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Home Automation through FPGAC Controller Using Bluetooth

Rohit Chhabra* Manpreet Kaur Khurana**

Abstract : Technology has been advancing from wired technology to wireless technology and home automation is one of its applications. With the introduction of comfort in every area it is important to bring it in our life. This project includes the design and construction of an individual controlled home automation system using rs232, and FPGA controller. Home automation refers to automatically or semi-automatically controlling and monitoring theappliances, doors, gate and even the windows. This project demonstrates how to design and build a multi-purpose remotely controlled system. The system can switch off and on any electrical household appliance (including the security light) by dialing a phone that is interfaced to a FPGA controller for controlling a relay to automate the switching of the appliance. The phone will also send a feedback in the form of a short message service text indicating whether the appliance is switched on or off.

Keywords : Home automation, Bluetooth, FPGA

1 INTRODUCTION

Automation involves the use of control systems and information technology to control industrial machinery, equipment, and processes that will reducetheneedforhuman intervention. Different types of home automation systems have emerged to offer networked control [1]. The rapid development of cellular mobile technology has led to the development of mobile phone-based home automation systems to integrate mobile technology into home automation [2].

Application based on wireless lan for digital lighting has successfully been implemented and demonstrated with improved efficiency using field programmable gate array [3]. Systems with different interfacing have been achieved in many designs [4]-[8]. Differences in these designs lie in using different modules like gsm, bluetooth, zigbee etc. And the controlling unit in the center playing the role of smart home automation. Performance of the system increases while using FPGA rather than micro-controller as it will design only those gates which are required. Remaining space can be used for other purposes. The software code is written in verilog hardware description language to program FPGA which is more user friendly.

2. PROPOSED ALGORITHM

The complete system consists of following parts :

- Bluetooth module (hc05)
- FPGA board (basys 2 board with xilinxspartan 3*e*)
- Relays (spdt 12*v*)
- Voltage regulator (uln2803)

* Department of VLSI Engineering Centre for Development of Advanced Computing, Noida, Uttar Pradesh, India Email rohit. rohit.chhabra@gmail.com

** Department of Electronics, Instrumentation and Control Engineering University of Petroleum and Energy Studies, Dehradun, Uttarakhand, India Email- manpreetkhurana26@gmail.com

2.1. Block diagram

As shown in figure 1, system user interface consist of two parts, first the hc05 module which is connected to the mobile through an already developed android application named BluetoothSPP (jerry lee). This application transfers our command serially to the Bluetooth module and from there the command is forwarded to the FPGA receiver pin by transmitter pin of the Bluetooth.

The developed UART receiver code receives the data andcode for manipulating the commands then decides on which terminal the output should be sent to switch the devices. As the output of the FPGA board is 3.3 volt, therefore to control the 220v device, interfacing circuit consists of uln2803 and relay to connect board and device.

