Getting Started with the Mantis Sensor Wand

Contents

Document Propose

This document will explain how to use the Mantis Sensor Wand, Temperature and Turbidity probes with the CPALMS Code app to first time users

Prerequisites

Bluetooth Dongle

The Bluetooth dongle must be connected in order for Scratch projects to interact with the Mantis Sensors. If you are having issues connecting to the dongle see the document entitled “GettingStartedWithCPALMS-code” and go to sections “Bluetooth Dongle” and “Bluetooth Dongle Troubleshooting”.

Enable Flash

Flash must be enabled in the browser in order for the Scratch project to run. Instructions on how to enable Flash in your particular browser can be found on the CPALMS-Code App site at:

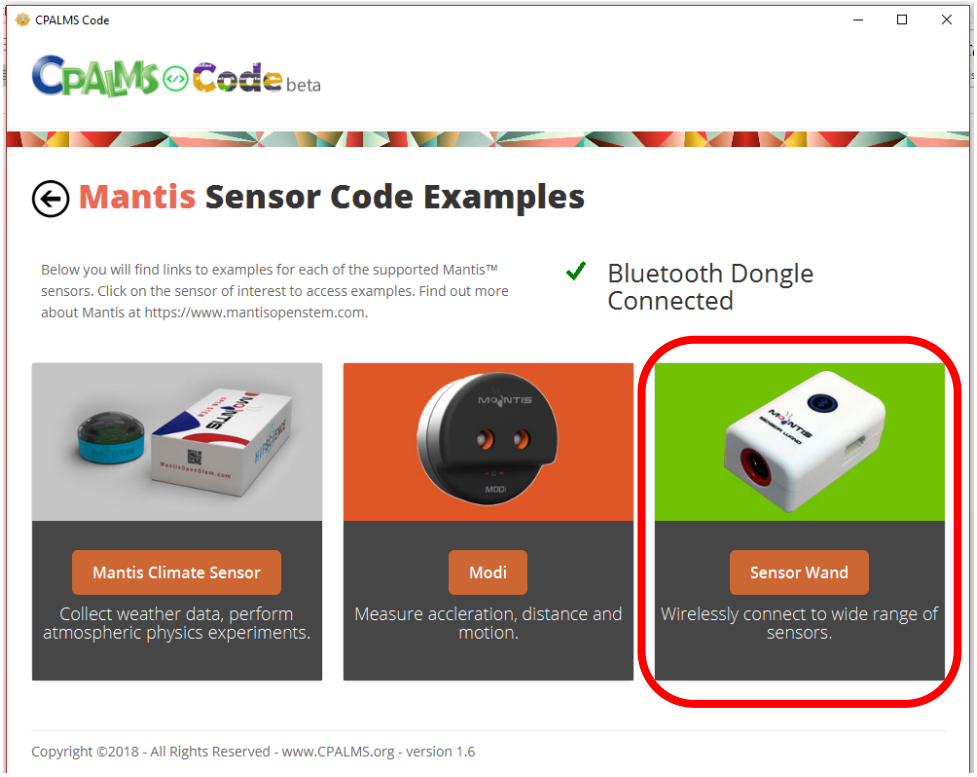
Windows: http://www.cpalms.org/page793.aspx

Mac: http://www.cpalms.org/page792.aspx

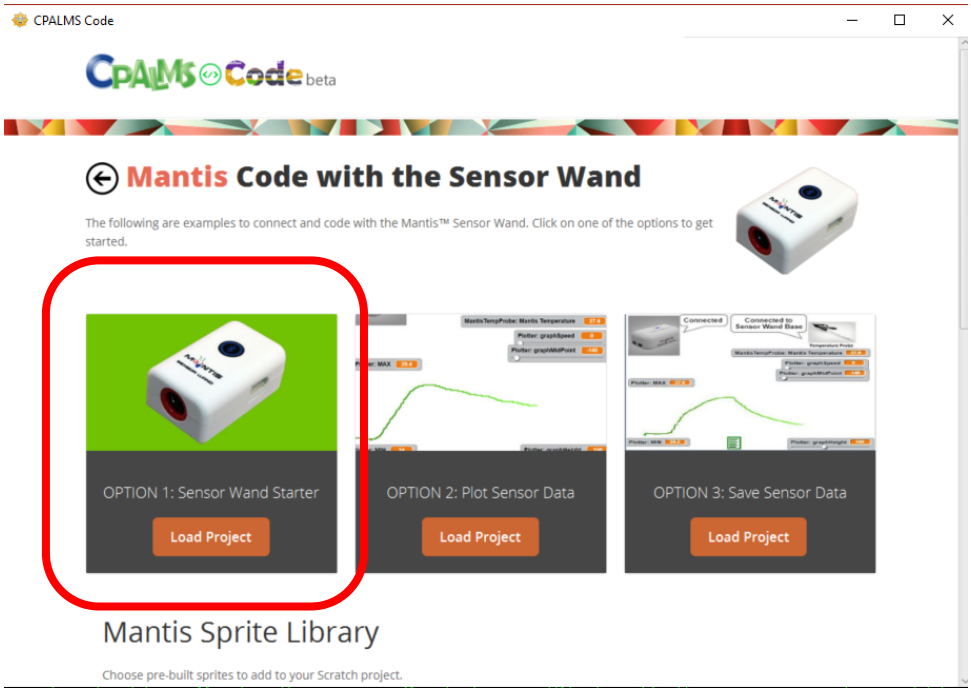
The Scratch project will load in the system default browser in a separate window or tab. Be sure your system default browser is set to Chrome, Firefox, Opera, or Safari (Mac). *The Edge browser will not work well.*

Running the Starter Project

From the CPALMS-Code App home page click on Mantis Sensors panel. Choose the Sensor Wand option from the Mantis Sensor Code Examples page:



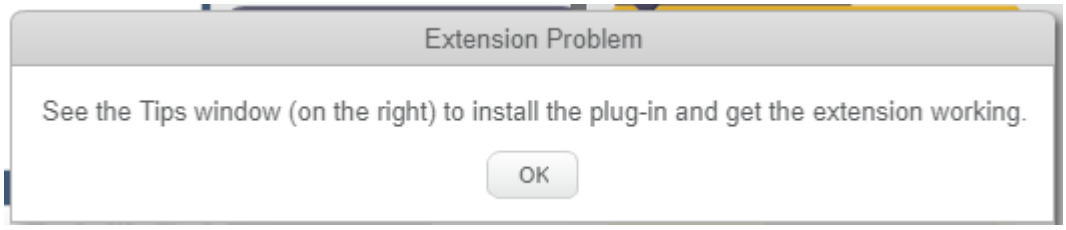
From within the Climate Sensor page choose Option 1: Sensor Wand Starter:



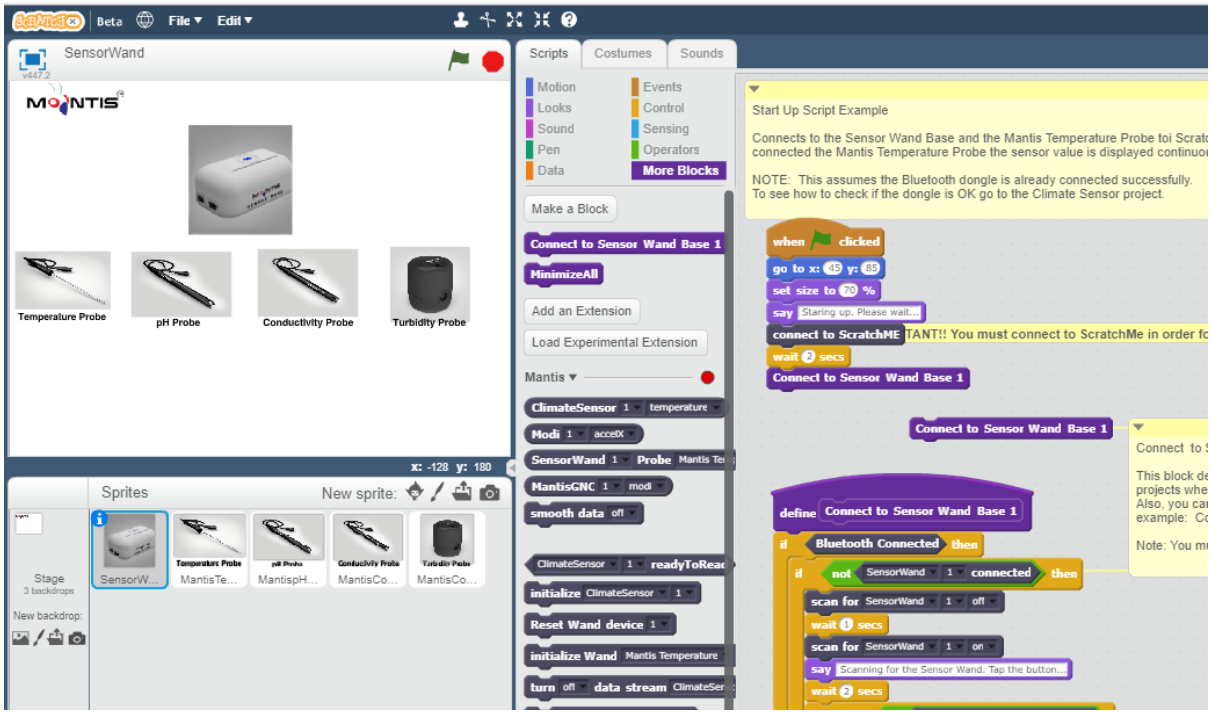
The project will open up in your system default browser in a separate window:

Click to continue:

When the project loads, click OK on the next error dialog. It is safe to ignore, there is no error:



You will now see the Sensor Wand Starter project:

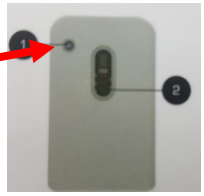


Connecting to the Sensor Wand Base

Start the Sensor Wand Base:

On the bottom of the Sensor Wand Base push the black button down for approximately 3 seconds:

