An Enhancement Approach For Augmented Reality And Virtual Reality In Medical Imaging Technology

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***Abstract*— Recent technology creations have generated innovative chances for the enhanced acquisition of Augmented Reality (AR) and Virtual Reality (VR) applications in the medical field. Meanwhile, medical applications have viewed greater acquisition from a patient represented as user applications, the latestgeneration of AR and VR technology has produced the condition for wider acquisition. Traditionally, in order to achieve the requisite quality of experience, the development of therapeutic use was restricted by the standard of technology.AR is a method by which we can alter how we realize the world around us with the aid of extending the digital component to it.Thus, it improves the reality experience. Whereas, VR is a technology that taken hold and enhances many areas of science, most preferably in the medical field. A specific concentration towards particular diagnosis and treatment of health disorders.This paper reviews the concept of AR & VR and briefly shows the history of their enhancement augmented and virtual reality which experienced a standard development in medicine. Meanwhile, the radiological images play the main role in the diagnosis and planification of surgical approaches. Finally, a brief reviews of AR and VR medical applications is obtainable before introduce a conceptual outline to view and manipulate medical images in AR and VR.**

***Index Terms*— virtual reality, augmented reality, medical applications, computed tomography**

I. INTRODUCTION

In medical imaging technology, both AR and VR has emerged opportunities for the real world in the medicinal field.To improve the insight of the real world, AR approaches are utilized.Visually, computeraided objects enhance the actual environment of a human vision. [1]During the 1990s, this system was introduced as methods to assist different fields such as complex assembly of medication and building marking. The complexity is to keep the virtual objects registered in AR with the real world image. In medical applications, this type of requirement is very typical. Because imaging technology is most applicable in the medical field and faster adoption of the AR approaches.With the use of image-guided surgery, many medical procedure processes are controlled. Pre-operative imaging studies of the CT or MRI images of the specific patient provide the required information into the internal anatomy to the surgeon.Pre-operative imaging studies of the CT or MRI images of the specific patient provide the required information into the internal anatomy to the surgeonin pre-operative learning from multiple views and slices. During surgical condition, The AR system can be employed such that the surgical team can able to monitor the MRI or CT data which is registered on the patient. The other application are based on ultrasound imaging and optical diagnostics in the medical field.

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Coming to VR, it is a revolutionary concept in the medical field to involve this technology to the next stage. The simulators of the VR provide a necessary capacity to operate the patients without supervision. It is importantly utilized for image control, understanding, planning and enhanced the correlations in the medical domain. It comprises of robotic surgery, phobia treatment, surgery simulation, and skill training. The nurse, doctors, and other medical personnel are allowed by Human simulation software to connect with patients in a communication environment. In this VR environment, there are different training methods are possible. This environment not only offers the VR but also helped in pain reduction. Assuming the training simulator to develop physician training with better evaluation in the medical field and also offers security for patients in medical care in some literature, training based VR improved separate medical talents. VR combines the computer produced environment with the interface. In the medical field, both digital and virtual reality plays an important role both in the surgical operation and for the benefit of education. This particular technology not only plays the main role in the medical field but also in education. So that the review focus on the enhancement of the augmented and virtual reality in medical imaging technology.

The below figure.1 depicts the visualization of the real-world images or elements through a head-mounted display using glasses. The main objective of this paper is to study in the medical sector both articles relevant to the technology based on the improved AR and VR. How it works and for what purpose we go for this reality. It is fully based on real-world applications. Different methods and techniques namely tracking system is used for the surgical operation, health care as well as medical education both virtually and directly.

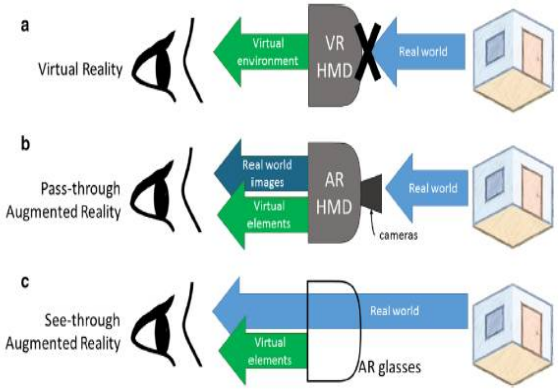

Figure:1 Visualization of virtual elements and real-world images with VR and AR

This survey is structured as follows. Section II explains the survey of augmented reality in medical imaging technology with various aspects and methodologies. Section III provides various reviews on virtual reality in the medical field. Section IV explains the various methodology review based on the medical domain in both AR and VR. Finally, section VII concludes this study.

