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A Real-Time Energy Efficient E-Health Approach for Autonomous Health Care

RENU RAVI
PG Student, ECE Department
Hindustan College of Engineering and Technology
Coimbatore, India
vanmuthu@gmail.com

K.VANMATHI
Assistant Professor, EEE Department
Hindustan College of Engineering and Technology
Coimbatore, India
renusranvi@gmail.com

Abstract **– Largest ever study of deaths show that heart ailments and respiratory failure have replaced communicable diseases as the biggest killer in rural and urban areas of the country. Population based studies in the youth show that the precursors of heart disease start in adolescence. In order to stem the tide of these diseases, early detection and primary prevention is needed. Early detection and primary prevention starts with education and awareness that these diseases poses the greatest threat and measures to prevent or reverse this disease must be taken.Here comes the need for automatic disease detection technique that would aid the physicians in an early detection of human body abnormalities. Heart rate, respiration and body temperature of the subjects are collected and testing is done using samples from reference database. All these three parameters are monitored using different sensors and these measured values are transferred to the PC using ZigBee that provides wireless transfer of data. As a result the patient health status can be acquired, monitored and synthesized immediately in a clear and easy way. The simulations are done using LabView software.**

Keywords**—e-Health, patient specific health care, monitoring, atherosclerosis, wireless transfer, low cost approach.**

I. INTRODUCTION

Due to certain myths and misconceptions, most of the people do not come out in the open to get themselves diagnosed and treated. In case of people who believe that all these diseases are fatal, contagious, genetic and that it can't be treated, death becomes inevitable. Since the population mainly belongs to an intermediate risk group, conventional risk factors have low predictive power and here comes the necessity for the integrated e-health approach for early detection of human body disorders. Health care practice supported by electronic processes and communication, dating back to atleast 1999 is termed e-health. In other words it is the health [1] care practices using the internet.

Early detection is the key to successfully treating most types of disorders.Early disease detection is the use of screening tests to find health problems before symptoms appear. It can also be defined as diagnostic tests, medical examinations, and self-examinations to detect a disease or other health problem early in its course.

Early disease detection is made use of due to many reasons. Often, the earlier a disease is diagnosed, the more soonerit can be cured or successfully handled. Dealing with a disease, especially early in its course, may lower its impact on our life, prevent or delay serious complications.The tests suggested for early detection of human body disorders depend on the age, health, and gender. Often, they also depend on the risk factors. The risk factors may include age, family history, smoking habits etc. When and how often screening tests should be done may dependon the age, gender, family history, health status, lifestyle, and the cost of testing. Certain screening times can be scheduled based on expert guidelines. In some cases, testing is also done as part of a routine checkup. Here body parameters like heart rate, respiration and body temperature are being monitored using noninvasive techniques. This detection by means of noninvasive techniques for the evaluation of structural and/or functional parameters could provide a major opportunity in the early diagnosis and prevention of human body diseases.

Cardiovascular diseases, CVD [2]-[5] is a class of diseases that affects the cardiovascular system and its associated blood vessels. Most CVDs reflect chronic conditions while some may be acute events such as heart attacks and strokes.The process of atherosclerosis evolves over decades, and begins as early as childhood. However, most adolescents are more concerned about other risks such as cancer, HIV and accidents than cardiovascular disease. The most recent studies show that 1 in 3 people will die from complications attributable to atherosclerosis.Heart Rate and Heart Rate Variability are important measures that reflect the state of the cardiovascular system. HRV analysis which is a non invasive measurement has gained prominence in the field of cardiology for detecting CVDs. Thus CVD detection by means of non invasive evaluation of structural or functional vascular parameters could provide a major opportunity in the early diagnosis and prevention of cardiovascular diseases.

Respiration monitoring is one of the most important elements of accessing the physiological state. Respiration failure can be difficult to predict. In just a few minutes life-threatening conditions can arise. So by monitoring the chest movement continuous measurement and free access to all vital organs can be done. This makes possible the measurement of not only the respiratory signalfrequency but also the analysis of the patients' respiratory cycle. This non invasive evaluation of respiration helps in early diagnosis and prevention of respiratory accidents with an advantage of providing reliable and accurate information about the extent of respiratory motion magnitude.

