ISSN (ONLINE): 2395-695X
ISSN (PRINT): 2395-695X

International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Volume 2, Special Issue 19, October 2016

Real Time Ambulatory Health Monitoring System using Wearable Sensors

N.GOWRI PRIYA[#1], VASUDHA V[#2]
[1]*Assistant Professor, BME, Dr NGP Institute of Technology. gowripriya@drngpit.ac.in*
[2]*UG Student, Dr NGP Institute of Technology, Coimbatore, India*

Abstract- ***The main focus of this paper is to implement the health monitoring system continuously without hospitalization using wearable sensors. Wearable sensors monitor the parameters of the human body like temperature, pressure, pulse rate, ECG and also send the information to the doctors and ambulance for emergency cases through mobile application. This method reduces the time, easy to use and also used for self monitoring the patients anywhere at any time. The implementation of the system is done by using Arduino Uno microcontroller.***

Key Words: **Arduino Uno, ECG, Pulse Rate, Blood Pressure, Temperature.**

I. INTRODUCTION

The health problem is rising along with increasing population in the today's world. In hospitals, continuous monitoring is needed for heart attack, after major/minor operation, temperature related illness, physical disorders. But the 24x7 monitoring of patients is difficult and also leads to high cost. For elderly people who alone stay in home for long term monitoring without person is a complex situation. To overcome the situation without hospitalization for monitoring the patients using wearable sensors is used in this paper. Wearable sensors are popular in many applications such as entertainment, security, medical purposes. Wearable sensors are worn on the human body for temperature, pressure, pulse rate, etc., In the medical field, sensor are collect the data about the person and send the information using wireless technology. This method reduces the health care cost of patients.

II. OVERVIEW OF WIRELESS TECHNOLOGY

Wireless technology has reached a turning point, as vendors and researchers prepare to take it to the next level. Most industry observers agree that next-level wireless technology will offer more bandwidth, security, and reliability, making it more suitable for multimedia, e-commerce, video conferencing and other advanced applications.

Data is to be transmitted to remote location as per our projects main requirement. There are various communication technologies used for data transmission these are ZIG-BEE, BLUETOOTH, GSM, and GPRS. ZIG-BEE is used to create personal area networks built from small, low-power digital radios. It is based on an IEEE 802.15 standard. It has Short-range wireless transfer of data at relatively low rates. It transmits data over longer distances by passing data through intermediate devices to reach more distant ones. It has Low data rate, long battery life, and secure networking applications. It's Data Rate of 250 kbit/s. but zigbee is not suitable for medical application GSM Standard for mobile communication. SMS was developed as part of the GSM Communication. Useful when the mobile phone user is not expect to answer or respond immediately. By using GSM only SMS can be sent but medical data cannot be transmitted. GPRS (General Packet Radio Service) is Based on GSM and IP. The Data Rate of GPRS is up to 40 Kbit/s. It is one of the quick and cost- effective solutions. It has 3GSM networks and services. The GPRS is useful in medical data transmission because it has direct data uploading capability to server. Interfacing GPRS modem to controller the data can be transmitted from patient side to server. Then the smart phone is having an application that will make that received data available globally.

III. PROPOSED TECHNOLOGY

3.1 Block Diagram

The proposed system consists of ECG electrodes, LM35 temperature sensor, and Blood Pressure sensor and pulse rate detector. The sensors are connected as inputs to the microcontroller. The ECG signal acquired are noisy and are amplified and then given as input to microcontroller. The instrumentation amplifier AD620 was used, which has a very high CMRR (90dB) and high gain (1000). The micro controller converts analog signal

to digital signal and check abnormality condition, sends the data to mobile where it is displayed through Android application. The block diagram of the proposed work is shown in the figure 1.

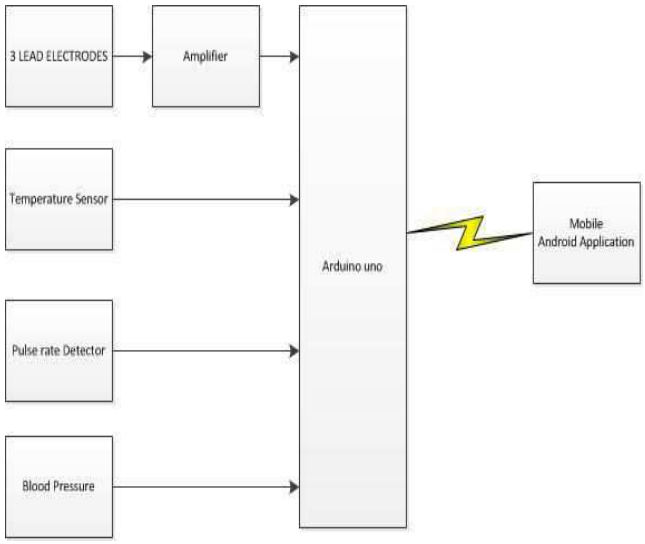

Fig 1: Block Diagram of the proposed work

3.2 ECG Electrodes

An ECG electrode is a device attached to the skin on certain parts of a patient's body generally the arms, legs, and chest during an electrocardiogram procedure. It detects electrical impulses produced each time the heart beats. From the QRS wave the activity of heart. The ECG records, in a great detail, are used to diagnose a very broad range of heart conditions.

