Augmented Eye Glasses

A.Tamizharasi M.E[1], V.Sai Likitha[2], B.Thanusha[3], D.Tejasree[4]

[1]*Assistant Professor/ Department of CSE, R.M.D Engineering College, Tamilnadu 601206*
[2,3,4]*UG Student/ Department of CSE, R.M.D Engineering College, Tamilnadu 601206*

Abstract— Surgeons are regularly on the lookout for technologies which will enhance their operating environment. they're often the first adopters of technologies that allow their field to supply a far better surgical and patient experience. Augmented reality (AR) are rapidly becoming increasingly available, accessible and importantly affordable, hence their application into healthcare to reinforce the medical use of knowledge is for certain . Whether it relates to anatomy, intra operative surgery, or post-operative rehabilitation, applications are already being investigated for his or her role within the surgeons. AR is that the addition of artificial information to at least one or more of the senses that permits the user to perform tasks more efficiently. we propose a system during which important information for the doctors are displayed on semi-transparent glasses included in an AR-headset and thus are mixed with the real-worldview

Keywords— Augmented reality, surgical, semi-transparent glasses

I. INTRODUCTION

Head-up display (HUD) is a transparent display that can present information in front of users' eyes so that users can see the information without moving sight away. AR-HUD is a special kind of HUD which can provide driving related information directly in the driving environment through windshield, such as overlaying a navigation path on the road, marking pedestrians with surrounding rectangles, or sticking labels on interesting buildings. It is challenge to keep virtual image registered accurately with real world objects with onvehicle AR-HUD due to the complex optical paths introduced by freeform reflectors in the system, such as the windshield. There are some researches on the calibration for AR-HUD. Wu et al. [4] built an indoor system prototype to simulate the actual driving situation on the road. They mainly focused on the distortion correction with fixed viewing angle and fixed head position. They projected a pattern and built a function to avoid the windshield distortion based on pre-warped points and interpolation. It provides primitive idea of augmenting the reality by 2D overlaying but lacking 3D registration of virtual world in the real world.

Surgeons have great interest in adopting the newer technologies that provide them a better surgical environment. The main need of medical augmented reality came from the need of visualizing medical data and patient within the same medical space. Augmented reality (AR) supplements the real world with virtual objects, such that virtual objects appear to coexist in the same space as the real world[1]. The main reason for using AR is that it improves the quality of care. Developing this method really helps doctors during surgery and reduces the medical errors. It continuously monitors the patient‟s health condition during surgery. AR technology lets users to provide digital information onto the existing environment. AR innovations can help enhance doctors and surgeons ability to diagnose, treat, and perform surgery on their patients more accurately by giving them access to real-time data and patient information faster, and more precisely than ever before. In the existing system, the doctors should take care of any parameters during surgery manually. It will be difficult to monitor the parameters of the patients undergoing surgery continuously for the doctors and it may cause some serious case. So, there is a need for the system to monitor the parameters continuously. Hence we proposed the doctor assistive system using Augmented Reality.

II. LITERATURE REVIEW

In 2014, a review[1] made by Egui Zhu, Arash Hadadgar, Italo Masiello and Nabil Zary tells that Augmented reality (AR) amounts to the real world with virtual objects, such that virtual objects appear to coexist in the same space as the real world. AR is used in Clinical care as it provides with an internal view of the patients without any invasive procedures. AR implemented in several healthcare areas and aimed at all level of learners. But, this paper has a Lack of learning theories to guide the design of AR. It did not clearly describe which kind of learning theory was used to guide design or application of AR in healthcare education. So, in this project we provide a clear idea for the use of augmented reality in surgeries by providing the surgeons the semi transparent glass where they will be alerted if any parameters go above the threshold ranges.

A paper published in 2016 by Nikola Popovic, Ognjen Djekic, Marko Kovacevic, and Tomislav Maruna [2] gives the software architecture responsible for processing of the data received from ultrasonic sensors in vehicle, preparing and providing the data to higher layers of the system. Inputs in our algorithm are raw data from ultrasonic sensors. Problem with this solution can be computational bottleneck, especially when lots of data from different type of sensors comes to one place and needs to be processed in rational amount of time. From that reason we suggest a certain level of optimization.

