Real Time Low Power Bluetooth Communication between FPGA and Android System

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ABSTRACT:

Android based smartphone are first preference of people as these devices are rooted with large compatibility and mobility, whereas they are low cost devices. FPGA based embedded systems have faster processing capability, low power usage and is reconfigurable as per need. Applications in areas essentially telehealth and household security generally need wireless communication among low-power embedded systems and personal smartphones. The proposed paper introduce the design of the real time remote monitoring using Bluetooth between FPGA based embedded system and android smartphones. This system essay a complete higher processing capability and lower power and user friendly way of 24 hours real time remote monitoring for tele health, household security and industry safety using short messaging service.

Keywords: android, FPGA, Bluetooth, wireless communication

1. INTRODUCTION:

Wireless communication is commonly use in fields such as telehealth, household security and industrial safety etc. Android operating system based smart phones are very popular nowadays because of its simplicity and is open source to create application. The use of FPGAs in such systems gives faster processing capability, low power usage and is reconfigurable . The FPGA based system can watchdog surrounding by using different sensors. For wireless carrier Bluetooth communication system is suitable as it has the low power requirement . This paper presents a design and implementation method that creates a Bluetooth connection between an FPGA and a smartphone using an Android operating system (OS). This system is very effective for reporting and surveillance with advantages like user friendly interface and is comfortable to end user.

Nowadays, human health is unpredictable because of many reasons. For an example, a person may need to inform their close one for medical help during emergency and in case it is not available at that time, it may lead to serious issue for that person's health. Furthermore if a person is away from home and any fire accident happen at that time such system can alert the person and autonomously contact the fire brigade. In manufacturing Industry it requires to maintain the temperature and pressure standards to ensure that there is no defect in the product, in such cases this system alert the employee if temperature and pressure crosses its limits. The design is suitable for applications that need real time monitoring of data such as health monitoring , industrial safety and household security and communicating the measured values immediately.

2. LITERATURE SURVEY

After surveying on Different Technologies of wireless communication system, it concludes that a Bluetooth telehealth, household security and industry safety implementation by android smart phone system can be as follows:

2.1 FPGA: A **field-programmable gate array** (**FPGA**) is an integrated circuit capable of high speed parallel processing and can be bought off the shelf and reconfigurable by designer. Each reconfiguration takes only a fraction of a second, an integrated circuit able to perform a completely different function. These features of FPGA makes it preferable over traditional microprocessors. High Performance, low Time to Market, low Cost, high Reliability, and Long Term Maintenance these are the added advantages of FPGA.

2.2 Bluetooth: Bluetooth is very fast growing wireless technology which offers short distance communication. Due to this both Bluetooth software and hardware are very popular. Bluetooth consumes low power which make suitable for mobile devices. It works in the license free 2.4 GHz band and having data rates up to 600Kbps.The Bluetooth has high speed margins, low power consumption, wide operational range, freedom of transceivers position, and simplicity.

2.3 Android: In this system Android application is developed to read and display the data of health of the person, home and industry to the end user in real-time. Android is a mobile operating system created by Google, based on the Linux kernel. Furthermore, this open source code allows the software to be modified with ease.

3. SYSTEM DESIGN

From the referred papers it is observed that as FPGA is reconfigurable each time, it is used as principle controlling device. Because of this we found that use of FPGA than traditional microprocessor can increase the processing capability of our system. Besides of this we are using Bluetooth as communication device other than GSM, GPRS because of its low power usage and it is most suitable while transferring data between two or more devices that are near each other when speed is not an issue. Also it is best suited for low bandwidth applications as it has standardized protocol and low interference.

The figure 1 shows the block diagram of system architecture. The system consists of different subsystems like various sensors, FPGA, Bluetooth module and android smart phone. In this embedded system sensors are interfaced with central controllers. The controller used is FPGA (SPARTAN XC3S400) while parameters to be measured are pulse rate, temperature and pressure. As per the required application input from sensors are applied to 12-bit ADC MCP3201. The MCP3201 ADC operates over a voltage range (2.7V -5.5V). When analog signal is converted to digital it is processed by FPGA. If the temperature is to be measured after processing it by FPGA it shows temperature values. Likewise, pressure can be measured. Pulse sensor can be directly given to FPGA without conversion as it has output kind of digital signal.

