

Geographic Information System (GIS) and the basics of sport maps for education

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ABSTRACT

This article presents an algorithm for creating the basics for sports maps with the possibility of further mapping using the free Geographic Information System (GIS). Modern education is hard to imagine without gaining practical skills and abilities that are difficult to obtain only in the classrooms of the school. Training that forms practical competencies is more effective. However, the deficit of appropriate cartographic material, namely the quality sports maps, prevents such training sessions for students. Using GIS technology and remote sensing technology, you can easily combine the skills of orienteering and skills of using geoinformation methods in the educational process. With the help of SASPlanet GIS, the available free space images of the territory are analysed, the best ones are selected and saved as a 'base map' in the appropriate projection and coordinate system with a georeferences file. The OpenOrienteering Mapper GIS has all the tools available to geotag a base map, create a base, and then create a sports map. Moreover, this GIS has the ability not only to create a map, but also to plan distances and prepare sports maps for printing. Both programs are completely free and available in many languages.

KEYWORDS

orienteering, sport map, GIS, education, geography

Introduction

An access to the Internet speeds up the retrieval of information, which depends primarily on the Internet connection. When we talk about geography or geogra-

pher, there are usually associated with maps. Gaining skills and abilities is much more difficult process here, there are those that can be obtained only by 'live' experience. For example, online you can learn basic terms to determine location, find the highest point, calculate the curvature of the surface etc., but learning learning to use a compass and navigate the terrain "online" is quite difficult. A modern geography teacher is not only a "cabinet geographer" who knows everything about geography, but also a teacher who can manage a tourist and geographical and local history club, organise competitions in sports tourism, and be a guide. Orienteering is an example of combining geography and personal physical development. This combination is not difficult to organise in the area surrounding the school. The main obstacle is the lack of appropriate cartographic material, namely – a quality sports map. Thanks to GIS-technologies, it becomes possible to organise such types of classes. During the last ones on the territory of the Taras Shevchenko National University of Kyiv (KNU) campus on the map, under our guidance, created by a master's student of the Department of Geography of Ukraine, a competition in orienteering was organised. In 2020, students of the Department of Geography of Ukraine master the skills of creating sports maps for the purposes of orienteering and tourism. Therefore, the purpose of this article is to present the disclosure of the algorithm for preparing the basis for the creation of sports maps using GIS SASPlanet and OpenOrienteering Mapper.

Methods

The research methodology is based on the analysis and generalisation of geoinformation software for the creation of sports maps, analysis of the applicability of satellite imagery resources of the territory of Ukraine and other cartographic materials. The GIS mapping method was used – from the selection of the optimal projection and the corresponding coordinate system to the creation of a sports map in the OpenOrienteering Mapper program.

Results

Orienteering is a sport is a sport in which participants move independently (orient themselves) from start to finish, using only a map and compass (Rule, 2016). And on the other hand, it is a type of recreational activity in which not only sports and physical components are important, but also intellectual ones – to be able

to correctly “read” the map, determine the optimal way and overcome it most effectively. For example, Hannah Eber, world champion and Olympic biathlon champion, notes the importance of engaging in various sports. So, orienteering taught her to be always focused, keep high speed all the time and plan her actions during biathlon competitions. Moreover, in the United Kingdom and the Nordic countries, orienteering is given considerable attention because it replaces physical education classes with orienteering classes. After all, physical, intellectual and recreational components are combined here. Orienteering is also a sport in which there is almost no age range. Thus, the youngest is the age group up to 10 years, and the oldest – 75 and older.

The main problem limiting the growth of this type of activity in the education system is the lack of appropriate cartographic material. A sports map (orienteering map) is a topographic map with additional symbols applied to facilitate orienteering (Specification, 2019). Of course, this is a generalised definition, because, in addition to the specifics of the use of colours (to mark the possibility of the territory), certain symbols, on such maps, the application of horizontals is allowed more freely, to more accurately reflect the terrain and so on.

