

Patient Monitoring System by using Wired and Wireless Sensors

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Abstract-In hospitals treatment of patient, it is very important to monitoring physiological signals of the patient. Heart rate, blood glucose temperature etc are highly important signals included in the physiological signals. It is very difficult work for doctors to monitoring each patient for 24 hours. The paper introduce new system -first collect the physiological signal of patent, after that transfer these physiological signals to personal computer of doctors using Ethernet controller. So doctor or personal staffs can easily analyzing patient current situations that mean heart rate, temperature rate, blood glucose rate from personal computer. Also see this signal on LCD screen. To save energy efficiently, here use Texas Instrument Company MSP 430 microcontroller. We can use wired and wireless sensors. we use intra body communication method in connectionless sensors ,which is mainly uses the conductive properties of the body to transmit signals. In patient monitoring system we use two methods capacitive intra body communication and surface to surface galvanic intra body communication.

Keywords- Ethernet, Msp430 microcontroller, IBC (intra body communication), implant.

I. INTRODUCTION

A piece of information is called data. Data mining is, collect related data from different sources and produce new useful information. Many people suffer from chronicle diseases, like heart attack, diabetes and also other diseases need to monitor physiological signal of the patient. Today many hospitals use patient monitoring systems, these systems has some technical limitations. This system is very costly also to need more number of staff to do work. The evolution of information technology and electronics make changes and give more powerful health care system. Heart rate, temperature, blood glucose, are some physiological signals. It is hard work for doctors to monitor each patient for 24 hours. Here proposed system is, collect physiological signals of patient and send this signal to doctor's personal computer using Ethernet controller. So doctor or other personal staffs can easily analyze the current situation of the patient from personal computer.

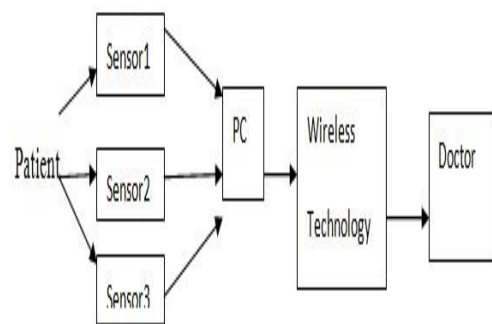


Fig1: Architecture of wireless health monitoring system

Here patient monitoring system uses three sensors heart rate, blood glucose and temperature; These sensors are placed on the body of the patient. Sensors receive signals. Wireless technology is used to communicate between sensors and PC (personal computer). Signal collected and sends to the doctor's computer. To save energy Texas instrument MSP430 low power micro controller is used. It is mainly used for data processes. Ethernet controller is used to send all information to doctor's computer. In patient monitoring system we can also use wireless sensors. Intra body communication is a method of wireless communication used to transmit signals. Mainly two type of intra body communication is used capacitive and surface to surface galvanic intra body communication.

II. LITERATURE SURVEY

A) Review of Patient Monitoring System with Wireless

The paper described about wireless communication. The paper is mainly focused on continuous monitoring aspect of patients living in houses. This requires a reliable, energy efficient patient monitoring system that can be able to send parameters of patient in real time [1]. So the doctors can monitor patient's parameters easily (temp, Pulse rate, Blood Glucose).The major influence of the final proposed system is that it detects processes and sends patients data ((temp, Pulse rate, Blood Glucose))over a wireless.

Wireless communication is easy to handle and it has reducible cost, user device can move easily, these are the advantages of wireless communication. Wireless communication is slower than wired communication. Wireless communication has low bandwidth and outsiders can easily access network. These are the dis-advantages of wireless communication. Patient monitoring system is another application of wireless communication.

B) Comparison of approaches to intra body communication

The paper described about intra body communication. Intra body communication is a path for electronic device to communicate with each other. In 1996 IBM was first introduced the concept of intra body communication. In intra body communication two methods used –capacitive intra body communication and galvanic intra body communication. Capacitive intra body communication has connection with ground and galvanic intra body has no connection with ground. Implants to implant communication, Implant to surface communication, Surface to surface communication are the different types of galvanic intra body communication. If devices are inside the body radio frequency is used. Radio frequency is used for communicate with outside body device. Intra body communication has high rate of data, it is highly protected, and transmission quality is very high, these are the advantages of intra body communication.

C) Patient monitoring system using MSP430 microcontroller

The paper describe about patient monitoring system using MSP430. MSP430 micro controller is a low power microcontroller. Low power microcontroller is released in market in the late 1990s. MSP430 microcontroller is 16 bit. And it is a RISC based, and also is a mixed signal processor. MSP430 microcontroller mainly has three types low current modes. SMCLK,ACLK,MCLKthese are three low current modes. The paper describe ethernet controller. It allows many computers from single station to one another through network. This networking is done with the help of Ethernet protocols and Ethernet hardware. The main benefit of Ethernet is it can sense collision on the network. Processing ability of MSP430 micro controller is very strong, simulation technology performance is very high these are the advantages of MSP430 microcontrollers. Features of ethernet controller are-To avoid collision and It support both full duplex and half duplex modes.

