

Hypertension and cardiac arrest detection using silver electrodes and heart sensor on FPGA platform.

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Abstract

Hypertension is the condition in which the force of the blood against the artery walls is too high. Cardiac arrest is an unexpected loss of heart system working, breathing and anything related to heart. Both these states are measured by the device called Mercury Sphygmomanometer. Mercury sphygmomanometers are considered the gold standard. They show blood pressure by change in height of mercury. But there is a discontinuation in mercury sphygmomanometer due to its bulky size, inaccurate gauge and underperformed on hearing and visually impaired people. This paper studies a hypothesis to investigate the possibility of obtaining simultaneous accurate blood pressure measurements which can parallelly cause cardiac arrest and skin response through the pulses to detect the tension rate using FPGA. In this paper we will be studying XILINX SPARTAN 3 XCS 400(4MHZ) FPGA. The analog value from the GSR (Galvanic Skin Response) and Heart Rate Sensor is converted into digital value using analog to digital converter. The digital value is further processed by the FPGA to check the GSR and Heart Rate Sensor and give the alert. If the value is crossed through certain threshold limit then the alert is displayed into 16*2 LCD.

Keywords—Galvanic Skin Response, Heart Beat Sensors, FPGA, Hypertension, Cardiac Arrest.

I. INTRODUCTION

With the turn of the century, cardiovascular diseases (CVDs) and hypertension have become the leading cause of mortality in India. The cumulative incidence of total deaths and sudden cardiovascular diseases at 1 month, 1, 2, 3 years and at conclusion of the study was 10.1%, 13.2%, 14.6%, 15.8%, 17.3% and 4.9%, 6.5%, 8.0%, 8.9% and 9.7%, respectively. Overall prevalence for hypertension in India was 29.8% In comparison with the people of European ancestry, CVD affects Indians at least a decade earlier and in their most productive midlife years. For example, in Western populations only 23% of CVD deaths occur before the age of 70 years; in India, this number is 52%. In addition, case fatality attributable to CVD in low-income countries, including India and neighboring countries, appears to be much higher than in high-income countries. The World Health Organization (WHO) has estimated that, with the current burden of heart related diseases. from the loss of productivity and spending on health care over a 10-year period (2005– 2015), India would lose \$237 billion. Reasons for the high propensity to develop heart related diseases, the high case casualty, and the high premature deaths include biological mechanisms, social determinants, and their involvement. Addressing this significant burden requires an understanding of both the biological and social reformer, and the complex dynamics underlying their interaction, as well. In this review, we summarize the heart disease or CVD in India, the reasons for the high burden, prevention, and treatment strategies for CVD. The cumulative incidence of total deaths and SCD at 1 month, 3 years and at conclusion of the study was 10.1%, 13.2%, 14.6%, 15.8%, 17.3% and 4.9%, 6.5%, 8.0%, 8.9% and 9.7%, respectively. Hypertension remains one of the most significant causes of deaths in worldwide. It is preventable by proper medication and lifestyle formation. Office blood pressure (BP),

out-of-office BP measurement with continuous BP monitoring, and self-BP measurement at home are reliable and important data for measuring hypertension. Primary hypertension can be defined as an elevated BP of unknown cause due to cardiovascular risk factors resulting from changes in environmental, stress and lifestyle things. Another type, secondary hypertension, is caused by various toxicities, and congenital diseases. Complications of hypertension are the clinical results of continue high BP that result in CVD, atherosclerosis, kidney related disease, diabetes mellitus, metabolic syndrome, preeclampsia, and eye disease.

