SACRAMENTO
STATE

MARIO PALACIOS
LAB COURSE: CpE 185 – SECTION 03
MONDAY (6:30PM – 9:10PM)
LAB 00: INTRODUCTION TO MICROCONTROLLERS AND LAB TOOLS
INSTRUCTOR: SEAN KENNEDY

Introduction:

For this lab we were introduced to the basic I/O for STM32 board, along with its' tools needed to program it and run functions. The equipment being used in this lab is the STM32 Nucleo F303K8 and Analog Discovery 2. In order to use the STM32 microprocessor the software; STM32CubeMX and Atollic TrueStudio is needed. We will learn how to assign GPIO pins in the microprocessor using STM32CubeMX and program functionalities using Atollic TrueStudio. A review of Finite State Machines will be covered in order to complete the practical in Part2. Lastly in Part 3, we will use the Analog Discovery 2 and see its' tools.

Part 1. General Purpose Input / Output

Description: To provide an introduction to the STM32 microprocessor, STM32CubeMX, and Atollic TrueStudio.

Engineering Data:

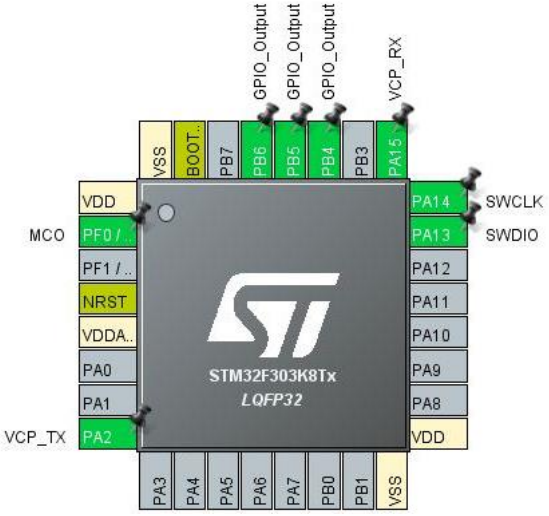


Figure 1. The GPIO Layout for a Unique LED Sequence

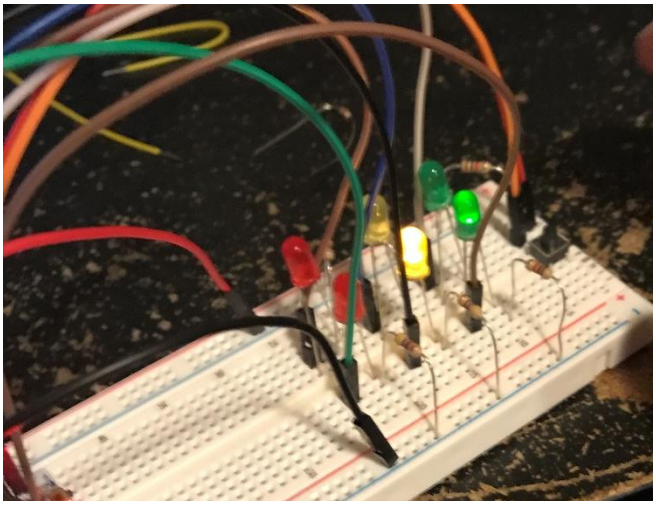


Figure 2. Unique Light Sequence Programmed on the STM32 Microprocessor

Conclusion: Overall this part of lab allowed me to understand the I/O of the STM32 microprocessor. While programming the unique LED sequence I gained more knowledge how properly write a program to display the LED lights on the breadboard by the use of a push button.

Part2. Finite State Machines Software Design Patterns

Description: Create a Finite State Machine to make North-South road traffic light green only when a switch is pressed; while also maintaining the East-West road green.

