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Augmented Reality to Study Human Anatomy

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Abstract: ***Many educators and developers all over the world research about the factors that influence a virtual school and student's efficiency learning. Furthermore, the growing interest for research on alternative methods of education in Medical Schools, led to the use of videos and podcasts during the e-learning process. The traditional anatomy curriculum has been challenged since the early 80s and educational technology has attracted great interest with the introduction of many innovations such as virtual anatomy courses and dissections, three-dimensional (3D) atlas etc. application, which uses augmented reality (AR) for smart devices. Augmented reality could be a growing field of technology where reality is modified and enhanced by sights and sounds generated by a computer. AR makes the prevailing reality more meaningful because it allows interacting with it. Augmented reality features a great potential to be utilized in the classroom because it changes the way students interact with the world, enhances student engagement, and makes the learning of their subject content a fun. When incorporated into education, AR motivates students to explore and, during this way, learn. It expands student's horizons and fosters their creativity and imagination. Hence the proposed system uses augmented reality for displaying 3D view of anatomical structures which are printed in textbooks' in two-dimensional (2D) view. The proposed system is mainly developed for secondary and higher secondary students so as to give them a basis knowledge of an actual anatomical structure, how it looks in the real world which before was difficult to understand from a 2D perspective.***

Keywords: Augmented reality, 3D, Anatomical structure, Image processing

1. Introduction

The current education system in schools relies heavily on images in textbooks for imparting knowledge about the complex anatomical structures. The students are still learning with a two-dimensional perspective even though 3-D technology is readily available. With the availability of current technology, we have a wonderful opportunity of reforming our current education system, making it more interesting and interactive for the students. Augmented Reality has a huge potential in enhancing the learning experience using mobile/portable devices. In the proposed system we will be making an application that will act as a study material of staff as well as a student for a better understanding of anatomical structures. This application will not only be used in interactive learning but can possibly run on a minimum of the resources and without any extra cost

2. Literature Review

The following research paper were selected keeping in mind the similar use of the technology with few or other dependencies.

Ussman durani, researched on whether AR and VR are viable options for imparting education. The study was a six year(2012-2018) literature review of empirical research on the application of VR/AR in education based on the finding on 38 empirical studies in peer-reviewed journals found by using specific search criteria it was an attempt to the status of the research on VR/AR in education and to indicate some research perspective such as academic level subject area, research method, evaluator role and the result of the study however due to time complexity accurate results were not achieved.

Tian xie, worked on iRay: Mobile AR Using Structure Sensor in medical field where the person has to wear a red T-shirt which is designed to be a target source of the system and when scanned with the additional structure sensor the whole anatomy would be displayed on top of the human body since the limitation was expensive inputs and a hardware module which is not so affordable if we consider rural areas as well.

Rina Ashida, worked on a similar application where a new learning method for chemical bonds using (AR) and projection type smart devices was proposed. However, the subject was the barrier in this case. The domain was completely different.

3. Proposed System

The conventional systems used today are very high end and not related to human anatomy, where a subject is the barrier in such case the system which are already available for anatomical structures are mainly for higher level of education in this field. This software often comes with a price tag and expensive inputs which make it not-so-affordable for every user of the platform. Additionally, this software isn't specifically designed for a secondary/higher secondary student, where else for imparting basic knowledge these systems are often more complex which is not required at that stage. Also, the main goal of the proposed system is to enhance the e-learning without any additional cost.

The system is an application which uses augmented reality to display 3D anatomical structure whenever the target image is kept in front of the camera this target image is stored in database generated by Vuforia which is an integrated module of Unity 3D and used for storing target images that can be scanned in real-time in an application whenever pointed by the smart device. A virtual structure will be displayed over the target image in real time. These structures are the object files created via Autodesk Maya and both the target image and the structure is linked with each

other via Unity 3D which further helps us in development of the application. system also incorporates a video AR section where on detection of target image a video will be played on top of the target image itself

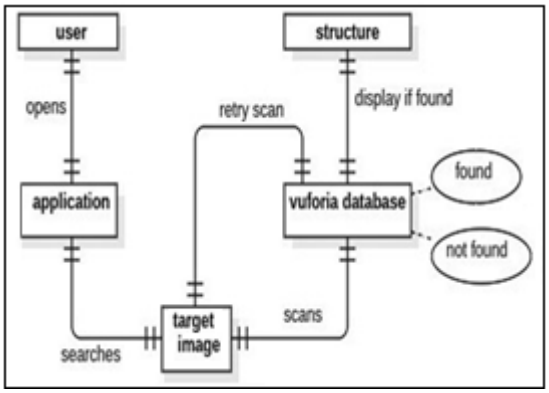

Figure 1: System Architecture

Following are the modules of this system:

a) Target images

Target images are the images which on which the application will give the output after successfully scanning and matching the copy of the same which is stored in the backend i.e. Vuforia database. Vuforia can track and recognize targets by analyzing the features based on the contrast of the target that is visible to the camera. By improving the visibility of these features through adjustments to the target's design, its rendering and also the way it's printed, we can improve the performance of a target. One can also improve detection and tracking performance by designing your app's user experience to obtain the best image of the target and by controlling the focus manually of the device camera

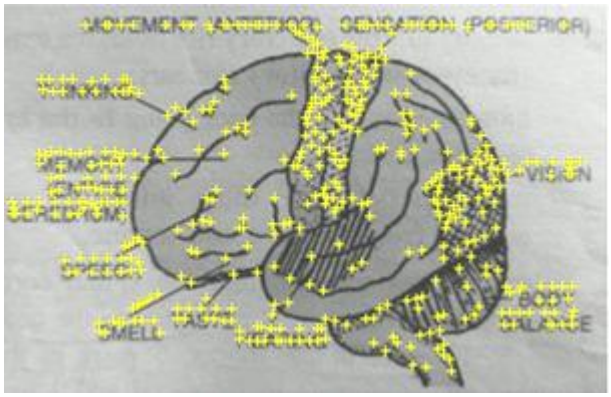

Figure 2: Image detection based on contrast

b) 3D Objects

3D objects or structures are created with the help of Autodesk Maya, a tool which is used for building 3D b assets, animation, etc. with irrespective of geometry. Autodesk Maya stitches two or more images and allows user to give them a curved structure further helping in creating anatomical structures. Since anatomical structures are not made on co-ordinates system a tool like Autodesk Maya and adobe blender helps us in achieve these results

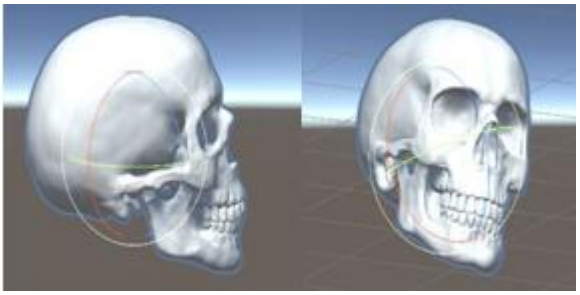

Figure 3: 3D model created using Autodesk Maya

c) Camera module

Unity 3D allows us to use an in-build AR camera module and gives the feasibility to alter its functionality as per our needs. Since Vuforia maps the points based on contrast of the images, even a phone with as small as VGA camera can detect the target image and track the points. Keeping the camera module with no user interface gives the application "point and play" functionality. It also keeps the application simple and helps in reducing the size of the application.

4. Results and Discussion

This section includes the snapshots of the actual outputs that were seen by the user and also contains the results of the proposed system.

The accuracy levels achieved by the proposed systems are regal, but to generating the desired result takes a large amount of time and human-effort. The current system is the depicts the fully working model created to show the implementation.

Following are the screenshots in an orderly manner:

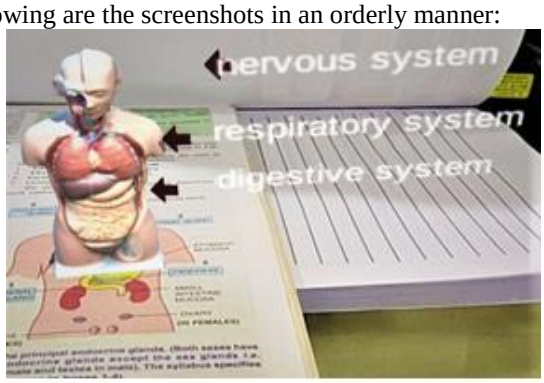

Figure 4: Output: 3D model - Internal organs

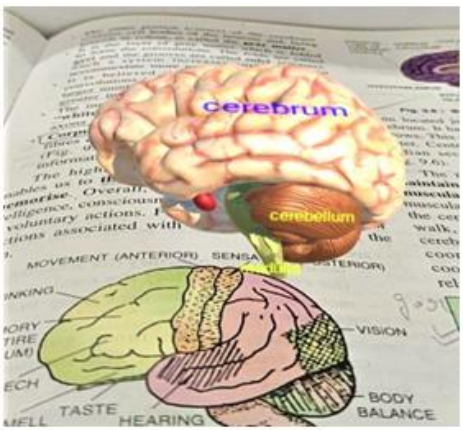

Figure 5: Output: 3D model – Brain

5. Conclusion

AR's potential utility goes far beyond that kind of triviality; future of AR is vast. in the proposed system we built an application that helps student get a clarity of anatomical structure which is way more difficult to understand in 2D perspective without any additional hardware of software and with minimum of the resources this application will not only cater urban schools but also rural areas since all the system need is a smart device with minimum configuration and since the application runs without internet there is almost negligible cost associated with the project.

The application can be enhanced with more working hours in terms of GUI the incremental model can have virtual buttons that can perform certain task such as opening a web page or a video or as simple as rotating the model, having 3D animations, touch functionality and a lot more with the help of AR not only human anatomy but one can even learn other subject. AR in education will create a great impact in interactive learning.

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