

Health Monitoring System Using MSP 430

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Abstract: *Telemedicine is the use of telecommunication and information technologies in order to provide clinical health care at a distance. It helps eliminate distance barriers and can improve access to medical services that would often not be consistently available in distant rural communities. It is also used to save lives in critical care and emergency situations.*

Telemedicine allows remote diagnoses and monitoring of patients [1]. It guarantees agility, safety, and reliability in modern health-care institutions. There are several challenges associated to automation in this sort of environment [2], viz: heterogeneity of devices, protocols, and programming interfaces; the requirement for flexible, impact-free deployment; the requirement for easy to configure, easy to manage, scalable and, if possible, self-adjusting systems, and others.

We focus on the problem of patients' vital data collection, distribution, and processing. We suggest that current solutions based on manual note taking are slow, time consuming, and labor resource intensive. Besides, it imposes an obstacle to real-time data access that curbs the ability of clinical diagnostics and monitoring.

We present a solution to automate this process from bedside data collection to information distribution and remote access by medical staff. Our solution is based on concepts of wireless sensor networks and utility computing. "Sensors" are attached to existing medical equipments that are inter-connected to exchange services; these are integrated to the institution's computing network infrastructure. The information becomes available in the "cloud", from where it can be processed by expert systems and/or distributed to medical staff for analysis. We argue that these technologies provide desirable features for automation in telemedicine environment addressing the challenges listed above.

Our contribution is two-folded in social and scientific fields. In social we demonstrate an innovative and low cost solution to improve the quality of medical assistance delivery and; in scientific field we address the challenges of how to integrate sensors connected to legacy medical devices which cloud computing services to collect, process and delivery patient's vital data.

I. Motivation:

As described below the process works based on manual notes. The interactions are described below.

- (i) A staff member collects patient's data at bedside, writing it down to a paper spreadsheet;
- (ii) The notes are typed in a data entering terminals;
- (iii) The data is transmitted to a database server that organizes, indexes, and make it accessible through a database interface; and
- (iv) At this point, medical staff can access this information through an interface application. It is clear that there is latency between (i) data gathering and (iv) information accessibility. This is undesirable and prevents real-time monitoring of vital patients' data, restricting the clinician's monitoring capabilities. Moreover, this process is error prone, as there is a possibility of incorrectly input.

We suggest the following high-level requirements for the solution:

1. It must implement the methods to collect, process and distribute patient's vital data, from bedside to remote accessibility.
 2. It must be open, flexible and extensible; that is, it must support heterogeneous equipments in different numbers that can be added to system on ad hoc basis.
 3. It must be secure; that is, the system must guarantee the integrity and confidentiality of medical data.
 4. It must be manageable; that is, it must provide control over the myriad of computing devices connected to the environment.
 5. It must be reliable; that is it must guarantee system availability despite of fluctuations of operational conditions and punctual issues.
 6. It must be scalable, to support the deployment in large health –care environments and the integration of different institutions.
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7. It must be optimized for computing resources; that is, the application must run in inexpensive, low profile computing devices.

Here device is plugged in and begin to operate, i.e. to collect and transmit data; computer resources available to receive, store, process, and distribute the information. Different than multi-layered engineered computing environments, resources can be plugged in and out the micro controller and configured for the different aspects of the operation sharing the common infrastructures for communication, management, and security.

1.1 BLOCK DIAGRAM :

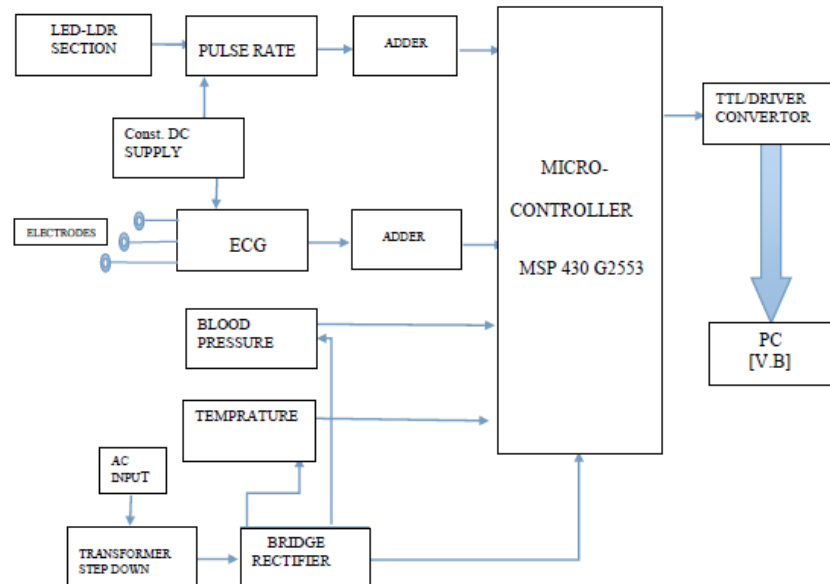


Figure no 2.1 System Block Diagram

1.2 BLOCK DIAGRAM EXPLANATION :

This system basically scans the parameters such as Body temp, Pulse rate, ECG and Blood pressure at regular intervals of time and send them to the PC base station where they will display using VB 6.0

The μC will scan this parameter at regular interval using inbuilt timer. The Timer is set at 10 ms interval. At the end of 10 ms the μC will log these parameters via inbuilt ADC and store the parameters in its internal RAM memory. Then the micro controller will transmit the parameters via serial link RS 485 towards PC.

