

## Implementation 7 Segment Display by Educational Board - Software /Hardware Interfacing -

Abdulrahman A.A.Emhemed

College of Electronic Technology-Bani Walid, Libya.

### ABSTRACT

The paper presents a simple design and implementation of a Seven-Segment Displays Designs on Education Board. Logic design transforms algorithms and processes conceived by people into computing machines. A grasp of digital logic is crucial to the understanding of other basic elements of digital systems, including microprocessors. The training program for “Altera DE1 Board” is used and applied in this study by connect the board using computer and get solution to the problems of digits binary used their equivalents in hexadecimal. “Altera” now get big success from the world market for electronic devices. “Altera DE1 Board” is important for many applications. A hypothetical example is a logic circuit to examine three switches and turn on an LED if two and only two of the three switches are turned on. These are input/output and architectural components. The input/output description specifies the input and output connections (ports) to the hardware. The architectural component defines the behavior of the hardware entity being designed. A typical VHDL description includes a port statement contained within an entity statement. All keywords in VHDL are reserved follows. The purpose of this paper to practice implementation Verilog codes and performing simulations on various counter designs and implement designs on FPGA with DE1 board utilizing switches, LEDs, and seven-segment displays.  
 Keywords – 7 segment display, VHDL, DE1 Altera board.

### I. INTRODUCTION

Digital electronics is one of the fundamental courses found in all electrical engineering and most science programs. A grasp of digital logic is crucial to the understanding of other basic elements of digital systems, including microprocessors. A hypothetical example is a logic circuit to examine three switches and turn on an LED if two and only two of the three switches are turned on. The truth table for such a circuit is as in next the discussion part. Each VHDL description contains two blocks. These are input/output and architectural components. The input/output description specifies the input and output connections (ports) to the hardware. The architectural component defines the behavior of the hardware entity

being designed. A typical VHDL description includes a port statement contained within an entity statement which is important in start every program.

### II. SEVEN SEGMENT DISPLAYS

Digital displays link the digital world of ones and zeros with numerics of the human world. You have seen how parallel combinations of ones and zeros can represent binary, hexadecimal, or digital numbers. For most simple instruments, digital displays use the numbers 0-9 and are represented by seven segmented displays. Each segment is controlled by a single bit, and combinations of segments turned ON or OFF can display all the numbers 0-9 and a few characters, such as A, b, c, d, E, and F.

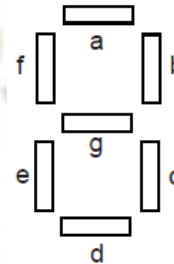


Figure 1. Seven-Segment Display Uses Seven LED Bars.

### III. BLOCK DIAGRAM OF THE DE1 BOARD

Figure 2 gives the block diagram of the DE1 board. To provide maximum flexibility for the user, all connections are made through the Cyclone II FPGA device. Thus, the user can configure the FPGA to implement any system design.

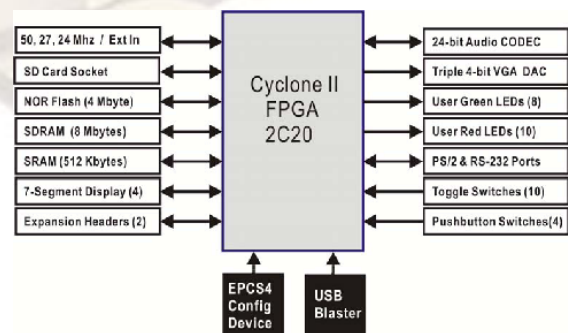


Figure 2. Block diagram of the DE1 board.

The purpose of this paper is to learn how to connect simple input and output devices to an FPGA chip and implement a circuit that uses these devices. We will use the switches SW 9–0 on the DE1 board as inputs to the circuit. We will use light emitting diodes (LEDs) and 7-segment displays as output devices.

Equipment Required to apply this work is computer running Microsoft Windows® 2000 SP4/XP SP2/XP Pro x64 with minimum of 512MB RAM with USB ports and installed with Altera Quartus II software. Altera DE1 Development and Education Board, with 7.5-V DC power supply and USB cable.

### V. IMPLEMENT A CIRCUIT CORRESPONDING ON THE DE1 BOARD

The following steps to implement a Circuit corresponding on the DE1 Board:

1. Create a new Quartus II project for your circuit. Select Cyclone II EP2C20F484C7 as the target chip, which is the FPGA chip on the Altera DE1 board.
2. Create a Verilog module for the code and include it in your project.
3. Include in your project the required pin assignments for the DE1 board, as discussed above. Compile the project.
4. Download the compiled circuit into the FPGA chip. Test the functionality of the circuit by toggling the switches and observing the LEDs.

