Health Care Monitoring System Using FPGA Interface

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***Abstract*- Health has prime importance in our day-to-day life. This project aims at developing a system which gives body temperature and heart rate using temperature and pulse sensor respectively. These sensors are interfaced with Field Programmable Gate Array (FPGA). FPGA has been used here instead of microcontroller as it is reconfigurable and necessary hardware can be added as and when required. When the parameters are above the threshold value, buzzer is ON. And values are displayed on LCD. Here used FPGA will help to reduce power consumption.**

***Index terms*- Field programmable gate array, Health-care monitoring, Heart beat sensor, Temperature sensor.**

I.INTRODUCTION

Health monitoring is the major problem in today's world. Due to lack of proper health monitoring, patient suffer from serious health issues. Changes when observed at regular interval of time can be stated as health monitoring. Identification of fluctuations occurring in health parameters can also be stated as health monitoring [1].Health parameters such Heart beat and temperature can be measured using sensors.

The system proposed in this paper is used for monitoring of health parameters. Health care monitoring system measures the parameters like Temperature and Heartbeat. With the help of heart beat sensor heart beat is measured. Heart beat is pulsation of the heart. Heart rate should be between 60 to 100 bpm. Temperature sensor measures body temperature. Normal body temperature is 37ºC. Pmod tmp3 temperature sensor is used for temperature measurement having range from -40ºC to 150ºC. Output of Pmod tmp2 is in digital form. All the values measured by sensor will be given to the FPGA.

Measured value will be display on LCD. If the value of temperature and heart rate is greater than threshold value buzzer will indicate danger.

II. LITERATURE REVIEW

Various types of research works have been done and still going on related to health care monitoring. Some are listed below:

Vaibhavi Bhelkar, focuses on A patients health monitoring device based on FPGA has been developed for monitoring parameters such as heartbeat, temperature and motion. When the parameters are above the threshold value, email, message will be sent directly to the doctor for remote monitoring [1].

Nitin P. Jain, et al. have designed wireless, remote patient monitoring system and control using feedback and GSM technology which is used to monitor the different parameters of an ICU patient remotely and also control over medicine dosage is provided. Measurement of vital parameters can be done remotely and under risk developing situation can be conveyed to the physician with alarm triggering systems in order to initiate the proper control actions [2].

Abhilasha Ingole, et al. Focuses on development of system where basic parameters like body temperature & heart beat is monitored and is transferred on webpage to make it locally visible for users. The system is design to read the body temperature and heartbeat of patient at run time. The system mainly focused on collecting the physical parameter and then that information is made available for multiple users. The results or the collected information is sent to multiple users who share same area network [3].

Aung Soe Phyo, designed wireless sensing element network for remote patient monitoring with advances in electronic circuit miniaturization and micro-electromechanical systems , and also discussed about wear able sensing element nodes is accustomed acquire physiological signals from patients body and transmit them to a foreign location which may be accessed by the doctors [4].

H. Ting and W. Zhuang, have introduced Bluetooth enabled device also used for in-home patient monitoring. A Bluetooth enabled in-home patient monitoring system was proposed to detect Alzheimer disease. In the patient's home, patient carries the Bluetooth enabled monitoring device and an access point is placed in each room then all are connected to the local database. Once the connection is established the current location and movement of the patient are traced and stored in a local database with the help of Bluetooth communication [5].

Juan M. Corchado, et al. focused on wireless Sensor Network which is used for in-home patient monitoring. The objective of this model was that resources to be distributed among multiple WSN and to execute over different wireless devices independently. Various networks from different wireless technologies can also be connected using this model [6].

Muzaffar Rao, et al. have introduced wireless body sensor networks sensors which continuously monitor human physiological activities using medical sensors, for example; blood pressure, body temperature and electrocardiography (ECG). A WBSN can be used to develop a patient monitoring system [7].

So from survey we can conclude that continuous health monitoring can save up to 60% of human lives through timely detection to prevent heart attacks. And further using programmable components to develop a system makes device cost effective and convenient. Hence health monitoring system using FPGA would contain a low-cost, analog to digital converter which is used to transform an analog signal into a digital one.

III. METHOD

A. Health Parameters

Different health parameters can be measured for health care monitoring. Vital parameters such as temperature and heart rate can be measured.

Ranges of parameters are:

Sr No.	Parameters	Range	Unit
1.	Body Temperature	36.1-37.2	^{0}C
2.	Heart Beat	60-100	bpm

Figure 1: Specification of parameters.

B. Sensors and Components used

1. Heart beat sensor:

Heart beat sensor is designed to give output of heart beat when a finger is placed on sensor. It starts working when LED on top side will starts blinking with each heart beat. To see the sensor output, output pin of sensor is connected to FPGA. The heartbeat sensor used here works on the principle of light modulation. It measures the change in volume of blood through any organ of body which causes a change in the light intensity through that organ. The flow of blood volume is decided by the rate of heart pulses. Heartbeat sensor is used to give digital output of heartbeat when finger is placed on it.

Figure 2: Heart Beat Sensor

2. Temperature sensor:

There are various temperature sensors are available but we are using Pmod tmp3 temperature sensor as it is compatible with FPGA. Pmod tmp3 uses I2C protocol for communication. Sensor is put in contact with body and it senses body temperature.

