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TECHNOLOGICAL FEATURES OF CREATION OF DIGITAL TOURIST MAPS FOR CYCLING ROUTES USING GPS-LOGGER

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Keywords: GPS track, GPS logger, tourist guide.

Formulation of the problem

Tourism development is one of the priority strategic directions in the socio-economic and cultural development of the Carpathian region over the coming decades. Every year the interest of travel agencies and travel agencies in this region increases and the flow of tourists increases. The problem is that the information is needed for tourists is not fully provided, in the Internet there are sites with information about establishments of rest and food, but this information applies to the most well-known tourist destinations, and the more remote villages remain without proper attention [1, 2, 3, 4, 5]. In addition, tourist is interested in other attractions including museums, folk craftsmen, bazars, waterfalls, Hutsul churches, monuments of nature, history, culture and architecture.

Considering the rapid increase and popularization of GPS-navigators and smartphones supporting GPS-navigation, there is a need for the creation of tourist guides which will include popular tourist destinations and will be presented on special internet resources and will be freely accessible so that they can be used on your device for your own journey.

Therefore, in order to provide comprehensive infrastructure for tourism in this region and comprehensive, detailed and useful information for tourists, progressive and advanced technologies need to be introduced.

The introduction of the latest technologies in the development of tourism should become a new prerogative of this area of activity. This will contribute to its effective development, and will enable consumers to use all the possibilities of tourism information base in a convenient and accessible way.

Formulation of objectives

The use of geoinformation technologies in conjunction with GPS-system devices will allow the creation of geospatial data bases in tourism more efficiently and qualitatively, and provide full information on all tourist destinations. Because these technologies are affordable and relatively easy to implement, they can be successfully implemented in order to create interactive cartographic Internet resources in the tourism industry [6, 7, 8, 9, 10].The main task is to create a GPS track and collect information about the route laid through the Carpathian rock formations, which include the rock-cave complex "Dovbush Rocks" and the fortress "Tustan", as well as work out and present these data in the form of a tourist guide on the Everytrail online service taking into account features of the terrain, which will affect the timing of implementation. Perform an analysis of the created GPS track in GPS-Track-Analyse.NET software.

Scientific novelty

Scientific novelty and practical significance is the study of the modern method of obtaining and processing geospatial data and combining them with semantic information, for the creation of digital tourist maps of cycling routes.

Methods of implementation

1. To create a tourist route and record it as a GPS track using the GPS logger for its digital representation.
2. To make detailed descriptions, photos, videos, coordinates of all tourist attractions along the route (green tourism estate, hotels, restaurants, leisure establishments, bus stations, lakes, waterfalls, churches, museums, nature monuments, history, culture and architecture).
3. To systematize and classify the collected information.
4. To record and process data on a special online resource for creating Everytrail tourist guides.

Presentation of the main research material

The implementation of this process can be divided into two stages: field and office. Preliminary there are implemented route selection, and laying on the map, determining its complexity and length, selecting approximate stopping points.

The task of the first stage is to create a track using a GPS logger, and collect information necessary to describe this tourist cycle, namely

photographs and descriptive information of the stops.

The second stage was to process the resulting track using the online resource of Everytrail, as well as to systematize descriptive data. The final point is the presentation of a ready-made tourist guide on the online open-access service.

Creation of the track

The track was created using the Holux M-241 GPS Logger (Fig. 1).

Fig. 1. GPS-logger Holux M-241

GPS-logger Holux M-241 is versatile GPS device which is capable of storing 130000 positions that include location coordinates, height and time values into device memory. After that, data can be downloaded to a stationar PC, for example, for overlaying a route to the map using Google Earth resources.

The tourist route is laid out by the Carpathian rock formations and includes the rock-cave complex "Dovbush cliffs" and the fortress fortress "Tustan".The road passes through such large cities and towns: Stryi - Morshin - Bolechiv - Bubnishche - Trukhaniv - Upper Synyovydne - Korchin - Urich - Skhidnytsya - Borislav – Truskavets

Creating a route was performed in clear weather for better signal reception from satellites, to avoid possible interruptions in the operation of the device, which may lead to incorrect information upon completion of the route creation. Also, with the help of the device were fixed "points of interest" or POI (English point of interest) - the geographical objects marked on the map with special labels. Usually these objects relate to the infrastructure of a society, for example, shops, pharmacies, gas stations, hospitals, banks, hotels, cafes and restaurants, theaters, nature monuments, etc. POIs can be created by a card developer or user. In these places, they took photos and collected descriptive information.

