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# Augmented Reality – Current Use and Future Influence in Healthcare

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**Abstract:- Application of Augmented Reality can be witnessed across various fields like ecosystem, geography, education and chemistry etc. Doctors are demanding the application of AR in healthcare as it provides an internal view of the patient to the doctor and thus reduces the need for invasive procedures. Since the medical professionals and students need more situational experiences in healthcare, thus the need to further examine the use of AR in healthcare arises. It would be an extraordinary method to get familiar with the future as it is accepted that AR is the future. We're in the beginning of AR in healthcare, yet the future will carry huge advances to the education of patients and medicinal experts, correspondence, and patient results. This research paper investigates the current use and potential future of Augmented Reality in the healthcare sector and analyzes the benefits it will carry to patients and doctors. The starting of the research paper talks about the current use of AR technology in the healthcare sector and the conclusion part talks about upcoming benefits of using this technology. The research paper talks about the current companies building AR technology for the healthcare sector and the benefits it is providing to doctors and patients.**

***Keywords:-*** *Augmented Reality, Healthcare, Medical Sector, Technology, Future, Doctors and Patients.*

## I. INTRODUCTION

Augmented reality (AR) is associated with interactive expertise of a real-world setting wherever the objects that reside within the real-world are increased by computer-generated sensory activity data, generally across multiple sensory modalities, as well as visual, auditory, haptic, sensory system and olfactory. Augmented Reality supplements the real world with virtual objects in such a way that these objects co-exist in the same space as the real world (Zhu, E., Hadadgar, A., Masiello, I., & Zary, N. (2014). Augmented reality in healthcare education: an integrative review. PeerJ, 2, e469). To put it simply, Augmented Reality is a method of putting digital pictures on prime of the user's surroundings. AR technology enhances the user's surrounding environment by overlaying digital pictures on numerous surfaces around the user, therefore AR links reality with fascination and lets the user experience his world with all new perspectives. Unlike Virtual Reality, which produces a synthetic environment, Augmented Reality uses a real-world environment and overlays additional information on top of it. Healthcare is an industry where stakes are very high as human life is involved and thus thinking about the public in general intrigue, the healthcare industry is open to new technological developments. The adequacy of healthcare is exceptionally dependent upon its utilization of most advanced solutions. So, AR and Healthcare seems a perfect fit. These technologies offer feasible solutions to difficulties of the healthcare industry and offer diverse opportunities of its usage in different fields like medical training and diagnosis. Medical sector involves complex learning like understanding complex physiological frameworks, creating versatile ability and procuring the collaborative aptitudes required in multidisciplinary medical practice. It includes authority of skills that empower the person to viably perform work related exercises to the benchmarks expected in the expert condition. This requires sufficient chance to rehearse and the capacity to encounter every single imaginable variety in settings and conditions so as to get experienced. Use of AR in healthcare will allow medical procedures to be carried out easily and will increase the accessibility and availability of these services. AR in healthcare can drastically improve overall effectiveness and efficiency of medical services.

## II. LITERATURE REVIEW

Kamphuis, Barsom, Schijven and Christoph in their research paper Augmented Reality in the Medical Sector? (Kamphuis, C., Barsom, E., Schijven, M., & Christoph, N. (2014). Augmented reality in medical education? Perspectives on medical education, 3(4), 300-311.) states the use of Augmented Reality for complex learning in the Medical sector and using AR to offer a highly realistic learning experience in collaboration with complex learning. Examples and empirical evidence used in this research paper are 2014 based, so these are not up to date and new trends in AR needs to be analyzed in the medical sector. Barsom, Graafland and Schijven in their paper Systematic review on the effectiveness of augmented reality applications in medical training (Barsom, E. Z., Graafland, M., & Schijven, M. P. (2016). Systematic review on the effectiveness of augmented reality applications in medical training. Surgical endoscopy, 30(10), 4174-4183.) tries to recognize the value of AR applications for preparing experts in medication. The primary target in this research paper was to give an outline of ARAs utilized in medical learning and training. The subsequent target was to assess their legitimacy in doing so deliberately. It states that ARAs have been created to prepare or instruct restorative experts, as a route device during surgeries to upgrade perception at the operating room and as a helpful device in the treatment of patients. Jennifer Herron in a research paper titled ‘Augmented Reality in Medical Education and Training’ explains how augmented reality can help in student instruction and education, and additionally can affect patient consideration through its capacity to upgrade medicinal practice and training. Therapeutic libraries can participate in this new trial by monitoring applications in augmented reality that can benefit students and teachers (Herron, J. (2016). Augmented reality in medical education and training. Journal of Electronic Resources in Medical Libraries, 13(2), 51-55). Wee Sim Khor, Benjamin baker and

