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Real Time Multi Parameter Monitoring Using Internet of Things (IOT)

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***Abstract*— The multi parameter monitoring is a medical equipment life supporting machine used extensively by patients in the Intensive Care Unit(ICU). The patients in the ICU ward needs special care than the other patients .So, it is a must to monitor the patient's condition. But the doctors cannot always stay with the patient checking their condition. To overcome this problem, in this paper we developed a device called multi parameter monitoring which can continuously monitor patients vital science using the concept of INTERNET OF THINGS. This device consists of three sensors to monitor the patient. One sensor will be monitoring the patient's blood pressure level another one will be monitoring the amount of blood getting diluted and the third sensor will be monitoring the pulse rate. These sensors will be fixed with some value at the initial stage. So there will be no problem until the patient's condition is below that level. If the sensor detects the pulse rate or blood rate above or below the threshold value that has been set at the initial stage then it means the patient has gone into the abnormal condition. Once the sensor detects something abnormal in the patients condition then this information will be automatically sent to the micro controller which converts the analog signals into digital signals. Then this information will be sent to the doctors mobile phone in the form of a notification message and an alarm will be generated to alert the doctor. The information is transferred using the TCP/IP protocol. The alarm will be off only if the patients pulse rate becomes normal or nil. This could save more people and could easily drive the doctor's attention more easily. Since the concept of Internet of things is being used the transfer of data will be more faster and accurate. And it also can cover a larger area compared to the other existing system. This device is not so expensive so hence it could be used in every hospital to reduce the work of doctor and to care the patients in a more effective way.**

***Index Term*- WI-FI M03,IR Pulse Detector,SPO2 Probe, Temperature Sensor, Microcontroller ATMEGA 2560**

I. INTRODUCTION

Internet Of Things heralds a vision of the future Internet where connecting physical things. This will give immediate access to information about physical world. The IOT is the network of physical objects(devices, vehicles, buildings and other items)embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data.

IOT is used in communicating Between two objects without any human ,interactions. Huge amount of data can be created. IOT works in underlying technology that the various wireless radios that allow these devices to connect to the Internet and to each other. These include more familiar standards like Wi-Fi, low-energy Bluetooth, NFC and some that probably have heard ZigBee.

The Internet of Things IOT also sometimes referred to as the Internet of Everything IOE. Consists of all the web-enabled devices that collect, send and act on data they acquire from their surrounding environments using embedded sensors, processors, and communication hardware.

Here to implement the IOT concept we are using Wi-Fi MO3 which supports more perfect transmission performance,the sending rate can reach to 11KB/s.

II .LITERATURE SURVEY

1. A Wireless Tracking System for At-home Medical Equipment during Natural Disasters

This system was proposed by David Li, Student Member, IEEE Department of Science Commack High School 1 Scholar Lane, Commack, NY 11725 Davidli27606@gmail.comElectricity-operated durable medical equipment (DME), such as ventilators, dialysis machines, and patient monitoring devices, are life-supporting machines used extensively by patients at home. Using the Adhoc network and the Zig-Bee concept the data's are being transferred.

2.An Integrated Health Monitoring System

This system was proposed by Norhan S. Hammed R & D department BioBusiness Cairo, Egypt.Integrated Health Monitoring System (IHM) is a complete solution of acquiring, processing, monitoring and storing the vital signs of the patients starting from home until reaching the hospital. The IHM consists of five major components: intensive care unit patient monitor (BioMon), wireless patient monitor (WiMon), a mobile application (Healthpad), Central Monitoring System (CMS), and a cloudbased server.

3. Design of Vital Sign Monitor based on Wireless Sensor Networks and Telemedicine Technology

This system was proposed by Nair Siddharth Shivakumar [i]Department of Electronics and Communication Engineering, College of Engineering Guindy Campus,Anna University, Chennai, India nair.siddharth.s@gmail.comThe Vital Sign Monitor is based on a wireless sensor network and telemedicine technology. This system is designed to be a mini patient monitoring system which measures the vital parameters like ECG, Heart Rate and Respiration Rate. The various algorithms used in this application which were designed revolve around the principles of Green Computing, Green Electronics and Green Communication.

