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Augmented reality for analyzing visual interpretation for medical Application in Real time environment

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Abstract

Surgeons are regularly on the lookout for technologies that will enhance their operating environment. They are often the early adopters of technologies that allow their field to offer a better surgical and patient experience.AR is the addition of artificial information to one or more of the senses that allows the user to perform tasks more efficiently. In this research, the real time data of patients in hospital collected by the sensors attached to patients once the sensor measured the values then it is processed and send to doctors augmented reality glass through wireless and alert if abnormal condition occurs. The doctor can take appropriate action based on the patient's current health condition.

Keyword: *Augented reality, patient health care monitoring and surgical life*

I. Introduction

Augmented Reality (AR) is a powerful tool in the medical field, where it gives the opportunity to offer more patient information to the physician by including relevant clinical data in the sight between him and the patient. This medical information can be obtained from imaging studies of the patient (e.g. computed tomography [CT], magnetic resonance [MR], positron emission tomography [PET]) that can be displayed overlaid on the physical world, enabling user interaction and manipulation. During the past two decades, AR has facilitated medical training or surgical planning and guidance. A powerful application of AR in tumour resection surgery is the visualization of a 3D model of the segmented tumour over the patient [1], providing relevant information to the surgeon about location and orientation. AR has also been evaluated in training applications [2][3], where novel physicians were able to improve their skills in terms of spatial vision and surgical ability. All these examples, while showing the possibilities of AR in different medical scenarios, have some limitations in terms of portability, calibration and tracking [4]. Recent technological developments could overcome some of these restrictions. Devices such Microsoft HoloLens, a compelling head mounted display, or new software development kits (SDKs) such ARToolKit [5] for mobile devices, will facilitate cheaper and simpler to set-up AR systems spreading their use. One of the main difficulties for introducing AR in surgical guidance procedures is registering augmented data to the real-world space [6]. Up to now, patient registration has been achieved with

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optical or electromagnetic tracking systems [7][8], applying manual alignment [9] or more advanced algorithms such as speed up robust feature (SURF) [10]. These are solutions that seem to work in some specific applications, but require extra hardware, add complexity to the workflow, increase procedure time and may not be accurate enough. Previous research in integrating desktop 3D printing with surgical guidance could solve some of the identified limitations of AR in surgical applications. Patient specific designs, created from CT or MR studies and then 3D printed in-hospital, have already shown their advantages in orthopaedic surgery in scenarios such as open-wedge high These guides are designed to fit precisely in a planned position on the patient. The combination of these surgical guides with a 3D printed AR tracking pattern would avoid the registration problems previously identified. Recent studies have shown applications of this approach in maxillofacial surgery, attaching a tracking marker to a specifically designed tool that fits in the mandibula of the patient enabling AR registration [13]. Even though this technique showed good accuracy, the attachment of the tracking marker and the occlusal splint was manual, requiring a surface scan for registration, which includes a complex step in the workflow. To overcome the previous limitations, we propose an AR approach that uses a desktop 3D printer to create patient specific tools with a tracking marker attached, enabling automatic registration between AR and real-world spaces. This patient specific tool fits on the patient only in the place it was designed for. The clinical data to be included in the AR scene is previously referenced to the tracking marker and can be easily visualized. This solution was developed as an AR application on Microsoft HoloLens.

II. Literature Survey

Objective To develop an augmented reality (AR) neuronavigation system with Web cameras and examine its clinical utility. Methods The utility of the system was evaluated in three patients with brain tumors[1]. A novel augmented reality simulation called PalpSim has been developed that allows the trainees to feel a virtual patient using their own hands. The palpation step requires both force and tactile feedback[2]. Planning surgical interventions is a complex task, demanding a high degree of perceptual, cognitive, and sensorimotor skills to reduce intra- and post-operative complications[3]. We are on the verge of ubiquitously adopting Augmented Reality (AR) technologies to enhance our perception and help us see, hear, and feel our environments in new and enriched ways[4]. ARToolKit is an open-source computer tracking library for creation of strong applications that overlay virtual imagery on the real world. Currently, it is maintained as an open-source project hosted on GitHub[5].