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other authors stated that Augmented reality (AR) and Virtual reality (VR) are quickly getting progressively accessible, available and critically moderate, consequently their application into healthcare to improve the healthcare utilization of information is sure. They examined the application of AR in surgeon's armamentarium and they provide potential zones of advancements in this field (Khor, W. S., Baker, B., Amin, K., Chan, A., Patel, K., & Wong, J. (2016). Augmented and virtual reality in surgery—the digital surgical environment: applications, limitations and legal pitfalls. Annals of translational medicine, 4(23). KJ Carlson and DJ Gagnon in their research paper talks about how Augmented Reality Integrated Simulation Education (ARISE) includes the concept of AR and game-based education theories. ARISE is a developing, adaptable instructional technique for medicinal services disciplines being built for medical students for open-source use (Carlson, K. J., & Gagnon, D. J. (2016). Augmented reality integrated simulation education in health care. Clinical simulation in nursing, 12(4), 123-127). When compared with these research papers in the field of study of AR in healthcare, this research paper talks about the current usage of AR in this field along with suitable examples and also talks about possible upgrades this technology may provide to the medical and healthcare sector.

## III. ANALYSIS

According to Digi Capital (https://www.digi-capital.com/news/2019/01/for-ar-vr-2-0-to-live-ar-vr-1-0-must-die/) augmented reality is an industry which is expected to grow over 2.5 billion in global market. AR in the healthcare sector has already made its way and is surprising everyone by transforming the healthcare and medical sector; from supporting doctors during complicated surgeries to improving the overall quality of service provided to patients. Use of AR in medical procedures is both beneficial for doctors as well as patients, following are the benefits of using Augmented Reality:

The application of Augmented Reality helps doctors in 2 ways, firstly in training and learning aspects and then in improving the quality of diagnosis overall.

AR technology allows learning and teaching to be more interactive helping doctors to access the practicality of the subject in a better way. For e.g. Having such an AR app that if it is placed upon a page with a heart image, this application will show 3-D beating heart. This way students can learn the functionality in a better way. Another example is Medical Realities which is an innovative medical training organization that allows users to experience operation through the eyes of a specialist, seeing what they are doing, how they are doing and looking for some valuable techniques they can learn from them. This all happens using AR and Google glass (https://www.medicalrealities.com/).


Fig 1: Students using Google Glasses

AR will improve the doctor's ability to diagnose the health issue by allowing them to access real time data and information faster than ever. AR helps surgeons to access information without even shifting their attention from the patient. Important information and statistics are kept in front of the surgeon's eyes, thus enhancing the quality of treatment and medical procedure. Microsoft's HoloLens changes the way doctors learn human Anatomy by overlaying CT scans and other details onto the patient's body. This will make diagnosis better by providing real time and accurate visual information. In simple words, it provides students with real life stimulation of surgeries without actually being involved in one (https://case.edu/hololens/).

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Fig 2: Real life stimulation of surgery using Microsoft HoloLens

AR can allow nurses and doctors to find the nerves of patients easily by putting in IV needles, thus making the process easy, especially in case of babies and elderly people. AccuVein uses AR for vein visualization. It is a scanner that allows nurses and doctors to look for patient's veins easily, thus allowing easy penetration of needles for blood tests etc. This method places the patient's vein mesh on top of him, making the procedure much easier and uncomplicated.

