ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 5, Issue 9, September 2016

Real-Time FPGA Based Health Monitoring System

Abhijit Shivdas Mule[1], Prof S. S. Vasekar[2]

***Abstract* -- For critical patients it is a primary need to monitor the various body parameters on regular basis to avoid any sudden critical situations. Right now, few hospitals have digital display devices which monitors and display the body parameters of critical patients. But it requires continuous manual observations.. The proposed system in this paper uses FPGA as main controller, which will provide the instant alert if any vital parameters of the body goes beyond the normal value, hence it will notify the concern doctor to take the correct action. We are using wireless sensor for measuring the heart rate data from ADC and transmitting sensor values on Bluetooth module. This Bluetooth module is configured to be paired with an Android base Smartphone. The received sample data plot on android application.**

Index Terms **- FPGA, Android, Bluetooth module, Embedded System, Sensor.**

I. INTRODUCTION

Now days, smart phones is the basic need of many people's day to day life due to their features such as wide potentiality, versatility, low cost , low power and ease to handle. This smart phone devices are interfacing with other electronic equipment such household security systems and health monitoring systems. Due to the wireless capabilities of smart phone devices it is possible to control other embedded devices and to monitor various sensors including wireless sensors. The example of system is that when people go to remote area and they face health related problem and doctor may not be able to analyze the patient problem, in such case telehealth play important role between doctor and patient. The doctor gets health related data of patients via its smart phone when patient wear the sensor part. The doctor can monitor patient problem and suggest the required medication to the patient. The use of this system is that doctor can easily manage the patient problem related to health at any remote location and at any time.

This proposed system presents an online health monitoring system with the real time communication between the FPGA and an android. The design of system is ideal for application that requires data of heart rate of patient and communicating instantaneous measured value. For this purpose, real time communication has been established between the FPGA Spartan-3 board and the android smart phone using Bluetooth. The Android operating system is open source in the market and the most common operating system used in the mobile market nowadays. Key benefits like easy to use and open source make it very efficient while developing the applications. This project is the combination between software and hardware in order to implement the wireless data communication.

II. H/W AND S/W SYSTEM DESIGN

A. Hardware

- Sensor
- Spartan-3 FPGA
- Bluetooth serial module
- Android Smart phone

B. Software

- Xilinx ISE
- Eclipse

III. PROPOSED SYSTEM

The figure below (1) shows the proposed schematic block diagram of the system. The proposed systems consist of sensors, FPGA, Bluetooth module and an android operating system smart phone.

The implementation of the system includes an embedded system with the sensor interfaced to the controller of the system. The main controller which is used here is a FPGA based to measure the pulse rate parameters. Figure shows Block diagram of system implementation. As per the application the pulse sensor is input to the FPGA. Means pulse sensor interface with FPGA .The output of pulse sensor is in the form of digital signal is directly given to FPGA without any conversion of the signal. The data is the sent to UART where the Bluetooth module is connected. This Bluetooth module works on AT commands and it is configured to be paired with the android based smart phone.

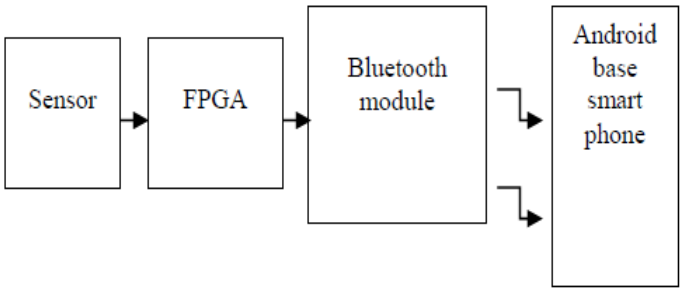

FIGURE1
SYSTEM BLOCK DIAGRAM

At the android smart phone end, we have developed android application which is user friendly for people and the waveform of heart rate is shown on the application of android smart phone. So they can easily access data anywhere anytime.

A. FPGA

Here FPGA is used as an embedded system. The sensor is interface with FPGA Spartan -3. Xilinx ISE Software is used for the implementation purpose. The most important features of FPGA are capability of high speed parallel processing and build a hierarchy design, which is very powerful and fast enough to fulfill the requirements of the proposed system, which makes it more preferable over the general purpose micro-processors or micro-controller and also the re-configurability feature provides and additional advantage for future development. FPGAs are reprogrammable silicon chips at the highest level.

B. Bluetooth module

Bluetooth is one of the technology which offers short distance communication. The advantage of Bluetooth is low consumption which make suitable for mobile devices. The sensor data from the board is then sent to the UART where the Bluetooth module is connected. This Bluetooth module works on AT commands and it is configured to pair with the smart phone which runs on an android operating system.

C. Android

Android is an operating system (OS) which is developed for mobile devices by Google, and designed basically for touch screen mobile devices such as a tablets and smart phones. At the other end of the proposed system i.e. on smart phone side, an android application for end user i.e. doctor/ nurse which shows the waveform of Pulse rate on an android smart phone has been developed. So they can easily access data anywhere and anytime and can get the details of vital parameters for critical patient.

IV. IMPLEMENTATION

A. Algorithm

1. Start.
2. Reading Sensor values from ADC.
3. Preprocessing / Calibration on sensor reading.
4. Transmitting sensor values using serial protocol on Bluetooth module.
5. Pairing transmission Bluetooth module in Android Application.
6. Reading values/Samples.
7. Plotting received samples in in Android Application.
8. Stop.

