International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 4 647 - 650

Health Parameters Monitoring System

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***Abstract*—**This paper deals with design and implementation of the biomedical system such as Health Parameter Monitoring System. Biomedical engineering is nothing but the application of engineering principles and techniques which will be applied into the medical field. The development of biomedical engineering is responsible for improving healthcare diagnosis also useful in monitoring and therapy of patient's health. It ensures to provide quality health service to each and everyone. It monitors parameterslike ECG, EMG, temperature and heart beat rate and sending the data to doctor's end via GSM. Periodic health monitoring or preventative care allows people to discover and treat health problems before they have consequences so that timely checking will result in positive effect. Especially for risk patients and long term applications where doctor need to monitor parameters frequently such a technology offers more freedom, comfort, and opportunities in clinical monitoring and diagnosis. The goal of the health system is to provide service to community. Many a times Chronic diseases have a significant influence on healthcare costs and are frequently caused among people. lack of health and social care personnel force us to study new innovations and really provoked us to improve existing system. Many times senior doctors have to make frequent visits to their nurse to get data regarding parameters measured that consists of Pulserate, Bodytemperature, ECG, EMG etc.

Keywords*-body sensors,parameters,feedback from doctor*

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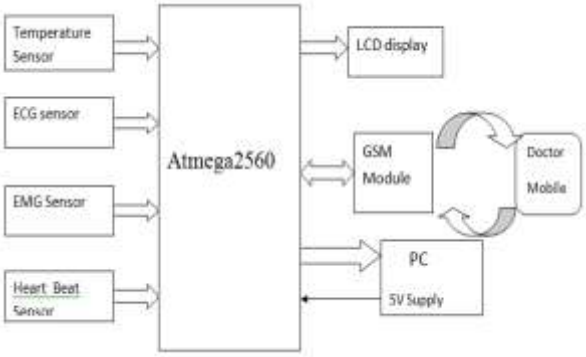
I. INTRODUCTION

Now a days health is one of the global challenges for humanity . According to the constitutions of World Health Organization (WHO) the highest attainable standard of health is a fundamental right for an individual.To keep individuals healthy an effective and readily accessible modern healthcare system is a prerequisite. In traditional healthcare system healthcare professional must be on site of the patient all the time also patient remains admitted in a hospital, wired to bedside biomedical instruments, for a period of time.

To overcome these problems we have designed a new health parameter monitoring system. The goal of Health Parameter Monitoring System is to develop a low cost, low power, reliable and non-invasive parameters monitor which collect different type of body parameters and the sampled parameters are sent to a health care professional via GSM. Here we are designing and building a system which can measure and display accurate parameters i.e .heart rate, ECG, EMG and body temperature readings. After data is being processed we are going to transmit parameters and signal display on PC.Constant monitoring is also required in case of hospitals where the patients must be under active medical care or under continual observation for longer duration as per doctors advice. Even though the patient is not in dangerous situation, the doctors would still need confirmation on their health. In such cases also continuous monitoring is essential. In recent times, government is spending lots of money for healthcare services. Hence the health policies in countries like USA, UK has shifted its focus on preventive care outside the hospital or the precautionary health care system.

Now a days health parameter monitoring systems are available in two forms i.e. single parameter monitoring system and multi parameter monitoring system. In single parameter monitoring system we can measure only one parameter at a time. In case of multiparameter monitoring system we can measure more than one parameters according to requirement.In this project, health parameters EMG,ECG,Bodytemperature,Heartrate of Patient is implemented using bio-signals acquired from the body which are connected to the electrodes. The electrical impulses produced in the body during metabolism are analyzed to recognisespecific patterns and are displayed on the screen. Different types of bio-signals like electrocardiograph(signal taken by chest leads)and electromyograph (signal produced when muscles expand or contract) can be used to check. This work involves the use of estimating some significant parameters i.e. body temperature,heartratecalculation, ECG measurement and EMG signals to implement Health Parameter Monitoring System.

