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INDIVIDUAL GEOINFORMATIC AND CARTOGRAPHIC PROJECTS: A CASE STUDY IN VÁC, HUNGARY

Abstract. This article presents the findings and methods employed in two individual projects: the Individual Geoinformatic Project (IGP) and the Individual Cartographic Project (ICP). The projects were conducted in the town of Vác, Hungary, with the IGP focusing on environmental measurements and the ICP on mapping tourist attractions. The goals of the projects were to design and create maps, develop a geodatabase, and produce related materials such as reports and presentations. The project area covered a specific part of Vác, including prominent landmarks, historic sites, and residential areas. Data for the projects were collected through field surveys and office work, using various data sources and tools such as GPS devices and ArcGIS Collector. The process involved planning, data collection, and extensive laboratory work to process and analyze the acquired data. The results include two sets of environmental maps and two touristic maps, as well as a comprehensive website showcasing the findings. The article concludes with recommendations for future projects, highlighting the importance of continuous data collection and more sophisticated measurement techniques for accurate map representations.
Keywords: geoinformatics, cartography, environmental measurements, tourist attractions, Vác, Hungary.

Introduction. Individual Geoinformatic Project (IGP) and Individual Cartographic Project (ICP) are two different subjects that are based on the same location. However, they have different thematic topics. IGP – environmental theme, which includes measurements of surrounding environment. ICP – tourist theme, which focuses on significant and remarkable places that are interesting for tourist audience.

The goal of these projects is to learn how to design maps beginning from data acquiring and field survey and finishing by creating of layout and publishing. As a main result, our group is supposed to present two environmental maps and two touristic maps. Along with that the proper geodatabase, map layouts, report, presentation and Web page should be complemented.

The project area is located in Vác, town with 35 000 inhabitants 35 km away from Budapest. This ancient town is approximately thousand years old. Due to its good location of the meeting point of mountains area and Great plain this place was favorable for human needs. The availability of water transportation was a good background for trade and commerce, not to mention the important trade routes and the possibility to cross the Danube [2] This place is a lovely and interesting place to visit and explore combination of ancient ruins, churches and monuments with modern life facilities and advanced infrastructure.

Figure 1 –
Small scale overview of study area in Vác

Our group had to explore and map only southeast part of Vác (figure 1). The approximate area of exploration is about 6854161 sq.km. This area includes picturesque Baroque Square, area along Danube bend, historic sights, cemetery, lovely lake and mashes and residential area of private houses and apartment buildings area.

Data Sources. Data sources is a variable object that depends on thematic. Regardless of the topic, almost every map should start from the basic information that refer the topic to the place. In addition, later as a new layer the theme data provides with additional information.

For creating base map, we used variable materials such as scan copies of the city map (scale 1: 15 000), topographic map (scale 1: 10 000), satellite image and Open street map.

For environmental map, we collected necessary data from the points of measurements (POM). They were temperature, noise, solar radiation and humidity. As the area is big and complicated to walk these data was gathered in two days 1 and 7 of October 2019. Totally we were able to collect 143 POM.

For tourist map, we explore our part of Vac in order to register points of interest (POI). Many sightseeing were under our attention. For example, famous Március Square, The Cathedral (Konstantin Square), museums, churches and so on. More general objects for basic needs such as café and restaurants, bus stops, parking lots, drug stores and car services were also under consideration. Around 120 POI were input in our database.

Description of workflow. As the usual scientific researches, our project mainly comprised of field and office work. We started with planning the field data collection in office weeks before the trip. We divided the work into two days, according to the plan, one filed work to collect cartographical data and another day to make measurements regarding environment. However, we made some change regarding the environmental data measurement as it was only possible to be accomplished in two different sessions. On the other hand the office work consists of planning and dealing with the raw data to get the desired output.

Field work. Planning. Every project starts with a good planning to make the steps clear. An effective plan can lead to good management, less time to perform the work successfully. Making it more specific, we planned for both cartographic and geoinformatic projects. Firstly, we started with getting some general information about Vác city, reading about the city, checking available maps, and planning for the transportation with the help of our lecturer supervisor.

Preparation for the first field work, cartographic point of interest data collection. The work was done with the help of handheld GPS devices and making notes about the important features of the city. We planned to make the work more efficient and well-arranged, for this purpose, we used ArcGIS Collector. This is an interactive and robust application designed to collect data in field and immediate transferring the gained information to the account (figure 2). Then, the data can be downloaded informs of shapefile or table.