Fig 3: Use of AccuVein to find nerves

For patients, Augmented Reality will considerably improve the standard of treatment they receive from their healthcare provider. For starters, the risks related to minimally invasive surgery (which involves creating a small incision within the patient's skin and inserting medical instruments) are often reduced by keeping the foremost necessary information front and center for the doctors. InnerOptics uses AR technology for needle-based interventions, providing a 3-D stereoscopic interface that allows surgeons to accurately perform complex needle operations. InnerOptics provides real time navigation for use in minimal invasive operations. InnerOptic's product magic loupe uses ultrasound and electromagnetic technology along with AR to help surgeons guide needles while invasive operations to their intended location, thus helping in improving accuracy in complex operations which are currently performed using ultrasounds only.

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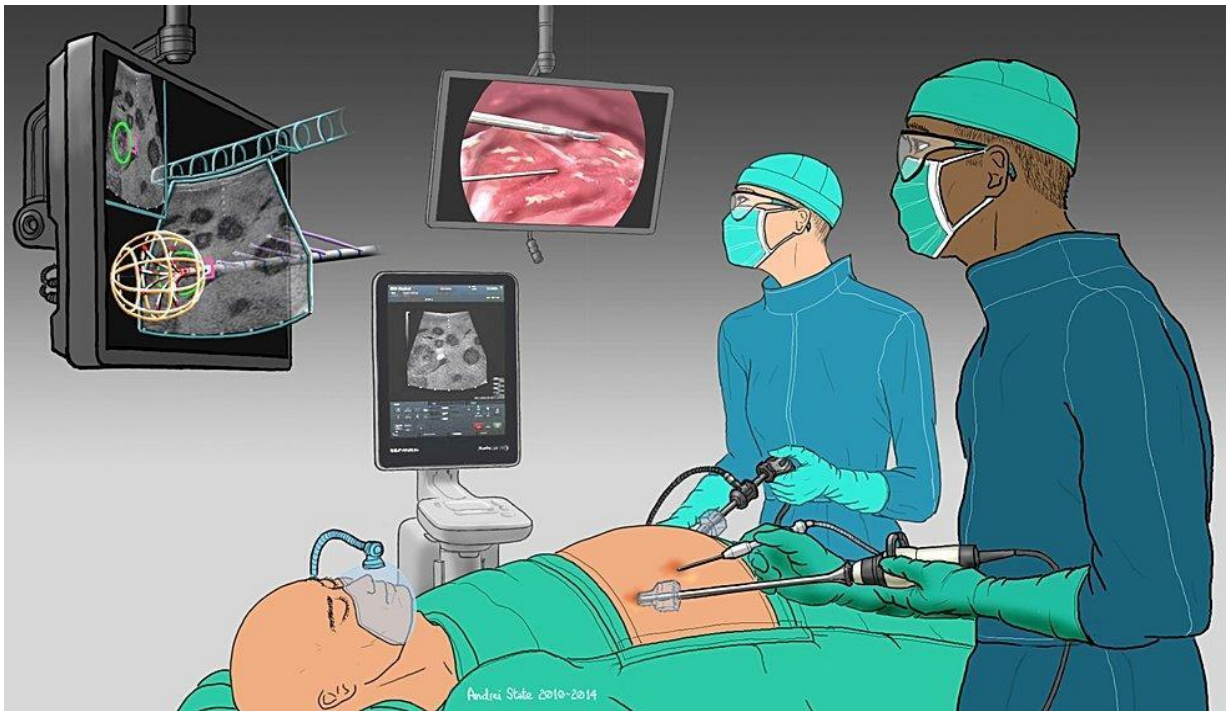

Fig 4: Real life stimulation of InnerOptics

Earlier monitors and systems were required in operation rooms to display vital images and statistics, which were delivered by endoscopic microscope but AR will help during the procedure and will help them focus on operation.

