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RESEARCH ARTICLE

EDUCATION of BRAIN FUNCTIONS with AUGMENTED REALITY for DISABLED PEOPLE

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ABSTRACT

In recent years, it has been possible to prepare very important studies in the field of education by using Augmented Reality technology. With this technology, video, graphics, sound and three-dimensional models are used in the environment of physical objects in the real world. Today, Augmented Reality technology is used in industry, education, medicine, logistics, industry, etc. are frequently used in the fields. Therefore, due to the development of applications in this field, technological devices have been enabled to communicate with their environment and acquire new information. In this study, an application has been developed to help disabled individuals understand the functions of their brain functions and to improve their learning abilities. In the application, the functions of brain functions are explained, thanks to the content activated with the help of a button that appears on the screen on any technological device. If a visually impaired person uses this application, brain functions are explained only with audio narration and animations. If a hearing-impaired individual uses it, brain functions are explained only with texts and animations. In this way, the learning abilities of the disabled are improved more easily and it is easier to understand the subjects.

Keywords: *Disabilities, Augmented Reality, Brain Dec, AR*

1. INTRODUCTION

Augmented Reality (AR) defines a function for using images, objects, locations, three-dimensional objects and videos created using computer hardware and software on a real world environment[1]. With Augmented Reality, video and images combined on real physical environments are decoded as part of the real world environment. Therefore, logistics, military, education, medicine, construction, health, etc. widely used in industries. The use of three-dimensional visual objects in AR studies attracts the attention of individuals with disabilities, enables them to participate more in training and motivates them to learn. It also offers a different perspective in the presentation of the subjects [1].

For AR, the first process to be created is the creation of videos, objects and images with application software that will be combined in real environments. These combined videos, objects, and images are often combined with three-dimensional objects [2].

The developed study was added to the dec application and combined with various location data, it was provided to work with real environments. It has also been made available for use with smartphones, tablets or technological devices so that the images created can be transferred to individuals with disabilities [2]. Thanks to the unique interaction feature provided by AR technologies, it is possible to gain significant advantages in developing some special abilities of the disabled that cannot be obtained with traditional studies [3]. The AR method helps people with disabilities learn about complex real-world issues. Astronomy, geography, medicine, biology, chemistry, physics, etc. It prepares a realistic understanding environment for the transfer of the subjects.

Thanks to the DEC application, it also improves the communication between the disabled individuals in an easy way by enabling them to perform the tasks they will perform on complex issues. It helps people with disabilities develop their imagination and creativity. AR can be used as a useful method for the learning or education of people with disabilities by improving their perception and interaction with this world in the real world.

In the second part of this study, there are details about AR. In the third chapter, information about the vuforia application used in this study is given. In the fourth chapter, the output samples and codes of the application developed for this study are given. In the fifth chapter, the conclusion part of this study is given and the results obtained from the application are explained.

2. MATERIAL and METHODS

2.1. Augmented Reality

Technologies used in AR studies also consist of optical and video-based technologies. The difference between these technologies is where the environment created by separating the virtual and real worlds is seen. The separation of the virtual and real world are the differences between virtual and real world environments. Scenes combined in video processes are deconstructed with the help of technological devices (mobile devices, tablets, computers, etc.), optics is a combination of studies and the integration of glasses with real environments is provided [2].

AR allows individuals with disabilities and educators to identify the knowledge and skills they have learned by combining their learning environments with the real worlds they live in[4].

AR applications are developed using one of three methods: marker-based, location-based and unsigned-based [5].

Marker-Based AR: It is created by placing virtual objects on images in real environments. It is the most used structure. Artoolkit, Vuforia, Wikitude, Layar etc. It is used with software development kits [5].

Location-Based AR: It is created to display the materials created in virtual environments using location or location information in real environments by being triggered at certain locations. It is more widely used in the tourism industry. ARtoolkit6 is used with Vuforia and Wikitude applications [5].

UnMarker-Based AR: It is used today with the help of new generation smart glasses. It involves the user in interacting with a real environment. Military, education, medicine, logistics, etc. It is used in many fields, especially in fields. ARKit, Vuforia, Wikitude, Vuforia, ARtoolkit6 etc. It is used with applications [5].