Preparation of the second filed work, cartographic environmental data collection. Planning for this work was more challenging as there were some regulations regarding the amount of measured data and the maximum distance between the individual points. We created a fishnet or grid of points using ArcMap toolbox and we performed a check to find out if it is acceptable (figure 3). Each of the distances were checked with distance measurement tool (geodetic measurement) in ArcMap, then, uploaded to the collector. The data to be collected were noise, temperature, humidity, and solar radiation through a device.

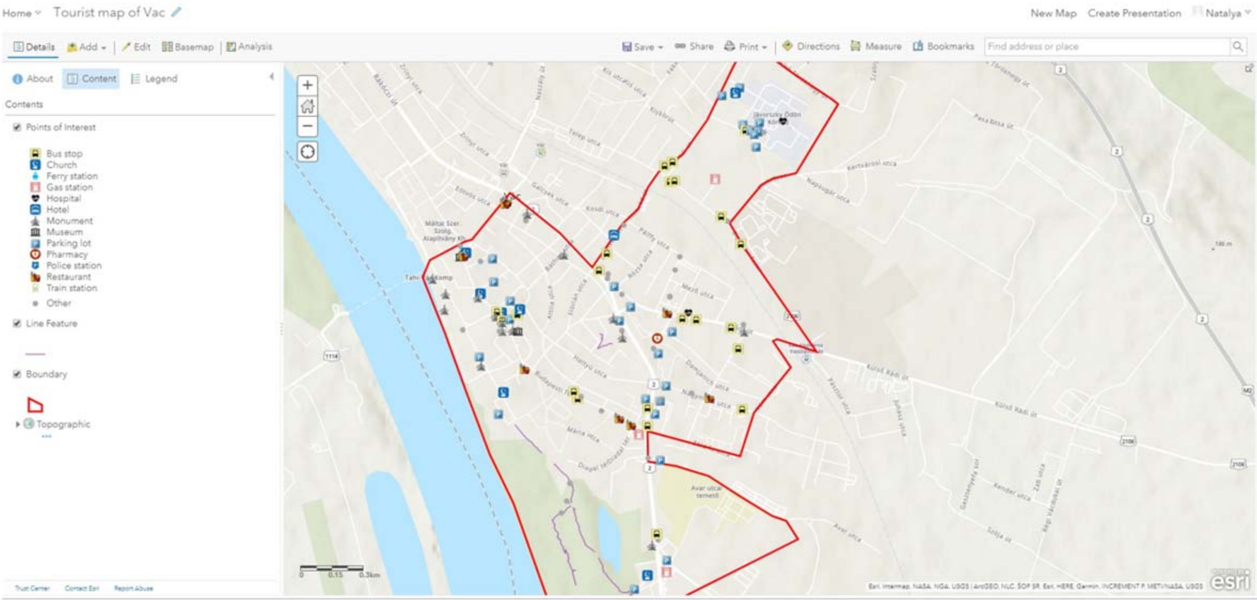

Figure 2 – POI in ArcGIS Online website

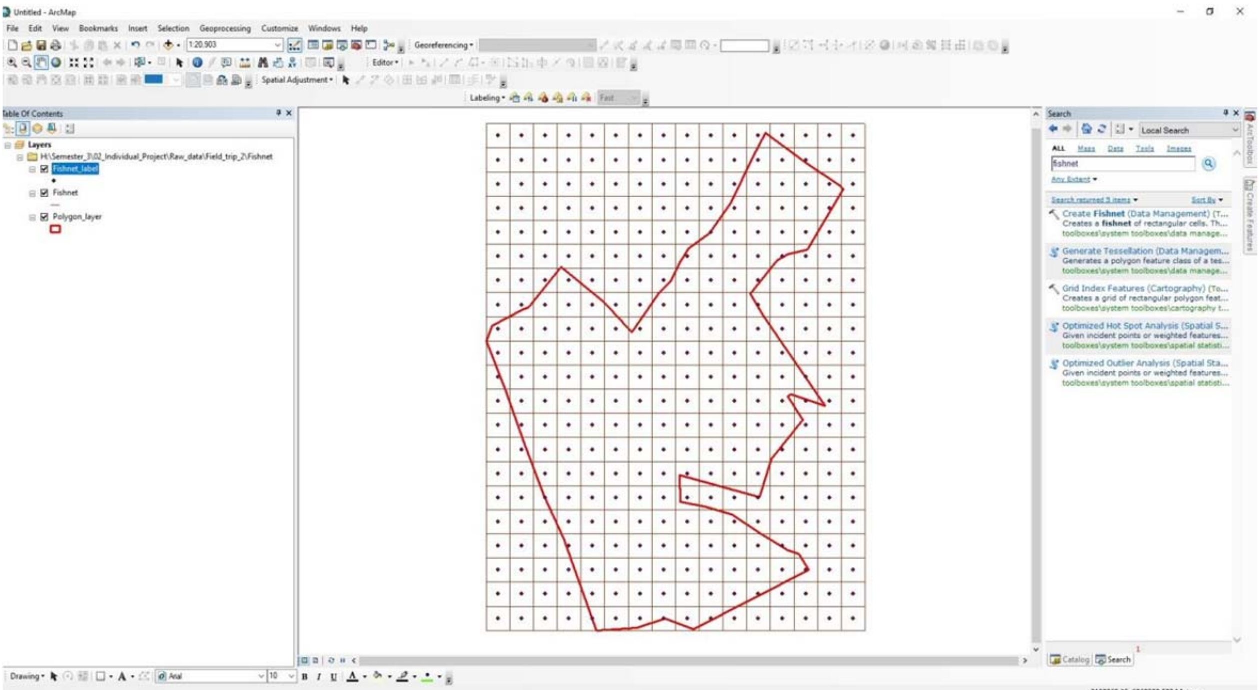

Figure 3 – Creating a fishnet (200 to 200 m)

Data collection. On the first day, we started to collect information about the interesting points in Vác city. We used ArcGIS Collector, handheld GPS, capturing photos, and making notes. The aim for gathering these data was to create a touristic map, thus tourism interesting features must be collected. These features were churches, museums, theater, restaurants, pubs, children playground, swimming pool, and some other necessary places like hospital, markets, and bus stops.

On the second trip, we started from the north-east part of our area of the city to acquire measurement of the pre-defined points. Both ArcGIS Collector and Voltcraft (UM 5/1 100 Environment meter). Devices were used to get the locational and environmental information. Unlike cartographic data collection, the time measurement was restricted between 11 am and 3 pm. This is due to the fact that the environmental measurement varies greatly with time due to various factors. This process was more challenging to handle because of the time restriction, device functions, walking around restricted areas, and methods needed to be followed for each measurement. For instance, the temperature, humidity, and solar radiation were greatly affected by the sun, thus, variations happened while measuring in the shade. The noise was not an absolute value and unpredictable, it can be different from time to time and there can be different ranges, however, we took an average of the minimum and maximum noise recorded at each point.

