International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Remote Monitoring of CHF Patients Health Using Wearable Sensors

K. Arun.[1], K. Lalitha[2]

[1]PG Scholar, Department of Electronics and Communication Engineering, Sri Muthukumaran Institute of Technology Chennai, Tamilnadu, India

[2]Assistant Professor, Department of Electronics and Communication Engineering, Sri Muthukumaran Institute of Technology Chennai, Tamilnadu, India

Abstract: ***This paper proposes a step towards the preventive health care forCHF(chronic heart failure) patients admitted in hospitals. Hereby the sensors which are directly fixed intothe human body and they are connected with a high processing microcontroller. In such cases, failure of any desired temperature, blood pressure, heart rate or any emergency situation if the patient is suffering with vital signs will be immediately indicated to the ward incharge who is near to the patient through the buzzer and the parameter which is affected will be displayed in LCD. The care section (1b) block diagram in our proposed system is designed as a handhold device and it is given to the doctors in hospitals. i.e, During an emergency period, a message of a particular emergency patient's condition will be displayed in LCD and a voice output also given to the doctor's handhold device through the zigbee module from the transmitter to the receiver section. In addition, a text message about the patient's condition is also send to the doctor's mobile through GSM module.***

Keywords: ARM, LCD, chronic heart failure(CHF), zigbee, wireless sensor

1. Introduction

Chronic heart failure (CHF) is one of the most frequent chronic disease in all countries, affecting approximately 25 million people in U.S and more than 10million in Asia and Africa with a wide range from 1% to 5% and an accidence of 5.6 million new cases each year in U.S and 550000 cases in Asia.[1]-[3].Recently, the use of wireless body area sensor networks (WBASNs), a growing research area, has increased in medical healthcare applications. WBASNs provide healthcare monitoring, especially for the elders, infantsand chronically ill people. Generally, a WBASN consists of several wireless sensor and actuator nodes placed on, near, or in a human body. The WBASN nodes sense and process vital signs (blood pressure, blood flow, body temperature, pulse oximetric, electrocardiography, etc.) acquired from the human body[4]-[6].This Paper represents an objective to avoid the delay in reaching patients during an emergency and also to provide timely and immediate care. Patients' signs, symptoms and raised alarms can be received by healthcare providers, and aggravations can be quickly detected and acted upon. It mainly aims in providing several benefits, such as identifying emergency conditions for patients, producing alerts, and allowing alerts to be accessed using mobile devices [7]. In addition, employing WBASN-based systems decreases the workload, enhances the efficiency of medical personnel, and improves the comfort of patients[8].

2. Existing Topology

The existing system doesn't have voice message. As well as no particular sensor has been placed to give the heart rate of a patient apparently. Also, there won't be particular sensor to monitor patient condition. Patient medical record can be send only to a server. An ultralow power microcontroller C51 is used in an existing system. This low power microcontroller can be used only for limited applications with slow processing speed and also maximize delay between two process. A separate ADC is needed in this type of microcontroller. In case of emergency, the doctors may not be available all the time so there will be a delay in taking remedy actions immediately. Here the home gateway may be PC or laptop normally connected to the power line, but the internal battery ensures about 5h of autonomy in case of power failure. A separate ADC is needed in this type of microcontroller.Without internet the user cannot access the developed health face. Unavailability of networks leads to failure in sending the reports to the patient's database. As an existing prototype is using Bluetooth power consumption will be more.The system faces the difficulty of operating in situations that challenge instrumentation designed for use in the controlled environment of a clinical situation.

3. Proposed System

During emergency, there is little tolerance for system errors and poor designs. Though the use of standard-based software and best-of-breed hardware, our goal is to deliver a system which is scalable, reliable, and user-friendly. This mainly consists of temperature sensor, heart rate sensor ,blood pressure sensor and fits sensor. The heart of the project is microcontroller unit. The hospitality technology is making use of GSM technology and zigbee technology which is serially interfaced with microcontroller. Due to the advance in sensor technology, people came forward in the development of systems for monitoring human subjects over long period of time using wearable monitoring units. Wireless sensor networks(WSNs) provide capabilities that are valuable for continuous remote monitoring, as research into military and environmental systems attest.For healthcare applications, they can be deployed inexpensively in structures without IT infrastructure. Data are collected automatically, enabling daily care and medical monitoring and diagnosis. The wireless devices can integrate with a wide variety of environmental and medical sensors.

