

DESIGN AND IMPLEMENTATION OF REAL TIME VITAL SIGN MONITORING SYSTEM USING MODERN COMMUNICATION TECHNOLOGY

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Abstract: Nowadays, Diagnosis human body physiological parameter are become more important because of to improve healthcare. The main purpose behind design this project is to provide information about vital sign monitoring of human health this system able to continuous measurement of bio signal like ECG, Temperature, pulse rate, Blood pressure and Respiratory signal. In India specially, rural area the diagnosis and treatment against various disease is very poor due to the poor patient to doctor ratio so main motive behind designed this project is to provide very proper health care monitoring facilities to improve patient care so this portable device measure various vital sign of the human body and convert them into the suitable form and processed in to the DAQ which is made up of an Embedded system and display the reading on to the suitable display. Due to advancement in communication technology and IOT based system this device is able to monitor the measured data at anywhere and based on it doctor can give their valuable prescription to improve patient care and this system is also essential to provide better care with less numbers of medical staff members and better security about patient confidential information. Also, this system has facility to generate alert file if any physiological parameter has gone beyond its normal value.

IndexTerms - Vital signs, Electrocardiography, Pulse oximetry, Asthma, Communication technology;

I. INTRODUCTION

There are many types of patient who may need to continuous measurement or emergency care some person who may need to monitor their vital signs in order to check the proper functioning and rhythm of their body organs due to critically ill condition or person who may recover from major surgical procedure and some other cardiac surgery so patient is often placed in some specialized unit in a hospital it is also known as Intensive care units. It is a specialized unit where their vital sign can be monitor continually with help of some monitoring devices. But due to rapid growth and advancement in telemedicine Sector this system become more advance but some time increases the cost of medical care and also transmitting all the data at that time was a difficult due to some big data size, range of wireless devices and some problem related to security and some confidential information about the patient privacy may be lost due to the cyber-attack. By the 1960s telemedicine was introduced when the national aeronautics and space administration expressed the need to monitor vital signs for their astronauts during their mission [1]. But after some time, due to very fast and rapid growth of communication technology like Bluetooth, GSM and ZIGBEE etc. The speed of Communication media is become so fast and cost is also decreasing after it telemedicine is develop so fast now days it is possible to performs surgery via remote location. Vital sign monitor is a device which is used for continuous monitoring of individual physiological parameters like ECG, heart rate, pulse rate, blood pressure, temp. etc. Basically, it is consisting of sensors, mcu, output part and Wi-Fi trans receiver module.

CLINICAL IMPORTANCE OF PHYSIOLOGICAL PARAMETER

This section describes various type of biomedical parameters and its measurement technique like ECG, pulse rate, body temperature, heart rate & respiration rate and it's important in normally human life.

A. ELECTROCARDIOGRAPHY AND HEART RATE

The process of measurement of electrical activity of heart for long period of time is known as electrocardiography and it is basically measure by placing electrodes over skin's surface. Basically, these electrical activities are generated due to proper depolarizations and repolarization of heart muscle. The ECG signal is characterized by six peaks and valleys labelled with successive letters of the alphabet P, Q, R, S, T, and U [2]. Always measurement of cardiovascular function of human health is considered as an important parameter because it provides valuable information about human heart activity. The normal value of heart rate is 60 to 100 Bp/m/ If any changes in normal heart activity occurs it is considered as abnormality related to the heart and it will lead to cause some life threatening heart diseases like ventricular fibrillation, tachycardia (Fast heart beat) and bradycardia (low heart beat).

B. BODY TEMPERATURE

The body temperature is important parameter to consider because it provides valuable information about how much amount of heat is gain and lost by our body this phenomenon is known as thermoregulation process. If temperature is beyond its normal value it is called hyperthermia and If it is low then it is considered as hypothermia. Whether the patient is under normal condition or not, the normal body temperature is 98.6 °F or 37.0°C if body temperature is higher than the 102 °F is notify as fever or it will harmful for patients.

C. Plethysmography

The process for measurement of the percentage of oxygen saturation of the blood circulates in arteries is known as pulse oximetry. The measurement of pulse rate provides information about the cardio respiratory function. SP02 gives the percentage of oxygenated hemoglobin as comparing the total amount hemoglobin in blood. The normal pulse rate value is 95 to 100bpm if the value is less than 95bpm it will consider as hypoxia (absence of enough oxygen in the blood) and if the value is more than normal range it may consider as hyperoxia. (oxygen supply is higher than the normal). The whole system work on the principle of Beer-Lamberts Law.

$$A = -\log T = \log I_0/I = \epsilon DC$$

Where I_0 and I are incident and transmitted light intensities

ϵ = extinction coefficient

D = depth of absorbing layer

C = concentration

D. Respiration Rate

Respiration rate is defined as the number of breaths take per minute. The normal respiration range is 12 to 22 to breaths per minute, if the value of respiration rate is more or less as given to us it will consider as abnormality of respiratory system. It may consider as asthma, pneumonia etc.

