BCM3263
Augmented Reality

FINAL ASSESSMENT

TITLE:ULNA

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Youtube link : https://youtu.be/8N_NKKTwZvA

Material and APK Google Drive link :
https://drive.google.com/file/d/1GfRk71NGTS0Uc-eNGjY8NHEP3QYw1sUt/view?usp=sharing

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INTRODUCTION

a) Provide an introduction that relates to current issues in Augmented Reality that related to Health Care or Medical Education.

Augmented reality describes the use of displays, cameras, and sensors to superimpose digital information on the real world. Unlike virtual reality (VR), which creates an altogether new universe, augmented reality (AR) allows us to incorporate the most useful information from the digital domain into our perspective of the world around us. Although augmented reality is not a new concept, breakthroughs in camera and sensor technology, as well as AR-focused software development, have made it realistic in recent years. Indeed, the healthcare and medical industries will be among the first to embrace AR in a large way. In fact, many nurses and doctors use augmented reality applications every day to improve patient education and results. Despite having important distinctions, the three technologies—augmented reality (AR), virtual reality (VR), and mixed reality (MR)—are frequently conflated. With augmented reality (AR), users can see the actual world while superimposing digital data on their current surroundings. By completely blocking out the outside world and creating a fully simulated environment, virtual reality (VR) produces an entirely immersive experience. According to The Medical Futurist (n.d.), VR is therefore thought to be more immersive than AR.

Healthcare workers have been quick to recognise the advantages of AR technologies. Education is a clear application of augmented reality in the healthcare industry. Healthcare workers must study an immense amount of information about anatomy and how the body works. AR apps enable learners to visualize and interact with three-dimensional representations of bodies. However, the benefits of augmented reality extend beyond healthcare staff. It is also proven to be a very valuable tool for patient education, allowing medical personnel to help patients learn surgical procedures and how medications function.

Surgeons now use a variety of visualization techniques to plan and execute procedures. With the potential to show three-dimensional models of a patient's anatomy straight into the surgeon's field of vision, augmented reality (AR) is quickly becoming a game-changing tool. By offering real-time, comprehensive anatomical insights, this invention is anticipated to greatly enhance surgical accuracy and patient outcomes (HealthManagement.org, n.d). Vein visualization technology is one useful AR application that is now in use. Patients who feel uneasy or anxious during injection or blood draw procedures can especially benefit from this instrument. Medical personnel may detect veins more precisely with the use of this technology, which minimizes the need for repeated punctures and enhances patient satisfaction (HealthManagement.org, n.d.).

The journey of AR in healthcare is fascinating, full of potential and promise. Challenges exist, but they are not impossible. With continuing innovation, collaboration, and regulation, augmented reality has the potential to radically revolutionize the healthcare business by providing more precise, effective, and personalized care. The future of healthcare with AR is more than simply technology, it is about establishing a more interactive, educated, and focused on patients medical world.

ADVANTAGES

b) State THREE (3) advantages of the developed AR application for SIHAT Medical University students.

There are three advantages of the developed AR application for SIHAT Medical University students. Firstly, the complex anatomy may be visualised in 3D. The AR program allows students to interact with precise 3D representations of human anatomy, providing a new way to visualize complicated structures that are frequently difficult to learn using traditional approaches such as textbooks or static models. Students, for example, can zoom in, rotate, and dissect the model to examine the chambers, valves, and blood flow channels of the human heart. This dynamic visualisation promotes a better knowledge of the spatial interactions between anatomical components, which is essential for medical practice. Such interactive experiences can bridge the gap between academic understanding and actual application, allowing students to better understand complex subjects.

Secondly, by using mobile devices to superimpose 3D anatomical models on the human body, augmented reality (AR) enables contextualized and situated learning. The placement of organs and systems is visible to students, making for an interesting and realistic learning environment. By imagining the respiratory system in action during breathing, for example, this method assists students in making the connection between abstract ideas and practical situations. Furthermore, by highlighting how crucial it is to comprehend anatomy in relation to the human body in order to make accurate diagnoses and provide appropriate treatment, this contextualized learning approach gets students ready for clinical settings. Their preparedness to handle actual medical difficulties is improved by the chance to practice and learn in a secure, virtual setting (Bajaj et al., 2022).

