiektów, możliwa dzięki ciągłemu poszerzaniu oferty poprzez udostępnianie nowych informacji. Autor wskazuje również na możliwości wykorzystania usług przeznaczonych dla turystów przez osoby z branży turystycznej oraz naukowców. Jako przykłady opracowań najnowszych technologii przedstawiono: geoportal (Szlaku Naftowego) i usługi wirtualnego zwiedzania zabytków (Muzeum Podziemnego Miasta Osówka w Górach Sowich oraz klasztoru benedyktyńskiego w Jarosławiu), stworzone przez studentów koła naukowego KNGK Geoinformatyka oraz jego opiekunów.

1. INTRODUCTION

In recent years all over the world we can observe transferring the vast part of our lives into virtual space. This

tendency concerns also polish monuments, which administrators more and more often share their stocks and interiors with visitors online. For some years now Poles are becoming convinced into geoinformatic tech-



nologies and rising of new objects boosts, for instance act about Spatial Information Infrastructure. Nowadays tourist does not imagine that there is no possibility to check prices of entry or time of opening the object online. He will plan access to the object with help of tools that are completely based on geoinformatic solutions. He is also more and more demanding, which even more influences on growth of interests similar services among administrators and self-governments.

All sectors, including “historic” sector, are using the increasing number of Internet users, together with the development of geoinformatics and mobile technology. Ministries, institutes, facilities and museums managers, history and nature lovers – they all compete in the possibilities of using the Internet to popularize and protect the monuments. As a result, the tourist does not have to rely solely on paper and often expensive guidebooks, he also does not feel a need to plan trips well in advance. Geoinformatics resources and services available on the network offer the possibility of spontaneous learning about the world around them and explore the virtual and as a next step – the real.

1.1. Geoinformatics and geoinformatics services definition

Due to numerous, often dramatically differing definitions of geoinformatics science, the author accepted the definition of force for over 15 years in PAU Geoinformatics Committee. The definition was constructed by professor Janusz Kotlarczyk, the Honorary Chairman of PAU Geoinformatics Committee, after two-part panel discussion May 16th and June 20th 2001. Its actuality was upheld on the occasion of the author’s committee meeting on March 9th, 2016 year.

The definition reads as follows: (...) *geoinformatics is the study of methods of collection, storage, processing, analysing and presenting of data, defined in the Earth’s space-time, using appropriate information technology*. In discussion’s summary professor stresses that *the development of this discipline will depend on enriching the technical capabilities of the methods used (ie. GIS, remote sensing, GPS) and the final achievement will be getting a better presentation of geographic information* (Kotlarczyk, 2001).

Alvarez and Fitz name the following “the technologies”: remote sensing, digitization and data scanning, automatic mapping, the use of Global Positioning Sys-

tem (GPS) and Geographic Information Systems (Alvarez, 1998, Fitz, 2008). At the same time Mouketou-Tarazewicz by accepting this nomenclature in the following paragraphs, smoothly moves to calling of the same technologies (or methods – in the Kotlarczyk’s case) “the tools” (Mouketou-Tarazewicz, 2014). Geoinformatics terminology is therefore vary depending on the author. GPS, SIG or remote sensing that are repeated in elaborations are being called technologies, methods and geoinformatics tools. The team from the Department of Photogrammetry and Remote Sensing AGH, in cooperation with the Geoinformatics Commission PAU, took an attempt to standardize the terminology (Jachimski et al., 2005). Unfortunately, the attempt failed – the website is not working. Moreover, term “geoinformatic tools” in the context of the definition of cartographic tools (ie. cartographic generalization, methods of cartographic presentation) should be used to call techniques for user interaction with the system, for example spatial analysis or record information about the world in the form of layers (Hu & Ge, 2008).

In view of these discrepancies author by later in the article, according to the geodetic terms adopted, accepted the term “geoinformatics technology” (analogous to the measurement) to determine ways of obtaining data, broadcast georeferencing or geographic information systems (GPS, remote sensing, SIG). Geoinformation methods (measurement) would clarify the method chosen for this technology, eg. a static method of measurement GNSS.

For elaborations like geoportal or virtual tours the author accepted the term “geoinformatics services or products”. Products described later in the article include the above-mentioned geoinformatics tools (the ability to conduct research and demonstrate the layer character), and the data for them were obtained using geoinformatics methods and technologies.

