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Smart Health Care System Using Arm7 and Lab view

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Abstract: **-- The main objective of this paper is to provide excelling provision to hospitalization for patients and mainly for physician who are unable to supervise their patients at the right time in the hospital itself. The benefits of the system are to acquire different signals like temperature, heartbeat, ECG, blood pressure using specific sensors. The proposed model makes user to improve health related risks and reduce healthcare costs by collecting, recording and analyzing large data streams in real time. The idea of this project is to reduce the headache of the patient to visit the doctor every time he needs to check his blood pressure, ECG, temperature, etc. With the help of this system the time of both the patients and doctor is saved and doctors can even help the patients in emergency situation as much as possible. The outcome of this project is to give proper and efficient medical services to patients by connecting and collecting using health status monitors using specific sensors. The complete evaluation of the system is done using software called NI Lab view. The NI Lab view software is cost- effective and smart, so it is the best platform to display the results of the system. It can be used by everyone, by elderly and post-operative patients as well as by the patients at remote locations and also by the patients who cannot afford the expensive healthcare in cities.**

Key words— ECG, Elderly, NI Labview, post-operative, healthcare.

I. INTRODUCTION

A recent healthcare system should provide better healthcare services to people at any time anywhere in an affordable and patient friendly manner. Currently, the healthcare system is going to change from a traditional approach to a modernized patient centered approach. In the traditional way the doctors play the major role. For necessary diagnosis and advising they need to visit the patients. There are two basic problems related to this approach. Firstly, the healthcare professionals must be not at place of the patient all the time and second the patient remains admitted in the hospital, wired to bedside biomedical instruments, for a long period of time. In order to solve these two problems the patient oriented approach has been received. In this theme, the patients are aware with knowledge and information to play a more active role in disease diagnosis and prevention. The important element of this second approach is a reliable and readily available patient monitoring system (PMS) [1]. 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. Healthy persons can secure their life time income and hence to increase in gross domestic product and in tax revenues. Healthy persons can also reduce pressure on the already overwhelmed hospitals, clinics, and medical professionals and reduce workload on the public safety charities, networks, and governmental or non-governmental centers. To keep people effective and healthy, a readily accessible modern healthcare system is a prerequisite.

Monitoring of vital parameters can include at least blood pressure and heart rate, and preferably also pulse oximetry and respiratory rate. In operating rooms for the display a simultaneous measure of physiological parameters, multi modal monitors get coherent into anesthetic machines and the bedside monitors for critical care units [2]. These permit for continuous supervision of a patient as their any changes in normal condition of patients get continuously informed to medical staff. Today before visible signs are observable to clinical staff, such as atrial premature ventricular contraction (PVC) and fibrillation some monitors are available which can even warn of pending fatal cardiac conditions. For electrocardiographic monitoring (ECG), old analog patient displays, usually had only one channel and based on oscilloscopes, normally reserved.

II. PROPOSED SYSTEM

The system uses smart sensors that generates raw data information collected from each sensor and send it to a database server where the data can be further analyzed and statistically maintained to be used by the medical experts. Maintaining a database server is a must so that there is even track of previous medical record of the patient providing a better and improved examining.

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The system consists of the advance embedded ARM-7 controller to which we have connected the Temperature sensor, HB sensor, Blood pressure sensor and ECG sensor. All collected data are transfer to the PC. Then all data are received by PC that will be displayed using Labview software.

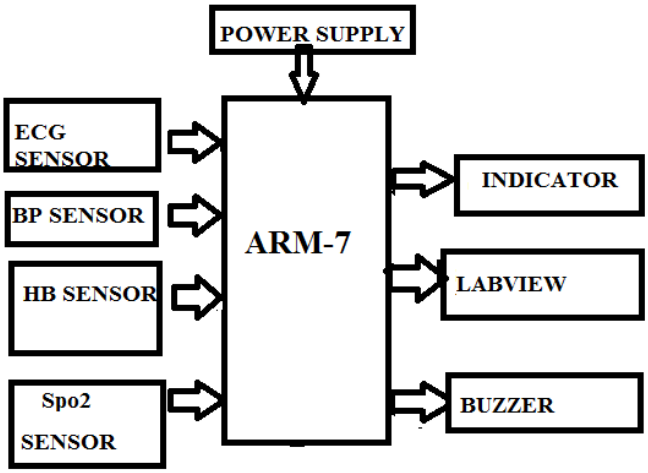

Fig. 1. Block Diagram Of System

III. HARDWARE

A. ECG ANALOG FRONT AD8232

After testing in different configurations and with different DAQs, the AFE AD8232 from Analog Devices has been chosen for our implementation due to its gain and input impedance [3]. AD8232 is an integrated signal conditioning block for ECG and other bio potential measurement applications. The main components of Analog Front End (AFE) are shown in fig2 [4].