Here, only one sensor value is taken into account and there can be a problem when more sensors come to one place. So, we provide a distributed architecture in order to read values from different kinds of sensors such as respiratory sensor, heart beat sensor, temperature sensor. In 2018, Filip Malwski[3] developed the Augmented reality for car assistive system. Based on this paper we got the idea of developing the same system for assisting doctors. The AR technology [4]can be used in Handheld Devices, Stationary AR Systems, Spatial Augmented Reality (SAR), Systems

Head-mounted Displays (HMDs), Smart Glasses, Smart Lenses. Major medical applications deals on robot-assisted surgery and image guided surgery. Because of this, substantial research is going on to implement AR in instruments which incorporate the surgeon‟s intuitive capabilities[5]. The proposed system to implement the AR technology and to monitor the patient health. To select biomedical sensor to maintain the patient health condition. To process the sensor output value using PIC controller.

III. SYSTEM DESIGN

A. *EXISTING SYSTEM*

To measure the heart level and Pressure level of the environment there is no continuous monitoring for the levels. Manual work is performed to predict the pressure level in the environment. Existing health monitoring systems often do not fully address the evaluation of population exposure to toxic air pollutants and the assessment of the resulting health effects. Early studies in activity recognition employed vision-based systems with single or multiple video cameras, which remains the most common means to date. In general, such systems may be acceptable and practical in a laboratory or well controlled environment.

DISADVANTAGES:

- Camera based approach includes shadow disturbances
- Effects of external lighting conditions effects monitoring
- painful for the patients only the light rays will be passed through the skin.

B. *PROPOSED SYSTEM*

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. • To measure the human body temperature we LM35 sensor. • LM35 sensor measure temperature more accurate than a using a thermister since it is industrial temperature sensor. • Heart beat sensor provides a simple way to study the function of the heart which can be measured based on the principle of psycho- physiological signal used as a for the virtual for the stimulus for the virtual reality system. • The Arduino Uno is a microcontroller board based on the ATmega328. A simple pragmatic solution to this problem can be made using Arduino, a credit card sized single board computer.The dengue is identified from the immunity calculations and is intimated to the doctor. The other parameters of the patient are constantly monitored and logged to the cloud.If anyone of these parameters go beyond a threshold level, it is notified to the doctor immediately.

ADVANTAGES:

- Continuous measurement will be available for the physical parameters and those updated on the mobile phone.
- Confidentiality Maintained and Freshness of data monitored.
- Multiuser access as well as able to get information from anywhere in the world.

IV. METHODOLOGY

Overall system consist of mainly two parts i.e. hardware and software. Whereas hardware part consist of two sections i.e. transmitter and receiver, in which transmitter developed by four sensors, Master and Slave type combination. In master circuit four input sensors viz. O2 level, temperature, heartbeat and saline level are connected to the controller ATmega328. This controller will give the output on the LCD and also on doctor’s AR via Zigbee transmitter, whereas there is a Zigbee receiver model at doctor’s AR Glass. Range of this Zigbee module is 100mtrs.