2. THE MARKET FOR GEOINFORMATICS SERVICES DEDICATED FOR HISTORICAL MONUMENTS IN POLAND

Internet users, particularly mobile Internet, are able to check the opening hours or entry prices to the interesting object wherever they are. There is also no problem with access to anywhere, because they will benefit from

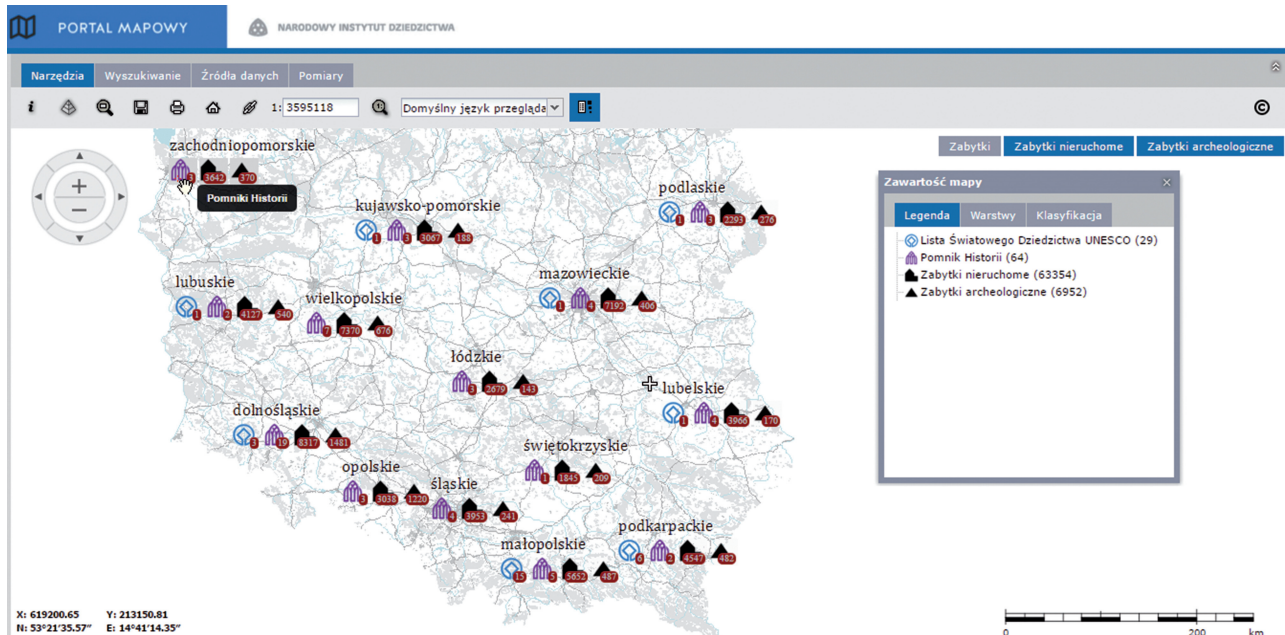


Fig. 1. Map portal NID (www.mapy.zabytek.gov.pl/nid)

Rys. 1. Widok okna portalu mapowego NID (www.mapy.zabytek.gov.pl/nid)

navigation or mobile charts. The development of Internet technology around the world, including Poland, is driven primarily by its users' requirements. When it comes to spatial data technologies, for Poland and Europe Inspire directive (Infrastructure for Spatial Information in Europe), published in 2007, was also very important. In short, the directive obliges all EU countries to provide a variety of spatial data in the form of network services, directory services, and primarily through metadata.

According to the principle "from general to specific", geoportals are created for both large and small areas. So from geoportals covering the whole country we go down the administrative divisions ladder to the municipal or local. Provinces have their own geoportals (eg. Lesser Poland Infrastructure for Spatial Information that enables you as a private user to create your own layer), as well as districts, municipalities or cities (eg. Kraków's Municipal Spatial Information System providing a beautiful historic calibrated maps, which you can compare with the current course of roads, rivers or buildings). National parks, companies or universities (eg. AGH University in Kraków) are also creating their own geoportals.

The best example of nationwide geoportal in Poland created by institution responsible for historical monuments is the one launched in November 2014 by Na-

tional Heritage Institute. The geoportal presents all immovable monuments and archaeological sites entered in the register of monuments, historic monuments and buildings on the UNESCO World Heritage Site. The first component of the said portal is a guide showing through extensive repository of information about historical objects, media files (photos, videos, 3D models) and descriptions. Second component which is the most important one is the geoportal (fig. 1) (www.mapy.zabytek.gov.pl/nid, 2014).

