# Experiment 0
# Self-test on HaHa

In this experiment, you will go through a complete test of the HaHa board.

# 🖥️ Experiment Set-up: Configuration

The hardware and software needed for this experiment include:

1. The HAHA Board
2. A USB Blaster.
3. A USB A-to-B cable.
4. A computer.
5. Quartus to program the FPGA.
6. Atmel studio 7 to program the microcontroller.
7. An oscilloscope or analog discovery.
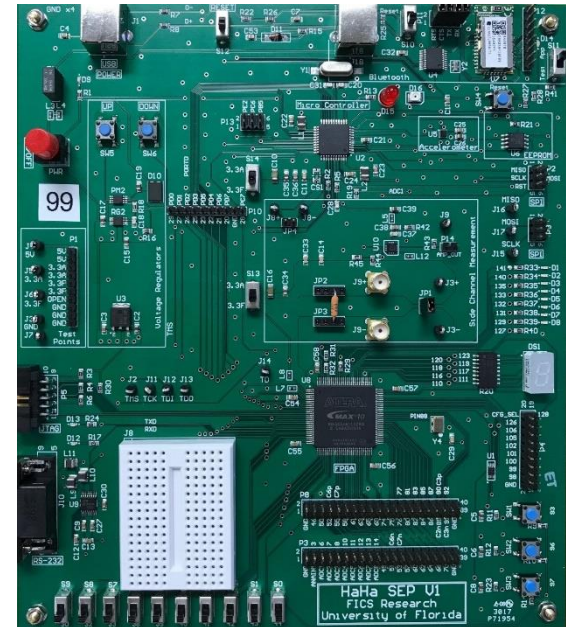
# ⚑ Instructions and Questions

## PART I Test the power supply

1. Connect the board to a USB power supply with a USB cable. Turn on the power to see if the power light is on. If not, check the voltage across the fuse, if it is not zero, the fuse should be replaced.
2. Check the voltage (using an oscilloscope or analog discovery) of the input and output of the voltage regulator (U3), if the input is 5V while the output is not 3.3V, the voltage regulator should be replaced.
3. Check the voltage on the test point 3.3A. Use button SW5 and SW6 to change the voltage. Answer this question: what is the adjustable voltage range?

## PART II Test the FPGA

0. If you have any questions doing the following parts (II, III, IV), please refer to the Manual of the board and the FAQ document that you can find on Canvas.
1. Connect the JTAG port to a computer through a USB Blaster cable. Open Quartus and use the auto-detect function in the programmer window to detect the chips in the JTAG chain. There should be 2 chips in serial exist in the JTAG chain. If not a success, possible reasons could be 1) the FPGA is not powered because a current sensing resistor is not mounted in socket JP2/JP3, please mount it; 2) the driver of the USB Blaster is not corrected installed in the PC, please download it online and install it, then re-do the detection. Please note the Quartus version should be 15 or higher. However, the driver version for the USB Blaster you got should be found in the installation file of Quartus 13.1. Please install both.
2. Program the FPGA with the pof file (test.pof) attached. If succeed, the 8 LEDs of on the board should be blinking and that means the FPGA and the LEDs are working well. At the same time, the 7-segment display will be counting from 0 to 15 in the hexadecimal. To check the function of the 10 user switches, just switch any of them and you will see the 8 LEDs will change their pattern of blinking. There are two different patterns of blinking and whenever any of the switches is switched, the pattern should change. If not, replace the switch. To check the function of the pushbuttons, just push any of them, and you should see the 7-segment display stops counting and start to repeat blinking with a fixed number. If you don't see this, the button should be replaced.
3. For this part, just attach a screenshot of the programmer window showing that you successfully programmed it.

## PART III Test the microcontroller and the accelerometer

1. Finish Part 2 before you do this. Program the microcontroller with the provided file (U_ACC.elf). The microcontroller will read the acceleration data from the accelerometer and send it to the FPGA. The FPGA will show the value in binary on the eight LEDs if you place the most significant four switches to "1001". Please rotate the board and see if the value showing on the LEDs are changing. If not, the accelerometer is probably not working well.

2. Attach a photo of the board showing the acceleration value on the LEDs in your report.

## PART IV Test the EEPROM

1. Finish part 2 before you do this. Program the microcontroller with the provided file (U_EEPROM.elf). The microcontroller will read the signature of the EEPROM and send it to the FPGA. Put switches S9 – S6 to "1001" to see the values on the LEDs. The LEDs should be showing 00101001 (0x29).
2. Attach a photo of the board showing the value 0x29 on the LEDs in your report.

## PART V Feedback

Please note this part is *not* optional.

1. What problems have you met when doing the tests? How did you solve them?
2. What suggestions do you have to make the test process easier and more friendly to students?

# ☞ Lab Report Guidelines

1. In your report, answer ALL the questions.
2. Give screenshots and photos as required.