IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

VITAL SIGNS DETECTOR

[1]G.M.G.Madhuri, [2]T.Manikanta Praveen, [3]K.Ujwala, [4]M.Madhuri, [5]G.Achyuth
[1]Associate Professor, [2]Student, [3]Student, [4]Student, [5]Student
[1]Department of Electronics and Communication Engineering,
[1]Potti Sriramulu Chalavadi Mallikarjuna Rao College of Engineering & Technology, Vijayawada, India.

Abstract: Vital Signs are the diagnostic signs of a human body. They are measurements of the body's most basic functions. Vital signs are useful in detecting and monitoring medical problems. The vital signs show how well the body of an individual is functioning. It is a mechanism to universally communicate a patient's condition and severity of the disease. Vital signs detection is the simplest, cheapest and probably the most important information gathered on hospitalized patients. The idea is to develop a low cost, reliable, easily portable device to monitor vital signs like Body Temperature and Heart Rate. The device is very much useful for people over 40 years of age and people who need regular check-ups. The device processes and analyses the data acquired from the sensors and determine whether they are within the Normal range or not. The device is implemented on Edge Artix 7 using VHDL Programming language.

1.INTRODUCTION

Now-a-days, the scope in the medical field has risen exponentially over the decades. As many deadly diseases are hitting the word, vital signs detection has become the prominent factor in human's life. Individuals over 40 years of age have higher health care costs. Senior citizens have to make regular visits to their doctors for their regular check-ups and get their vital signs measured. Regular monitoring of vital signs such as Body Temperature, Pulse Rate, Blood pressure, etc., are essential as they are primary indicators of an individual's physical well-being. The early detection of changes in vital signs typically correlates with faster detection of changes in the cardiopulmonary status of the patient as well as up-gradation of the level of service if needed.

Field Programmable Gate Arrays (FPGAs) are semiconductor devices that are based around a matrix of configurable logic blocks (CLBs) connected via programmable interconnects. FPGAs can be reprogrammed to desired application or functionality requirements after manufacturing.

Interfacing 16*2 LCD, Temperature sensor and Pulse sensor with FPGA can be achieved by using any of the modern FPGA boards and software like Vivado for writing code either in Verilog or VHDL (Very-High speed integrated circuit Hardware Descriptive Language). To achieve this a EDGE Artix 7 development board is used. It has many modules like Wi-Fi module, Bluetooth module, USB port, JTAG/UART port, In-built Temperature sensor and LDR sensor. Even this in-built temperature sensor can be used to read the temperatures.

2. DEVICE INTERFACING

The 16*2 LCD, temperature and heart rate sensors will be interfaced with the Edge Artix 7 board. The input from the sensors will be given to the ADC's and then the required output will be represented on the display.

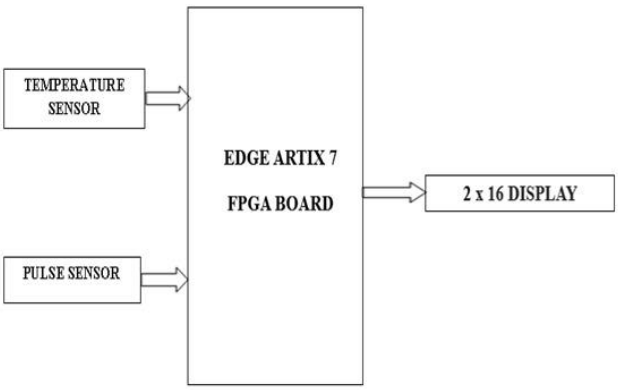

fig 1:Block diagram

2.1. Interfacing 2*16 LCD

A 16*2 LCD means it can show 32 characters in 2 horizontal lines. Which means it can display 16 characters per line. There are eight data lines to this display board which are data[7]- data[0]. To interface the LCD with Artix7 board connect the 16*2 lcd board with the board at the provided pins. To write the data on to the LCD make lcd_rw = '0'. After making this to send command signal give lcd_rs = '0' and for sending data lcd_rs = '1'. The data to the lcd is given as Hexadecimal data. Every character has its own hexadecimal code. Whenever rising edge of clock occurs the lcd_e (enable) is given one and the data is transferred to the eight data lines of the LCD display.

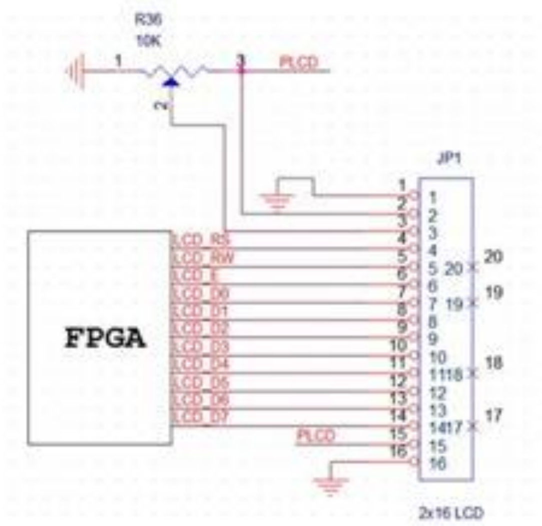

fig 2: FPGA 7 LCD Interfacing

The data which is given as input in the form of hexadecimal codes can be seen on the display. Since the Temperature and Pulse rate values changes continuously, in the code the data which is being given to the LCD will be set in a loop so that every time after a specific amount of time the data will be changed, so the changes in the display can be seen.

