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Design A Portable and Low Power Multi Parameter Signal Monitoring System

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Abstract:

The project presents a multi-parameter physiological signal monitoring system. We designed a multi-parameter physiological signal monitoring system which is characterized by the low power, high precision and high-capacity. The system can obtain ECG, EEG, EOG, EMG, pulse and respiration.The traditional multi-parameter monitoring system can only monitor fewer types of signals and the speed of data transmission is slow. Signal at low operating frequency. At the same time, it can also handle. Both SD card storage and USB data transmission.

Keywords:

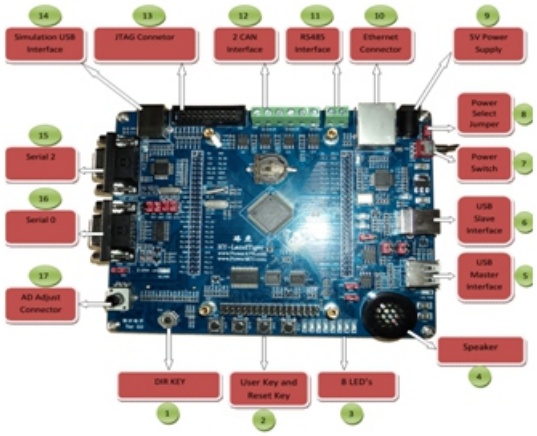
INTEL GALILEO, multi-parameters, storage, transmission.

INTRODUCTION:

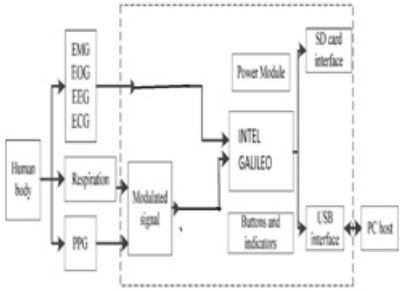
The system can obtain ECG, EEG, EOG, EMG, pulse and respiration signal at low operating frequency. They have an extremely important value in themonitoring of the human health. It is necessary to access tothese physiological signals timely and accurately to helphealth workers assess the patient's physical conditionproperly. It is also conducive to find the disease and takeeffective measures. So it is very important for maintainingthe patient's health. At the same time, it can also handle both SD card storage and USB data transmission. The system reduces its power consumption under the premise of ensuring the realization of a number of functions.

Hardware:

A portable application (portable app), sometimes also called standalone, is a program designed to run on a compatible computer without being installed in a way that modifies the computer's configuration information.



This type of application can be stored on any storage device, including internal mass storage and external storage such as USB drives and floppy disks – storing its program files and any configuration information and data on the storage medium alone. If no configuration information is required a portable program can be run from read-only storage such as CD-ROMs and DVD-ROMs. Some applications are available in both installable and portable versions. Like any application, portable applications must be compatible with the computer system hardware and operating system.



Block diagram

Heart beat sensor

Heart rate is the number of heartbeats per unit of time and is usually expressed in beats per minute (bpm). In adults, a normal heart beats about 60 to 100 times a minute during resting condition. The resting heart rate is directly related to the health and fitness of a person and hence is important to know. You can measure heart rate at any spot on the body where you can feel a pulse with your fingers.

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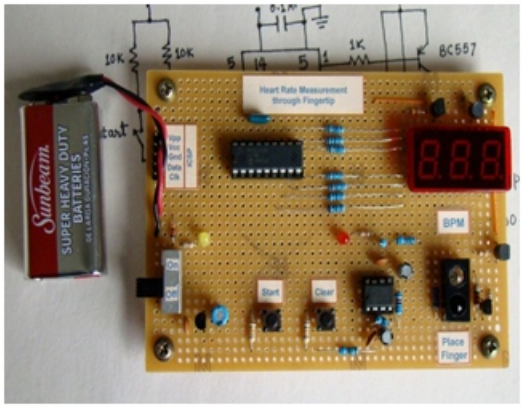
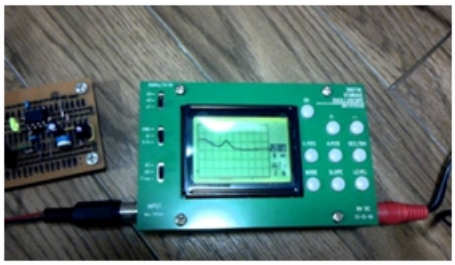