With properly selected intervals user may track the number of monuments in accordance with the Polish administrative division (county-district-municipality), and in easy way find interesting sights in a given area. The keynote of the creators was to enable spontaneous visit without prior planning and buying guides. When you change the display scale window appears with the monuments and their descriptions (fig. 2). For easier usage you can find dynamic legend containing the classification of objects. The map portal and mobile application "Monuments in Poland" awarded in Polish Association of Cartographers competition "Online Map of the year 2014/15". They won respectively third place in the category of online mapping portals and distinction in the category of mobile applications (www.polishcartography.pl).

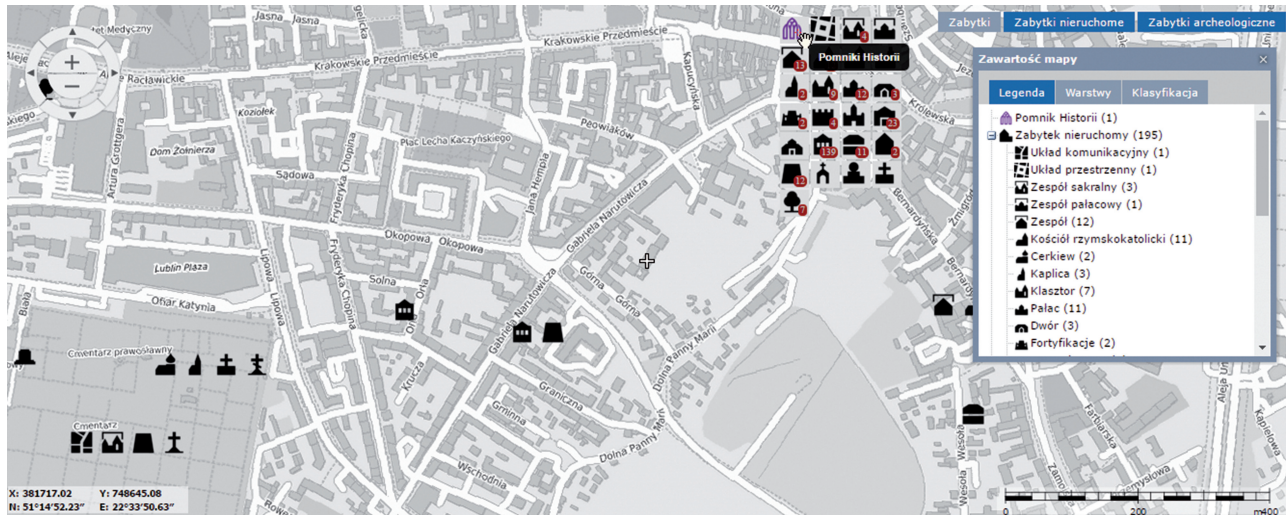


Fig. 2. Lublin city center in map portal NID (www.mapy.zabytek.gov.pl/nid)

Rys. 2. Centrum Lublina w widoku portalu mapowego NID (www.mapy.zabytek.gov.pl/nid)

Worth notice are two more nationwide initiatives fit within the trend of conscious tourism. Tourists visiting historical buildings in the vast majority have digital cameras. They photograph monuments, share hundreds of pictures online, but often retaining copyright. As a result, there are still historical objects that can not be officially and legally present because of the lack of photographs on the free licenses (CC-BY-SA 3.0). As part of the project “Open sights” (otwartzabytki.pl) and “Wiki likes Monuments” (wikizabytki.pl) volunteers are making photos and writing descriptions of historical sites and then adding them on the free licenses to the database. Both organizations provide the appropriate geoinformatic tools, enabling users to add the coordinates of objects and basic information, eg. opening hours. Community built on the principles of crowdsourcing is providing constant replenishment of the data, their updating and verification.