Due to the mentioned limitations, the environmental data gathering attempt could not cover up the area in the second day, therefore, we needed one more filed work. We calculated our performance in the second day using our average speed, the time required only for the measuring data, time required for walking between these points, and comparing all these with the limited range of time of the work (11 am - 3 pm). The result showed that it was impossible to cover up the whole area in one day. On the other hand, this brought another issue which was the weather conditions difference. As a result, we decided to deal with the data separately and divide the area into two parts.

Laboratory work (process of raw data). Work in a laboratory is a most time-consuming part of this project. As it was mentioned above, two different thematically projects were taken a place at the same area. However, at the end there must be two thematic maps produced.

After finishing with field survey and collecting necessary data the laboratory work took place with the following algorithm:

1. Preparation of the base map.
2. Design tourist map.
3. Design set of environmental maps.

Each part of this workflow has its own specific.

Detailed workflow of designing base map. Base map is a crucial part in designing maps. It helps to refer studied area in the spatial distribution, points out at the road infrastructure and shows geographical environment demonstrating landscape and other morphology features. That is very important for users to understand the surrounding area in order to interpret the topic better.

Only previous materials of the studied area were taken into consideration in base map processing. The necessary set of layers were created for digitizing and necessary attribute fields were added (such as “name”, “type” for road layer and land cover layer).

Detailed workflow of designing tourist map. Tourist map is presented in A3 format, scale 1:8 000 in Hungarian language (figure 4).