V. RESULTS

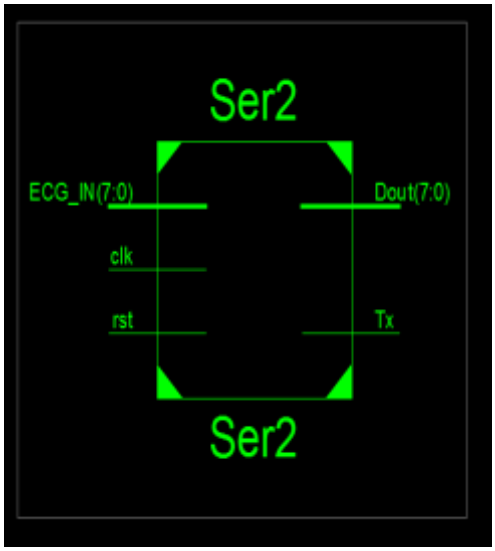

FIGURE 2
RTL SCEMATIC

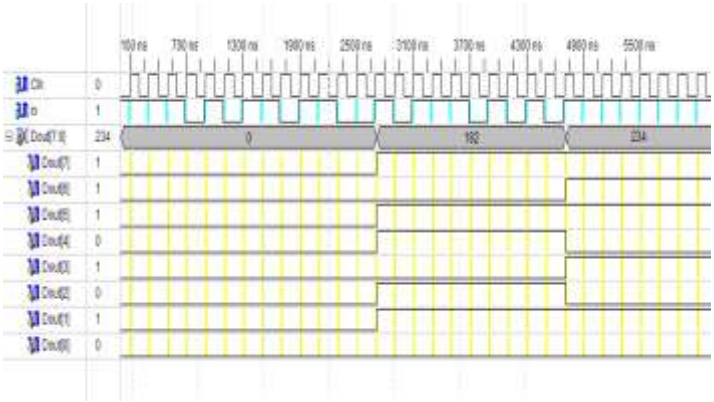

FIGURE 3
TESTBENCH WAVEFORM

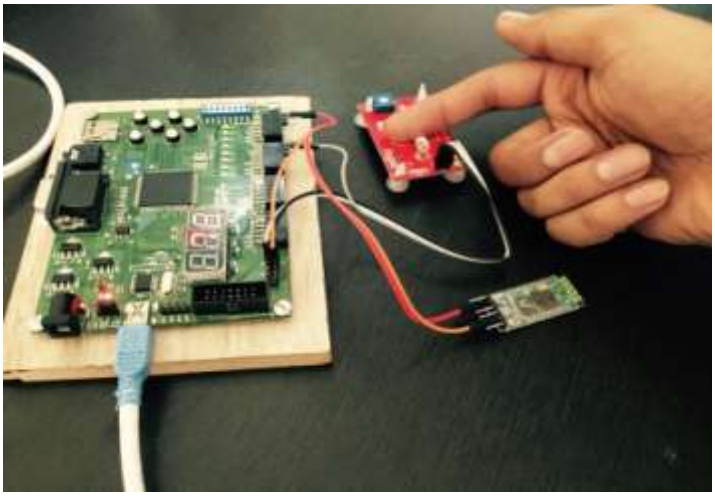

FIGURE 4
ACTUAL SYSTEM IMPLEMENTATION

TABLE 1
DEVICE UTILIZATION SUMMARY

Parameter	Value (Out of)	Percentage (%)
No of Slices	55 / 704	7
No of Slice Flip Flops	55 / 1408	3
No of 4 input LUTs	106 / 1408	7
No of IOs	19	
No of bonded IOBs	19 / 108	17
No of GCLKs	2 / 24	8

TABLE 2
TIMING ANALYSIS SUMMARY

Parameter	Value
Minimum period	7.321ns (Maximum Frequency: 136.588MHz)
Minimum i/p arrival time before clock	5.212ns
Maximum o/p required time after clock	5.531ns
Maximum combinational path delay	5.900ns

VI. CONCLUSION

The effective Real time communication established between FPGA and android operating based smart phone can serve as the revolution in the health monitoring systems in the coming days. The proposed system provides the key benefits to the health monitoring systems which will make it more advance and precise to measure the vital parameters of the Critical patient and which will save the millions of lives.

VII. ACKNOWLEDGEMENT

Author would like to thank Prof. S. S. Vasekar for their valuable suggestions and the guidance throughout the project work. Author also would like to thank Prof R. P. Patil and HOD Dr. S. K. Shah for their valuable support and conceptual guidance.

REFERENCES

[1] Sunil B.Somani, Virendra V.Shete, Piyush V.Savaliya, “FPGA based RT Bluetoth Communication for Household security, Telehealth and industrial safety” IJIRCCE, Vol-3,Issue 8 August-2015.
[2] Sunil B.Somani, Virendra V.Shete, Piyush V.Savaliya, “A Bluetooth Tele health, Household industry safety and security Realization byAndroid Smartphone”IJARCCE ,Vol-4, Issue 8, ,June 2015.
[3] J.Udaykumar, M.Lakshmipathy, “Patient Health monitering Using RT Bluetooth Communication between Embedded system and an andriod phone” IJSETR ,Vol-03, Issue.49, Pages 9980-9982, December -2014.
[4] P.Girish, B.V.Ramana, Dr G.M.V Prasad, S.V.S.M.Madhulika, “Wireless RT health monitoring system built with FPGA and RF n/ws”IJRCCT,Vol-3,Issue 11, Nov-2014.
[5] Mrunali M.Lambat, Santosh C.Wagaj,”Health Monitoring system”, IJSR, 2013-14.