Finally, easy to access and flexibility of learning. The AR application's portability, which can be accessed via smartphones or tablets, means that students may interact with the content at any time and from any location. This flexibility enables students to study and reinforce their knowledge outside of the classroom at their leisure, supporting a variety of learning styles and schedules. Furthermore, the program eliminates hurdles such as the high expenses and ethical problems associated with traditional dissection labs, making advanced anatomy education more accessible to a wider spectrum of students. By democratising access to high-quality educational resources, the AR application promotes equal learning opportunities and a more inclusive educational setting.

MULTIMEDIA ASSETS

c) Justify the usage of FIVE (5) multimedia assets/elements that can represent the content of your developed AR application. Each multimedia asset should be discussed in terms of technical implementation and its contribution to the educational value of the developed application with picture support.

An Augmented Reality (AR) application for the ulna can be an effective teaching tool, offering an interactive and interesting learning experience. By merging numerous multimedia materials, the program can improve comprehension of the ulna's anatomy, function, and therapeutic importance.

First, we have the Ulna's 3D model. Technical implementations, such as a high-resolution 3D model of the ulna, can be built with 3D modelling tools like Blender or Maya. The model should precisely depict the bone's shape, size, and surface characteristics. The model can be loaded into an AR application via AR development platforms such as Unity or ARKit. A 3D model provides instructional value by allowing users to visualise the ulna from various angles, study its fine intricacies, and understand its spatial interactions with other bones in the forearm. Users can rotate, zoom, and dissect the model to better comprehend its anatomy.

Figure 1

Second, consider the X-ray overlay. The technical implementation allows an X-ray image of the forearm to be superimposed onto the 3D model of the ulna utilising image recognition and processing techniques. The application may be programmed to recognise the user's forearm and superimpose the X-ray image on it, aligning the virtual image with the real-world anatomy. The X-ray overlay provides educational value by helping viewers grasp the relationship between the 3D model and real-world anatomy. It is useful for identifying common ulnar fractures and anomalies, such as the Monteggia fracture.

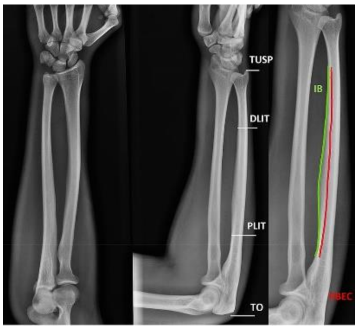

Figure 2

Third, the animated muscle attachments. The technological implementation is the creation of animations to highlight muscle attachment locations on the ulna. The software may show these motions on the 3D model, emphasising the muscles that move the forearm and hand. Animated muscle attachments provide instructional value by helping users comprehend the biomechanics of the forearm and how the ulna contributes to its movements. It can also be used to visualise how muscle injuries or nerve damage affect forearm function.