Workout the track and create a map. The GPS track was processed in the online resource of Everytrail, as the result should be a complete travel map of the cycle.To start, you need to download a track from the GPS-logger. You can do this with the HOLUX ezTour for Logger or GPSBabel software or other software for exporting tracks from the device.

The track selection is performed side by side with a note. You can export tracks in the following formats: GPX File (* .gpx), NMEA0183 File (* .nmea), KML File (* .kml), Excel File (* .csv). POI points are stored separately from tracks.After uploading the file from the device, we download it to the online service Everytrail. To do this, you must first register before you can fully use all of its functions.

Next we choose "create a guide" and a corresponding window will appear in which there will be a sequence of four stages of creation. The first stage of the creation includes the title and subtitles (Fig. 2).

Fig. 2. First stage of map creation

The next step is to download the track. The program offers several ways to download (Fig.3):

1) using "points of interest", we upload the POI, and the path between them will automatically be created by the program;

2) importing a trip from another cartographic Internet source, for this you need to enter a URL address;

3) download the track from the PC;

4) apply the track on the map in manual mode.

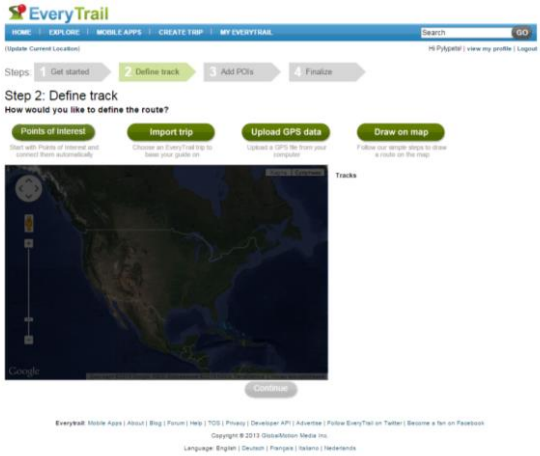

Fig. 3. Choose the method to download the track

We load track using the third way. We choose the path to the file on the PC, we also select the POI import and execute the download.

After performing the above actions, we get a POI track. In this window, you can also edit the route and "points of interest" (Fig.4).

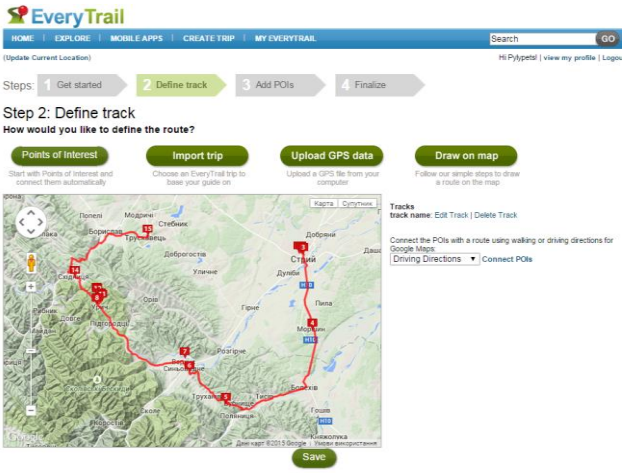

Fig. 4. Track loading

After that, we do third stage - adding and editing the POI (Fig.5).

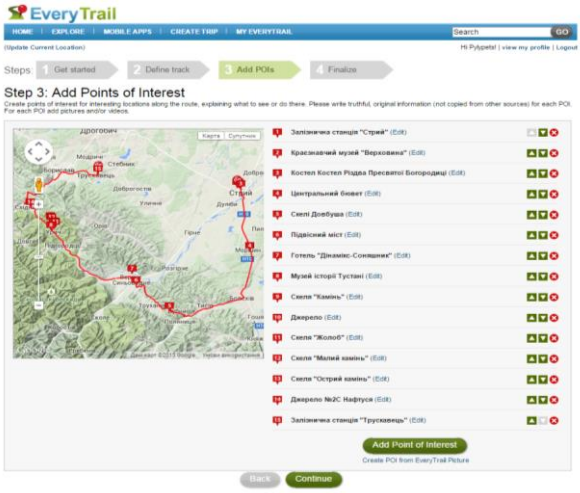

Fig. 5. Adding POI

To edit a point, choose Edit and open a window where we enter information about the object and add photo and video files.

