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Cardiac: Augmented Reality

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***Abstract*— Today's world calculating our heart rate is very easy due to wearable's available in market as well as application that help us to calculate heart rate. But the question is. Is it accurate? and it is interesting the answer is no. We can argue about accurate of an heart rate but it is definitely not interesting the only way to make calculating your heart rate interesting is by adding augmented reality to it. There are many heart rate monitor application available. But none application is using augmented reality in their application to make the application more fun and interesting. The following are some of the smart devices in the category of heart rate monitor application. The cardiac application will make the study of heart more interesting and it will give accurate heart rate output. There are not a single application which has integrated AR in their application. And result are also not accurate it will benefits in study of medical.**

Keywords: Augmented reality, heart rate.

I. INTRODUCTION

The term *cardiac* is related to "heart" as our project is also related to heart. Cardiac is a Real-Time Augmented Heart Rate monitor application. we introducing augmented reality to our application that makes calculating heart rate more interesting. The main objective of our project is to make calculating heart rate more interesting and accurate. That's not all it will make studying of medical more fun.

To develop cardiac we used unity, C# , particle photon. Unity is an application that helps us to integrate 3D model of heart, skeleton and BPM. To superimpose this 3D model in one image we use C# , as cardiac is IOT (internet of things) based we are using particle photon. And for augmented reality projects particle photon is the most preferable.

The main motivation behind cardiac is to showcase calculating heart can be more fun.

II. PROBLEM STATEMENT

The cardiac application will make the study of heart more interesting and it will give accurate heart rate output. There are not a single application which has integrated AR in their application. And result are also not accurate it will benefit in study of medical.

III. LITERATURE REVIEW

Superman like X- Ray vision [1]
Brain-computer interface (BCI) device which is been used by superman like X – Ray Vision and a gaze tracker that is used to allow the user controlling the augmented reality (AR) visualization. BCI device is added into two medical AR systems. To see what's the potential of superman like X- Ray vision feedback is been taken from doctor's first. While in this pilot study not the full range of available signals but only electro graphic signals are used, the medical doctors provided very positive feedback on the use of BCI for medical AR.

ARAV -Augmented Reality Aided Vertebroplasty [2]
In Augmented Reality (AR) for preoperative diagnostics and planning, intra operative navigation and postoperative follow-up examination has been a topic of intensive research over the last two decades. Studies shows integration of augmented reality and medical environment is very rare. The incor-portion of an AR system as a standard tool into the real clinical workflow has not been presented so far. This paper reports on the strategies and intermediate results of the ARAV

Advanced Training Methods using an AR Ultrasound Simulator [3]
The system setup of this method is carried out by a device called Video see through HMD and ultra sound probe. For training US we propose an AR ultrasound simulator where the US slice is simulated from a CT volume. The location of the US slice inside the body is visualized using contextual in such techniques. We also propose advanced methods how to use an AR simulator for training.

Hololens in medical use [4]
The future of augmented reality and mixed reality is very bright. HoloLens opens up radically new ways for medical education as it is able to project the human body.

Augmented Reality for the Study of Human Heart Anatomy [5]
In this Many educators and developers all over the world research about the factors that influence a virtual school and students' efficiency learning Furthermore, the growing interest for research on alternative methods of education in Medical Schools led to the use of video and podcasts during the e-learning process The traditional anatomy curriculum has been challenged since the early 80s and educational technology has attracted great interest with the introduction of many innovations such as virtual anatomy courses and dissections three dimensional (3D) atlas and "marble" application, which uses augmented reality (AR) for iphone AR enriches the user experience and describes the appearance

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of a digital element generated with a computer AR creates a unique result, since the user can see through the human body, to its anatomy Furthermore, an application its full size in front of med students. Thus, the organs, veins or bones will be visible accurately in 3D, and future medical professionals will be able to analyze their shape, remember their characteristics more vividly than it is possible when studying from a book. There are already some universities who plan to introduce the new technology: Case Western opens its new health education campus in collaboration with the Cleveland Clinic in 2019, where students won't learn anatomy from cadavers either, they'll learn it from virtual reality.