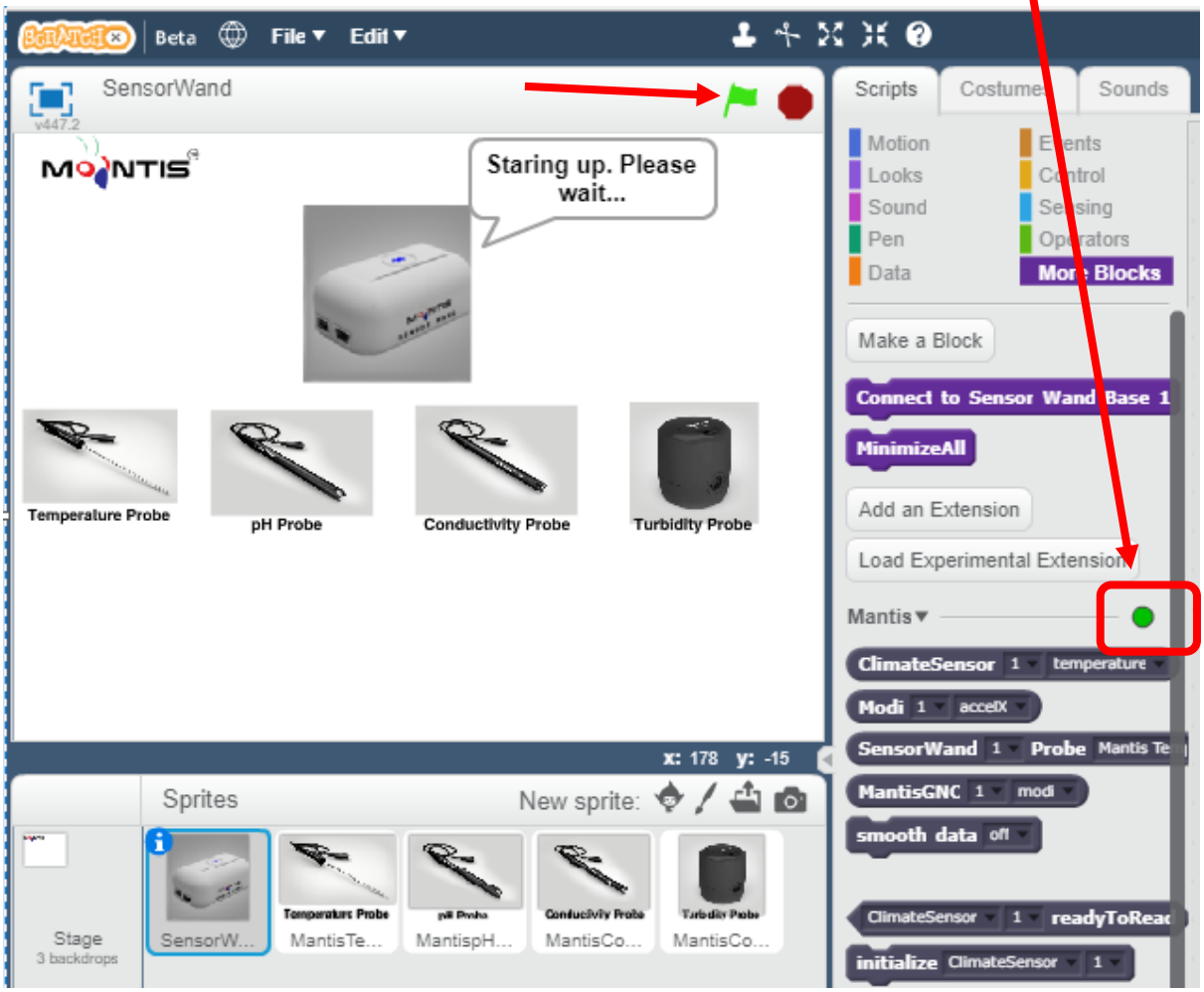
The button is located on the bottom of the sensor wand:



The Bluetooth light will come on:

Starting the Sensor Wand Starter Project:

Click the green flag to start the project. The Mantis Driver status light should turn green to indicate successful driver status:



The Sensor Wand Base sprite will guide the user through the connection sequence. The states of the sequence are now given:

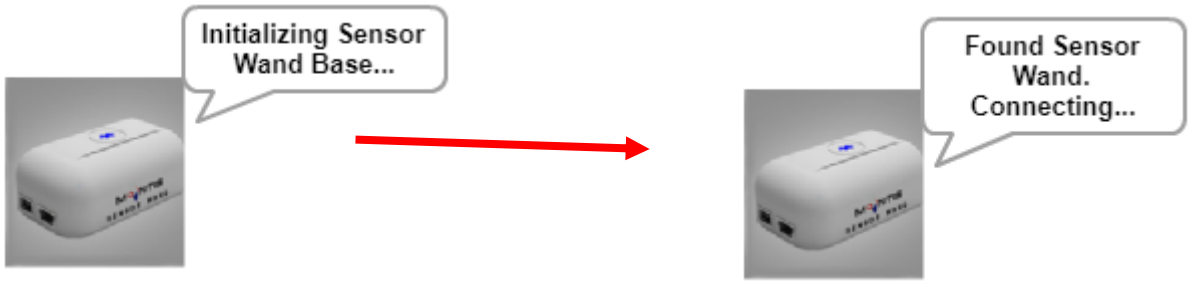
Tap the Button

You'll be prompted to tap the black button.

Important: Tap the button immediately! Do not wait **longer than 2 seconds after the message appears**. If this opportunity is missed, just click the green flag and start again.

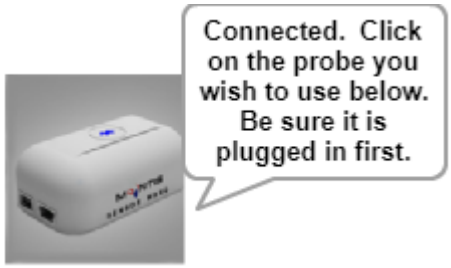
Pairing

If the button was tapped within the 2 second time window, the Scratch project will automatically find and connect to the Sensor Wand:



Sensor Wand Base Connected

Once Sensor Wand Base is connected it is time to select a Mantis probe to connect. The Mantis Probes also have a Bluetooth connection and must go through a connection sequence:

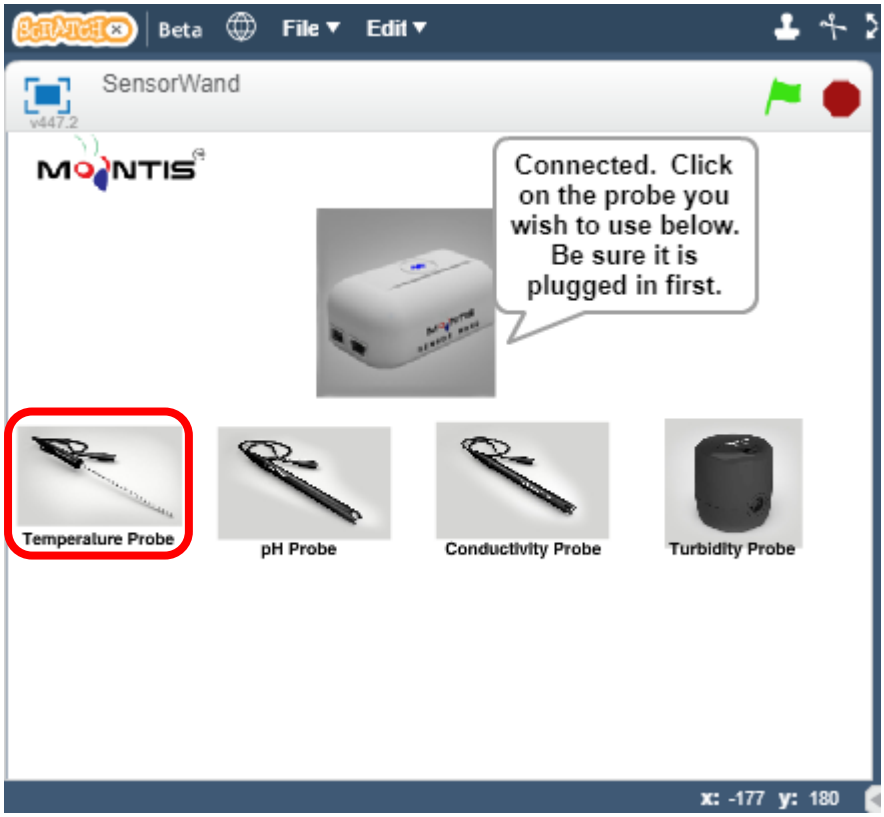


We'll connect to the Mantis Temperature probe in this example:

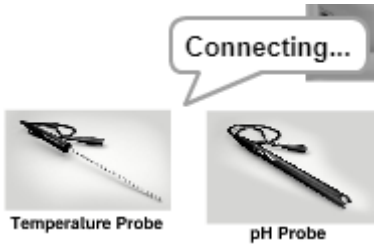
Connect to the Mantis Temperature Probe

Plug the Mantis Temperature Probe into the analog port:

