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Doctors Assistive System Using Augmented Reality Glass Critical Analysis

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Abstract: ***Surgeons are constantly searching for new technologies that can improve their operating room. They frequently use technologies that enable their industry to provide a better surgery and patient experience early on. Numerous advancements have been recognized as potential disruptive technologies in the surgical workplace as a result of the ongoing improvement of the surgical environment in the digital age. Augmented reality (AR) are rapidly becoming increasingly available, accessible and importantly affordable, hence their application into healthcare to enhance the medical use of data is certain. Whether it relates to anatomy, intraoperative surgery, or post-operative rehabilitation, applications are already being investigated for their role in the surgeons. 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-worldview.***
In this paper, 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.
Index Terms: Infrared images; Infrared target detection; Pedestrian detection; attention mechanism; YOLOv5

I. INTRODUCTION

Surgeons are constantly searching for new technologies that can improve their operating room. They frequently use technologies that enable their industry to provide a better surgery and patient experience early on. Numerous advancements have been recognized as potential disruptive technologies in the surgical workplace as a result of the ongoing improvement of the surgical environment in the digital age. Augmented reality (AR) are rapidly becoming increasingly available, accessible and importantly affordable, hence their application into healthcare to enhance the medical use of data is certain[1]. Whether it relates to anatomy, intraoperative surgery, or postoperative rehabilitation, applications are already being investigated for their role in the surgeons. AR is the addition of artificial information to one or more of the senses that allows the user to perform tasks more efficiently[2].

II. LITERATURE REVIEW

1) *Filip Malawski, AGH University, "Driver Assistance System Using Augmented Reality Headset," IEEE Transactions on Electronics and Telecommunications, vol. 3, pp. 978-1-5386, 2018.*

Doctors are regularly on the lookout for technologies that will enhance their operating environment. The digital world, the continuing enhancement of the environment has led to number of innovative ideas being highlighted as potential disruptive technologies. Augmented reality (AR) application into healthcare helps to enhance the medical use of data. AR is the addition of artificial information that allows the user to perform the tasks more efficiently. Our system gives doctor a goggle which helps to identify patient's details using augmented reality technology. In a hospital, the details such as patient's temperature, pressure, heartbeat rate, activities of the body and respiration rate are measured for critical patients and alert if any abnormal condition occurs during surgery. Then the doctor can take appropriate action based on the patient's current health condition.

2) *Y. Xu, D. Xu, S. Lin, T. X. Han, X. Cao, and X. Li, "Detection of sudden pedestrian crossings for driving assistance systems," IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics), vol. 42, no. 3, pp. 729–739, 2012.*

Recent advances in image processing and machine learning methods have greatly enhanced the ability of object classification from images and videos in different applications. Classification of human activities is one of the emerging research areas in the field of computer vision.

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It can be used in several applications including medical informatics, surveillance, human computer interaction, and task monitoring. In the medical and healthcare field, the classification of patients' activities is important for providing the required information to doctors and physicians for medication reactions and diagnosis. Nowadays, some research approaches to recognize human activity from videos and images have been proposed using machine learning (ML) and soft computational algorithms.

III. SYSTEM REPRESENTATION

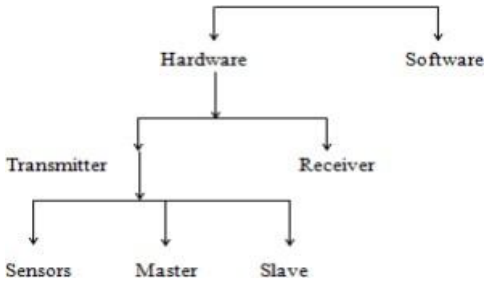


Fig1.System representstion

The hardware and software that make up the entire system are its key components. Whereas hardware part consist of two sections i.e. transmitter and receiver, in which transmitter developed by four sensors, Master and Slave type combination[3]. 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.