Any abnormalities in human body cause a variation to the normal body temperature. This is one of the most easily detectable changes that occur initially. As a result body temperature is also measured using different sensors [6].

II. BLOCK DIAGRAM

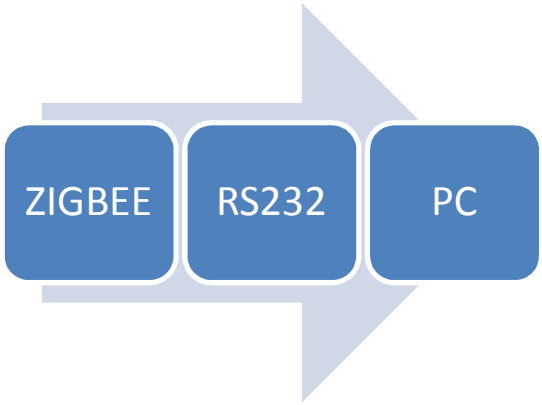


Fig.1 Block diagram

Wireless communication systems have been gaining popularity as it provides mobility and convenience. Development in this technology has given rise to numerous options of data transfer with coverage ranging from a few meters to thousand kilometers.

Zigbee can be defined as a low cost, low power, wireless mesh network standard. It is used in mesh network form to transmit data over longer distances. This data is passed through intermediate devices so that it can reach more distant ones. It is targeted at applications that require a long battery life, secure networking and low data rate. Zigbee also provides short range wireless transfer of data at relatively low rates. It is simpler and less expensive than WPANs such as Bluetooth.

Another advantage of using Zigbee is that it provides large network capacity and saves power. RS232 provides connection between a Data Terminal Equipment (DTE) and a Data Circuit Terminating Equipment (DCE). Is is commonly used in computer serial ports. RS232 can also be used as a standard for serial binary single-ended data and control signals.

