EEE 102 Lab 6

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Github: https://github.com/enesinanc/Lab-6

Purpose:

The purpose of this lab is to show students the tasks of register and counter in practice. In addition, the operation of the circuit synchronously plays an important role in this lab. In this lab, which takes two 8-bit numbers as input to the basys3, the gcd of two numbers were found. While finding, the above-mentioned objectives were adopted by the students.

Methodology:

GCD can be found by using Euclidean algorithm.

- Compare the numbers
- If the numbers are equal, Gcd equals to the numbers.
- In the other case, the second number is subtracted from the larger number and its steps are repeated by going back to the beginning. GCD is found when step 2 is achieved

For example, let's say number1 is 44 and number2 is 12.

44 – 12 = 32

32 – 12 = 20

20 – 12 = 8

12 - 8 = 4

4 = 4 So GCD is 4

Design specification and Results:

In this design, two basic modules were created, namely datapath and control unit. A top module was created to connect these units to each other and run them synchronously. The two basic modules exchange data between each other. The controller generally generates outputs to determine the next states. The Datapath module, on the other hand, performs basic operations such as comparison and subtraction by using the already existing data from the control unit. The module that ensures the synchronization between the two and makes them work on the same clock signal is the top module. It is quite safe to run a test on vivado before implementing the code in Basys3. After this process, the code can be safely implemented and run in basys3.

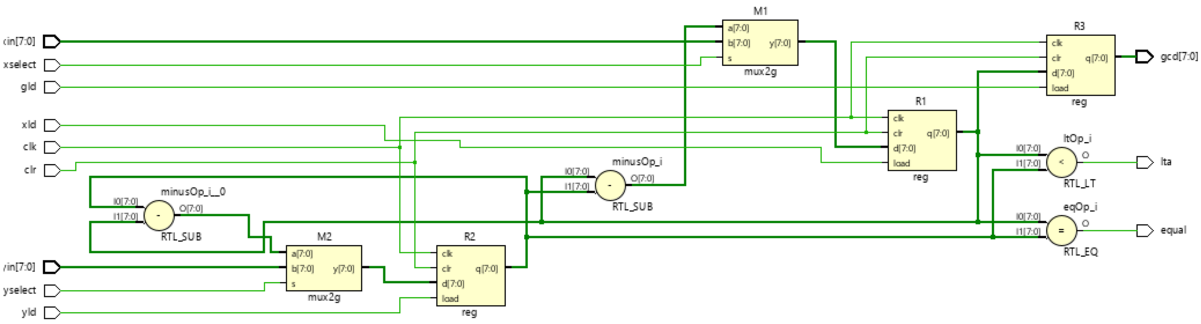

Figure 1 (Datapath module)

