Bit Banging Project 4 – 8051

Summary:
This project has 3 main parts. For part 1, you will be interacting with the QX-mini51 and implementing some of the features on the board. For part 2, you will connect an I2C board to your main board to read button presses and light up LED's over the I2C bus. For part 3, you will connect the existing I2C to the I2C on the back of the 1602 LCD. You will then send 2 lines of text to the LCD.

Required Components:

- QX-mini51

- IC2 Device (PCF8574)

- 1602 LCD with I2C backpack

- Breadboard & wires

- 4 LED's (and resistors)

- 4 Button switches

- Logic Analyzer (For software, use "Logic 2" from saleae.com)

Procedure:

Research and locate data sheets for all of the components above.

1. **Part 1:**
   1. In your linux distro, install SDCC, and use python pip3 to install stcgal
      - Here are 2 different examples of ways to write data to the MCU:
        - Using a make file: make && stcgal -p /dev/ttyUSB0 -P stc89 -a mini51.ihx
        - Using sdcc: sdcc stcboot.c i2c.rel lcd_1602.rel pcf.rel && stcgal -P stc89 stcboot.ihx
   2. Using LED's 1 – 8, create the following patterns:
      1. Binary count (increments & shows the current count in binary from 0 - 255)
      2. Cylon (Starting from the top, 2 of the 8 LED's get turned on. The LED's that are turned on are changed so that it looks like the LED's are sweeping back and forth)
      3. Dual Cylon (Similar to the Cylon, but there are two sets of lit LED's. One starts at the top, and the other at the bottom. They overlap in the middle)
   3. Using the 7 segment LED and button switches S3 & S4, be able to show numbers 0 – 9999. S3 increments the number, and S4 decrements the number. The number will roll over to either 0 or 9999 if out of range.
   4. Use button switch S1 to toggle between all the different features from Part 1.

2. **Part 2:**
   1. Plug your I2C device (PCF8574) into the breadboard. Connect to the device from the MCU.
   2. Wire up the 4 LED's and 4 Buttons to the I2C device.
   3. Turn on the corresponding LED's if a button press is detected. (Associate 1 button to 1 LED)
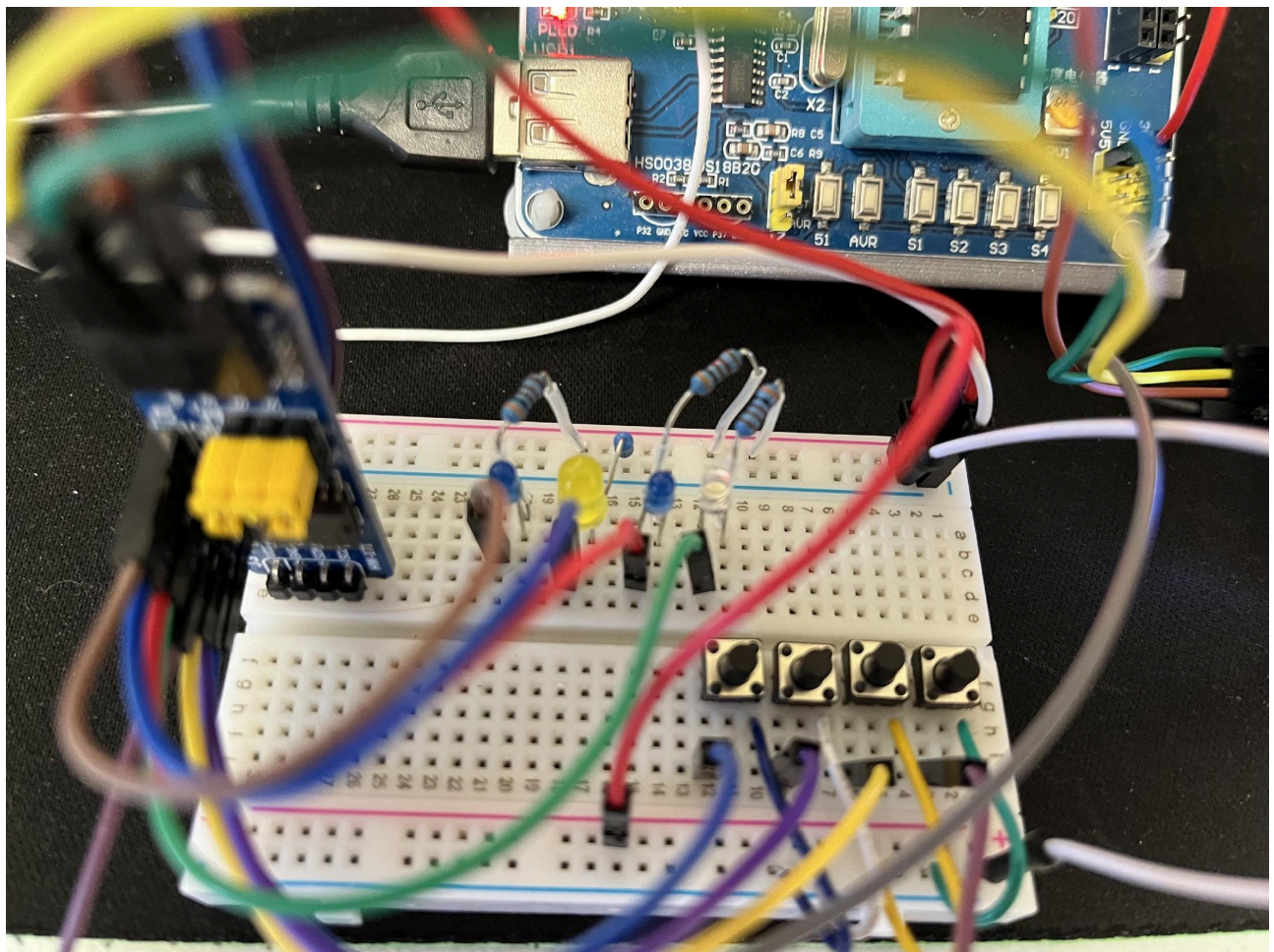
3. **Part 3:**
    1. Connect the I2C on the back of the 1602 LCD to the I2C on the breadboard. The MCU will be able to talk to either I2C device by simply addressing the correct device.
    2. Display 2 lines of text on the LCD –

        ▪ "Hello World"

        ▪ "Bob is Great!" (aligned right)

Figure 1: Part 1

Figure 2: Starting point of the 'Dual Cylon'

Figure 3: Part 2 - I2C Bus with button switches & LED's

Figure 4: Part 3: Fully Assembled