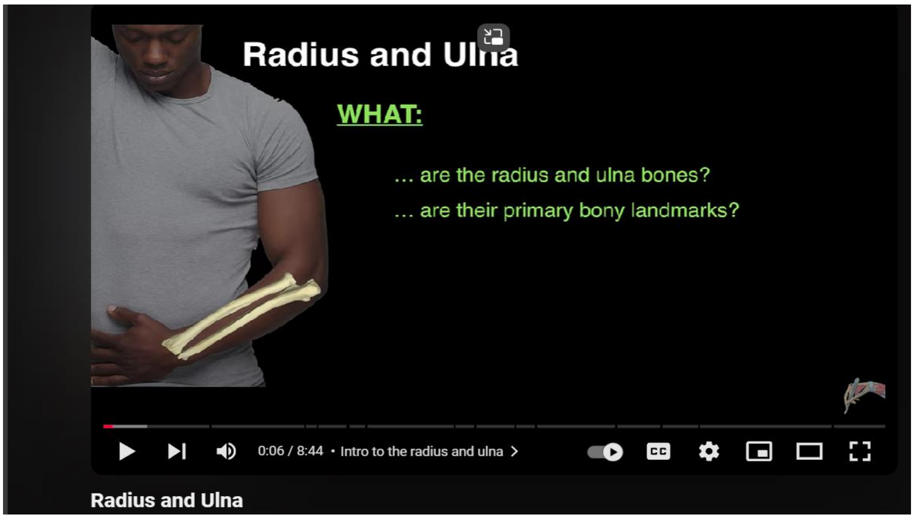

Figure 3

Furthermore, there's the interactive quiz. The application's technological implementation may contain a quiz component in which users are asked questions concerning the ulna's anatomy, function, and clinical importance. Users can answer questions by interacting with the 3D model and X-ray overlay. For instructional purposes, the quiz component offers users an interactive way to check their comprehension of the ulna. It can also be used to highlight areas in which users require additional training.

Radius and Ulna Bone Quiz (Anatomy)

Radius and Ulna bone quiz for *anatomy and physiology*!

Figure 4

Finally, consider augmented reality labelling. The technical implementation is that the program can display labels on the 3D model of the ulna to identify major anatomical landmarks and features. Users can tap on the labels to get further information, including definitions, functions, and clinical relevance. Augmented reality labelling helps users understand anatomical nomenclature related to the ulna, adding educational value. It can also be utilised to emphasise clinically significant structures like the olecranon process and radial notch.

Figure 5

TRACKING METHOD

d) Explain tracking method you used in the developed AR application. Justify FOUR (4) reasons why it is suitable for your developed AR application.

The tracking mechanism used in the AR application is Simultaneous Localisation and Mapping (SLAM). SLAM is particularly well-suited to this application for a variety of reasons.

Firstly, proper environmental mapping. The SLAM is excellent at generating a real-time 3D map of the user's surroundings. This is critical for smoothly integrating the virtual ulna model with the physical environment. Understanding the environment's geometry and features allows the application to precisely put the 3D model on objects such as tables or walls, ensuring that it seems realistically anchored inside the user's range of vision. This accurate mapping improves the immersion and realism of the augmented reality experience, making it more engaging and useful for learning.

Secondly, strong position and orientation monitoring. SLAM continuously monitors the user's location and orientation inside the mapped environment. This guarantees that the virtual ulna model remains in sync with the user's perspective as they walk about. Even whether the user walks, turns, or tilts their device, the 3D model maintains its correct location and orientation in relation to the real environment. This comprehensive tracking is required for a solid and realistic AR experience, since it prevents disorientation and improves the user's ability to interact with virtual information efficiently.

Thirdly, managing dynamic surroundings. SLAM algorithms are intended to adapt to changing conditions. This is especially useful in educational contexts, as users can interact with the AR experience in a variety of locales and lighting situations. SLAM can handle these dynamic scenarios by constantly updating the map and tracking data, ensuring that the AR experience remains steady and accurate as the environment changes. This adaptability improves the AR application's versatility and usability, making it appropriate for a variety of learning scenarios.

Finally, consider adaptability and platform compatibility. SLAM is a widely used technology, with significant support from key AR developer platforms like as ARKit. This makes it a viable and accessible option for developers, as it provides powerful tools and resources for integrating SLAM-based tracking into their applications. Furthermore, the ubiquitous use of SLAM means that the AR application may be simply deployed on a variety of devices, making it available to a bigger user base. This versatility and platform compatibility increase the AR application's overall efficacy and reach as an instructional tool.

TESTING METHODS

e) Describe in detail TWO (2) testing methods that are suitable for your developed AR application.

Firstly, user acceptance testing (UAT). The UAT involves real users interacting with the AR application in a controlled environment. This testing phase focuses on evaluating the application's usability, functionality, and overall user experience from the perspective of the target audience. The UAT is highly suitable for this AR application as it allows for direct feedback from users who will ultimately utilize the educational tool. By observing how users interact with the 3D models, X-ray overlays, and other interactive features, developers can identify potential usability issues, areas for improvement in the user interface, and any unexpected behaviors. This feedback is invaluable for refining the application and ensuring it meets the educational needs and expectations of its intended users.