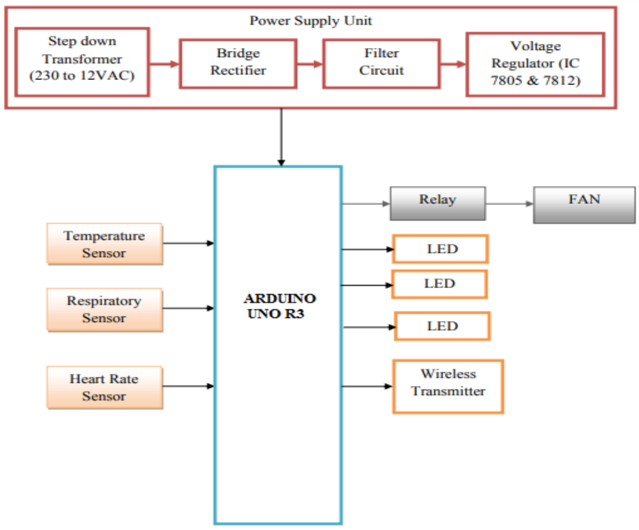

Fig 1: Main Block Diagram

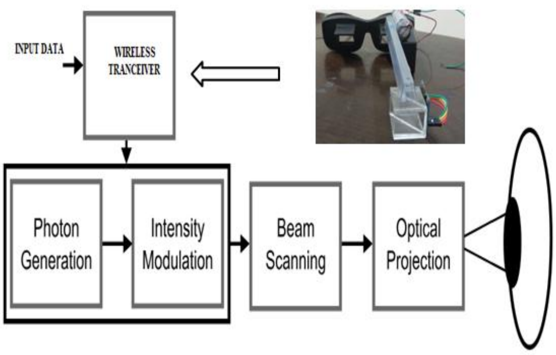

Fig 2: Functional Diagram for AR Glass

A. *HARDWARE REQUIREMENTS:*

- Power supply unit
- ATMEGA328 Microcontroller

- Temperature Sensor
- Respiratory Sensor
- Heart Rate Sensor
- Relay
- FAN
- Wireless Transmitter
- LED

B. SOFTWARE REQUIREMENTS:

- ARDUINO IDE
- Embedded C

V. COMPONENTS DESCRIPTION

A. POWER SUPPLY UNIT:

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

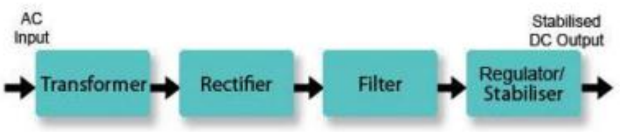

Fig 3.Power Supply unit

B. Controller (ATMEGA328)

Controller is heart of our system. This controller following features: 32Kbytes of in-system programmable flash with read-while-write capabilities, two 8-bit Timer/Counters, 23 programmable I/O Lines, and operating Voltage is 1.8 - 5.5V, Temperature Range -40°C to 105°C, three flexible Timer/Counters.Pin configuration of ATmega328 IC consists of 28 pins. There is Port B, Port C & Port D an 8-bit bi-directional I/O port with internal pull-up resistors.

C. TEMPERATURE SENSOR

Temperature is the most-measured process variable in industrial automation. Most commonly, a temperature sensor is used to convert temperature value to an electrical value. Temperature Sensors are the key to read temperatures correctly and to control temperature in industrials applications. A large distinction can be made between temperature sensor types. Sensors differ a lot in properties such as contact-way, temperature range, calibrating method and sensing element. The temperature sensors contain a sensing element enclosed in housings of plastic or metal. With the help of conditioning circuits, the sensor will reflect the change of environmental temperature

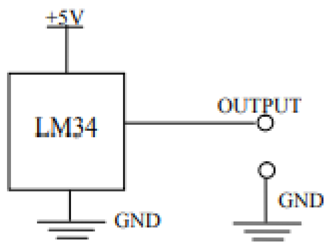

Fig 4:LM34 Interfacing Diagram

In the temperature functional module we developed, we use the LM34 series of temperature sensors. The LM34 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Fahrenheit temperature. The LM34 thus has an advantage over linear temperature sensors calibrated in degrees Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Fahrenheit scaling. The LM34 does not require any external calibration

D. RESPIRATORY SENSOR

The Respiration Sensor is used to monitor abdominal or thoracical breathing, in biofeedback applications such as stress management and relaxation training. Besides measuring breathing frequency, this sensor also gives you an indication of the relative depth of breathing. The Respiration Sensor for Nexus can be worn over clothing, although for best results we advise that there only be 1 or 2 layers of clothing between the sensor and the skin. The Respiration Sensor is usually placed in the abdominal area, with the central part of the sensor just above the navel. The sensor should be placed tight enough to prevent loss of tension.

Fig 5:Respiratory Sensor Model

E. HEART BEAT SENSOR

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger.

