FPGA based Real Time Low Power Bluetooth Communication with Android System

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ABSTRACT:
Real-time Bluetooth monitoring system which can used to boost the people’s health guarantee, Home security and industrial safety using android smart phone is presenting in this paper. This technology is primarily used to detect the pulse of patient, smoke level in home and temperature of the industry, the monitor data is received by end user using Bluetooth wireless communication device. Android based smartphone is the first choice of people as these devices are established 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 requirement. In this paper we introduce the design and implementation of the real time remote monitoring using Bluetooth between FPGA based embedded system and android smartphones. This system is very useful where 24 hours real time remote monitoring for reporting and vigilance is required. Advantages of this system is user-friendly interface and is comfortable to end user.

Keywords: Android, wireless communication, FPGA, Bluetooth

1. INTRODUCTION:

Nowadays, smart phones have become many people’s primary personal computing device due to their vast capabilities, low cost, and mobility. This pushes towards interfacing these devices with other electronics such as medical monitoring and household security equipment. By exploiting the smart phone’s wireless capabilities, a user is then able to control various other devices and monitor a wide array of sensors remotely. As an example, the advantages of this ability in telehealth applications are numerous. Remote medical monitoring let on patients to collect and view health related data while on the go, improving the quality of life of those asked to wear sensors for tests. This data is then easily accessed by health care providers, given that smart phones are easily synced with an online database that hosts a content management system (CMS). This has proven to lower health care costs, improve the quality of the care provided by offering 24 hour monitoring, and provide access to those living in remote areas or have trouble travelling to hospitals and clinics. And user needs or say demand for their comfort has been increasing day by day. Keeping this thing in mind here we are introducing a system.

2. LITERATURE SURVEY

This section gives incentive for the targeted research topic. With respect to the research field, some core topics, especially FPGAs, Bluetooth, and Android are described as follows.

2.1 FPGA:  Field-programmable gate array is an integrated circuit designed which can be configured by a customer after manufacturing – hence "field-programmable". The FPGA configuration is specified using a hardware description language (HDL), similar to that used for application specific integrated circuit (ASIC). FPGAs contain programmable logic components called logic blocks, and a pyramid of reconfigurable interconnects that allow the blocks to be wired together something like many logic gates that can be interconnected in different configurations. The FPGA can be used as the platform for the embedded system is a Xilinx Spartan 3E found on the Nexys 2 development board provided by Digilent.
2.2 Bluetooth: Both Bluetooth software and hardware are very popular because Bluetooth is very fast growing wireless technology offering short distance communication. The main advantage of Bluetooth is low power consumption, high speed margins, wide operational range, freedom of transceivers position, and simplicity. It operates in the license-free 2.4 GHz band and supports data rates up to 600Kbps.

2.3 Android: In this project a particular android app is developed to display status of health of the person, home and industry to the end user. Android is an open source operating system based on the Linux kernel. This open-source code permits the software to be freely adjusted and assigned by device manufacturers.

3. SYSTEM DESIGN

In the referred papers it is observed that FPGA is used as fundamental controlling device because of its reconfigurable property. It has higher processing capability than traditional microprocessor. In the given system Bluetooth is used as a communication device for transferring data between two or more devices. Bluetooth is best suitable for this system because of its low power usage, low bandwidth application because of its standardized protocol and low interference.

To develop the given system Xilinx’s ISE is used using VHDL. To establish the communication between phone and the board Android SDK as plug-in is used while Java is used to write android application. Figure 1 indicates the architecture of the system developed. By using communication interfaces such as UART, RS-232 port, the system is configured to acquire the data.

![Figure 1. Block Diagram of System Architecture](image)

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
- Android Studio
4. RESULT & DISCUSSION

A flexible embedded system with an FPGA platform is developed to communicate data wirelessly to the Android phone through Bluetooth from the board to the phone’s display accurately and in real time. By selecting the input from the board, data can be send from board to phone which shows the values of measured parameters accurately in real time on phone’s display. The screenshot in Figure 2 shows the android application which shows the reading of temperature and pressure.

![Figure 2 Android Application](image1)

The figure 3 shows the Android application activity which we have created using Android studio.

![Figure 3 Android Application Activity](image2)

Figure 4 shows the complete transmitter module of the system. To the FPGA chip the programs were downloaded which integrates all the modules and starts to the implement collection. It enhances the real-time processing, compression and transmission of the data from the board to the phone’s display.

![Figure 4 Complete Transmitter Module](image3)
5. CONCLUSION
The hardware of system is tested using Xilinx Spartan 3E development board and for android application Android studio is used. The implementation of system mainly focused on FPGA based real time low power Bluetooth communication with android system. Like temperature and pressure other parameters can be measured such as pulse rate in real time. The proposed project is not only can be used to measure the temperature and pressure but also can be used as automation system in home, offices and industries. The automation system will provide great comfort to common people as well as to handicap people. The heart of system is FPGA which is reconfigurable, higher processing capability and lower power usage.

REFERENCES