II.LITERATURE SURVEY ON EXISTING SYSTEM

The most of the vital sign monitoring system design are consisting based on wired or wireless devices. Using wired devices, we will easily measure biomedical parameters but it has followed some demerits like patient in icu room, every time doctors or any others medical staff physical present are required. The proposed system overcome the demerits the doctor can monitor their patient anywhere.

The system which was comprises wireless sensor area network it has also followed some disadvantage it may depended which communication technology is used by the developer. Bluetooth, Zigbee, WI-FI, are some most common technology which are used for wireless communication it all has been some disadvantage like Bluetooth having a short range(1-100m), high interference. Wi-Fi(802.11n) having disadvantage of short range, connectivity and increasing the size of hardware. ZigBee also cover good range but low transmission speed, higher set up cost and weaker in providing better security makes them not suitable for these operations.

In these propose system has inbuilt features of transmitting a patient's data on to the internet which is known as web publishing tools. And more implementation is possible if we make some particular android application than we can easily send a patient data and also manage and analyze those data in very accurate and manner.

TABLE I COMPARISION BETWEEN COMMUNICATION TECHNOLOGY IN VITAL SIGN MONITOR

SR NO.	CHANNEL	VITAL SIGNS	DEMERITS
1.	BLUETOOTH	HEART RATE, BODY TEMPERATURE	SHORT RANGE HIGH INTERFEARENCE
2.	WIFI (802.11)	HEART RATE ,TEMP,PULSE RATE	SHORT RANGE LOW CONNECTIVITI
3.	ZIGBEE	Heart rate, temp, ECG	SHORT RANGE.HIGH COST FOR SETUP
4.	GSM/GPS	HEART RATE,TEMP	LOW CONNECTIVITY,COST

III. HARDWARE DESCRIPTION

This section describes a various noninvasive measurement technique available in our system for the measurement of various type of vital signs and it also describe a hardware use for it and generalized block diagram of vital sign monitor with using modern communication technology.

