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Doctors Assistive System using Augmented Reality for Critical Analysis

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Abstract:
The goal is to design and construct an assistive system for doctors to test the condition of the patient. The details such as temperature, respiratory and heartbeat rate of the patient via sensors attached to them. Once the sensor measures the values, it is processed and sent to doctor's wireless augmented reality glass and alerts if an abnormal condition occurs. The doctor can take appropriate action based on the patient's current health condition. Augmented Reality (AR) makes the surrounding environment interactive by overlaying digital 3D models or some plain text information over and around the tangible objects in its radius. 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.

Keywords: Augmented Reality (AR), Sensors, Zigbee, PIC Controller.

I. INTRODUCTION

Augmented Reality interface so far has been used for a great number of tasks, and have shown a great promise for increasing user's performance compared to traditional GUI. This technology expands our physical world, adding layers of digital information onto it. AR appears in direct view of an existing environment and adds sounds, videos and graphics to it. AR plays a vital role in future of medicine. AR can help doctors access the latest and most relevant information about their patients. Augmented reality can be beneficial for healthcare professionals in the aspect of diagnostics and treatment providing access to real-time patient data. AR provides opportunities for more authentic learning and appeals to multiple learning styles, providing students a more personalized and explorative learning experience. There are two systematic reviews about AR; one is on AR in rehabilitation to improve physical outcomes, and the other is focused on AR tracking techniques. We use augmented reality to visualize the basic medical report of the patients.

Components Required

Heat beat sensor, LCD display, Respiratory sensor, PIC microcontroller, Temperature sensor, Zigbee.

Block Diagram of the proposed system

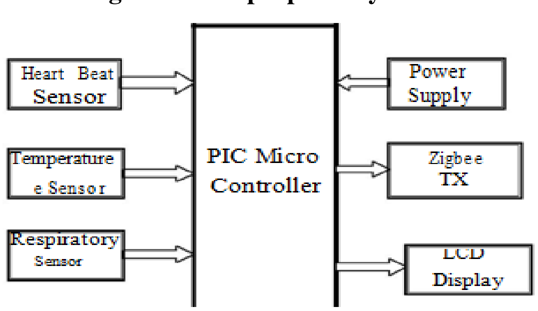


Figure.1. Transmitter section

Figure .2. Receiver section

II. WORKING

The Microcontroller is connected to temperature, heartbeat and respiratory sensor which is shown in fig.1.The microcontroller is connected to an external power supply. These are placed near the patient bed. As soon as the patient gets admitted the details are inputted to the microcontroller through the sensors. The information is recorded in the microcontroller and sent to the doctor's goggles through wireless Zigbee transmitter and received through the zigbee receiver placed at the goggle. The block diagram of the receiver section is shown in fig 2.

PIC Microcontroller

PIC microcontrollers are a family of specialized microcontroller chips produced by Microchip Technology in Chandler, Arizona. The acronym PIC stands for "Peripheral Interface Controller," although that term is rarely used nowadays. A microcontroller is a compact microcomputer designed to govern the operation of embedded systems in motor vehicles, robots, office machines, medical devices, mobile radios, vending machines, home appliances, and various other devices. A typical microcontroller includes a processor, memory, peripherals, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB- to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

Figure.3. PIC Microcontroller 16F877A

Respiratory Sensor

The Respiration Sensor is used to monitor abdominal or thoracical breathing, in bio feedback 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 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.

Figure. 4. Respiratory sensor

Temperature Sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to t h e Celsius (Centigrade) temperature. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4℃ at room temperature and ± 3⁄4℃ over a full −55 to +150 temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.

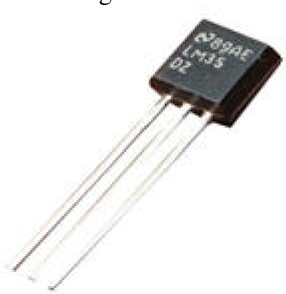


Figure.5. Temperature sensor

Heart Beat Sensor

Heart beat sensor works on a very basic principle of optoelectronics. All it takes to measure you heart rate is a pair of LED and LDR and a microcontroller. IR led emits infrared radiation and surface reflects the infrared light. Depending on reflectivity of the surface amount of light reflected varies this reflected light is made incident on reverse biased IR sensor which results in reverse leakage current. Amount of electron-hole pairs generated depends on intensity of incident IR radiation. More intense radiation results in more reverse leakage current. This current can be passed through a resistor to get proportional voltage. Thus as intensity of incident rays varies, voltage across resistor will vary accordingly.

