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Virtual Buttons Interaction for Medical Learning Interfaces

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Abstract - This paper presents an interaction method for wearable AR (augmented reality) by using VR box with virtual buttons. It is introduces an Android applications that could help medical students in their learning. Anatomy education is traditionally performed by the dissection of cadavers. This AR technology could offer an additional teaching method for anatomy education, depending on how it is implemented. Studying AR in medical education could provide benefits for medical education and provide students a more personalized and exploration in learning experiences. Virtual buttons interaction in this application to make more natural gesture while wearing the wearable AR device.

Keywords **- virtual buttons; augmented reality, medical education learning**

1. Introduction

It is nearly impossible for medical students to investigate in depth the layered anatomy structures and explore the complex structures from different angles. The text and the visual representations of the anatomy in a number of manuscripts are inadequate to convey the complexity and the volume of the information related to the complex region. Studying AR (Augmented Reality) in medical education could provide benefits for medical education and provide students a more personalized and exploration learning experience. We intend to explore on how to use natural gestures for input in AR medical education applications, which can provide intuitive interaction. The idea to produce a visual learning by using virtual buttons interactions are to help them getting better understanding in their learning. Besides, virtual buttons in interaction to make more natural gesture while wearing the wearable AR device. By adding this new level of experiences, hand gesture interaction with virtual buttons can significantly increase the attractiveness of learning application in medical education. To fulfill the intention, the first stage is to explore the new technology will be used to make natural interaction by using virtual buttons, how this idea can ensure the user will get benefit by interact with appropriate visual learning interfaces provide in this application. According to Badariah et. al 2014, AR is a technology that allows the physical real world environment to

be enriched with computer generated information. AR can be divided in two part which are marker detection which requires special fiduciary marker and markerless detection also known as nature feature tracking, identifies more abstract object components such as shape and color. Therefore, the application architecture is more complex in comparison to marker based AR. The application developed through this study applies the technique of marker tracker in order incorporate AR technology with the printed media. The proposed AR application includes several features, user could interact with the 3D model using virtual buttons provided in the illustration. These virtual buttons user can rotate, scale up and scale down the 3D model of human brain anatomy.

2. Methodology

2.1 Virtual buttons in advertising apps

Nowadays, virtual buttons were used in interaction with music instruments, advertising, entertainment, and gaming. In this propose research to transfer the usage of virtual buttons in AR into medical education learning. Badariah et. al 2014 has developed mobile applications that combines the used of printed media and marker based AR technology as an effective and engaging platform in promoting the Malaysian traditional games. This application allowed the users to interact and manipulate the 3D objects by using few assigned virtual buttons. The aim of their study is to investigate the feasibility of mobile AR application as a promotion for traditional games for tourism. In his paper, he suggested to apply AR in other fields, for example in education, such as Physic and Chemistry, which are hard sciences, and require student's imagination to understand the subjects. With this technology of AR, students are able to visualize the entire phenomena to increase their understanding on the topic. Hence, this study of developing the medical learning interfaces using virtual buttons is one of the solutions to ease medical students in their learning.

2.2 Virtual buttons in music instruments apps

Budi Arifitama et. al 2017 stated in his paper use technology with multiple marker to digitalization the traditional Sundanese music instruments. They provides few marker and place the virtual buttons on the marker that have music notes for each Sundanese music instruments such as "saron", "suling", "angklung" and "kendang". The virtual creates an interaction experiences between the user and markers, the buttons is not visible but the user could interact by touching area part on the marker that already marked. Every time an area is scanned by camera, the animated object will augment and the user could interact freely by touching the part of the marker to hear the sound of each instruments. Budi Arifitama claimed in his paper, that the used of multiple markers would give benefit on user interaction experiences while using different markers at the same instant. For this study of human anatomy learning, it's also applied the same methods which use multiple markers, this is because the performance of the AR should be fast when user interact with it, and also the precision of virtual buttons pressing. Zhaparov et. al 2014 produces AR based on Kazakh instruments named "Dombyra", this application also have a similar with the Sundanese music

instruments, but for this they used few virtual buttons that have different functions scale up, scale down, rotate clockwise and anti-clockwise, and translate on x and y axis. These functions were applied in medical learning interfaces especially for human brain anatomy because students can scale and rotate the 3D model to see closely for their learning. They claimed that they will made the research on target detection, in order to increase the level of successful detection.