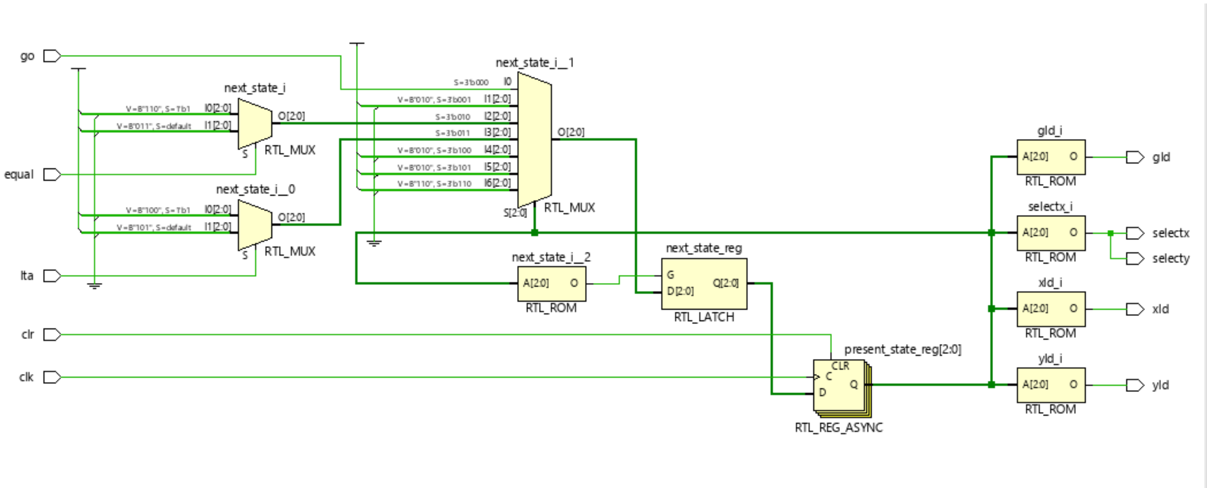

Figure 2 (Control Unit)

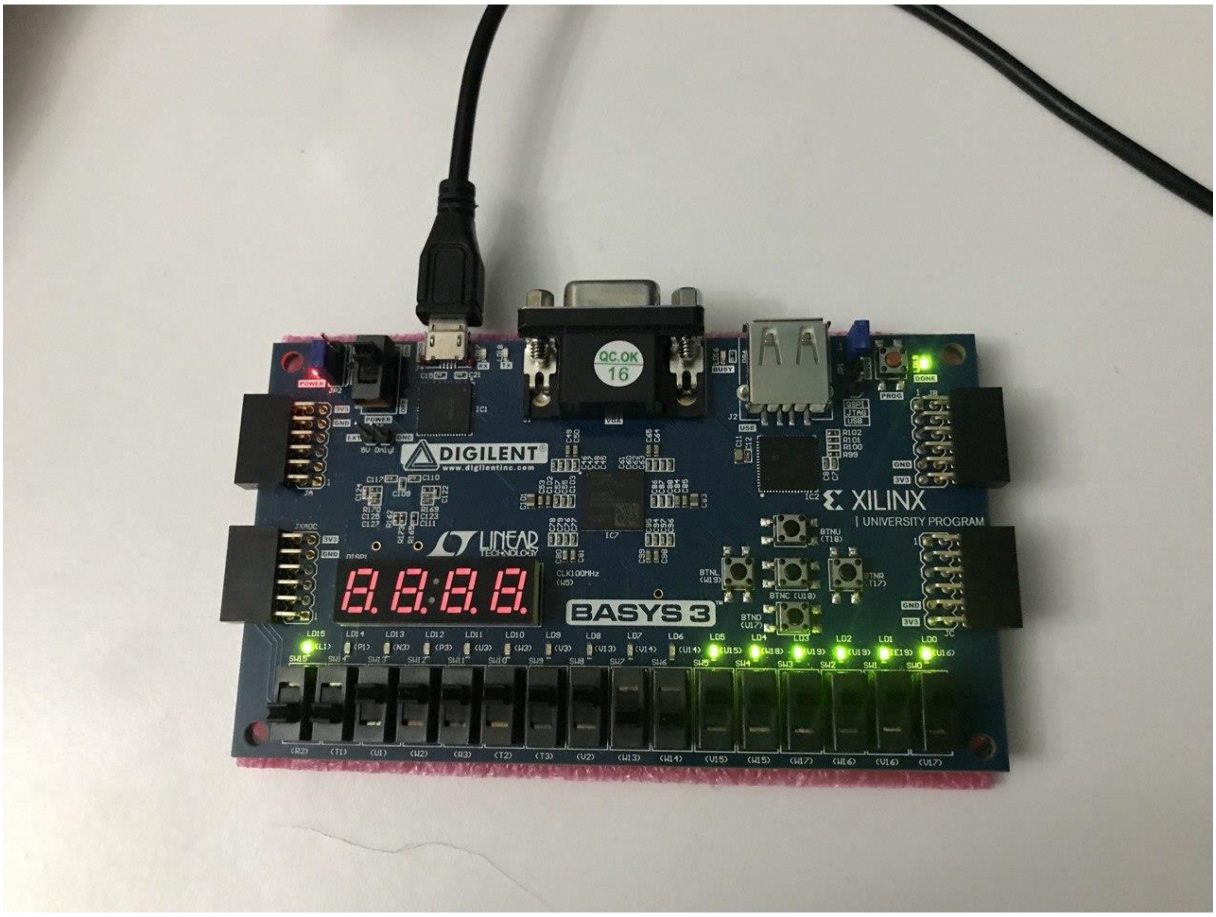

Figure 3 (Some examples)