A. Block Diagram

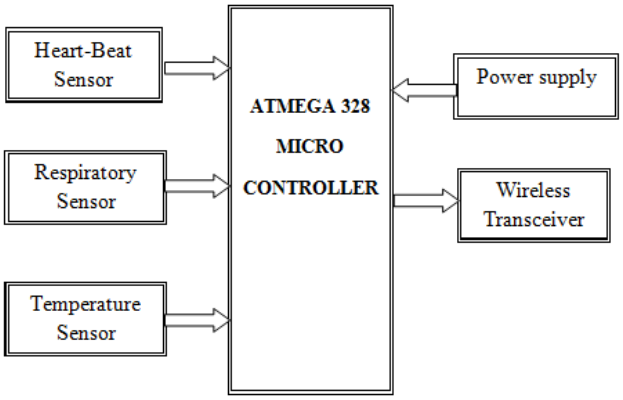


Fig2- Main Block Diagram

B. Augmented Reality

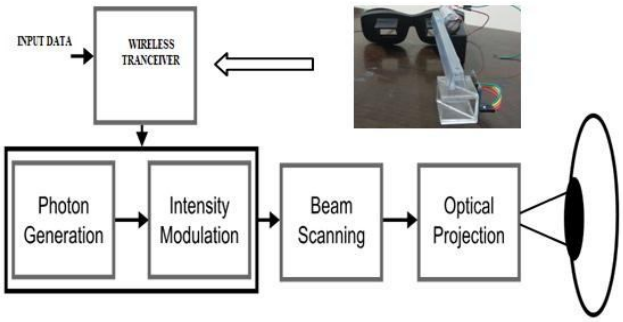


Fig.3Augmented Reality

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IV. COMPONENTS DESCRIPTION

A. 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.

B. Heart Beat Sensor

The pulse rate sensor's main use is to monitor a person's heart rate. The pulse rate's maximum and minimum set points are provided during programming. If the pulse rate goes below or above the set point then the alert will be immediately issued by the m Sensor is the essential part of any instrumentation system. Sensing is the first stage of any process in the instrumentation system. Sensors are required to sense the variations in the physical quantities. According to the variations in the physical quantities sensors give the output, which is electrical in nature

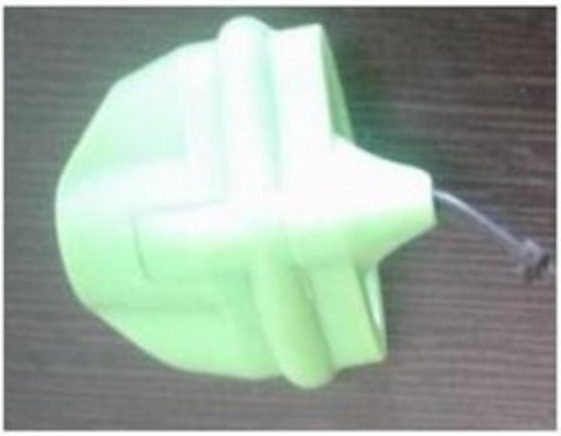


Fig4- Heartbeat Sensor

C. Temperature Sensor

The body's temperature is detected using a temperature sensor. It is able to determine a person's body temperature. It is an analog sensor and gives the output into form of analog signal. This signalis feed to ARM controller and ADC will convert it into digital form. Once converted into analog form the controller can process the digital temperature signal as per the application.

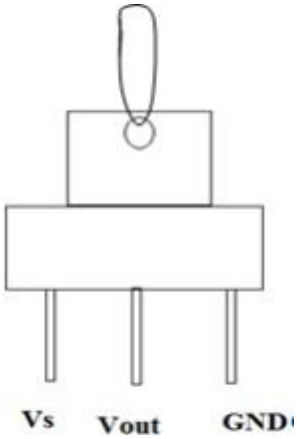


Fig5- Temperature Sensor

Temperature sensor senses the temperature of body. It can sense the temperature of human body. It is an analog sensor and gives the output into form of analog signal. This signal is feed to ARM controller and ADC will convert it into digital form. Once converted into analog form the controller can process the digital temperature signal as per the application

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D. Oxygen Sensor

Structure and configuration of MQ-6 gas sensor is shown as Fig. 1 (Configuration A or B), sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-6 has 6 pin, 4 of them are used to fetch signals, and other 2 are used for providing heating current

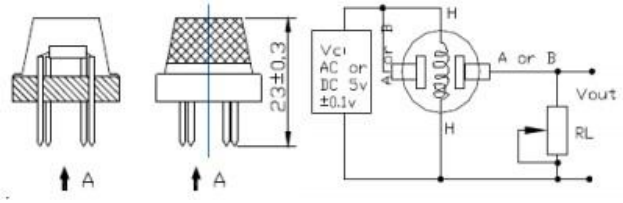


Fig6- Oxygen Sensor

E. LCD

The 16/2 LCD display is used to visualize the output of the application. It issued to check the output of different modules interfaced with the microcontroller. Thus LCD plays a vital role to see the output and to debug the system module wise in case of system failure in order to rectify the problem display device is required only at the coordinator end. To know what is going on the sensing node. The data must be shown on the display. This data can also be recordedand kept safe for the analysis. Health status of the human canonly be known by observing the data. That's why the displayis must for the presented application. For the presented work,LCD is used as a display device. LCD is the short form of the liquid crystal display. LCD displays utilize two sheets ofpolarizing material with a liquid crystal Units

