

Using of augmented reality for environmental monitoring

Many cutting-edge researches are focused on the development of environmental technologies and the search for alternative, environment-friendly energy resources. The humanity diligently monitors the environmental condition of the planet from satellites, using advanced technology of environmental monitoring, measures the amount of harmful emissions from factories, and monitors the purity of the oceans. There are several methods of environmental monitoring: remote, physico-chemical and geographical. All these methods use ecomonitoring data methods of computational and mathematical biology (including mathematical modeling) and a wide range of information technologies for the data processing. Modern monitoring tools allow collecting large amounts of data. Then there arises a new problem. How can we visualize these data to timely identify dangerous trends and unexpected changes? How can we avoid information overload while not limiting access to all the data? In other words there is the problem of data visualization. With the current pace of development of information technologies there are several options for the development of methods of processing the monitoring data [2].

Firstly, there is a technology of virtual reality. Virtual reality create by technical means a world, in which a person feels close to how they feel in the real world. The degree of the freedom of behavior and perception of a human in virtual reality is called the degree of immersion [4]. Technical means to achieve this technology are the virtual reality helmets, special screens, system for tracking movements of body, head, eyes, virtual reality gloves, 3D controllers, etc. Such devices can also be used in augmented reality technology, which in our day, along with the technology of virtual reality, exists and is actively developed.

Augmented reality is an environment with direct or indirect addition of digital data to the image of the real world in real time with the help of computing devices – tablet PCs, smart phones and innovative gadgets and specialized software. Despite the name, this technology is able not only to complement the surrounding world objects in the virtual world but to remove some objects from it as well. In other words, possibilities of augmented reality technologies are limited only by the capabilities of the respective devices and software. However, today all or almost all decisions based on augmented reality have exclusively the functionality in its name, that is, adding data [4].

Augmented reality is already being successfully used in military applications, entertainment and education (see overview of educational applications in [3]). Advanced development of augmented reality technology can be applied successfully to environmental monitoring. It just need to adapt existing models of monitoring for this technology.

Gadgets that use augmented reality technology contain a software which can support a variety of applications. An example of such a gadget is Hololens augmented reality glasses, based on the Windows 10 operating system [1]. In this case, we consider the use of augmented reality glasses and the ability to use them to simulate a model of ecological conditions of the environment. The solution of this problem would be creation of special applications, which parameters would include the opportunity to visualize points environmental pollution, indicate the components that make up the pollution and their percentage with different colors on the glasses' screen. Such devices can be used not only with visual interface, but also with gestures and voice commands. With their help, it will be possible to zoom in the object or area of pollution to see more detail and more detailed data. Or vice versa, zoom out the object to assess the extent of contamination. It is also advisable to supply the application with function of prediction, so that you can clearly see the dynamics of pollution at specific emissions, access on-line databases of maximum permissible emissions and maximum allowable concentrations, geo-location and wind rose data. Already existing

developments in eco-analysis of data would simplify this task. Using available hardware for augmented reality and adapting them to display the collected environmental data we would get accessible and fast way to monitor without the need to build additional devices and equipment.

Advantages of this technology are compactness, visibility, advanced functionality (you can clearly see the sources of pollution and the relationship between them, which may not be obvious in the tabular data analysis), if you turn up the zoom function, you can get more accurate readings. The disadvantage is cost of equipment which is still high.

In the future the technologies of virtual and augmented reality will help people organize and visualize the collected data on the ecological state of the environment and allow to model the «what if» scenarios and to simulate results in such visual form that will facilitate quick and correct decisions.

References

1. The era of holographic computing is here. [Электронный ресурс] URL: <https://www.microsoft.com/microsoft-hololens/en-us>
2. Методы экологического мониторинга [Электронный ресурс] URL: <http://dic.academic.ru/dic.nsf/ruwiki/596098>
3. Н.Н. Зильберман, В.А. Сербин Возможности использования приложений дополненной реальности в образовании Открытое и дистанционное образование. – Томск, 2014. – № 4(56). С. 28–33. URL: http://www.huminf.tsu.ru/wordpress/wp-content/uploads/serbin_va-zilberman_nn/2014/возможности-использования-приложений-дополненной-реальности-в-образовании.pdf
4. Что такое дополненная реальность. [Электронный ресурс] URL: <http://arnext.ru/dopolnennaya-realnost>

Scientific supervisor: D.V. Shepetovsky, Senior teacher, TPU (Tomsk polytechnic university), Russia