

ARM Platform-Based Reconfiguration of Wireless Field-Programmable Gate Arrays

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Abstract—This paper discusses the use of reconfigurable logic in the computing industry, which has expanded over the past few decades to include many different architectures in field programmable gate arrays, or FPGAs. The novel concept or notion employed in this work is the Internet of Things (IOT), which is sensitive, delicate, adaptable, and responsible for human purposes. It encompasses a wide range of human needs, services, and other physiological elements that are connected, interact, and share information. The fused, merged, or combined architecture of the FPGA and ARM processors is also presented in this study. This kind of wireless communication is called Zig-bee, and it is adapted to the IOT devices by remodelling information in the processor core. It is one of the sensors network's key characteristics.

Index Terms— Gumnut processor, ARM, Zig-Bee transceiver, and FPGA.

I. INTRODUCTION

One of the main processors in the industry is the Advanced RISC Machine (ARM), which offers great performance due to its common RISC architecture. The three conditions in which the ARM processor operates are determined by the number of bits in use. Because of its load store command, ARM processors are the most recommended in many industries and other sectors. Its energy consumption is lower. It can access all of the 32-bit registers that are integrated into the CPU, and 16-bit operation uses 40% less memory than 32-bit ARM code processing [1].

The microcontroller wireless sensor nodes were used to carry out the preloaded task. Microcontrollers are necessary for many distributed networks. Information processing and information transfer to the node are its functions. The location of the server node was used. The server is equipped with both wired and wireless interfaces [2].

Communication between the sensor node and the server node of the interface is required by this server. Due of its elasticity or mobility, we recommended using the wireless interface as shown in fig 1. The ARM processor (LPC1248) and the XILINX FPGA (Spartan 3A) of the two distinct states are identified in this work. They have interacted via UART, and it shows how many sensor nodes are connected to the FPGA using the Multiple Input and Multiple Output (MIMO) technique. The most common issues in embedded network systems are insecure and distance coverage power supply issues. The fig 2 shows a wireless sensor network. The Zig-bee technology is used in the study to solve the aforementioned issues. Typically utilised in wireless controllers and monitoring

applications, Zig-bee technology allows communication between central computers and the devices [3, 4].

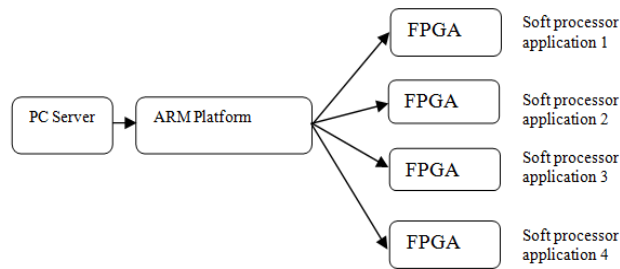


Fig 1: Basic Block Diagram of ARM Platform

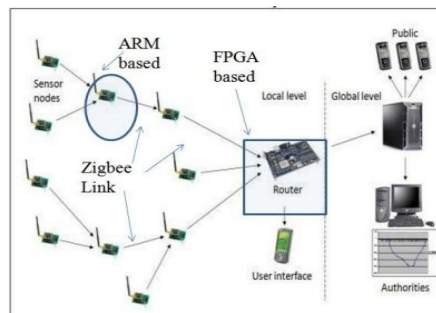


Fig 2: Wireless Sensor Network

II. OBJECTIVE

This paper aims to showcase the concept of enabling communication between FPGA platforms and embedded network systems by constructing a prototype and configuring them through UART for data transmission and reception. Additionally, it demonstrates how the FPGA soft processor can be remotely modified in a fixed manner using wireless connections.

III. SYSTEM DESCRIPTION

In the Internet of Things (IOT), wireless communication is used to replace wired communication when reconfiguring an unnamed vehicle from a far-off location (point). This is because it is very difficult to reconfigure an unnamed vehicle from a far-off location using wired communication systems [5,6]. The fig 3 shows the detailed block diagram of the proposed system.