3. TYPES OF GEOINFORMATIC SERVICES DEDICATED TO THE PRESENTATION AND PROTECTION OF MONUMENTS TO THE EMBODIMENT OF THE SCIENTIFIC SOCIETY KNGK GEOINFORMATICS

Students and patrons of Scientific Society KNGK Geoinformatics are dealing with the field of data processing, using the classic science such as geodesy and

computer science. The activities of the Society is therefore very consistent with the definition of geoinformatics constructed by professor Kotlarczyk, brought up in chapter 1.1. Some students and patrons are also lovers of history and monument objects. In consultation with managers and supervisors of the objects – the directors of museums and abbeys or Polish Society Tourist-Touring – in recent years they made a number of technologically advanced studies. Among them they were also geoportals and point clouds developed for objects made available as virtual tours, inventory reports or 3D models that enable architectural, reconstruction and exploration works.

3.1. Virtual tour and analysis in Underground City „Osówka”

Project Riese (German for giant) was built in Owl Mountains, Lower Silesia and it is known as the biggest mining and building project of Nazi Germany. The vast majority of construction work was performed by forced laborers and prisoners of concentration camp Gross-Rosen, located nearby. Because of lack of documentation, the purpose of Riese remains uncertain. There are many hypothesis, but few facts. What is certain is that the project was abandoned due to approach of the Red Army. So far in Walim and Głuszyca six underground structures are discovered: Jugowice (500 meters of tunnels), Osówka (1700 meters of tunnels),

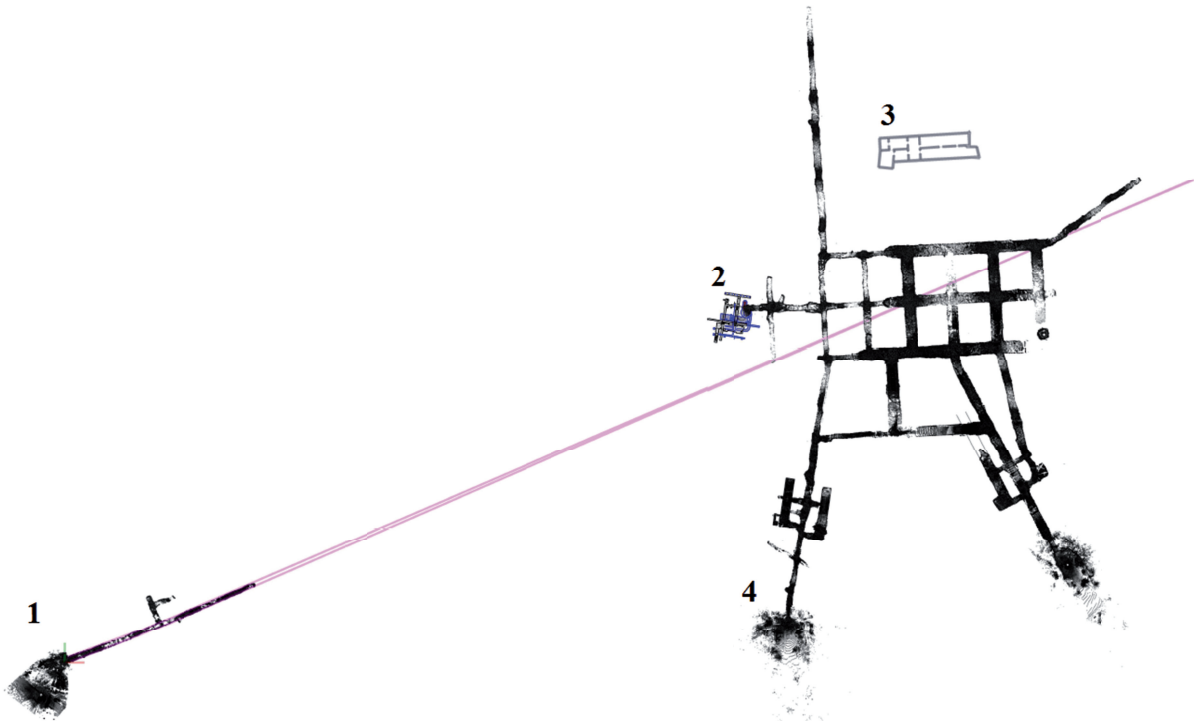


Fig. 3. Analysis of geometrical relations between Osówka complex objects. 1. Water Adit, 2. Gym, 3. Casino, 4. Main entrance to the Underground City of Osówka. Direction of Water Adit has been marked in pink

Rys. 3. Analiza zależności geometrycznych pomiędzy obiektami kompleksu Osówka. 1. Sztolnia Wodna, 2. Siłownia, 3. Kasyno, 4. Główne wejście do Podziemnego Miasta Osówka. Kolorem różowym oznaczono kierunek Sztolni Wodnej

Rzeczka (560 meters of tunnels), Soboń (740 meters of tunnels), Sokolec (or Gontów, 800 meters of tunnels), Włodarz (3000 meters of tunnels), and approximately 600 meters of tunnels under Książ Castle in Wałbrzych (Aniszewski 2002, Graba 2012). There is a theory that all complexes were supposed to be combined. It is believed that many kilometres of the underground tunnels are undiscovered (Cera 1998).