II. HEALTH PARAMETER MONITORING SYSTEM



A. LM35 Temperature Sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature.Three pins, +Vs, GND, and Vout are defined for the sensor.It has an output voltagethat is proportional to the ^{0}C...The scale factor is 0.01V/^{0}C. When used as a basic temperature sensor, any change in Temperature by 1 degree Centigrade will be converted to 10 mV or the output voltage.The general equation used to convert output voltage to temperature is: Temperature (^{0}C) = Vout * (100 ^{0}C/V).The output voltage varies linearly with temperature.

- Linear + 10-mV/C Scale Factor
- Operates from 4 V to 30 V
- Less than 60-A Current Drain
- Rated for Full -55^{0}C to 150^{0}C Range

B. ECG Sensor

For ECG sensing we have used thesensor.It is an integrated signal conditioning block for ECG also it is used for other biopotential measurements and its applications in biomedical sciences. It is designed to extract, amplify, and filter small biopotential signals in the presence of noisy conditions, which are created by movement of a person or remote electrode placement.LO-,LO+ are terminals called as leads of detection.The ECG sensor is used in implementation of a two-pole high-pass filter further which is used for eliminating motion artifacts and the electrode potentials also. Further filter is tightly coupled with the instrumentation architecture of the amplifier which is used for large gain purpose. Next high-pass filtering is done in a single stage. It results in saving space and cost of the sensor.TheSensor includes a fast restore function that reduces time .Otherwise long settling tails of the high-pass filters is required.

- Low supply current: 170 µA (typical)
- Single-supply operation: 2.0 V to 3.5 V
- Common-mode rejection ratio: 80 dB
- Performance is specified from 0°C to 70°C
- Operational from −40°C to +85°C.

C. EMG Sensor

Measuring muscle activity by detecting its electric potential, referred to as electromyography (EMG).This sensor will measure the electrical activity of a muscle outputting 0-Vs Volts depending the amount of activity in the selected muscle, where Vs signifies the voltage of the power source. It's that easy: stick on a few electrodes, read the voltage out and flex some muscles.

- Small Form Factor
- Adjustable Gain
- 3.5mm Connector
- Power supply voltage: min. +-3.5V

D. Heart Beat Sensor

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, LED glows for each digital high output. The beat LED flashes in unison with each heart beat so it is convenient to visualize heart beats. Then the next process is digital output is to be connected to ATMEGA2560 directly to measure the Beats per Minute (BPM) rate. The principle of light modulation by bloodflow through finger at each pulse is used in this project to measure heart rate.

- Operating Voltage +5V DC Regulated.
- Opertating Current 100ma
- Output Data Level 5V TTL Level
- Light Source 660nm Super Red LED
- Heart Beat Detection Indicated by LED and Output high pulse

E. GSM

GSM/GPRS module is used to establish communication between a computer and a GSM GPRSsystem. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network.GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS232, USB, etc) for computer.

1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice call.

F.Softwares

a) ATMEGA2560(Arduino) :

ATMEGA2560 is an open-source prototyping platform .It's hardware and software is very easy to use. ATMEGA is able to take input through light on a sensor, figure on a button. Also it can create output such as turning on LED, activating motor etc.This board can be used for everyday objects to complex scientific instruments. It is preferred by novice as well as experts because of its simple coding.Thisboard is adapting new upcoming changes which can be implemented in IOT based applications.Designers and architect use it to build interactive prototypes.

ATMEGA2560 can be powered via USB connection or with an external power supply.External power can be given by using AC or DC adapter.The adapter can be connected to plugging.The board can operate on external supply of 6 to 20V.But usually recommended range is 7 to 12V.

The power pins are:

- Vin: It is input to the arduino board.

