

# Implementation of Reliable Wireless Real Time Automation System Based on Android Mobile Phone and FPGA

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**Abstract:** *Technology advancements have made possible the implementation of embedded systems within appliances used in offices, industries and home. The automation system improves the lifestyle of the control of the devices at offices, colleges, industries and home. This seminar presents a possible solution whereby the user controls devices by employing a central Field Programmable Gate Array (FPGA) controller to which the devices and sensors are interfaced. Control is communicated to the FPGA from an android mobile phone through its Bluetooth interface. This results in a simple, cost effective, and flexible system, making it a good gadget for future smart automation system that can be easily designed for offices, colleges, industries and home. The concept of intelligent homes, offices, industries has attracted the attention of a number of researchers and practitioners during the last years. User needs that home, offices, industries must satisfy and can vary from basic requirements to external and internal aesthetics to comfort within home, offices. The advancement of technology has increased the usage of the electronic devices in homes, offices, industries, hotels. The wireless technology is most popular technology to control the devices from distances.*

**Keywords:** Automation system, Speech recognition, Android mobile phone, FPGA

## 1. Introduction

The requirement for a suitable technology that enhances the quality of life in homes, offices, industries has always been at the center of research. With the development of new electronic technologies and their integration with older, traditional building technologies, smart system is at last becoming a real possibility. Many researchers are working on smart automation system that can be easily design for homes, offices, industries, colleges. Initially the microcontroller based system was introduced. After that different methodology including LAB view, Arduino Uno single Board Microcontroller, JAVA application based systems were developed. We are going to introduce a smart system which is implementation over system explained above.

Users needs or say demand for their comfort has been increasing day by day. Keeping this fact in mind here we are introducing a system. The system includes FPGA as a central controller to control the devices connected to it. We monitor the devices wirelessly by using the Bluetooth. We are using the android mobile for Bluetooth connectivity. In this system we are using the FPGA other than the micro controller because we can connect many devices which can be monitored and the FPGA can be used as a controller or a process.

The automation system that we are going to design provides great comfort not only to common people but also handicap people too. Its messaging or speech recognition technique provided by an android mobile phone prove that the system provide great level of comfort.

## 2. Background Work

In [1] Bader M. O. Al-thobaiti, Iman I. M. Abosolaiman, Mahdi H. M. Alzahrani, Sami H. A. Almalki presents design and implementation concepts for a wireless real-time home automation system based on Arduino Uno microcontroller as central controllers. The proposed system has two operational modes. The first one is denoted as a manually-automated mode in which the user can monitor and control the home appliances from anywhere over the world using the cellular phone through Wi-Fi communication technology. The second one is referred to a self-automated mode that makes the controllers to be capable of monitoring and controlling different appliances in the home automatically in response to the signals comes from the related sensors. In [2] Carl J. Debono and Kurt Abela introduce a Field Programmable Gate Array (FPGA) controller at the core of the system to provide the intelligence for the home system. Moreover, the controller interfaces to a mobile device through the Bluetooth communications port to allow monitoring, configuration, and switching of devices. This allows the user to set the home environment according to the personal needs. They used a mobile phone supporting JAVA application and based on it they design a JAVA application for controlling the devices. Sweatha K N, Poornima M, Vinutha M H in [3] presents a novel technology where the user controls the devices through mobiles. Implementation is done using FPGA (Field Programmable Gate Array) as a controller to which the devices are directly interfaced. Control to the devices is communicated to the FPGA from the mobile phone using speech recognition technique. They also uses the pic microcontroller to control the sensors through the SMS having password. In this paper since we are using an android mobile phone, we are going to discard pic microcontroller. K. Gill, S. -H. Yang, F. Yao and X. Lu, in [4] introduced

Zig-Bee based home automation system. In this paper for the devices operation they make use of Zig-Bee module. We are going to use Bluetooth communication via android phone.

### 3. System Design

The system includes a novel technology where the user controls the devices through android mobiles. Implementation is done using FPGA (Field Programmable Gate Array) as a controller to which the devices are directly interfaced. Control to the devices is communicated to the FPGA from the mobile phone using speech recognition technique or text messaging. A block diagram of proposed system is shown in Figure 1. It consists of an android mobile phone, a central FPGA controller and number of devices which are connected to central controller.

