Smart Glass Integrated with Augmented Reality in Medical Field

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Abstract- *Smart Glass is a wearable sensor presented to facilitate and access information, assist people while performing tasks, today there are multiple applications and much research analysing the potential impact of augmented reality technology in different fields of health care. Smart Glass integrated with augmented reality can satisfy the need of managing and having rapid access to real-time information in different health care scenarios up to a limit. The smart glasses also works as an extension for people with poor vision or partially blind using up a head-up display (HUD) along with augmented reality. Among the most common applications are access to electronic medical records, display monitorizations, decision support and remote consultation in specialties ranging from ophthalmology to surgery and teaching. The device enables a user-friendly hands-free interaction with remote health information systems and broadcasting medical interventions and consultations from a first-person point of view. However, there are few important technical limitations in its use and integration, some of them are failure in connectivity, poor reception of images and sometimes automatic restart of the device. Results have allowed to obtain a basis to define requirements for medical applications to prevent network, computational and processing failures associated with the use of smart Glass.*

Keywords: Augmented reality; Imaging; Integration; Learning; Medical systems; Poor vision; Smart Glass; Surgery; Throughput

I. INTRODUCTION

Augmented reality is a view of a physical, real-world environment which is live, direct or indirect. It is related to a general concept called mediated reality, which means a view of reality is modified. This technology functions by enhancing user's current perception of reality. The user can see the real world and also perceives virtual content that is created by a computing device and is displayed by an additional light source which does not prohibit the perception of real world. Interaction with those virtual objects is a way of communicating with the computing devices. The confluence of advanced smartphone technology and widely available geospatial databases, the opportunity for a fundamentally different approach. The current generation of smartphones is sufficiently powerful to render multiple voices of spatialized audio, and also integrates GPS, compass, accelerometer and other sensors that allow for a complete audio augmented reality system that is useful and enriching to the medical industry recent development of consumer-grade augmented reality has opened new doors to potential solutions, augmented reality devices overlay holograms or computer-generated objects onto the user's view of reality in real time .the smart glass involving augmented reality technique can help in various ways such as used during surgical procedures to consult with other physicians and sharing information with providers nationally and internationally, the glass could also be used as a teaching tool during surgeries by live video screaming or capture the video and refer for studies later , emergency service technicians can use the smart glass in the field to get support from other medical professionals getting guidance for difficult procedure and serve as time and life saver, hands free glasses would also be cleaner and safer to use in health care environment since they are not touching multiple surfaces like smart phone or tablet and hence more sanitary

II. HARDWARE

Smart Glasses are spectacles embodying the wearable computing concept and either allowing people to see better or acting as an enabling technology for augmented reality .Smart Glass is made up of many different components with each part specialized for doing different tasks.

1) FRAME

The frame is the simplest part of smart Glass and requires the smallest number of materials, its basic structure is a frame, a core processor located inside of the frame, and the optical display that is presented in front of the user's eye.

2) PROCESSING

The basic piece of all digital technology is the silicon chipThere are central processing unit, a flash drive and a random access memory chip. The silicon chip contains hundreds of integrated circuits, mainly transistors that are made of germanium, which are layered upon each other to form an

intricate network. These components can perform control, logic, and/or memory functions." This material is essential for electronics to function. These chips are conceptually the "brain" of the device. Inside the frame is where the central processing unit (CPU), memory, and other technical parts are stored that make smart Glass able to perform as powerful technology. It's held on a printed circuit board (PCB), The CPU is where many impressive functions of smart Glass are executed, such as the ability to record videos right in front of your eye, have maps and directions displayed and translate language instantly. The memory consists of a flash drive and a random access memory (RAM) unit, which are both made on the same printed circuit board as the CPU. The flash drive and RAM both have resistors, capacitors and transistors. The flash drive allows the smart Glass user to store information long term, while the RAM allows processes to be loaded quickly and hold memory for a short period of time. Both of these units are fairly small and fit neatly in the frame of smart Glass.