Figure .6. Heart Beat Sensor

Zigbee Module

The ZigBee (cc2530) is a true system on chip (SoC) solution for IEEE applications. It combines the excellent performance of a leading RF transreceiver with an industry-standard enhanced 8051 MCU, in system programmable flash memory, 8 kB RAM, and many other powerful features. Received Signal Strength Indicator (RSSI) is a measurement of power present in a received radio signal. RSSI is an indication of the power level being received by the receive radio after the antenna and possible cable loss. Therefore, the higher the RSSI number, the stronger the signal

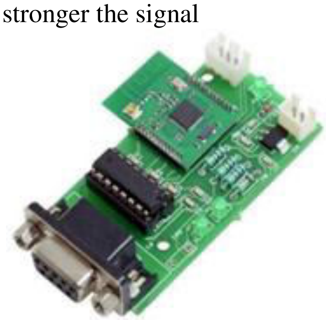
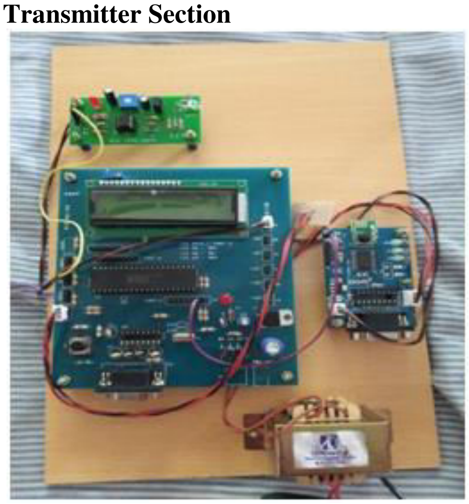


Figure .7. Zigbee module

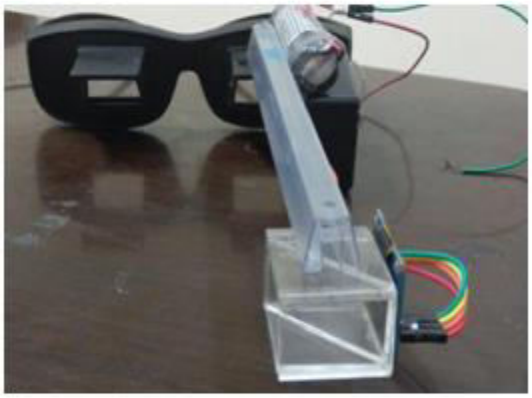
III. RESULTS

Transmitter Section



The transformer is used to convert 230 KV to 12 V to give power supply to the kit. The bridge rectifier converts alternating voltage to direct voltage and filter is used to remove the ripples. The heart beat sensor, temperature sensor and respiratory sensor is connected to the PIC microcontroller. The LCD display is connected to display the values of the temperature, heartbeat and respiratation. The Zigbee module is used for wireless transmission of the values to the AR headset receiver.

Receiver Section



The receiver section consists of a Dc battery, Zigbee receiver module and OLED display. The Zigbee receiver receives the values that are transmitted and displays in OLED display connected to it. Through the wearable glass the information such as the temperature, breathing and heart beat rate is displayed by using a prism.The prism is used for enhancing the display of characters.

Output

The output gives the temperature (T),Heart beat rate (H) and Breathing rate (R) of a normal healthy person. In case of an abnormal condition it gives an alert to the doctor by displaying the message 'ALERT'. The range of abnormal value for temperature is above 40°C.The range of abnormal value for heart beat is above 75 beats per minute (bpm) and for breathing rate is above 100 breaths per minute (bpm).

IV. CONCLUSION

Augmented reality appears to be a powerful tool possibly capable of revolutionizing the filed of surgery through a rational use. In this project, the real-time data of patients in hospital are collected by the sensors attached to them. Once the sensor measures the values they are processed in the PIC microcontroller. The digital outputs are sent to doctor's augmented reality glass through wireless communication and alert if abnormal condition occurs. The doctor can take appropriate action based on the patient's current health condition.

Future Scope

In the future, AR will likely serve as an advanced human – computer interface to surgeons, allowing them to achieve even better results. This technology will allow students to practice the surgery on a virtual environment rather than the patients. Smart medical with augmented reality can be used to practice in surgery, simulation to assist the doctors. This allows the doctors to interact with patient specific organs and tissue in an open 3D space. It enables doctors to immediately identify, evaluate and dissect clinically significant structures.

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