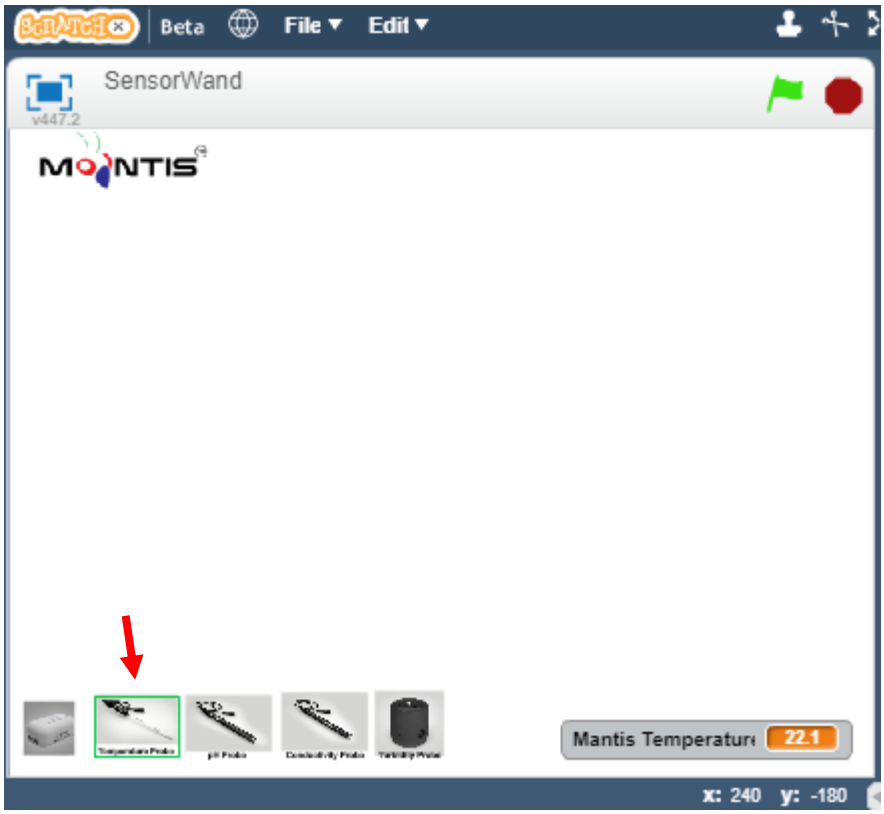
Click on the Temperature Probe as directed by the prompt:



The Temperature Probe sprite will respond with the connecting message:

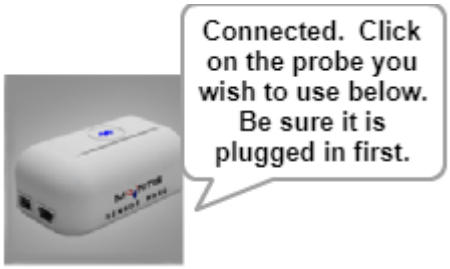


The sprites will automatically minimize and move to the lower left. The Temperature Probe will have a green highlight indicating it is the probe which is connected:



Connecting to an Already Connected Sensor Wand

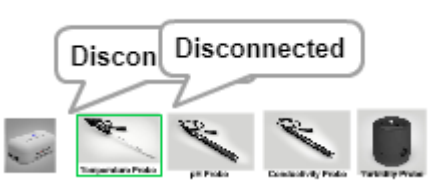
The code blocks in the Sensor Wand Sprite were built detect when the Sensor Wand is already connected. In this scenario the Sensor Wand goes immediately into the connected state:



What's happening is even though the Scratch project had been stopped, the Sensor Wand is still connected to the CPALMS-Code App. When the project is started up again, the Sensor Wand sprite resumes receiving data from the Sensor Wand over the same Bluetooth connection.

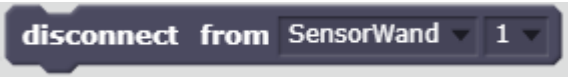
How Do I Disconnect the Sensor Wand?

To disconnect the Sensor Wand, tap the black button once while it is connected. The Sensor Wand and Temperature Probe will indicate its disconnected state.



Be Careful!! It is easy to accidentally tap the black button while handling the Sensor Wand. This will disconnect your Sensor Wand when you don't want to.

Also, it is possible to run the disconnect block. This is useful to disconnect when you've accidentally connected to someone else's Sensor Wand and can't tap the button:



Connect Once and Run Multiple Projects

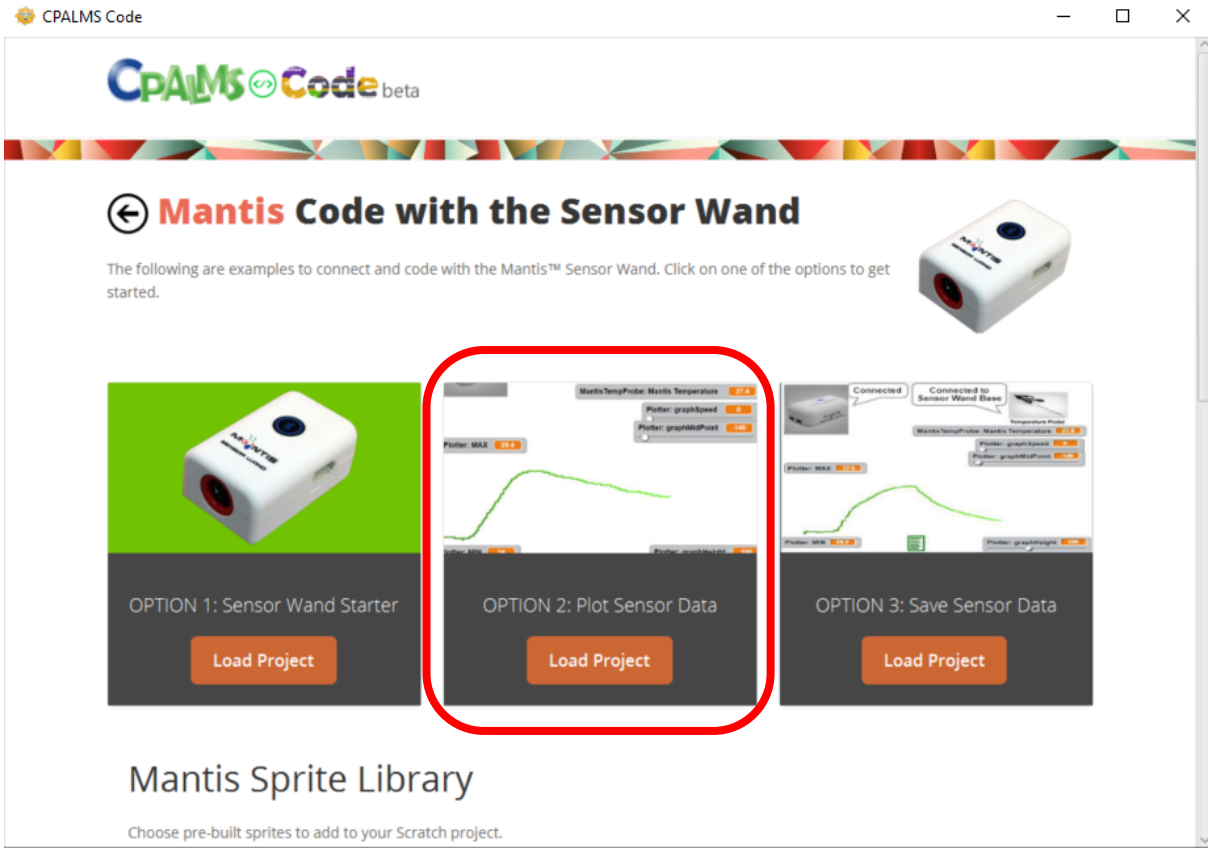
Once the Sensor Wand has been connected in one project, then all subsequent projects can automatically receive data from the same Sensor Wand. Let's do this with the Sensor Wand Starter Project and the Plot Sensor Data project:

Step 1:

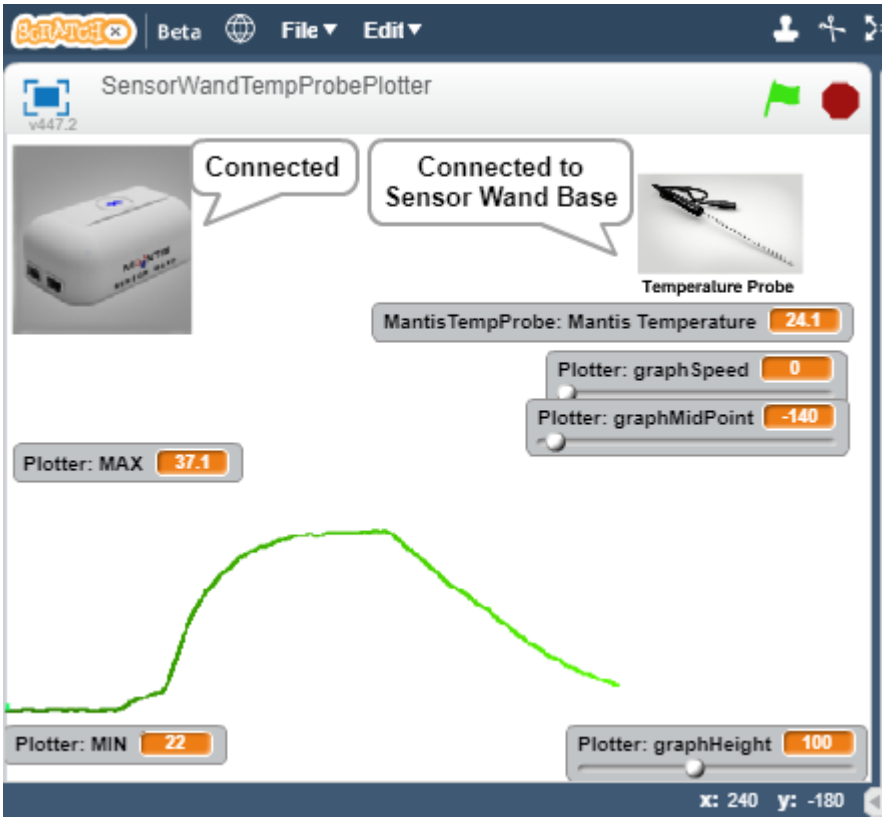
Connect to the Sensor Wand using the Sensor Wand Starter project as described above.

