

Using Augmented Reality Technologies for Mobile Application Development

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Abstract. This work is devoted to reviews of existing methods of working with AR and methods for its implementation. The second part of this work contains a description of the development of the interface for the prototype of the “Mendeleev's coin” information system. To create a 3D model of objects, the Unity program was used in conjunction with the augmented reality platform Vuforia. To test the performance, Android devices with average technical indicators were selected. The application compiled for testing showed stable operation.

1. Introduction

Augmented reality is a technology of adding, introducing into real life, into a three-dimensional field of human perception of virtual information, which is perceived as elements of real life. With quality content, a person blurs the line between reality and the artificially created world. Reality is expanding (or supplemented) by introducing virtual information into it. Augmented reality (AR) is a technology that allows you to transfer virtual images to real-world objects. The widespread use of mobile devices has led to the fact that now most users have instant access to AR-friendly devices. All you need is a smartphone connected to the Internet, a high-resolution screen and a viewfinder. Then, as a marketer or developer, you can create digital animations to overlay them with reality.

The world of augmented reality has the following properties: combines virtual and real, interacts in real time and works in 3D. To create augmented reality, the following are used: a processor, a display, a camera and position-determining electronics such as an accelerometer, GPS and a compass. A touch screen smartphone, for example, has the necessary kit so that the gadget owner plunges into the world of augmented reality. Augmented reality applications work as follows: a special label is used, the label is read by a mobile device or computer, a layer of additional information is played on the screen.

2. Main part

An augmented reality application “Mendeleev's coin” was developed, which, when the camera was aimed at an object, displayed our augmented drawing on its surface.

The first step for implementing this project is the question of choosing a development platform. Given the trendy trends, we have chosen the Unity platform. Unity allows you to create applications running under more than 20 different operating systems, including personal computers, game consoles, mobile devices, Internet applications and others. The next question in the implementation of the application is the choice of augmented reality platform. We liked the most under the name

Vuforia. It is an augmented reality platform and augmented reality software developer toolkit for mobile devices. Vuforia uses computer vision technology, as well as tracking flat images and simple three-dimensional real objects (for example, cubic) in real time. Devices implementing our AR project: mobile (tablets, smartphones) and stationary (TV, computer screen).

The possibilities of augmented reality technology are endless, it can be used in all areas of modern man's activity. Stages of the project:

1. Technical task.
2. Concept and elaboration of the scenario.
3. Prototyping low and high detail.
4. Application design and preparation of 3D models.
5. Programming.
6. Create an anchor point (label).
7. Testing.
8. Finalization.
9. Launch of the project.

3. Description of tools used during application implementation

There are many AR devices on the market, but the main goal of AR applications is the mobile space of platforms such as iOS and Android. This is where the combination of Unity and Vuforia is convenient - in cross-platform development. Another plus is that the application can be tested in the editor.

Unity is more than an engine; it is an environment for the development of computer games, which combines various software tools used to create software - a text editor, compiler, debugger, and so on. At the same time, due to ease of use, Unity makes creating games as simple and comfortable as possible, and the multi-platform engine allows game developers to cover as many gaming platforms and operating systems as possible. First of all, as we already mentioned, the Unity3D engine makes it possible to develop games without requiring any special knowledge. Here, a component-oriented approach is used, in which the developer creates objects (for example, the main character) and adds various components to them (for example, visual display of the character and ways to control him). Thanks to the convenient Drag & Drop interface and a functional graphical editor, the engine allows you to draw maps and arrange objects in real time and immediately test the result. The second advantage of the engine is the presence of a huge library of assets and plugins, with which you can significantly speed up the development process of the game. You can import and export them, add whole pieces to the game - levels, enemies, AI behavior patterns, and so on. No fuss with programming. The third strength of Unity 3D is its support for a huge number of platforms, technologies, and APIs. Games created on the engine can be easily ported between Windows, Android, iOS, to VR and AR devices.