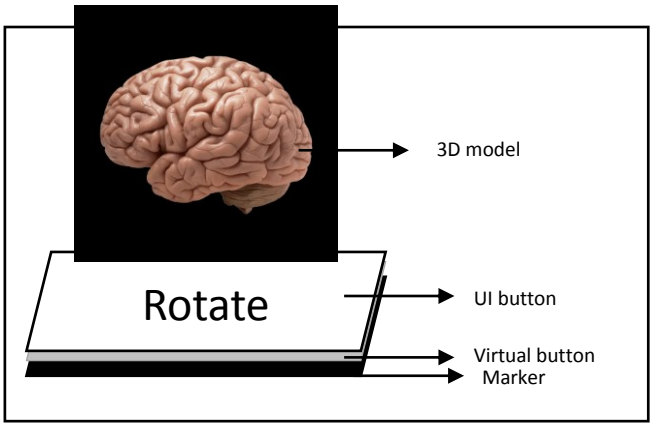

Fig 1: Virtual button interaction to rotate the 3D model

2. 3 Virtual Buttons Constraints

Sung Lae Kim et. al 2014 stated in their paper, they tested the virtual button in their mobile augmented reality game, the reflected light on the image target caused error in operating virtual button. He made a test using a player and team to identify the virtual button error. In the meantime, according to them, each of the virtual buttons has its own sensitivity level, which can be define before the runtime of applications. They tested the virtual buttons in their project of music instruments and continued their work on target detection, in order to increase the level of successful detection. Siddhant Patil et. al 2016 stated that the sensitivity of the virtual button has to be increased which leads to the output becoming more responsive to shadows. They stated that the camera in question should be highly sensitive to recognize the inputs of the shadows that fall on the virtual buttons. This because for the virtual button, camera will recognizes the shadow of the hand and displays the properties of the particular objects. According to Hyejin Kim et. al 2015 used methods of hierarchical virtual buttons which placed on the image target for more precise and faster interaction with augmented objects. However, they claimed it was difficult to apply bare-hand tracking based interaction in a mobile device due to computational resources. They also said, as the number of virtual buttons increases, the interaction is not feasible because it takes a long time to process the button occlusion event handling. He suggested for dynamical hierarchical virtual buttons arrangements. They claimed that their planned future work will improve the fingertips button detection algorithm and developing the natural movements of the second layer buttons.

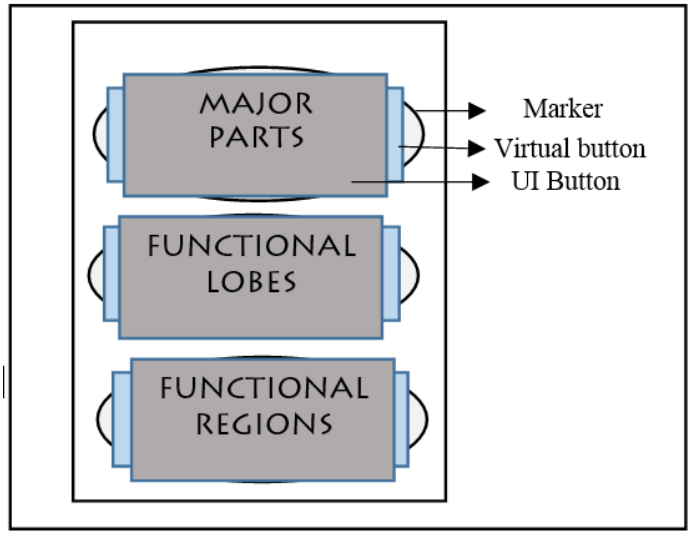

Fig 2: Position of virtual button in between marker and UI buttons

3. Results and Discussion

For this medical learning with AR application, the marker used in the main page of this system has three images called image target. In this development of AR, using Unity SDK, virtual buttons will be placed on top of each target image. These virtual buttons will actually functions according to user interaction. Virtual buttons cannot be viewed by the user, but if the user's hand is through these virtual buttons, it will detect the shadow of the hand and assume as buttons pressing and these virtual buttons will work. To make it easier for users to use this system, the UI button is placed on virtual buttons and this can be seen by the user, so users can identify where virtual buttons are placed in this application. The user will interact with this virtual button and it will work according to each button. For virtual buttons "major parts", 3D model of human brain will be displayed and there is another virtual button there, when the user puts the hand on the button, the brain model will rotate. Similarly with the virtual button "functional lobes", user will be displayed with the model of the brain with labels, they can resize this model using virtual button scale up or scale down. The user will use the VR Box and face the marker with a virtual button to interact. It has been tested by some medical students and they are very fun using this app. However, there is still a shortage in the accuracy of virtual button detection because of virtually every button's virtuous position, making the virtual button that it deserves to be pressed, but the other button works first.

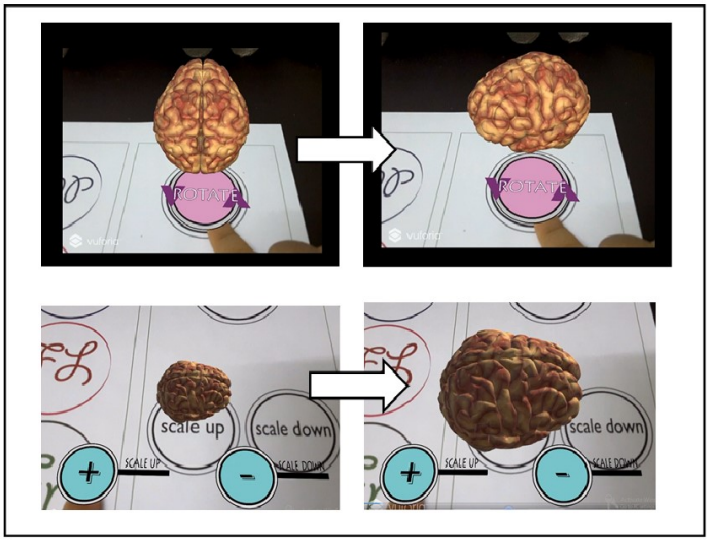

Fig 3: Rotation and scaling of model when user put their finger at virtual buttons

Fig 4: Medical students has been tested the apps with AR using VR Box

4. Conclusions

The use of AR with virtual buttons in medical learning applications is best suited to help students achieve the imagination of learning the subject of human anatomy. It is a new method of learning and is well received by medical students themselves. Apart from the content of the subject itself that fulfills their wishes as a user, the pleasure of using this app is also important. Some improvements will be made as well as setting the size and position of the virtual button so that it does not overlap with other buttons, making the virtual button UI be more precise.

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