

A Bluetooth Tele Health, Household Security and Industry Safety Realization by Android Smartphone

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Abstract: Wireless communication is often require in fields such as tele health, household security and industrial safety etc. Android operating system based smart phones are increasingly used nowadays because of its simplicity and is open source to create application. FPGA based embedded systems have faster processing capability, low power usage and is reconfigurable as per requirement. The FPGA based system can monitor surrounding by using different sensors. The Bluetooth communication system has the low-power requirement making it suitable for wireless carrier. This paper presents the real time wireless communication using Bluetooth between these type of embedded system and android smart phones. This system is very useful for reporting and vigilance with added advantages like user-friendly interface and is comfortable to end user.

Keywords: Wireless, Field-programmable gate array (FPGA), Android, Bluetooth.

I. INTRODUCTION

Android based smart phone are primary choice of people because these devices are inherited with huge compatibility and mobility, although they are low cost devices. This helps in interfacing this device with other electronics system such as health monitoring, industrial safety equipment and household security equipment. Android applications are easy to develop and are an open source so no cost is incorporated in developing android application [1]. These applications provide flexibility in development, so required function can be performed by application.

For an example, a person goes out of city to a remote location for some work or trip and faces a medical problem and the doctor may not be able to inspect the patient, in such cases the telehealth provide useful way of communication between doctor and patient. The patients only have to wear sensor part and doctor gets health related data of patients via its smartphone. The doctor can easily monitor patient and suggest the required medication to the patient. With the help of this system doctor can monitor the patient at any remote location and at any time [1]. Similarly when a person is away from his house and any fire accident happen at that time such system can alert the person and autonomously contact the fire brigade.

And also during production of medicine requires continuous temperature monitoring of reaction in such cases this system alert the employee if temperature crosses its boundary. This paper presents the method of establishing a wireless communication between the FPGA and Android operating system (OS) running Smartphone via Bluetooth connection. The system is most suitable for application where real time monitoring and immediate action is required as stated in above cases.

For this purpose, sensors were synchronized with FPGA along with Bluetooth adapter for communicating with android application on any android smart phone to read and display real time data.

The wireless communication eliminates the huge maintenance cost incurred with wired communication system also it provides long distance connectivity and reduce complexity because of these advantages; we have selected wireless communication as transmission medium [2].

II. LITERATURE SURVEY

Literature survey say that currently there are lots of wireless communication systems available but those systems are not low-power, low cost system. And now a day's Applications in areas such as tele health and household security and in industry often require wireless communication between low-power embedded systems and personal smart phones. Survey on Different Technologies of wireless communication system says that A Bluetooth tele health, household security and industry safety realization by android smart phone system can be implemented in follow ways:

A. FPGA

The Field-programmable gate array (FPGA) system is capable of high speed parallel processing and builds a hierarchy design, which is powerful and fast enough to fulfill all the need of functionality, making it preferable over general purpose processor or micro-controller and has the added advantage of being reconfigurable for future development. At the highest level, FPGAs are reprogrammable silicon chips.

Using prebuilt logic blocks and programmable routing resources, we can configure these chips to implement custom hardware functionality without ever having to pick up a breadboard or soldering iron [3]. Also Benefits of FPGA Technology like high Performance, low Time to Market, low Cost, high Reliability, and Long-Term Maintenance. Real time applications FPGAs are perfectly suitable for applications in time-critical systems [4]. The proposed system uses this FPGA as a main controller which will give the instant alert if any unexpected events occur.

B. Bluetooth

Bluetooth is one of the fast growing technology which offers short distance communication. Because of this there is high demand for both Bluetooth software and hardware. The main advantage of Bluetooth is low consumption which make suitable for mobile devices [5]. It operates in the license-free 2.4 GHz band and supports data rates up to 600Kbps. The Bluetooth 2.0 protocol has high speed margins, low power consumption, wide operational range, freedom of transceivers position, and simplicity.

For this advantage Bluetooth is more suitable for our proposed Bluetooth Tele health, Household security and Industry safety Realization by Android Smartphone system.

C. Android

In this system a particular android app is created and that will display status of health of the person, home and industry to the end user. Android is an operating system based on the Linux kernel, and designed primarily for touch screen mobile devices such as smart phones and tablet computers. This open-source code allows the software to be freely modified and distributed by device manufacturers [5].

The proposed system uses this android based approach, to develop one android app that can show the status of health of the person, home and industry whenever end user want and also alerts if any unexpected event occurs.

