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Augmented Reality in Healthcare

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Abstract - *An AR system integrates digital content into the real-world environment of a user. A innovate nursing assessment and education in medicine is possible with this technology. Caregivers can better understand complex medical situations with the help of AR, which is used in liposuction planning and medical interventions augmented reality, and the technology's importance has grown in recent years. In addition, its medical applications have been extensively studied as well. Surgeries that need advanced levels of accuracy can benefit from augmented reality in unique. Introduction to augmented reality and recent applications in medicine are discus sed in this paper. These basic concepts are followed by brief descriptions of three key components of augmented reality. In this article, the authors discuss a variety of applications they have developed in their science lab Even though augmented reality is still not a mod ern technology, HoloLens and Nintendo's Smart glasses are making it more popular and building momentum in clinical school. It can not only help students learn, but it can also improve patient care by enhancing medical training. As part of this new initiative, healthcare collections can get involved by becoming cognizant of augmented reality applications that can be beneficial for the students and educationalists.*

Key Words: Augmented Reality, medicine, healthcare, technology.

1.INTRODUCTION

Through contrast, the use of augmented reality (AR) to teach medical treatments is still in its infant stage. Simulated organs segmented from or before imaging data are merged with the real operating scene to create natural terms of inter surgical navigation none of them go beyond combining visual data with the real world. The adaptation of visual augmented reality to educational needs, including the inclusion of tactile feedback, is a central focus of our work. The clinical benefit is that the surgeon can focus on the operating f field instead of staring at a monitor.

1.1 Augmented reality in healthcare

With ever-increasing computational resources, AR in medicine has been able to not only connector image data in real time but also undertake dynamic simulation for ever-more complex models. Two distinct domains have benefited from its use: simulation and intervention. For the most part, AR uses images from medical image modality to show organ systems and surgical targets inside the human body, much like the sci - fi idea of x-ray vision. ***(06)(01)***

For e.g., we recognize the fusion of two or three imaging modalities, such as ultrasound (US) and video, and computed tomography (CT), or even US and CT and video, as examples of AR. It's possible that the "real" scene doesn't exist, but is represented by a surrogate image (a video, for e.g.) that represents the current world. ***(06), (12)***

1.2 Benefits of Augmented reality

Multisensory objects can be created, along with aesthetic, hearing, sensorimotor, olfaction and haptic. A virtual environment allows physical data from multiple sources to be combined in real-time. After years of development, 3-D anatomy information can now be viewed overlaid on a patient. They are often created using eye-wear showcases that overlay data on the world of the viewer. If doctors can keep their eyes on the patient while using a single AR display, they can improve productivity, safety, and reduce costs by reducing treatment regimen difficulties. Augmented reality in medicine has the potential to reduce costs due to safer practices and the elimination of the need for redundant screens, among other things. Nowadays, healthcare facilities must purchase expensive ultrasound, computed tomography, and bronchoscopy systems, each with a separate display. Additionally, Augmented Reality does provide a shared display, eliminating the need for each patient's data to be displayed on a separate monitor over time. ***(13)***

In regards to medicine, retail, and tech, augmented reality is making inroads into a variety of other industry as well. As far back as the late 1970s, people have been working on the concept of augmented reality. Take a closer look at the perks that use augmented reality in the healthcare industry in this article. In the following sections, you'll learn how augmented r reality (AR) can revolutionize health coverage and its long term. Augmented World (AR) technology allows users to see the world today and prototype digital information onto it. In real life, AR is a meld of Virtual Reality and Reality imposed on the world around us. Audio or virtual picture applied to videos or 3D models are examples of virtual environment. Devices, electronic items, a camera, and a pattern identification are used create Augmented Reality. ***(13)***

2. TECHNOLOGIES FOR AUGMENTED REALITY

Augmented Reality and Virtual Reality share a number of similarities in terms of technology and features, such as computer-generated virtual scenes, 3D objects, and interactivity. The primary distinction is that virtual reality seeks to replace the real environment, whereas augmented reality compliments it.