Step 2:

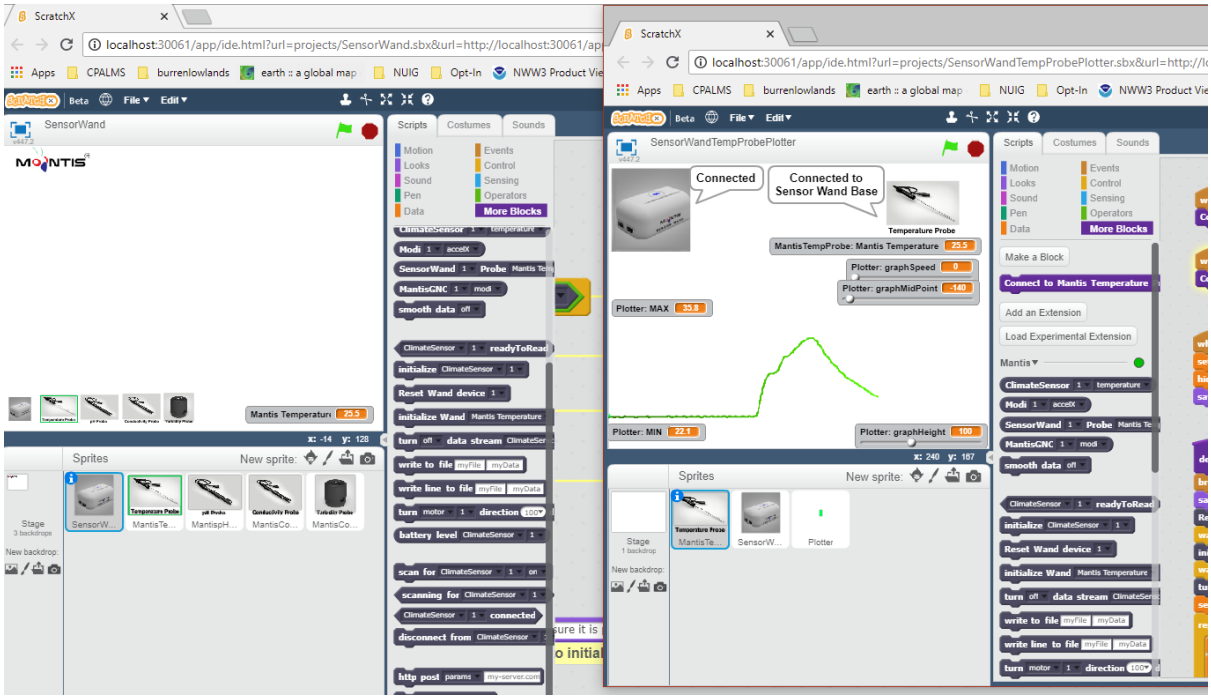
Start the Plot Sensor Data project:



When clicking the green flag the Sensor Wand and Temperature Probe detect the connection and immediately start receiving and plotting data. Grip the Temperature Probe in the palm of your hand and watch the plot react to the change:

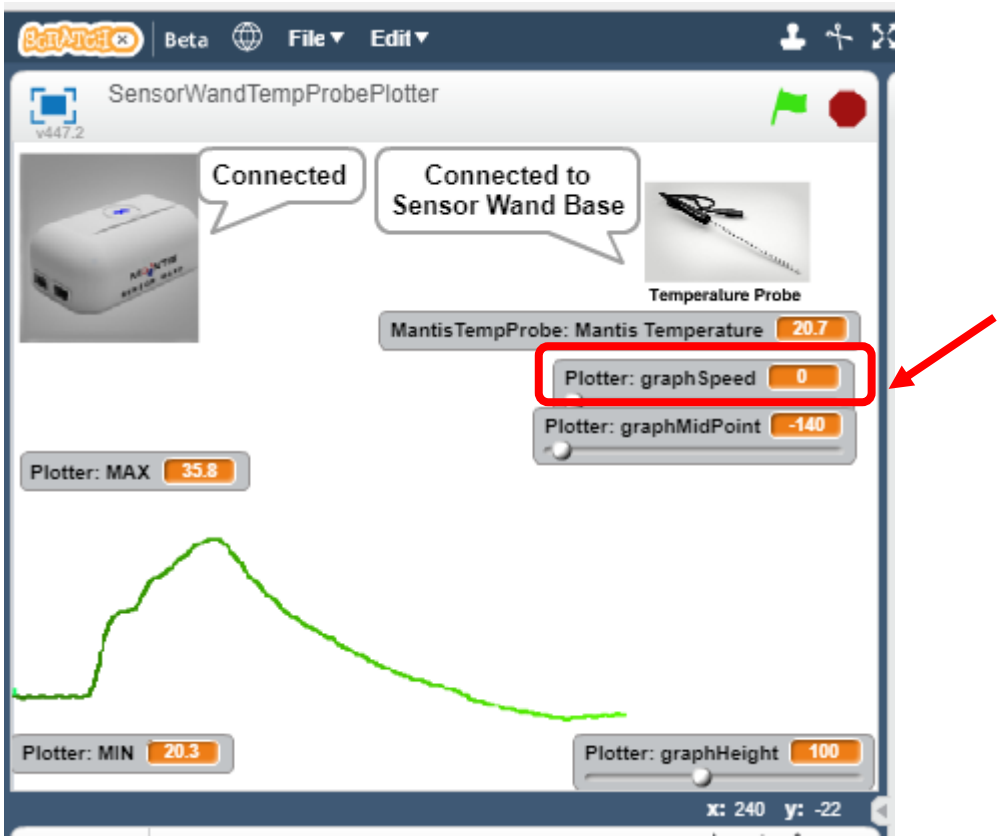


This picture shows the Sensor Wand Starter and Plot Sensor Data running simultaneously and sharing the same data connection:



Visualizing Data

The Plot Sensor Data project can be used to visualize data for laboratory experiments lasting for minutes or hours. The data rate can be adjusted so that the entire observation period can be made to fit on the Scratch stage. The data rate is controlled by the variable “graphSpeed” which can be adjusted by a slider:



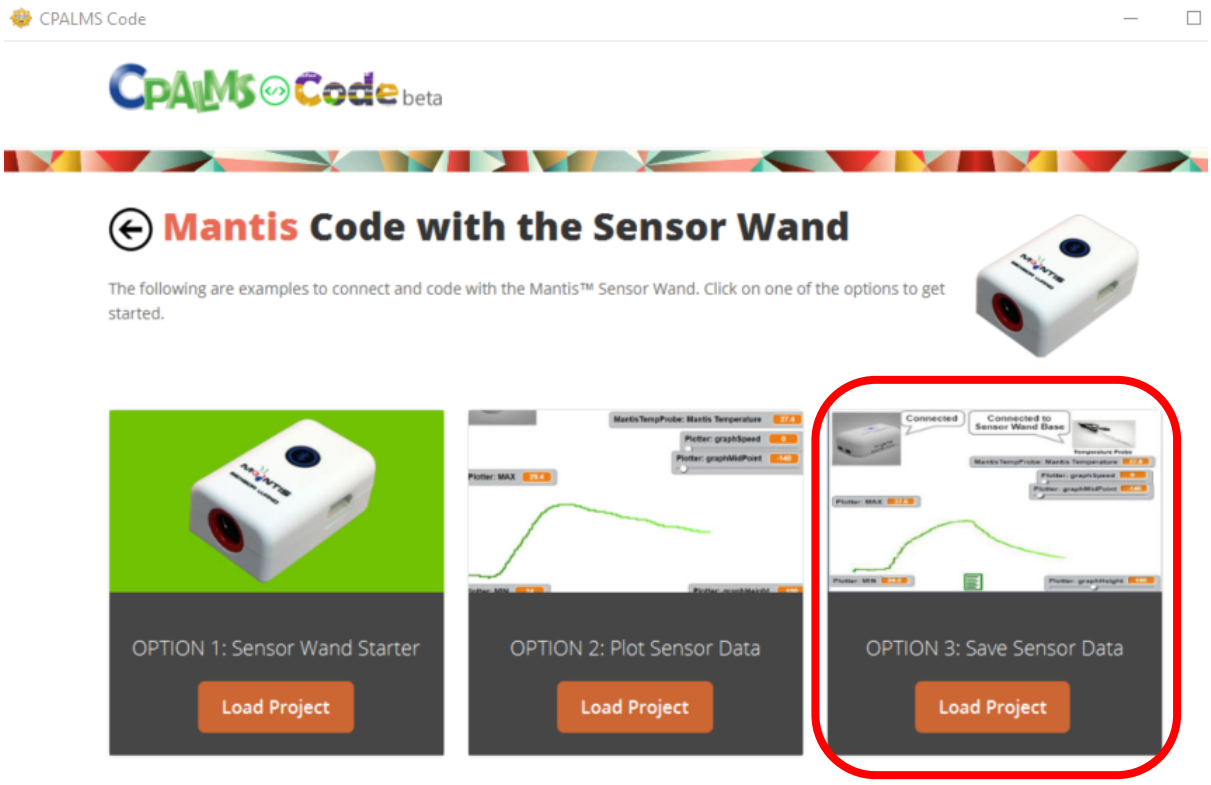
The graphSpeed variable represents the number of seconds to wait between plotting a point on the graph. Therefore, when the graphSpeed value is a:

- **small number** – the graph fills the screen *quickly* as it is waiting *less* time in between plot points
- **large number** – the graph fills the screen *slowly* as it is waiting *more* time in between plot points

For laboratory experiments the plot rate can be set to a small number such as 5 -60 seconds to cover a 20 minute observation period.

Saving Data

Data can be saved to a file by using the Save Sensor Data project which is started by choosing Option 3:

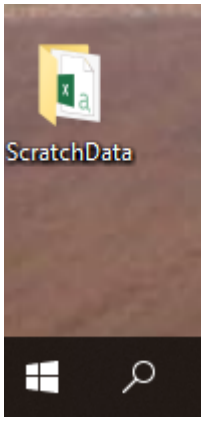


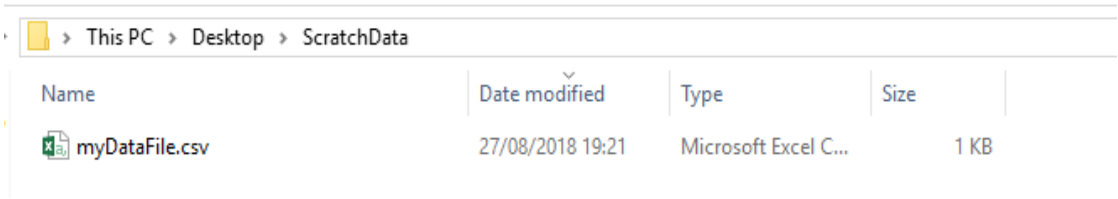
This project is exactly the same as the Plot Sensor Data project with the added feature of being able to create a file to which to write data.