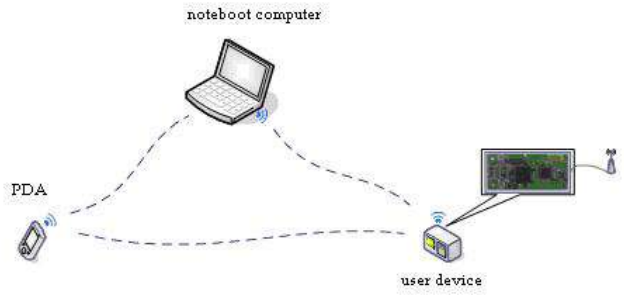
4.A Mobile Biomedical Device by Novel Antenna Technology for Cloud Computing Resource toward Pervasive Healthcare

This system was proposed by Ke-Ren Chen**a**, Yu-Lun Lin**bc** and Mu-Sheng Huang**b** The Department of Electronic Engineering Chung Chou Technology University, Yuanlin, Taiwan 510, R.O.C.**a**Pervasive healthcare monitoring (PHM) system primarily takes care of elder or chronic patients who need long-term and continuous collection of physiological data, the vital signs monitor (VSM) signs delivering the emergency information to medical center server to storage and analysis for further processing, biomedical cloud computing.This system completely works on the concept of cloud computing.

III.MODULES

A. WI-FI M03

HLK-WIFI-M03 is the new third-generation embedded Uart-Wifi modules studied by Shenzhen Hi-Link ElectronicTechnology co.,Ltd. Uart-Wifi is an embedded module based on the Uart serial,according with the WiFi wireless WLAN standards, It accords with IEEE802.11 protocol stack and TCP / IP protocol stack， and it enables the data conversion between the user serial and the wireless network module. through the Uart-Wifi module, the traditional serial devices can easily access to the wireless network.



Wireless network based on ad hoc network (Adhoc). Wireless network based on ad hoc network (Adhoc)

B. SPO2 PROBE

Pulse oximeters measure how much of the hemoglobin in blood is carrying oxygen (oxygen saturation) which can be found in areas such as operating rooms, recovery, critical care, wards, and ambulances. The hemoglobin without oxygen we will call de oxygenated hemoglobin (deoxy Hb). The hemoglobin with oxygen, we will call oxygenated hemoglobin (oxy Hb).

Pulse oximetry uses light to work out oxygen saturation. Light is emitted from light sources which goes across the pulse oximeter probe and reaches the light detector. If a finger is placed in between the light source and the light detector, the light will now have to pass through the finger to reach the detector. Part of the light will be absorbed by the finger and the part not absorbed reaches the light detector.

The amount of light that is absorbed by the finger depends on many physical properties and these properties are used by the pulse oximeter to calculate the oxygen saturation. The amount of light absorbed depends on the following:

1. concentration of the light absorbing substance.
2. length of the light path in the absorbing substance
3. oxyhemoglobin and deoxyhemoglobin absorbs red and infrared light differently

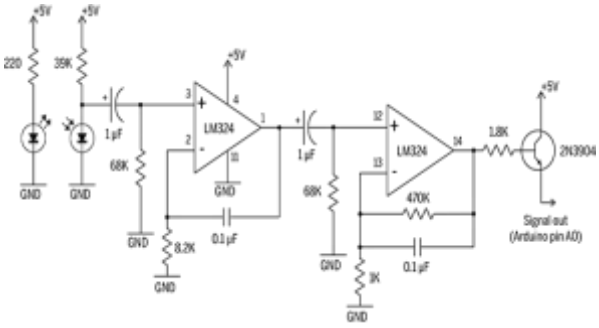
Light wavelengths are very short, and the unit of measurement is nanometer (nm). Oxy Hb absorbs more infrared light than red light.Deoxy Hb absorbs more red light than infrared light.

Pulse oximeters often show the pulsatile change in absorbance in a graphical form. This is called the“plethysmographictrace” or more conveniently, as “pleth”.

C. PULSE DETECTOR

Modern pulse oximeter plays an important role in modern medicicne spefically in operating rooms.One of the most important people in the operating room is the anesthesiologist..They are incharge of keeping the Patients alive within specified limits.The detector consist of 2 IR one

as transmitter and the other as receiver.,8 resistors with different values(68k,82k,1k,470k,1.8k,220k,39k),4 capacitors,LM34 IC.



D. TEMPERTAURE SENSOR

The LM35 is a common TO-92 temperature sensor. It is a precision IC temperature sensor with its output proportional to the temperature in degree Celsius.The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. The LM35 produces voltages from 0 to +1V.

With LM35temperatue can be maesured more accurately than with thermistor.It also possess low self heating and does not cause more than 0.1°.The LM35 has three pins one for V_{in} ,another one is for V_{out} and the other one will be grounded.