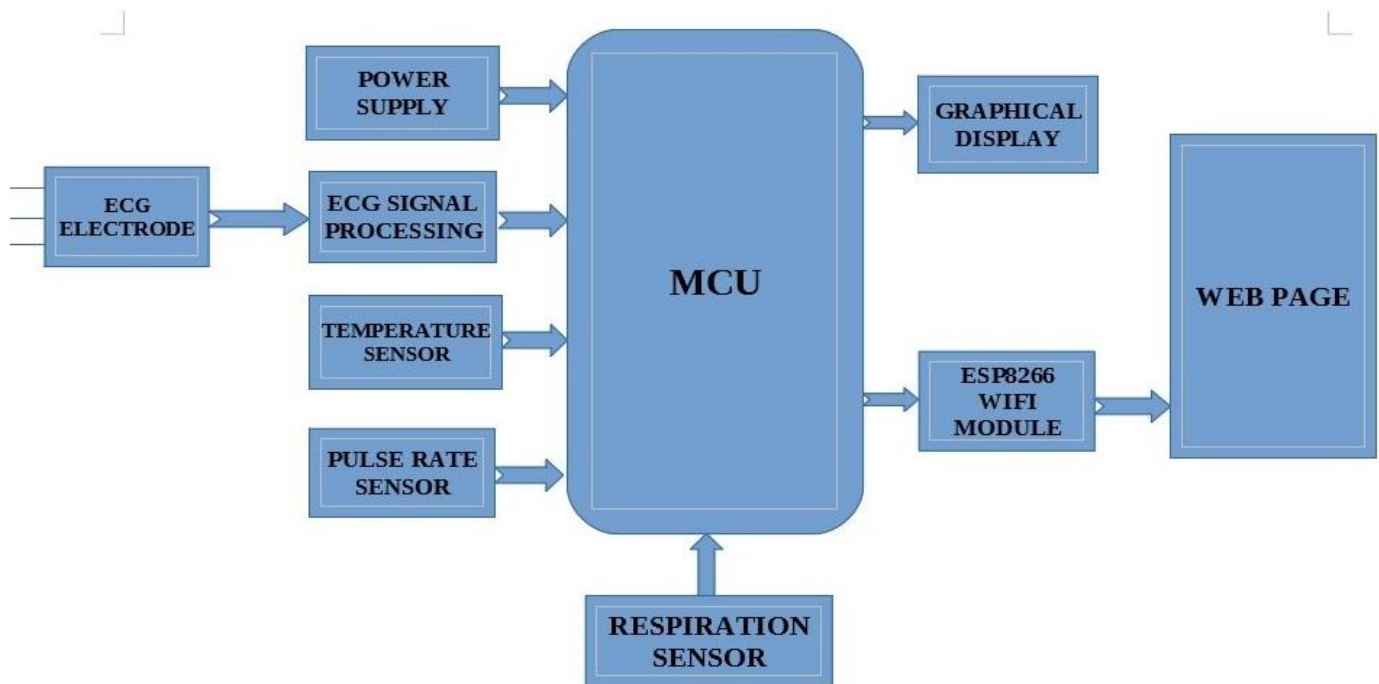


Figure 3.1 Basic block diagram of IOT Base vital signs monitor

Figure 3.1 show the basic block diagram of IOT base vital sign monitor. It has mainly comprised of four part 1. sensors 2. microcontroller unit 3. Display unit and 4. wi-fi module.

Generalize block diagram of IOT based vital sign monitor: Sensors are devices which is used to detect the physical parameter and convert it into the signal which can be measured electrically and easily processed by the controller. Vital sign monitor will consist few biomedical sensors which can detect physiological parameters (ECG, PR, Respiration rate & Body temperature etc.) from human body. After this electrical signal is amplified, filtered and converting into the digital form with help of DAQ. Mainly DAQ was consisting of embedded system. Then after processed the physiological parameters by microcontroller unit it will check if any parameter goes beyond its normal value so alert file is created and due to the advance facilities in communication technology and ESP8266 WI-FI module we will send the data at anywhere in world but better security purpose we provide one particular web server so physician can access it.

A. ANALOG SIGNAL PROCESSING FOR ECG:

The process of measurement of electrical activity of heart for long period of time is known as electrocardiography and which is basically measure by placing electrodes over skin surface. The electrical activity picked by the electrodes is very low in terms of voltage typical like 1mV and amplitude range was 0.1-5mv and frequency range is about 0.05 to 120Hz. So further amplification of ECG signals is need for better response. To get accurate, stable and amplify ECG signal we are use instrumentation amplifier IC126 because of its good CMRR and low noise differential signal acquisition and its low cost. After amplify the low voltage ecg signal we need to use filter for removal of various type of noises are present in ECG signal. Based on the American Heart Association Standards for ECG signals [2], the ECG band pass filter was designed to pass frequencies between 0.05 and 100 Hz. Further ECG signal filtering was implemented for QRS detection. We are basically implemented a band pass filter with help of operational amplifier IC OP07. A bandpass filter with corner frequencies of 13Hz - 17Hz was used for this purpose. After the detection of QRS Complex we are easily extract the heart rate.

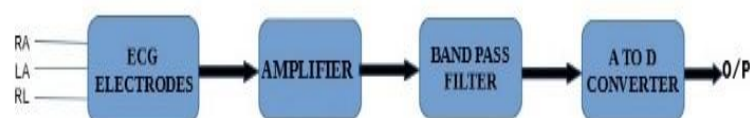


Figure 3.2 Block diagram of data acquisition system of ECG.

B. ECG SENSOR:

ECG signal comes from patient body via the electrode's its amplitude range is to low (millivolts) so further amplification of ECG signal is required, for this purpose we used preamplifier circuit basically it's made up of an instrumentation amplifier. From



Figure 3.3 AD8232 srnsor

our requirement purpose we choose $R_G=10k\Omega$ due to it we are able to adjust the gain 13 v/v, actually the gain is not very large for reason that the instrumentation amplifier has high common mode rejection ratio but noise is still affected to output of the circuit.