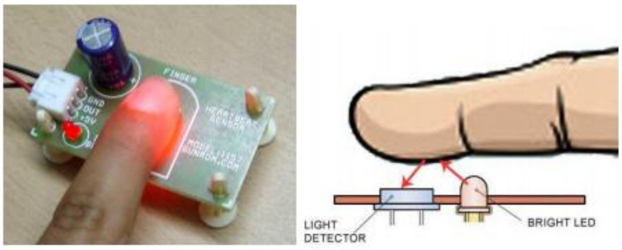

Fig 6: HeartBeat Sensor Model

Medical heart sensors are capable of monitoring vascular tissue through the tip of the finger or the ear lobe. It is often used for health purposes, especially when monitoring the body after physical training. Heart beat is sensed by using a high intensity type LED and LDR. The finger is placed between the LED and LDR. As Sensor a photo diode or a photo transistor can be used. The skin may be illuminated with visible (red) using transmitted or reflected light for detection. The 39 very small changes in reflectivity or in transmittance caused by the varying blood content of human tissue are almost invisible. Various noise sources may produce disturbance signals with amplitudes equal or even higher than the amplitude of the pulse signal. Valid pulse measurement therefore requires extensive preprocessing of the raw signal. The new signal processing approach presented here combines analog and digital signal processing .

F. DC FAN

A fan is a machine used to create flow within a fluid, typically a gas such as air. The fan consists of a rotating arrangement of vanes or blades which act on the fluid. The rotating assembly of blades and hub is known as an impeller, a rotor, or a runner. Usually, it is contained within some form of housing or case. This may direct the airflow or increase safety by preventing objects from contacting the fan blades.

VI. OPERATIVE BENEFITS

AR and VR have the potential to impact on surgery in a number of novel ways as discussed above, especially in the arena of surgical training in the virtual surgical environment (Figure 7). However, real-time enhancement of the surgical procedure remains a slightly tentative application. It is not yet validated that surgery can be enhanced with AR and in some instances, it could be distracting. Some features may be useful of systems like GG where with voice activation the operator could communicate beyond the theatre environment, retrieve images and test results without breaking scrub.

Real-time updates regarding the progress of the trauma list would reduce unnecessary fasting of patients in the event of a delay in theatre. Real-time augmentation of surgery usually involves the blending of acquired 3D imaging with surgical reference points. Novel applications of AR include use to project optimal port placement on the abdomen for laparoscopic surgery (42); using AR to identify the position of sentinel nodes with 3D freehand single photon emission computed tomography (43,44); and using this with near infra-red spectroscopy to provide visual guidance in lymph node dissection in cancer surgery (45). Specialised near infrared (NIR) devices have been developed for the detection of tissue vascularity using indocyanine green (ICG) dye (46). The use of ICG in lymphatic surgery is already well developed to help identify vessels and check for their patency hence the move from microscope to HMD is a likely future development (47). AR technology would also be able to seamlessly project diagnostic images intraoperatively for surgical planning to guide surgeons with optimal incisions and approach.

Several studies have demonstrated the use of AR to guide surgeons through intricate anatomy during minimally invasive surgery. Su et al. [2009] demonstrated the use of pre-operative imaging with intra-operative 3D overlay to guide robotic laparoscopic limited partial nephrectomy. Minimal access limited partial nephrectomy has been an area of interest for AR guided surgery (48). AR guidance allows for projection of 3D imaging onto the laparoscopic image to mark surgical incisions within the laparoscopic view (49). AR has been used extensively in neurosurgical procedures. Use of pre-operative imaging to detect suitable vessels for extracranial-intracranial bypass allows for image injection into the operator's microscope to guide intraoperative dissection. Similar techniques for AR have been utilised for intracranial arteriovenous malformation surgery.

VII. RESULT AN DISCUSSION

The analog processing circuitry and the sensors were assembled on PCBs which were placed within the wrist strap. Fig 3 shows the flowchart of the system & Fig 4 shows the prototype hardware. The prototype was powered with a 9 V battery. The RF transmission using Zigbee has been tested to operate successfully at 30 meters range through obstacles such as concrete walls. When in operation, the wrist unit consumes 20 mA of current at 3.3 V power supply.

Fig 7.Experimental Setup

VIII. CONCLUSION

The proposed system helps the doctor identify the critical patient's faster by using the AR goggles and themicrocontroller with sensors ,which displays the temperature pressure and heart beat of the patient which helps toclassify if the patient requires immediate attention or not. This thus reduces the doctor time to a greater extentpreventing the doctor to check the basic details moving to each patients bed. Thus the zigbee based wireless Heartbeat and Temperature monitoring system is designed and implemented using microcontroller atmega 328, in which all signals directly measured from the human body and all parameters values displayed on LCD on the transmitter side. This data is transmitted to the receiver wirelessly through ZigBee. The received signal send to pc via AR Glass window display patient's Physiological Parameter.

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