Engineering Data:

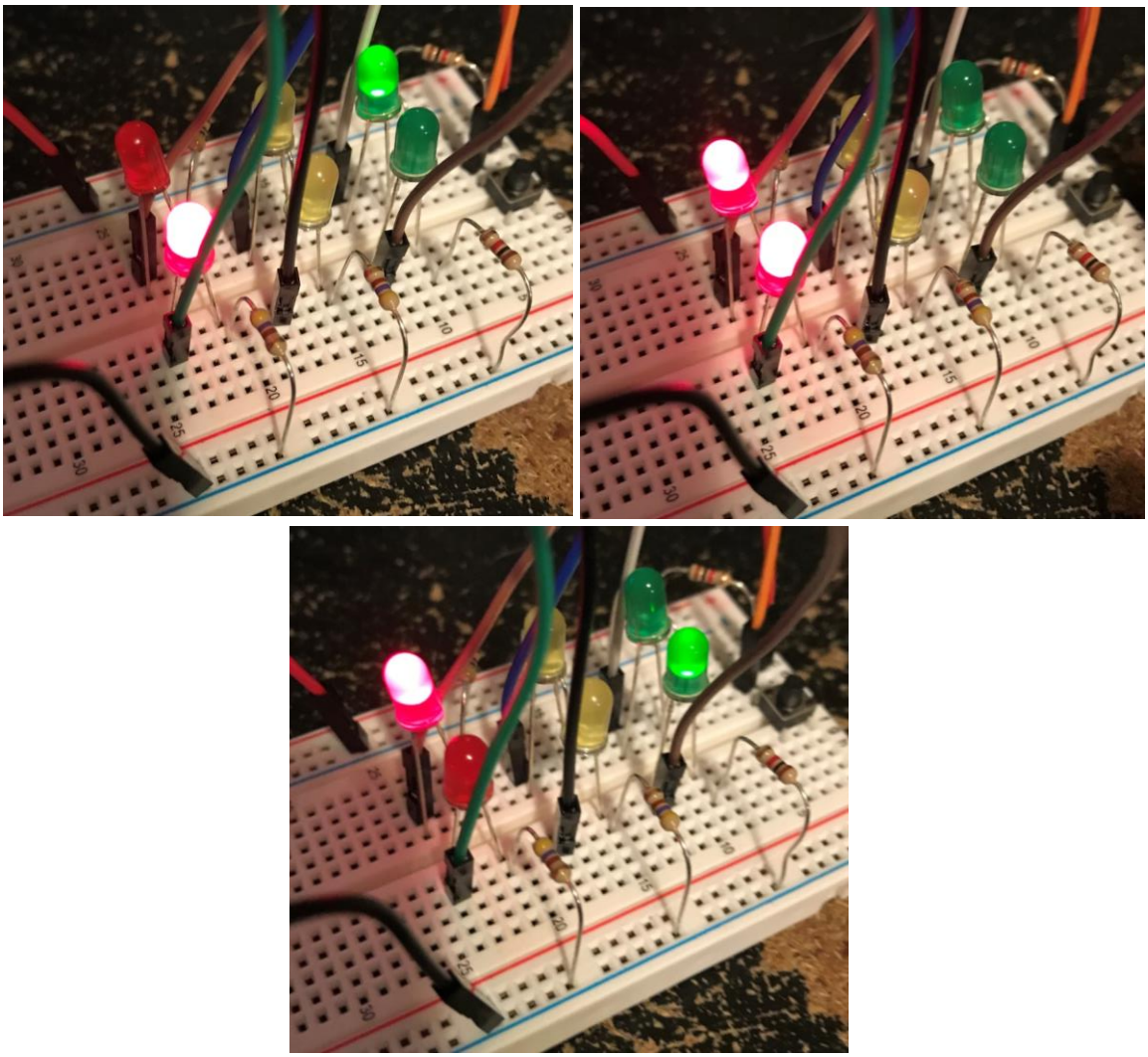