On clicking the green flag the user is asked for a file name:

It is recommended to end the file name with the ".csv" extension because the program creates the data in the (Comma Separated Values) CSV format. By naming with the .csv extension, the computer will know to open the file with a spreadsheet application such as Excel.

You only have to type in the filename. The file will be placed in the ScratchData folder on the desktop. The result from the example above:

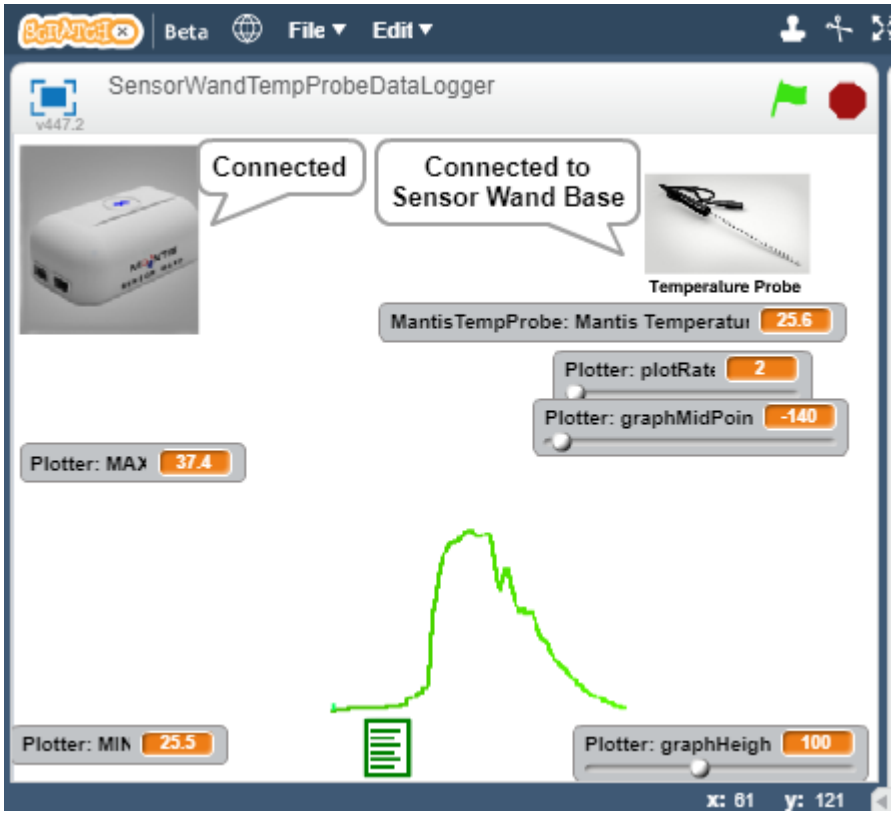




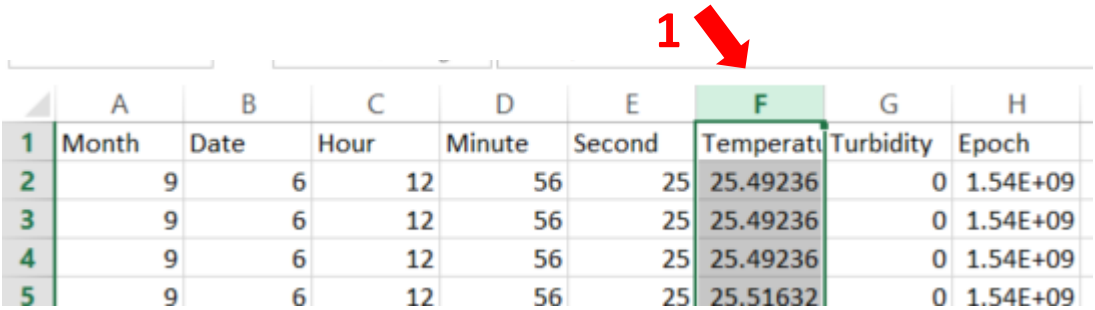
Plotting Saved Data

Let's plot the data which we saved to the file "myDataFile.csv".

We set the graph speed to 2 seconds and dipped the temperature probe into a cup of warm water and then took it out. The temperature data plot looks like this:



Let's see what the file in "myDataFile.csv" looks like. Open the file and plot the data by choosing the entire Temperature column:

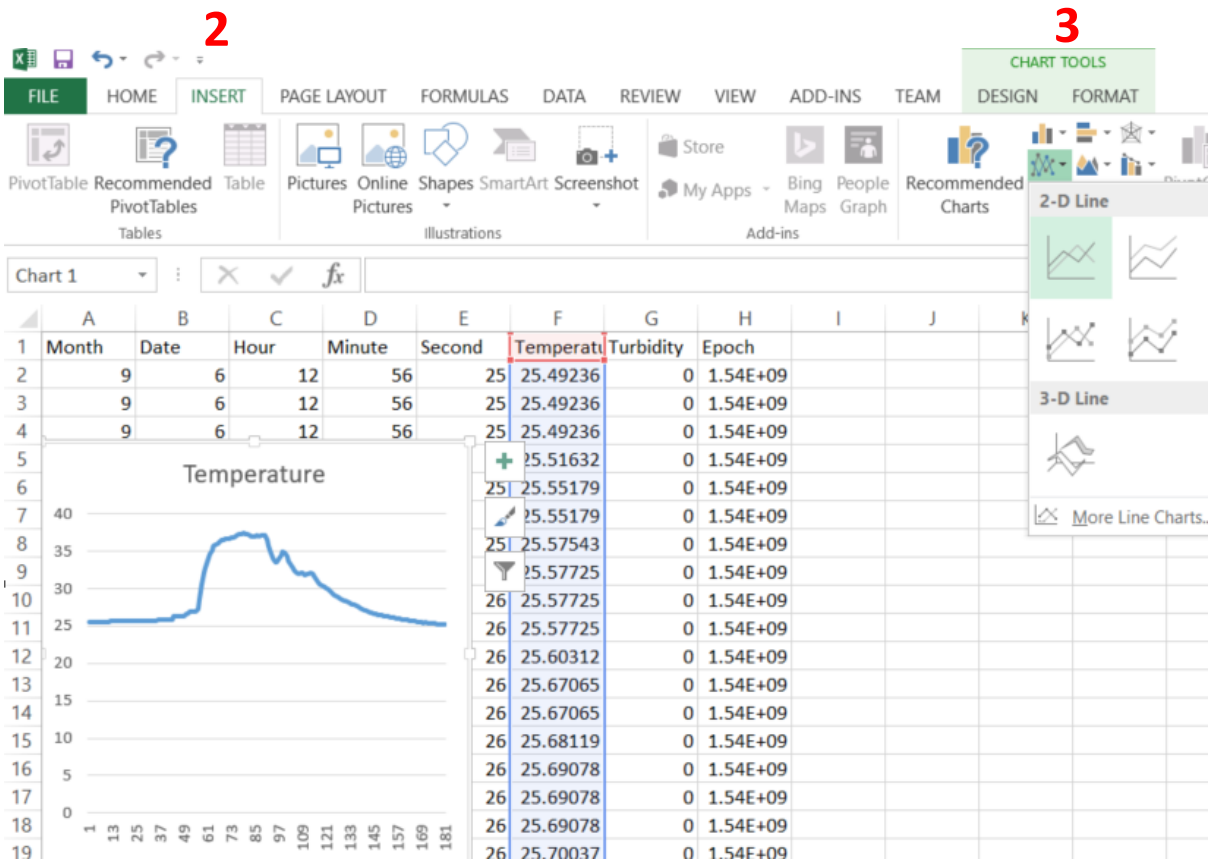


	A	B	C	D	E	F	G	H
1	Month	Date	Hour	Minute	Second	Temperatu	Turbidity	Epoch
2	9	6	12	56	25	25.49236	0	1.54E+09
3	9	6	12	56	25	25.49236	0	1.54E+09
4	9	6	12	56	25	25.49236	0	1.54E+09
5	9	6	12	56	25	25.51632	0	1.54E+09

To make a plot:

1. Choose the entire column of Temperature data
2. Choose the Insert tab
3. Choose Recommended Charts -> 2-D line chart

The graphs are similar, the length of the horizontal axis is the graph can be adjusted to be closer in scale to the graph in the Scratch project:



Create Your Own Project with 2 Sensor Wands and Probes

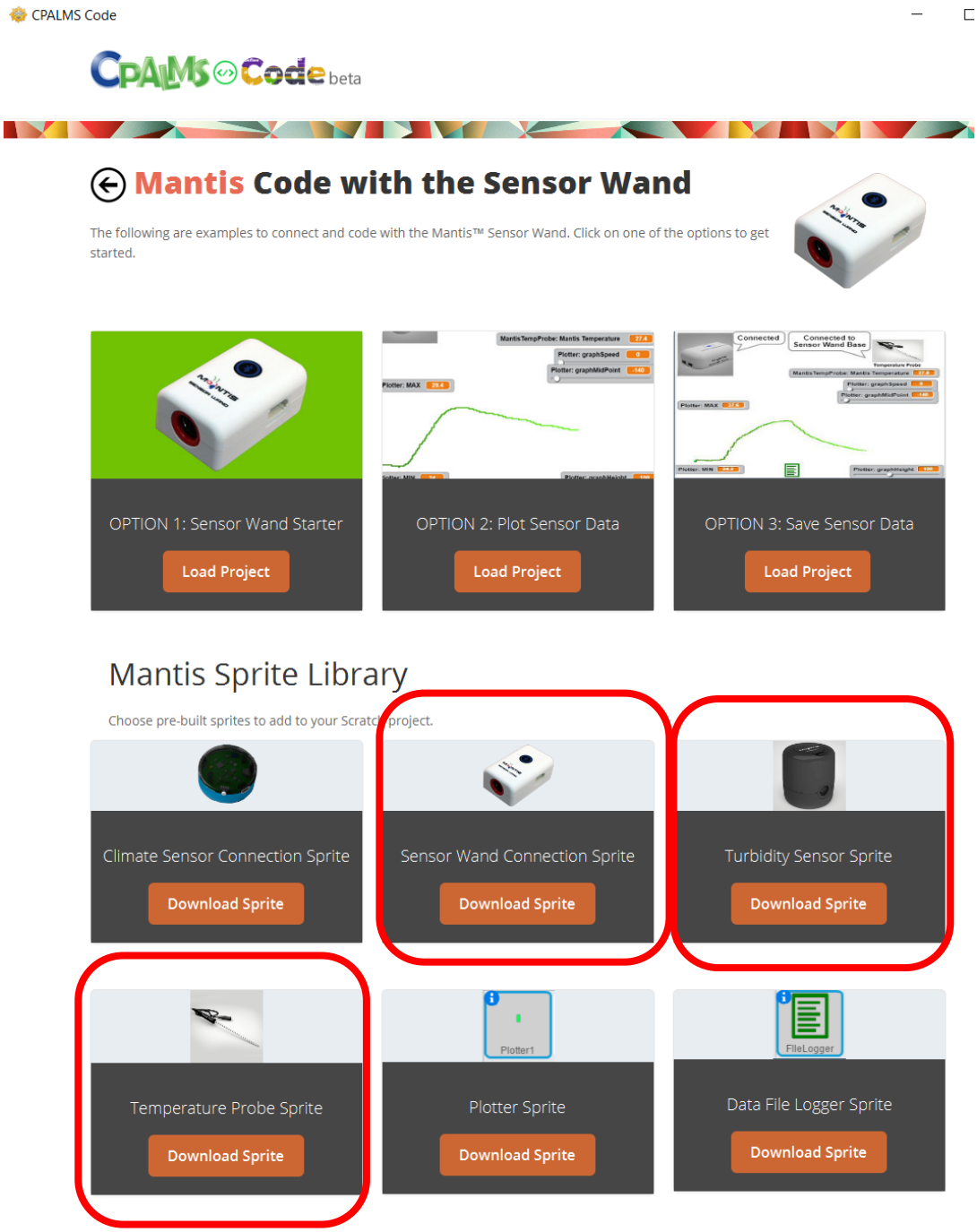
We will build a single Sensor Wand project that will simultaneously acquire data from the Temperature Probe and Turbidity Probe. Note that two Sensor Wand bases are required:

- Use Sensor Wand Base #1 to connect to the Temperature Probe
- Use Sensor Wand Base #2 to connect to the Turbidity Probe

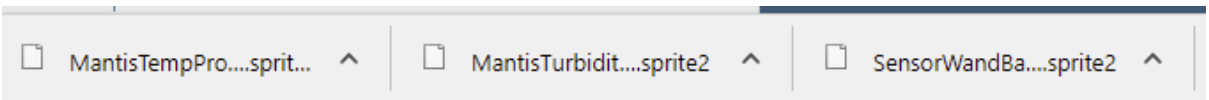
This example will show how to build a new project by importing sprites, thus saving time because each sprite comes with its own code blocks already made.

Scroll down the page so the Mantis Sprite Library panel comes into view.

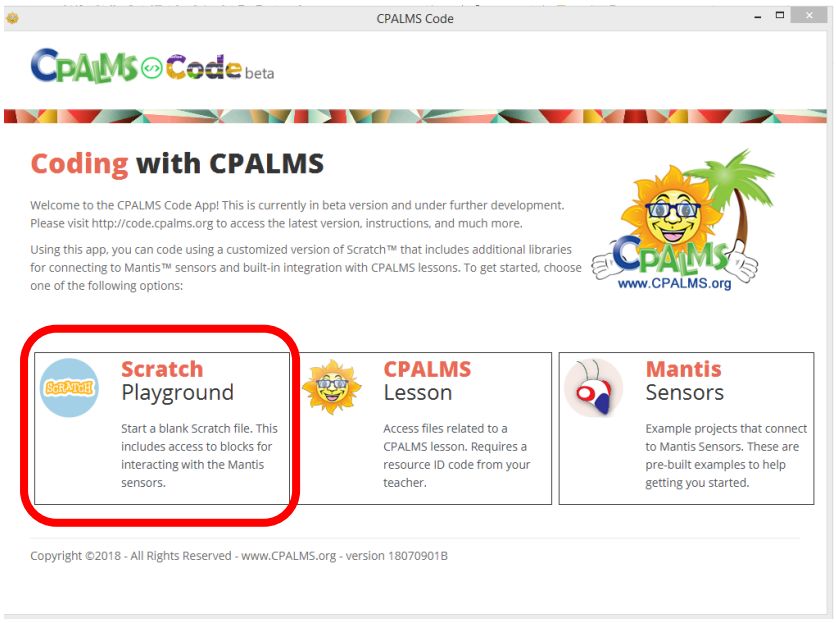
Download sprites for the Sensor Wand Connector Sprite, the Temperature Probe Sprite and the Turbidity Probe sprite:



They will usually end up in your downloads folder:

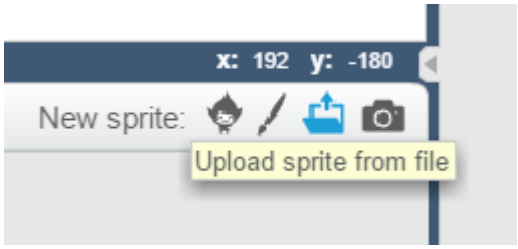


From the CPAMS Code home screen open a new project by clicking on the “Scratch Playground” option:

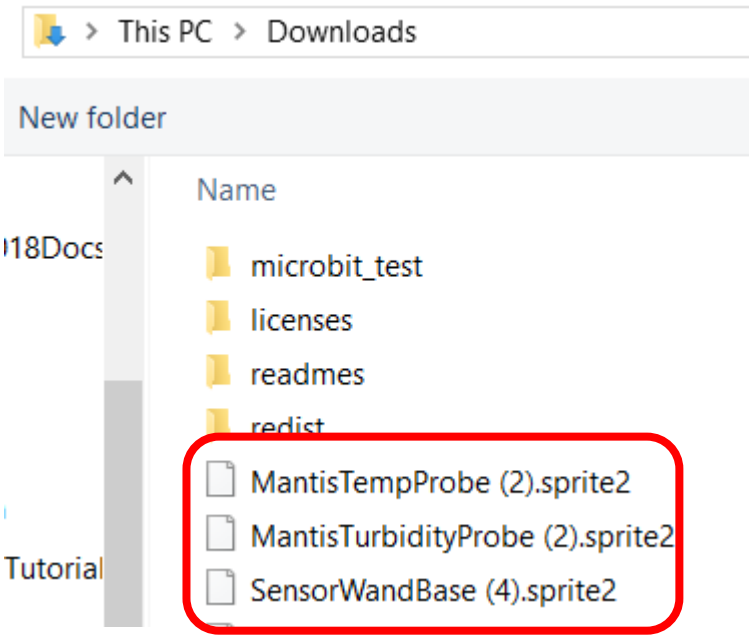


Load the Sprites

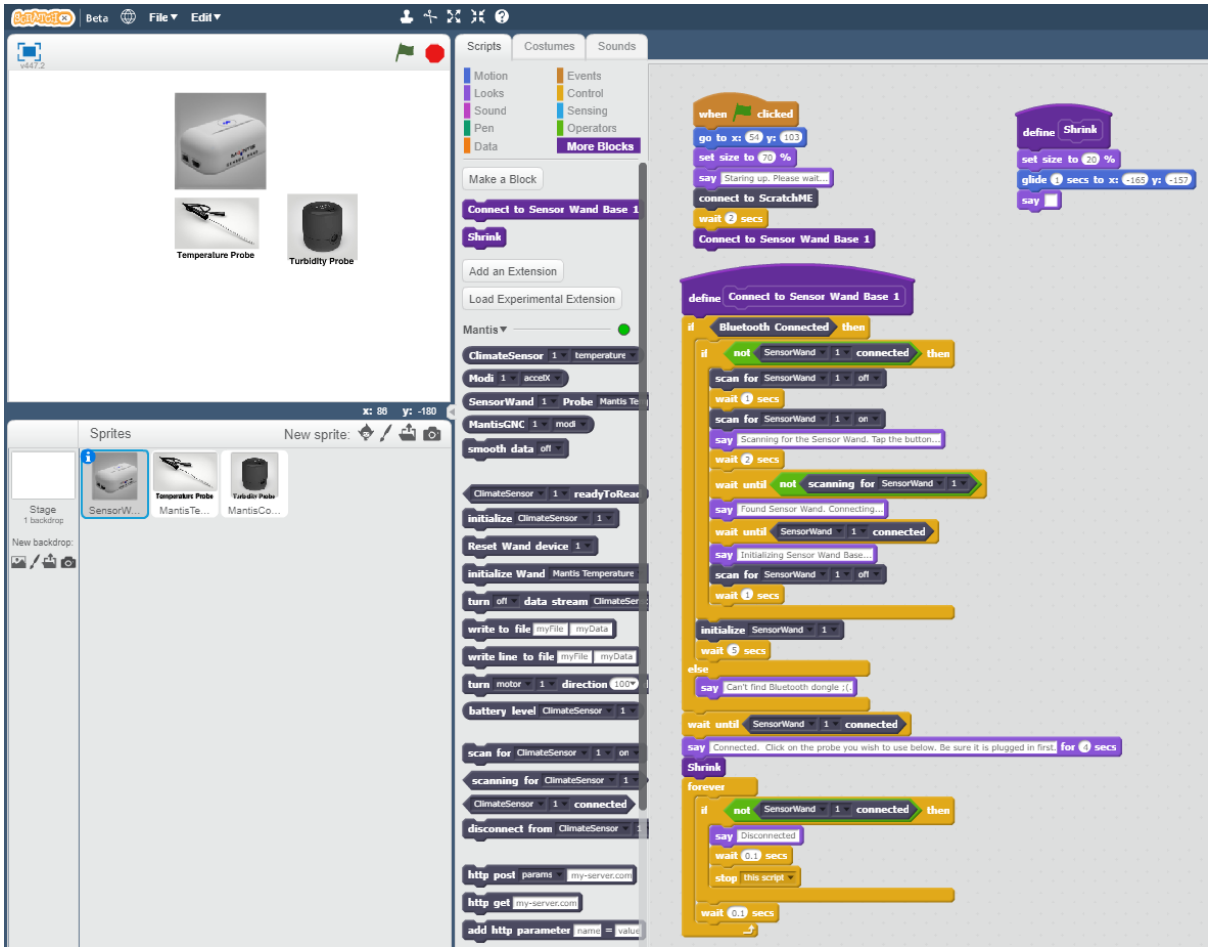
From the new project import these sprites into your new project using the "Upload Sprite from File" button:



Select the sprite files from where you downloaded them:



Congratulations! You saved yourself a lot of coding:



When you click the green flag, the sprites will go to pre-designated places on the stage. You can change these locations to suit your project.

