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Augmented Reality (AR) for Education System

Anushka Chaudhari, Leena Chaudhari, Nita Patil

[1,2]*Student, VIII Semester B.E., Computer Engineering*
Datta Meghe Collage of Engineering, Airoli, Navi Mumbai – 400708 (Maharashtra) (India)
[3]*Associate Professor, Computer Engineering Department,*
Datta Meghe Collage of Engineering, Airoli, Navi Mumbai – 400708 (Maharashtra) (India)

Abstract - *Due to Covid-19 pandemic changes the traditional teaching and learning activity into real time education with AR technology through small digital device. Recently many technologies are been used for learning purpose. One of them is Augmented Reality (AR) which is developed rapidly in recent years. Also widely used in education teaching due to its strong sense of visualization. For teaching and learning anatomy subject especially requires real world anatomy models. Visualizing the three-dimensional organs is a difficult task. Therefore, to provide ease to learning augmented reality is used. Augmented reality (AR) tool provides three-dimensional human anatomy with more fun and interactivity to educators and learners. The augmented reality technology is implemented to attract the personal impacts and feeling towards real organ during anatomy practices. This tool is able to show the learners actual form of human anatomy and also assists the educators in explaining the scientific concept behind the human anatomy models with more interest. Unity 3D is used to implement the task followed by Vuforia for databases. The implementation results show through real visualization learners are getting more effective learning method.*

Key Words: **Augmented Reality (AR), three-dimensional, 3D, human anatomy, education, learning, Unity 3D, Vuforia**

1. INTRODUCTION

This document is template. We ask that authors follow some simple guidelines. In essence, we ask you to make your paper look exactly like this document. The easiest way to do this is simply to download the template, and replace(copy-paste) the content with your own material. Number the reference items consecutively in square brackets (e.g. [1]). However, the authors name can be used along with the reference number in the running text. The order of reference in the running text should match with the list of references at the end of the paper. provide a realistic experience. This all-angle view is integrated with labelling and information present within virtual visualization. Providing easy and clear visualization of complex and clogged organ diagrams by presenting exact virtual replica as of real organs. Providing better understanding of concepts by learning with real like virtual organs first person perspective. Making best possible use of technology in human anatomy education. Providing teachers with better tools to deliver. Enable individual users to access learning materials anytime and just with their portable devices. Creating a joyful environment and interesting way of learning.

The several sections involved in this paper are organized as follows: Section II gives a brief overview of the research on the existing system is conducted to find out the advantages, limitations and also methods or tools used and focus on the systems of AR in human. Section III presents the technical software will be including throughout the implementation. Section IV shows the detailed description on architecture of Augmented Reality (AR). Section IV presents detail information of proposed system architecture. Section V shows the database collection and creation details. Section VI includes the experimental results. Finally, Section VII concludes the paper.

2. LITERATURE SURVEY

In healthcare field, the amount of usage on Augmented Reality (AR) for trainings is increased so this is great demand that can upgrade current medical practices. Therefore, the situation offers amount of usage on AR for operation, medical and recovery is increased so this is great demand that can upgrade current medical practice. Therefore, this situation offers to the designer, computer programmer, engineer and users the outline of the possibility of Augmented Reality (AR) development in cultivating the designing of helpful applications with computer-generated elements. Currently, the medical and healthcare fields will use AR on a large scale. Nowadays most doctors and nurse use AR to increase patient educational and perspective.

Wan Aezwani Wan Abu Bakar1, et al.,[1], introduce GAAR is an android mobile Augmented Reality (AR) learning tool to assist the educators and learners in internalizing 3D human anatomy with more fun and interactivity. ChangYuan Li, et al.,[2], researcher idea is to allow the user to view the virtual object in the real world using an Object based AR system. This research paper describes Augmented Reality (AR) and Unity 3D, how it applies to learning and training, and the potential impact on the future of education. Rubaiya Hafiz, et al.,[3], the main motive of this researcher is to help the medical students and school level science students to learn human anatomy and nervous system in an interactive way