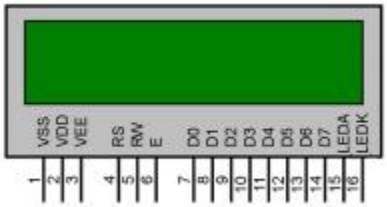


Fig7- LCD Display

F. Power Supply

At the coordinator end and sensor node, many components are used. These components have different operating voltage such as controller operates at 3.3 – 5v. ZigBee transceiver operates at 1.8 V to 3.8 V, LM 35 and LCD display operates at 5 V. To meet these requirements of different operating voltage ranges a proper arrangement of power supply is required. The 7805 voltage regular is usedto provide 5 V regulated power supply.

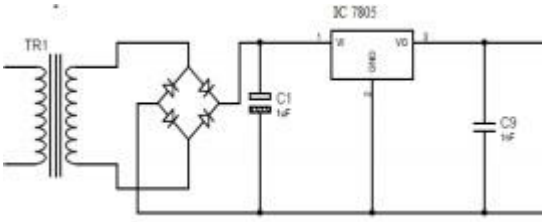


Fig8. Power suply

V. CALIBRATION PROCESS

In this work, we use Microsoft HoloLens1 as the calibration tool. We implement our calibration process with Unity3D2. The first step is to calibrate the HoloLens' coordinate system with the vehicle coordinate system. We use ICP algorithm to calculate the transformation between HoloLens spatial mapping and our reference model.

Next step is taking mappings by HoloLens' front cameraat different viewpoints to form the training data set. Normally 500 samples that approximately cover the feasiblerange are enough. Finally we train the model using Matlab3 nonlinear regression toolbox.

VI. OPERATIVE BENEFITS

As mentioned above, AR and VR have the potential to have a variety of unique effects on surgery, particularly in the area of surgical training in a virtual surgical environment (Figure 9). Real-time improvement of the surgical method, however, is yet a somewhat experimental use. 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 [4]; using AR to identifythe position of sentinel nodes with 3D freehand single photon emission computed tomography; and using this with near infra-red spectroscopy to provide visual guidance in lymph node dissection in cancer surgery. Specialised near infrared (NIR) devices have been developed for the detection of tissue vascularity using indocyanine green (ICG) dye . 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 . ARtechnology would also be able to seamlessly projectdiagnostic images intraoperatively for surgical planning to guide surgeons with optimal incisions and approach [5] Several studies have demonstrated the use of AR to guide surgeons through intricate anatomy during minimally invasive surgery.

VII. RESULTS

The sensors and analog processing circuitry were put together on PCBs and put within the wrist strap. Fig 9 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 3.3V power supply.