II. LITERATURE SURVEY

Emotions play a significant role in everyday life of human beings. Developing algorithms for computers to recognize emotional expression are widely studied area. In this study, emotion recognition from galvanic signals was performed using wavelet based and time domain features. various feature set attributes are used for feature extraction. Feature extraction are done by Various length windows. Various feature attribute sets have been implemented. Arousal and valence have been relationship and categorized between physiological signals and arousal and valence has been studied using Random Forest machine learning algorithm. They have achieved 71.53% and 71.04% accuracy rate for arousal and valence respectively by using only galvanic skin response signal. They have also showed that using convolution has positive affect on accuracy rate compared to non-overlapping window based feature extraction [1]. A reliable method to measure potential difference (PD) in the lower airways would be of interest in the field of cystic fibrosis. They have developed silver/silver chloride (Ag/ AgCl) electrodes to measure PD in the lower airways [2]. Sometimes, we need to control different emotional situations which can lead the person suffering them to dangerous situations, in both the medium and short term. There are studies that indicate, stress increases the risk of cardiac arrest and several problems. In this paper we have studied and built a stress sensor based on Galvanic Skin Response and controlled by ZigBee. In order to check the device's performance, we have used 16 adults (eight women and eight men) who completed different tests to show emotions, such as mathematical operations or breathing exercise. On completion, we appreciated that GSR is able to detect the different states or emotions of each user with a success rate of 76.56%. In the future, they have planned to create an algorithm which is able to differentiate between each state [3]. Presence of doctor is essential for proper patient care. But doctors cannot be present at each and every place to provide medical attention. So remote watching of a patient is that the correct resolution. However the most drawback is convenience of net association during a geographic area. Therefore this impressed U.S.A. to use GSM module during this paper, since the medium network is wide unfold among rural and concrete space of the Asian nation. this method is employed to watch physical parameters like heart beat and send the measured knowledge on to a doctor through electronic messaging. System consists of associate degree IR base heart beat sensing element, GSM module and arduino Uno. This device are able to live heart beat of an individual. The low value of the device can facilitate to produce applicable home base effective watching system [4]. high blood pressure is one in every of the foremost common diseases today, and it's necessary to watch the vital sign during apatient's existence. The goal of this work is to style associate degreed develop an intelligent and easy-to-use digital pressure gauge for convenient personal use. because of the high speed offered by Field- Programmable Gate Array (FPGA) and since FPGA overcomes the disadvantages of a single-chip microcomputer's lack of on-chip resource and high-end Advanced architecture Machine (ARM) processors' higher prices, FPGA is chosen because the processor during this work. that they had initial used a pressure sensing element to capture the vital sign signal, out of that a pulse wave is electronically extracted through a band-pass filter to see the heartbeat and pulsation points. each the initial pressure signal and also the pulse wave signal area unit digitized associate degreed fed into the FPGA that implements an oscillometric methodology to method these 2 digital signals to induce the blood pressure and also the blood pressure. The readings area unit then shown on a show module. Experimental studies demonstrate that the digital pressure gauge is quick and correct in mensuration vital sign [5].

III. DESIGN

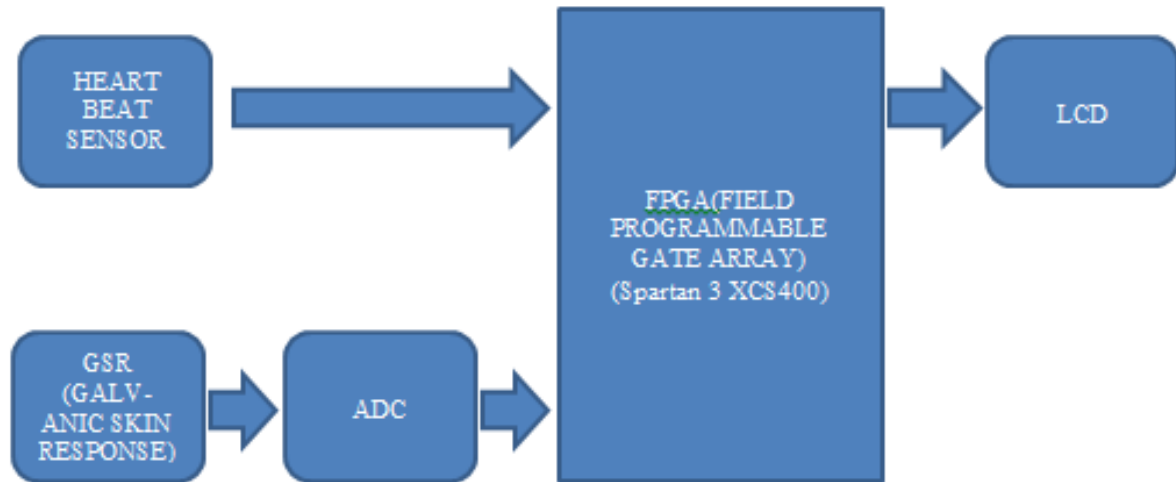


Fig. 1. Proposed System Block Diagram

Fig. 1 shows the block diagram of proposed system. This paper studies a hypothesis to investigate the possibility of obtaining simultaneous accurate blood pressure measurements which can parallelly cause cardiac arrest and skin response through the pulses to detect the tension rate using FPGA. In this paper we will be using XILINX SPARTAN 3 XCS 400(4MHZ) FPGA. The analog value from the GSR (Galvanic Skin Response) is converted into digital value using analog to digital converter and the heart beat sensor will directly gives its digital output to FPGA. The digital value is further processed by the FPGA to check the GSR and Heart Rate Sensor and give the alert. If the value is crossed through certain threshold limit then the alert is displayed into 16*2LCD.

