Set-Up

Activity Overview: The students will un-box their Sparkfun LilyPad ProtoSnap Plus development board in this computer programming lesson. The students will establish a connection between their development board and computer. They will also upload their first program. This first program uses many of the components on the development board.

Learning Objectives:

Students will be able to:

- Set-up the LilyPad ProtoSnap Plus by establishing a connection between the computer and development board
- Upload and run a program

Supplies needed for each student:

- Computer
- Sparkfun LilyPad ProtoSnap Plus
- 1 USB Micro-B cable
- Engineering journals

Project Outline:

- Introduction – 5min
- Set-up LilyPad ProtoSnap Plus – 10min

Vocabulary:

- Board – the physical programmable circuit board
- Port – a physical connection to some other device
- Processor – responds to and processes the basic instructions that drive the computer
- USB-Serial or COM – a USB connection to a port used for communication through which information transfers in or out one bit at a time
- ProtoSnap Plus development board a.k.a. Dev board – the prototyping board made by Sparkfun that includes the simple board four pairs of LED's, buzzer, button, switch, a light sensor, plus extension ports

The Development Board:

The LilyPad ProtoSnap Plus development board is designed to get you started in the world of e-textiles. Combining a LilyPad Plus Simple Board with other LilyPad components like light sensor, a buzzer, a button, four pairs of colored LEDs, and a slide switch the ProtoSnap LilyPad development board lets students dive right into wearable electronics. The Protosnap also includes expansion ports to connect external sensors and components to the board.

Don't snap apart the LilyPad ProtoSnap Plus until students are ready to use the pieces in a project. If the pieces are left attached to the board, students will be able to prototype and test their projects before sewing.

Parts and pins of the Protosnap Plus Board:

The Lilypad Protosnap Plus has twelve components connected to the microcontroller by conductive pathways called traces. Below is a diagram of the Protosnap Plus board.

II. The Protosnap Plus board communicates with the computer through the use of a USB port and a micro-B USB cable. At its core the Protosnap Plus board as a LilyPad USB Plus microcontroller with a built-in RGB LED and bar graph of LEDs, as well as two additional power (+) and ground (-) sew tabs for ease of use. The LilyPad USB Plus is shown below.

Features of the LilyPad Protosnap Plus:

- USB port for connecting to a computer
- Two sets of power (+) and ground (-) sew tabs.
- Built-in RGB LED attached to bins 12 (R), 13(G), and 14(B).
- A row of six white LEDs attached to pins 15-20
- Charging circuit for single-cell (3.7V) Lithium-Polymer batteries.

Arduino:

The LilyPad ProtoSnap Plus development board programmed using a coding language called Arduino. Arduino is an open-source platform used for building electronics projects. In the following steps you will 1) Install the Arduino program. 2) add the Protosnap board to the preferences and finally 3) add some code so that Arduino will recognize the board. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (integrated Development Environment) that runs on a computer, used to write and upload computer code to the physical board. More information on Arduino is available from Sparkfun using the link below:
https://learn.sparkfun.com/tutorials/what-is-an-arduino

Step 1. Install Arduino

To start using the LilyPad ProtoSnap Plus download and install Arduino. Note: the board requires Arduino version 1.8 or higher so be sure to update the most current version of Arduino has already been installed.
Download and Install Arduino

1. Visit URL: http://arduino.cc/en/Main/Software
2. Download current version for you r operating system
3. Follow steps and procedures for installation based on your configuration and OS

For additional help with installing Arduino the link below:
https://learn.sparkfun.com/tutorials/installing-arduino-ide

Step 2. Add the board to the Arduino Preferences

Now that you have the Arduino program installed open the Arduino software on your computer. In Arduino, open the Preferences window by choosing File > Preferences from the menu.

In the “Additional Boards Manager URLs” text box type the following:
https://raw.githubusercontent.com/sparkfun/Arduino_Boards/master/IDE_Board_Manager/package_spark-fun_index.json

The image below (left) displays the Additional Boards Manager URLs textbox. If more room is needed, click the button to the right of the box as shown in the right hand image below. This will open a window allowing you to type the URL into a new line. Clock OK when done.

Step 3. Install SparkFun AVR Boards
In this step you will add the LilyPad USB Plus through Arduino’s Boards Manager Menu. Open the Boards Manager by choosing Tools > Board > Boards Manager… as shown in the imager right. When the Boards Manger window opens, it will present a long list of options. Type “sparkfun” (without quotes) into the “Filer your search” box at the top of the window. This will bring the list down to SparkFun’s options.
You should see several entries. Look for the one labeled SparkFun AVR Boards by SparkFun Electronics as shown on the right below.

Click anywhere in the SparkFun AVR Boards box. A version number and an “Install” button will appear. Click the install button. This will download and install the extension, once installed select the close buttion. If it is already installed, update to the latest version (LilyPad USB Plus and example code included 1.1.8 and higher). For troubleshooting tips vist:
https://learn.sparkfun.com/tutorials/lilypad-protosnap-plus-hookup-guide?_ga=2.233140382.1272845635.1526487639-54715019.1523295674

Uploading Code:

Now that the Arduino software has been installed students can begin to upload code from their computer to the ProtoSnap Plus board. Youth will need to perform three steps every time they want to program the board. These three steps are:

1. Connect the LilyPad ProtoSnap Plus to the computer using a USB cable
2. Select “LilyPad USB Plus” from Arduino’s “Boaard” menu (pictured below)
3. Select “LilyPad USB Plus” from Arduino’s “Port” menu (pictured right). On Windows ports are listed as com##; on a Mac or Linux machine they will be “/dev/cu.usbmodem###”. Slide the switch on the LilyPad USB Plus to the ON position. Students will not be able to upload code to the board if it is set to the OFF position. Once plugged-in and powered on the board will light-up and cycle through the Yellow, Red, Green and Blue LEDs as well as the white LEDs on the board and the built-in RBG LED in the center of the board.

Uploading Code:

When all the following have been completed students will be ready to upload their first program.

- Connected the LilyPad ProtoSnap Plus to the computer using a USB cable.
- Selected the board type (“LilyPad USB Plus” NOT “LilyPad Arduino USB”).

- Selected the COM port.
- Students are ready to upload code! Let's upload some code to try it out:

Load the "Blink" example form the menu File > Examples > 01.Basics > Blink, and click the "Upload" button (the large round button with the right arrow in it). This is a very simple example program; it just binks a LED on and off once per second.

Arduino will compile the code, then send it to the LilyPad USB Plus via the USB cable. While the code is uploading, the built-in LED will blink to signal the code is transferring. When the code finally runs, the RGB LED at the center of the board will slowly blink green. Success!

Using the Expansion Ports:

The LilyPad ProtoSnap Plus features five expansion ports connected to sew tabs on the LilyPad USB Plus. These allow you to easily attach external components to the board, including LilyPad and non-LilyPad boards. The expansion ports and accommodate alligator clips for testing and experimentation.