QRS Complex Normal and Abnormal Values:

- Normal: 0.06 - 0.10s
- Prolonged QRS Duration (> 0.10s):
  - QRS duration 0.10 - 0.12s
    - Incomplete *right* or *left* bundle branch block
    - Nonspecific intraventricular conduction delay (IVCD)
    - Some cases of left *anterior* or *posterior* fascicular block
  - QRS duration ≥ 0.12s
    - Complete RBBB or LBBB
    - Nonspecific IVCD
    - Ectopic rhythms originating in the ventricles (e.g., ventricular tachycardia, pacemaker rhythm)

3.3 LM35 Temperature Sensor

Temperature Sensor LM35 sensor is used to measure the temperature of the human body. Body Temperature changes depend upon on the time to time and day to day, but no more than 1.0oC.For many diseases such as typhoid , viral fever etc.,. So it needs to monitor continuously the patients. It also used to self monitoring the patients easily. If the temperature level is too low, the patient needs medical emergency. Because too low temperature leads to death occur and also for high level. It is measured in degrees Celsius (oC).

Table – 1: Classification of temperature range

Category	**Temperature Range (oC)**
Hypothermia	<35.0
Normal	36.5 – 37.5
Hyperthermia	> 37.5 – 38.3
Stage 1 hypothermia	35-36
Stage 2 hypothermia	34 – 33
Stage 3 hypothermia	32
Hyperpyrexia	>=40.0 -41.5

3.4 Blood Pressure Sensor

Pressure Sensor The Pressure sensor is used to measure the systolic and the diastolic pressure level using the device. Systolic is the higher of the two number measures the pressure in the arteries when the heart beats. Diastolic is the lower of the two number measures in the arteries between heart beats. It is measured in millimeter mercury (mmHg). Blood pressure changes from minute to minute.

Table – 2: Classification of blood pressure.

Category	Systolic/diastolic pressure (mmHg)
Hypotension	< 90/60
Desired (normal)	90-119 / 60-79
Prehypertension	120-139/80-89
Stage 1 hypertension	140-159/90-99
Stage 2 hypertension	160-179/100-109
Hypertensive	>= 180/>=110

The symptoms of the low blood pressure are Dizziness or lightheadedness, Fainting (syncope),Lack of concentration, Nausea, Depression, Thirst, Cold, Clammy, pale skin, Blurred vision, Rapid, shallow breathing, Fatigue.

3.5 Pulse rate Detector

Pulse rate of a body can be counted by change in blood flow in blood vessels. In the system the IR led and IR detector is used to fulfill the requirements of pulse rate counter. The normal pulse rate of the person is 78 bpm. It is measured based on the beats per minute. If it is more than 100 BPM causes Tachycardia and if it is less than 60 BPM causes Bradycardia.

3.6 Android Application

Android SDK has been used which has been integrated with Eclipse IDE built by Oracle corporation. The Android SDK is open source tool, It is freely available on the developer website. The Eclipse program has become the most popular IDE for Android application development. Android developer site has powerful plug-in for facilitating Android development. Android applications are written in java programming language, developers are already familiar with many of the packages provided as part of android SDK, such as java, dotnet. Android development tools (ADT) plug-in for eclipse. Android application provides automated builds and application deployment to android emulators and handsets. A report will be generated through mobile application whether the patient is normal or abnormal. If the patient is abnormal then the report will be sent to concern Doctor and Ambulance for immediate treatment.

IV. RESULTS

The vital parameters were acquired and sent to the mobile application. The patient physical condition whether normal or abnormal are displayed through the application created. The format of the report is shown below in the Figure 2.

REPORT

Personal Information	
Name:	Date:
Sex:	Day:
Age:	Time:

Normal Values			
QRS Interval	Heart Rate	Blood Pressure	Body Temperature
(0.04 - 1.2) ms	(60 - 100) BPM	(120/80) mmHg	37.4°C

Your Test Results			
QRS Interval	Heart Rate	Blood Pressure	Body Temperature
0.06 ms	65 BPM	(110/70) mmHg	37.0°C

Fig 2: Report Format

V. CONCLUSION

This work presents the requirements and the realization in terms of sensing devices and sensor data signal processing to improve the provisioning of healthcare services for CHF patients. With the remote monitoring, the medical staff can realize changes in the parameters of patients without frequently visiting them and consequently they can take concerned action to prevent possible aggravations. The benefits extend beyond the early detection of clinical exacerbation to optimizing specialized resources scheduling and to reduce unnecessary travels to hospital. It reduces the Re-hospitalization rates. This system reduces costs by enabling in home monitoring of patients, eliminating the need for utilization of expensive facilities. In this proposed work vital multi parameters like ECG, pulse rate, blood pressure and temperature has been measured. The measured outputs can be visualized and are easily understandable by the physician and the patient care taker by the means of an android application.

REFERENCES

[1] Shyr-Kuen Chen, Tsair Kao, Chia-Tai Chan, Chih-Ning Huang, “A Reliable Transmission Protocol for ZigBee-Based Wireless Patient Monitoring” IEEE Transactions on Information Technology In Biomedicine, Vol. 16, No. 1, January 2012.

[2] H. Wang, D. Peng, W. Wang, “Resource-aware secure ECG healthcare monitoring through body sensor networks”, IEEE Wireless Commun., vol. 17, no. 1, pp. 12–19, Feb. 2010.

[3] Suhas Kale, S. Khandelwal, “Design and Implementation of Real Time Embedded Tele-Health Monitoring System”, 2013 International Conference on Circuits, Power and Computing Technologies [ICCPCT-2013].

[4] M. Chaitanya Suman, K. Prathyusha, "Wireless ECG System Based on ARM LPC 2138 Processor", IJECT Vol. 3, Issue I, Jan. - March 2012, ISSN: 2230-7109 (Online) ISSN: 2230-9543 (Print)

[5] S. J. Devaraj and K. Ezra, “Current trends and future challenges in wireless telemedicine system,” in Proc. IEEE ICECT, 2011, pp. 417–421