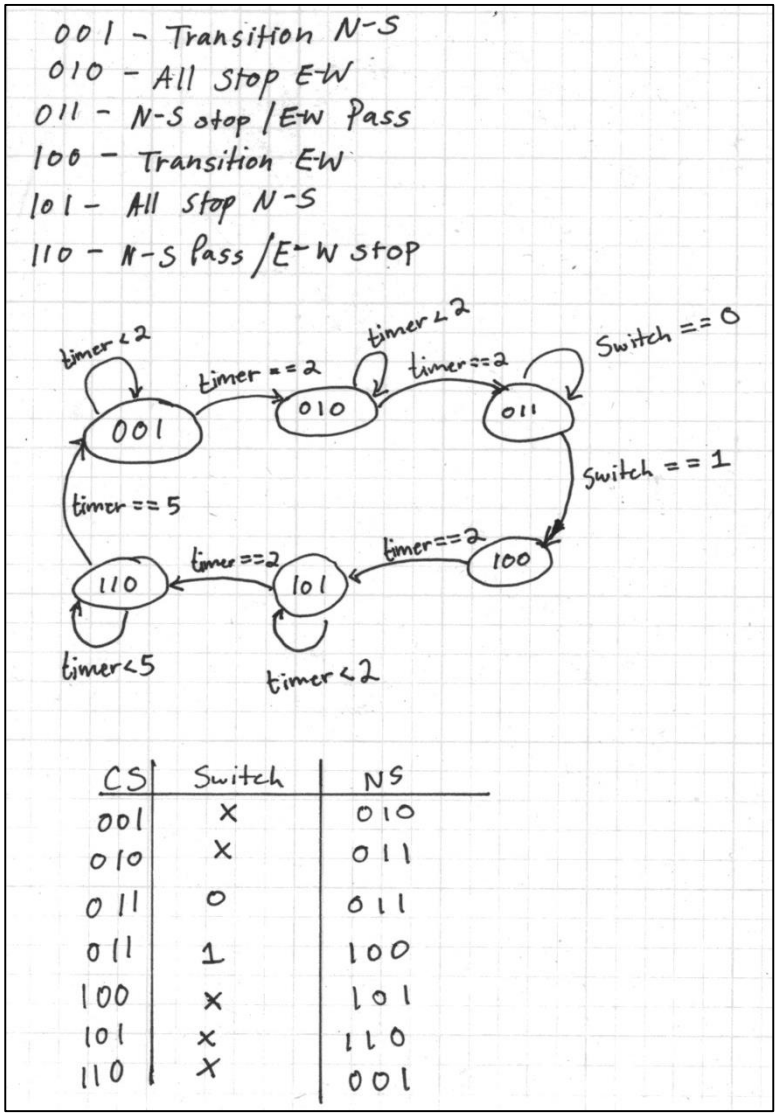


