● Arduino Interaction Code for Taught Classes:

○ Description

■ The code that is included in this directory are three different software/hardware projects that I've personally designed for use in high school career and technology education (CTE) classes. The projects are designed where students need to combine basic programming, electronics design, and digital fabrication skills to produce functional, interactive projects. In addition, the projects require student to work as small production teams, creating scenarios where they need to consider the application of manufacturing and production engineering processes for efficiency of implementation.

■ These sample code projects are part of curriculum that we have our high school participants participate in as part of our ongoing NSF supported research projects, "***Collaborative Research: Preparing Students for the New Manufacturing Economy: An Integrative Learning Approach" (NSF award # 1949439)*** and ***"Broadening Participation for Remote Communities: Situated Distance Telepresence Mentoring through Embodied Communications" (NSF award #1917950).***

○ Class_Assignment_LED_Umbrella

■ Project Description

- This code assignment I designed for the high school students gives an example of how to control a large array of LEDs embedded on an umbrella for interactive purposes. The idea was to demonstrate to students how a large amount of arrays can be controlled where there are far more potential outputs in terms of individual LEDs than what may be immediately available in terms of actual pinouts available on the Arduino Mega. I introduced the concept of row and column addressing in terms of electrical/programming design. Included in this directory is the basic code to run on the Arduino Mega, the instructions for assembly for the class, and finally, the 3D print files for reproduction.
- **In the directory, *Class_Assignment_LED_Umbrell*a:**
  - In the sub-directory, *CTE_LED_Umbrella_Code* , there is C code that can be uploaded into an Arduino Mega.
  - In the sub-directory, *LED_Umbrella_3D_Parts*, there are the 3D files to print for the project.

        - There is a .pdf available that describes how to assemble the 3D printed parts with the electronics.

- **Language**
    - Arduino platform with C language.
- **Operation**
    - Upload to Arduino Mega via Arduino IDE

Class_Assignment_Paper_LED_Array

- **Project Description**
    - This code assignment I designed for the high school students gives an example of how to control individual LEDs in a 3 x 3 array. The idea was to demonstrate to students how patterns can be represented through an array of LEDs based on their on/off state.
    - **In the directory, *Class_Assignment_Paper_LED_Array*:**
        - The sub-directory, 2D_LED_Array, is an example code I provide for students to create patterns via 2 dimensional arrays used in conjunction with a “drawing” function that controls the state of LEDs in accordance with 2D array values. The code is meant to be used with Arduino UNO.
        - *LED Grid.png* is a visual of how the LEDs are arranged in relation to one another and the Arduino.
        - *Paper LED Grid Assignment with Buttons (for teachers and mentors).pdf* is a daily lesson plan that I wrote that builds towards the code described in 2D_LED_Array.ino, encompassing a variety of basic programming concepts including *functions, conditional statements, and arrays.*
        - *paperLED_Grid_front_back_button.pdf* is the template that I provided for the classes to assemble. The first and second page include the design of the LED grid template with the intention of printing on both sides. The third page includes a template for 6 buttons that follow a pull-up resistor design pattern. Students apply copper tape where indicated and solder wire to create a paper-based electronic circuit that is controlled by an Arduino UNO.
- **Language**
    - Arduino platform with C language.
- **Operation**
    - Upload to Arduino Mega via Arduino IDE.

- # Class_Assignment_Seven_Segment_Display
  - ## Project Description
    - This code assignment I designed for the high school students gives an example of how to extend their knowledge on controlling individual LEDs, this time in the form of a 7 segment display. The intent of the project is to demonstrate to students an example case where discrete control of LEDs can be used.
    - **In the directory, *Class_Assignment_Seven_Segment_Display*:**
      - *numDisplay.ino* is the basic Arduino code that specifies the exact pinout combinations that are responsible for a given numerical digit. The existing code iterates from 1 through 9 by calling individual functions that draw the specific numerical digit.
      - *3D_Print_Files* includes the 3D print files that house the electronics that are controlled by the Arduino UNO.
      - *numDisplayDecompose.MOV* and *numDisplayOperation.MOV demonstrates how the code works via Arduino.*
  - ## Language
    - Arduino platform with C language.
  - ## Operation
    - Upload to Arduino Mega via Arduino IDE.