E. ATMEGA

The ATmega640/1280/1281/2560/2561 provides the following features: 64K/128K/256K bytes of In-System Programmable Flash with Read-While-Write capabilities, 4Kbytes EEPROM, 8Kbytes SRAM, 54/86 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), six flexible Timer/Counters with compare modes and PWM, four USARTs, a byte oriented 2-wire Serial Interface, a 16-channel, 10-bit ADC with optional differential input stage with programmable gain, programmable Watchdog Timer with Internal Oscillator, an SPI serial port, IEEE® std. 1149.1 compliant JTAG test interface, also used for accessing the On-chip Debug system and programming and six software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, SPI port Timer/Counters, and interrupt system to continue functioning.

The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or Hardware Reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the Crystal/Resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.

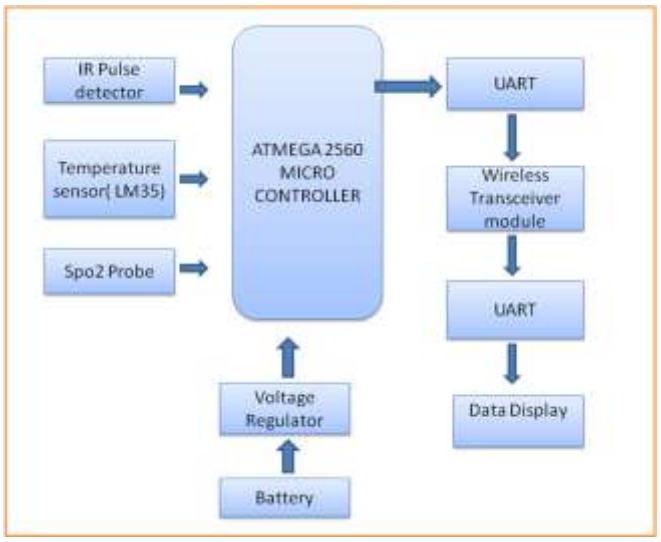
Atmega offers the QTouch® library for embedding capacitive touch buttons, sliders and wheels functionality into AVR microcontrollers. The patented charge-transfer signal acquisition offersrobust sensing and includes fully debounced reporting of touch keys and includes Adjacent Key Suppression® (AKS®) technology for unambiguous detection of key events. The easy-to-use QTouch Suite toolchain allows you to explore, develop and debug your own touch applications.

The device is manufactured using the Atmel high-density nonvolatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional nonvolatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation.

By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega640/1280/1281/2560/2561 is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications.The ATmega640/1280/1281/2560/2561 AVR is supported with a full suite of program and system development tools including: C compilers,macro assembler,program debugger/simulators, in-circuit emulators, and evaluation kits.

IV.HARDWARE DESIGN

The hardware is based IOT having three sensors used for detecting the patients vital science.These three sensors are then interfaced with the 8-bit microcontroller which has the in build ADC to convert the analog signals into digital signals.These generated values will be send to the UART which is used to transmit the data in a sequential fasion. The data from the UART will be sent to the wireless transceiver.This is the sending part.

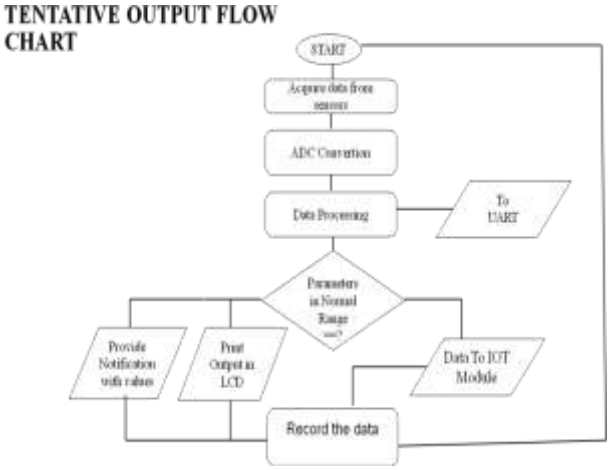


The data from the wireless transceiver uses the TCP/IP protocol.This is based on the IOT concept which is used to send the information wirelessely.The information from the transceiver is sent to the UART which provides the serial coversion.o regulate the volts from the battery to the controller which is 5v.The battery with 9 volt provides the power supply and the voltage regulator is used to regulate the volts from the battery to the controller which is 5v .At last the warning message will be displayed in the mobile phones.

V. FLOWCHART

The flowchart describes the flow of the output process .Flow chart usually tells how a work is being carried out. The first step is to acquire the data's from the sensor and the last step is displaying it in the mobile phone.