2.2. Temperature sensor

The temperature sensor LM35 is used. LM35's output is in the form of voltage(analog output) which is proportional to the temperature. For every centigrade rise in temperature we can see a change of 10mv in the output of LM35. For example if the output form the sensor is 300mv then the temperature is 30°c(300mv/10 = 30). The pin configuration is as shown in the figure 3.

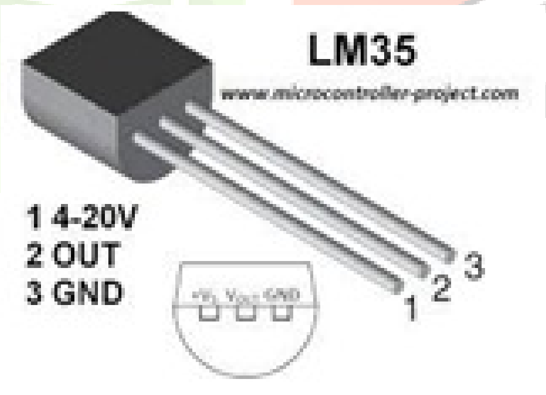

fig 3: LM35 Sensor

The FPGAs process digital data. So we have to use Analog to Digital converter for this purpose but the Artix 7 board has in built ADC. The ADCs have a nominal analog input range from 0V to 1V. In unipolar mode (default), the analog inputs of the ADCs produce a full scale code of FFFh (12 bits) when the input is 1V. Thus, an analog input signal of 200 mV in unipolar mode produces and outputs code of 0.2/1.0 × FFFh = 819 or 333h. The on board temperature sensor has a transfer function.

$$\text{Temp } (°C) = (\text{ADC Code} \times 503.975 / 4096) - 273.15$$

To use the on board temperature sensor connect jumper between 7 & 9tn pin of J13. The output voltage of this sensor is digitized by the ADC to produce a 12-bit digital output code (ADC code). The temperature measurement result is stored in the status registers at DRP(dynamic reconfiguration port) address 00h. An algorithm to check whether the temperature is normal or not is as given below.

2.2.1 ALGORITHM FOR TEMPERATURE SENSOR

```
Input: Temperature_sensor
Output:  red_led, green_led, yellow_led
set internal signal value with 8 bits

if Temperature_sensor = '1' then
      ADC input = Temperature_sensor output
            value = ADC output/10
end if

if value > '36.6' and value < '37' then
      green_led<= '1'
elsif value< '36.6' then
      yellow_led<= '1'
else
      red_led<= '1'
end  if
```

As given in the algorithm the three led's i.e. red green and yellow indicates the high, normal and low temperatures respectively. The temperature from the on board sensor can be observed in XDC monitoring after connecting the board to the system, which will give the graph of the temperatures.

2.3. HEART RATE SENSOR

The pulse sensor, SEN11574 is used for measuring the heart rate from the user. It's a biometric pulse rate sensor. It's operating voltage is +3.3v – 5v. The output of the sensor is pulsating signal, which is similar to the heartbeat. The sensor has an inbuilt amplification circuit. The pulse sensor pin configuration is as discussed below.

fig 4: Pulse Sensor (SEN11574)

The sensor has 3 pins namely GND, Vcc, signal. The signal is a purple coloured wire which is given as input to the XADC or to one of the ADC pins. Measuring of the heart rate continuously depends on the internal clock. A counter is designed to count the pulse for 15 seconds. And then the obtained count is multiplied with 4 to get the Beats per Minute (BPM). Since multiplication is somewhat difficult process the obtained count value is converted to its equivalent binary value and then left shifted by 2 bits which is equal to the multiplication by 4. Algorithm for pulse rate sensor is as given below.

2.3.1 ALGORITHM OF HEART RATE SENSOR

```
Input: clock, pulse_sensor
Output: pulse_led, high_led, low_led, normal_led
set internal signal pulsesensor_counter with 8 bits
set internal signal pulse_count_15 with 8 bits
for every tick of the clock
if pulse_sensor = '1' then
      pulse_count_15<=pulse_count_15+1;
      pulse_led<= '1';
else
      pulse_led<= '0';
end if;
if counter = "111" then –15 seconds
      sensorcounter<= pulse_count_15 left shit by 2 bits;
else
      sensorcounter<= (others=> '0');
end if;
```

```
if sensorcounter> "01100100" – decimal 100
      high_led<= '1';
end if;
if sensorcounter< "00111100" – decimal 60
      low_led<= '1'
end if;
if sensorcounter> 60 and sensorcounter<100
      normal_led<= '1'
end if;
end for;
```

The heart rate is indicated with 3 different LED's high_led, low_led, normal_led. Whenever the heart rate is low it is indicated with low_led, same as with the remaining led's also.