These actions are performed for all "points of interest" (Fig. 6).

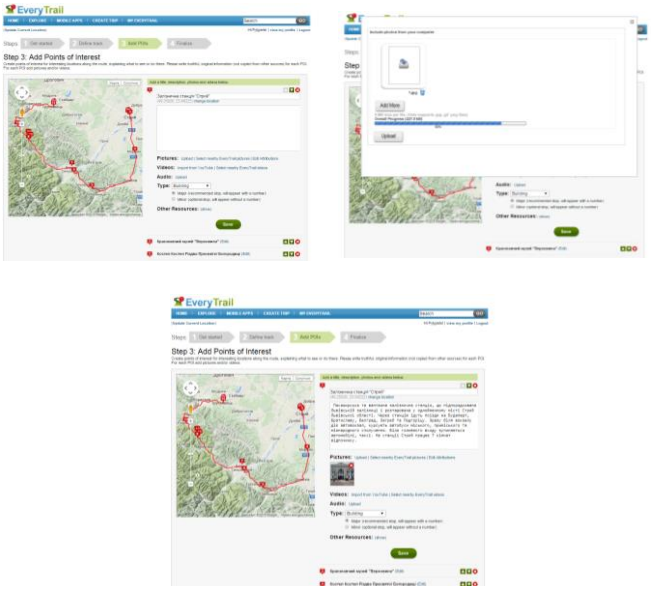

Fig. 6. Editing of POI

The final stage is the completion of the guide. Here we introduce a general description of the route, indicate the complexity and duration, and also note the subject of the route and the type of tourism (Figure 7).

After completing the guide, we received a full informative tourist map with a description and easy navigation for all popular tourist destinations along the route.

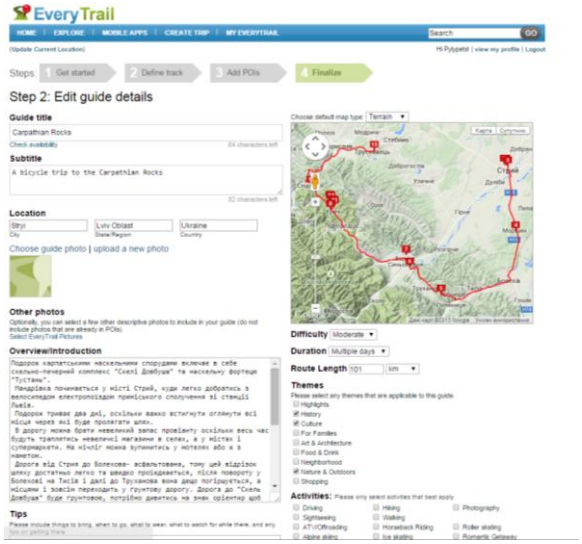

Fig. 7. Final stage of tourist map creation

The map can be downloaded from the website * GPX format for GPS-navigation or smartphone with the installed program Everytrail on it, and use it offline (Fig. 8)..

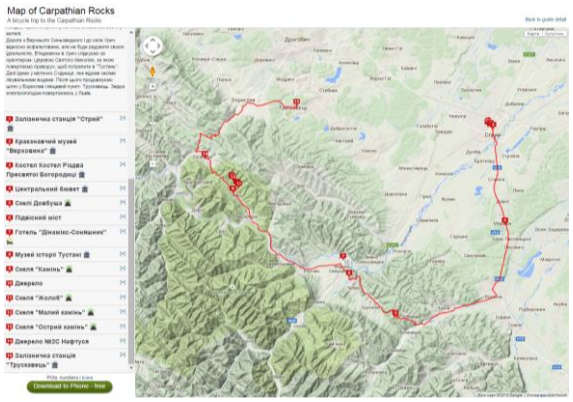

Fig. 8. Tourist map of bicycle route

Additional research of GPS-track

The essence of additional studies of the GPS track is the creation of relief profiles, the detection and analysis of complex segments of the track.

