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AUGMENTED REALITY AND GIS

The popularity of GIS technologies in general, and augmented reality technologies in particular, is currently on the rise for various tasks in the professional GIS field. Works, which previously were technically difficult or impossible at all, are now available thanks to the introduction of Augmented Reality technologies. Thus, this work is relevant due to the fact that augmented reality technologies are innovative and can significantly improve the quality of work, as well as the convenience of their implementation.

Augmented reality is a modern technology that overlays computer-generated virtual information onto the real world and is a branch of virtual reality technology. AR enhances users' perception of the real world and provides a new way to communicate with the world.

There are two basic definitions of augmented reality. One is proposed by P. Milgram and F. Kisino: augmented reality is a space between reality and virtuality (closer to reality). The second definition was suggested by Ronald Azuma: augmented reality is a system that combines virtual and real, interacts in real-time and operates in 3D.

Computer vision technologies are widely used in augmented reality technology. AR equipment provides the function of improving and augmenting normal human vision. Typical tasks include such tasks as automatic identification and tracking of objects; autonomous tracking, and 3D modeling of the surrounding real scene. To display and interact with augmented reality scenes, which are the product of fusion of images obtained with cameras and virtual objects, technological devices such as: Google Glass, Microsoft HoloLens, Magic Leap One, Meta 2, NextMind, Microsoft RoomAlive are used.

Scientists, researchers and developers continue to work tirelessly on the development of AR in order to make it possible to apply this technology in such fields as: geographic information systems and urban planning, industrial production and service, marketing and sales, medicine, military, film and television, entertainment, video game industry, educational sphere, restoration of historical monuments and values, maintenance and design of communication networks

In the field of GIS technology, three-dimensional models displayed on top of the real scene have many applications, from general planning and analysis of city development to assisting in timely response in emergency situations. When three-dimensional models can be combined with virtual or augmented reality, it is easier for users to become familiar with the objects they see.

An example of the use of augmented reality would be to make a three-dimensional image of a building and combine the resulting image with an emergency evacuation plan in case of a fire. The resulting augmented reality model can be used to train all building users in case of emergencies, as well as to provide additional assistance to firefighters.

The 3D Live Scanner application developed by the independent studio "Lubos Vonasek Programmierung" is designed to scan various objects or the environment and then reconstruct them in real time. The software works thanks to the AR-module embedded in the mobile device. The resulting models can also be used in various augmented and virtual reality projects. For example, if you have the necessary hardware, you can create a miniature model of a city or settlement.

LandscapAR is an application developed using augmented reality technology. The application allows users to create virtual islands and landscapes, based on elevation pattern data drawn by the user. The method of artificial keypoint recognition is used for tracking. LandscapAR allows creating

landscapes of different levels of complexity, from simple elevations to complex mountain systems.

Considering the conducted research, we can say that the relevance of AR-technologies in the field of GIS and related areas is obvious. Augmented reality is currently one of the most advanced technologies in the world. This also leads to the fact that leading technology companies such as Google, Samsung, Apple, Meta and Amazon invest time and money in the development and popularization of augmented reality. As the level of technological progress develops, augmented reality technologies will become more and more promising, useful, and in demand by professionals and ordinary users alike.