Designing tourist map consists of sorting and filtering acquired data in order to understand what should be included in tourist map. To answer this question every cartographer should know the target audience, its age and language, not less than the format of the map and the scale. The tourist layer included only one point layer with POI. As it is appeared, some points became not

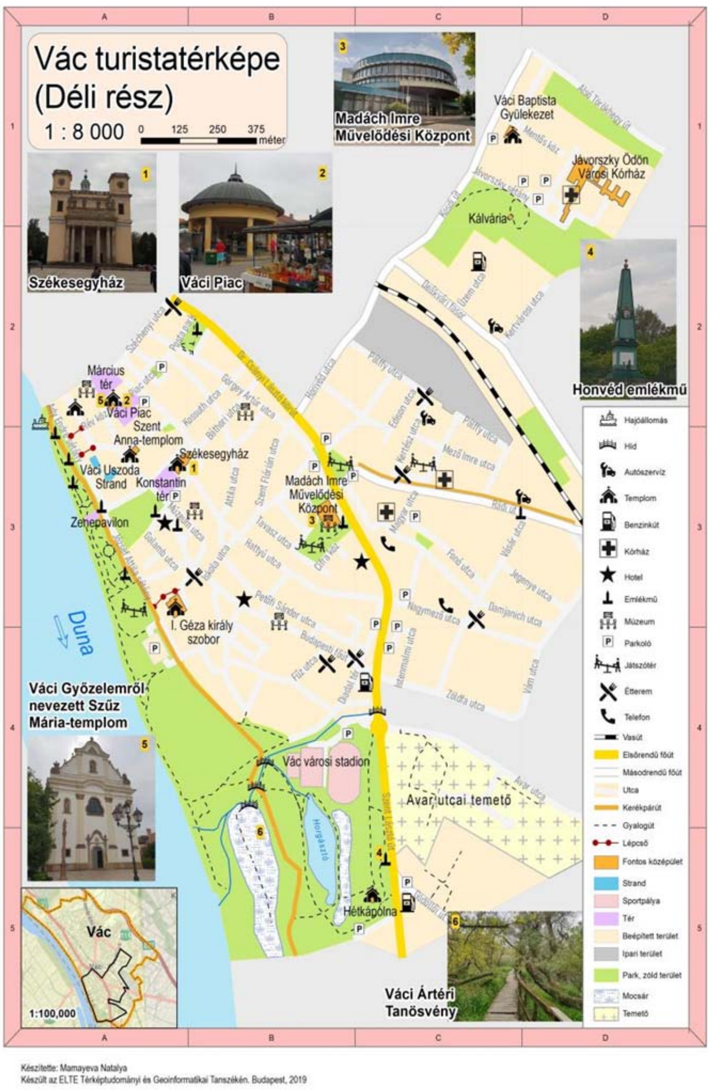

Figure 4 – Touristic map of Vác in Hungarian language

interesting any more when it was displayed on the screen. There could be several reasons, for example, overloaded area of old town, uneasy task to display all bus stops with its connection and routes, unnecessary information and so on. All these reasons made the final legend of 13 symbols on it in Hungarian language.