For years, the region is studied by treasure hunters and scientists. Treasure hunters, apart from using maps and metal detectors, now are also using GPRs. Scientists interest in Riese steams from many underground tunnels in various sizes and depth, as well as huge amount of steel consumed in adits' reinforcement. Due to all mentioned details scientists are able to perform many different types of research. There geophysicists test equipment and methodology, especially in the field of measurements of gravity, magnetic or GPR (Porzucek 2013). All geophysics measurement require absolute coordinates, local or global. Additionally in order to eliminate gravity or magnetic effect of the excavations

and steel reinforce their shape must be known. In order to meet the needs of scientists, researchers, tourists and museum authorities full inventory of Complex Osówka was performed. It was done in year 2015 by authors of this report, together with students, and covered all underground and ground objects.

Underground objects together with two ground objects of the complex were scanned (laser scanning), altogether 1700 meters of tunnels in main part managed by Museum of Underground City Osówka), 130 meters of Water Adit, Siłownia and Kasyno. It is suspected that two mentioned ground objects served respectively as nuclear energy plant and Hitler's headquarters or command headquarters (Cera 1998). The following equipment was used during measurements: laser scanner (Faro, Focus 3D), tachymeter (Topcon, OS103) and GPS receivers (Topcon, HiperPro) for georeferency were used (Jabłoński i in. 2016).

During inventory works point clouds of the complex objects were collected. As a result, tests verified yet unacknowledged or acknowledged by other methods location