There are three main technical components of AR in medicine, including photographic inspection, patient enrollment, and object tracking.

2.1 Photographic Inspection

Things in the real world are typically captured by a camera and displayed on a display device e. In order to merge virtual objects with the reality, the camera coordinate system must be converted to real world coordinates. It is necessary to define the camera's characteristics before estimating the transformation. As a simple camera model, the pinhole model converts s the three-dimensional real world into a two-dimensional (2D) co - ordinate system known a s the images plan.

To work, an AR system needs a camera that can detect the user's movement and merge the virtual objects with the real environment, as well as a visual display, such as glasses, through which the user can see the virtual things overlaying the real world.

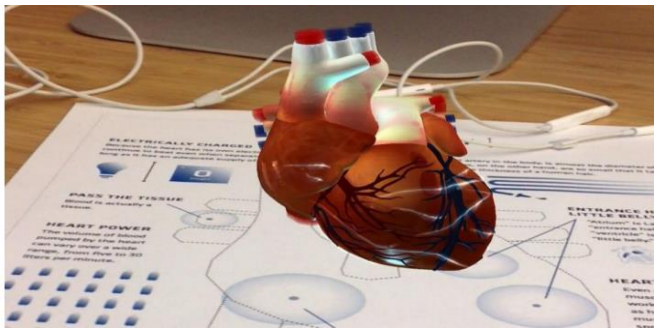

Fig -1: Heart Simulation

2.2 Patient enrollment

Data from computerized tomography or magnetic resonance imaging is used to create 3D volumetric models of the patient (MRI). Due to the fact that it provides the surgeon with a view of the internal anatomy and target points, it is necessary to register patient data in relation to real-world coordinates (patient enrollment). Enrollment using creating a strong affixed to the patient's body is a reliable method. A rigid conversion is used to register a set of more than four fiducial points with another set of coordinates.

However, the role of AR in consumer healthcare isn't wholly unknown. It's already having a big impact on our industry, with people using it for everything from assisting surgeons with visualization purposes during surgery to educating patients about their conditions and even exploring important medical data in more immersive ways, which helps researchers rethink how they do things.

To estimate the location of the device or marker on surgical equipment, object tracking is required. An object's relative position to the camera's position is generally determined in Augmented - reality tracking. ***(11)***

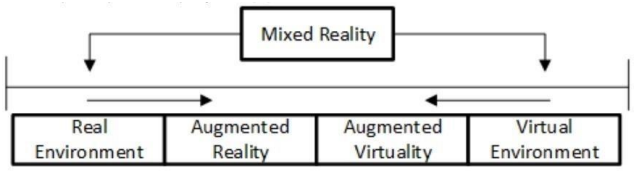

Fig -2: Spectrum between reality and virtuality by Miller - Urey et al.

2.3 Overview of augmented reality technology

To help you distinguish between AR and VR, this section provides an overview of AR and its definitions. There will also be a brief overview of the technology's development and its potential applications. Many different types of Augmented reality technology exist depending on how it enriches our surrounding with artificial means added information and whether one is able to interact with that information.AR is a form of virtual reality. Unlike VR, an AR system allows the user to see their own reality in true. This means that the VR system imitates reality rather than merely "probiotics the real world." MR is another term used in this specific sense, which could be explained by Miller-Urey et al "reality-virtuality's spectrum." Virtual reality (VR) and augmented reality (AR) are the two ends of the spectrum of MR. ***(10)***

A virtual or real environment can be enhanced with AR by adding a digital, often interactive overlay. The term augmented reality application (ARA) refers to digital applications that add an extra layer to the world around us. As a result of the blending of virtual and physical environments, the user experiences an immersive, interactive experience. The potential of ARAs in training medical personnel is therefore enormous. ***(01)(06)***

