International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 02
February 2017

Design of Medical Data Monitoring by Using Raspberry Pi

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ABSTRACT: *Healthcare and health control is one of the maximum promising programs of information technology. The telemedical mechanism makes a speciality of the measurement and assessment of essential parameters, e.g. ECG, heart rate, heart rate variability, temperature, and fall detection. The proposed system presents a personal healthcare system that is both flexible and scalable. Employing embedded wearable low-power sensors, the device measures health parameters dynamically. Our system is designed to be used in hospitals for measuring and tracking diverse parameters like temperature, ECG, heart beat and so forth. The outcomes can be recorded using Raspberry Pi displayed on a LCD display. Also the results can be sent to PC through RS-232 cable. The values stored in Raspberry Pi will be sent to PC via serial (RS232) wired interface and a serial port will be opened in the Labview by using a serial object. GUI is programmed to make the user interface interactive and simple.*

IndexTerms: Raspberry-pi, heath condition, heath application ARM11

I. INTRODUCTION

Information and communications technologies are transforming our social interactions, our lifestyle and our workplaces. One of the most promising applications of information technology is healthcare and wellness management. Healthcare is moving from reactive responses to acute conditions to a proactive approach characterized by early detection, prevention and long-term healthcare management. In this framework, health condition monitoring and wellness management are seen as significant contributors to individual healthcare and wellbeing. This is particularly important in developed countries with a significant aging population, where information technology can be employed to significantly improve the management of chronic conditions and, thereby, overall quality of life. Continuous or even occasional recording of biomedical signals is particularly critical for the diagnosis and treatment of cardiovascular diseases. For example, continuous recording of an electrocardiogram (ECG) or photoplethysmogram (PPG) by a wearable sensor provides a realistic view of a patient's heart condition by tracking such factors as high blood pressure, stress, anxiety, diabetes and depression, during normal daily routines. Further, automated analysis of such recorded biomedical signals supports doctors in their daily work and allows the development of warning systems. This brings several benefits, such as decreased healthcare costs, by increasing health observability, collaboration among doctors and doctor-to-patient efficiency. Moreover, continuous monitoring serves to increase early detection of abnormal health conditions and diseases, offering a way of improving patient's quality of life.

Nowadays, more attention is focused on the prevention and early detection of diseases as well as on optimal management of chronic conditions. These functions are often augmented by new location-independent technologies. In order to fully realize a pervasive or ubiquitous environment, personal area networks (PAN) must be connected to internet protocol (IP)-based networks. Such integration enables resource sharing within networks, maximizing the utilization of available resources. In addition, communication with the individual nodes in a network requires an efficient addressing mechanism.

In this paper we present a good design based healthcare monitoring system (HMS), which can provide real time information about medical status of a patient. The proposed system consists of sensors, a data acquisition unit, PC, and the LabVIEW program. The system is able to display, record, and send patient's physiological data. The LabVIEW program assists monitoring and displaying the data.

II. LITERATURE SURVEY

Raspberry Pi is a credit card sized single board computer with ARM11 microprocessor. In this study, a system is designed to continuously monitor the Electrocardiogram

(ECG) and other vital parameters. This data is stored in a database and can be displayed in a website that can be accessed only by authorized personnel [3].

Patient monitoring system and control using feedback and GSM technology is used to monitor the different parameters of an ICU patient remotely and also control over medicine dosage is provided. This system enables expert doctors to monitor vital parameters viz body temperature, blood pressure and heart rate of patients in remote areas of hospital as well as he can monitor the patient when he is out of the premises [8].

A module that provides mobility to the doctor and the patient, by adopting a simple and popular technique, detecting the abnormalities in the bio signal of the patient in advance and sending an alert SMS to the doctor through Global system for Mobile(GSM) thereby taking suitable precautionary measures thus reducing the critical level of the patient [9].

In addition, new generation mobile phones have an important impact on the development of such healthcare systems, as they seamlessly integrate a wide variety of networks (3G, Bluetooth, wireless LAN and GSM) through access points (APs), thereby providing an opportunity to transmit recorded biomedical signals to a central server in a hospital. As a result, continuous monitoring of biomedical signals will no longer be restricted to the home environment.

III. PROPOSED FRAMEWORK

Following Fig.1 show the system architecture block diagram including the ARM processor based development board, Temperature sensor, Heart Rate sensor, ECG sensor and MEMS sensor,LCD and related hardware.

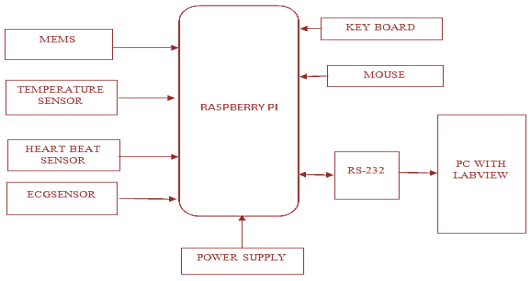

Fig.1 Block diagram of functional unit

The design of the system is divided into two parts: Hardware components and software components.

A. Hardware components

Raspberry Pi: The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, VideoCore IV GPU and was originally shipped with 256 megabytes of RAM, later upgraded (Model B & Model B+) to 512 MB. It does not include a built-in hard disk or solid-state drive, but it uses an SD card for booting and persistent storage, with the Model B+ using a MicroSD. The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC (via the RISC OS image or the Brandy Basic clone for Linux), C, Java and Perl.