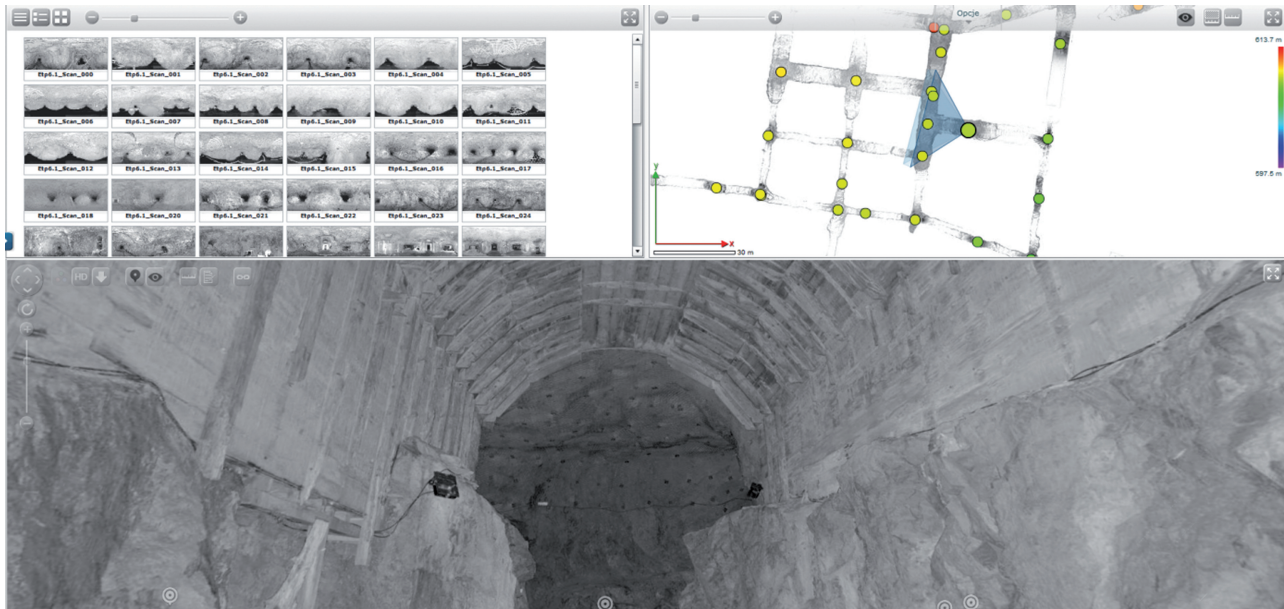


Fig. 4. Virtual tour inside the Underground City Osówka

Rys. 4. Widok wirtualnego spaceru po sztolniach Podziemnego Miasta Osówka

of objects in relations to each other (fig.3). Location of not finished lift shaft and stairwell inside the gym on the plan of complex was documented. Additionally, an accurate direction of Water Adit and its location relative to the Museum adits were set. By using the intensity of the reflection of the laser beam in the tunnels it was also possible to determine areas in which the deposited gypsum can be found, which can be a witness to the presence of hidden concrete chambers or strengthening.

Another effect of the inventory is a virtual museum, available to users at the Museum of Underground City Osówka website (fig. 4). User can virtually reach all the places, including those not made available to the public in the museum part. “Osówka” complex in possession of such modern tools has joined the leading Polish museums. During inventory measurements flooded adits have been also scanned: in Water Adit (in November 2015 the entrance collapsed), in the museum and in Siłownia (previously the water was pumped to allow the measurement in the stairwell and the alleged lift shaft). Another place available only online is the shaft connecting forest near the Kasyno with the undergrounds. Virtual Tour enables measurements of selected surface, the distance between points and preview coordinates and altitude in an interesting place (Jabłoński i in. 2016).

3.2. Inventory works and virtual tour in Benedictine Abbey in Jarosław

Since 2006 students of the Faculty of Mining Surveying and Environmental Engineering are performing periodical control measurements to determine the state of security and stability of the ancient walls surrounding the Benedictine Abbey and Benedictine Sisters Monastery in Jarosław. They are also checking the declination changes of St. Nicholas and Stanislaw Bishops church towers.

In 2015 for the first time laser scanner was used during measurements, in addition to the tachymeter and GNSS receivers. Scans from 66 positions were made, which included the entire area of the Abbey along with most of the outside of the surrounding wall, which can be safely reached. As reference points, serving in later works, students used polystyrene spheres and discs of reference in the form of chessboards, measured by tachymeter in local coordinates system. Point clouds created as a result of the scanning was used in two ways. The main part in which the cloud was used was to analyse the declination of church towers (which allowed the comparison and checking the results of measurements of classical methods). In addition on the basis of the points cloud three-dimensional model of the Abbey

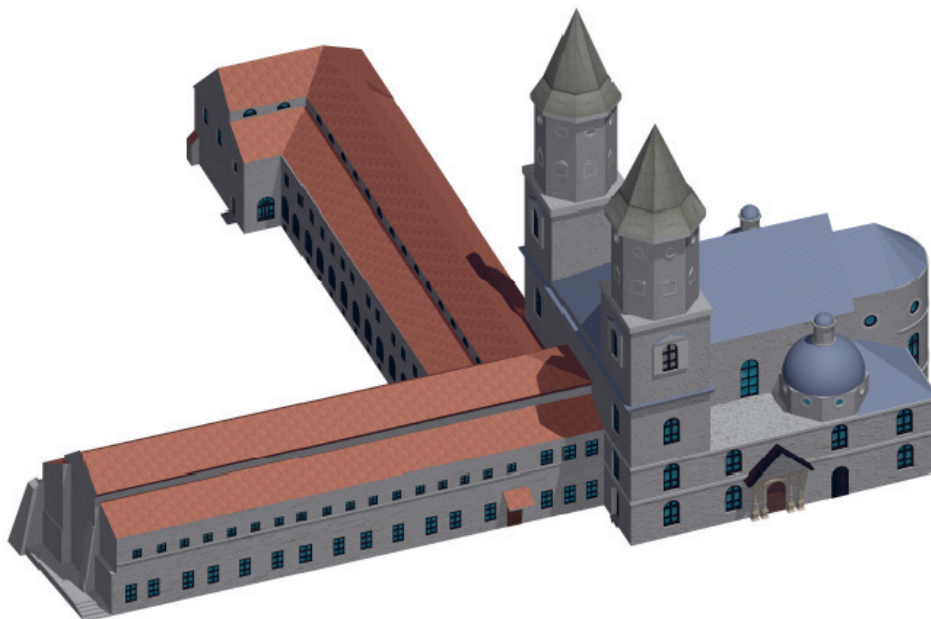


Fig. 5. Model of church and monastery complex in Jarosław (Lipecki et al. 2016)

Rys. 5. Bryłowy model zespołu kościelno-klasztornego w Jarosławiu z narzuconymi teksturami (Lipecki i in. 2016)

was created (fig. 5), together with virtual tour. At the moment, the virtual tour includes the Abbey and monasteries gardens and the surrounding historic walls and towers. In subsequent years, to be complemented by the interior of the church and other buildings.

