Acceptance of Augmented Reality as a Method of Training in the Medical Field

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Abstract - Recent studies have indicated the acceptance of augmented reality across various departments in the medical field. The usage of augmented reality (AR) has reduced the complications faced by doctors and nurses during procedures and also helped in reduction of anxiety in patients and their relatives. This study looks at the impact and importance of augmented reality in the medical field by exploring the current technology and systems of AR. It also looks at various obstacles that may be encountered when developing any application using augmented reality. The paper is split into many sections, each describing in detail the importance and effectiveness of augmented reality. In the real world, a new or upgraded technology or tool can be explained to the general public through architectural models and this is where AR comes into play. This research proposes a newer avenue - training using augmented reality in the medical field. It also discusses the acceptance of such technology in the said field.

Keywords: Augmented reality, augmented reality technologies, medical training, technology acceptance

1. Introduction

As most studies indicate, the general public prefer to understand the latest introductions in the market through visual means and media. Augmented reality (AR) technology helps in this and provides users an overview of products that are yet to be launched through visual effects. The technology creates a computer generated image of a user’s view of the real world merged with the features of the product thus providing an approximate image of the product to the user. This unique feature has resulted in the advancement of the technology and making it one of the largest industries present in the current world. The acceptance and popularity is mainly due to the unique feature of making users understand what they will be experiencing when they invest in products well before hand.

This study is based mainly on the usage of the features of Augmented Reality in the medical field across various departments like training new personnel, making the patients understand about the treatment they are about to receive and areas of specialisation for doctors The study will explain in detail about how this can be implemented and as to how it will help the doctors, students, patients and any personnel associated with medicine all alike. To cite an example that can reiterate this point, based on a study related to the methodological approach in implementing simulators for radiation therapy, the treatment of cancer was classified into surgery, radiotherapy, and systemic treatment. In most cases, radiation therapy (RT) was done to control small tumours and to analyse the treatment which can be provided to each patient based on the size of the tumour. Hence, most patients diagnosed with cancer go through a RT procedure. However, the unavailability of trained personnel result in the application of the technology in RT by lesser skilled personnel with the basic level of training in both technical and non-technical skills. As per the study, a person involved in RT should stay updated on the latest tools and skills required for the same.

2. Usage of AR technology in the medical field

AR in Medical field will be a revolutionary process and will help the doctors, nurses in diagnosis and providing treatment to the patients based on the results. Also it can be used by pharmaceutical companies to explain the advantages of a drug newly introduced in the market. AS also makes the job of nurses a lot more easier by allowing them to identify veins easily for blood transfusion on injecting any medicine in a patient. Major complex surgery
can be made simple by assisting surgeons in the operation theatre. Patients can be scanned for diagnosis and start treatments without making them go through any difficult task or without making the patient suffer in any manner. Also as a patient has every right to know the procedure that is planned to be performed and the treatment which will be administered after the surgery. There are numerous cases where AR has been used in the real world. To cite an example, a team of surgeons performed a shoulder replacement procedure using google glass and AR tool VIPAAAR. The professionals in the medical field are accepting the technology with both hands and are open for wide use of AR in the future. With proper platform, all medical professionals can simplify their jobs through AR and the most important is the minimalist of risk involved. However the major hindrance in implementation of AR is the lack of information and the ignorance of benefits AR. The common knowledge is that AR cannot be used across different device. But this is a common misconception and many apps have been developed for usage across devices and can be applied for various medical procedures.

3. Need for the study
The first thing that comes to a person’s mind on hearing the words augmented reality are video games. It is true that AR was first used by the gaming industry and was used for entertainment purpose initially. But now companies understand the need of AR in retaining top talent and also simplify the tasks at hand for doctors and patients alike. The usage of AR will also help in transformation of safety in the health industry by providing an alternative to the real world scenarios and information through a computer generated image incorporating the scenarios.

4. Implementation of AR for training medical professionals
AR is gaining polarity through the usage of Google glass and MS HOLOLENS in student education and patient care. The medical field is vast and involves complex learning which involves extended hours of analysis of complex physiological systems, expertise over them and acquiring the skills for medical practices. This requires multiple practical approaches to reach the expert level which can be reached through AR through facilitation of meaningful learning and transfer. Augmented (virtual) part visualizes the invisible and simulate relevant and other aspects of the real world task. It helps in providing the necessary variations in the training task including collaboration which supports authentic learning. Real time interactive nature of AR provides immediate learner feedback which supports taking control over the learning process. AR learning environments do not always require an expert or instructor to observe trainee performance. AR learning environments can provide situated just-in-time and just-in-place learning. AR can also be used to train medical professionals and now we can see certain tools which are currently in use for the same. VR Dentist is an AR application helping dentists to understand the tooth structure and perform procedures based on the results. SMARTSKIN and ANATOMY 4D are advanced AR applications which display changes in the skin of patients undergoing radiation therapy and visualizes detailed bone structures and organ systems respectively. As for the development of new applications in AR the existing applications are analyzed and modified, Google Glass being one of the major applications used for this purpose.

The aim of this study was therefore to investigate of the current state of AR in healthcare education and its reported strengths and weaknesses of the reported AR applications for education in healthcare.

