Vitals Monitoring system using Augmented Reality

V. Bharani[1] R. Srisivakumar[2] AL. Subramanian[3]

[123]Department of Electronics and communication engineering

[123]Velammal college of engineering and technology

Madurai

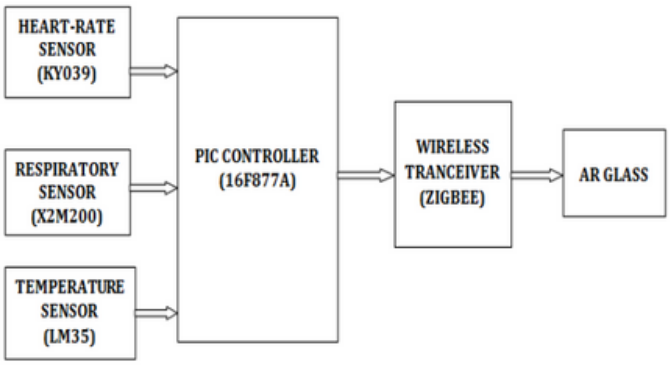
***Abstract*—**The goal is to design and construct an assistive system for doctors to test the condition of the patient. The details such as temperature, respiratory and heartbeat rate of the patient via sensors attached to them. Once the sensor measures the values, it is processed and sent to doctor's 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.

Key Words: Augmented Reality, Sensors, PIC Microcontroller, Zigbee

I.INTRODUCTION

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. The main objective is 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. To generate alerts under abnormal conditions in the AR glass and headset.

Block Diagram



The Generalised block diagram is shown. In this project, the real time data of the patient's during surgery is displayed in the AR glass through wireless transceiver i.e. Zigbee transceiver. The parameters are sensed using the sensors such as heart rate sensor, respiratory sensor and temperature sensor. The Heart rate sensor is used to measure the heart rate of the patients. The respiratory sensor is used to measure the respiratory rate of the patients. The temperature sensor is used to measure the temperature of the patients. These measured values are processed using the PIC controller. The PIC controller is programmed using the Embedded C programming. The processed values are sent to the Doctor's augmented reality glass through the wireless mean only when these values reach above the threshold values.

1. Heartbeat Sensor

This sensor shown in Fig 3.1 is used to measure the heartrate of the patient during surgery. Here, we are KY039 heartbeat sensor.This sensor is based on the principle of photo phlethysmography.

Specification:

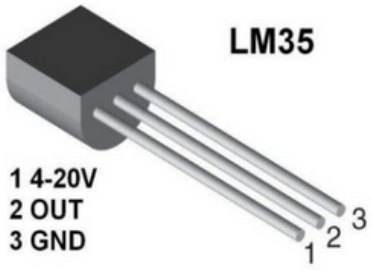
16 x 116 x 3mm (l x w x h) IR Emitter and Receiver 3 - 5V DC Input M2 Mounting holes (centres 10mm apart) Designed to be compatible with standard 2.54mm socket.

3. Respiratory sensor

This sensor is used to measure the respiratory rate of the patient. Here X2M200 respiratory sensor is used for the measurement of respiratory rate of the patient during surgery. The respiratory rate is the number of breaths a person per minute. The rate is usually measured when the patient is at rest. Respiration rates may increase with fever, illness and other medical conditions. The X2M200 sensor module shown in Fig 3.2 is designed for respiration monitoring of people of all ages for health and well being purpose

3. Temperature Sensor

This sensor is used to measure the body temperature of the patient during surgery.LM35 temperature sensor shown in Fig 3.3 is used to measure the patient body temperature. The LM35 has an advantage over linear temperature sensor and it does not require any external calibration.LM35 is widely used temperature sensor because of its low cost and high accuracy. The measured temperature value is given to the output devices.