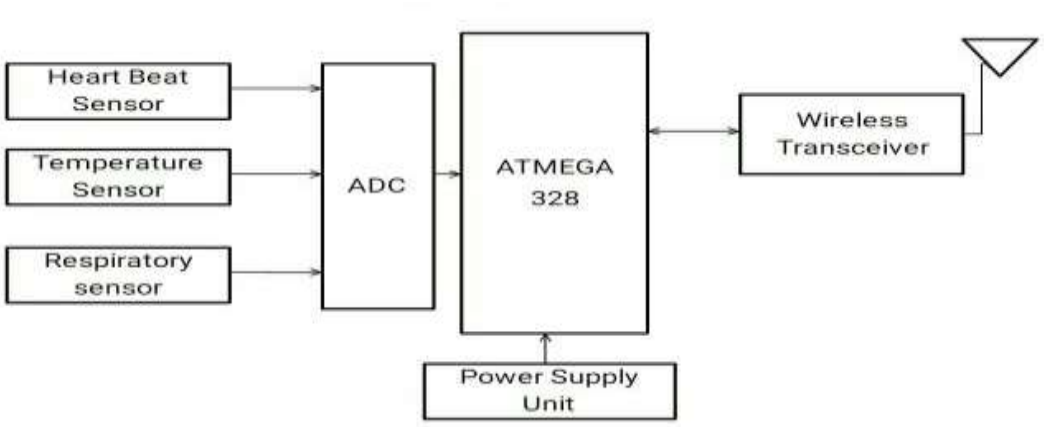
III. Existing Methods

The AR solution we present includes two main components: an AR application developed for Microsoft HoloLens and a 3D printed patient-specific tracking marker.The accuracy evaluation of the proposed system was performed on a 3D printed phantom replicating a real clinicalcase: a patient with an EES of the distal leg. Our institutionhas previous clinical experience 3D printing surgical guidesto facilitate the resection of this kind of sarcomas [12]. The addition of relevant clinical data, such as the visualization of the tumour to resect, over the patient during surgery was achieved adding the tracking marker to this surgical guide.For this specific clinical case, the 3D printed phantomincluded the tumour and surrounding anatomical structures(tibia

and fibula).The solution for registration fits perfectlyinto this case; first, because the tracking marker is added to a surgical guide that was already used for this surgery; second,the modification of the guide does not interfere with the surgical working area; and last, the surgical guide ispositioned on a rigid structure, the tibial bone, which means that its position could be replicated during surgery. The accuracy of this placement was also validated on the 3D printed phantom.

IV. Proposed Methodology

Surgeons are regularly on the lookout for technologies that will enhance their operating environment. They are often the early adopters of technologies that allow their field to offer a better surgical and patient experience.AR is the addition of artificial information to one or more of the senses that allows the user to perform tasks more efficiently. we propose a system in which important information for the doctors are displayed on semi transparent glasses included in an AR-headset and therefore are mixed with the real world view. In this project, the real time data of patients in hospital collected by the sensors attached to patients once the sensor measured the values then it is processed and send to doctors augmented reality glass through wireless and alert if abnormal condition occurs . The doctor can take appropriate action based on the patients current health condition.Arduino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages C and C++.