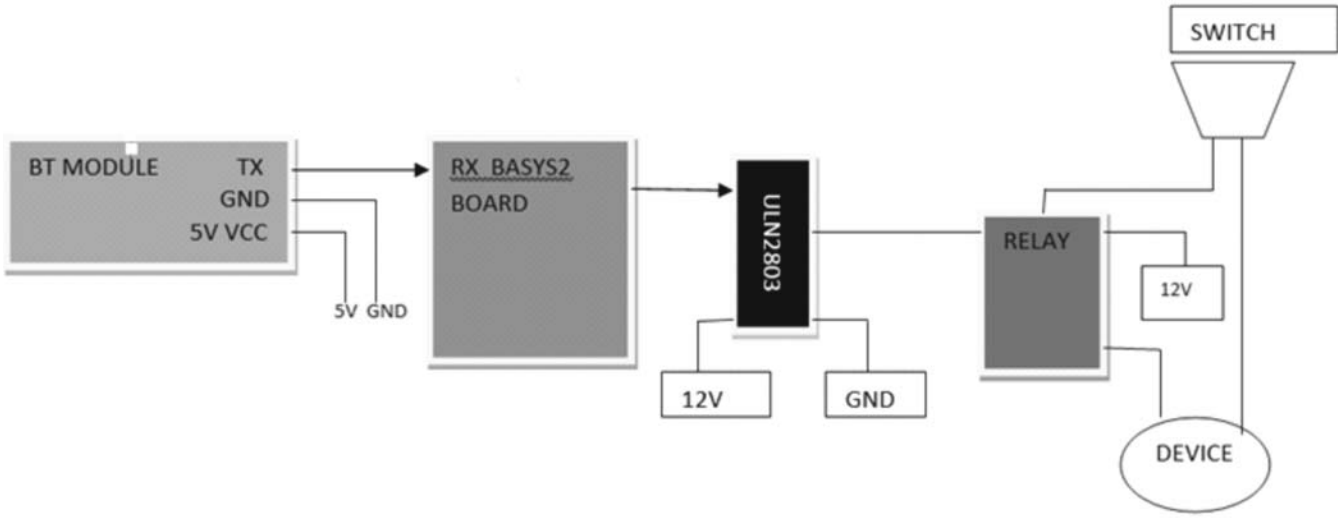

Fig. 1. Block Diagram

2.2. Flowchart

Figure 2 shows three different phases followed for the completion of system. Receiver and baud rate generator are combined so as to receive the data at 9600 baud rate which equal the transmitting rate of Bluetooth module. After that the code is simulated in questasim and synthesized in XILINX ISE design suite. After successful synthesis then the code is transferred to the FPGA board by again using XILINX ISE design suite. The interfacing circuit is the circuit connecting FPGA to the devices as explained above.

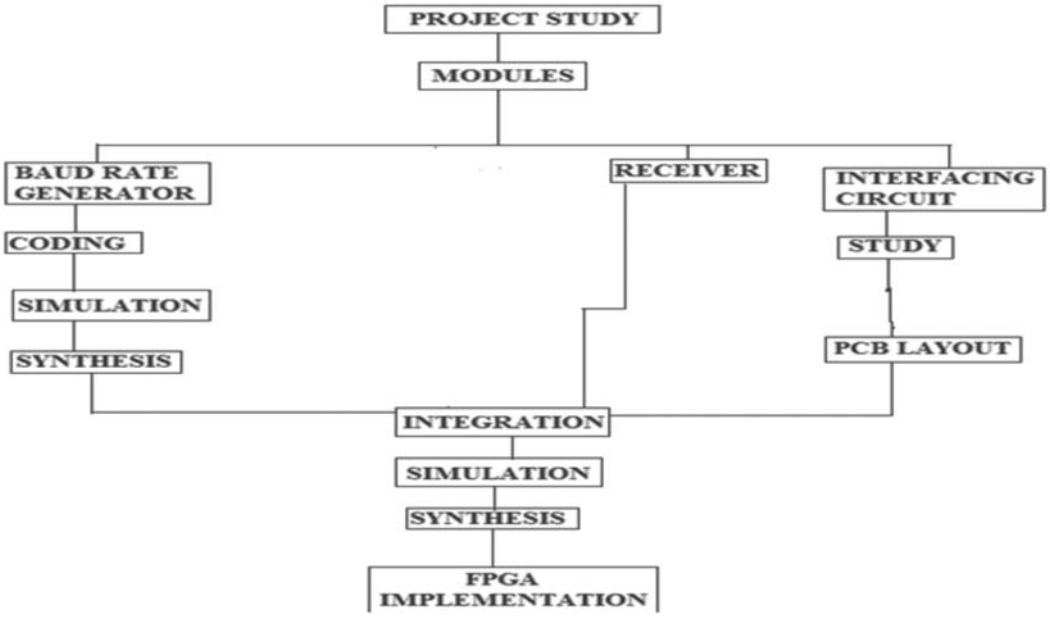

Fig. 2. Flow Chart

3. EXPERIMENT AND RESULTS

The 9600 baud rate of the circuit is checked through TERATERM by transferring the data from computer and its display over FPGA led as shown in figure 3.