Mixed Reality: Augmented – Virtual and Its Usage in Medical Science [6]

Mixed Reality with the help of Computer modelling and simulation have become increasingly important in many scientific and technological disciplines owing to the wealth of computational power. Calculation of these computational models is increasingly replacing experiments on real world objects for example, in the car industry (tests based on simulated crashes) or in the development of nuclear weapons and is becoming an indispensable tool in the development of new products and procedures. Likewise, the development of techniques for acquiring data (for example, medical imaging) has enabled the easy generation of high resolution copies of real world objects from the computer's memory. The development of imaging technologies, such as magnetic resonance imaging, computed tomography, and ultrasound, has made the acquisition of highly detailed anatomical and partially functional models of three dimensional human anatomy a routine component of daily clinical practice. The principal aim of virtual reality technology is to present virtual objects or complete scenes to all human senses in a way identical to their natural counterpart Simulated three dimensional reconstruction of organs from radiological cross sections is an important diagnostic tool by providing clinicians with a more naturalistic view of a patient's anatomy Preoperative planning with the use of a computer including realistic prediction of the outcome has become an integral part of the intervention in certain disciplines, such as radiation therapy, craniofacial surgery, or neurosurgery Computerized three dimensional atlases of human anatomy, physiology, and pathology are about to revolutionize the teaching of these subjects Several virtual reality systems have been developed and tested for the physical or mental rehabilitation of patients and for supporting mental health therapy Virtual reality technology plays an important role in telemedicine from remote diagnosis to complex interventions.

A Quantifying attention shifts in augmented reality image-guided neurosurgery [7]

In Image-guided surgery (IGS) has allowed for more minimally invasive procedures where smaller incisions are used, leading to better patient outcomes, a reduced risk of infection, less pain, shorter hospital stays and faster recoveries. There's One drawback that has emerged with image-guided surgery techniques, is that the surgeon must shift their attention from the patient to the monitor for guidance. However, it has been shown that there are negative effects of shifting attention on both cognitive and motor tasks. Augmented reality, which merges the real world surgical scene with preoperative virtual patient images and plans has been proposed as a solution to this drawback. In this work we studied the impact of two different types of augmented reality IGS setups (Mobile AR and Desktop AR) and traditional navigation on attention shifts for the specific task of craniotomy planning. We found a significant difference in terms of time to perform the task and attention shifts between traditional navigation but no significant differences between the two different AR setups. However, with Mobile AR users thought the system was easier to use and their performance was better. These results suggest that regardless of where the AR visualization is shown to the surgeon, for certain tasks AR can reduce the amount of attention shifts, leading perhaps to more streamlined and focused procedures.

that uses AR, which was named "Miracle" and was created by Tobias Blum. Another AR education tool for anatomy named "BARETA" is a platform that combines AR with 3D models to provide the student with stimulation for touch as well as sight Also a pilot program was set to explore the distance healthcare education Overall a debate has been arisen with advocates of the traditional curriculum, on the one hand, and of the innovative curriculum, on the other hand. Many important reasons are responsible for the increasing popularity of online distance learning, particularly in higher education, such as the increased number of participants and, in many cases the ability of the participant to attend the course at a convenient time E-learning, as an instruction delivered through digital devices, includes numerous types of media (text, audio, images, animation and streaming video) and has broad applications not only in anatomy courses but in medicine generally. Visualization Cardiac AR is a derivative of virtual reality and enables the user to combine the virtual with the natural environment this technology integrates computer generated 3D models into the real word and constitutes a potential learning tool. In the School of Medicine of the Aristotle University of Thessaloniki, Greece, educational innovations in anatomy teaching have been regarded with scepticism for one main reason: historically, the most fruitful eras for anatomy was when dissection was not banned the known paradigm of Andrea Vesalius This fact is evident towards the necessity of anatomy dissection. To replace anatomy dissection is probably not feasible, but educational technology has a potential to supplement the traditional curriculum the main scope of the present article is to describe and demonstrate the development of a free educational web application that, with the use of AR, will interact and provide the user with anatomical knowledge for the human heart. An envisaged breakthrough of the present paper is that the aim for use of this web application, target at the introduction of new technological techniques and tools that may reinforce the education processes when it comes to anatomy teaching in Greek universities.

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IV. PROPOSED SYSTEM ARCHITECTURE

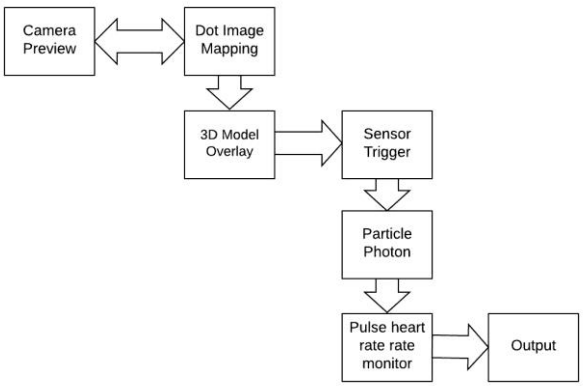

Fig 1 : System architecture of cardiac

From the above figure we will be giving the brief description of cardiac architecture.