Also it doesn't require external calibration. Range from -40 0C to 150 0C.

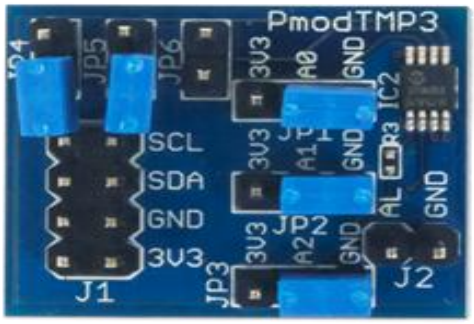


Figure 3: Pmod Tmp3

3. Pmod CLP :

The Digilent Pmod CLP is a 16x2 character LCD module display up to 32 different characters. The Pmod CLP utilizes a Samsung KS0066 LCD

controller to display information. The module can execute a variety of instructions, such as erasing specific characters, setting different display modes, scrolling, and displaying user-defined characters. Here Pmod CLP will display temperature and Heart rate.

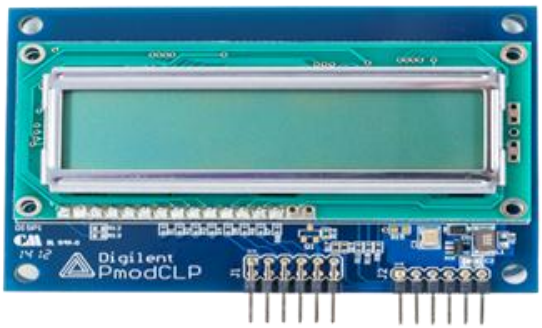


Figure 4: Pmod CLP

4. Field Programmable Gate Array:

The Field Programmable Gate Array (FPGA) is a family of reconfigurable hardware, where Field Programmable means the operation changing capability in the field, and Gate Array means the construction of basic internal architecture of the device. FPGA can be programmed with VHDL (Hardware Description Language).Here FPGA is used for data processing.

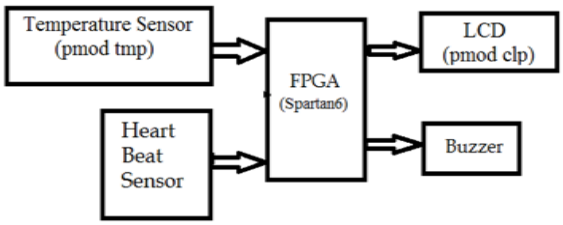
The main advantage of the FPGA is the ability to reconfigure it after it has been manufactured. This helps to fix bugs easier and more quickly. FPGA also has lower non-recurring engineering costs. FPGA being reprogrammable, necessary hardware can be added when required. FPGA board used here is Nexys3. The Nexys 3 is a complete, ready-to-use digital circuit development platform based on the Xilinx Spartan-6 LX16 FPGA. The Spartan-6 is optimized for high performance logic, and offers more than 50% higher capacity, higher performance, and more resources as compared to the Nexys 2's Spartan-3 500E FPGA.

System is coded by using VHDL this code is dumped in FPGA development kit by using Xilinx ISE tools The key advantage of VHDL is that it allows the behavior of the required system to be described and verified before synthesis tools translate the design into real hardware. VHDL is a dataflow language in which every statement is considered for execution simultaneously.

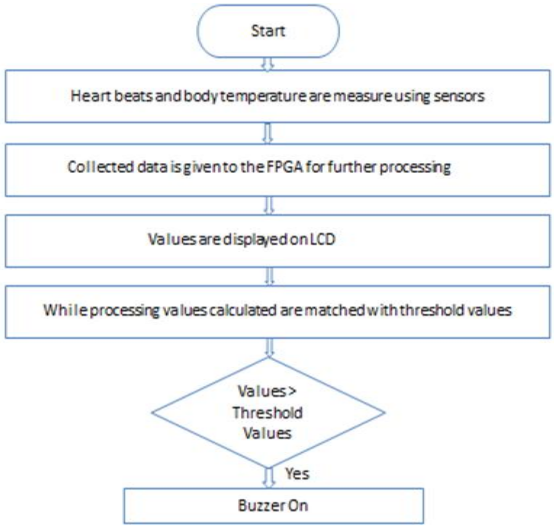
Figure 5: FPGA

IV. PROPOSED SYSTEM

Figure 6 shows the proposed system. In proposed system, temperature sensor & heartbeat sensor are used to measured patient's health parameters. Using Pmod Tmp3 we are monitoring body temperature and using heartbeat sensor we are measuring heartbeats. The data collected by sensors is given to FPGA. The signals or values are processed using FPGA and checked whether the values are normal or changing in accordance with the threshold values. These values are displayed on LCD (Pmod CLP) and buzzer is used for critical condition.



V. FLOWCHART



VI. CONCLUSION

Our project work is giving the opportunity to monitor patient and alert family members when health parameters are above threshold values. Our project will reduce health care cost for monitoring patient. Health parameters such as temperature and heart beat can be measured using our project. It can be further extended using IOT so that data can be access through website.

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