Figure 3. Transition from N-S Stop / E-W Pass (Top Left) to All Stop N-S (Top Right) and Finally Reaching N-S Pass / E-W Stop (Bottom)



CS	Switch	NS
001	X	010
010	X	011
011	0	011
011	1	100
100	X	101
101	X	110
110	X	001

Figure 4. FSM Diagram Along With Table Showing When Switch is High it Allows to go to New State (100)

Conclusion: This part of the lab was a good review on Finite State Machines. While allowing us to create a real life scenario to how a microprocessor can be useful.

Part3. Lab Tools

Description: In this part of the lab we were introduced to the Analog Discovery 2 and its useful debugging tools, that can be used in future labs. The tools used were Logger (Voltmeter), Oscilloscope, Logic Analyzer, and Arbitrary Wave Generator (AWG).

Engineering Data:

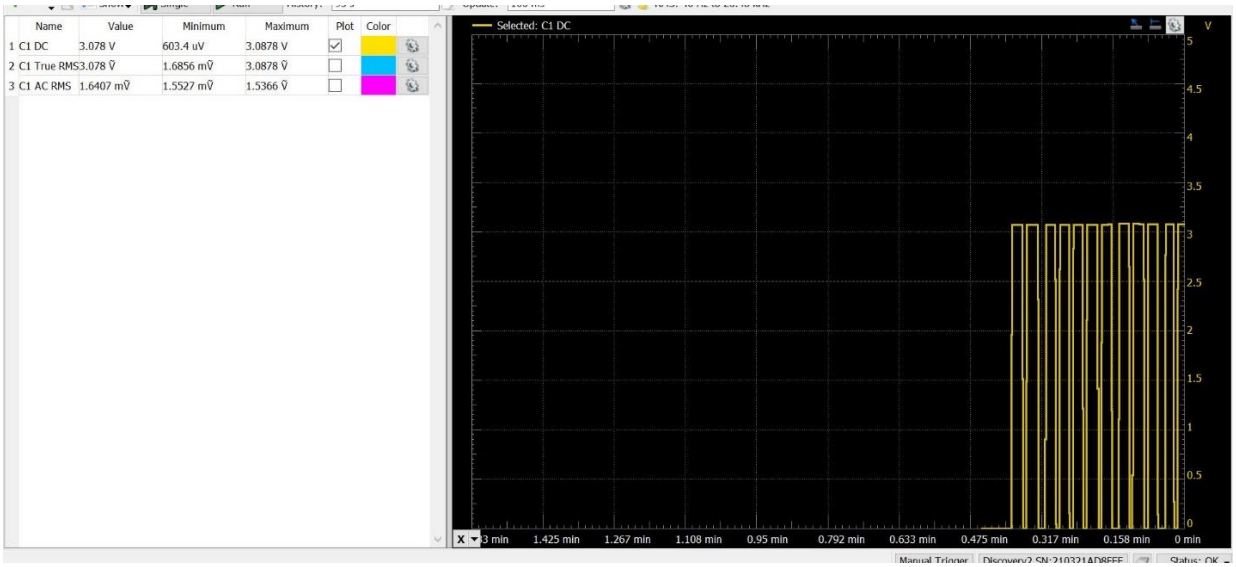


Figure 4. Logger (Voltmeter) Displaying the Voltage Across a Resistor and LED

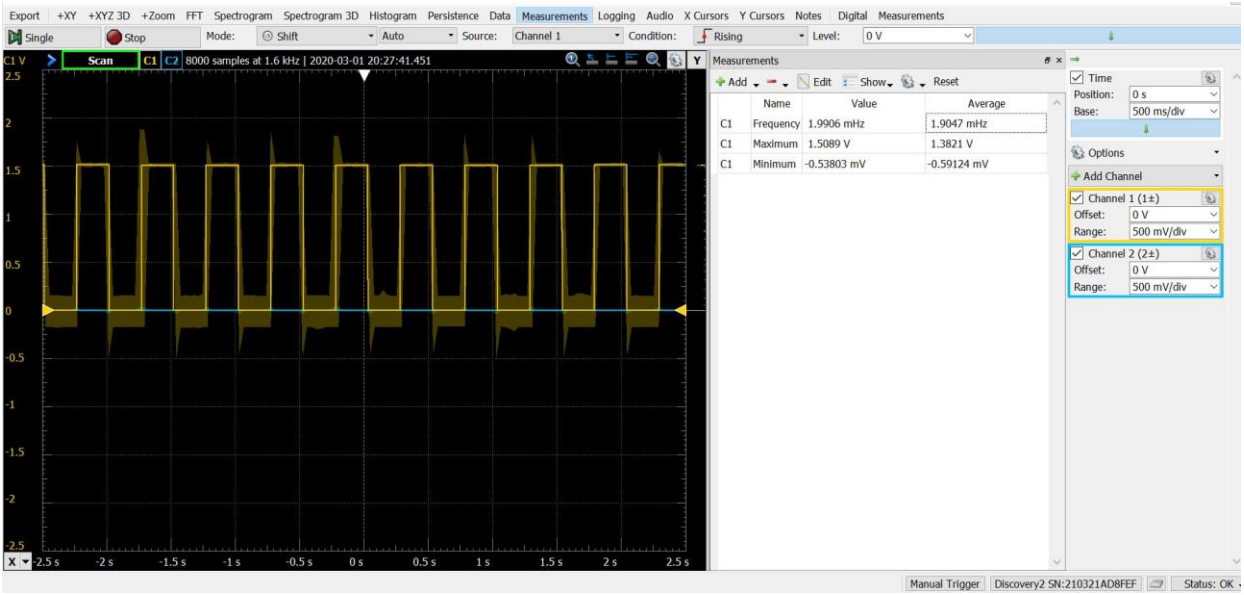


Figure 5. Oscilloscope Displaying Voltage Across a Resistor

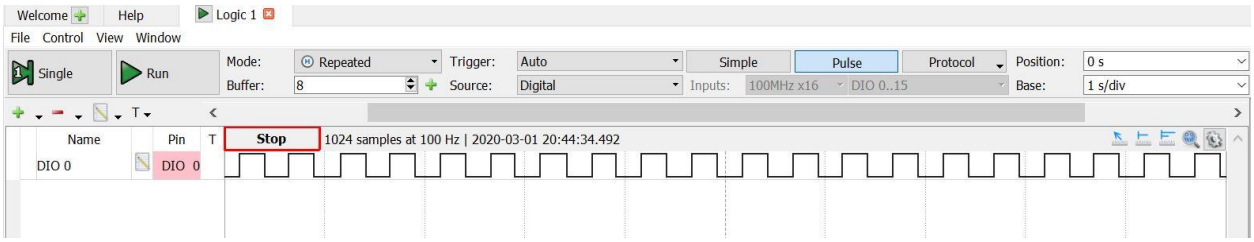


Figure 6. Logic Analyzer Tool Displaying the Digital Input (Rising Edge) of an LED Turning on