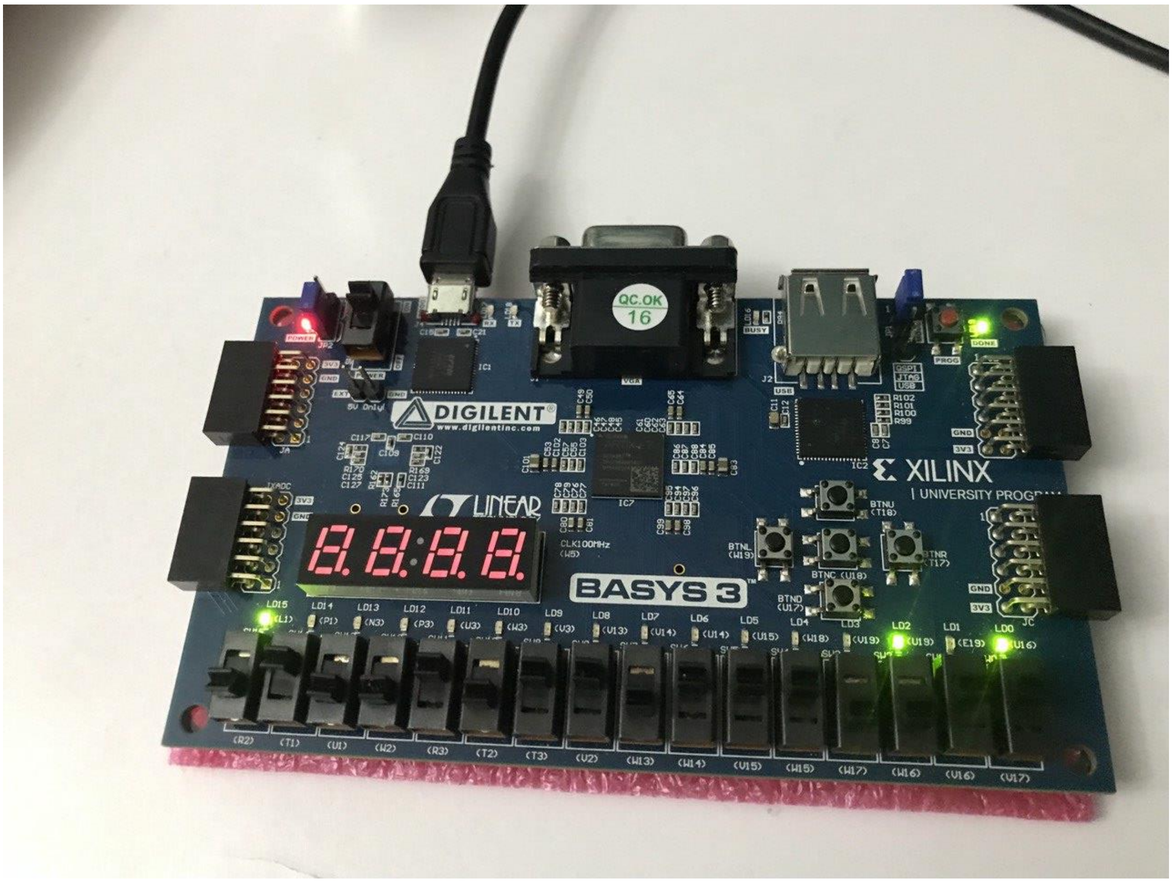

Figure 4 (Some examples)

