DOI: 10.35598/mcfpga.2023.006

Overview of Modern Augmented Reality Capabilities for Creating a Navigation Aid for the Blind

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***Abstract*—This work considers the prospects and possibilities of using augmented reality to create a portable navigation assistant for the blind, the hardware requirements for working with ARCore.**

Keywords—ARCore, augmented reality, Google, smartphone, styling.

I. Introduction

Augmented reality is a technology that adds the ability to use a computer to perceive elements that are absent in the natural perception of a person. This type of task relies on various algorithms to determine the position of the device and / or user in space and the subsequent reconstruction of a three-dimensional scene, in which virtual objects are added. Google's ARCore framework provides the ability to determine the depth of a scene.

According to the WHO, there are at least 39 million blind people in the world. They are severely limited in mobility. Mobility should be seen as the possibility of free movement, independent of outside assistance. To increase it, you need a portable navigation assistant. The methods underlying AR and their implementation in frameworks open up new possibilities for creating such devices [1].

II. Types of Augmented Reality

Augmented reality includes two types of technology. Let's consider them in more detail.

A. Marker based AR

The first attempts to create augmented reality worked on the basis of markers . Additional content loaded on top of or near the markers. The marker is an object known to the application, such as an image, logo, or sound. The most commonly used QR code. The limitation is that this type of augmented reality can only be used with a smartphone [2, 3].

Marker augmented reality solves the problem of Perspective -n- Point - restoring points in 3D space by their perspective projection onto the device's camera plane. Thanks to it, you can restore the position of the phone relative to the picture from the camera.

B. AR without markers

This type of augmented reality uses various hardware sensors for orientation, such as a camera, global positioning systems (GPS , GLONASS, etc.), a compass, a gyroscope, an accelerometer, or depth sensors.

Based on information from available sensors, simultaneous localization and mapping (SLAM) is applied to scan the environment and generate appropriate maps for the placement of virtual objects. SLAM scans the environment and creates 3D placement maps of virtual objects , even if the objects are not in the user's field of view, do not move as the user moves, and the user does not need to scan new images.

Thus, this technology is able to detect objects or feature points in a scene without prior knowledge of the environment, for example, it can identify walls or intersection points. It is a technology that is characterized by association with the visual effect of combining computer graphics with images of the real world.

The first systems using this type of AR used the location and hardware services of the device to interact with the resources provided by the AR software in such a way that the location and orientation of the user in the space where he was determined [3].

III. Overview of the ARCore Framework and Hardware Support

At the moment, there are two frameworks that allow integrating AR capabilities into the application . These are Google 's ARCore and Apple 's ARKit . ARCore is now available for Android , Android NDK, Unity for Android , Unity for iOS , iOS , Unreal Engine .

The most interesting features of ARCore in the context of the development of portable navigation aids for the blind is the internal implementation of SLAM algorithms, which allows you to get a depth map and geospatial navigation that allows you to use links to Google street view.

API change that now uses 16 bits per pixel to represent depth, which increased the maximum depth from 8 meters to 65 meters. Depth values are measured in millimeters [4].

Geospatial anchors can improve navigation accuracy in cities through integration with Google street view. They would be of interest for building advanced GPS- based navigation .

You can't bypass the hardware either. Not all smartphones support the required depth API. Without them, basic functions like surface detection are available, which are not able to provide the required accuracy.

Unfortunately, devices of recent years do not have a hardware ToF depth sensor. Manufacturers were forced to abandon their use due to low interest from users. ToF camera is available and supported in several LG, Samsung and Sharp models .

API support must be checked for each model according to the list on the official ARCore page. It is constantly expanding and updating.

IV. CONCLUSION

Despite the fact that after the Second World War, more than 40 different systems were created, of which only 13 reached the stage of a commercial product [5]. Nothing is known about them in Ukraine. In underdeveloped countries, the situation is even worse. Blind people have little or no government support.

Taking into account the fact that the ultimate goal is the creation of a navigational assistant for the blind [6], it is necessary to take into account the realities of Ukraine. The material security of this category is low, so we can assume the possibility of acquiring a suitable smartphone with depth support API in the secondary market. Nevertheless, there is a laboratory base [7, 8] and experience in creating telemedicine services [9-11], which can be useful for developing such an assistant for visually impaired people.

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