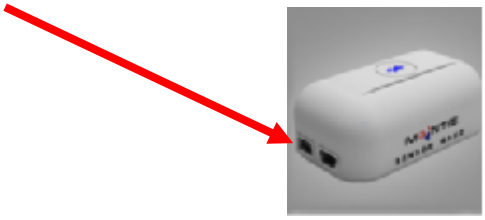
Run the Project

Click the green flag and connect to the Sensor Wand Base and Temperature Probe as described earlier:

Note the Turbidity Probe is unused. A second Sensor Wand Base is required in order to connect to the Turbidity Probe.

Connecting the Turbidity Probe to the Sensor Wand Base

You will connect the Turbidity probe to the Sensor Wand Base using the port in the back of the Sensor Wand Base.

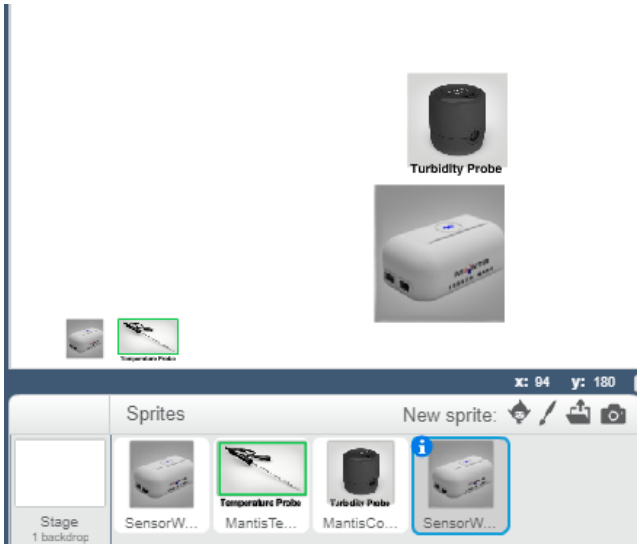


The rest of the process is the same as explained in the aforementioned “Connecting to the Sensor Wand Base” section of this document.

Create a Second Sensor Wand Base Sprite

We wish to connect the Turbidity Probe to Sensor Wand #2. Right click on the Sensor Wand sprite and duplicate it:

Sensor Wand 2 appears containing the same code as the original:



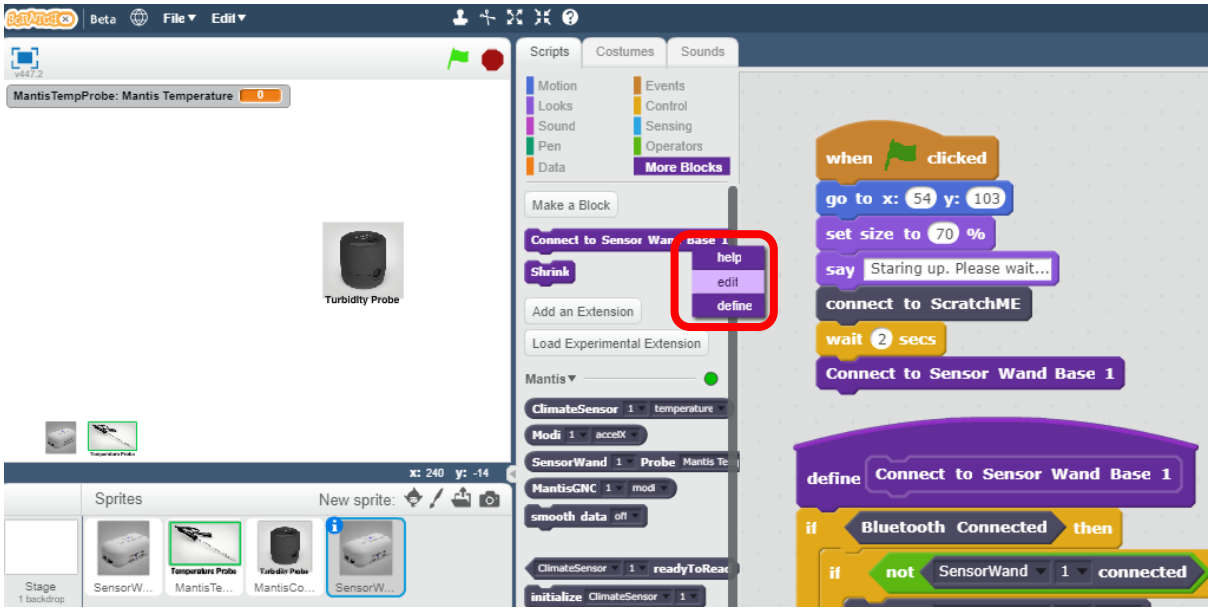
You may want to adjust the appearance of the duplicated Sprite by writing the #2 on it so it can easily be seen on the Stage to help you remember which sensors wand is # 1 and #2. You can do this by going into costumes, on the duplicated sensor wand, and adding text.

Adjusting the code

You must adjust the code on the newly duplicated Sensor Wand sprite, as the code from Sensor Wand 1 was duplicated and it refers code from Sensor Wand 1 only.

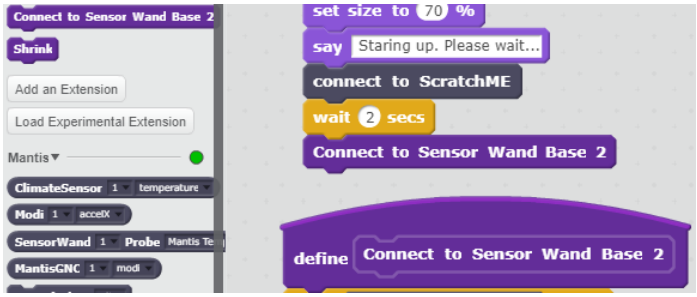
Step 1 Create a new block:

Be sure you have clicked and are working off the second Sensor Wand sprite. Click on the More Blocks Scripts. Right click on the "Connect to Sensor Wand 1" block and select "edit"



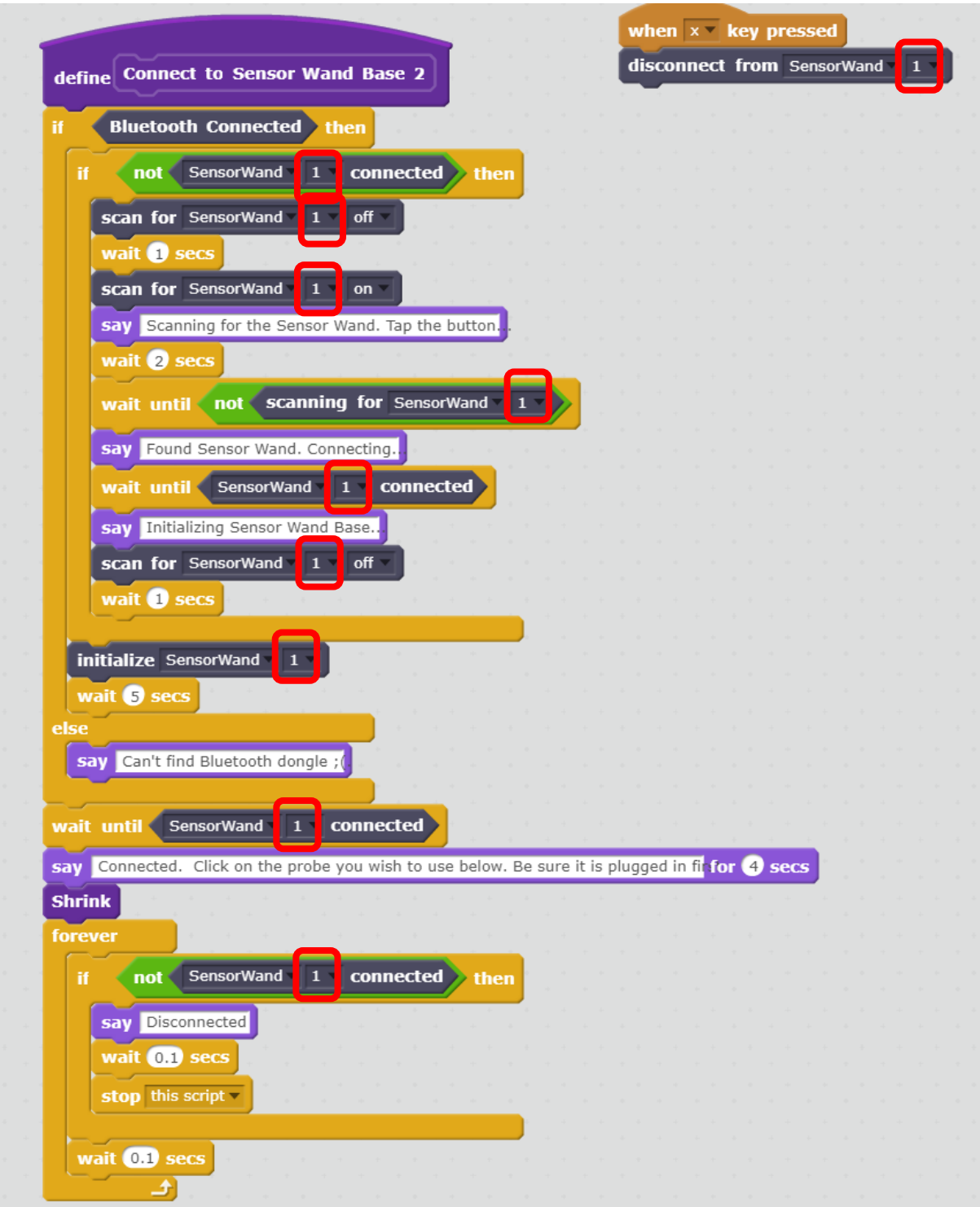
Type in the name of the new block- It should say something like "Connect to Sensor Wand **2**". Be sure to use the number 2 since this is the second sensor wand.