In this paper, an ARM7 LPC2148 microcontroller is used. ADC serial and parallel communication are inbuilt in this microcontroller and also provides high speed processing. This project is a step towards the preventive health care for patient in hospitals. Here the sensors are directly fixed in the human body and these sensors are connected with a high processing microcontroller. Also, it will be continuously monitoring the heart rate, temperature, blood pressure, fits and displayed on LCD. Failure of any desired temperature, blood pressure, heart rate or any sudden ill condition or if the patient is suffering with fits will be immediately indicated to the care taker who is near to the patient through the buzzer and the parameter which is affected will be displayed in LCD. The care section block diagram in our proposed system will be designed as a handheld device and will be given to the doctors in hospitals. That is, during an emergency period, a message of a particular emergency patient's condition will be displayed in LCD and a voice output also given to the doctor's handheld device through the zigbee module from the transmitter to the receiver section. In addition, a text message about the patient's condition is also send to the doctor's mobile through GSM module.

4. Advantages of Proposed System

It's automatically detect the heart attack. It will alert the physician so that he can give immediate treatment.No unnecessary visit to patient's ward.No need of additional computer to view the affected vital parameters.Doesn't need any intranet connection or web browser.No chance of network failure in alerting doctors and caregivers. Additionally, it will also alert the physician through a voice message.

5. Block Diagram

The block diagram of the complete hardware circuit is shown in Figure 1.

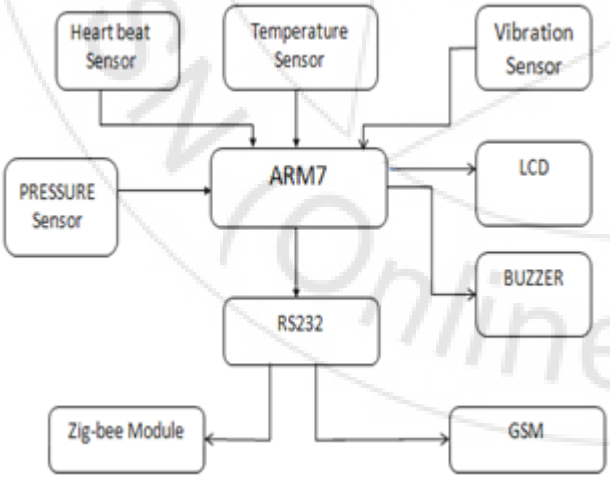


Figure 1a: Patient Section

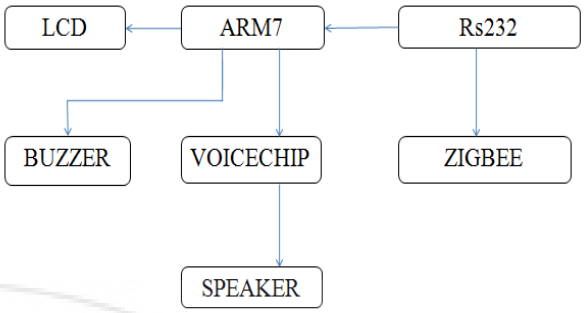
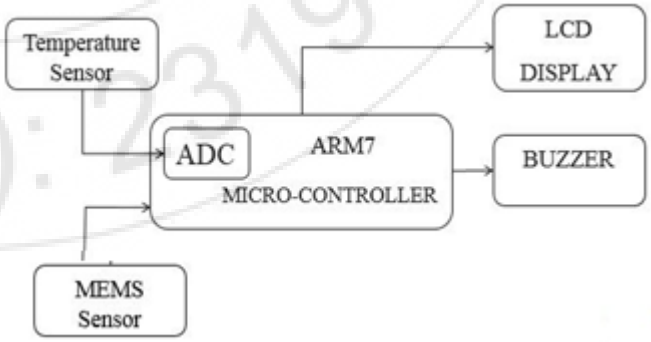


Figure 1b: Care Section

Figure 1: Complete Functional Block Diagram

The health at hospital is making use of GSM technology and zigbee technology which is serially interfaced with microcontroller. The body temperature is measured using LM35 temperature sensor which helps to measure body temperature. The controller is programmed in such a way that if the patient temperature rises above or falls below threshold value it will indicates through a buzzer and also displayed in LCD. Meanwhile, a text message will be send to the doctor's mobile through GSM and a voice output also send through the zigbee module. For demo purpose the changes in temperature can be shown by bringing any hot material near to sensor. The heart rate sensor is used to measure the pulse of the patient, where this is an analog device so it is connected to controller through ADC. Crossing of the threshold heart rate will be indicated by the programmed microcontroller.