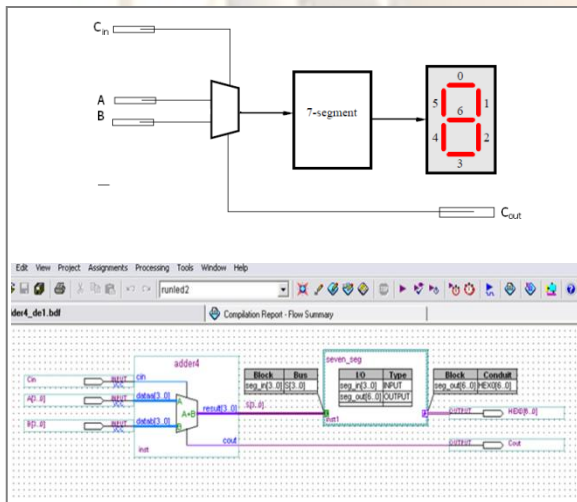


Figure 3. Block diagram of the circuit.

After programming the FPGA, your design is now operating on the DE1 board. Press the push-button switches (KEY0 to KEY3) and change the toggle switch positions (SW0 to SW7). Observe how the LEDs and seven-segment displays respond to these changes. Verify whether they react correctly as described in the tasks given.

The Compile the circuit shows in figure 4, and the connection of the board completed as show in figure 5.

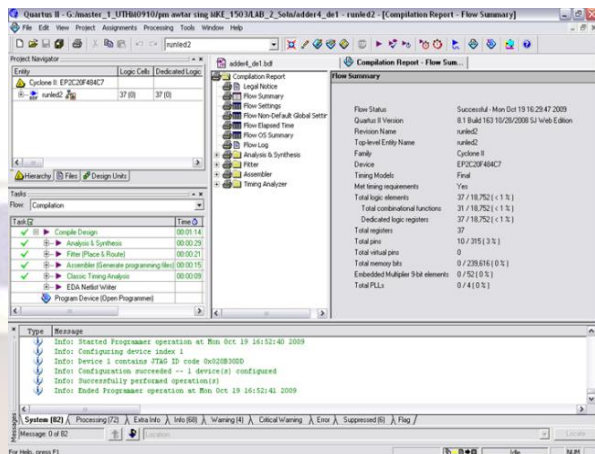


Figure 4. Compile the circuit.

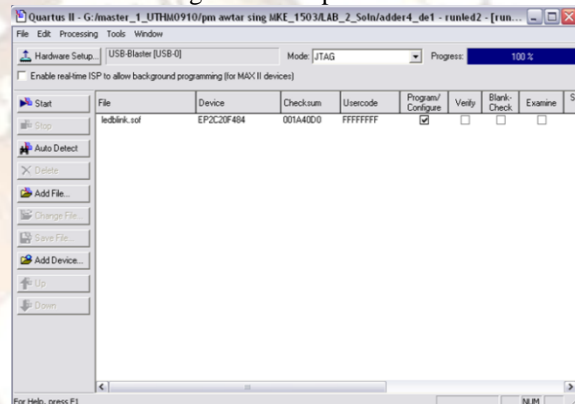


Figure 5. Success connect the program with Hardware board.

### VI. DISCUSSION AND RESULTS

The purpose of this paper is to learn how to connect simple input and output devices to an FPGA chip and implement a circuit that uses these devices. We will use the switches SW 9–0 on the DE1 board as inputs to the circuit. We will use light emitting diodes (LEDs) and 7-segment displays as output devices. This table below shows the digits used in hexadecimal and their equivalents in binary and decimal:

HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
DEC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
BIN	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111

