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FPGA Based Multifunction Wireless Medical Surveillance System

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Abstract: The architecture introduced in this paper is based on wireless communication. Here we have used wireless communication protocol and Radio Frequency (RF) at the transmitter side. Where as arm processor and GSM module are at the receiver side. Field Programmable Gate Array (FPGA) chip is the main part of the system. This controls all the operation of our system. This system is called FPGA based wireless medical surveillance system. This is capable to do lot of function with help of field programmable gate array. With the help of Data Acquisition Module this system receives real time parameters such as Heart beat pulses, Pressure, Temperature etc. These real time parameter signals can be transmitted in the network. Through the wireless receiver these signal are received at the server i.e. community hospital. The doctor can see the real time parameter signals by Web or mobile.

Keywords*:* GSM, Wireless, RF, FPGA.

I. INTRODUCTION

The facility for the patients is limited due to typical instruments are used for monitoring real time parameters in medical field. At every moment it is not possible for patient to go to the hospital and take a service. Here we are introducing a system helps in taking care of patient by themselves as well as doctor. Where not only they measure parameters related to body but also they can see it.

At the same interval hospital and doctor can also touch up with patients health updates and they can give related instruction after they come to dignose. The system which we have made is helps patients to take care of themselves. The wireless devices which are use in these days these are having 1) High working performance.2) Able to tolerate faults.

Medical errors are eliminated due to the wireless devices. So the workload at the nurse station of the hospital is reduced. This increases ability of staff because now they can use there time for some important work.

We are introducing here surveillance system means it take corrective actions if output is above and below threshold. This system is multifunctional because FPGA takes data, process that data, analyse it, calculate the results and display them.

The FPGA used here is Spartan –III.whose hardware is easily available. Its programmability gives us facility in design upgrades for this no hardware replacement necessary.

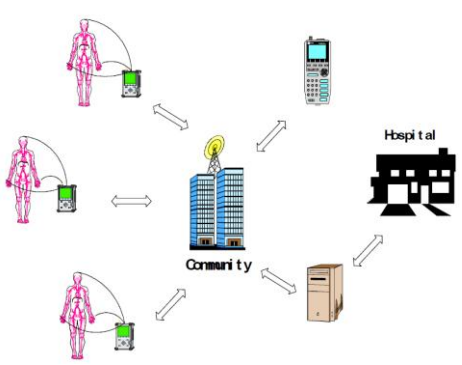
There are some drawbacks of wireless systems used in medical field due to there size, power consumption and interferences. Also they do not have compatibility with medical standards.

We have two sections of our system
1) Transmitter
2) Receiver

Transmitter: it consists of first block is sensor to sense parameters of the patients. Here we have used heart beat sensor. Second one is ADC 0808. This is used for conversion of analog input into digital output. Amplification and sampling is also done since signals are weak. Next block is FPGA who is heart of all system. Next one is buffer and wireless transmitter with encoder from where we are transmitting data of the patient at the receiver.

Receiver: at the receiver side wireless decoder is there. Armcontroller does collection of data and gives it to server as well as GSM module. Where this module sends it to the mobile of particular doctor whose mobile no is feed in programming.

Here monitoring is done at the patients terminal. Wireless base station is having FPGA which controls all the operation. Server is the pc of hospital at nurse station where we can see data of all patients.



Block graph of system function.

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II.BLOCK DIAGRAM OF PROPOSED WORK

Figure 2. Shows the block diagram of FPGA based multifunction wireless medical surveillance system.Different types of sensors connected to human body; this sensor senses the human body and produces the analog output. This analog output is connected to High speed 8 channel ADC 0808. ADC performs the analog to digital conversion and the digital data to FPGA. FPGA kit collects all the data at high rate, to perform high speed operations and it verifies the digital data and stores in it.