A vibrator sensor is used to sense when the patient is suffering from fits and a buzzer is raised so that the patient can be treated immediately. Thus, remote monitoring of patient is possible. Time maintenance can be achieved. Immediate nursing care can be given. Alerting the concerned doctor and care taker immediately. Hearing audio output for chronic conditions will increase the patient safety used by specific applications. It leads to an improvement in quality of care. 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.



Phase 1: Block Diagram

BLOCK DIAGRAM FOR PHASE-1

Figure 2: Phase-1 Hardware Model

Figure 3: If a patient is suffered by fits, immediately the MEMS sensor will sense the fits and it will display the message as above.

Figure 4: If the patient's temperature is decreased or increased abnormally above 44 degree Celsius or below 37 degree Celsius then the following message will be displayed in the LCD

6. Simulation Results

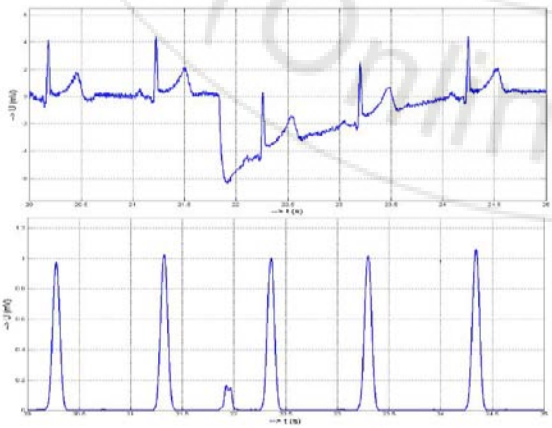


Figure 5: Simulation Result for ECG Using Matlab

7. Conclusion and Work Plan

Our proposed system provides the preventive health care to the CHF patients in hospitals by continuously detecting the changes in their vital parameters. It Alert the physician during the emergency period, so that he can give immediate care. As already in phase-1 the temperature and MEMS sensor are used to sense the vital parameters like temperature and fits in patients during an emergency period. In phase-2, the care section block diagram will be designed as a handheld device and will be given to the doctors in hospitals. That is, during the emergency period, a message of a particular emergency patient's condition will be displayed in LCD and a voice output also given to the doctor's handheld device through the zigbee module from the transmitter to the receiver section. In addition, a text message about the patient's condition is also send to the doctor's mobile through GSM module.

References

[1] SurananNoimanee,SomkiatWattanasirichaigoon (2008), "Implementation of vital signs monitoring system using wireless networks" international journal of applied biomedical engineering, vol.1, no.1.

[2] Ismail kirbas, CuneytBayilmis(2012) , "Health Face: A web-based remote monitoring interface for medical healthcare systems based on a wireless body area sensor networks" Turk J Elec. Eng& Comp Sci C-Tubitak , Vol.20, No.4.

[3] Jeevanvijay,Sathisha M.S.,Shivakumar K.M.(2013), "Android based portable ECG monitor" International journal of engineering and computer science volume 2 issue 5.

[4] Tia Gao,Dan Greenspan, Matt Welsh,RadfordR.Juang and Alex Alm(2005), "Vital signs monitoring and patient tracking over a wireless network", In Proceedings of the 27th Annual International Conference of the IEEE EMBS, Shanghai .

[5] Jae Hyuk Shin, Boreom Lee, and Kwang Suk Park (2011), "Detection of Abnormal Living Patterns for Elderly Living Alone Using Support Vector Data Description" IEEE transactions on information technology in biomedicine, vol. 15, no. 3.

[6] Youqun Shi, YueZhang (2014), "Smartphone Based Body Area Network System", International Conference on Medical Biometrics.

[7] HaikKalantarian, Nabil Alshurafa, Majid Sarrafzadeh(2014)," A Wearable Nutrition Monitoring System", 11th International Conference on Wearable and Implantable Body Sensor Networks.

[8] Luca Fanucci, SergioSaponara (2013), "Sensing Devices and Sensor Signal Processing for Remote Monitoring of Vital Signs in CHF Patients" IEEE transactions on instrumentation and measurement, VOL. 62, NO.3.