To perform the above-described work GPS-Track-Analyze software was used.

After downloading there will be opened dialog boxes with a section of the relief will appear with a map showing the traveled route, and a path table containing information about all points containing the track: the serial number, the name (if it is a POI), coordinates, altitude, height difference and time of adjacent points and the distance between them, as well as speed, time and recovery gradient (Fig. 9).

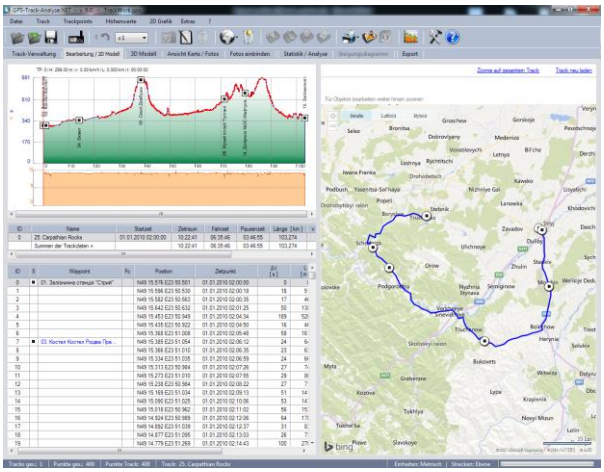

Fig. 9. Dialog boxes after downloading the track

After analyzing the table, one can notice characteristic values of the gradient, when it is raised, it is positive, and on descents is negative, on the flat part of the road it matters, fluctuating with a small difference in the same range. On the way there are places where you can see the areas where the gradient changes the value which differs sharply between two neighboring points and reaches comparatively high values (Fig. 10).

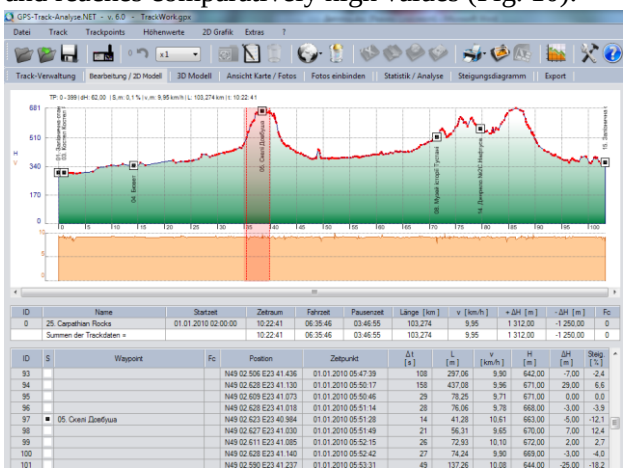

Fig. 10. The part of the route with a large gradient difference

Such points usually occurred on the segments of the route, where there are high altitudes, and significant elevations in height along a small section of the route, and less often in plain areas. The following values of the quality of the signal are explained, because they arose in the areas of bad signal passing, namely in wooded terrain with a mountainous relief. Because because of delayed reception of the device signal from the satellites, built a longer segment of the route, then it was calculated more value of the height gradient. You can see the above-mentioned tendency by looking through the data of the track area through Google Earth (Fig. 11a, Fig. 11b).

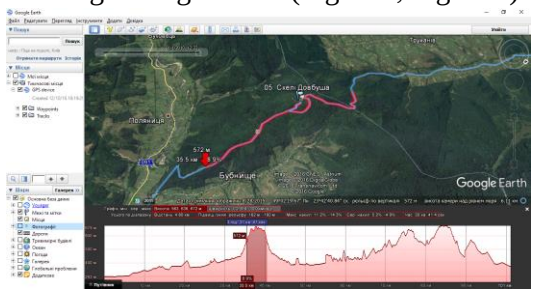

Fig. 11a. The first section of the route with large values of the gradient

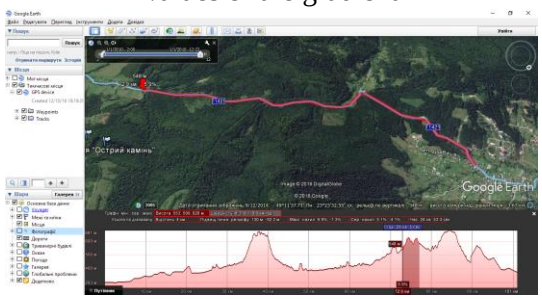

Fig. 11b The second section of the route with a large gradient value

The following profile (Figure 12) shows areas with sharp fluctuations in the form of a color gradient. Here, more clearly, you can follow the above-described tendency to areas where the