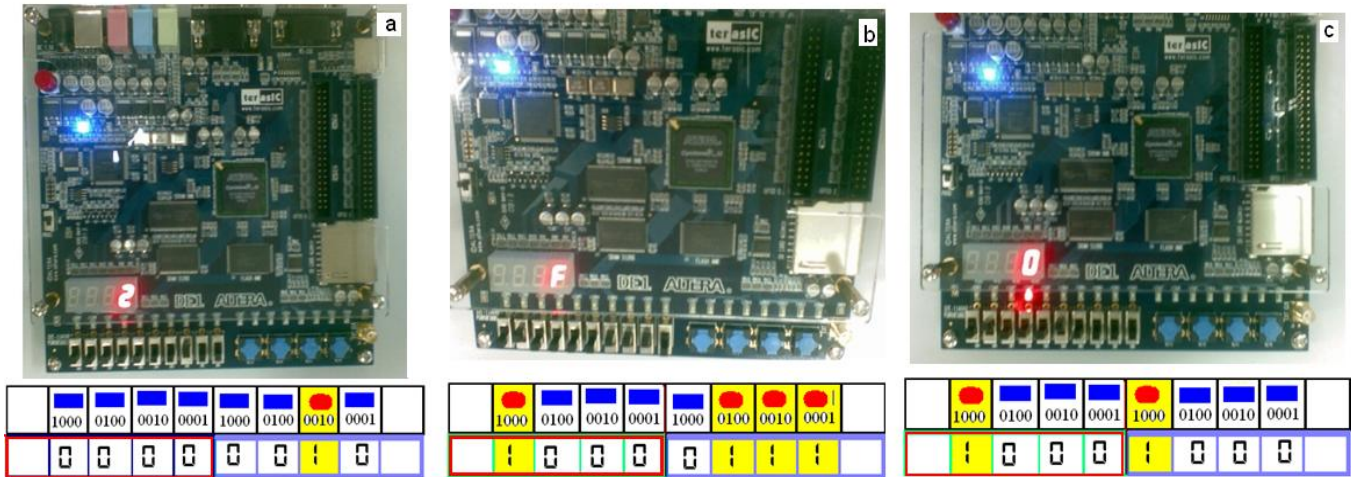


Figure 6. seven segment display s on DE Altera board.

First case in figure 6(a) enter on the right side the binary number **0010** and sum it to the left four bit binary number **0000** on the board, the result will get on the screen number hexadecimal **2**.

second case in figure 6(b) enter on the right side the binary number **0111** and sum it to the left four bit binary number **1000** on the board, the result will get on the screen number hexadecimal **F**.

Third case in figure 6(c) enter in the right side the binary number **1000** and sum it to the left four bit binary number **1000** on the board, the result will get on the screen number hexadecimal **0** and carry is **1** as shown in figure 5(c) the light point in the board means it has carry equal one.

**CONCLUSION**

The main result of this work has been the training program for “Altera DE1 Board” by connection by computer and get solution to the problems of digits binary used their equivalents in hexadecimal. As show in figure 5 (a),(b) are after summation the result only value without carry but in case (c) the value is *zero* but it has carry equal to *one* ,it’s clear from the “light point” under the *zero*. “Altera” now get big success from the world market for electronic devices. “Altera DE1 Board” is important for many applications, so the practice is important to get knowledge about implementation Verilog codes and performing simulations on various counter designs and implement

designs on FPGA with DE1 board utilizing switches, LEDs, and seven-segment displays and digital electronics systems.

**REFERENCES:**

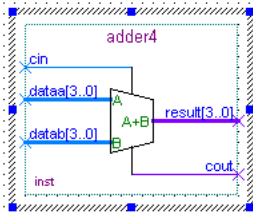
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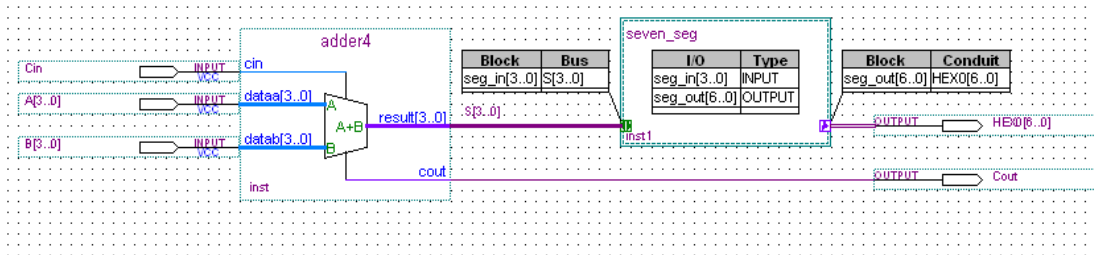
Abdulrahman A.A.Emhemed is studying PhD at University Technology Malaysia, Faculty of Electrical Engineering, Department of Mechatronics and Robotics Engineering; He was a lecturer at College of Electronic Technology-Bani Walid, Libya. His area of interesting is Artificial Intelligent, Microcontrollers Applications, Process Control , and Robotics.

APPENDIX

Block diagram of 4 adders:



Block diagram of the circuit:



Block diagram of the counter & shifter2 & 7 LED:

