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A CONFIGURABLE LOW POWER MIXED SIGNAL FOR PORTABLE ECG MONITORING SYSTEM

VIKAS HARIBHAU SATONKAR[1], D. S. SHILWANT[2]

[1] Vikas haribhau Satonkar, student, Shreeyash college of Engineering &Technology, Aurangabad, Maharashtra, India.

[2] D.S.Shilwant, M.E, Shreeyash college of Engineering &Technology, Aurangabad, Maharashtra, India.

Abstract:

ECG works mostly by detecting and amplifying the tiny potential changes on the hand that are caused when the electrical signal in the heart muscle is charged and spread during each heart beat.

This is detected as tiny rises and falls in the voltage between two electrodes placed either side of the heart or other body part like hand. At the stage of continuously measure the heart beat or a pulse rate the graph is given it is in the form of analog one and with that it will much fluctuate the actual reading of ECG can't get correctly.much variation in the graph are followed, the power requied to that system is also variable.

The AFE supports concurrent 3-channel ECG monitoring, with impedance measurement and band-power extraction. The custom digital signal processor consisting of a 4-way SIMD processor provides configurability for a wide range of application and advanced functionality like motion artifact removal, accurate R peak detection algorithm, arrhythmia classification and HRV analysis. Various algorithms are possible, allowing different power-performance trade-offs depending on the application requirements. An adaptive sampling ADC significantly reduces the equivalent data-rate of the ADC output without affecting the information content of the input signal, leading to a reduction of data memory access and processing complexity in the DSP domain. The loop buffer integration enables reduction in the access power of the program memory. The SoC has been integrated in a wireless ECG monitoring system with Bluetooth protocol. Thanks to the advanced features of the SoC like adaptive sampling and local processing, which includes motion artifact removal and accurate R peak detection, the monitoring system can reduce the overall power consumption by factor of 20 compare to a generic system without local processing. This allows to long-term and continuous high integrity signal monitoring and also reduces the system form-factor.

***KEYWORDS**: ECG Sensor, PC.*

I. INTRODUCTION:

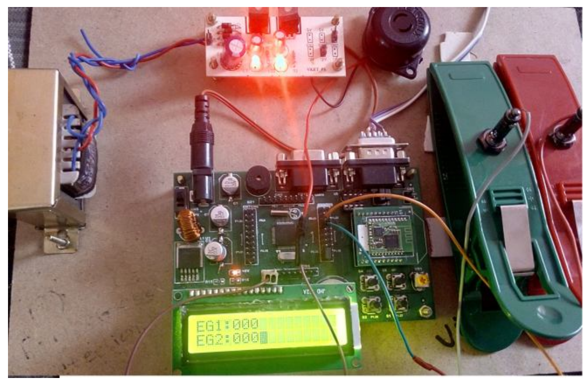
With the increasing use of ambulatory monitoring system, not only continuous signal collection and low-power consumption, but also smartness with robust operation under the patients daily routine is required. The target is emerging to enable configurability for different applications, ranging from simple heart rate calculation towards more complex medical diagnostics under ambulatory conditions, with extreme low power consumption and high accuracy. Especially, one of the major problems in ambulatory ECG monitoring system is the presence of motion artifacts, which lead to poor signal quality, and potentially wrong clinical diagnosis. High signal integrity recording quality and robust operation under the presence of signal artifacts will allow a higher level of physical activity for the subjects. In order to address this challenge, local data processing with advanced functionalities is required, such as motion artifact reduction and accurate feature detection.

The proposed mixed-signal SoC consists of an AFE that supports continuous and simultaneous monitoring of 3-channel ECG monitoring, with electrode-tissue-impedance (ETI) measurement and band-power (BP) extraction for extracting signal fluctuations in the specified frequency band, with sampling rate of 512-sample/sec and 64-sample/sec, respectively. A 12-bit successive approximation (SAR) analog-to-digital converter (ADC) with adaptive sampling scheme is capable of compressing the ECG data by a factor of 7 before digital signal processing, which in turn reduces the processing power of the DSP and the wireless data transmission. The custom DSP back-end, using SIMD processor architecture, hardwired accelerate unit, effective duty cycling, on-chip memory reduction schemes, and clock gating, provides low power operation while performing multichannel ECG processing. Further, due to the high integration level, a small form-factor can be achieved with minimal use of external components enabling to reduce the system complexity.

II. HARDWARE SYSTEM:

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.



Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

Block diagram:

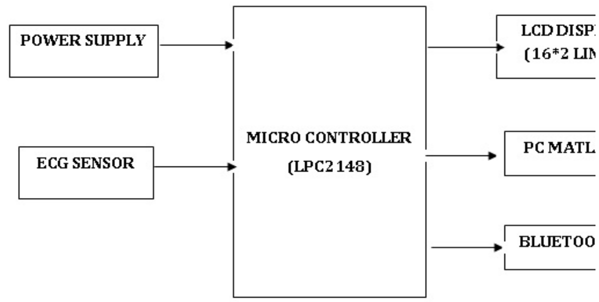
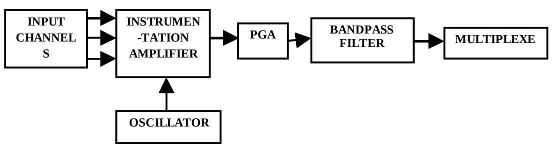


FIG: ECG Sensor

ECG Sensor:



III. Board hardware resource features:

ECG SENSOR:

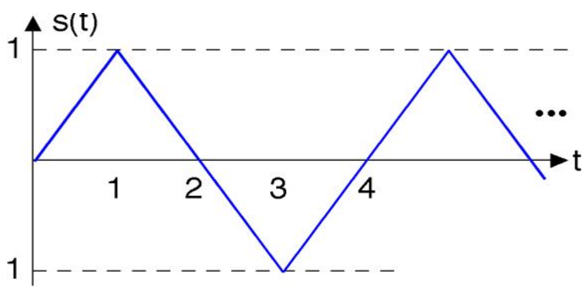
Electrocardiography (ECG) is the process of recording the electrical activity of the heart over a period of time using electrodes placed on a patient's body. These electrodes detect the tiny electrical changes on the skin that arise from the heart muscle depolarizing during each heartbeat. In a conventional 12 lead ECG, ten electrodes are placed on the patient's limbs and on the surface of the chest. The overall magnitude of the heart's electrical potential is then measured from twelve different angles ("leads") and is recorded over a period of time (usually 10 seconds). In this way, the overall magnitude and direction of the heart's electrical depolarization is captured at each moment throughout the cardiac cycle

The graph of voltage versus time produced by this noninvasive medical procedure is referred to as an electrocardiogram. During each heartbeat, a healthy heart will have an orderly progression of depolarization that starts with pacemaker cells in the sinoatrial node, spreads out through the atrium, passes through the atrioventricular node down into the bundle of His and into the Purkinje fibers spreading down and to the left throughout the ventricles. This orderly pattern of depolarization gives rise to the characteristic ECG tracing.

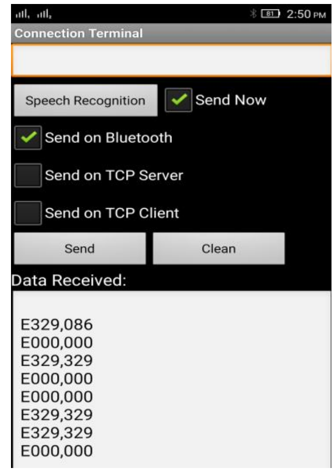
To the trained clinician, an ECG conveys a large amount of information about the structure of the heart and the function of its electrical conduction system. Among other things, an ECG can be used to measure the rate and rhythm of heartbeats, the size and position of the heart chambers, the presence of any damage to the heart's muscle cells or conduction system, the effects of cardiac drugs, and the function of implanted pacemakers.

III. RESULT

1) We Can Monitor Digital graph With The help Of MATLAB Like below image



2) Bluetooth Protocol is used for wirelessly transmit the value of pulse rate Digitally on mobile phone with the help of connection terminal application



3) Low power battery provides power for the system. From the above figure we find out the values in given table 1.

Technology	General ECG system	New ECG Monitoring System
Voltage Level	5-7V (D.C)	3.3V(D.C)
Frequency	2 MHZ	1 MHZ
Memory Size	-	32kb
Bit Width	16 bit	32 bit

IV. CONCLUSION:

This paper presented a mixed-signal ECG SoC, with integrated analog front-end and DSP back-end. The AFE supports concurrent 3-channel ECG monitoring, with impedance measurement and band-power extraction. The custom digital signal processor consisting of a 4-way SIMD processor provides configurability for a wide range of application and advanced functionality like motion artifact removal, accurate R peak detection algorithm, arrhythmia classification and HRV analysis. Various algorithms are possible, allowing different power-performance trade-offs depending on the application requirements. An adaptive sampling ADC significantly reduces the equivalent data-rate of the ADC output without affecting the information content of the input signal, leading to a reduction of data memory access and processing complexity in the DSP domain. The loop buffer integration enables reduction in the access power of the program memory. The presented SoC consumes a best-in-class power consumption of only 31.1 W from a 1.2 V supply in beat detection mode. The SoC has been integrated in a wireless ECG monitoring system with Bluetooth protocol. Thanks to the advanced features of the SoC like adaptive sampling and local processing, which includes motion artifact removal and accurate R peak detection, the monitoring system can reduce the overall power consumption by factor of 20 compare to a generic system without local processing. This allows to long-term and continuous high integrity signal monitoring and also reduces the system form-factor.

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