This research narrates the concept, application development and results of the pilot test. This test is conducted by the medical students of different medical colleges of Bangladesh. Faizal Shaikh [4], 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. Shubham Gupta [5], the application and platform developed as part of this thesis project works as a proof of concept for having Augmented Reality (AR) applications as a higher education learning tool. This project describes how Augmented Reality (AR) can be utilized for education and training, and the potential impact on the future of education. The positive response towards this AR application shows that there are good future prospects for it. Abudhllah Mubarak Ghare [6], this paper discussed the concept of augmented reality including its applications in the various fields and also gave a review on how the augmented reality is increasing in the field of health care. Also discussed the future scope under the augmented reality and gave the best suited. Min-chi Hsieh, et al.,[7], this article puts on an effort to review the advances in Augmented Reality (AR) -based healthcare technologies and goes to peek into the strategies that are being taken to further this branch of technology. This article explores the important services of augmented-based healthcare solutions and throws light on recently invented ones as well as their respective platforms. Kartik Adapa [8], this work provides a detailed view into 5 years of AR research in medicine. AR in medicine is an emerging technology that can benefit medical practitioners, health care professionals, and patients. Jaanyu Yang et al., [9], report this system is packaged into an android app. The running results show that the app has a strong sense of immersion and interaction, and it also has strong expansibility so that we can change the human structure model into any other models. Soonja yeom [10], project is to investigate the use of interactive 3D anatomy pictures with haptic feedback to teach and test anatomy knowledge, of the abdomen in particular, and to compare the results with other existing learning methods such as 2D images, models.

Based on literature survey, most of the researcher's used portable devices as a tool to display Augmented Reality (AR). The majority of the researcher also used Unity and Vuforia as the software to design and develop the creation of Augmented Reality (AR). applications. In terms of the purpose of the research, most of them want to introduce AR technology to their users. They want to make this field to become more interesting and enjoyable by using Augmented Reality (AR) technology. From the observation, the marker-based technique has been a favorite choice among the researcher because it is cost-effectively.

From the overview of the research and state of the arts that had been made, there are a lot of advantages and several disadvantages of different approaches and methods used to develop an AR application. Several factors need to take action to design and develop this application system. The main key that needs to decide is the type of Augmented Reality (AR). technique that will be used in this system. The other factor that needs to identify who will be used this system and this system needs to be planned in an organized and orderly manner. From the observation of the existing project, it is difficult to find an Augmented Reality (AR). application that has a lot of information about the all-human organs because of costly models. The existing project mostly shows the Augmented Reality (AR). 3D models only without more additional information. Therefore, this system planned to overcome the lack of that part.

3. DEVLOPMENT TOOL

The software must derive the real-world coordinates, independent from the camera, from the images captured by the camera. This process is called dynamic image registration which uses different methods of computer vision, and consists of two stages. The first stage is the feature detection method, used to detect fiducial markers, interest points, or optical flow in the camera images. The second stage restores a real-world coordinate system from the data obtained in the first. Some of the software that we will use are Unity 3D, Vuforia.

Unity 3D: Unity 3D is one of the most widely used and efficient game engines with user friendly development environment which allows us to build 3D and 2D projects in real time. This also allows to import and assembles the assets means 3D models, write the code to interact with the object, use for create animation etc. Because of this specifications unity 3d is not just limited to game development. It also has various features like adding animation, sound, text, images and many more. Applications can be deployed on mobile, desktops, web and consoles.

Vuforia: Vuforia is a Software Development Kit (SDK) that is available as a plugin on Unity 3D. It helps create applications or software related to Augmented Reality. One of such features allows the application to recognize images targets and objects, and let the application interact with spaces in the real world. It includes impressive digital features like recognize, analyze and improve user designed target image for better performance of application.

C#: C# is one of the most versatile object-oriented programming languages. It is very often used as a scripting language with very high usage when it comes to development of games or interactive applications. It is extensively used in Unity 3D.