3) DISPLAY

The optical display is the main component that makes smart Glass what it is for users: technology without getting in the way. A very small prism is placed over the eye and the image one sees is projected through this prism directly onto one's retina, creating a "virtual reality layer. The optical display is set on a printed circuit board. The optical display is made of silicon, liquid crystal, and liquid crystal on silicon It also has an organic light-emitting diode (OLED), made up of carbon, a liquid crystal display (LCD) made of glass and liquid crystal, and a cathode ray tube (CRT) made of lead glass, potash-soda lead glass, and barium lead. This high-tech optical display allows the user to see the various control functions the device has, such as seeing a person on video chat, taking a picture or video, or seeing directions on a map.

4) CAMERA

The camera, which is also part of the optical display, is similar to a smartphone camera. A standard smartphone camera is made up of LED lenses and cyclo-olefin polymer. The LED lenses have different chemical makeups based on which colour they emit, another component of the optical display is the ambient light sensor, which detects light levels and is made of titanium. Smart Glass is making it easier than ever to capture a task, demonstration, or event from different perspectives. This capability opens up new opportunities for knowledge sharing in a range of fields including healthcare, engineering, energy, real estate, and construction.

5) WORKING

AR software injects non-existent objects into our physical world. AR experience can be achieved with no dedicated gear; all you need is a smartphone or tablet. The software uses QR codes or GPS data to place virtual objects on top of a user's camera feed. The device (in this case your phone) transmits a live or indirect view of a physical, real-world environment which is augmented by computer-generated sensory input such as sound, video, graphics or GPS data. In the future, augmented reality could be a built-in feature in a digital contact lens. Smart Glass will communicate with other mobile phones via Wi-Fi using 4G the fourth generation of cell phone mobile based on communications standards. It provides mobile the ultra-broadband Internet accessing, for example to smart phones, to laptops with USB wireless modems and to other mobile devices. Or Bluetooth and display contents on the video screen and respond to the voice commands of the user. The video camera is sensible to the environment and it recognizes objects and people around.

III. APPLICATIONS

1) SMART GLASS INTEGRATED WITH AUGUMENTED REALITY IN MEDICAL FIELD

Looking to the near and distant future of medical technology, augmented reality (AR) will be central to innovation. The medical field will be enhanced dramatically via the rise of augmented reality products emerging, the entire healthcare experience will look entirely different from the medical environment today with the use of augmented reality .By integrating medical information with the real world like visible patient information, mapping an individual's body for surgery, or even venipuncture   Augmented Reality can provide a hands-free, cost efficient/time-efficient approach for doctors to treat patients, teach medical students, and react quickly in emergency situations

2) CRITICAL DATA IN PLAIN VIEW AND HANDS -FREE GESTURE TECHNOLOGY

Today, doctors and nurses record patient information via iPads and other computer devices that most people are familiar with. The method of documenting patient information has already begun to change with innovations like gesture technology paired with AR glasses that allows healthcare professionals to see patient information projected in front of them and then record information with hand gestures (even if they are wearing gloves) and motions. Creating gesture technology that provides medical professionals with a hands-free approach to documenting medical information. This type of technology can be particularly useful for first responders and

military paramedics, who are treating patients in stressful and sometimes dangerous environments and need to record information extremely fast. This efficient approach to patient documentation can also allow first responders to send information about the patients' medical history to the hospital prior to the patient's arrival, which can allow the hospital and the doctor to be prepared and better equipped.