gradient value changed uncharacteristically. As you can see on the profile, these segments of the route are grouped precisely in areas with high altitudes.

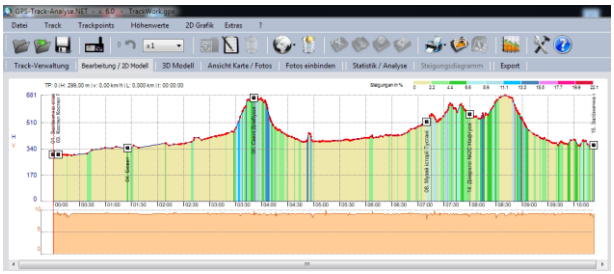

Fig. 12. Chart with a color gradient mapping

In the tools you can choose to display additional charts. In this case, this is the profile of the track in height, along the X-axis is the distance in kilometers, and along the Y-axis, the height in meters (Fig. 13a). You can additionally apply a smoothed line of relief, which will reflect the overall trend of the route (Fig. 13b).

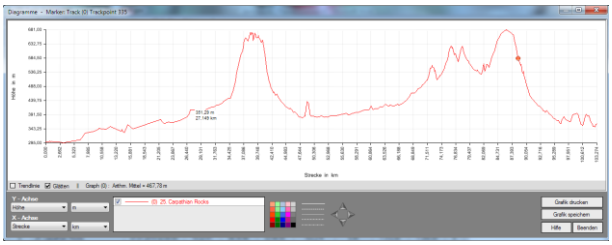

Fig. 13a. Height chart

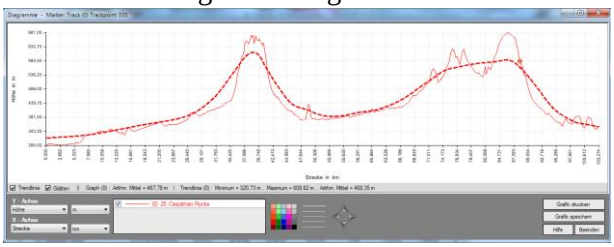

Fig. 13b Height chart along the trendline line

You can also display charts to display the speed change in the horizontal plane (Figure 14) and the vertical plane (Figure 15).

The chart of the speed variation in the horizontal plane along the X axis contains the length of the kilometer, and the values can also be displayed in hours. The Y axis shows the speed value in kilometers per hour.

In the chart in the vertical plane along the X-axis you can set the same value as the previous one, and the Y-axis is the speed value in meters per minute in the range from negative to positive. The sign depends on the gradient of the segment, if negative, then on the graph the speed will be denoted in the negative range and vice versa for a positive value.

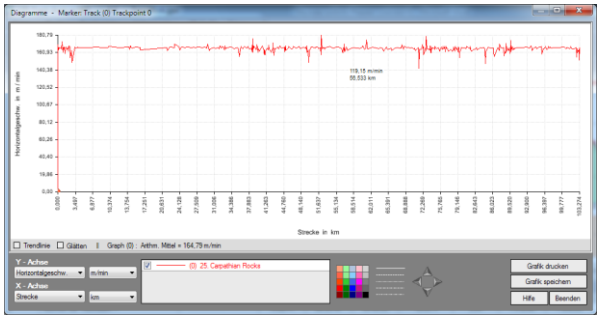

Fig. 14. Chart of quality in the horizontal plane

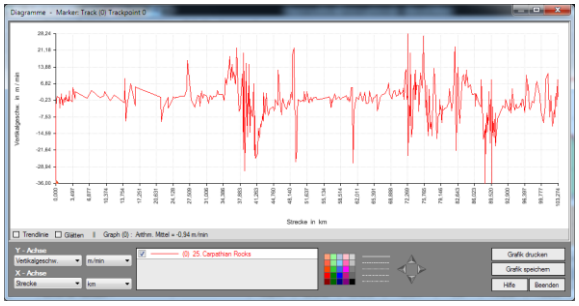

Fig. 15. Chart of quality in the vertical plane

Next, select the next tab in which you can display the track as a 3D terrain profile, you can use it to visualize the path complexity to indicate areas with uplifts (Fig. 16).