4. ARCHITECTURE OF AUGMENTED REALITY

The four steps to be carried out by the AR system: Scene Capturing, Scene Identification, Scene Processing, Visualizing Augmented Reality (AR) scene.

i. Scene Capturing:

The devices used in scene capture are physical components which recognize the reality which should be boosted. There are two types of scenes capture devices:

a. Video Through Devices: For realizing the real time environment scene capture devices are used. This are the physical components which helps to recognise the reality. Scene capture device can be classified into two groups, these devices are easy to use. Because this are the devices, we are using in our day-to-day life. And comparatively available at cheap cost. E.g., Smart phones, video cameras, web cameras.
b. See Through Devices: This are the devices which are specially made to visualize Augmented Reality (AR). Such devices capture the reality in different way than the video through devices. Available at high cost to use. E.g., head mounted displays.

ii. Scene Identification:

Scene identification used for classification of scenarios. There are two basic types of scene identification techniques which are discussed as follows:

a. Marker based: The marker-based approach is just like using QR codes for scene identification. The visual tags contain the feature perceptions to analyse the real scene.
b. Non-Marker based: The non-marker approach uses the real object image for scene identification. THIS are the images which are provided by the developer.

iii. Scene Processing:

After calculating the spot of a specific non-marker image in real space the system looks for the corresponding virtual model to each non-marker in the 3D.

iv. Visualizing Augmented Reality (AR) scene:

At the end, the system produces the image of the projected 3D object and present digital information.

5. PURPOSED SYATEM ARCHITECTURE

Following diagram represents flow of architecture of system.

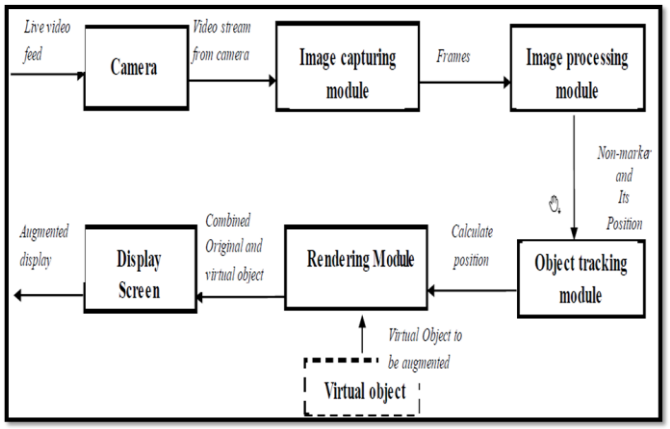

Fig.1. Flow of Architecture

i. Camera:

Real time live video will be provided by user. This video is to capture through the devices is an input to the unity module. This live video contains the frames of image which is next given to the image capturing module.

ii. Image Capturing Modules:

The input provided to Image Capturing Module is the live video feed from the camera of a device. This module analyses the video steam, by analysing each frame of image.

iii. Image Processing Modules:

Image processing module takes input from the image capturing module i.e., frame of images. For detection of AR camera these images are processed using image processing technique. For placing the virtual object finding the position detection of AR camera is essential. Once the AR object is detected, its location is provided as an input to the Tracking Module.

iv. Object Tracking Modules:

The object tracking module is calculates the relative position of the camera in real time.

v. Rendering Module:

There are 2 inputs to Rendering Module. First is the calculate position from the Tracking Module and second is the Virtual Object to be augmented. The Rendering Module combines the original image and the virtual components using the calculated position and renders the augmented information on the display screen of the mobile device.

6. DATABASES

Image Targets are Vuforia features that are implemented in this project. 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. Gathering 3D models of human anatomy from various website. Which will be augmented on selected target images. Image targets is made up of images that the application's vision functionality detects and help the system to generate the corresponding model attached with that image target. Using target images collected from internet, augmented reality model can scan images through the camera of a devices.

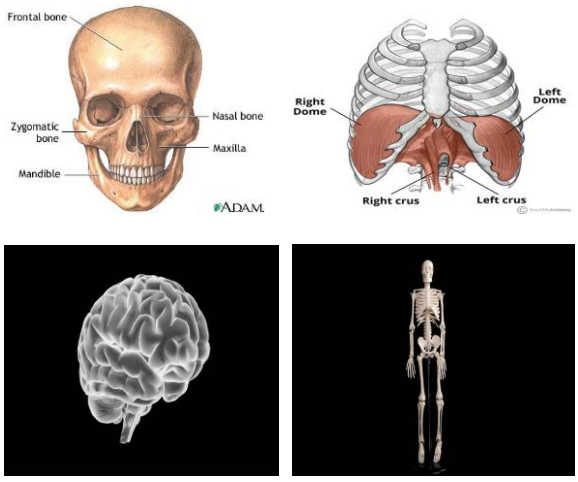

Fig.2. Images from Databases

Databases are created in Vuforia SDK a cloud recognition service is an enterprise class image recognition solution. First by creating Vuforia account we need to create a licence key for accepting the databases from Vuforia in unity 3D. Create new database at Vuforia Target Manager shown in dig. VI. 2.