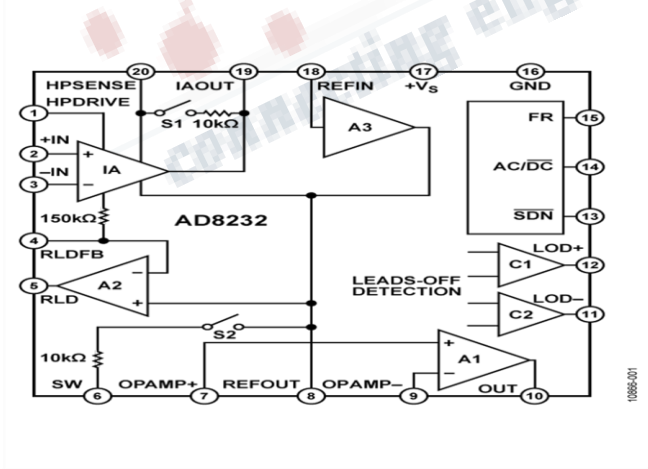

Fig 2. AD8232 integrated signal conditioning block

This sensor is a cost-effective board used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram and output as an analog reading. ECGs can be extremely noisy, the AD8232 Single Lead Heart Rate Monitor acts as an op amp to help obtain a clear signal from the PR and QT Intervals easily.

The AD8232 is an integrated signal conditioning block for ECG and other bio potential measurement applications. It is designed to extract, amplify, and filter small bio potential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement.

This AFE provides not only signal conditioning in terms of amplification and filtering, but also fast recovery of ECG signal after lead off condition. The built-in current feedback instrumentation amplifier, with two well-matched trans conductance amplifiers guarantees high common mode rejection and removes half-cell electrode potential. Filtering of the data measured is done by low-pass and high-pass filters. The cut off frequency of the two-pole high pass filter can be optimally selected to remove motion artifacts and the electrode half-cell potential. Additional noise is removed by three-pole low-pass filter built around AD8232 with external components.

B. HEART RATE VARIABILITY

A normal one-cycle ECG signal consists of several waves, as shown in Fig. 3. The wave with the highest amplitude is the R wave. An RR interval is the time elapsed between two successive R waves. The waves with the lower amplitudes are the P wave and the T wave. RR intervals show the variation between consecutive heartbeats. Heart rate variability (HRV) measurements analyze how these RR intervals change over time.

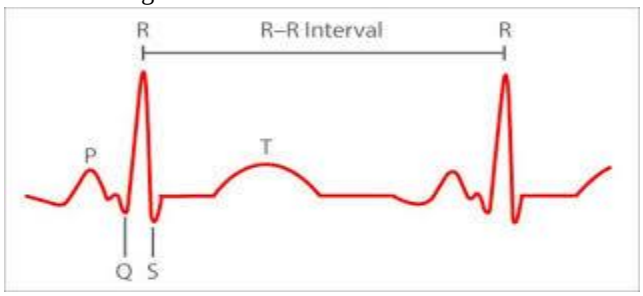

Fig 3. R Peaks and RR intervals of an ECG signal

To analyze heart rate variability (HRV), the RR intervals must first be acquired and pre-processed by AD8232

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Analogue Front End. Fig. 4 shows the process of acquiring RR intervals.

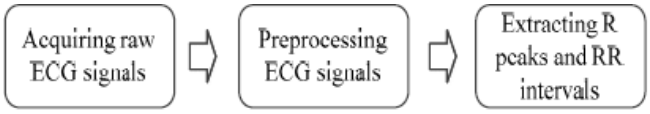

Fig 4. RR interval acquisition process

C. Heart Beat Sensor

Heartbeat sensor is use to calculate the Heart Rate or pulse rate of a person. Heart Beat sensor actions the heart rate through the fingertip. This Heart Beat Sensor provides an easy way to combine heart rate measurement into project. When the heart beats it pumps blood into your artery of your finger tip. This causes a change in the blood volume which is then sensed by our HeartBeat sensor [9]. The sensor used infrared light source on one side of finger and a photo detector on another side to measure this change in the blood flowing.