Heart rate measuring device using PIC16-F628A

Result for Heart Beat sensor

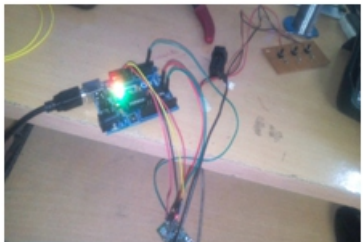
•EOG is a technique for measuring the corneo-retinal standing potential that exists between the front and the back of the human eye.



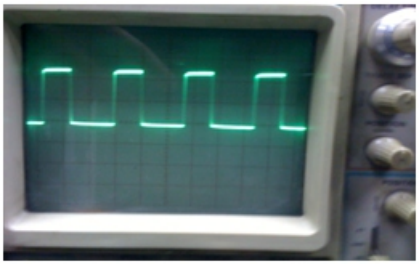
Output for EOG

•The electrocardiogram, or ECG / EKG are a surface measurement of the electrical potential generated by electrical activity in cardiac tissue.

•In conventional scalp EEG, the recording is obtained by placing electrodes on the scalp with a conductive gel or paste, usually after preparing the scalp area by light abrasion to reduce impedance due to dead skin cells.

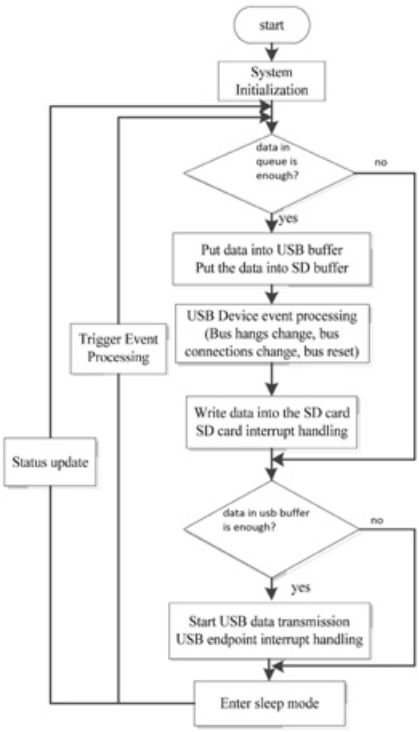


Hardware for EEG



Output of EEG:

SOFTWARE DESIGN:The embedded software in the system achieves the data collection, storage and transmission based on LPC 1788. The system captures multiple signals and generates a largeAmount of data, taking into account the capacity of the SD card and the time the system needs to work, the sampling rate of EMG, EOG, ECG and EEG are set at 512Hz. The system extracts multi-parameter humanphysiological signals based on the LPC I 788.1t uses a SOcard as a data acquisition memory and uses the USBinterface to achieve real-time communication.



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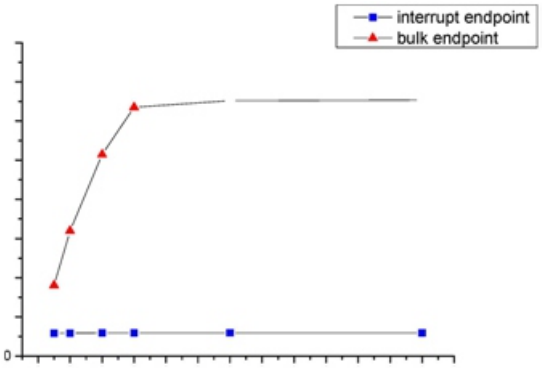
Flow chart of Software Design

Data transmission:

When the amount of data is sufficient, the system will transfer the data to computer by USB bus. The USB interface used by the system supports hot-swappable and dynamic configuration, It has the advantage of high-speed and stabilization. It is fully compliant with USB2. 0 Full Speed specification and supports 16 logical endpoints to achieve bulk endpoints and isochronous endpoints with double buffer. The specific transmission is achieved by the interruption of endpoint.