Based on the results of measurements inventory report which includes expert reports on the state of the walls and towers of the church were prepared. It was found slight deflection of the wall in the northern part of the Abbey and the deepening deflection of the church towers. What was also developed is the distribution of benchmarks and control stamps throughout the facility. Also consultations with specialists in the field of geotechnical and construction to prevent deepening trends was proposed. Inventory report and points cloud are to be used in the conduct of further renovations or reconstruction in case of damage. With data and published conclusions it was possible to identify which sections of the wall need the fastest intervention (Lipecki et al. 2016).

3.3. Geoportal and Oil Trail demarcation based on analysis

Oil Trail is a cross-border route connecting with places associated with the birth and history of the oil industry in Poland. Its main part goes through Jasło, Kro-

sno, Sanok, Lesko i Ustrzyki Dolne. Further area of the trail, not covered in this study, is on the Ukrainian side.

Students of scientific society within the popularization of this Polish region, which is a source of pride because of Ignacy Lukaszewicz's contribution to the development of the world, decided to build a geoportal and website about curiosities of the region where Polish oil industry begun. Due to the nature of the presented content (maps, track), geoportal was built on the basis of geographic information systems. The route was determined on the basis of the analysis of the existing routes (the assumption was that the new thematic trail was to cover as far as possible from existing) and sites relevant to the history of the Polish oil industry. It was decided to build a geoportal extended with the educational part and informing about local sites. Geoportal is dedicated to the use of browser and in mobile version (fig.6) (Jabłoński et al. 2015).

Constructed maps present topographical, geological and environmental information of the areas where oil and natural gas is present. Maps have been further enhanced with high-quality digital terrain model, which has been prepared based on the LiDAR data. Required data was obtained from free sources: OpenStreetMap and the Geological Institute. The location of individual objects was verified in the field using GPS technology, checking

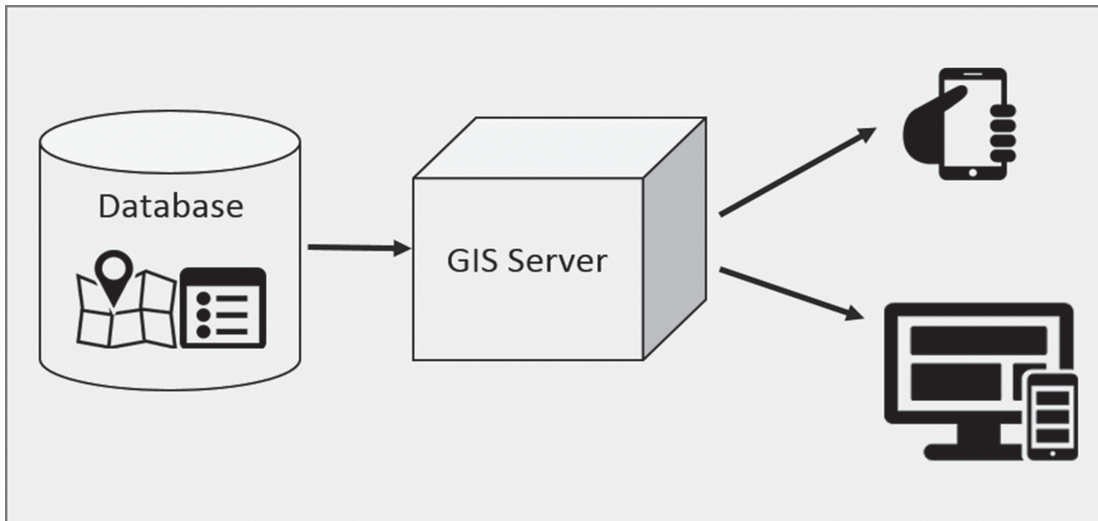


Fig. 6. Diagram of data communication system (Jabłoński et al. 2015)

Rys. 6. Schemat udostępniania danych (Jabłoński i in. 2015)

simultaneously the possibility to access them. The main result of the project is the geoportal presenting Oil Trail (Fig. 7) – available for use in a web browser and in a mobile version.