Secondly, the performance testing. Performance testing evaluates the application's responsiveness, stability, and resource utilization. This involves testing the application under various conditions, such as different device configurations, network speeds, and user loads, to identify potential bottlenecks and performance issues. Performance testing is crucial for an AR application, as real-time rendering of 3D models and interactive elements can be resource-intensive. By conducting performance tests, developers can identify and address issues such as frame rate drops, latency, and excessive battery consumption. This ensures that the application provides a smooth and responsive user experience, preventing distractions and enhancing the overall learning experience.

By employing a combination of UAT and performance testing, developers can thoroughly evaluate the AR application, identify and address potential issues, and ultimately deliver a high-quality and effective educational tool for users.

PLAN

f) Clarify TWO (2) plans to maintain and update the developed AR application to reflect current anatomical knowledge and user feedback for the future market of applications.

One of the preclinical courses that requires a thorough identification of the many human body structures is anatomy. There are drawbacks to the earlier approach to teaching human anatomy that used a human cadaver, even if it allowed students to examine anatomical features in the most precise and detailed way possible. Teaching anatomy is complicated by concerns about the availability of cadavers, ethical issues with using the human body, the risks associated with the chemicals used to treat and preserve cadavers, and supervisory issues.

There are two plans to maintain and update the developed AR application to reflect current anatomical knowledge and user feedback for the future market of applications. Firstly, the continuous integration of updated anatomical knowledge. A strong content management system (CMS) will be used to ensure that the AR application matches the most recent advances in anatomical research. What is content management system? A content management system (CMS) is software that allows users to create, administer, and alter content on a website without requiring technical skills. In other words, a CMS allows you to create a website without having to write code from scratch or knowing how to code at all (Kinta, 2024). Instead of developing our own system for creating web pages, keeping images, and performing other duties, the content management system handles all of the fundamental infrastructure for you, allowing you to focus on the more forward-facing aspects of your website. This technology will enable medical practitioners and specialists to easily upload or change anatomical models and training information in response to new scientific discoveries or revised standards. Updates will be transmitted via cloud services, allowing for real-time synchronisation across all user platforms and ensuring access to the most accurate and current information. For example, if new research reveals a previously unknown structural component of a human organ, the CMS will ensure that it is quickly integrated into the AR model following testing and validation. Collaborations with medical institutes and research organisations will improve the quality and dependability of the content.

Secondly, the systematic feedback-driven development. A systematic feedback-driven development process is required to ensure the AR application grows in line with user needs and expectations, especially in the competitive and rapidly changing healthcare and education markets. To do this, a multi-channel feedback system will be implemented to collect insights from a variety of user groups, including educators, students, and healthcare professionals. This feedback system will capture qualitative and quantitative data through periodic surveys, in-app feedback forms, user interviews, and social listening. Advanced analytics tools will be used to monitor and analyse user interactions with the application. These tools can provide useful information about how users interact with features, how long they spend on specific tasks, and where potential usability bottlenecks exist. For example, if analytics show that users regularly quit jobs when engaging with a 3D anatomical model, this indicates the need for design adjustments or more training to increase usability. Feedback will be analysed to discover patterns, prioritise updates, and guide product enhancements. These improvements could include improving navigation, adding accessibility features, or incorporating user-requested functionalities like more layers of anatomical detail or interactive quizzes. Furthermore, constant contact with users, such as organising focus groups or beta testing new features, will help to strengthen the development process.

To ensure rapid reactions to user feedback, an iterative update cycle will be used, allowing for continual enhancement of the AR application via smaller, more frequent updates. This technique not only keeps the application relevant, but it also increases user loyalty by exhibiting a dedication to satisfying their demands.

Finally, the consistent feedback-driven development method guarantees that the AR application remains user-focused, intuitive, and a viable tool for education and professional use, giving it a competitive advantage in the healthcare sector.

REFERENCES

g) List SIX (6) references that you cited in this report using APA Style.

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