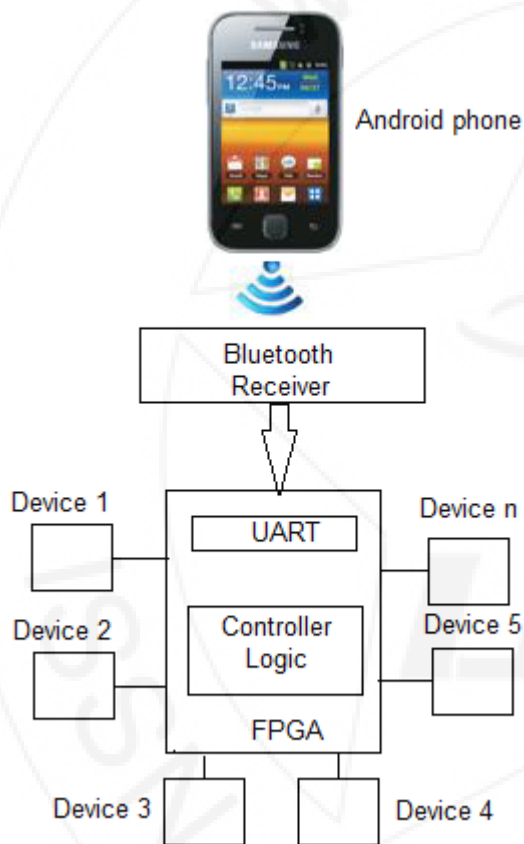


Figure 1: Block diagram of the system

#### 3.1 Bluetooth Interface

The central FPGA controller communicates with the Bluetooth module through a serial interface. This requires a Universal Asynchronous Receiver /Transmitter which is employed on FPGA. This technology was selected over other solutions because it is available in most mobile phones, it can be implemented with low cost, it consumes low power, and provides a level of security through its use in short distances and through its pairing function. The mobile device communicates to its inbuilt Bluetooth module. On the other hand, a Bluetooth module must be interfaced with the PIC microcontroller, where accurate clocking must be generated for the UART to correctly interpret the received data.

#### 3.2 Mobile Device

The system requires an android mobile device having a Bluetooth module. The mobile phone communicates to devices through FPGA via Bluetooth module either by speech recognition or text messaging. It is used for the controlling of the devices which are connected to the controller using Bluetooth technology.

#### 3.3 Control and Monitoring Devices

The number of control and monitoring devices attached to the FPGA depend on the number of free input/output ports available on the FPGA. The implemented system uses the parallel communication so that the speed is increased. The devices are directly connected to the FPGA Controller and is controlled using the speech recognition technique or text messaging.

### 4. System Description

These block together work as below. In this system we are using an android phone to provide Bluetooth connectivity either via text messaging or speech recognition technique. Signals from mobile will receive by a Bluetooth receiver. Bluetooth receiver having interfacing with FPGA which act as a central controller there will be serial signal reception, but FPGA can't recognize serial reception of signal. Thus here we are designing an UART IP code which allows serial reception through FPGA. In addition to UART it is also required to design a controller logic which controls the operation of devices. The controller logic can be designed using finite state machine (FSM).The brief discription of sysem can be as above. Thus the system simply include an android mobile phone that can control the number of devices connected to FPGA. To control the devices the mobile phone required to set bluetooth communication with FPGA via bluetooth module. Once bluetooth communication is set, user can give instruction to bluetooth module using mobile phone either via text messaging or speech recognition. The bluetooth module then transmit those signal to FPGA. But there will be serial signal reception between Bluetooth module and FPGA. Since FPGA cannot recognize serial reception, it is required to design an UART IP code which allows serial reception through FPGA

### 5. Conclusion

An implementation of smart automation system using an FPGA central controller was presented. This proposed system provides more comfort to human at home, offices, industries. Reduce time and effort required for device operation also Provide great comfort not only to common people but also handicap people too.

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