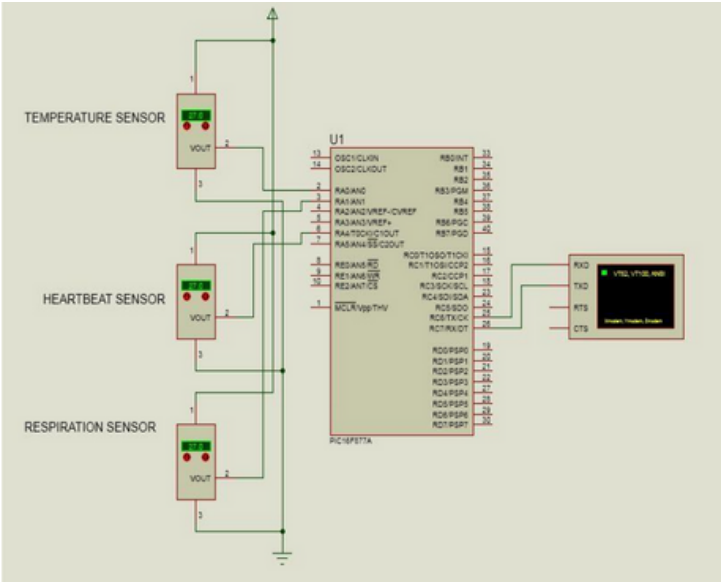
4. PIC Microcontroller

Pic controller used is PIC16F877A shown in Fig 3.4.The PIC microcontroller is based on the flash technology where the data is remained even when the power is switched off[6]. Easy programming and erasing are the other features of PIC16F877A. Here the PIC microcontroller is programmed with embedded C programming. The sensor senses the input and the values are processed and are checked with the threshold values using PIC microcontroller

5. Zigbee wireless transceiver

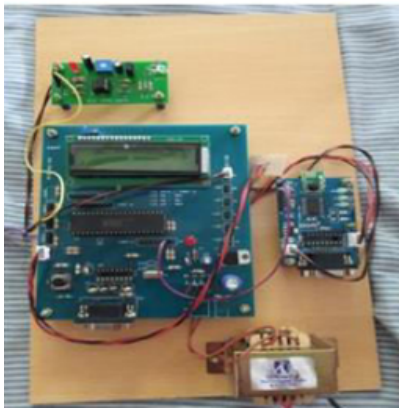
Zigbee shown is an IEEE 802.15.4 based, low power, low data rate supporting wireless networking standard, which is basically used for two-way communication between sensors and control system. It is a short-range communication standard like Bluetooth and Wi-Fi, covering range of 10 to 100 meters. Bluetooth and Wi-Fi are high data rate communications standard supporting transfer of complex structure like media, software etc. In this method Zigbee protocol is used for wireless communication. Zigbee protocol transmitter is connected to pic microcontroller and the Zigbee protocol receiver is mounted on the AR glass. It supports low data rate of about 250 kbps. The operating frequencies are 868 MHz, 902 to 928 MHz and 2.4 GHz. Zigbee Technology is used mainly for applications requiring low power, low cost, low data rate and long battery life. Zigbee transmitter receives signal from PIC controller and it transmits signal to the Zigbee protocol receiver which is mounted on the AR glass and the final output is displayed on the AR glass which is provided to the surgeons.

Connection Pin Diagram



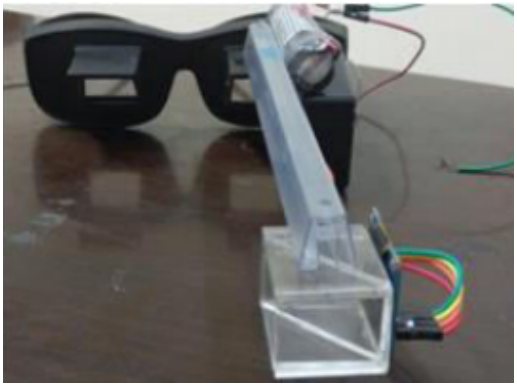
Transmitter Section

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 Side

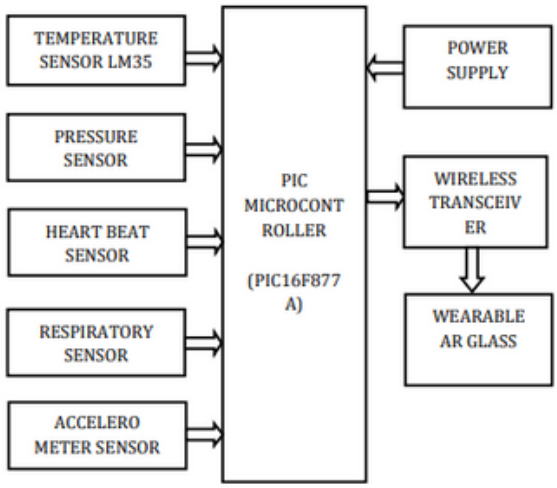
The receiver section consists of a Dc battery, Zigbee receiver module and OLED display. The Zigbee receiver receives the values that are transmitted and displays in OLED display connected to it. Through the wearable glass the information such as the temperature, breathing and heart beat rate is displayed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

Future Scope



Conclusion

The real-time data of patients in hospital are collected by the sensors attached to patient. The measured sensor values are given as input to the "PIC microcontroller "and the values are processed. The wireless ZIGBEE transceiver receives and displays the real time patient's body details in augmented reality glass and alert if abnormal condition occurs. The doctor can take respective actions based on the patient's current health condition. When the doctor enters the patient ward with the googles as soon as he goes near the patient the information gets transmitted using these information the doctor can analyze the critical patients and treat them first.

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.

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