II. Augmented Reality In Medical Imaging Technology

[1]Presented a prototype designed on distributed medical training to train medical doctors. Here the AR explained the systems class that utilized computers to surface virtual data on the real world. AR's learning abilities are enhanced in medical training and experiment by the system's ability to show 3D-medical models at remote locations. With the aid of AR approaches this proposed system was accomplished.AR environment has been maintained using the Adaptive Synchronization Algorithm (ASA), which improves participants ' sense and accommodates interactivity given delays in infrastructure. This program allowed paramedics, students, and pre-hospital staff to direct their expertise without actually touching a patient.

[2] Proposed a novel approach to support vessels by improving short videos with the help of spectral analysis and motion magnification from the surgical microscope. Cerebrovascular surgery act towards abnormalities of vessels that have been added arteriovenous malformations and aneurysms (AVMs) in the brain and spinal cord. The results showed that the proposed technique produced an accurate classification of blood vessels during surgery.

[3] Reviewed on AR technology such as camera calibration, patient registration, and object tracking, and then on medical applications such as cardiac interventions, resection of bone tumors, spinal and sinus surgery.The experimental results show the various application in the researcher's laboratory with their system configuration for each medical application.

[4]investigated the extent of AR which supported the medical professional training. Nowadays computer-based applications are utilized to aid the professional training in a medical environment that profit public and scientific interest. It provides an interactive virtual layer. Finally, the AR application is an interesting technology in medical education since interactive components are related to the traditional learning environment.
[5]described the technique for improved visualization that consists of AR, targeted staining method, unspecific and optimal modality namely narrow-band imaging. This emerged to improve the surgical field causes low invasive, elegant treatment and target-oriented that provide a necessary benefit to the patients. [6]The creation of the AR application to increase the excised tumor margin is based on the surgery of the skull-base. The Iso surface reconstruction algorithm was coupled with Microsoft Hololens and a self-contained holographic tool to enable simulation of computed tomography (CT). The results revealed that for the removal of lesions, Microsoft Hololens was used to design and overlay the patient's image data.In fact, Digital Imaging and Communication in Medicine (DICOM) software will be updated to the units.