In addition, sports maps are made on a very large scale (1: 4000 – 1: 20000), differ depending on what type of orientation they belong to (for example, on a sports map when orienteering on a bicycle more highlight the paths and mark the fallen trees on paths). Of course, to create a sports map of the forest, even with moderately dissected terrain, to organise competitions in the middle distance requires enough time and the appropriate level of qualification. All educational institutions are located within the settlements and occupy a small area. In such an area can be neglected terrain and a slight difference in altitude will not significantly affect the choice of route, the area is easily deciphered from space images, scale 1:4000 – 1:5000. The algorithm for creating a basis for a sports map (Figure 1) was developed on its own practical experience, work (Bobrysheva and Gryniuk, 2016) and the work of cartographer Mazur (2016, 2020) from his personal blog. It should be noted that the algorithm itself does not depend on the territory selected for mapping.



Figure 1. Algorithm for creating a basis for a sports card

A satellite image of the territory (using separate services EO Browser, SASPlan) can be chosen. This solution allows not only view all available topographic, satellite and other materials for a specific area, but also save them in a drawing format with reference to the selected projection and coordinate system.

The main advantage of this program is free access and concentration of all functions together. The latest for the study area are satellite images from Google and Bing, which can be used for non-commercial use. The latest image of the territory is selected, as well as attention is paid to weather conditions (clouds), seasons and exposure of the territory. The left image is newer, but, at the same time, the exposition of the skyscraper captures the northeastern part of the territory, and almost no deciphered trails (Figure 2).

All this affects the speed and quality of map creation. Of course, it is possible to use two or three satellite images, for example, “Maxar” provides images of the Faculty of Geography KNU taken in the summer (relevant for the reflection of vegetation), but older.



Figure 2. The Faculty of Geography KNU the pictures Bing (left) and Google (right)

Saving the image in jpg format and using the scale Z 19–20, which is enough to create maps at a scale of 1:15 000 to 1:4 000 is recommended. After all, when mapping an urban area, image quality plays an important role. Using a scale larger than Z 20 significantly increases the file size and has almost no effect on image quality. An important point when saving and “gluing” the image is the choice of projection (Mercator / WGS84 / EPSG:3395 – this projection is best for

further work in the program OpenOrienteering Mapper) and save the file attachment (word document – shot ext). Such solution leads to work with image in the GIS program and make the correct georeference.

Geotagging is a very important part of preparing for mapping. OpenOrienteering Mapper is a multi-module software that allows to create, edit, prepare, and print sports maps. It combines the properties of both GIS programs and programs for working with vector graphics, such as OCAD, QGIS, CorelDraw, Adobe Illustrator. Most programs are paid, at the same time OpenOrienteering Mapper – free and with support for 27 languages (Ukrainian localization was one of the first), works on almost all platforms except IOS. In addition, this software allows to clearly perform geo-binding in automatic mode, you only need to enter a certain value of the magnetic declination, which is obtained from the service of the National Oceanic and Atmospheric Administration (Figure 3).

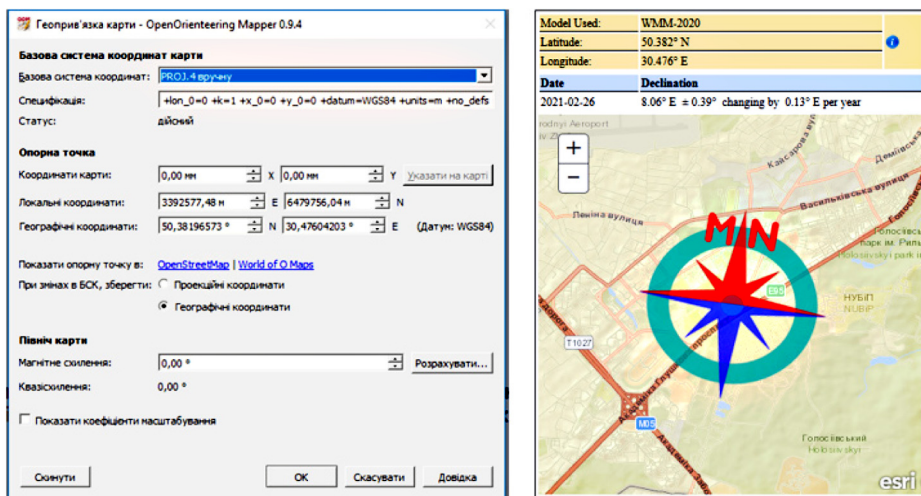


Figure 3. Geotagging the image

As a result of all the above actions, it is possible to get a completely ready basis for creating sports maps in the program OpenOrienteering Mapper (Figure 4).