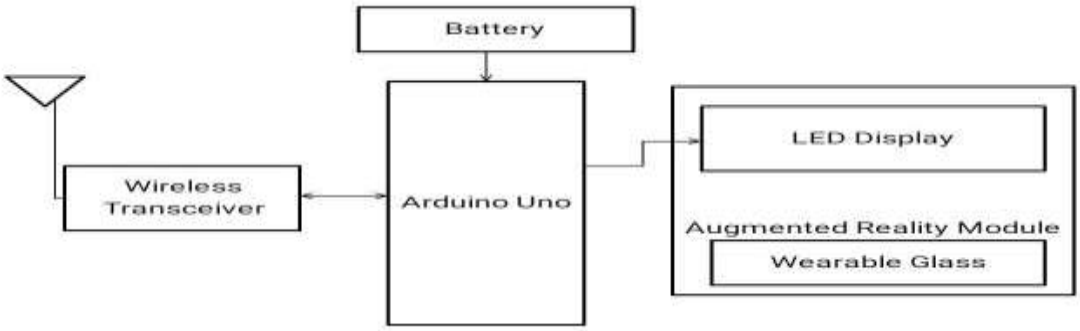


Fig.1 Transmitter and Receiver block diagram

V. Results

Real time data of patient collected by sensors attached to patient then this data send to ARDUINO micro controller with help of ADC, processed data then send to receiver through wireless transceiver, atmega 328 microcontroller in receiver Section process the data and displayed on LCD real-world view obtained with semi transparent glasses

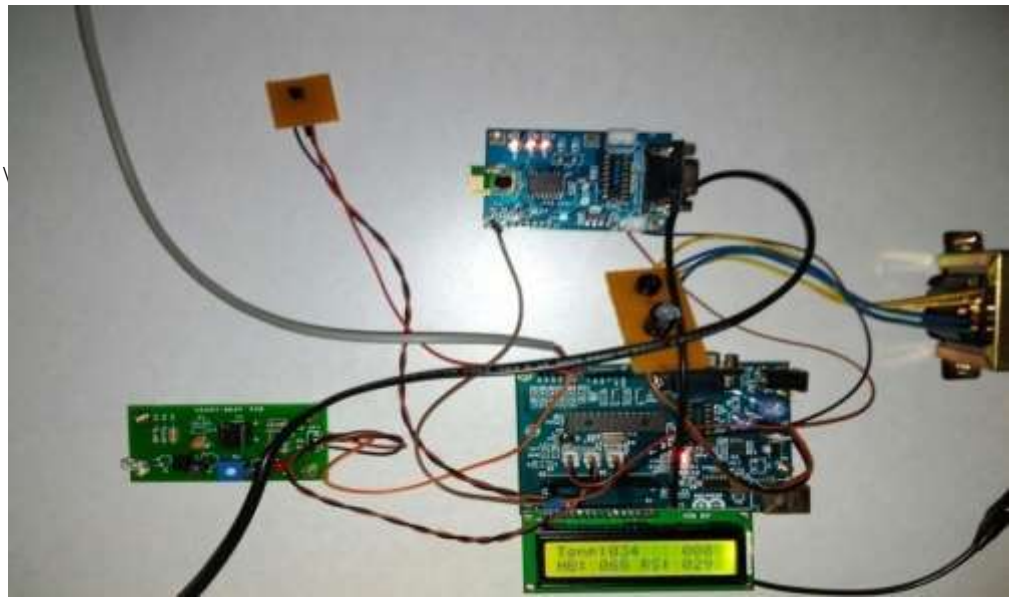


Fig.2. Experimental Transmitter Setup

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Fig.3. Experimental Receiver Setup

VI. Conclusion and Future Work

Thus, this project describes a prototype system to send important information of patient to doctor through wireless and this real time data displayed on semi-transparent glasses, in order to make sure of patient current health condition and safety, this project use Augmented Reality to explore medical circular data.where a person need to be with patient to ensure his current condition, this method efficiently transfer real time data of patient in hospital to doctor, sensors are used to collect data from patient & wireless transmission in the range of 100m.Future work extends smart voice & real time scenario of patient in motion picture, In higher level of implementation by adding data limits to this real time data doctor get an indication when ever abnormal conditions occer,can connect "n" number of patients hence process is easy and more empowered, can also used in commercial way.

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