Camera Preview : Camera is primary to run cardiac you must have camera be it on your laptop or on your smartphone. Camera on your laptop/smartphone will try find an image in environment on which super impose of 3D objects have been done.
Dot Image Mapping: An image with most numbers of dot help us to superimpose the 3D object. It will be super ease for the camera preview to locate and super impose the 3D objects.
3D Model Overlay: In cardiac we have two 3D model heart and skeleton. 3D model overlay will help to overlay the 3D object properly on to the image which are going to superimpose.
Sensor Trigger: After 3D objects are superimposed on the image sensor will be triggered.
Particle Photon: the main job of particle photon is to send data to us. All scripts which we write in C# will be imported to it and particle photon will be able to perform tasks that we have told in form scripts.
Pulse Heart rate monitor : Will get the pulse rate of the user send it to particle photon so particle photon can display it on the screen of the laptop/smartphone.

V. METHODOLOGY

Methodology for cardiac is as given in following steps.
Step 1 create 3D templates in Unity 3D For implementation.
Step 2 Assemble those templates as per the requirements.
Step 3Superimpose that 3D template on specified image target which can be cylinder, Cuboid. (In this case piece of paper with image of stones)
Step 4 For the process of Image targeting we are using latest version of Vuforia ,which helps to track the small networking dots on the image.
Step 5 As the process of Image targeting is done its time for Setting up Augmented reality camera which will simulate this process will work as medium for the Cardiac.
Step 6 Packages of AR camera and Vuforia is to be imported so there can be linkup between Vuforia's image target and AR camera inside Unity 3D.
Step 7 As per the 3rd module this software needs to be linked with IoT compatible device in this case we are using Particle photon as arduino and basic bpm sensor.
Step 8 Basic ground and Vcc connection is done with particle photon supplying stable power source by using Type B USB cable.
Step 9 Particle photons need to be connected to high speed network with help of particle photon app.
Step 10 Then IoT code is been flashed inside the particle photon for the linkage between AR camera and Arduino.
Step 11 Code is injected in 3D templates of Cardiac for as per directed functioning.
Step 12 Code is been rendered and we are ready to use Cardiac at real time.

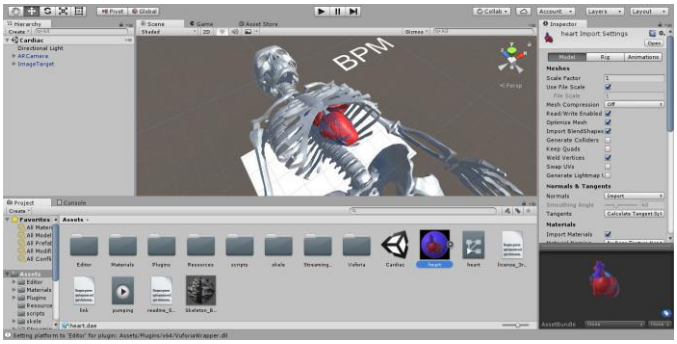

Fig 2 : Cardiac 3D Implementation On Unity

Fig 3 : Final Output Of Cardiac

VI. RESULT ANALYSIS

Here we will compare the results generated by our system with other products already available in the market. This section shows the pulse rate of a patient.

Table [1] Standard Value of pulse

Virtual parameters	**Specification**
Pulse Rate	72 – 90 beats per minute
Temperature	97^0 F (36.1 C) to 99^0 F (37.2^0 C)

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Table [2] BPM Calculated by MI Band, Cardiac and Samsung

Patient Name	MI	Samsung Health	cardiac
Jai Patel	78ºC	79ºC	78ºC
Rahul Karekar	79ºC	75ºC	83ºC
Yogesh Karekar	83ºC	81ºC	88ºC
Samruddha Karekar	94ºC	90ºC	99ºC

In the above fig 3 we have evaluated heart rate of 4 person using different measuring heart rate measuring application or wearables and compare it with cardiac.

FORMULA

To calculate heart rate the formula is Heart rate (beats/min) X stroke volume (mL/beat) = cardiac output (mL/min).
accuracy is spot on.

CONCLUSION

Conclusion of this project as AR is been used for fun-loving application, so we threw some light that it can be simulated in the health and fitness, In our case it is heart. And we have achieve accurate heart rate.

FUTURE SCOPE

Advancement in technology can leads to use this application in phones and other AR related medium anytime anywhere on the go.

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