5. Theoretical Background
Augmented reality (AR) prepares an illusion which merges the objects in the real world with virtual objects and produces an image such that it is visualized to co-exist in the same space (Zhou, Duh & Billinghurst, 2008). AR is a powerful tool which has the potential to provide a clear cut picture in explain theories to students and also provide ample opportunities for exploring complex structures of the human body by medical professionals. Students can make use of AR to understand the connection between the real world objects and virtual objects thus bringing the data to life. Doctors prefer working with AR so as to get an internal view of the patient without doing any invasive procedures (Bajura, Fuchs & Ohbuchi, 1992; Chris, 2010; De Paolis et al., 2011; De Paolis et al., 2008; Pandya, Siadat & Auner, 2005).

AR has put forth the following beliefs in the general public and medical professionals:

- Medical students can help in achieving core competencies, such as decision making, effective teamwork and creative adaptation of global resources towards addressing local priorities (Frenk, Chen & Bhutta, 2010).
- Provides a more personalized and explorative learning experience to the students.
The patients’ safety is safeguarded if mistakes are made during skills training with AR.

AR is a technology that creates a virtual scenario by integrating objects in the real world through computer generated images with virtual content. This results in enhancing the perception of the object by different individuals in the real world. The 3 commonly accepted criteria of AR are the combination of real and virtual environment, the interactive nature in real time and the incorporation of the real world and virtual object into a 3 dimensional single object. There are multiple personnel who have worked for contributing towards advancement of AR technologies across all fields. One such person is Mark Gregot, co-founder, and CEO, NuEyes, who was determined to prepare AR glasses for people with low vision perception. Currently, NuEyes has $1.2 million investment for the development of smart glasses that are built on ODG R-7 platform. Also, around 50 percent of the cost of the glasses is covered by the shares held by NuEyes in insurance hence making it more affordable to the visually impaired. On analysis of customers using smart glasses by NuEye, it was found one of the most satisfied customer was Felix who was just 9 years old and was blind due to a rare condition. However, the smart glasses opened a new world to Felix by allowing him to see at least different shades of color even though he is not able to focus on facial expressions or objects placed in a room or place. However he is now not completely shut out from the outside world as he is able to see faces of his classmates and hence is able to experience the learning in a similar manner to that of his classmates from an educational perspective.

Similarly, another company, Fujitsu, has developed a heart simulator capable of giving a 360 degree experience of the human heart to the students and other personnel involved in the medical profession. The model will display muscle activities and blood flow networks allowing the medical personnel to recreate cardiac conditions and allowing them to understand better about the condition and start treatment based on the analysis. It also allows personnel to increase the effectiveness of simulators used during cardiogram lectures scheduled for the students of various universities. The plan was to commercialize the VR heart simulator for educational purposes so that there will be a rapid growth in the medical field through the usage of AR technology.

Another major breakthrough was by a therapeutic company, Pear Therapeutics, for delivering therapies digitally for various disorders related to stress and tension. Also, the company received FDA clearance for launching one of their AR application on mobile device which will assist in treatment of substance use disorder (SUD). This instance was the first of its kind which was legally approved by FDA. As quoted by Beth Rogozinski, Chief Content Officer, Pear Therapeutics,”FDA approval for prescription digital therapeutics using virtual reality moves the use of this technology beyond the noise in the market and creating scalable, affordable digital tools that work for patients, “In other words it is best for the patients who are in dire need of treatment for various ailments.

6. Technology acceptance model (TAM) model

The technology acceptance model (TAM) explains the different ways on how various users understand accept and start using a new or modified version of a technology. TAM does this by making use of the information system theory. Whenever a user is introduced to a technology for the first time he or she accept it based on a number of factors, like, usefulness and ease of use of the technology for their daily work. The interest of the medical professionals and general public in understanding different kinds of illness has elevated the need and significance of theories which explain acceptance and use of different treatments and medicines. This can be achieved through AR and hence the Technology Acceptance Model (TAM) model may be appropriate to understand the acceptance. TAM was developed so as to analyze the use of updated and latest technology in various fields including the medical field.

If the acceptance of AR in medical training is assessed using the TAM model, we can ascertain what motivates or prevents users from considering AR as a worthy substitute to the existing models. There are many advantages of using TAM Model during introduction of a new technology in any field. Primarily, in the current world both patients as well as medical professionals are influenced by the use of technology. To cite an example, patients and relatives search for information based on symptoms and results before and after diagnosis. Medical professionals on the other hand prefer technology to reduce the complexity of the task at hand. But as expected a coin has always two sides and with benefits do come certain disadvantages. One major disadvantage is the social pressure that may lead to the credibility of the technology.

7. Future Scope

AR is currently being widely used across industries for multiple purposes, but still it has not yet reached to all the industries and market available. It still has to reach out to the general public in such a manner that the people
accept it as the most familiar user interface. Once the technology is accepted by one and all, it would be easier to incorporate it in uses of daily life.

AR can be used in educational purposes in the medical field for making the students understand better about the human body and anatomy. Doctors can make use of AR to understand the illness suffered by a patient and provide the treatment based on the results at a reduced price and reduced investment. Patients can be made aware of their illness through 3D images and displays. A patient who understand his or her disease will be easier to handle for the medical team and hence can bring about a drastic reduction in the cost incurred during treatment for patients and the time consumed by medical team for investigation and diagnosis of the illness.

8. References