III. SIMULATION MODEL

A.Heart Beat

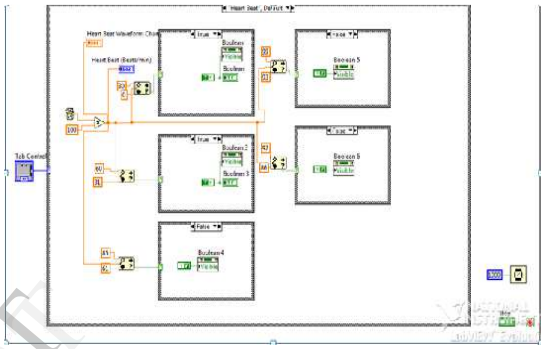


Fig. 2 Heart beat simulation model

Respiration

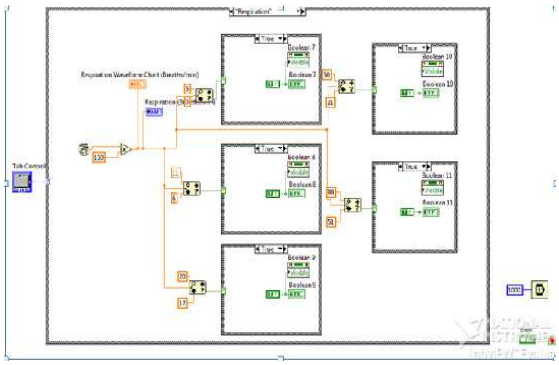


Fig. 3 Respiration simulation model

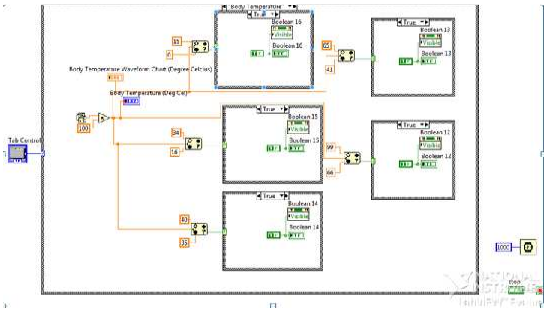


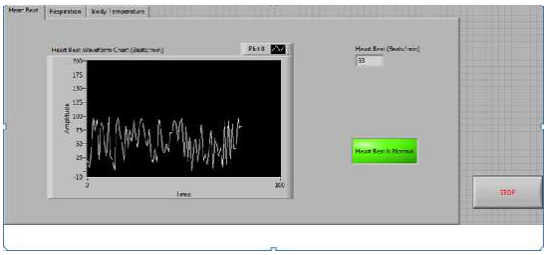
Fig. 4 Body temperature simulation model

Heart rate, respiration and body temperature of the subjects are monitored using different sensors [6] and these measured values are transferred to the PC using ZigBee that provides wireless [7] transfer of data. As a result the patient health status can be acquired, monitored and synthesized immediately in a clear and easy way. The simulation is done using LabView.

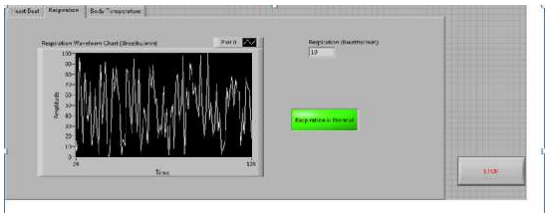
The normal values for heart rate, respiration and body temperature are earlier fed into the system. The measured values of the subject's heart rate, respiration rate and bodytemperature [8] are then loaded into the system. All the three parameters including heart rate, respiration rate and body temperature acquired using different sensors are then tested using samples from the reference database. If the measured value of the subject differ from the normal value then there will be an indication showing that the parameter of the subject under analysis is abnormal. Healthy subjects show no difference between calculated and estimated risk values. Repeatable non-invasive technology is being used for this purpose. Thus detection by means of noninvasive techniques for the evaluation of structural and/or functional parameters provides a major opportunity in the early diagnosis and prevention of human body diseases and also improves patient specific diagnosis.

IV. RESULTS AND DISCUSSION

Heart Rate



Respiration



Body Temperature

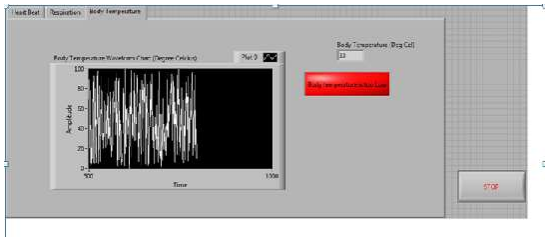


Fig. 5 Simulation results

The signals for heart rate, respiration and body temperature are monitored for further evaluation. The signal conditioning, classification and user-interface of these recorded signals is implemented in software usingLabview 8.6. The main advantage is that multiple parameters can be monitored at a time. The parameters including heart rate, respiration and body temperature can be acquired, monitored and immediately synthesized in a clear and easy way by considering a minimum amount of data. All these provide benefits of patient specific monitoring and treatment support tools for early detection of human body disorders. More over this can be made use at our own convenience using computer aided instruction [9-13]. The introduction to wireless connections to exchange sensor's data also provides a great flexibility for both patient and medical staff. Moreover low cost and repeatable noninvasive technology is justified.

V. CONCLUSION

The main advantage of this paper is the benefit of patient specific monitoring and treatment support tools for early detection of human body disorders. Its recommendations should not be used as a basis for delaying, or else as a substitute for, evaluation and treatment by a physician. Leading a healthy lifestyle and also paying heed to the suggestions of experts is recommended. Higher awareness among people are required in order to avoid undue advantage of the patient's desperation. They should be aware that health decisions should not be based on hope and desperation but should be rational and practical.

The work presented is aimed for the early detection and prevention of human body abnormalities in real-time.

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