IV. HARDWARE SPECIFICATIONS

The Spartan-3 family of Field-Programmable Gate Arrays is specifically designed to satisfy the requirements of high volume, cost-sensitive shopper electronic applications. The eight- member family offers densities starting from fifty,000 to 5,000,000 system gates. The Spartan-3 family builds on the success of the sooner Spartan-II family by increasing the quantity of logic resources, the capability of internal RAM, the full range of I/Os, and therefore the overall level of performance as well as by rising clock management functions. varied enhancements derive from the Virtex®-II platform technology. These Spartan-3 FPGA enhancements, combined with advanced method technology, deliver a lot of practicality and information measure per greenback than was antecedently potential, setting new standards within the programmable logic trade. as a result of their exceptionally low value, Spartan-3 FPGAs area unit ideally suited to a good vary of shopper physical science applications; as well as broadband access, home networking, display/projection and digital video equipment. The Spartan-3 family could be a superior different to mask programmed ASICs. FPGAs avoid the high initial value, the long development cycles, and therefore the inherent inflexibility of typical ASICs. Also, FPGA programmability permits style upgrades within the field with no hardware replacement necessary, Associate in Nursing impossibility with ASICs

A. Galvanic Skin Response



Fig. 2 Galvanic Skin Response Sensor

GSR, standing for galvanic skin response, could be a technique of activity the electrical electrical phenomenon of the skin. Sturdy feeling will cause information to your sympathetic system, ensuing a lot of sweat being secreted by the sweat glands. Grove – Fere phenomenon permits you to identify such sturdy emotions by easy attaching 2 electrodes to 2 fingers on one hand, a noteworthy gear to form feeling connected comes, like sleep quality monitor.

B. Heart Beat device



Fig. 3 Heart Beat Sensor

Heart beat device is intended to present digital output of warmth beat once a finger is placed on that. once the center beat detector is functioning, the beat LED flashes in unison with every heartbeat. This digital output will be connected to microcontroller on to live the Beats Per Minute (BPM) rate. It works on the principle of sunshine modulation by blood flow throughfingerat every pulse.

C. Analog To Digital converter

An ADC can also give Associate in Nursing isolated measuring like Associate in Nursing electronic device that converts Associate in Nursing input analog voltage or current to a digital range representing the magnitude of the voltage or current. Generally the digital output could be a two's complement binary range that's proportional to the input, however there are alternative prospects. it convert device output into digital output.

D. liquid crystal display

A LCD is Associate in Nursing electronic display module that uses liquid to supply a lucid image. The 16×2 LCD could be a terribly basic module normally utilized in DIYs and circuits. The 16×2 interprets to show 16 characters per line in a pair of such lines. during this liquid crystal display every character is displayed in an exceedingly 5×7 element matrix.

V. SOFTWARE SPECIFICATIONS

A. Xilinx IDE 14.5

Xilinx ISE (Integrated Synthesis Environment) could be a code tool made by Xilinx for synthesis and analysis of alpha-lipoprotein styles, facultative the developer to synthesize ("compile") their styles, perform temporal arrangement analysis, examine RTL diagrams, simulate a design's reaction to completely different stimuli, and piece the target device.

B. Programming Language

VDHL artificial language is usually wont to write text models that describe a logic circuit. Such a model is processed by a synthesis program, on condition that it's a part of the logic style. A simulation program is employed to check the logic style exploitation simulation models to represent the logic circuits that interface to the look. This assortment of simulation models is usually referred to as a check bench. VHDL has constructs to handle the similarity inherent in hardware styles.

VI. RESULT

This paper studies a hypothesis to investigate the possibility of obtaining simultaneous accurate blood pressure measurements which can parallelly cause cardiac arrest and skin response through the pulses to detect the tension rate using fpga. In this paper we will be using xilinx spartan 3 xcs 400(4mhz) fpga. The analog value from the gsr (galvanic skin response) and heart rate sensor is converted into digital value using analog to digital converter. The digital value is further processed by the fpga to check the gsr and heart rate sensor and give the alert. If the value is crossed through certain threshold limit then the alert is displayed into 16*2 lcd.

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