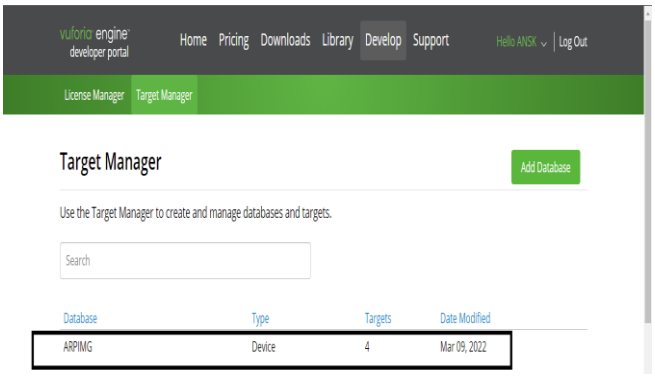

Fig.3. Created database at Vuforia Target Manager

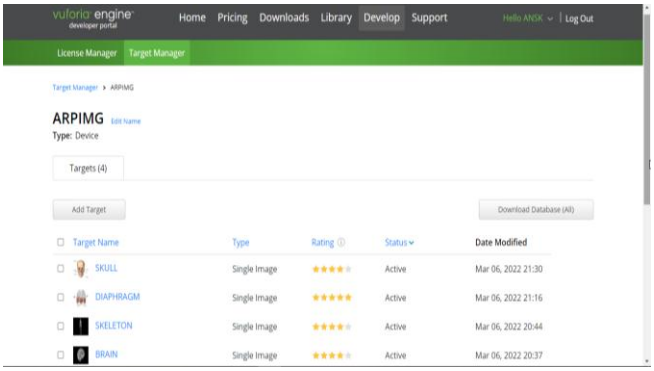

Fig.4. Images at dataset

Add images to the created dataset as shown in Fig. VI. 3. Vuforia shows the rating for each image whether how much that camera will be able to detect the feature from image. For our image dataset we got rating 4 to 5. Which shows the good scale for detection through devices.

7. EXPERIMENTAL RESULTS

The project aims to enhance learning and teaching process in human anatomy by providing 3D view. Performed on intel core i5 processor with 8GB RAM and Unity 3D version 2021.1.23 and Vuforia Engine version 10.

We have developed interactive application for desktop device. After running the tool welcome user interface appears as shown in fig.VII.1. When the user using application, they will go to home menu consisting of two buttons. After clicking on start device camera get started to capture the scene. By clicking exit application will be close.