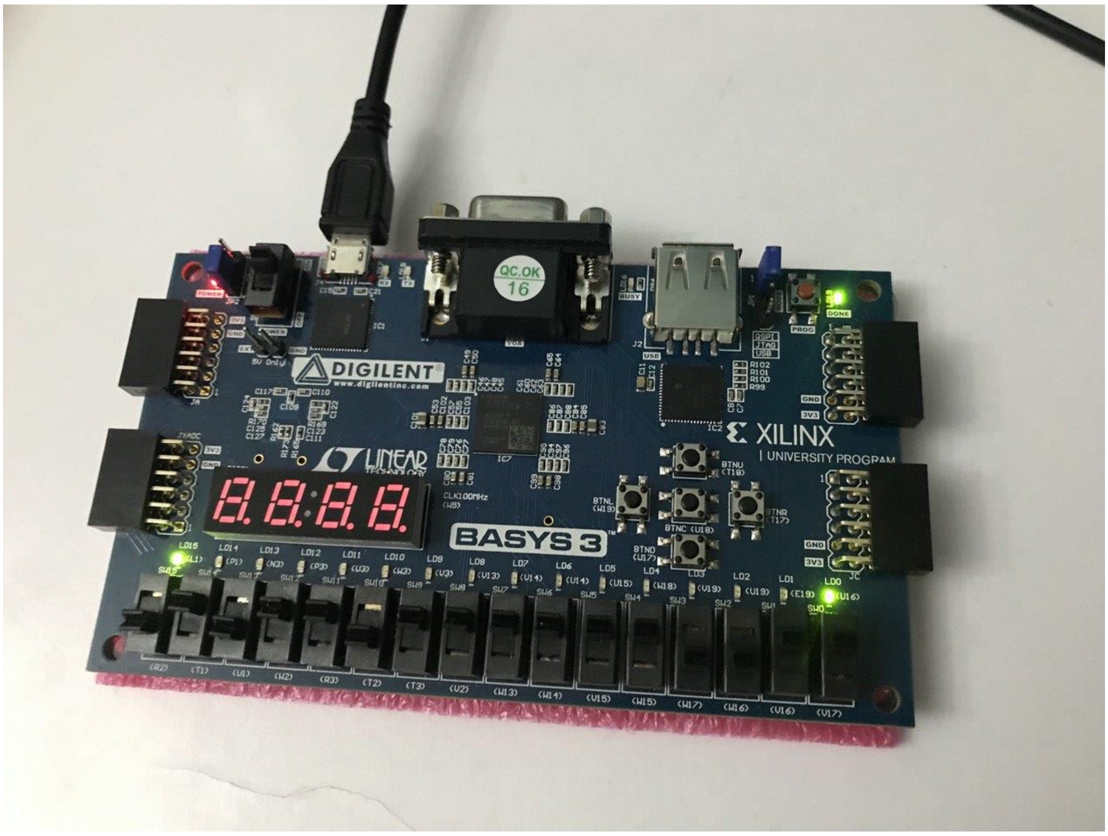

Figure 5 (Some examples)

Conclusion:

In this lab, the GCD of two 8-bit numbers was found using the Moore machine and bitwise operations. And this application was implemented on basys3 and simulated via vivado and the correct result was obtained. GCD was found using the Euclidean algorithm, one of the fundamental algorithms of computer science. Although the combinatorial circuit is faster and cheaper than the Moore machine, it cannot store any data. In order for us to find gcd with the euclidean algorithm, we need to save the data. In addition, combinational circuits are also used in this lab. For example, in comparator and subtractor modules, because these modules do not need registers. There were approximately 300 clock times to compute the GCD of 140 and 12. I also think that now with a technical improvement on the combinational circuit, these clock times can be optimized. This seems to be the most efficient way for now.

References:

https://www.youtube.com/@LBEbooks

Codes:

You can reach my codes from here: https://github.com/enesinanc/Lab-6