1) Temperature sensor (LM35): It is a sensor used to measure temperature. The LM35 series are precision integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It measures temperature more accurately than thermistors. It is sealed and does not undergo oxidation. It does not require output voltage to be amplified.

Fig. 2 Temperature sensor (LM 35)

2) Heart Rate sensor: The sensor gives the digital output of heat beat when a finger is placed on it. When the sensor starts, the LED flashes in unison with beat. The output generated is in Beats per Minute (BPM) rate.

Fig. 3 Heart rate sensor

3) ECG sensor: ECG electrode sticks to chest to pickup ECG signals. Then wires are connected to AD8232. This sensor is a cost-effective board used to measure the electrical activity of the heart. 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.

4) Raspberry Pi: The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. The Raspberry Pi Model B+ has dual core ARM11 processor with 512MB SDRAM and powers through Micro USB socket of 5V. Sensors are connected to the Raspberry Pi Model B+. Raspberry Pi sends the information to servers through GSM module.

Fig. 4 Raspberry Pi

4) Max232: The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. This makes it difficult to establish a direct link between them to communicate with each other. The intermediate link is provided through MAX232. Low Supply Current 8 mA.

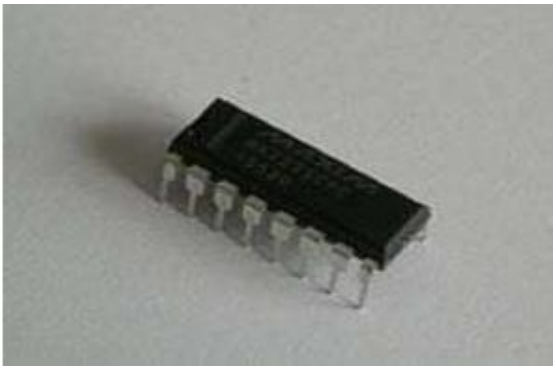

Fig. 5 MAX232

7) LCD: Liquid crystal display a type of display used in digital watches and many portable computers. It is used to display the measured data. We have used 16 x 2 Alphanumeric Display which means on this display we can display two lines with maximum of 16 characters in one line.

Fig. 6 LCD Display

8) MEMS sensor: This sensor can measure static (earth gravity) or dynamic acceleration in all three axis. Application of the sensor is in various fields and many applications can be developed using it. The accelerometer measures level of acceleration where it is mounted, enables us to measure acceleration/deceleration of an object, or tilt of a platform with respected to earth axis.

MMA7361 Features

Simple to use
Analog output for each axis
+5V operation @1ma current
High Sensitivity (800mV/g @ 1.5g)
Selectable Sensitivity (+- 1.5g, +- 6g)
0g detect for free fall detection
Robust design, high shock survivability
Low Cost

B. SOFTWARE COMPONENTS

LabVIEW based patient monitoring system consider to implement the system. In this technique we connect the sensors attached with the patient's body the data sends to local monitoring unit (which is a Laptop or PC with LabVIEW software in it. The local monitoring unit displays the final data. Another major advantage of our system is that we used LabVIEW software to design the front panel. It is an excellent integrating platform for acquiring, processing, and transmitting the physiological data. The LabVIEW software also includes a number of advanced mathematical blocks for functions such as integration, filter, and other specialized capabilities. By using the LabVIEW we can automatically store the physiological data of patients in spread sheet, which was one of the key features for us

IV. RESULTS AND DISCUSSIONS

The Raspberry-Pi run on Linux based OS, an open source operating system. In this system we used raspbian OS which is Linux based OS. The programming language for the Raspberry-Pi for the system implementation is Python/Embedded C. The algorithm that is program flow for the raspberry is as follow:

1. Initialize the Raspberry-Pi.
2. Load OS on Raspberry-Pi.
3. Select the input parameter.
4. Read the equivalent digital data of the parameter selected.
5. Display the received data.
6. Send the received data.

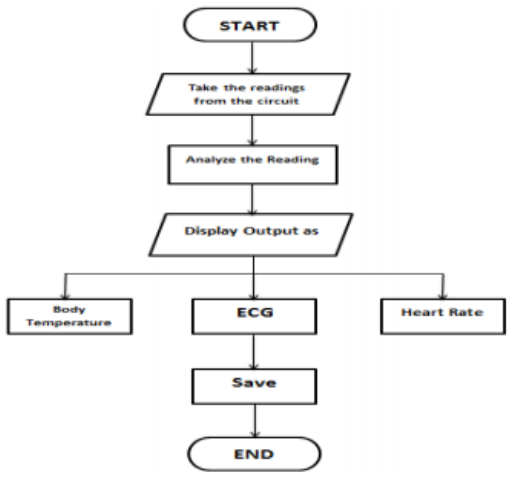

Fig. 7. The Program Flowchart

The program flowchart (see Fig. 7) shows the steps of the program for the system. The program starts by receiving the readings from the sensors connected to the patient's body through wires. The acquired data is then sent to the programming environment (i.e., LabVIEW Software). The program analyzes and displays the data regarding the body temperature, ECG and heart rate. Finally, the data are saved and are also used to generate well-organized report by the system with respect to the time.

V. CONCLUSION

As health care services are important part of our society, automating these services lessen the burden on humansand eases the measuring process. Also the transparency of this system helps patients to trust it.

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BIO DATA

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