- 5V: This regulated power supply is given to controller by USB or external source.
- 3.3V : It is generated by the on board regulator. Maximum current drawn is 50 mA.

b) Processing Software:

Processing is an open source programming language. It is used as Integrated Development Environment. It is built for electronic arts, visual design communities for teaching fundamentals of computer programming in visual context... One of the stated aims of Processing is to act as a tool to get non-programmers started with programming .It gives instant gratification of visual feedback .Processing includes a sketchbook, a minimal alternative to an integrated development environment (IDE) which is used in organizing projects. Every Processing sketch is actually a subclass of the Java class .It also implements most of the Processing language's features.All additional classes in processing are treated as inner classes when code is translated in pure java when it is being compiled. Unless you explicitly tell processing that you are going to code in pure Java model the use of static variables and methods in classes are not made available.

III.IMPLEMENTATION

In our system human body acts as a test component that is the component to be tested. The potential is measured from body. Here we are using Transducer's i.e. LM35, ECG sensor, EMG sensor, Heart Beat sensor. Transducers are nothing but devices which converts physical, mechanical quantity or non-electrical quantity into electrical quantity .Transducer used to convert given non electrical bio potential to electrical potential.

Here output of ECG Module is of very weak signal say in**UV**then needed operation is to convert weak signal to strong signal. This is done in signal processing by amplifying by using amplifier. Further noise in signal is the most important part to eliminate. This is done by using filters. And all other sensors output is given to ATMEGA 2560.Temperature, Heart rate can be seen on LCD disply.ECG,EMG wave is to be displayed on PC.Also information regarding parameters is sent to doctor via GSM & feedback is collected. Transmission of signal through body to sensor can be done through electrode because it acts as an interface in between body and electronic measuring devices. Current in body flows in ionic form while in electronic devices it is in the flow of electrons. So electrodes acts as a transmission media interface between body and transducers.GSM i.e. global system for mobile also used here in case of remote monitoring. Through GSM text message can be sent to doctor.Text message will content the temperature value, heart rate in bpm, ECGCardiac status means there is elevation in any of p, qrs, s, u wave or depression if any or normal wave.In case of electromyography first is checked where muscles are contracting or not then contraction value and relaxation value is sent via text message.

IV.RESULTS

A. Body Temperature

Body Temperature and Heart rate in BPM (beats per minute) are together displayed on LCD. Connect regulated DC power supply of 5 Volts. Black wire is Ground, Next middle wire is Brown which is output and Red wire is positive supply.Put finger on the marked position, and you can view the beat LED blinking on each heart beat. The output is active high for each beat and can be given directly to microcontroller for interfacing applications

B. ECG Waveform

Chest Leads are connected as close as to heart to display clear Electrocardiogram.Chest Leads are connected on RA(Right Arm),LA(Left Arm) and LL(Left Leg) to form Einthoven triangle.Data functions are serially given to Processing software through Atmega2560 board to analyse ECG Wave.

C. EMG Waveform

Three electrodes are connected on muscle under test.Muscle under tests position is in between 2 electrodes and third electrode act as a referenceas.Muscle contraction and relaxation depend on the strength of muscles and this strength is plotted in serial plotter and contract and relax values of muscles can be viewed on serial moniter.

D. Doctor's Message

Parameters with patients name and age to doctor in hospital.In serial monitor windowkey's' is pressed to send

message to doctor and 'r' is pressed to receive message from doctor with help of GSM.

V. Conclusion and Future Scope

This paper consists of GSM based modern health parameter monitoring system that is designed and developed for remote patient monitoring. The primary function of this system is to monitor the temperature and heart beat rate of a patient's body, and display it on the LCD display. ECG, EMG wave is displayed on the PC.By observing the wave nurse or physician can send the message to doctor's mobile accordingly therefore doctor could diagnose disease as soon as possible and give feedback to them. Thus it is a low cost, low power, reliable and non-invasive vital signs monitoring system. System is stable and can be used at home.

In this system no of physiological parameters can be increased.Therefore this system timely diagnose patient and helpful to save their life.This system can be further extended for storing data of patient health parameters by uploading data on web server.

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