SENSOR	VALUES	COMMENTS
PULSE SENSOR	Less than 120/80	Normal
	Above 180/100	Hypertensive
TEMPERATURE	98.8	Normal
	Above or below 98.8	Abnormal
SPO2	85% and Above	No Evidence Of Impairment
	65% and Above	Impaired Mental Function On Average
	55% and Above	Loss Of Consciousness On Average



After acquiring the data it will be sent to the ADC converter which is being present in the microcontroller and the data processing happens. The values Will be initially present as analog signal which has to be converted into digital to be processed.So the processor converts the analog signal to digital signal for displaying it.Then based on the condition i.e. if the data that is being received is normal or upto the initialized value then the data's will be normally recorded if the values are above or below the threshold value then automatically an alarm and a notification message will be sent to the corresponding doctor to alert them to monitor the patient's condition.

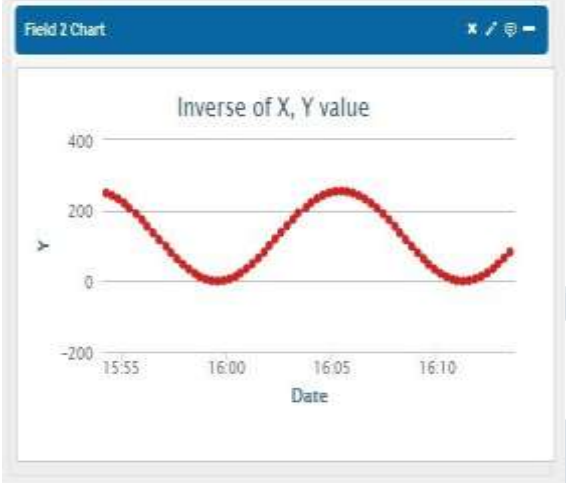
VI.IMPLEMENTATION

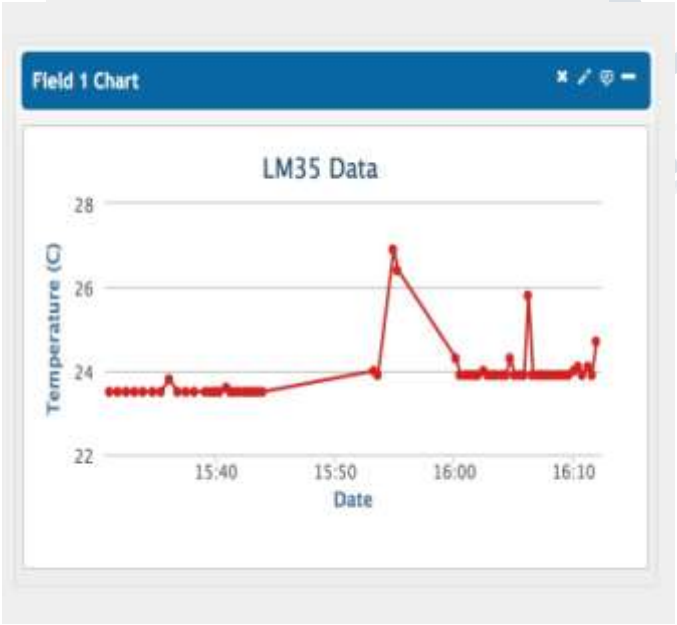
The implementation part includes the way of how the data's are being processed and sent as the information to the doctor. The normal value of the pulse rate, temperature and spo2 will be already initialized. So as the detecting sensor continuously sends the data to the microcontroller it checks whether the current value of it normal or above or below the threshold value

If the value is normal then there will be no alarm or notification message being generated which means that the patient is in normal condition.If the value goes above or below the threshold value then the information will be sent to the doctor's mobile using TCP/IP protocol .

OUTPUT:-

The output will be in a graphical form in the doctor's mobile which describes the patient's vital science in a easier way and the alrm will also be generated in the doctor's mobile phone.





VI.CONCLUSION

This paper demonstrates the use of an integrated patient monitoring system as a key infrastructure for enabling continual health monitoring. We have described this system to be consisted of a three sensors that are located in the patients bed. The data's are obtained from these sensors and are transferred to the doctor's mobile using the Wi-Fi mo3. By using this technique the data's are transferred easily to the doctor's mobile without any traffic. This task is performed with the concept of IOT which allows supports and facilitates this communication as it frequently stores patients data received from the sensors that are interfaced with the micro controller. This proposed technology has a great potential to offer a wide range of benefits to patients, health-care improvement and society through continuous monitoring and potential knowledge discovery through data collection gathered from the sensors. This gives detailed information about the patient to the doctor, this helps the doctor to recognize the condition of the patient very easily and the method is more convenient

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