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Обзор технологии «Дополненная реальность»

В статье рассматривается технология дополненной реальности, описаны принципы работы, компоненты для реализации, сравнение данной технологии с виртуальной реальностью. Рассмотрены существующие реализации приложений на основе дополненной реальности. Предоставлена информация о перспективах развития технологии.

Overview of Augmented Reality Technology

In summer 2016, a game called Pokémon Go became extremely popular worldwide. Nice 3D models of fantastic creatures overlaid real world's view from a smartphone or tablet camera and interacted with users. A technology that allows to implement this concept is called augmented reality or AR.

AR lets virtual objects to be placed on top of the real world's image in real-time. The result of this process is enhanced information about the world around us. Information can be presented in different ways, such as text or pictures. Devices with a camera and a display, as well as applications with AR logic are required for this technology.

In spite of the fact that AR has gained its popularity not so long ago, the first attempt of using this technology was made in 1968 when computer scientist Ivan Sutherland developed the first head-mounted display system called 'The Sword of Damocles'. The system used computer-generated graphics to show users simple wireframe drawings. One of the first functional AR systems used in daily life was displaying the yellow first down line seen by TV viewers during an American football match in 1998.

Nowadays, as different technologies have been spreading everywhere, there is a common misunderstanding of two terms: *virtual reality* and *augmented reality*. They are similar in a way that their output is visual information. While the concept of augmentation is to add information to the original scene, virtual reality completely changes the world around, though it interacts with it as well as AR. The user is isolated from the reality and can have experiences impossible in his current circumstances, such as flying on a plane or riding on a roller coaster.

For enhancing information, AR uses plain text, graphs, pictures, 3D models and even sound. The important thing in it is that visual components interact with real environment in real time. When the environment changes, the graphic elements change, too. Text and images can appear or disappear, change their position and angles. Graphs can update values of their subject every period of time. But the full potential of the technology is revealed through the usage of 3D models. Three-dimensional models can be rendered from any angle of the device's position that creates an effect of model's presence in the real world.

Real-time interaction implies immediate changes of a model after the change in the environment. This can be achieved with a help of a device's sensors, such as an accelerometer that measures the device's movement and orientation, a gyroscope that measures angular rotation in the inertial frame, and a magnetometer that can determine cardinal points. Almost all smartphones and tablets have these. More complicated devices use depth sensors, and that gives the ability to operate with actual sizes. On obtaining the required input data, the model is rendered accordingly.

In some cases, when augmentation takes place in more responsible areas, such as industrial environments, hand devices become uncomfortable to use. It would be better if information appeared right before a person's eyes and a job could be done manually. In this case, helmets and glasses, combined under a category of head-mounted displays, could be a solution. Microsoft and DAQRI are the leaders in the production of such tools. Microsoft presented HoloLens [5], Windows 10-based glasses with a wide range of sensors. HoloLens glasses create holograms that can be controlled by head movements, gestures and voice commands. They are mostly used in entertainment and business spheres. The company sells the device even though it is under development.

DAQRI is a company that builds AR devices for industrial use, and smart helmets occupy a major part in the range of their products [3]. Equipped with powerful processor, high-speed wide-angle camera and a thermal camera, this DAQRI helmet can quickly locate thermal anomalies of any industrial facilities and place it on a display.

Each AR application has its own logic responsible for object recognition, tracking and rendering of the model, as well as for calculating the user's viewpoint. There are several toolkits for the development of such apps. Vuforia, augmented reality software development kit, is one of leading programming tools for creating AR applications [2]. Another perspective one is ARToolKit [1]. Both of them use computer vision algorithms for recognizing objects and the Unity game engine.

There are a lot of spheres where AR brings improvements. Commerce and marketing are two of them. This technology is widely used here, and one of the areas employs image scanning. Customers are able to see what lies inside a package before unfolding it by means of scanning a product's scheme or image, for example, a complex constructor or household appliances. The device recognizes the image and creates a 3D model of the product.

The process of ‘trying on’ products is another area of application. It is designed for clothes, shoes, accessories and furniture online stores. Customers can try on any things in the store’s assortment virtually – whether clothes fit on a certain part of the body, or whether the furniture can be placed on the given surfaces (floor and walls). IKEA, a leading home furnishing retailer, did a major breakthrough in 2014 by releasing their catalogues loaded with extended digital content. The readers had to download their IKEA Catalog app, and scan special pages with their device. Such features as 360° room views, tips and videos improve the perception of products and make experience more enthralling. The app also allows to place furniture models in a room.

One of the most significant benefits that AR brings into manufacturing is simplifying the process of working with complex industrial equipment. Using of the technology reduces time spent on training for manipulating, assembling or refitting different facilities. This can be achieved by providing real time information about the parts of such facilities, such as cables, buttons, components and by giving instructions or manuals about operation details within a person’s field of view. This means that using augmented reality allows people with minimum amount of training do their jobs consistently well, which reduces costs spent on their training.

AR technologies can also be used for detecting defects and problems in the machines. The following popular companies use augmented reality on a daily basis: Bosch, that actively uses it for training and education with Oculus Rift headset, and Lockheed, where the engineers train to assemble F-35 aircrafts by means of AR glasses.

Head-up displays, which also can be thought of as augmentation technology, came from military aviation, where pilots were able to see navigational information on the aircraft windshields. A bit later it came to use in commercial aircrafts and automobiles. DAQRI offers a smart display for automobiles that places information about a car’s speed, weather and road conditions on a windshield, and this gives safe and more enhanced driving experience.

Besides Pokémon Go application, in 2016 there were several popular apps that use augmented reality for entertaining. These are Snapchat and MSQRD; both recognize human face and overlay it with various effects, such as cat or dog masks, beards, hats and so on. The Snapchat app also uses sound effects.

There are also areas where the augmented reality is less implemented. Nevertheless, they have great potential. Tourism is one of them. When no guide is available, travelers can be entertained by a virtual one. After recognizing some place of interest, the display can show the information about it. Tourism is a sphere where sound augmentation is well suited, as audio information is always welcomed during sightseeing.

It is well known that visual representation of data makes it more memorable and captures attention. Therefore, education is another sphere that should be taken into account. A lot of objects are hard to explain in 2D, such as human anatomy, physics laws in action, and so on. And that is where AR helps. For example, it is capable of simulating processes that take place in a certain part of a human body or draw plots of math equations together with their solutions. AR can be combined with daily chores and healthy activities, so even the most tedious and routine tasks can turn into thrilling games.

According to Gartner, the world's leading information technology research and advisory company, all technologies have a hype cycle consisting of these segments: technology trigger, peak of inflated expectations, trough of disillusionment, slope of enlightenment, and plateau of productivity [4]. By June 2016 Augmented Reality had been considered being in the third stage. As compared to June 2005, it was not even reaching the peak of inflated expectations. This stage is characterized with waning of interest and fails of implementation, but gives time and ability to understand the technology limitations. In less than approximately five years AR will leave this area and pass into the next one, where its benefits will be widely understood but companies will still remain a bit cautious.

To sum up, augmented reality is a technology that has not revealed its full potential yet and is only becoming productive. There are plenty opportunities for AR developers in all spheres. AR can help to solve a wide range of tasks from education to manufacturing and promises to fill our daily life in the future.

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Создание безопасной социально-медийной среды в образовательном пространстве

В статье автор предлагает идею создания безопасной социально-медийной среды в образовательном пространстве. Также автором описываются основные положения безопасной социально-медийной среды и ожидаемые результаты. Приводится ряд особенностей безопасной социально-медийной среды и условия реализации в образовательном пространстве.