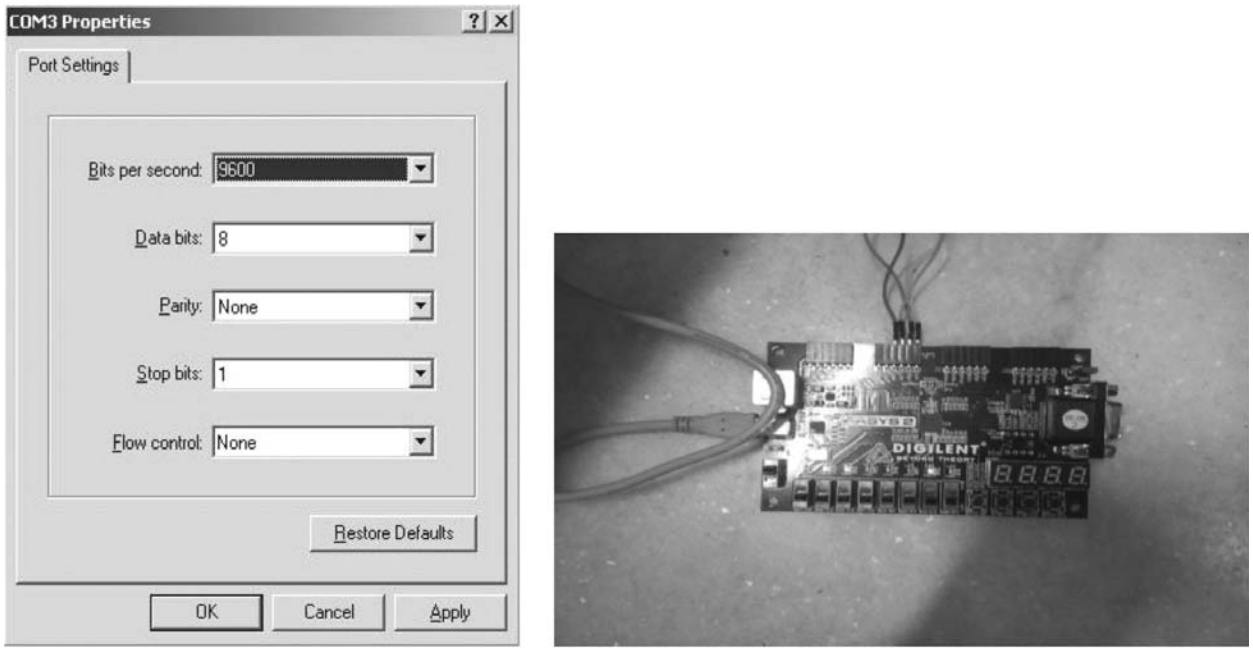

Fig. 3. Checking of baud rate

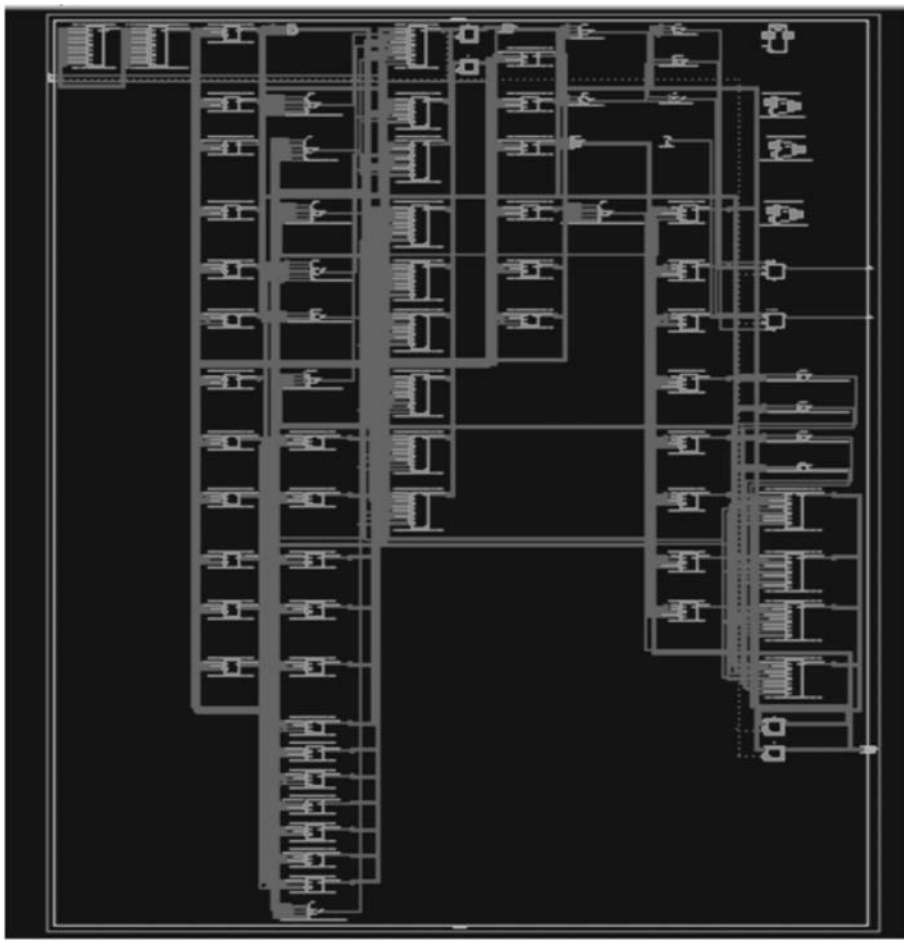

Fig. 4. RTL schematic

4. CONCLUSION

Alowcost project forreliableand scalablehomeautomation system has been designed. The system can be usedcanbe usedtoremotelyswitchonoroffany householdappliance,usinga FPGA controller. To achieve hard wares implicity, FPGA has been used.

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