3. RESULTS

The below figure indicates the change in the temperature while detecting the cold and hot objects.

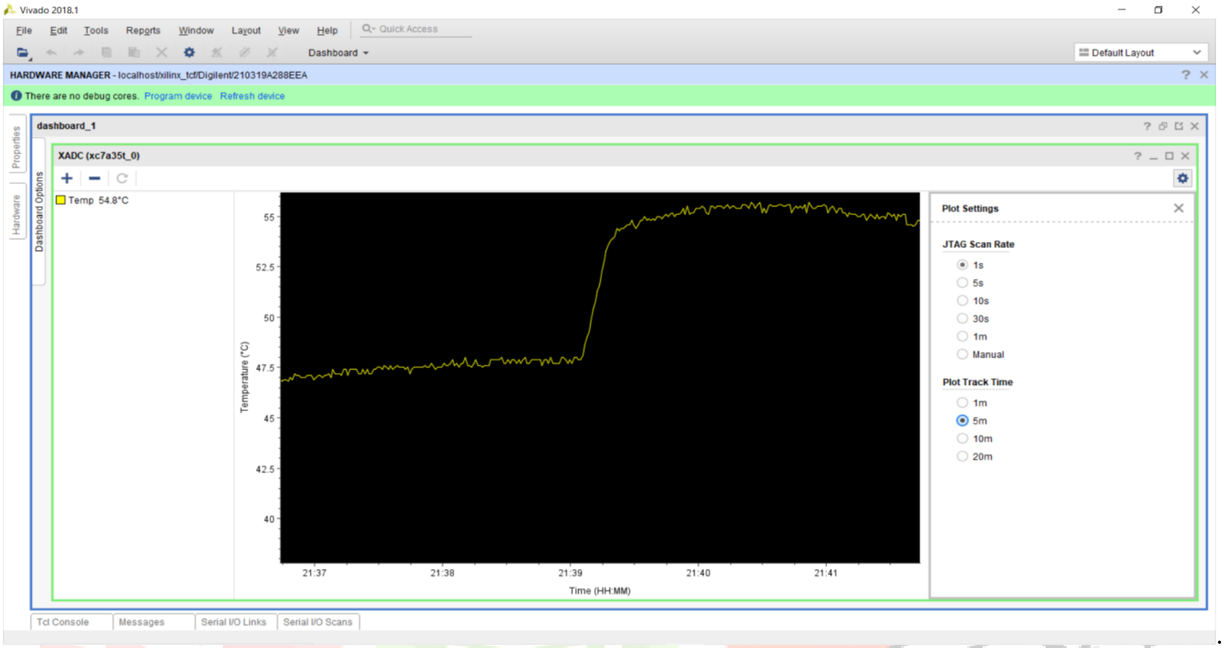

fig 5: LM35 Output

Similarly the following is the result obtained when the LCD display is interfaced with FPGA.

fig 6:LCD display output

4. CONCLUSION & FUTURE SCOPE

This project will be even more effective when the heart rate sensor is also interfaced. This will revolutionize the medical field. This device can be implemented as an android application, which can be operated from anywhere by just using an android cell phone with touch screen. For this, the user will simply touch the screen and it will show the Heart Rate count, Blood Pressure measurement etc.

5. REFERENCES

[1] V.A.Pedroni, "Digital Electronics and Design with VHDL", 4 ed., MORGAN KAUFMANN PUBLISHERS, USA, 2008.
[2] TigorHamonangan.; Nasution.; LukmanAdlinHarahap, "Predict the percentage error of LM35 temperature sensor readings using simple linear regression analysis", IEEE Xplore, 2020.
[3] F.M. Coetzee, and Z. Elghazzawi, "Noise-resistant oximetry using a synthetic reference signal," IEEE Trans. on Biomedical Engineering, vol. 47, pp. 1018-1026, August 2000.
[4] Buist M, Bernard S, Nguyen TV, Moore G, Anderson J.Association between clinically abnormal observations and subsequent in-hospital mortality: a prospective study. Resus-citation 2004; 62: 137–141.
[5] MamadyKebe.; Rida Gadhafi.; Baker Mohammad.; MihaiSanduleanu.; Hani Saleh.; Mahmoud AL-Qutayri. Human vital signs detection methods and potential using radars: A Review. Multidisciplinary Digital Publishing Institute, 6 march 2020 https://www.mdpi.com/1424-8220/20/5/1454
[6] Vital signs assessment. Available online :https://www.statpearls.com/ArticleLibrary/viewarticle/4180