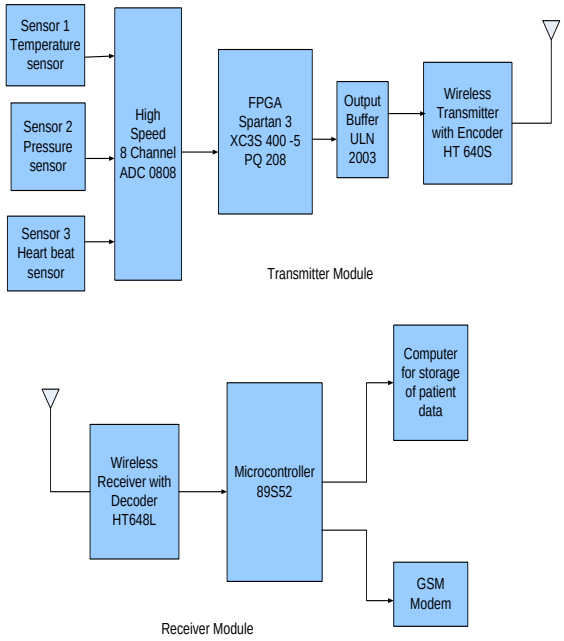

Fig 2: Block Diagram of Proposed work.

Output buffer checks the levels of the data, if it is same then send it to wireless transmitter. Wireless transmitter transmits the data to receiver with the help of FPGA. Receiver will send received information to microcontroller 89S52. Microcontroller collects all the data from receiver and Give it to computer.

The heart beat sensor is used in our system is operates on principle of it produces digital output of heart beat when finger is placed on it. This digital output of the sensor connected to FPGA which measures the Beats per Minute rate.

ADC0808 it converts the analog input of sensorinto digital form**.** This output of ADC given to the FPGA for further processing.

GSM module is used to send updates of patient as well as emergency message to the doctor. This message is send on mobile so quick service is available to the patientby the doctor.

III. RESULTS

RTL schematics of data acquisition system and UART module are shown in figure 3 and figure 4 respectively.

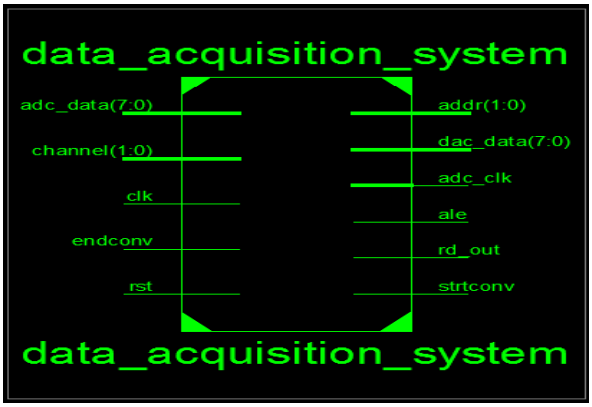

Figure 3: RTL schematic of ADC.

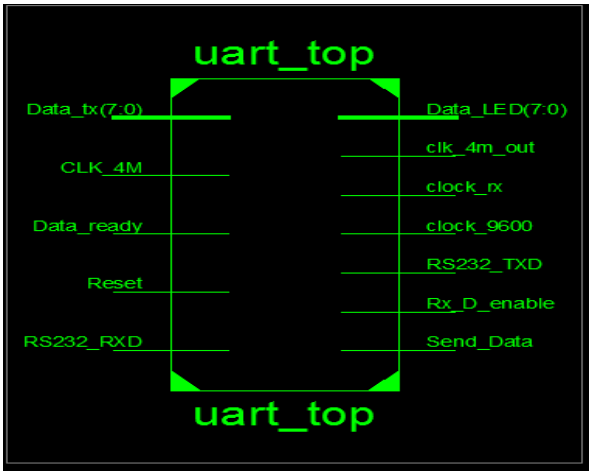

Figure 4: RTL schematic of UART module.

Internal RTL schematic of UART module is shown in figure 5.

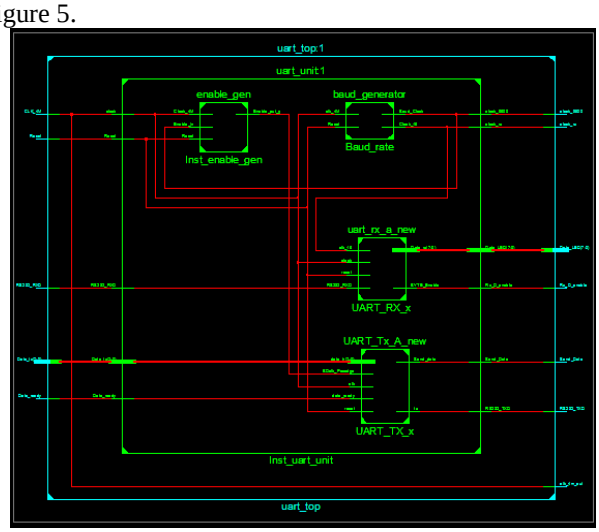

Figure 5: Internal RTL schematic of UART module.

