POSSIBILITIES OF REMOTE SENSING METHODS FOR THE FORMATION OF THE INFORMATION STRUCTURE OF THE TOURIST BUSINESS

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Abstract. The expediency of remote sensing methods application for information support of tourism is shown. Examples are given of the use of laser scanning technology, digital shooting with UAS and 3D modeling developed at Siberian State University of Geosystems and Technologies (SSUGT).

Key words: Information support of tourism, laser scanning, 3D model, UAV, Remote Sensing technologies

Information support of tourism is one of the important factors in the development of this sphere, we note the fundamentally important changes that have occurred in the field of methods of obtaining information using remote sensing. Firstly - the development of space multispectral imagery and obtaining images with a resolution of better than one meter, and secondly – the development of unmanned aerial vehicles and the ability to obtain color images of any objects, and the ability to perform indoor shooting. Thirdly, the development of terrestrial and air laser imagery and the acquisition of high-precision spatial models of any objects.

Global projects, such as Google Earth, certainly play a important role in the information support of world tourism. At the same time, there are local problems arising in the development of "local" business: advertising places that are not yet traditional and known for world tourism.

The development of tourism in Russia is closely connected with the expansion of accessible information about "unexplored" places for tourists, and this depends on the availability of information. Obtaining such information and building attractive tourist models on its basis, using the capabilities of modern remote sensing tools, is an important task. We will give novel remote sensing technologies for the creation tourism information model.

Laser scanning. At present, the development of excursion routes inside caves and various underground structures is becoming more extended. When developing such routes, there are three main problems:
- safety during excursions;
- detailed study of the dimensions of the aisles and compartments of structures for the unhindered passage of tourists;
- compilation of safety passports for sightseeing routes.

To solve these problems, the most effective method of collecting metric and semantic data is terrestrial laser scanning, which is caused by the following advantages [1-2]:
- the possibility of using in extremely dangerous and inaccessible areas without harm or harm to human health;
- possibility total darkness;
- the ability to promptly adjust the work program directly when shooting, using ledges, niches, crevices;
- obtaining data with a high degree of detail.

So the 3D model of Piusa cave was received in Estonia, which was closed to visitors in 2006, but thanks to laser scanning is available for a virtual visit. 3D model of the Denisova cave in the Altai was obtained by laser scanning in 2012.

Practical experience of doing such work has shown the effectiveness of the developed method of laser scanning of data collection on underground structures and caves for the compilation of tourist routes (Fig. 1).
For the construction, which have a large number of unique protruding parts, a special technique for combining scans by overlapping zones-scans of triangulation, which does not require the determination of reference points is developed [1].

![Figure 1. Example of creating a 3D model of an abandoned tunnel](image)

This workflow technology is also applicable for collecting metric data for indoor navigation. Construction of 3D models of tourist objects based on digital aero and land survey. To create 3D models of hotel complexes and the adjacent territory, as well as places for visiting tourists (monuments, parks, reserved places, etc.), a special technology for surveying and creating realistic 3D measuring models has been developed [2]. Such models allow not only to consider three-dimensional models, but also to measure objects, determine their size, distance between objects. Figure 2 shows the various models of the Golden Valley Hotel (Novosibirsk), derived from space, aerial and terrestrial surveys.
The use of unmanned aerial systems (UAS) to perform surveys of tourist sites to obtain detailed plans (ortho imageries) and spatial models of tourist sites and tourist routes.

Such information is advisable to have in the organization and implementation of sightseeing routes; 3D models are useful for climbers, water tourism - rafting, for park and reserved areas.

As an example of the use of UAS for the modeling of tourist sites- the Zashiver Church, established in the academic town of Novosibirsk, which is an open-air museum. The church is the oldest object of wooden architecture in Siberia. The survey was carried out in 2016 by the specialists of SSUGT with the use of a multi-rotor ALS DJI Phantom 3 (Figure 3).
The detailed information about the objects of tourism (especially little known) will contribute to the competitiveness of the tourism business in Russia and other countries developing new routes for little-known territories.

References

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