Gain is set by connecting an external resistor, R_G as shown:

$$\text{Gain} = 5 + 80k\Omega/1 = 13v/v$$

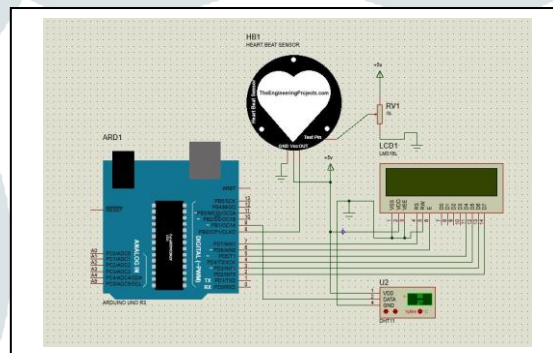


Figure 3.4 Interfacing of dht11 with Arduino

IV. RESULT AND CONCLUSION

RESULT

Table II Result table

SR NO	PATIENT NAME	TEM AND HUMI	HEART RATE
1.	HIMANSHU BAROT	37.2, 50%	TACYCARDIA
2.	PINTU PATEL	36.4, 38%	NORMAL
3.	KUMAR ZALA	36.2, 38%	BRDYCARDIA

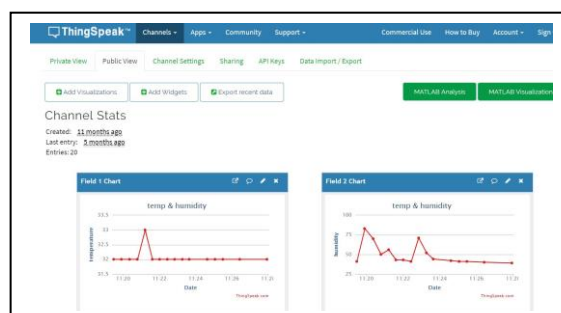


Figure 3.3 Humidity and Temperature on TOS

After Interfacing DHT11 sensor with controller we were able to get data on our created thing of speak channel so it was help to doctors to provide prescription according to patient requirement. Body temperature and humidity is very according to patient.

CONCLUSION

Here, we are going to present paper of all vital sign parameters of human body and it's important in normal human life and also discussing some communication technology use for transmitting those data from one point to another point. It is concluded after observing some old technique the diagnosis of some life-threatening disorders like ventricular fibrillation, asthma is more time consuming and difficult. But make the system correct we are going to introduce a new vital sign monitoring system which is provide fast, rapid and accurate measurement of various vital signs so doctor can give their valuable prescription at anywhere to the patient.

REFERENCES

- [1] Patricia Mendoza, Perla Gonzalez, Brenda Villanueva, Emily Haltiwanger*, and Homer Nazreen, "A Web-based Vital Sign Telemonitor and Recorder for Telemedicine Applications," Proceedings of the 26th Annual International Conference of the IEEE EMBS San Francisco, CA, USA, pp2196-2199,2004.
- [2]AkshayKenjale, AjayakumarYadav, Amit Khand gale, PoojaChaudhari, Trupti Mate, "LabVIEW based ECG Monitoring System," International Journal of Scientific Engineering and Applied Science (IJSEAS), Vol (2)5, pp266-268,2016.
- [3]Abasi Julius, Hang Jian-Min, "IOT based patient health monitoring system using LabVIEW and WSN," International Journal of Science and research (IJSR), Vol (6)3, pp894-900,2015.
- [4] Mohan lalsahu, Jignesh Kumar Kaushal, "Real time health monitoring system using Arduino and LabVIEW with GSM Technology," International journal of Advance Engineering & Research Development,201
- [5]Waseem Abbas, Assad Khaliq, Salman khan, M. umairsaleh, "Real time wireless health monitoring system,"journal of electrical and electronics engineering, vol (9)3, pp31-38,2014
- [6]VenkataVirajitGarbhapu, SundararajanGopalan, 2017." Iot Based Low Cost Single Node Remote Heath Monitoring System". The 7th international conference on current and future trend of information and communication technologies in healthcare (ICTH 2017), procedia computer science, pp408-415,2017
- [7] William Walker, A.L.PraveenAroul, Dinesh Bhatia.2009."Mobile Health Monitoring Systems". 31st Annual International Conference of the IEEE, MBS Minneapolis, Minnesota, USA, September 2-6, 2009, pp 5199-5202
- [8] Laura Juliana Vargas Escobar, Sergio Alexander Salinas., 2016. E Health Prototype System for Cardiac Telemonitoring, IEEE Electronics journals, pp 4399-4402.
- [9]Abasi Julius, Zhang Jian-Min., 2015."IOT Based Patient Health Monitoring System Using LabVIEW and Wireless Sensor Network", International Journal of Science and Research, 78(6) pp. 894-900.
- [10]ManjuBabu, Roshna Rose Raju, Sunil Sylvester, Teenu Mary Mathew, K M Abubeke., 2016. "Real Time Patient Monitoring System Using LabVIEW", International Journal of Advanced Research in Computer and Communication Engineering, 5(3) pp. 505-507.