AR when collaborating with applications will help in better understanding of diseases to patients by doctors, usually patients are not able to understand the disease due to technical terms etc. but AR can solve this problem by better illustrating the impact of diseases.

AR technology can help in improving patient's aftercare, especially older ones who usually have this problem of forgetting medications, AR combined with google glasses can be their personal healthcare assistant reminding them to take medications on time.

AR is now helping doctors to treat cancer in a better way by allowing them to locate cancer in critical areas.

Developed by University of Alabama at Birmingham, it is now possible for surgeons to perform surgery without being physically present. This technology, by using two-way interactive video conferencing, allows remote surgeons to actually feel and see what a local surgeon is feeling and seeing in an operation theater and in this way remote surgeons can assist local surgeons in performing surgery.

All of these examples explain the current usage of AR in the healthcare and medical sector that not only helps doctors but also patients taking this service. Current usage of AR in healthcare is already very promising, beneficial and efficient so expectations about the future of Augmented Reality in this sector are expected to provide enormous benefits and support to doctors as well as patients for better diagnosis and treatment. That implies there is a gigantic open door for organizations that comprehend augmented reality and have the vision to make creative new AR items and applications.

Following are the possible upgradation that Augmented Reality will provide to healthcare and medical sector:

Patients can explain their problems better using Augmented Reality as a lot of patients battle when they need to portray their manifestations and problems to their primary care physicians precisely. In different cases, individuals frequently end up blowing up a therapeutic circumstance or unexpectedly, disparage the issue. In ophthalmology, Augmented Reality may be the response for understanding patient instructions. Application which utilizes the camera show for recreating the effect of explicit conditions on an individual's vision. Utilizing applications like EyeDecide, specialists can show recreation of the vision of a patient experiencing a particular condition. For example, the application can show the effect of Cataract or AMD and in this way help patients comprehend their indications and their genuine therapeutic state. On the off chance that patients can encounter the long-haul impacts of their way of life on their wellbeing, it could spur individuals to roll out positive improvements.

AR can allow pharmaceutical companies to provide more inventive and innovative medicine and drug information and description. With the assistance of AR, patients can perceive how the medication functions in 3D before their eyes rather than simply perusing long depictions on the jug. Lab laborers could screen their analyses with expanded reality hardware. In pharmaceutical plants, laborers could begin working without hands-on training as the gadget would instruct them, and how to do it.

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Instructing students about human anatomy. There is a UK based company called Curiscope that makes vivid learning encounters in virtual and augmented reality. They built up the Virtual-tee T-shirt, through which you can see the inward pieces of the human body through practical 3D images. Virtual-tee breathes life into life structures to such a point of deception which as of now speaks to Arthur C. Clarke's renowned third law.

Augmented reality can help specialists in the operation theater. Specialists and even patients know about the way that with regards to medical procedure, exactitudes and precision is of prime significance. Presently, AR can assist specialists with getting progressively proficient at medical procedures. Regardless of whether they are directing a negligibly obtrusive methodology or finding a tumor in the liver, AR social insurance applications can help spare lives and treat patients consistently. Medsights Tech built up a product to test the practicality of utilizing augmented reality to make precise 3-dimensional recreations of tumors. The intricate picture reproducing innovation essentially enables specialists with x-rays views – with no radiation presentation, continuously and in real life.

Envision that you are strolling through a dim and deserted back street, and you all of a sudden hear the moaning and the sluggish development of weird animals and zombies. Even the laziest individual would accelerate in the wake of understanding that a "genuine zombie" is after him. This is the essential thought behind the Zombies Run application. The game consumes on the way that dread can propel individuals and the way that everything is by all accounts increasingly fun when transformed into a game. This application is ideal for the individuals who think about running an exhausting action. On the off chance that you hear as well as observe virtual zombies anticipated onto your telephone or gadget's screen, you won't just speed up and continuance, yet in addition feel that time is simply flying by.