3. TREND ANALYSIS

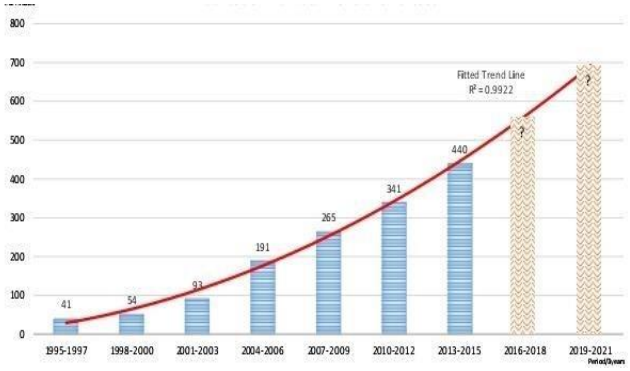

Chart -1

After analyzing seven historical periods, a matrix of articles was created using the topic and the attributes. FIGURE 3: Three-year trends (1995-97, 1998-2000, 2001-03, 2004-06, 2007-09; 2010-12; and 2013-15) are summarized in Figure 3. Charts all articles over seven time periods. In 41 publications in 1995-1997 to 440 articles in 2013-2015, the number of publications related to MR in medicine has increased more than 100 times. In the first decade of the 21st century (periods 2001-2003 and 2004-2006), the number of publications on magnetic resonance in medicine more than double from 93 to 191.

Physician encounter a wide range of medical challenges, and we have a magical boon that can help them overcome them. These are some examples of how Augmented Reality can be used in this context: Some of the streams listed below would benefit from it. ***(14)(05)***

4. STUDY SELECTION AND ASSESSMENT AR

Key terms (medical or surgery) AND (augmented reality) AND (educate* OR simulate* OR training) were searched for in Journal articles, Medline, INSPEC, and Systematically searched. Recently, on August 28, 2015, a new search was launched. Included were all types of research. In addition to conference proceedings, reviews, and studies that investigated confirmability or technological aspects, we overlooked reports that did not relate to a medical learning context. In accordance with the above criteria, all reports were evaluated based on their title and abstract. On the other hand, reviews deemed 'relevant,' 'dubious," or "unfamiliar" were analyzed in their entirety. ***(01)***

Accreditation council milestones can be assessed formatively using high-fidelity simulations in emergency medicine, but there is little evidence that they can be assessed summative or used as a mitigation tool ***(01)(08)(10).***

4.1 AR Solutions

When used correctly, augmented reality can enhance the perception of environmental conditions or situations. Knowledge about the user's surroundings becomes immersive and digitally enhanced with the help of sophisticated augmented reality technologies (e.g., adding computer vision, incorporating AR cameras into mobile phone, object recognition). Environment and object information is superimposed on the real world. AR can have a major impact on the growth of the organization. Workers and organizations can benefit from AR/VR technology by adding context, relevance and It will clarify a slightly elevated architectural features and identify the key components and interfaces required for an AR solution, according to the AR framework. ***(15)(17)***

In spite of the vast differences between AR applications, tracking, registration, pose estimation, location, template matching, and data intravenous are some of the common functionality's customization to every aspect of the organization. Can have a major impact on the growth of the organization. Workers and organizations can benefit from AR/VR technology by adding context, relevance and customization to every aspect of the organization. ***(17) (16)***

4.2 Visuo-Haptic Collocated Augmented Reality System

Using a head-mounted camera, we capture a representation of the entire scene, interpolate virtual objects on top of it, and showcase the augmented incident on a head-mounted display, as shown below. So that the virtual objects and the user's head can be perfectly aligned, the system must estimate the relative position between them. Because of this, it is essential to clearly estimate the head pose in relation to a world reference frame in which the visualizations are placed. ***(6)***

A trailing anomaly of around 2 pixels has been observed in experiments. Since the shorter delivery range otherwise may result in double images due to the blurriness among both left and right eye, the optoelectronic axes of either the left and right tubes must be merged by moving the tubes inwards and outwards in the current version. Weight of the Vario scope is approximately 300 grammes. ***(6)(7)***