Hardware, software, marker and AR glasses are used in AR technologies, respectively. All work on hardware peripherals takes place with a computer infrastructure. Generally, high-performance technological devices are needed in terms of the speed of the work application for the creation and display of three-dimensional models in real environments. Hardware units that can be used for AR technology include Ipad, PC, Notebook etc. devices can be shown as an example [6]. In software peripherals, there is a need for an auxiliary surface that will decode the virtual and real environment together. Software companies offer these utilities as licensed software packages. Generally, a number of features are designed in the software of these companies to provide some convenience for AR. These usually consist of dec mobile application devices, modeling and markup tools, and web interface developers [5]. In marker peripherals, markers provide the spatial link between the real and virtual environment. While markers were created in 2-bit shapes when they were first applied, nowadays any real-life object can be displayed as a marker [6]. AR glasses allow the users of the application to decipher the virtual and real environment so that the data and images between the real and virtual environment can be used with each other [6]. AR technology has become a technology that can allow the use of mobile applications on textbooks [7]. Additions to the Unity program can be made by using different applications for modeling [8]. During the collection and analysis of information, one of the first goals of augmented reality is to highlight its specific features in the physical environment to provide a better understanding and to obtain intelligent and accessible interior images that can be achieved by applications in the physical environment [9].

2.2. Vuforia

In this study, which was developed with AR, in the first step, three-dimensional brain images and brain functions were created with the help of Unity program. These images were created with the 3DMAX program. The three-dimensional images added to the application were named Assets in the Unity program. Unity allows us to work with 3D images on the Asset Store page for free/paid. In this way, the images to be used were imported from this section and used easily. After creating our three-dimensional images, the parts that we will position on the page should be selected. Cameras, often called markers, were provided for these surfaces. When the cameras focus on these images, three-dimensional images and texts will be created on them. After selecting the markers, the Vuforia Sdk developer was chosen to use them in the work. The process image of the Vuforia Sdk developer was shown in Figure 1.

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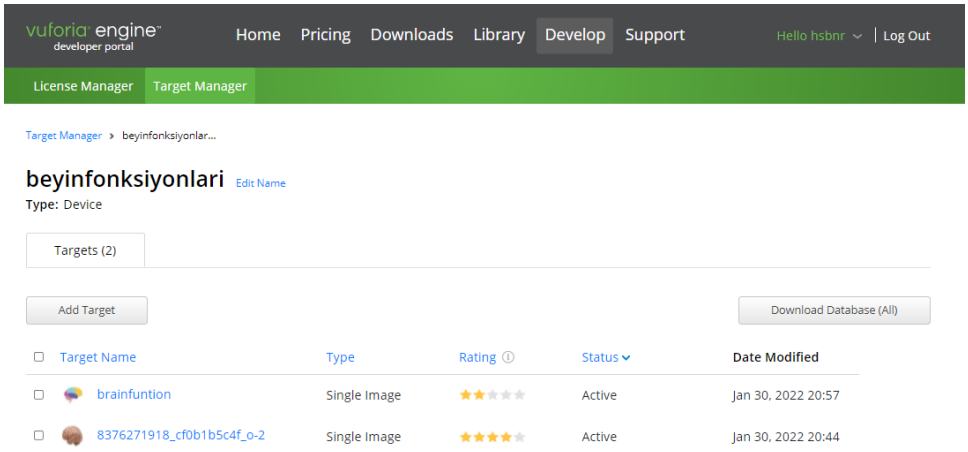

Figure 1. Vuforia database.

In order to create a database in Vuforia, a membership must be created on the web page in the first place. Then a key was created from the lower tab of the language key menu in the development section. The key provides the license key for the database portion of the AR application. A different key must be created for each application. The Vuforia object was also defined as a marker. For object images that received 5 stars in the evaluation of the object uploaded to Vuforia, it can be said that the tracking quality of the object is good. The more stars the marker receives, the higher the rate of evaluation of the marker.

3. EXPERIMENTAL WORK

Position and Marker Based AR was preferred in this study. While preparing this study, the widely used Vuforia SDK was used. Unity, Android Studio and Visual Studio were chosen as the development environment. Vuforia SDK was used with AR. Two buttons were placed on the home screen of this application, which was developed for disabled individuals. In the first button there are subtitled texts, animations and videos.

In the second button, brain functions are explained audibly. Both buttons used in the study have features such as 360 virtual tour rotation, enlargement and reduction with the visual created for brain functions in common. In this way, disabled individuals can see the important points they want to learn or comprehend for their brain functions from every angle. In this way, it was ensured that the attention of the disabled people was drawn more to the practice and it was aimed to improve their comprehension skills. C# codes for object enlargement, reduction and rotation written in Unity 3D application were shown in Figure 2.