Trough UART information is sent to Bluetooth module. The module is then paired with android phone and it works on AT commands. Android application is created at the at the smartphone end so the person can access it without any difficulty. Short message services (SMS) is the added advantage on android phone for wider range communication as Bluetooth can send the data at limited distance.
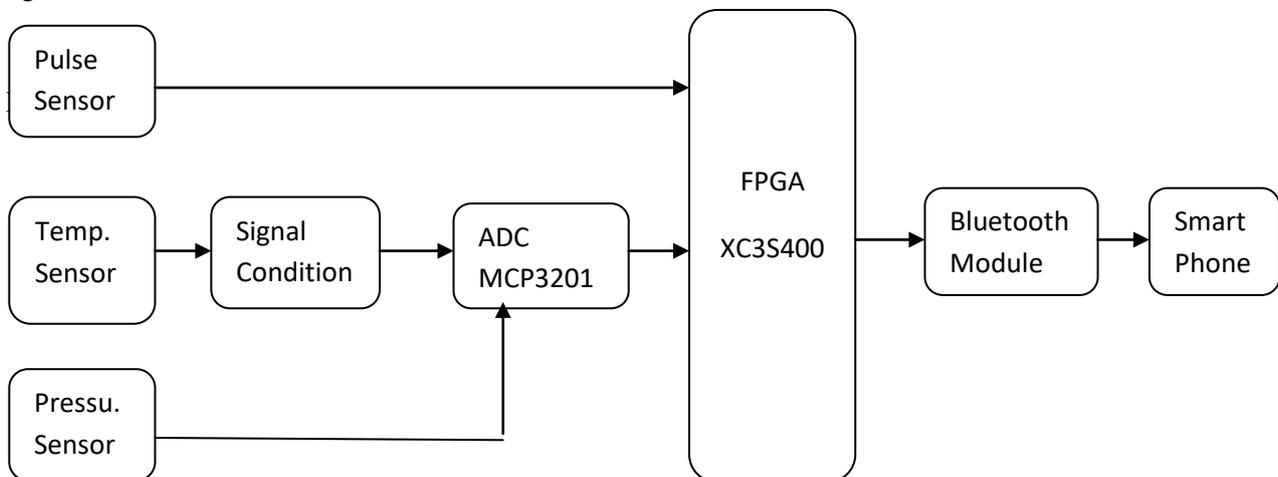
Figure 1. Block Diagram of System Architecture

3.1 Hardware & Software Requirement:

Hardware:

- Spartan XC3S400 FPGA
- Bluetooth Serial Module
- IR Pressure Sensor
- LM35 Temperature Sensor
- Android Smart Phone

Software:

- Xilinx ISE, VHDL Language
- Eclipse for JAVA

CONCLUSION:

It is a flexible embedded system with an FPGA platform that can communicate data wirelessly to an Android phone through Bluetooth. The system implementation primarily focuses on Real time low power Bluetooth communication between FPGA and android system for applications like telehealth, household security and industry safety where 24x7 monitoring is required. The heart of the system is FPGA which is having high processing capability, low power usage and reconfigurable for future work. All these features make faster connection between the devices which make setting a easy connection for telehealth, household an industry applications.

REFERENCES

[1] Samer Hawayek, Claude Hargrove and Nabila A. BouSaba, "Real Time Bluetooth Communication between an FPGA Based Embedded System and an Android Phone," in IEEE conference, Jacksonville, United States, 2013, pp. 1-4.

[2] Chalivendra G, Srinivasan R, and Murthy N. S, "FPGA based reconfigurable wireless sensor network protocol," in International Conference on Electronic Design (ICED) 2008.

[3] Sweatha K N, Poornima M, Vinutha M H –"ADVANCE HOME AUTOMATION USING FPGA CONTROLLER",International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 7, July 2013.

[4] Piyush V. Savaliya, Sunil B. Somani, Virendra V. Shete- "A Bluetooth Tele Health, Household Security and Industry Safety Realization by Android Smartphone",International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 6, June2015.

[5] J.Udaykumar,M.Lakshmipathy- "Patient Health Monitoring using Real-Time Bluetooth Communication Between and FPGA Based Embedded System and an Android Phone", International Journal of Scientific Research & Technology Research, Vol.03, Issue December 2014.

[6] Dhanabal R, Phanindra Varma, B.S.R., and Bharathi V., "Remote access of FPGA robot via internet, " in International Conference on Electronics and Communication Systems (ICECS) 2014.

[7] http://www.telehealth.philips.com/how_telehealth_works.html