5. SURGERIES IN AUGMENTED REALITY

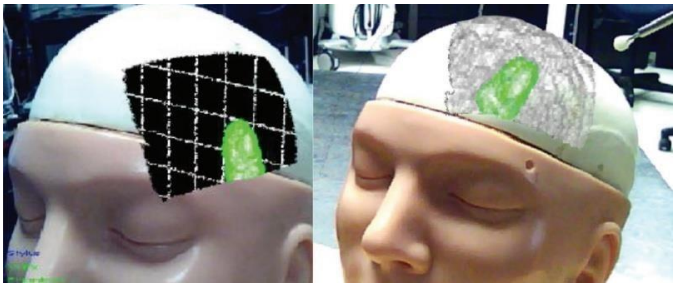

Fig -3 AR view of a tumor inside the brain, as visualized via a head-mounted video pass-through headset

To undertake mental transitions, surgeons usually rely on their previous experience or observation. These complexities may result in longer operation times or higher error rates for surgical interns. As a result, Abhari et al. developed a mixed-reality (augmented/virtual) system (Figure 3) to aid in brain tumor removal surgery training. Unaffected by the neurocognitive tasks that were performed, their proposed system outperformed conventional planning environments. Healthcare providers' time to perform clinically relevant tasks was also significantly reduced when they used the system. ***(12)***

This illustrated that AR and MR systems could assist residents in developing the spatial reasoning skills needed for planning interventional initiatives to enhance patient outcomes, as demonstrated by this study as a trainee in medical school, you are expected to "see one, do one, and teach one" in order to become a doctor and help the next creation. ***(9)***

5.1 Spinal Surgery

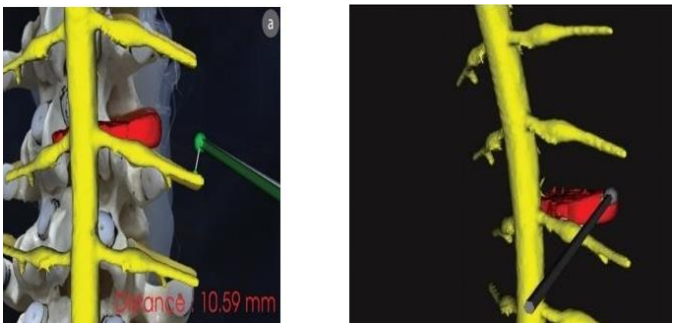

Fig. 4 Spinal Surgery Using AR

Most important in spinal surgery is the correct placement of the surgical instrument in the patient's anatomical structures. This has led to the widespread acceptance of AR-based surgical navigation systems, which help the surgeon to recognize anatomical structures on the Un VR/AR system with aligned view axes was proposed to improve depth perception by showing the distance among both surgical equipment and target body parts. Patient. Even though AR generates more insightful sensory information, inaccuracies depth perception is still a major issue in the field.

In the proposed VR and AR switchable surgical guidance system, there are sections for tracking position and visualizing results. Position tracking is calculated by an optical tracker and updated in real time with tracking data. Glass objects were displayed using a depth peeling technique based on a GPU and an open-source visualization library. It is possible to switch from AR to VR by revolving all around virtual camera, which shows the patient's anatomy in three-dimensional space. ***(11)***

6. CONCLUSIONS

It's really no surprise that the majority of research in the field tends to focus on interpersonal and inter surgical navigation. A multimodal system that could be used in medical education has been proposed as a potential use of this technology. ***(6)(12)***

The integration of haptic functionalities with high accuracy and stability was tested in order to achieve this goal There are a number of barriers to Simulink training in health care systems that can be overcome with virtual environment medical imaging, from therapy to simulation and training, is becoming increasingly interested in using mixed, augmented, and virtual reality approaches. There has been a lot accomplished, but there are still a lot of challenges to overcome. AR is a new method of teaching. There was an initial setback, but now it's showing its true potential in the medical field. Inevitably, developments in AR will have a significant impact on healthcare. ***(8)***

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