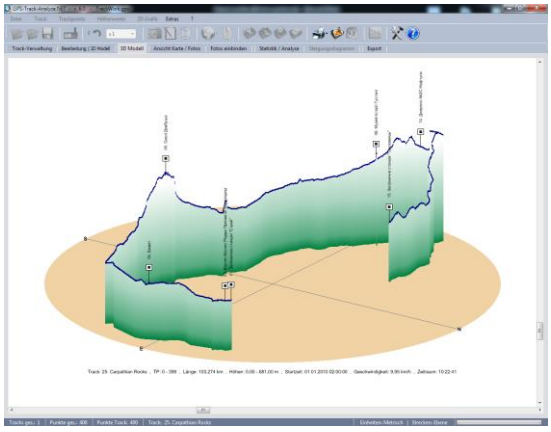

Fig. 16. 3D profile of relief

Conclusions

During the process of work, a bicycle route was selected through popular tourist destinations, namely through the Dovbush and Tustan Rocks.

The route was created using the Holux M-241 GPS logger. The main characteristics for choosing a logger is its time of operation, and the ability to capture the POI, as it is important to create a tourist route. During the research, a comprehensive information tour guide was created, which is relevant for use and download from the service of Everytrail.

This technology of creating tourist digital maps is successfully developing and will evolve

because of its accessibility for each user, since the materials are presented in an open form. Also of great importance is a fairly simple process of creation, which has no less important influence, because it will increase the number of performers, which will lead to competitive digital travel materials. An important point that also affects the success of this method is the small financial costs for the implementation of work.

Also, a study of GPS-track to identify certain patterns during its creation and definition recording quality data. We can say that the plains tracker worked with sufficient precision and no false values, and in areas with significant ups and downs encountered false values gradient height.

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Технологічні особливості створення цифрових туристичних карт веломаршрутів за допомогою GPS-логгера

Л.В.Бабій, Т.Я.Ільків, Ю.В.Пилипець

Створення цифрових туристичних карт веломаршрутів за допомогою GPS-логгера це сучасний крок у розвитку туризму оскільки даний метод є доступний і практичний для всіх користувачів та виконавців. Також це новий вектор дослідження в геоінформаційних технологіях, бо представляє собою сучасні методи отримання та опрацювання просторових даних і поєднання їх з семантичною інформацією про об’єкти.

В даній роботі розглянуто методику побудови повноцінного інформаційного туристичного гіду з використанням GPS-логгера, який є актуальним для користування і завантаження з сервісу Everytrail.

Technological features of creation of digital tourist maps for cycling routes using GPS-logger

L. Babiy, T.Ya.Ilkiv, Yu.V.Pylypets

The creation of digital tourist maps of cycling routes using GPS-logger is a modern step in the development of tourism, since this method is accessible and practical for all users and interested persons. It is also a new vector of researches in geoinformation technologies, because it represents modern methods of obtaining and processing spatial data and combining them with semantic information about objects.

In this paper we consider the method of creation of complete information tour guide with use of GPS-logger, which is relevant for using and downloading from the Everytrail service.

Технологические особенности создания цифровых туристических карт веломаршрутов с помощью GPS-логгер

Л.В.Бабий, Т.Я.Илькив, Ю.В.Пилипець

Создание цифровых туристических карт веломаршрутов с помощью GPS-логгер это современный шаг в развитии туризма поскольку данный метод доступен и практичен для всех пользователей и исполнителей. Также это новый вектор исследования в геоинформационных технологиях, потому представляет собой современные методы получения и обработки пространственных данных и сочетание их с семантической информацией об объектах.

В данной работе рассмотрена методика построения полноценного информационного туристического гида с использованием GPS-логгер, который является актуальным для пользования и загрузки с сервиса Everytrail.