D. Blood Pressure Measurement

Blood pressure is the pressure of the blood in the arteries as it is pumped all over the body by the heart. When the heart beats, it contracts and pushes blood through the arteries to the rest of the body [10].This force creates pressure on the arteries. Blood pressure is recorded as two numbers, the systolic pressure (as the heart beats) over the diastolic pressure (as the heart relaxes between beats). The device which measures this is called Sphygmomanometer. Here we use a wrist blood pressure monitor as shown in Fig.

Fig. 8. Blood Pressure Sensor

If you have high blood pressure, it is important to continuously monitor blood pressure. Blood pressure does not remain same all the time. It changes to meet your body's needs. It is exaggerated by various factors including body position, breathing or emotional state, exercise and sleep. It is best to measure blood pressure when you are relaxed and sitting or lying down. High blood pressure usually does not have any symptoms, so you need to have your blood pressure checked regularly. You can even measure the heart beats on the wrist blood pressure, so you don't need different hardware to measure heart beat.

Table 1. Classification of Blood Pressure

Stages	**Systolic (mm Hg)**	**Diastolic(mmHg)**
Hypotension	< 90	< 60
Desired	90-119	60-79
Prehypertension	120-139	80-89
Stage1 Hypertension	140-159	90-99
Stage2 Hypertension	160-179	100-109
Hypertensive Crisis	>180	>110

E. SPo2 Sensor

Spo2 sensor useful in sensing oxygen level of blood. This sensor is useful in making Pulse oximetry, which is a test that measures what proportion of the oxygen-carrying molecules in the blood (called hemoglobin) are actually carrying oxygen. This is known as oxygen saturation or SPo2. Pulse oximetry is a non invasive method for monitoring a person's oxygen saturation. The device passes two wavelengths of light through the body part to a photo detector.

One hundred percent oxygen saturation is attained when all hemoglobin in the blood is completely saturated with oxygen. Low oxygen saturation levels results from the heart's inability to receive oxygen-rich blood from the lungs.

For calculating the ratio of absorption of oxyhaemoglobin and deoxyheamoglobin which was derived in LabVIEW by equation as in (1).

$$R = ACR/DCR\backslash ACIR/DCIR \quad (1)$$

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R= ratio of absorption of oxyhaemoglobin and deoxyheamoglobin. The value of SPO2was then calculated by the equation as in (2)

SPO2= (110-25R) % (2)

The value of SPO2was then compared with the normal value which gives alert alarm, when the value of SPO2decreases from the normal range. And that will be helpful to physician for further patient analysis.

IV. SOFTWARE

The LabVIEW software is used as the integrating platform for acquiring, processing and transmitting the physiological data; it is an excellent graphical programming environment to develop sophisticated measurement, test and control systems using the graphical icons and wires that resemble a flowchart. The software also includes number of advanced mathematics blocks for different functions such as integration, filters and other specialized capabilities. The LabVIEWs' Professional Development System allows to create the stand-alone executables and 15 the resultant executable can be distributed unlimited number of times. The run-time engine and the libraries can also be provided freely along with the executable.

V. CONCLUSION

The main objective of this study has been to design and implement a low cost wearable health monitoring system that can detect inevitably whenever there is an abnormality in ECG. The paper presented allows the doctor to view the patient's vital parameters remotely and dynamically. The primary need of our paper is to monitor the system with high accuracy and security. Along with heart rate we can timely check the BP and temperature of the patient. The advantages of this implementation are hence enlisted as portability, low cost, scalability, immediate analysis of ECG, BP and sudden fall signals, momentary display of the result on the computer screen, user-friendly interface and comfortably wearable. Therefore, it is easy to say that wearable technologies play a key role in identifying transient activity related features to potentially predict near-term risks of cardiovascular events or deaths as considerable number of cardiovascular disease patients die suddenly without prior symptoms.

VI. ACKNOWLEDGEMENT

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