

# CpE 3150: Project 1

## Create Your Own WIMPAVR Version

**Goal:** To create, in Quartus II, and demonstrate your own WIMPAVR version on the Altera DE2 FPGA board.

## Preliminary work:

- Watch Lectures 4 – 8
- Get hands-on experience working with the WIMPAVR processor on the Altera board, which include entering the machine code for a typical program and its subsequent execution. You must build expertise in this area as it will help you debug your project quickly and save time.
- Review all WIMPAVR resources (look in the module titled “WIMPAVR Resources) available on Canvas including operating manuals, video tutorials, and the actual processor Quartus file.
- NOTE: You must execute the above tasks in parallel to make efficient use of your time. Think about watching the lectures during your chosen lecture time and working on the lab tasks outside class hours!

### Concurrent work: As you work on project 1

- Watch lectures 9 – 21
- Download MPLAB software and review tutorials on how to create and simulate an ASM program in MPLAB.

### Project 1 Objectives:

- To create a version of the WIMPAVR processor in Quartus II using Block Diagram Files (BDF).
  - The variation must include new and/or modifications to the current instruction set. The original instruction set cannot be changed and must work. Instructions must be added!
    - The instructor must approve the machine code, for the added instructions.
    - All added instructions must use the standard AVR machine codes ([AVR Instruction Set Manual \(microchip.com\)](http://www.microchip.com/avr/doc/1863a/AVR_Instruction_Set_Manual.pdf))
  - Creation of NOP instruction is not allowed but can be included for fun!
  - The variation must be significant.
  - The basic architecture cannot be changed.

- To demonstrate the successful working of the modified WIMPAVR using test programs. Your test program must be expansive and test all possible scenarios. The test program must test all instructions in the original WIMPAVR instructions set and your additions.
- To create a detailed report that must include:
  - Modified instruction set
  - Description of the modifications:
    - Logic description
    - Digital circuits of the modifications
    - Test programs

**Group Rules:** Work must be done in groups of 2 students. If there is an issue finding a group partner, please contact me for help. Groups must be decided by February 3, 2023.

#### **Deliverables & Deadlines:**

- Added instruction and machine code approval: By Friday, February 10, 2023
  - The approved instructions will be available on Canvas
  - An early approval is strongly recommended
- Final plan of action: Friday, February 24, 2023
  - Make sure to discuss your plan of action on a regular basis.
  - Design implementations must be significantly different from group-to-group
- Project report and demonstration: By Wednesday, March 8, 2023.
  - Project demonstrations must be scheduled outside normal class hours. Please work with me to schedule a demonstration time. Saturdays are also possible!
  - Project report must be typed and submitted via e-mail.
  - Entire project folder: Please e-mail your entire project folder. I should be able to compile and download your program, on the Altera board and run test programs.

#### **Grading Policy:**

- Project Demonstration: 70%
- Project Report: 30%

**Note: For the project submission to be valid the project must be demonstrated and a report must be submitted. Failure to do so will result in a reduced overall score for project 1.**