D) Wireless communication with implanted medical devices using the conductive properties of the body

The paper described about intra body communications. Implants to implant communication, Implant to surface communication, Surface to surface communication are the three different types of intra body communication. In Implant to implant communication Transmitter and receiver are placed inside the body. Receiver electrodes have connection to out of the body using wired or wireless radio frequency Telemeter. Radio wave is moving freely via air, so it doesn't need more power to transmit receiver

electrodes. In Implant to surface communication transmitter is inside the body receiver is outside the body or receiver is inside the body and transmitter is outside the body That means either one is present inside the body it may be transmitter or receiver. in this signal is passed via skin. Using Surface to surface communication we can understood heart rate, pulse rate, temperature and blood glucose level. Intra body communication has high rate of data, it is highly protected, and transmission quality is very high, these are the advantages of intra body communication.

III. PROPOSED SYSTEM

In this proposed system different sensors that are heart rate sensor, temperature sensor. Blood glucose sensor these connection as shown fig2 below. Temperature sensor is directly connected to MSP430 microcontroller. Heart rate sensor and blood glucose sensors are not connected directly it is first connected to amplifier (signal conditioning) and connected to MSP430 micro controller. LCD is directly connected to MSP430 micro controller and Ethernet is connected to serial port of MSP430.personal computer is connected using RJ45 connector.

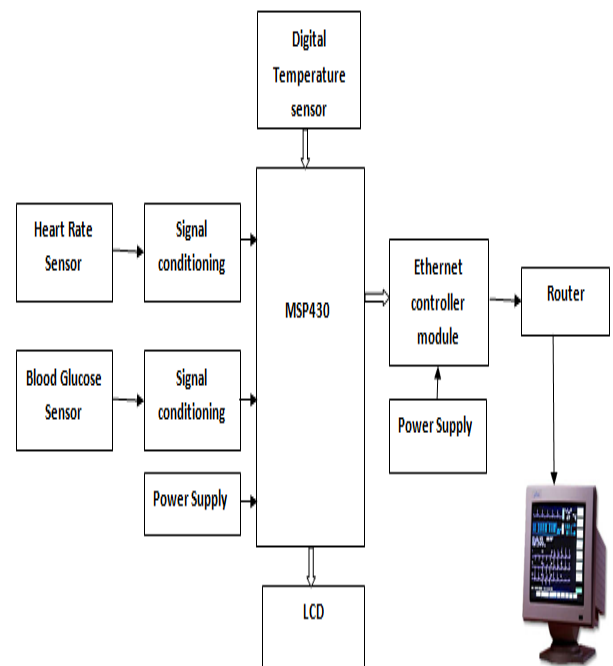


Fig2: block diagram of proposed system [3]

A. MSP430Microcontroller

MSP430 micro controller is a low power microcontroller. Low power microcontroller is released in market in the late 1990s. MSP430 microcontroller is 16 bit. And it is a RISC based, and also is a mixed signal processor. And it is easy to use and it has reducible cost, less power consumption for thousands of applications.MSP430 has different low power modes that are listed below table (Fig 3)

Low power modes	LPM0,LPM1	PM2,LPM3	LPM4
MCLK	OFF	OFF	OFF
SMCLK	ON	OFF	OFF
ACLK	ON	ON	OFF

Fig 3: Low power modes in MSP430 [3]

Processing ability of MSP430 is very strong, instruction cycle time of MSP430 is 62.5ns. It supports many power management features. Figure 3 shows the different power modes of main clock, sub-main clock and auxiliary clock

Features:

- It has low power supply
- It has low cost
- Microcontroller has 5 power saving modes
- It uses auto baud rate detection
- It will have 10 A/D converter with internal reference,

B. Ethernet controller

It allows many computers from single station to one another through network. This networking is done with the help of Ethernet protocols and Ethernet hardware. The main benefit of Ethernet is it can sense collision. A node on Ethernet network sends information to other source, first it will listen to the network and see if there is any network traffic, if there is no block or traffic it will send data. That means it avoids collision

Features:

- support full and half duplex modes
- Ethernet controller compatible with 10 or 100 base-T networks
- To avoid collision

C. Wired sensors

Digital temperature sensor:

It is a serially programmable sensor. Temperature sensor output gives accuracy measurement with low operating current it will be less than 250 micro ampere. Temperature sensors have mainly four connections: these are supply voltage, ground, CLK and DLK. Below Fig 4 shows the diagram of digital temperature sensor.