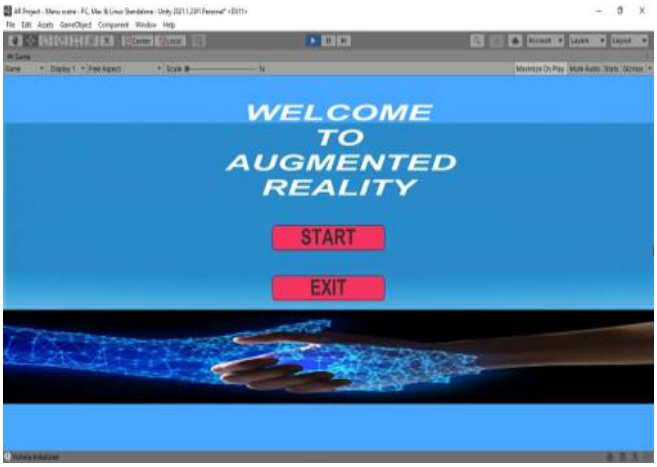

Fig.5. Home Menu User Interface

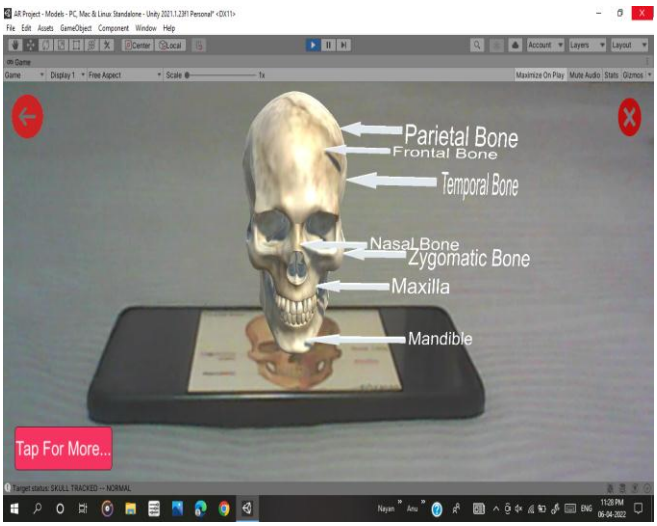

Fig.6. Augmented Skull 3D Model

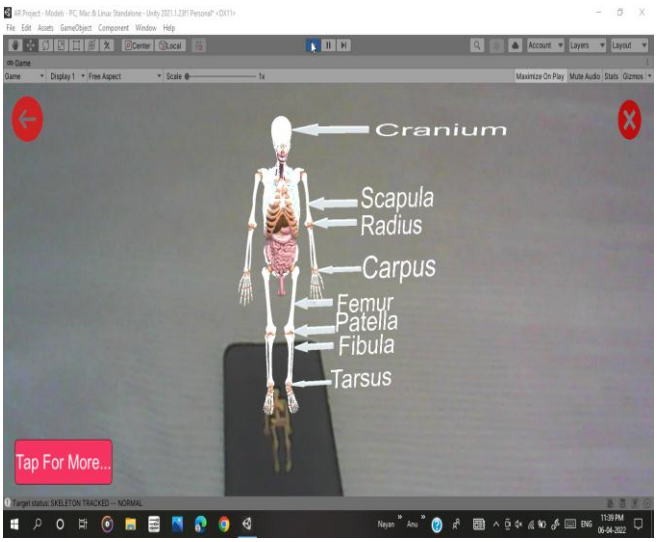

Fig.7. Augmented Skeleton 3D Model

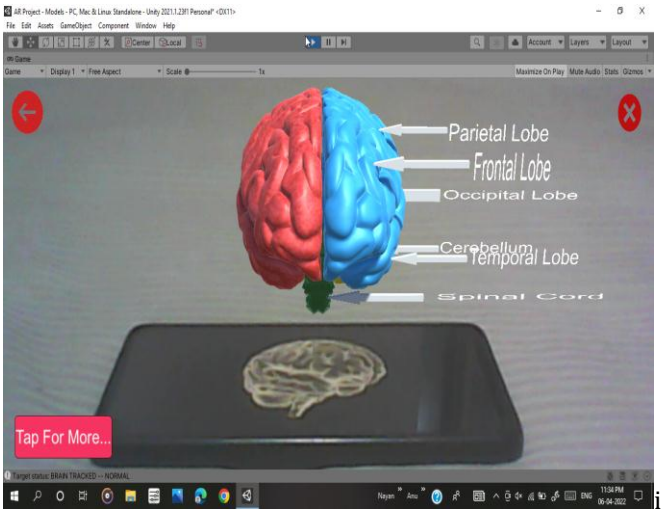

Fig.8. Augmented Brain 3D Model

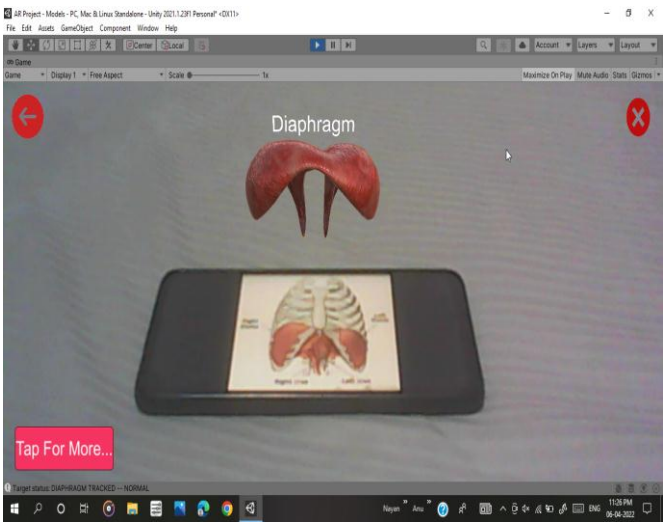

Fig.9. Augmented Diaphragm 3D Model

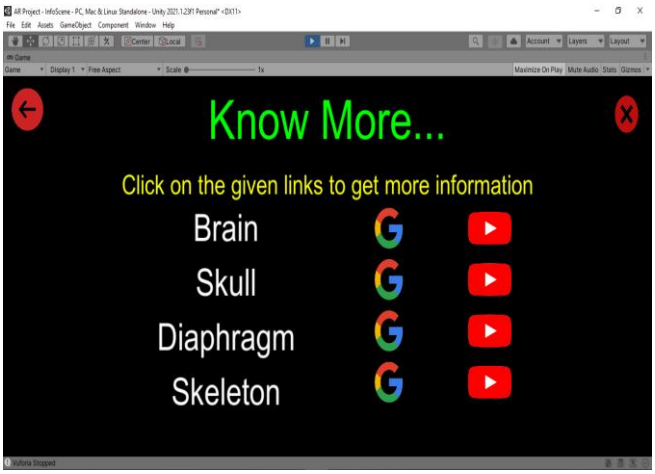

Fig.10. End Interface

As shown in Fig. VII. 2, Fig. VII. 3, Fig. VII. 4, Fig. VII. 5 we can capture the scene through camera device and a 3D model is displayed on the screen with proper labels. User can also exit the application by clicking on the given buttons. As shown in fig. VII. 6. "Tap for more" button consist last interface of application consisting google links and you tube links for more information regarding human anatomy. Lastly, hit the exit button to close the application.

8. CONCLUSION

Different aspects of this model help exponentially in understanding the diagrams and learning in a better way. The developed application will be easier to understand, more interesting and easier to use as the concept of learning the human body anatomy. AR technology in this application can be used as an alternative method for human body anatomy learning in addition to textbooks and props. Applications increase the interest of trainees and instructors to learn more about the anatomy of the human body.

Application provides solutions for student who has difficulty in visualizing the anatomy of a two-dimensional body shape into three-dimensional model.

REFERENCES