III. Virtual Reality In Medical Imaging Technology

[7] Summarized three imaging segments that traverse VR and AR. Firstly, this paper defined the AR and VR then explained its application for education, communication, and training and medical care in radiology of intervention. Lastly, reviewed the current drawbacks and future direction in radiology.
[8] presented an interactive virtual operating room (IVOR) tool to improve the methods of OR and also two novel touch-free interaction techniques such as foot and gestures. Computer-aided surgery had penetrated the OR. The technique was employed and estimated with 20 surgeons and the outcome shows that this method can be utilized with minimal learning time and had no relevant differences based on completion time. The utility compared to control condition relying on the assistance of verbal instruction. Also, the tool was received by surgeons, although they had no prior experience with virtual reality. This results in an effective tool for user-centered design and estimation.
[9] introduced the various classes of surgical simulators in neurosurgery. Neurosurgeons faced the challenges of learning,,planning,and performing complex surgical procedures in which a small space for error exists.The application of virtual surgical environments is restricted by several technical provocationswhile we cannot assume the automated patient to be unable to differentiate from reality, new developments are being made in computational methods.Thus, this paper highlighted the recent developments in research areas concerning VR simulation involves computer graphics, anatomic modeling, haptic, visualization, and physics simulation and discussed the implementation of the neurosurgery simulation.
[10]A systematic literature review was performed in full compliance with the recommendations of PRISMA until January 2014. It included all randomized controlled studies comparing the teaching in virtual reality to other simulation styles or no experience. Only experiments were included utilizing unbiased and reliable assessment methods. This systematic review and meta-analysis aim to assess VR.Finally,Thirty-one randomized controlled trials have been included that equate virtual reality training with other training models or no testing. The findings of meta-analysis showed that VR training is much more powerful than screen trainers, and at least as good as box trainers.
[11]In this approach, VR enabled users to feel a sense of presence in a three-dimensional computer-generated world.A monitor head mounted and advanced interfaces provide sensory information. Such apps control head movements so that the gestures and photographs shift automatically with head movement, allowing for a sense of immersion.VR, which encourages sensory stimulation through the therapist to be administered regulated, it's an easy and inexpensive care.A research on the effects of using VR in managing different psychiatric disorders, based on the available literature,with a particular focus on anxiety disorder treatment dependent on exposure. A comprehensive literature review was undertaken to classify studies utilizing VR- based treatment for fear or other psychiatric disorders.The paper addressed the context of the advancement of VR-based technology and its use in psychiatric treatment, the scientific evidence of VR-based therapy,and the benefits of VR-related therapeutic research and treatment.It also provided ideas on how to incorporate VR into psychiatric care and discussed possible approaches to treatment and clinical research focused on VR.
[12]Proposed a novel VR simulator to increase the surgical skills for the great capacity to complement endourological training. The test on transurethral resection of bladder tumors (TUR-BT) was performed with the merits and demerits od novel Uro teacher (UT).There are 22 doctors in this report, plus advisors and patients.Finally, there is a need to increase TUR-BT training as twenty-seven % had experienced over taxing environments and only a few reported high satisfaction. The controller of the novel VR shows a high face and develops authenticity.Thus, had a greater capacity to complement the training of endourology.

Table: I Review Of VR And AR In The Medical Field

Author	Method/ System	Advantages	Disadvantages
[16]	Robust tracking technique in an endoscopic AR system	• Fast motion • Free of error accumulation	• Parameters are differently related to different models and induce cumbersome tuning. • Doesn't carry out reference frame
[17]	Visualization of data into diagnostic and treatment rules in AR	• increases surgical training • Work efficiency • Safety and cost	• No advanced human-computer interface
[18]	Arteriovenous malformation system	• Tailoring the craniotomy to individual patient's anatomy • Identify draining veins.	• Integrating AVM's hemodynamics features.
[19]	Improved VR and 3D visualization system for anatomy teaching	• Enhance the medical education process. • It provides assessment tools. • Easy understanding of the student.	• No interactive navigation • No anatomical data for each structure.
[20]	PubMed database method in VR and AR	• Enhance neurosurgery • Revolution in resident education	• Real-time navigation in the operating room is not available
[21]	PubMed and google scholar used for Phantom limb pain (PLP) management	• Level of immersion increased • Low cost	• Moving for better quality and usage
[22]	PubMed and google scholar for the use of VR devices	• Preoperative surgical planning provides a more realistic prediction • Intraoperative reduces the possibility of major complications.	• Better to implement more realistic, immersive and interactive simulations.
[23]	Large scale assessment technology	• Retention of material • Used for procedural simulation	• Miniaturization of hardware and greater reliability are missing
[24]	The head-mounted display system in VR	• Reduces the level of visual discomfort without eye-tracking systems	• A game prototype is not available for the better public domain.
[25]	A real 3D guidance system for surgery	• Address resolution and accuracy degradation issues • Improve precision reliability	• Less applicability planning, microscopy, and other domains

IV. CONCLUSION

This survey concludes the literature review of the enhanced approach of AR and VR in medical imaging technology. The overarching aim of using this technology is more frequent. It improves the reality experience. Whereas, VR is a technology that taken hold and enhances many areas of science, most preferably in the medical field. A specific concentration towards particular diagnosis and treatment of health disorders. This paper reviewed the concept of AR and VR and briefly shows the history of their enhancement augmented and virtual reality which experienced a standard development in medicine. Meanwhile, the radiological images play the main role in the diagnosis and planification of surgical approaches. Furthermore, mixed reality (MR) will be utilized for the improvement of this technology and also it will benefit further from artificial intelligence as well as machine learning developments.

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