Rise of Augmented Reality: Current and Future Trends in Medical Field

Athira Pradeep
4th Semester BCA
Department of Computer Science
Christ Nagar College, Trivandrum

A S Lamya Fathima
4th Semester BCA
Department of Computer Science
Christ Nagar College, Trivandrum

Abstract- **Augmented Reality is an emerging technology that allows the introduction of digital components into the real world. The development of AR applications has become increasingly popular recently, with the spread of convenient and shoddy high constancy mobile devices. Augmented reality varies from computer virtual reality (VR) in that it adds an additional part to one's current reality as opposed to being totally submerged in a substitute reality. In the field of Medical, AR has evolved many new innovations. While there already exist several surveys regarding the involvement of AR in the day to day life. The use of AR acts as a boon to the medical field as they combine the digital parts with the practical environment. This paper gives a brief introduction of AR in the Medical field. It also gives detailed knowledge about future trends in the Medical field. We have also made a case study of the most recent blow in the medical field like Ultrasound Imaging, BCI, AccuVein, Keyhole Surgery based on AR. Diagnosis and treatment had become much simpler with the advent of AR. The benefits of AR is also greatly influenced by the patients right from the point of infection to the aftercare while leaving the hospital.AR applications enable the learners to imagine an interface with the three-dimensional representations of bodies.AR also allows the patients to understand the surgical procedure and the way how medicines work. This paper discusses AR's potential to display imaging data and other patient information that could save lives and decrease many medical errors. Also, we aim at providing information on some of the current technologies and the benefits of AR in the medical field.**

Keywords: Augmented Reality, Ultrasound Imaging, Brain Computer Interface, AccuVein.

I. INTRODUCTION

Augmented reality is the merging of the physical world into digital life. It can be also described as "unlocking the natural way the brain thinks using technologies". It aims to enhance the real world by overlaying computer-generated content with live visual display. The sector of augmented reality has existed for just over one decade, but the growth and development within the past few years have been wonderful.AR is totally different from VR where the user is completely immersed into a virtual world created by the computer. While AR brings virtual objects into the real environment of the user.AR is a mixture of advanced VR technologies. These virtual contents are usually in the form of digital images or videos implemented in 3D rendered models. The three key characteristics of AR systems: mixing virtual images with the real world, three-dimensional registration of digital data and interactivity in real time [1].

Over 40 years ago, the first AR with these characteristics was developed but due to less available technologies, mainstream adoption was limited. In 1997 and later in 2001, Ronald Azuma and his team presented a valuable and important survey on augmented reality[2]. Although, over the last few decades has been particularly rich in advances in this growing research field which opened perspectives for several opportunities to use AR in various application domains. Even with a wide variety of applications, AR finds itself mostly used in games and in the medical field. Other areas include military, robotics and in live presentations.

There's no question that we stay in a technology-obsessed world, with our dependence of the internet, computer systems, Smartphone, and different gadgets that promise to make our lives simple, or maybe assist us to get extra prepared. This generation has set up its place in society and technology has evolved quicker than most folks can even agree with. Plenty of industries, like in production, electronics, and education, are liable for enhancing and saving lives. Within the medical world, our dependence on technology is as essential as ever, and a way to its ever-evolving advancements, healthcare practitioners can maintain to find methods to higher diagnose illnesses, perform complex surgical procedures with laser-like precision, and enhance patient care extra than ever earlier than. The impact of the medical era on the world of healthcare will continue to significantly affect the lives of people around the arena.

Surgeons have relied on microscope oculars or other systems to operate, however, surgeons also typically depend on their own eyes and interpretations to execute the most precise task. Two of the most intricate surgical practices, neurosurgery, and retinal microsurgery, have been experimenting with new technology in the past few years. These stereoscopic systems not only keep a surgeons head up but they also immerse the surgeon into high resolution 3-dimensional presentation of a subject.AR technologies help in bringing a new scope in the field of medical science. Surgeons could now plan and practice operations without having a real subject, and medical students could now practice complex procedures through AR technology. No matter where you stand in the spectrum, there is no argument that AR technologies could

bring a new drastic change in the healthcare sector along with other fields. This paper tries to put a limelight on the current applications and future expansions and development of AR.

II. APPLICATIONS OF AUGMENTED REALITY

Although augmented reality has been around for years, it wasn't until Android and iOS smart phones came equipped with GPS, camera and AR capability that augmented reality came into its own with the public[3]. Augmented reality is technology that combines virtual reality with the real world in the form of live video imagery that is digitally enhanced with computer-generated graphics. AR can be experienced through headsets that people wear and through displays on mobile devices. The number of applications utilizing increased reality is increasing endlessly and also the outcomes are clear in several domains e.g. health care, business, education, and amusement. This section details with summarizing the previous researches that exploit the augmented reality applications in medical .