Vuforia SDK is a software package that includes an augmented reality platform and augmented reality software developer toolkit (SDK - Software Development Kit) for using AR on mobile devices: tablets, smartphones and AR glasses for iOS, Android and UWP (Windows). Vuforia SDK is integrated with the Unity 3D "game engine" (freeware software, the most popular "game engine" to date), which greatly facilitates the development of AR applications.

Vuforia SDK provides (Figure 1 and Figure 2):

1. The simplicity of creating scenarios for working with AR objects based on the most popular and freely distributed AR "engine"
2. Unlimited reuse of 3D data
3. The possibility of using the "Digital Advisor" and "Digital Double"
4. Using a wide range of user devices (iOS, Android, UWP).

In order to add something to the real world, you need to "cling" to an object in this world. It is for this purpose that the targets serve. In other words, the target is a real object, knowing which our application can place virtual objects in the right places and corresponding proportions. Vuforia provides a wide selection of targets (Figure 3).

Image targets - the basic type of targets, which is a regular picture, for example, the cover of a

magazine, a photograph or a poster of a new film. The image serves as a kind of two-dimensional barcode, only without black and white regions. Using it, we can determine which picture got into the camera lens, as well as its location in space and scale. It is worth saying that not every picture is suitable for creating a target. Good targets are those in which there are many contrasting details. It is on these details that the support matrix is built for subsequent target recognition.

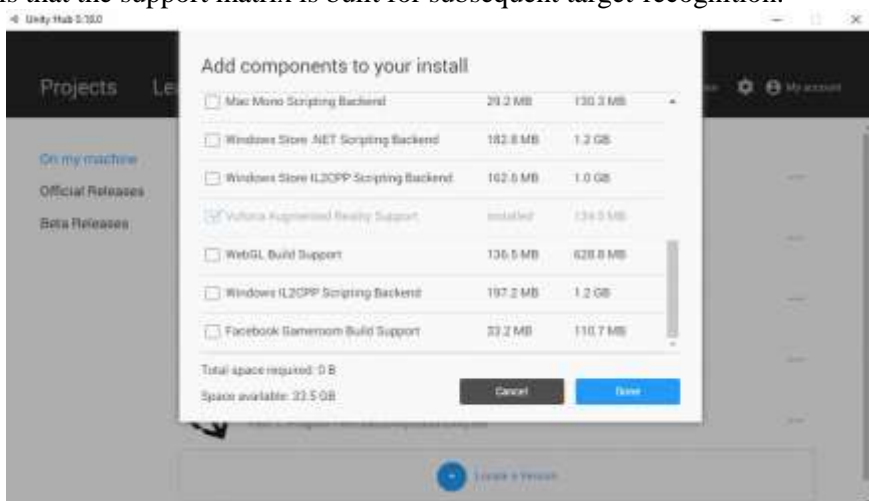


Figure 1. Adding Vuforia to a Unity project.

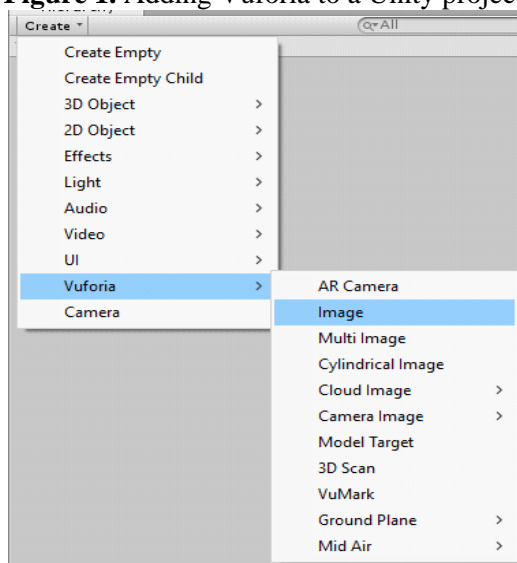


Figure 2. Adding targets to the Image Targets scene.