III. SYSTEM DESIGN

In the referred papers it is observed that they have used the FPGA as the main controlling device which supports our decision of using FPGA as main controlling device for our system. It is also observed that they have used GSM, GPRS or Bluetooth as communicating medium. For this system we are going to use Bluetooth as communication medium because of its advantages like low power, standardized protocol, automatic, inexpensive and low interference.

The figure 1 shows the block diagram of proposed architecture. The proposed system consists of different sensors, FPGA, Bluetooth module and android smart phone.

The implementation includes an embedded system that has the sensors interfaced to the central controller. The controller used here is FPGA (XC3S100E) and the parameters that are to be measured are temperature, smoke and pulse rate.

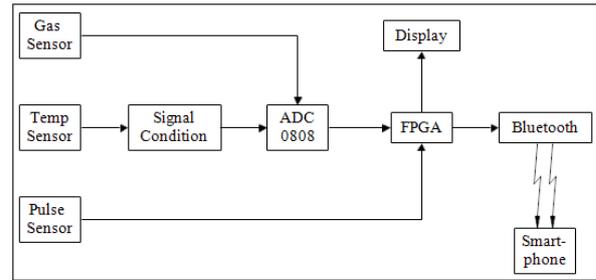


Figure 1: Block diagram of system implementation

As per the application, LM35D as temperature sensor, MQ-7 as smoke sensor and XA001 as pulse sensor are interfaced with FPGA.

The output of LM35D temperature sensor is in voltage and is applied to the ADC0808. The analog voltage signal is converted to the digital equivalent and is then processed by the FPGA which shows the temperature value. Similarly, for smoke sensor analog to digital conversion of output signal is performed by ADC0808 and fed to FPGA system for display. The pulse sensor has output in the form of digital signal which is directly given to FPGA without any conversion.

The data is sent to UART where the HC-05 Bluetooth module is connected. This module works on AT commands and it is configured to be paired with the android smart phone. At the smart phone end, we developed android application for people comfort so they can easily access data anywhere anytime.

IV. HARDWARE SYSTEM DESIGN

The hardware required for this system is Bluetooth module HC-05, Spartan 3E-FPGA, different types of sensors and android smart phone.

A. FPGA (XC3S100E)

XC3S100E belongs to FPGA family, having high clocking speed and great interfacing feature which will be required for sensors and Bluetooth module. The main advantage of using FPGA are its high speed and it needs low power for its functioning [3] [4].

Features of FPGA:

- Low power, high performance logic solution for high volume, consumer-oriented applications.
- Multi voltage, multi standard, select I/O interface pins
 - Upto 367 I/O pins or 156 differential signal pair
 - 3.3V, 2.5V, 1.8V, 1.5V and 1.2V signaling
 - IEEE 1149.1 JTAG programming/debug port
 - Densities up to 100K logic cell including optional shift register and distributed RAM support
 - Hierarchical select RAM memory(up to 72kb) architecture

B. Bluetooth module (HC-05)

HC-05 is a class 2 Bluetooth module with serial port profile which can configure as either master or slave with the help of AT command, design for transparent wireless serial connection setup

- Typical -80dBm sensitivity
- Up to 4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- UART interface with programmable baud rate
- Integrated antenna
- Auto-connect to the last device on power as default

C. Sensors

- LM35 Temperature sensor

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in C). Here we can measure temperature more accurately than using the thermistor.

- MQ-7

MQ-7 smoke sensor is simple to use carbon monoxide sensor suitable for sensing CO concentration in the air and output its concentration anywhere from 20 to 2000 ppm.

- Pulse sensor

The pulse sensor is a plug and play heart rate sensor. Simply clip it to your finger tip and you are ready to read heart rate data.

D. Android Smartphone

Android is most widely used smart phone OS. It is user friendly, easy to use, open source to create any application as per requirement. The android smart phone has the Bluetooth connectivity making it easy to connect to our system and obtain data wirelessly [6].

V. SOFTWARE SYSTEM DESIGN

The software used for this system are Xilinx ISE and android studio.

A. Xilinx ISE

Xilinx ISE is a design environment for FPGA. It is used for circuit synthesis and design while the models logic simulator is used for system level testing.

B. Android Studio

Android Studio is new software developed by 'Google' to generate android app. Java language is basic platform for app creation. This app is only created for android smart phones.

The main advantage of using Android Studio instead of Eclipse is that it have Maven-based build dependencies, Build variants and multiple-APK generation and advance android code completion and refactoring.

VI. RESULTS AND DISCUSSION

We develop a flexible embedded system with an FPGA platform that can communicate data wirelessly to an Android phone through Bluetooth without interruption or error, as values send from the board to the phone's display accurately and in real time.