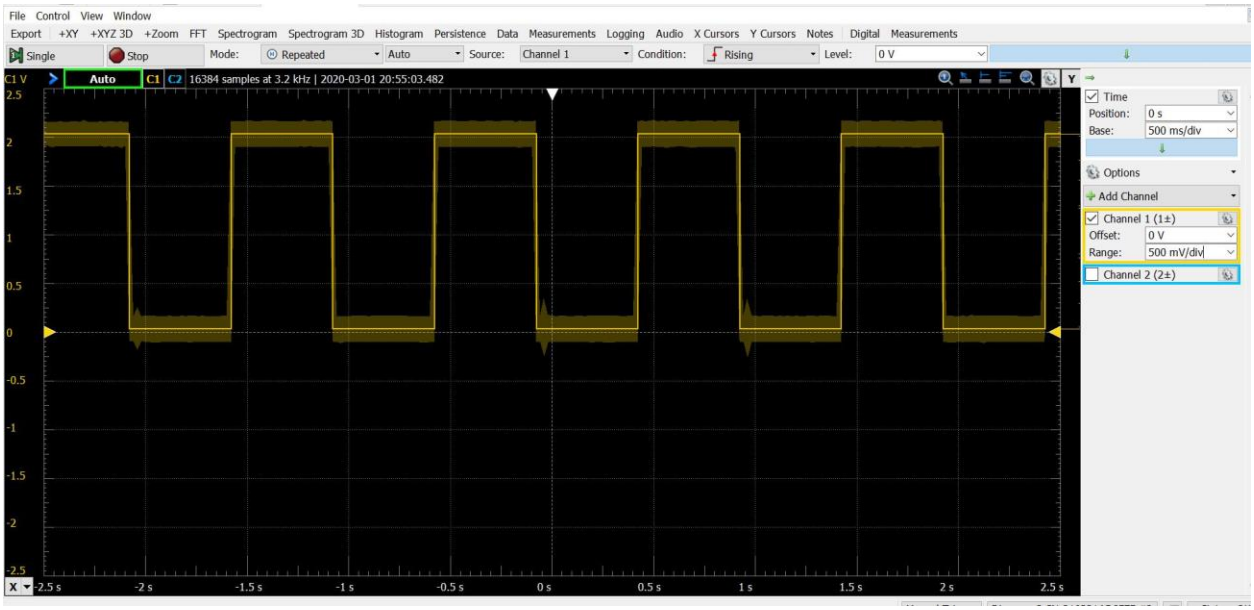


Figure 7. AWG Tool Displaying the Wavegen Output as a Square Wave

Conclusion: At the end of this part I gained a base of knowledge of how the debugging tools can be used when coming across issues during a circuit build.

Final Conclusion:

This lab helped me understand the use of a STM32 Nucleo board, STM32CubeMX, Atollic TrueStudio, and the Analog Discovery 2. The circuit build was fairly simple, I did come across an issue where one of my STM32 Nucleo boards was not allowing me to debug and run my programs on Atollic. Fortunately I bought two and once I connected the second one I was able to debug and run my programs on my Nucleo board. Having learned about FSM previously, it was a good refresher to apply my knowledge to the traffic light design. From using the Analog Discovery 2 debugging tools, I feel confident in knowing what tools to use when I come across an issue when building a circuit. Overall this lab was a good introduction to everything and did not take me a very long time to complete, about 2 hours.