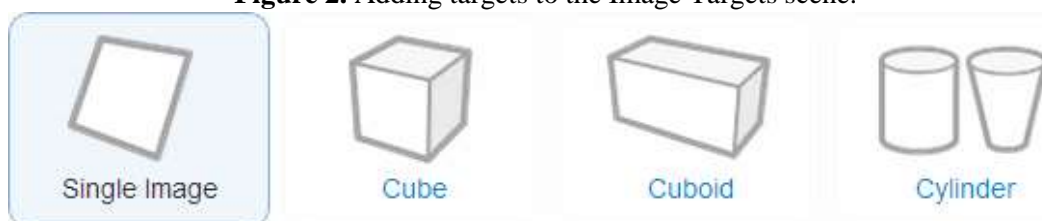


Figure 3. Adding targets.

Simple 3D targets (Cube and Cuboid) are targets in the form of rectangular parallelepipeds (including a cube). For example, a matchbox or just bought a board game can serve as such a target. Like any box, such a target consists of six planes, and to create it, we need six pictures for each of them. If you ever glued a cube of paper - then quickly cope with the task.

Cylinder targets - this type of target, despite the name, is a truncated cone with the ability to specify the diameters of the bases. Of course, if you choose the same diameters, you get just a

cylinder, but still this is a special case. In order to create such a target, we need to not only indicate the diameters of the bases and height, but also add three pictures - one for each of the two bases, and one more for the side surface.

Frame markers - this target in the form of a specially prepared frame, which is already much more like a barcode. You can put any picture in such a frame. This type of target is perfect if the picture was not detailed enough and you couldn't create a sensible image target from it.

Text (word targets). Text recognition is also built into the Vuforia library, so any word or combination of them can be a target.

Depending on the number of targets required for your application, you can either store them in the so-called Device Database, always have access to them and recognize them directly on the device itself, or transfer some of this load to Cloud Databases - a service from the Vuforia Web Services suite designed to store targets and determine them based on the data sent from the device. Both approaches have their pros and cons, but deciding on the goals of your application will not be so difficult to choose.

In addition, targets can be created directly from the application itself using the picture received from the camera. It is also worth noting that QCAR does not require the entire target to hit the frame. In order to recognize and use it, only parts will be enough. This is very important and allows you to view all the magic of your application from a variety of angles.

Static and dynamic 3D models. We can add any 3D object from a simple object to complex animation. Vuforia actively supports the ability to integrate with Unity, which further unties our hands. We are limited only by the imagination and power of smartphones / tablets.

Virtual buttons to interact with which will have to be quite real objects. For example, it can be a button on your target, clicking on which launches a virtual air

Videos and pictures that allow us to replace our target or make it a little more lively.

Changing the background, among other things, you can change the picture itself received from the camera. In other words, we can not only supplement the picture, but also operate with it ourselves.

4. Project Test Results.

Testing was carried out in 3 stages:

1. Testing Vuforia Technology
2. Performance Testing
3. Testing the finished application.



Figure 4. Virtual picture “Mendeleev's coin”.

Testing of the technology itself took place over a two-day period, we studied the main aspects of working with this module, as well as its capabilities and ease of design. Vuforia combines all the necessary qualities, which is why this technology was chosen for development. To test the performance, Android devices with average technical indicators were selected. The application

compiled for testing showed stable operation. After developing the application, we conducted control testing, which consisted of finding bugs, errors and identifying potential problems. All flaws and shortcomings were identified and eliminated. The final version of the application solves all the tasks assigned to the project. The result of the finished application (Figure 4).

5. Conclusion

In the work, an overview of object recognition methods was conducted and the best method for implementing applications was selected, a prototype of applications, its properties and features for developing for Android in the Unity development environment were described. An augmented reality application “Mendeleev's coin” was developed, which, when the camera was aimed at an object, displayed our augmented drawing on its surface.

The implementation of augmented reality in consumer products requires considering the design of the applications and the related constraints of the technology platform. Since AR systems rely heavily on the immersion of the user and the interaction between the user and the system, design can facilitate the adoption of virtuality. The technologies underlying augmented reality headsets and software are advancing all the time. They're getting smaller, lighter, more detailed, and more credible by the day. Augmented reality looks set to revolutionize on-the-job training, and enhance the abilities of designers, artists, retailers, game developers, and office workers.

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