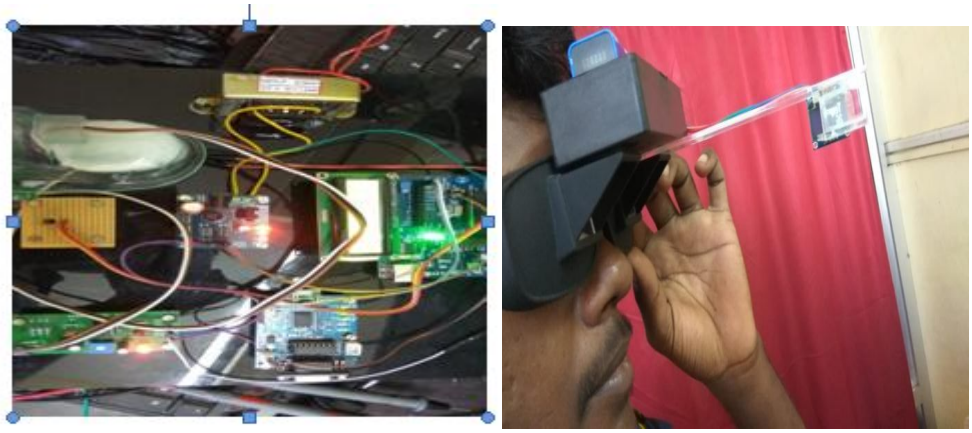


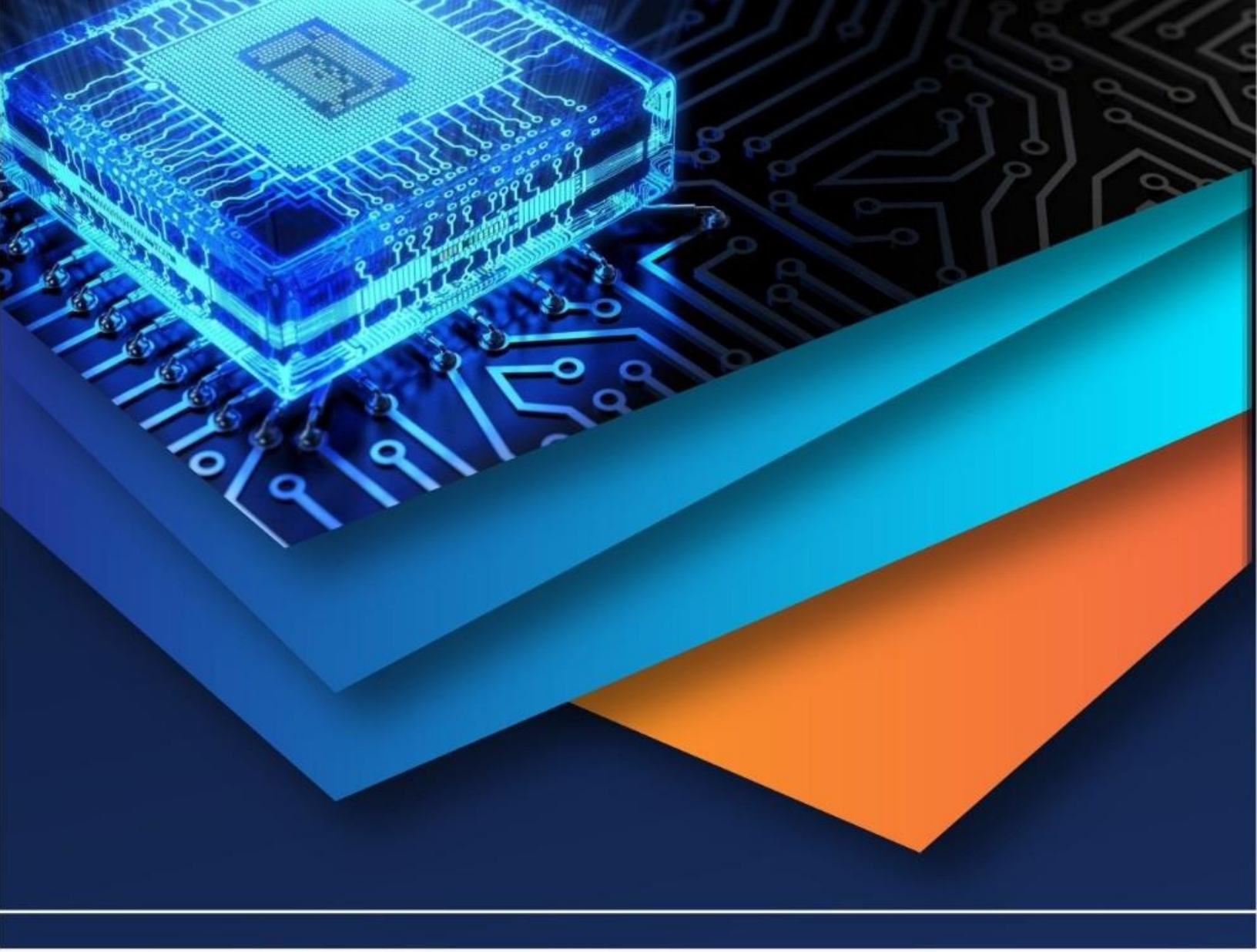
Figure 9: Prototype hardware and AR Glass Setup

VIII. CONCLUSION

Thus, the microcontroller atmega 328 is used to build and implement the zigbee-based wireless Heartbeat and Temperature monitoring system, in which all signals are directly measured from human bodies and all parameter values are presented on LCD on the transmitter side. Through ZigBee, this information is wirelessly delivered to the receiver. The patient's physiological parameters are shown on the computer by the received signal that is sent to it via AR Glass.

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