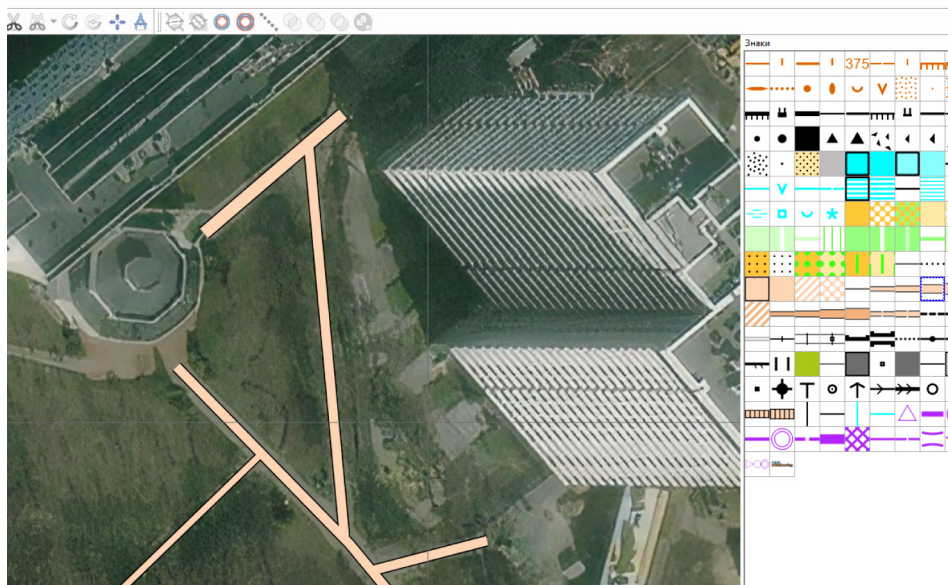


Figure 4. Map basis (The Faculty of Geography KNU) in OpenOrienteering Mapper

The advantage of using this geographic information software is that it is completely free, it can be installed on a personal computer, smartphone, or tablet (with Android operating system only). In the latter case, this software can be used to update the map in the open area and make changes to the map immediately on the ground.

To sum up: OpenOrienteering Mapper has all the tools for preparing a sports map or to create own sports sign.

Conclusions

Thus, orienteering is a sport, but it can also be considered as a recreational activity or hobby. At the same time, the experience of the Scandinavian countries shows that this can be a great addition or replacement for physical education lessons.

After all, orientation not only has a positive effect on physical condition, but also develops memory (location of key objects on the map) and logic (choosing the most optimal route), helps in concentration (finding your place on the map) and monitoring the environment. And it is through orientation that we can inter-

est children in a healthy lifestyle and positively influence their development. But the lack of sports maps of the school territory makes this aspect impossible.

Боярський академічний ліцей "Гармонія"



Figure 5. Sample map and distance in orienteering at Boyarka Academic Lyceum “Harmony” (from the report of a second-year student of the group “secondary education”; see Andriichenko, 2020)

At the same time, creating a sports map of the school territory is not difficult, because the appropriate software for creating maps is freely available.

OpenOrienteering Mapper is the software for creating sports maps. In 2020, second-year students majoring in “Secondary Education (Geography)” during their professional practice were not only creating maps, but also developed distance orienteering projects (Figure 5).

These maps can be used during the relevant pedagogical practice in a secondary school. It is easy to explain the relevant content, show the basic principles of orientation not in the classroom, but in an open area. Finally, they are useful to hold a simple competition for the school championship.

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