[1] Wan Aezwani Wan Abu Bakar1,et al., GAAR: Gross Anatomy using Augmented Reality Mobile Application, (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 12, No. 5, 2021

[2] ChangYuan Li et al., Research on The Application of AR Technology Based on Unity3D in Education 2019 J. Phys.: Conf. Ser. 1168

[3] Rubaiya Hafiz et al., Enhancement of Human Anatomy and Nervous System Learning using Mobile Augmented Reality Application, International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-9 Issue-3, February, 2020

[4] Faizal Shaikh et al., Augmented Reality to Study Human Anatomy, International Journal of Science and Research (IJSR) ISSN: 2319-7064 ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

[5] Shubham Gupta, LEARNING WITH AUGMENTED REALITY: A PLATFORM FOR HIGHER EDUCATION LEARNING APPLICATIONS

[6] Abdullah Mubarak Ghare1, et al., Augmented Reality for Educational Enhancement International Journal of Advanced Research in Computer and Communication Engineering ISO 3297:2007 Certified Vol. 6, Issue 3, March 2017

[7] Min-Chai Hsieh, el al., Preliminary Study of VR and AR Applications in Medical and Healthcare Education, DOI: 10.21767/2574-2825.100030, Vol.3 No.1:1 2017

[8] Karthik Adapa el at., Augmented reality in patient education and health literacy: a scoping review protocol, Adapa K, et al. BMJ Open 2020;10:e038416. doi:10.1136/bmjopen-2020-038416

[9] Jianyu Yang et al., Research on The Application of AR Technology Based on Unity3D in Education, ChangYuan Li and BaiHui Tang 2019 J. Phys.: Conf. Ser. 1168 032045

[10] Yeom, S. (2011). Augmented Reality for Learning Anatomy. In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), Changing Demands, Changing Directions. Proceedings ascilite Hobart 2011. (pp.1377-1383).