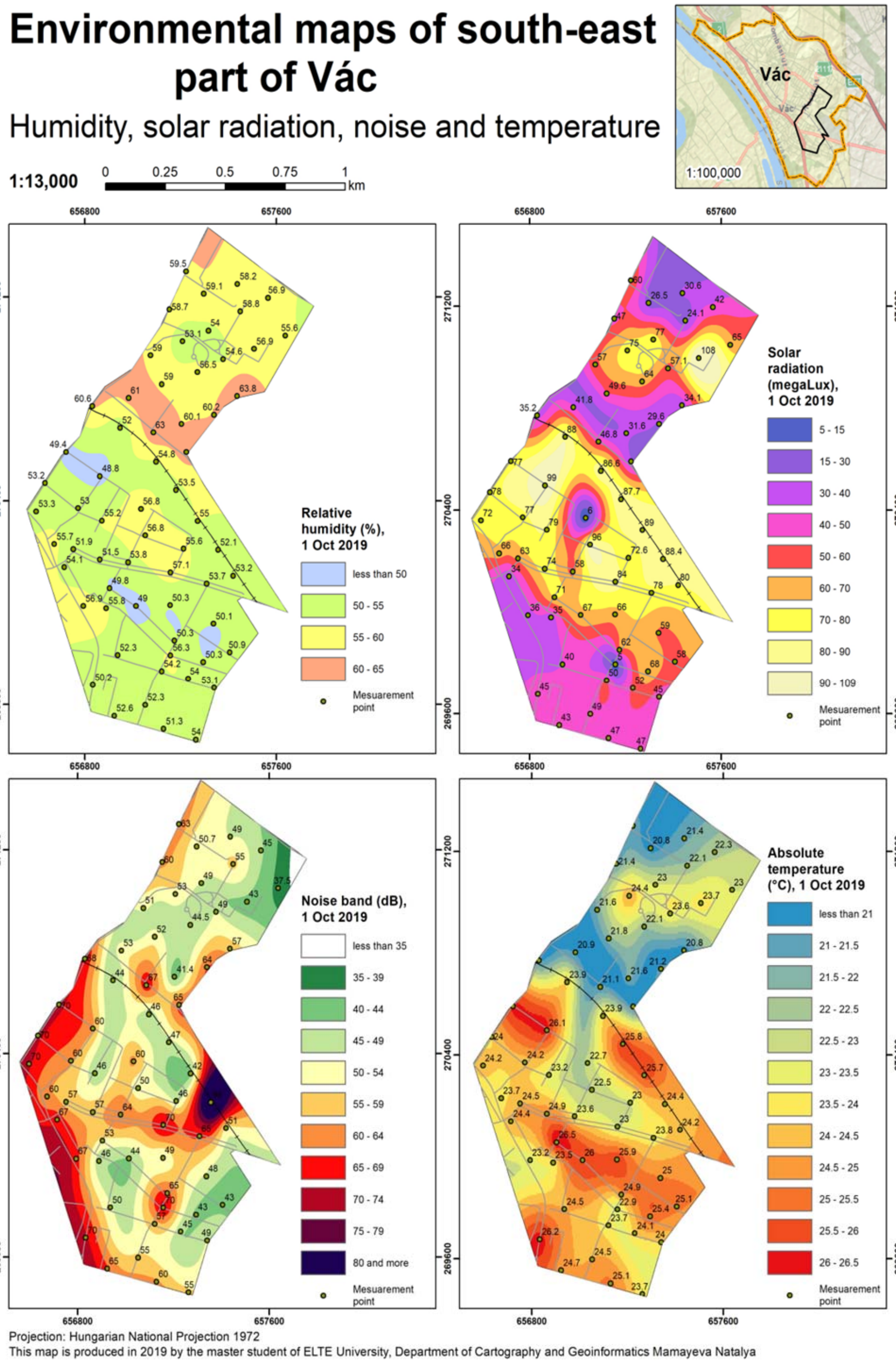

Figure 5 – Environmental map of Vác

Another step is to create a symbol set that match the tourist map and do not conflict with taste of the target audience. Symbols were created in Corel Draw soft, saved in png format and uploaded as the pictures into the point layer in ArcMap document. In order to make the map look better without overlapping, the size of the symbols were picked up and shifted where it was necessary.

Another stage is called “labeling”. The tourist map should include street names, important buildings, squares and places names. This process requires more attention, because base map, symbols and labels should be harmonic. Thus, for the names of roads the font named *Bahnschrift Light Condensed* size 5 was chosen and for labeling important place *Arial Narrow* size 6.

To make the map more attractive, bunch of photos were included on the layout. They have a reference number that can be found on the map and the full name. Moreover, a small-scale inset map used on the layout, which shows the town border and the study area.

Detailed workflow of designing set of environmental maps. The entire layout consists of set of thematic maps, such as temperature, noise, solar radiation and humidity (figure 5). Map scale is 1: 13 000. As a base map, one map used only road layer information; however, another map showed the whole city base map that was used in tourist map.

The interpolation tools are generally divided into deterministic and geostatistical methods. The deterministic interpolation methods assign values to locations based on the surrounding measured values and on specified mathematical formulas that determine the smoothness of the resulting surface. The deterministic methods include IDW (inverse distance weighting), Natural Neighbor, Trend, and Spline. The geostatistical methods are based on statistical models that include autocorrelation (the statistical relationship among the measured points). Because of this, geostatistical techniques not only have the capability of producing a prediction surface but also provide some measure of the certainty or accuracy of the predictions. Kriging is a geostatistical method of interpolation [4].