Simulation waveform for ADC and UART are shown in figure 6 and 7 respectively. The simulation results are obtained using ModelSim.

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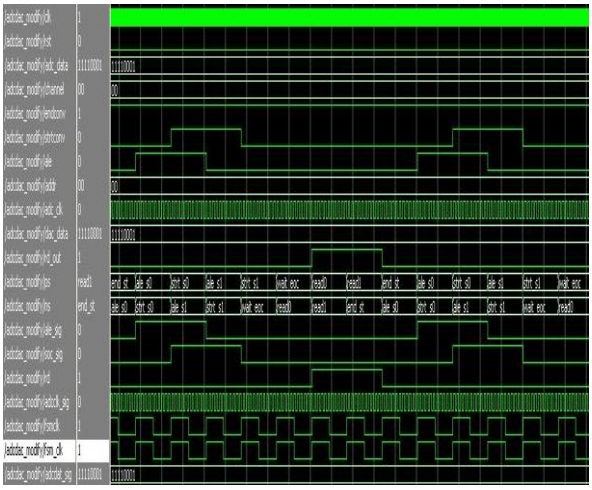

Figure 6: Simulation waveform for ADC.

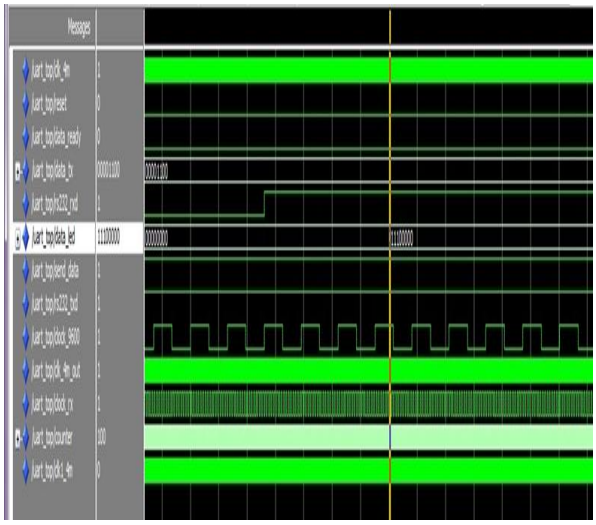

Figure 7: Simulation waveform for UART module.

Figure 8 shows the hardware implementation on Spartan 3E, TQ144 FPGA board.

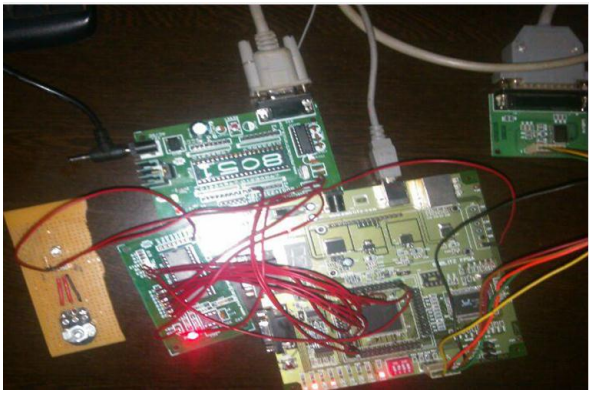

Figure 8: hardware implementation FPGA.

IV. CONCULSION

In this paper presents a new scheme which is very useful to take care of patient by themselves as well as by doctor. This wireless medical surveillance system gives accurate readings to server as well to doctor having mobile. Experimental results show that the system gives excellent performance. It gives lot of benefits. This is just start of improvement of current medical conditions. The patients who are alone and old for them this system is like wish come true. This scheme can be a good solution for taking care of old people and ideal for wireless transmission. Of course, we need to improve the system for a big place.

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