Google Glass may help new moms battling with breastfeeding. While Google Glass couldn't vanquish the world, it could be utilized to assist new moms with breastfeeding. A development organization called Small World led a Google Glass preliminary with the Australian Breastfeeding Association that adequately enabled their phone guides to see through the eyes of moms while they breastfed at home. Through such a way battling moms could get master help anytime and anywhere and they didn't need to put down the infant from their arms. By sharing the patient's viewpoint, diagnosis and consultation gets to another level.

AR can be utilized in finding the nearest emergency clinic and managing it. While its reasonableness is as yet constrained, it is an alternative that can possibly save somebody's life, and that is constantly significant. Then again, directing can be utilized by patients to explore enormous medical clinic structures to discover where their primary care physicians are arranged or how to arrive at a spot where their treatment will occur.

Augmented reality can conveniently fit into the medical and healthcare sector through envisioning information. A valid example could be pictured patient information with a probability of live details and statistics. Applicable patient data is one of the urgent components that empowers successful treatment. Augmented reality can show the details legitimately on the patient's body - calling attention to the risky focuses and indicating important details. While it sounds convoluted, the entire thing can fit into a couple of shrewd glasses and get through to the cell phone. Another significant method to fit AR into the assessment and medical procedure is by means of Body mapping. A full cloning of the patient's body may prove to be useful when the case is confused or when the specialist is physically inaccessible to go for treatment.

Augmented Reality is utilized in the healthcare and medical sector over the present reality, for applications that incorporate vein representation, careful perception and training. Late technology advancements have diminished the expense of augmented reality while essentially improving the experience for surgeons, doctors and patients. Ground breaking medicinal services suppliers are researching the potential advantages of AR to their clients and their business. We're in the beginning of AR in medicinal services, however the future will carry noteworthy advances to the training of patients and medicinal experts, correspondence, and patient results and diagnosis.

We have seen that AR is the mix of a physical preparation condition that is fundamentally the same as or equivalent to the genuine condition expanded with visual as well as other tangible data. Learning bolstered with AR innovation empowers pervasive, communitarian and arranged learning. It conveys a feeling of quality, promptness and inundation that might be useful to the learning procedure. The affordances of such learning situations can possibly invigorate important learning, a fundamental essential for the move of figuring out how to happen.

## IV. CONCLUSION

Augmented Reality applications are among the most energizing and historic innovations accessible today, and the potential for medicinal applications is stunning. By using this innovation, patients and doctors can settle on increasingly educated healthcare choices, prompting a superior standard of care and a superior personal satisfaction. While a significant heated discussion can be sorted out about the favorable circumstances and weaknesses of AR in the medical sector, nobody can deny that it is changing medical and healthcare for good. Yet, there is a great deal of refinement yet to come in the innovation, and we are yet to figure out how to intertwine AR with our lives more profoundly, however the underlying headways are promising and illustrate a magnificent image of the coming future. It is basic to come up with pragmatic answers for the issue as well as to keep them inside sensible limits that will forestall any conceivable immediate or symptom hurt. The stakes are a lot higher, and outcomes matter more in medicinal science where there is no space for pardons yet it is likewise significant that each AR solution to the medical sector additionally adds to

the examination of the long-haul impacts of utilizing augmented reality. It is just a beginning for AR in the medical learning and healthcare sector but it has huge potential in advancing in this field. So as for advancement of AR in the healthcare sector, an enormous amount of research is required along with a satisfactory research plan that not only incorporates prototypes but also substantial estimations. At exactly that point will the genuine value of such propelled technology frameworks become clear and ready to use.

## FURTHER SCOPE

This research has been done solely keeping in mind the medical and healthcare sector but with the upgradation of technology especially augmented reality and virtual reality, their impact can be analyzed in other sectors as well. This research paper is all about the use and future of augmented reality in the healthcare sector but the impact of virtual reality has not been touched at all and this side of technological development in the healthcare sector can be analyzed and written about.

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