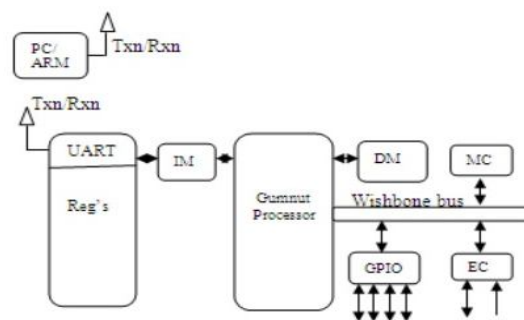


Fig 3: Detailed Block Diagram

The proposed system has registers, gumnut processor, UART etc....The gumnut memory contains 256 bytes of information memory (using 8 bit operations) and 4096 command memory with 18 bit instructions (using 12 bit operations), begins to execute commands within the central processor unit when the system resets the computer to zero. There are registers in the gumnut processor. It includes eight universal purpose registers, including r0 through r7; however, because it is hardwired and disregards the other registers, its value was zero. Depending on the outcome of specific commands, it contains the two single-bit code registers Z (zero) and C (carry), which are

set to either 1 or zero [7].

The Universal Asynchronous Receiver and Transmitter operates on the basis of asynchronous information dispatch, and thus does not require a clock signal to synchronise the sending and receiving ends. Instead, it relies on the predetermined acceptance between the devices that are dispatched and those that are received.

IV. IMPLEMENTATION

This serves to illustrate how the general block diagram in figure 1 represents the idea of wireless transmission between the two distinct machines using UART as a technique (way) of communication. The ARM board side is used on the transferring or dispatching side, whereas the FPGA board is placed on the receiving side. To start wireless conveyance, the RS-232 connector is interfaced with the Zig-Bee transceiver on both the receiving and transferring sides of the board. The UART technique of sequential communication transforms the commands from the receiving side (FPGA) and the dispatching side (ARM). The command transfers the string point to a character that is in the while loop. The CPU is filled with the Hex folder. The UART0 channel is set up to send commands wirelessly over a Zig-Bee transmitter to the receiving side. The UART soft core is connected to the 8-bit soft core CPU. The PCB is connected to the LEDs and Zig-Bee transmitter. The Win-Co fig-proc-system's primary component provides external connection, the Zig-Bee is connected via a Zig-Bee-RX wire [8,9,10].

A. Schematic, Synthesis and Simulation

The Field Programmable Gate Array (FPGA) uses the XC3S700 (Device), XILINX Spartan 3A (Family), -5 (speed grade), and 5FG484 (Package).

B. RTL Schematic

The Zig-Bee-RX and Zig-Bee-TX signals were used to interface the external Zig-Bee transceiver, and the led-position [7:0] is the result of the LED's position. The internal component for the UART transmission is called the based-clock.

C. Synthesis

This gadget has the advantage of using less resources because it can only consume 2% of flops.

D. Simulation Results

The XILINX ISIM Simulator was created as a simulation, and the XILINX project guide is the built-in simulator. Others are under zero circumstances, whereas X is the ASCII value that is turning the led and high. The 8-bit data is received by the UART receiver from the [7:0]. The results of the simulation command being transferred are displayed in the figure 4 and 5.

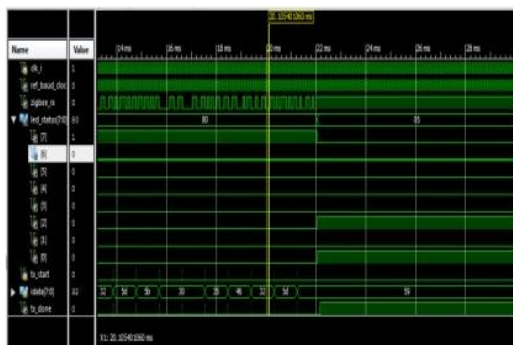


Fig 4: Simulation Result of led[7]



Fig 5: Simulation Result of led [0] & led [2]

V. CONCLUSION

The two distinct states of the XILINX FPGA (Spartan 3A) and the ARM Processor (LPC2148), which are communicating via UART, conceal all of the work. One of the most popular processors in the industry is the ARM processor, which is an embedded processor that offers the best interoperability. We can use the numerous processors in the industries to carry out a variety of functions, such as controlling, monitoring, and commanding. The sensor network's performance will be improved and conducted with the assistance of the ARM.

Eight LEDs are used, with the LED [2] and LED [0] having the values 0*05 as well as the ASCII Value Y, which is in the OFF state. The LED [7] is likewise off. The TX-done is set to one when the LEDs are using the

value 0*05.

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