A. ULTRASOUND IMAGING

Ultrasound imaging is a highly beneficial diagnostic tool. To a greater extent it is considered to be a safer method by providing real-time imaging of complex structures. Also, it is an indicative imaging method used in the medical field, which is depended on the use of ultrasound. It is utilized to make pictures of internal body organs like muscles, joints; blood etc thereby aims at finding the source of a disease and to avoid pathology. Many advanced techniques were put forward by several discoveries, but the most widely acknowledged and newer invention was the use of application of augmented reality in ultrasound imaging. It helps to speed up the process of leaning the use of ultrasound, by providing a patient explicit correspondence, between the ultrasound information obtained continuously and adequately detailed augmented 3D scene.

The initial ultrasound visualization system was featured by the capacity to show few individual ultrasound cuts of a baby superimposed onto the pregnant patient's abdomen. This framework utilized conventional chroma-keying strategies to join rendered ultrasound information with a digitized video picture from a head mounted camera. And in this system, the alignment was poor, the pictures were not clear and the sense of the 3D state of the embryo was inadequate.

Later ultrasound made a small revolution in the field of medicine. Today it has another opportunity to make the equivalent utilizing the AR. Already many AR software companies developed convenient ultrasound scanner, which with the assistance of smart glasses function as a conventional one. It is difficult to overestimate the helpfulness of this innovation. Particularly

when we talk about utilizing it in the developing countries, in military medicine and even an emergency vehicle. Augmented reality may progress symptomatic imaging further. The most advanced inversions in the use of augmented reality in ultrasound imaging will come into existence soon. Also, augmented reality may upgrade communication between the radiologist and specialists
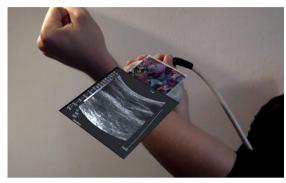

Figure 1 : Ultrasound imaging using AR[4]

B. BRAIN COMPUTER INTERFACE (BCI)

BCI also called a neural control interface or mind machine interface which acts as an interface between an enhanced or wired brain and an external device.   BCI can be utilized for repairing damaged sight and thereby giving newer functionality for people suffering from paralysis. The combination of Brain-Computer Interfaces (BCI) with AR can give extra correspondence channels, by expanding the transmission capacity of the human-AR connection. This is accomplished either expressly through dynamic BCIs or certainly utilizing uninvolved BCIs. Dynamic BCIs outstandingly enable clients to issue directions to gadgets or to enter content without the physical contribution of any sort, while latent BCIs screen a client's state (for example remaining task at hand dimension, intentional state) and can be utilized to proactively adjust the AR interface.

BCIs, together with AR, offers the likelihood for vivid situations through incited dreams of a falsely seen reality that can be used in essential BCI look into as well as helpful applications, human-PC Interaction, and so forth. To satisfy these desires, methodological advances are required for BCI connection and boost plan, synchronization, or managing AR explicit antiques and diversions. The objective of many newer technologies is to make comprehension of the momentum abilities of BCIs in AR applications, to propose a scientific categorization of flow and future applications, and to recognize and handle the most important specialized difficulties.

C. ACCUVEIN

Augmented reality (AR) is revolutionizing the delivery of medical field from routine checkups to point-of-care diagnostics to surgical procedures. AccuVein is at the forefront of this revolution [5]. About 40% of the principal intravenous injections fail, and this proportion is considerably higher on account of kids and old patients. The AccuVein utilizes augmented reality to adapt to this negative measurement. A handheld scanner extends on the

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skin and demonstrates the patients' veins. It builds the effective finding the vein from the first attempt in multiple times. That is the reason this creation got the best acknowledgment among the overall population and medical staff. Drawing blood from patients is a standout amongst the most intricate and precarious tasks for specialists. An organization called Evena has utilized AR to extend the veins of a patient straightforwardly on their arm to make blood transfusion simple.

Accuvein is basically a device used to improve the ability to find the veins in the health care department. By using the help of near infrared light reflection they create a map of veins in our body. The accuvein is also known as Near Infrared vein finder. Hemoglobin in the blood retains infrared light. At the point when the gadget held over the skin, veins show up recognizably not the same as the encompassing tissue. The vasculature shows up obviously on the skin's surface, helping in the vein area to gather a blood test.

Figure 3 : Keyhole surgery using AR [7]

D. KEYHOLE SURGERY

Keyhole medical procedure, or insignificantly intrusive medical procedure, is a careful strategy used to get to the inside of the body through a little cut, evacuating the requirement for open medical procedures. Amid keyhole medical procedure, a slim telescope fitted with a light source and a camera – called a laparoscope – is gone through a little entry point in the skin, giving specialists an amplified perspective within the body. Careful instruments can likewise be gone through the cut, enabling specialists to work. Keyhole surgery might be utilized to analyze certain ailments, just as to play out an assortment of surgeries, for example, the evacuation of harmed or unhealthy organs or parts of organs.

Keyhole surgery is a regularly performed strategy with various focal points over conventional open medical procedures. These incorporate diminished recuperation times after the medical procedure and decreased dimensions of agony, scarring and draining. The method is commonly sheltered, however conceivable inconveniences do exist.