Speed of Data Transmission Graph

Data storage

The SO card interface provided by LPC1788 has all the specific features of SO memory card. It has the advantage of safety, high-speed storage and so on, which meets the requirements of storing large quantities of data in the system. Different from the USB data frames, the data frame stored in the SO card consists of 5 12 bytes. It is necessary to format the SD card and create new files to store data and patient information before working. In the process of data storage, the system will be combined with the FATl6 file system and interruption of SD card interface to store the corresponding data into the specified folder. When the SO card is full, the system will automatically stop storing and open the corresponding indicator. Storing the data into SO card synchronously contributes to a more detailed health care diagnosis.

TESK ALLOCATION:

With the above modules described in this paper, the task is divided into many parts. By testing each module we found that the minimum operating frequency that the write operation of SO card requires is 30M Hz. So the system is required to be able to complete all of the features in the 30MHz.

The uptime of each part is tested under 30MHz, which is shown in TABLE I.

data	MODULE				
	data acq	data storage	data transmission	status update	trigger event
TIME	150us	3700us	1600us	100 us	20us

The Uptime Of Each Module:

Considering the sampling rate and the difference between SO data frames and USB data frames, the system gives priority to the interrupt of SD card interface rather than the interrupt of USB endpoint to ensure the priority of data storage. The system requires MCU to monitor some state variables such as the status of sensor connection during the operation. By referring to the running time of each module in the TABLE I, the execution time of timing cycle is still872 vacant except collecting the data. So these matters will be executed in the interrupt of timer, but the execution frequency can be lower than the frequency of the timer interrupt. In addition, to handle the affairs of some triggering event, the system opens an RTC interrupt. Since the frequency of some triggering event is relatively low, the system checks these state variables once per second. The interrupt priority is also the lowest. After operating the whole system in accordance with the above method, the system can capture these signals synchronously and achieve storage and transmission stably. During the second operation of the system, the time occupied By each firm is shown in

	MODULE				
	data acquisition	data storage	data transmission	status update	trigger event
TIME	204.8ms	148ms	32ms	8.2ms	20us

The Time Occupied By Each Module In One Second:

The software completes the requirements of the system and leaves 607ms to enter sleep mode based on the above design .It ensures the scalability of the task while reducing the power consumption. The power consumption of the system is tested. The result is shown in Table III, the final total power consumption of the system is not higher than 80mA.

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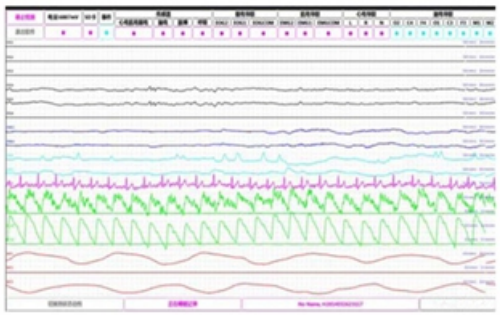
In addition, the data frame transmitted by USB and the data frame stored in the SO card can be customized, which makesThe system more responsive to the needs of different applications

	MODULE			
	MCU	SD CARD	AD MODULE	ANALOG CKT
T	33.1mA	5.6mA	6.7mA	30.3mA

The Power Consumption Test of The System

RESULT:

The system can measure the waveform of a plurality of physiological signals synchronously and the waveform is clear and stable.



The waveform display of the system

CONCLUSION:

Given all that, the multi-parameter physiological signal monitoring system based on Intel Galileo achieves the simultaneous monitoring of multiple physiological signals and completes a large-capacity storage and real-time transmission of data. And the software reduces system's power consumption through the rational allocation of tasks. The system has the advantage of high-capacity, low-power 873 and high speed of transmission, which meets the requirements of multi-parameter monitor on the market. It has vital significance to the comprehensive assessment of the user's health condition. A multi-Parameter patient monitoring system was designed, developed and tested. The major value of this patient monitoring system is low-cost, off-the-shelf component system which can be used for monitoring multiple patient parameters. We have designed the multiple parameter patient monitoring system, and in future, plan to interface wireless module so that mobility is provided to both the doctor and the patient

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