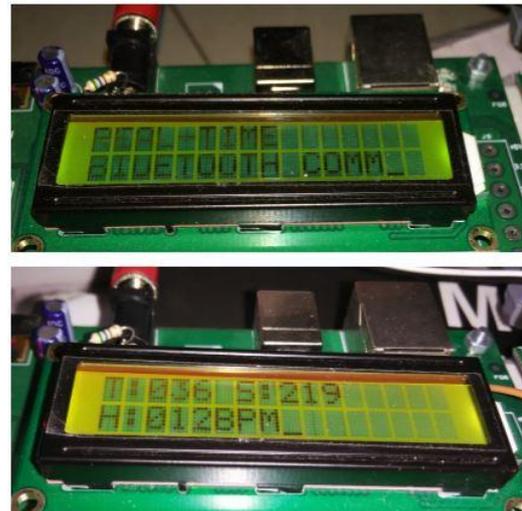


Figure 2: on-board output

Figure 2 shows the screen shot of the on board output which nothing are but temperature, smoke and pulse-rate reading. The following figure shows the Android application activity that we have created using Android studio.

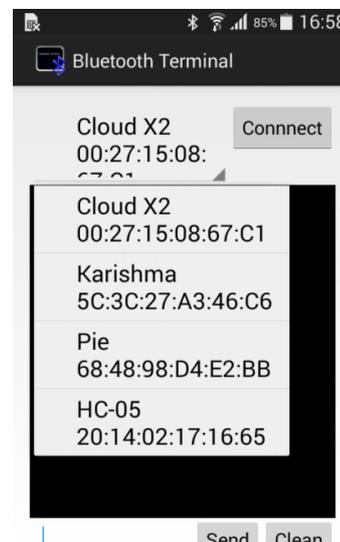


Figure 3: Activity

The above activity guide the user through the options such as Bluetooth initialization, operations etc.

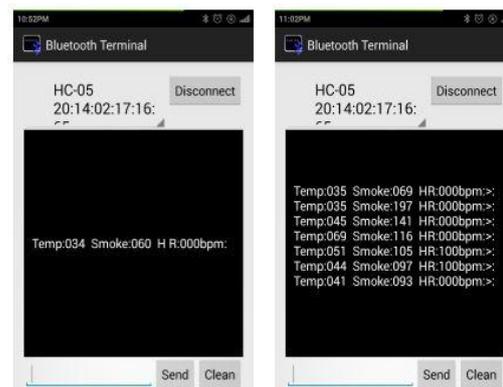


Figure 4: Android application

Figure 4 shows the screen shot of the android application, which shows reading of temperature for industry safety, smoke for home security, and pulse rate for telehealth monitoring.

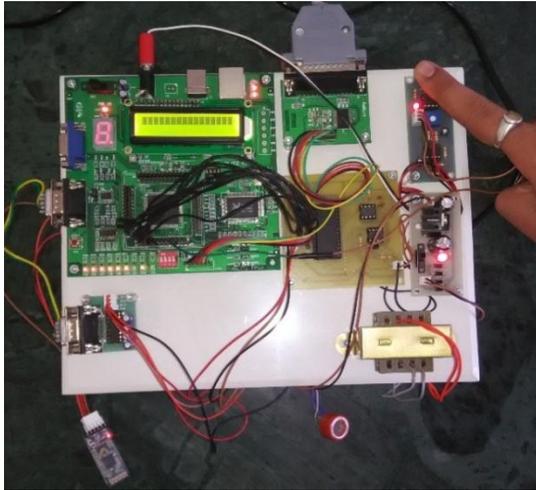


Figure 5: transmitter module.

Figure 5 indicates the full view of transmitter module.

VII. CONCLUSION

The system implementation mainly concentrate on Real time low power wireless system can be implemented with the help of FPGA, Bluetooth and android system as user interface for applications like telehealth, household security and industry safety. The use of FPGA in such systems promises higher processing capability and lower power usage than traditional microprocessors. Also FPGA has the added advantage of being reconfigurable for future development. Lower power consumption in operation make Bluetooth suitable for mobile devices. Ease of connection between the devices makes the setting a connection faster and easy for telehealth and other applications.

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BIOGRAPHIES



Piyush V. Savaliya received the B.E. degree in Electronics and Telecommunication Engineering from SCET, Surat, India in 2012 and is currently pursuing the M.E. degree in VLSI and Embedded systems from MIT College of Engineering, Pune, completing project based on FPGA.



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