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```
private void OnTrackingFound()
{
    Renderer[] rendererComponents = GetComponentsInChildren<Renderer>(true);
    Collider[] colliderComponents = GetComponentsInChildren<Collider>(true);
    foreach (Renderer component in rendererComponents)
    {
        component.enabled = true;
    }
    foreach (Collider component in colliderComponents)
    {
        component.enabled = true;
    }

    Debug.Log("Trackable " + mTrackableBehaviour.TrackableName + " found");
    if (mTrackableBehaviour.TrackableName == "2")
        TextTargetName.GetComponent<Text> ().text = "Limbik sistem ağrının d

}
```

Figure 2. Object zoom and rotate operations codes.

The screen output of the developed application was shown in Figure 3.

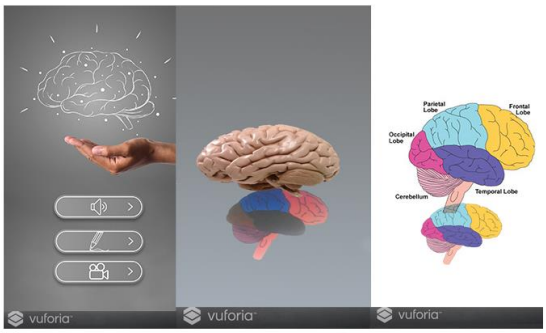

Figure 3. Application output (display of brain functions).

When the findings regarding the usefulness of this study, which was prepared for the training of brain functions for disabled individuals, were examined, it was determined that the disabled individuals could operate the application very easily and accurately by moving the markers. In addition, the easy usability, faster accessibility and use of this application with different technological devices have led to greater interest by disabled individuals and increased participation in the experimental study. Three-dimensional images, objects and information created by reading the points are planned to be more memorable by enlarging, reducing and rotating 360 degrees on these devices.

In the first button used in the application, brain functions and tasks were explained with sounds for the visually impaired. In the second button, the functions of the brain were explained in writing with the help of the cameras of technological devices for both hearing and other handicapped individuals. In the third button, animations and videos for all disabled individuals and brain functions were explained.

In the video in Figure 4, the brain functions of a hearing impaired individual using sign language were shown.

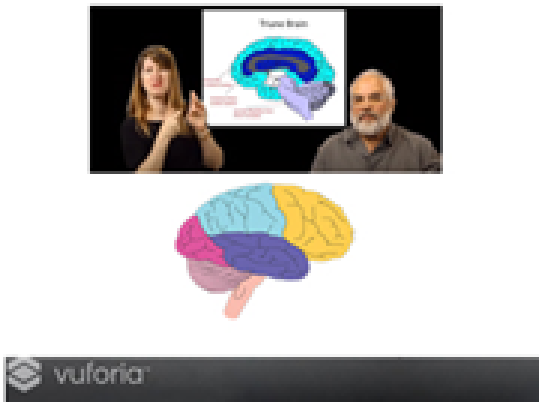

Figure 4. Video narration output for the hearing impaired.

4. CONCLUSIONS

This study has been prepared in order to facilitate the understanding and comprehension of educational information about brain functions for people with disabilities. In the application developed with AR technology, three-dimensional pictures of the brain and brain functions were mentioned and a more exploratory learning experience was offered to individuals with disabilities. Therefore, disabled individuals have experienced education in their own living environments by staying away from the risks of external environments with AR. It can also lead the development of more flexible practices according to the needs of disabled individuals and educators. This application will not only provide information or training, but also a better education will be provided to individuals with disabilities, with feedback on brain functions and course components, with the contributions of disabled individuals and trainers using this system. Today, when we take a break from face-to-face education due to Covid-19, such an application, especially in the field of education, helps people with disabilities to perceive their experiences and brain functions faster.

5. DISCUSSION

In this study, a more efficient and effective education environment has been prepared by using the AR method in applications for the education of the disabled. Since experimental and educational studies can be carried out on the real physical environment with AR technology, it is very easy to carry out their education with the disabled person in the environment they are in. One of the biggest shortcomings in this field is the lack of education materials and widespread use. It is thought that the prepared application can be an example for different researchers and can be developed. In future studies, it is planned to develop AR supported mobile applications in different fields.

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