1.3 SECTION WISE EXPLANATION OF THE PROCESS :

The block diagram explanation mainly consist of 4 sections as below

- A. Sensor measurement of Human Body
- B. Processing measured parameters in Micro Controller
- C. Displaying the output on PC
- D. Storing it in PC (VB)

A. SENSOR MEASUREMENT OF HUMAN BODY :

In the measurement of initial parameter, i.e. pulse rate, the input is given to LED LER section where it senses the blood flow in the body and then according to that they measure the pulse rate of Human Body. In the pulse rate stage filters are used to remove the noise in the signal. The HPF is designed such that it is tuned lower cutoff frequency which allows only those signals which are greater than it. As the coming input from amplifier section is of very low voltage it can not be connected directly to the micro controller. The adder circuit is used to convert it into $\pm 5\text{ V}$ and then it is connected to the micro controller.

Electrodes from the ECG circuits are connected to the body of patient in the observing room. In total 12 leads are used to measure of Human Body. The electrodes are connected to protection circuit in ECG stage to protect the patient from shock.

Cascading of filters are used here to remove noise in the signal and to get exact value signal in ECG wave form. The adder circuit is used to convert it into $\pm 5\text{ V}$ and then it is connected to the micro controller.

In Blood pressure measurement the pressure sensor is designed such that its pressure range is compatible for measuring minimum and maximum pressure of Human Body. The measured pressure is converted into electrical signal and then given to the micro controller. For Temperature measurement a simple LM 35 precision centigrade temperature sensor is used whose output voltage is linearly proportional to the celcius temperature. The LM 35 thus has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient centigrade scaling.

B PROCESSING MEASURED PARAMETERS IN MICRO CONTROLLER :

All the coming input signals from different types of sensors are processed in sensors and they are converted in their respective digital values by in built10 bit ADC in micro controller. The output of ADC which are digital values executed using the code burned into micro controller and final output is given to the output port of micro controller. Here the code is written using IAR complier and using flash magic soft magic it is burned into controller.

The whole circuit is supplied via 232 V AC, a step down transformer is used to convert it into 0 to 15 V range i e AC to AC step down conversion. Since we need DC supply for our circuit, we have to convert it into DC. To convert AC to DC bridge rectifier is used. But the DC coming from rectifier circuit is not so pure for pulse and ECG signal as they are of very low frequency. Hence a separate constant DC supply (Battery of 9 V) is used.

In TTL/Driver stage each receiver converts TIA/EIA 232 input into 5 V TTL/CMOS level so that it will interfaced with PC why serial link.

C. DISPLAYING THE OUTPUT ON PC :

The serial bits from TTL/Driver stage should be sent towards PC, so we need to used a serial to USB converter to get connected with PC. RS 485 is used for this purpose. Finally the output is displayed on PC using software Visual Basics 6.0 version.

D. STORING IT IN PC(VISUAL BASICS) :

To store the result in Visual Basic we have to use report generation in provided in Visual Basic. Mainly there are 2 steps to store your data using report generation.

- A. Report data environment
- B. Data report file generation

II. System Output:

After recording all the parameter and storing information of every patient is important for hospital records. We are storing these recorded values in Visual Basic using Report Generation provided in it.

The format for storing the individual report shown as below:

Name	Age	Gender	Date	Time	Temperature	Pulse Rate	Systolic	Distolic	ECG X	ECG Y
Sneha M	25	F	19/07/13	13:39:07	022.2					
Sneha M	25	F	19/07/13	13:39:07					2	9
Sneha M	25	F	19/07/13	13:39:07	022.2					
Sneha M	25	F	19/07/13	13:39:07					3	10
Sneha M	25	F	19/07/13	13:39:07	022.2					
Desai S	55	M	19/07/13	14:18:58	029.2					
Desai S	55	M	19/07/13	14:18:58					37	0
Desai S	55	M	19/07/13	14:18:59			117	69		
Desai S	55	M	19/07/13	14:18:59	029.2					
Desai S	55	M	19/07/13	14:18:59					38	0
Desai S	55	M	19/07/13	14:18:59	029.2	078				
Pooja K	21	F	19/07/13	14:22:19	030.3					
Pooja K	21	F	19/07/13	14:22:19					37	12
Pooja K	21	F	19/07/13	14:22:29		000				
Pooja K	21	F	19/07/13	14:22:29			116	64		
Pooja K	21	F	19/07/13	14:22:29	030.3					
Pooja K	21	F	19/07/13	14:22:29					38	9
Pooja K	21	F	19/07/13	14:22:30	030.3	066				
Pooja K	21	F	19/07/13	14:22:30					39	9
Pooja K	21	F	19/07/13	14:22:30	030.3					

References

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