Set of gathered points was interpolated into grid surface in ArcGIS environment with the tool Topo to Raster. This interpolation method specifically designed for creating continuous surfaces from contour lines, and the methods also contain properties favorable for creating surfaces for hydrologic analysis [4-8]. The generated raster then was classified and colored using suitable and standard color schemes.

Summary. To conclude, the project comprises of two important parts, cartographic and geoinformatics. Robust planning and approaches were followed in the process of field and office work. The cartographic touristic data collection went precisely as planned, however, the environmental field measurement, which was originally planned to be completed in one day was only been able to be accomplished in two different days. This found out to be normal according our field time and speed measurements and it also led to our suggestion for the future works. Using ArcMap software, we were able to create and manage geodatabases, layer, and the maps. The whole process was executed very successfully according to the plan and the workflow. Finally, the results are presented as two touristic maps, two sets of 4 thematic environmental maps, and a website, which is available on *https://mercator.elte.hu/~ztiwra/V%C3%A1c_project/web_app/Index.html*

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ЖЕКЕ ГЕОАҚПАРАТТЫҚ ЖӘНЕ КАРТОГРАФИЯЛЫҚ ЖОБАЛАР: ВАК МЫСАЛЫ, ВЕНГРИЯ

Аннотация. Бұл мақала екі бөлек жобада қолданылатын нәтижелер мен әдістерді ұсынады: жеке географиялық ақпарат жобасы (IGP) және жеке картографиялық жоба (ICP). Жобалар Вац қаласында (Венгрия) жүзеге асырылды, онда қоршаған ортаны өлшеу және туристік көрікті жерлерді ICP картасын жасауды қамтитын IGP бар. Жобалардың мақсаттары карталарды жобалау және жасау, геодеректер базасын әзірлеу және есептер мен презентациялар сияқты байланысты материалдарды шығару болды. Жоба аймағы әйгілі көрнекті жерлерді, тарихи орындарды және тұрғын аудандарды қоса алғанда, Вацтың белгілі бір бөлігін қамтыды. Жобаларға арналған деректер GPS құрылғылары мен ArcGIS Collector сияқты әртүрлі деректер көздері мен құралдарын пайдаланып далалық зерттеулер мен кеңсе жұмыстары арқылы жиналды. Бұл процесс жоспарлауды, деректерді жинауды және алынған деректерді өңдеу және талдау үшін ауқымды зертханалық жұмыстарды қамтыды. Нәтижелер экологиялық карталардың екі жиынтығын және екі туризм картасын, сондай-ақ нәтижелерді көрсететін егжей-тегжейлі веб-сайтты қамтиды. Мақала картаны дәл көрсету үшін үздіксіз деректерді жинаудың және күрделірек өлшеу әдістерінің маңыздылығына баса назар аудара отырып, болашақ жобаларға арналған ұсыныстармен аяқталады.

Түйін сөздер: геоинформатика, картография, қоршаған ортаны өлшеу, туристік көрікті жерлер, Вац, Венгрия.

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ИНДИВИДУАЛЬНЫЕ ГЕОИНФОРМАЦИОННЫЕ И КАРТОГРАФИЧЕСКИЕ ПРОЕКТЫ: НА ПРИМЕРЕ ГОРОДА ВАЦ, ВЕНГРИЯ

Аннотация. Представлены результаты и методы, использованные в двух отдельных проектах: Индивидуальном геоинформационном проекте (IGP) и Индивидуальном картографическом проекте (ICP). Проекты проводились в городе Вац, Венгрия, при этом IGP подразумевает измерения параметров окружающей среды, а ICP – картирование туристических достопримечательностей. Целями проектов были проектирование и создание карт, разработка базы геоданных и выпуск сопутствующих материалов, таких, как отчеты и презентации. Территория проекта охватывала определенную часть Ваца, включая известные достопримечательности, исторические места и жилые районы. Данные для проектов собирались посредством полевых исследований и офисной работы с использованием различных источников данных и инструментов, таких, как устройства GPS и ArcGIS Collector. Этот процесс включал планирование, сбор данных и обширную лабораторную работу по обработке и анализу полученной информации. Результаты включают в себя два набора экологических карт и две туристические карты, а также подробный веб-сайт, демонстрирующий результаты. Даны рекомендации для будущих проектов, подчеркивающие важность непрерывного сбора данных и более сложных методов измерения для точного представления карт.

Ключевые слова: геоинформатика, картография, измерения окружающей среды, туристические достопримечательности, Вац, Венгрия.