3) TAKING OR TRANSFUSING BLOOD

Drawing blood from the patients in case of emergency is not always a simple process, especially in the case of patients those who have particularly small veins: like the elderly and infants. Anyone who has been the recipient of multiple "sticks" for a blood test can testify that it is a rather unpleasant experience. An Augmented reality solution that allows doctors and medical professionals to see the veins of the patient projected directly on their arm, making blood exams and starting an IV that much easier. (e.g. fig 1) The smart glasses map out the veins of the patient outside of the arms so that the process of drawing blood is easier.
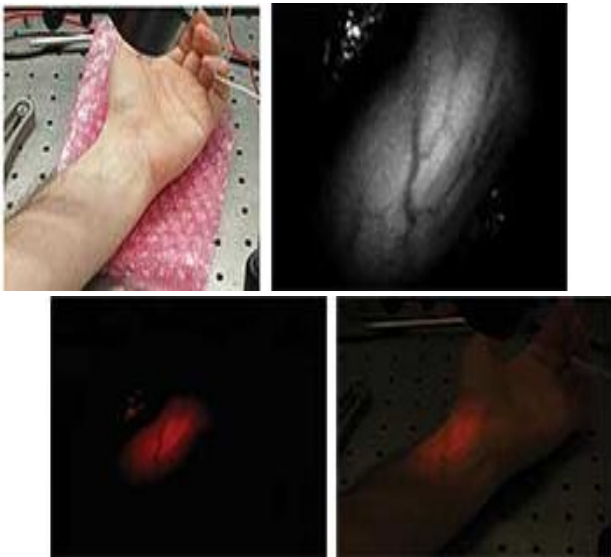

Fig 1 principle setup of veins viewer based on bidirectional OLED micro display

4) ULTRASOUNDS

Several AR software companies have also developed a portable ultra sound technology, where ultra sound technicians and patients can see the ultra sound image via smart glasses. A portable ultra sound can be especially useful when traveling to developing countries, where portability and affordability are of utmost concern.

5) SPINAL SURGERY

Spinal surgery is a long and arduous process, augmented reality technology is attempting to reduce the surgery time, invasiveness, and the overall surgical result. A technology that overlays information about the spine on the spine of the patient so that doctors can keep their eyes on the patient at all time and have the spinal information directly where needed. Surgeons wear a head-mounted that allows the surgeons to "see through" the patients' skin as if they have X-ray vision.(e.g. fig 2)Since the surgeon can see the anatomy of the patient without creating any openings – a lots of the procedures can be done externally without creating multiple incisions. The result of a less invasive surgery means less recovery time for the patient and a shorter hospital stay.
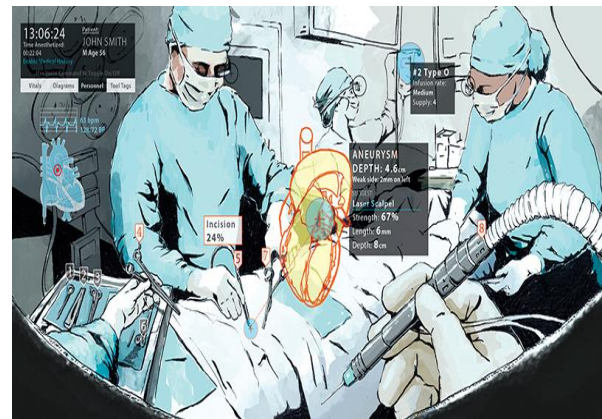

Fig 2 view from a smart glass in operation theatre

The future of medicine is on the brink of major change, which will be a transformative experience in healthcare for the hospital, patient, and medical practitioners alike. Who knew that the same technology used for gaming would be a catalyst to save lives and transform the future of medicine

6) PHARMA COMPANIES CAN PROVIDE MORE INNOVATIVE DRUG INFORMATION

If you got interested in discovering how the distant world of pills and medicaments work, we can know about how a drug works in the body, not by reading the undecipherable drug description. But With the help of augmented reality, patients can see how the drug works in 3D in front of their eyes instead of just reading long descriptions on the bottle. The workers in the factories will be able to work without hands by trainings as the device would tell them what to do, and how to do it.