A strong foundation of surgical augmented reality is first given so as to help the surveys. At that point, the different techniques for laparoscopic augmented reality just as their key undertakings are classified so as to all the more likely handle the present scene of the field. Finally, the different

issues assembled from these assessed methodologies are sorted out so as to plot the rest of the difficulties of augmented reality in the laparoscopic medical procedure. Studies propose that AR frameworks are getting to be similar to customary route strategies, with accuracy and wellbeing adequate for routine clinical practice. Most issues confronted by and by will be comprehended by further therapeutic and innovative research.

Augmented reality has all the earmarks of being an incredible asset conceivably equipped for upsetting the field of medical procedure through normal use. Later on, AR will probably fill in as a propelled human-PC interface, working in beneficial interaction with specialists, enabling them to accomplish far better outcomes. In any case, further progression is genuinely necessary to accomplish the most extreme potential and cost-adequacy of augmented reality.
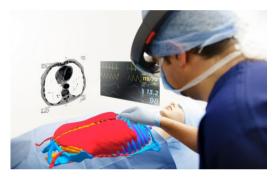

Figure 2: Accu Vein [6]

III. FUTURE TRENDS

Healthcare provision is one of the foundations of modern society. Out of the existing technologies applied to healthcare, AR also show many advances. AR technologies have already shown their value in healthcare and will bring more trends in the upcoming years. The future of AR in the healthcare industry will create business opportunities for companies with AR expertise. AR overlay digital information onto the real world. While VR takes us to an entirely new world. Over the last few years, advances in AR are in its peak stage. But when compared to VR, we are still in the early stage of AR revolution but in the coming years, we can expect an outbreak of AR devices and technologies on the market. Numerous organizations are currently working diligently to establish a frame work of the AR revolution. For example, Microsoft's Holo lens is massively remarkable and is seeing vast adoption throughout industry and the healthcare space.AR technologies enable doctors and other users to visualize and associate with 3 dimensional portrayals of bodies. Nowadays surgeons use many techniques to visualize the field on which they operate, but AR which can display 3 dimensional representation of the patients anatomy into the surgeons field of view, is likely to improve accuracy and outcomes for patient. Many feasible future directions are

speculated for future research. There are situation when it was hard to describe to the doctor what was bothering us. In order to increase patient's knowledge, medical app like Eye decides is using AR to show the simulation of the vision, harmed by the different disease. It helps patients to understand their condition and describe correctly their symptoms. Over the huge technological advancement in the last 25 years, including wearable technology and CT scans, have basically changed the diagnosis and treatment of patients. In the global market that will expectedly reach a value of $1.5 billion by the end of the year 2020, augmented reality has many benefits that will definitely change the medical world.

Humanity is at a crossroads over the last 200 years we've been able to achieve what in earlier times that have been described as miracles through our mastery, science and technology, we've been able to achieve the unimaginable. Despite huge advances in technology and Healthcare, surgery and new technology, Complex diseases among the population are soaring and healthcare expectations are rising. Surgeons just can't keep up. Today, you may wait a long time to get the surgery that you need or there is a need to travel long distances. Solutions and technology don't just happen; they are driven by reason, or a purpose. The internet and mobile technology connected the entire world. Augmented reality platforms allows surgeons to virtually transport oneself into any clinical setting anywhere in the world to visually and practically interact with another doctor in real-time guiding other doctors step by step, thus able to create virtual presence, thus recreating how the world collaborate together, as if they were in the same room.

IV. CONCLUSION

Even though there were many recent advances in AR, several researches, challenges, and issues still exist. In this paper, we have discussed considerable advances in the medical field. However, there are limitations and faults that need to be overcome. Due to the rise of AR technologies in the medical field, the distance between the doctor and patients has reduced. Most recent hardware and software advance reduced the cost of AR ultimately improving the experience of users and developers.AR apps introduced can valuable digital healthcare assistants for outpatient care. According to the studies made, AR has become comparable to existing navigation techniques with safety and precision required for daily clinical practice. In the future AR can be used as a powerful tool, capable of revolutionizing the field of surgery. Apart from the medical field, AR is utilized broadly in many other sectors in the form of social engagement, entertainment, and marketing etc.. As every day new forms are introduced. In addition, in the future AR will be easily accessible and will be a part of our day to day lives.

V. REFERENCES

[1]. Azuma, R.T., A Survey of Augmented Reality. Presence: Teleoperators and Virtual Environments 6, 4 (Aug 1997), 355–385, 1997.
[2]. R. Azuma, Y. Baillot, R. Behringer, S. Feiner, S. Julier, and B. MacIntyre, "Recent advances in augmented reality," Computer Graphics and Applications, IEEE, vol. 21, no. 6, pp. 34–47, 2001.
[3]. https://www.lifewire.com/applications-of-augmented-reality-2495561
[4]. https://www.medgadget.com/2016/02/augmented-reality-combined-with-ultrasound-hints-at-interesting-applications.html
[5]. https://www.outpatientsurgery.net/did-you-see-this/2014/04/accuvein-av400-vein-location-tool-616
[6]. https://www.accuvein.com/why-accuvein/ar/
[7]. https://www.theengineer.co.uk/through-the-keyhole-ar-headset-gives-surgeons-new-insights-during-operations/