Geoportal is a unique interactive educational path, which in addition to the function of teaching also fulfils the role of supporting tourism of the region. The social

objective of the project was to lay a trail in the area (in collaboration with the Main Centre of Mountain Tourist Association of Polish Tourist and Sightseeing Society – COTG PTTK) and its consolidation with the help of signboards with QR signs. Unfortunately, there were problems in determining the course of the trail through the areas managed by the State Forests and

- Museums
- Petroleum exploration related relics
- Cities
- Villages
- The Oil Trail
- Hiking trails
- buffer_2_km
- buffer_5_km
- National border
- Ortophotomap

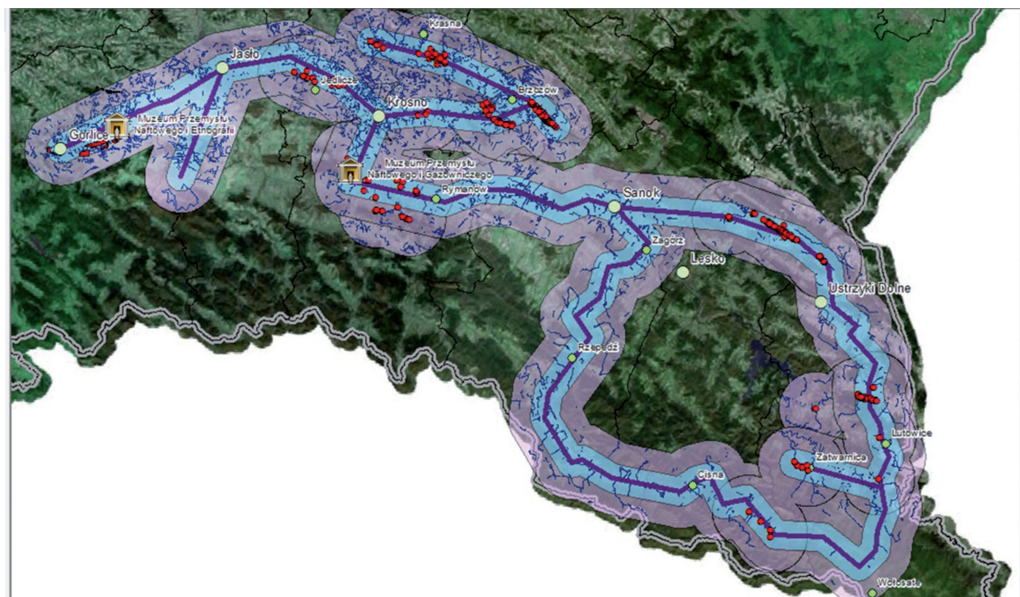


Fig. 7. Exemplary view of the application. A sample map of the trail is marked with purple color (Jabłoński et al. 2015)

Rys. 7. Przykładowy widok geoportalu Szlaku Naftowego. Przebieg oznaczono kolorem fioletowym (Jabłoński i in. 2015)

Polish Petroleum and Gas Mining (PGNiG). As a result, trail project along with information boards was submitted to the PTTK to carry out further implementation work.

4. SUMMARY

As from the definition of prof. Janusz Kotlarczyk, mentioned at the beginning of chapter one, geoinformatics is a very broad term. The article describes how variety of geoinformatics products and tools can be used in many ways, for several years also for the protection, inventory and promotion of Polish monuments. Geoinformatics is not only about building geoportal at government or local government level, which provides the data for ordinary citizens and businessmen. Geoinformatics is also about building small geoportals and map websites that are promoting regions and historical objects, creating models of historical monuments or virtual tours through them.

Described embodiments indicate that similar services can arise as a result of community service – students of scientific society together with their patrons performed all the work free of charge and only as a part of the hobby. Their actions greatly affect not only the promotion of historical objects and regions, but also on the cognitive process, providing knowledge for tourists, scientists and engineers. Thanks to spatial analyses and visualizations historians complement their knowledge, and the construction of models and their analysis allows the evaluation of the buildings, providing knowledge for experts in the field of construction and architecture.

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