7) AR IMPLEMENTED IN SEVERAL HEALTHCARE AREAS AND AIMED AT ALL LEVEL OF LEARNERS

AR is applicable in various health care education, such as: joint injection, thoracic pedicle screw placement, laparoscopic surgery, administering local anaesthesia, endotracheal intubation, ventriculostomy, forensic medicine, inguinal canal anatomy, diathermy, tissue engineering, alimentary canal physiology and anatomy, disease outbreak, clinical breast examination, cardiologic data, and life support training. AR can improve the learning effect by acquisition of skills and knowledge, understanding of spatial relationships and medical concepts, enhancing learning retention and performance on cognitive-psychomotor tasks, providing material in a convenient and timely manner that shortens the learning curve, giving subjective attractiveness, and simulating authentic experiences

8) IN PLASTIC SURGERY

The augmented reality system can be used in in plastic surgeries for planning and confirming reconstruction of the underlying facial bones, for example, in a patient with a congenital bone development disorder and patient with a complex facial fracture. The surgeon can superimpose the 3D digital simulation image of the desired appearance over the patient's face during surgery, the 3D simulation of the body surface provided a visual reference of the final facial appearance.it will help up to a great extent in visualizing the planned correction and confirming the final outcome

9) SMART GLASS FOR VISUALLY IMPAIRED

Many people registered as blind or partially-sighted retain some ability to detect light and motion ,there are many different levels of visual impairment, ranging from moderate (low vision) to severe (blindness).While low vision refers to a condition where the best-corrected vision is impaired enough to interfere with day-to-day activities Although many people with low vision maintain some visual function, they each have trouble with day-to-day activities, sometimes even risking injury because of their visual impairments By making use of their remaining vision we can increase the blind's ability to navigate independently and avoid obstacles. a pair of glasses that collects visual information using sensors and relays it back to the wearer using screens and headphones augmented reality glasses to help the visually impaired recognize and navigate objects in their environment. Think of it as a hearing aid for the blind, It is can help to recognize strangers in public using facial recognition .Smart glasses can help in enhancing whatever sight the visually impaired people may have left, and can give them more additional information about their surroundings. This glasses capture images of the world around the wearer with a depth camera, and use them to generate high-contrast images

in real-time that are then presented to the wearer on transparent displays so as to augment rather than replace what remains of their vision. Visually-impaired people face numerous challenges in their routine life, like avoiding obstacles on their way, recognise and interact with other people and objects. This can have a significant impact on their independence, confidence and overall quality of life. However, although visual impairments can prevent people from making use of visual signals from the world around them, only a small percentage of visually-impaired people are completely blind in the sense that they receive no useful visual inputs at all. Augmented reality integrated smart glass will ultimately be of huge benefit to the visually-impaired, with the potential to allow millions of people find greater independence and quality of life. These glasses dose not replace lost vision, but assist people with spatial awareness and are designed for people who are severely sight impaired, but not completely blind, numerous projects have investigated in assistive navigation technologies for the blind community, tackling challenges ranging from interface design to sensory substitution. However, none of these have successfully integrated

IV. CONCLUSION

Augmented reality is one of the most promising digital technology and has the greatest potential to help both the physicians and patients alike by changing healthcare and everyday medicine completely. Augmented reality has intriguing implications in healthcare, but practical applications of the technology are still lagging behind, the technical obstacles are absolutely temporal and cost-related barriers will also disappear in the future. The healthcare industry is expected to be one of the top verticals benefiting from AR in the near future, using some form of smart glasses .The Augmented Reality in Healthcare Education study found that ninety-six percent of the material studied claimed that AR is useful for improving healthcare education. The material outlined benefits of educational AR to include decreased amount of practice, reduced failure rate, improved performance accuracy, accelerated learning, and better understanding of special relationships.AR has the potential to give surgeons a more realistic training experience, resulting in better surgeries. Surgeons discovering new procedures can also take advantage of the anatomy views AR offers. While AR has many education benefits, the study also pointed out several drawbacks, including a lack of learning theories available to guide AR design and that traditional learning theories do not match up to the AR learning style. And it also lacks widespread adaption. Wearable tech promises to help make our lives easier and more productive up to an extent, offer a more convenient hands-free option for the visually impaired.

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