Fig4: Digital temperature sensor [3]

Features:

- It has low power
- Operating mode is -250 micro ampere
- Two-wire serial interface
- The operating supply range is 2.7V to 5.5 V
- Temperature sensor operates from -55 degree Celsius to +125 degree Celsius

Heart rate sensor:

To measure heart rate we are using a heart rate sensor. Heart rate refers to heart beats per unit time. Physical exercise, sleep, drugs, stress will affect the heart rate.

AGE	RANGE(bpm)	AVERAGE RATE (bpm)
0-1 months	100-180	140
2-3 months	110-180	145
4-12 months	80-180	130
1-3 years	80-160	120
4-5 years	80-120	100
6-8 years	70-115	92.5
9-11 years	60-110	85
12-16 years	60-110	85
>16 years	60-100	80

Fig5 (table): Average heart beat rate [3]



Fig5.1: Heart rate sensor module [3]

The sensor contains a bright LED and a light detector. The LED needs to be maximum light must pass through the finger and is computed by the detector. When the heart pumps a pulse of blood via blood vessels, so less light reaches the detector. The detector signal varies with each heart pulse and converted these variations into an electrical pulse. This signal is amplified through an amplifier which outputs a +5V logic level signal

Blood glucose sensor:

Amperometric is one of the methods of detecting blood glucose. In this method, a test strip is used, it consists of an electrode with chemical elements where a blood sample is deposited. And it will generate a reaction that over time an electric current will be produced and this current is converted into voltage. This signal is amplified and it is given to the microcontroller.

Fig 6 shows a blood glucose sensor. It will provide analog output signals. For further processing, this analog signal is applied to the microcontroller board.

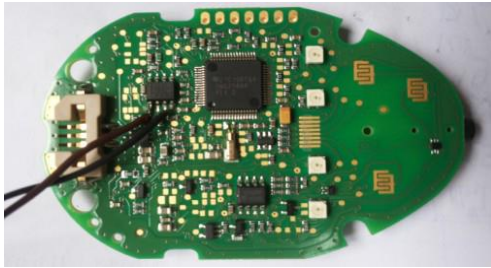


Fig6: Blood glucose sensor [3]

D. Wireless sensors

In patient monitoring system we can also use wireless sensors by using intra body communication. Here we use capacitive and surface to surface intra body communication. Intra body communication (IBC) is a method for wireless communication, which is used to transmit signal from patient body.

Capacitive intra body communication:

Capacitive IBC have ground connection .a small signal was passed through body receiving electrodes detected. In this system transmitter and receiving electrodes is placed near the skin. And is capacitive coupled to the body. Transmitter and receiver of other set electrodes oriented away from the body and capacitively coupled to the environmental ground. This type of process is called capacitive IBC.

Galvanic intra body communication:

Another type of intra body communication is galvanicIBC. In this a small current flow from transmitting electrodes on the chest, via body and it was detected by receiving electrodes. These transmitter and receiver have a direct contact with body. The resulting in galvanic coupling. It need low power that is the main benefit. Galvanic intra body communication is mainly divided in to three types

1. Implant to surface communication:

In this communication transmitter is inside the body receiver is outside the body or receiver is inside the body and transmitter is outside the body That means either one is present inside the body it may be transmitter or receiver. in this signal is passed via skin.

2. Implant to implant communication:

Transmitter and receiver are placed inside the body. Receiver electrodes have connection to out of the body using wired or wireless radio frequency Telemeter . radio wave is moving freely via air, so it doesn't need more power to transmit receiver electrodes.

3. Surface to surface communication: Transmitter and receiver is placed outside the body.

It does not have surgery to implant transmitter and receiver electrodes because sensors and devices are should placed outside the body.

IV. FUTURE WORK

The paper proposes a system for detecting patient's physiological signal using wired and wireless sensors. To save energy effectively Msp430 microcontroller is used. The future work aims by using solar battery. We can detect patient's physiological signal with the absence of current. Instead of Msp430 microcontroller we can use solar battery. So with minimum cost we can obtain treatment.

V. CONCLUSION

To monitoring physiological signal, currently available system suffers from technical limitations. Here the proposed system which collect patients physiological signal and send to doctors personal computer. So doctors or other personal staffs can easily analyze the patient's current situation. Here from proposed system we can monitor temperature, blood glucose, and heart rate of different patient by using connection and connectionless sensors. The usage of intra body communication method is done to transmit signal. To save energy efficiently Texas instrument MSP430 low power micro-controller is used. Ethernet controller is used to send all physiological information to doctor's personal computer. Wireless technology has a rapid growth in our world. using this emerging wireless technology, we can upgrade this application with more efficiently.

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