Notice that the name of the block changes everywhere in the sprite:

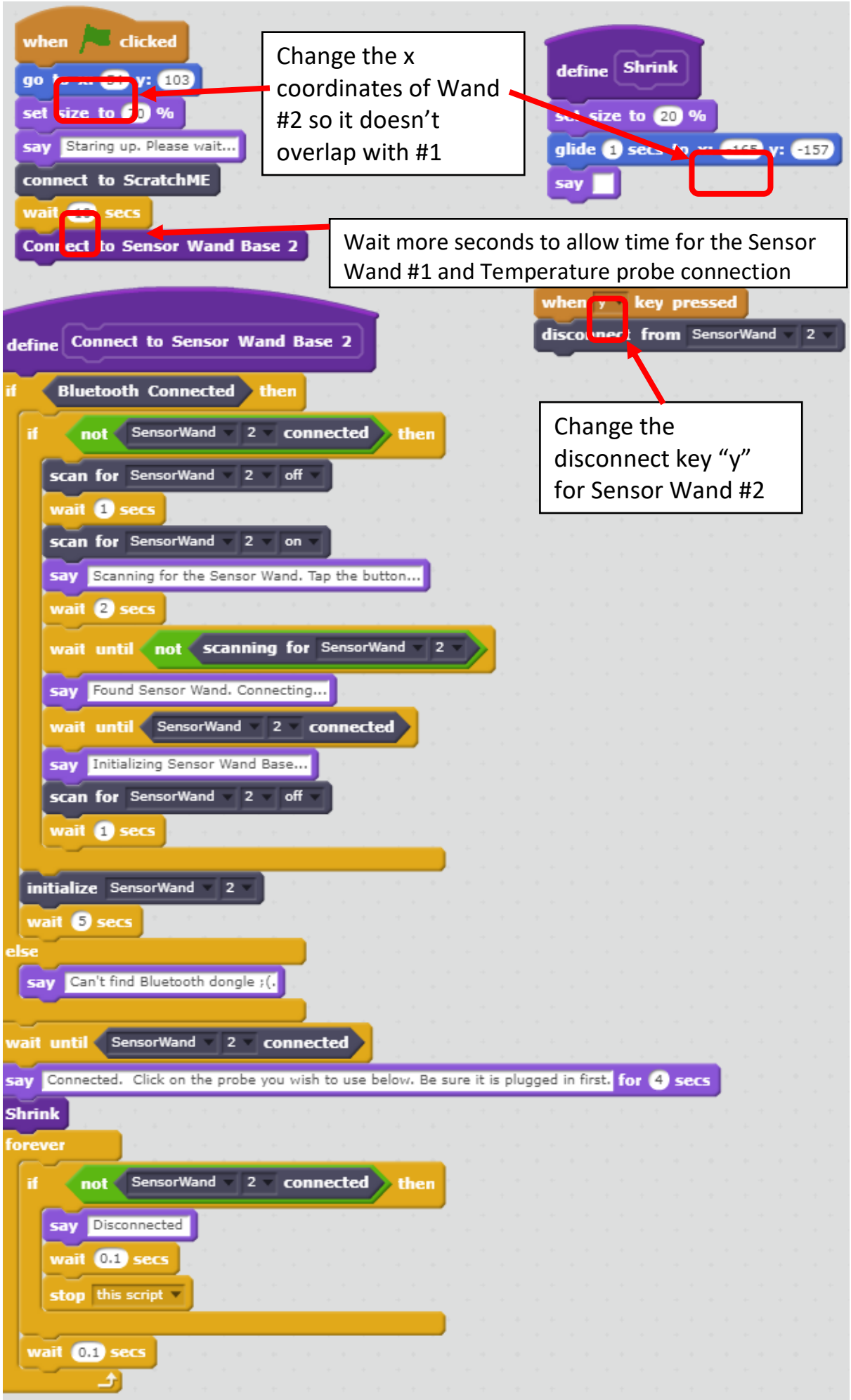


Change the Sensor Wand Number

In the remaining code, change all references of Sensor Wand 1 to Sensor Wand 2. This can be done using the drop down arrows. There are multiple places in which this must occur:

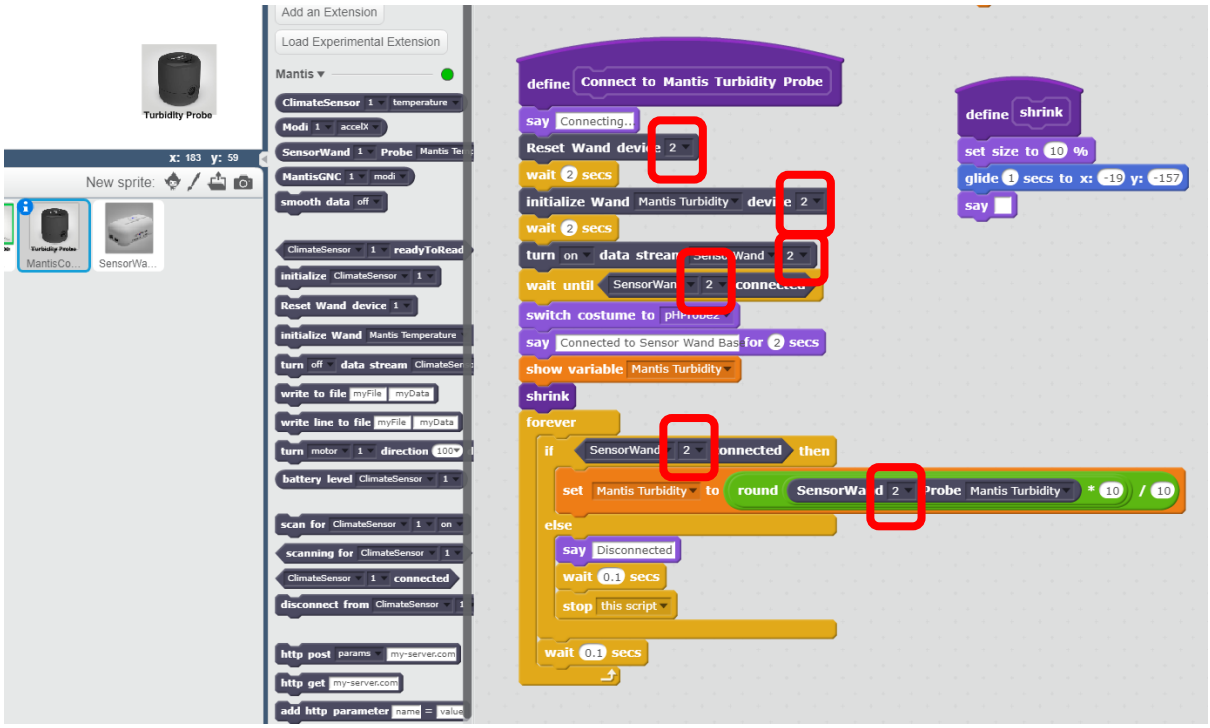


Final Sensor Wand 2 Code



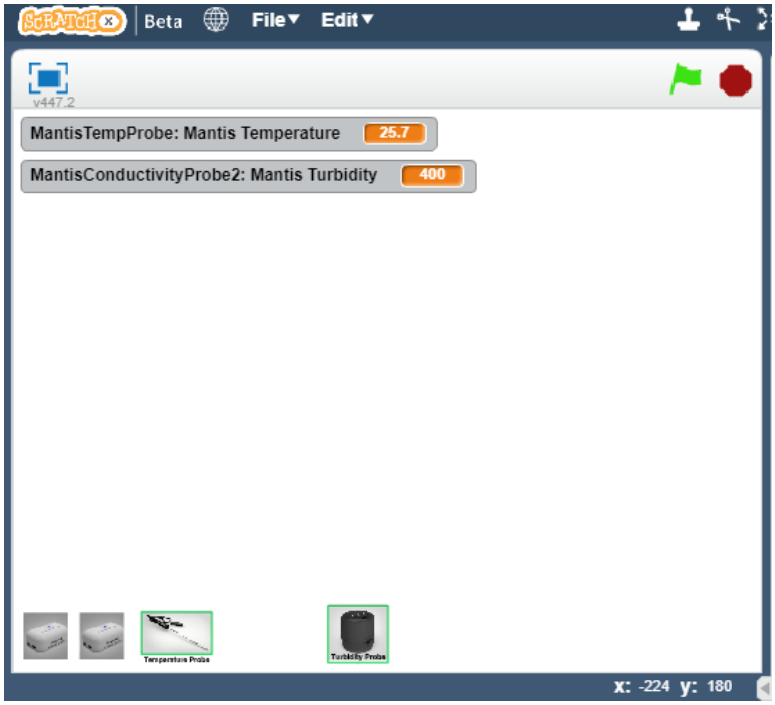
Change the Turbidity Sprite to Work with Sensor Wand 2

In the Turbidity Probe code change all occurrences of Sensor Wand 1 to Sensor Wand 2:



Ready to Connect

Click the green flag and connect to Sensor Wand 1 and the Temperature Probe and then after the wait delay (which you have set) connect Sensor Wand 2 and the Turbidity Probe. When both devices are connected the project will look like this:

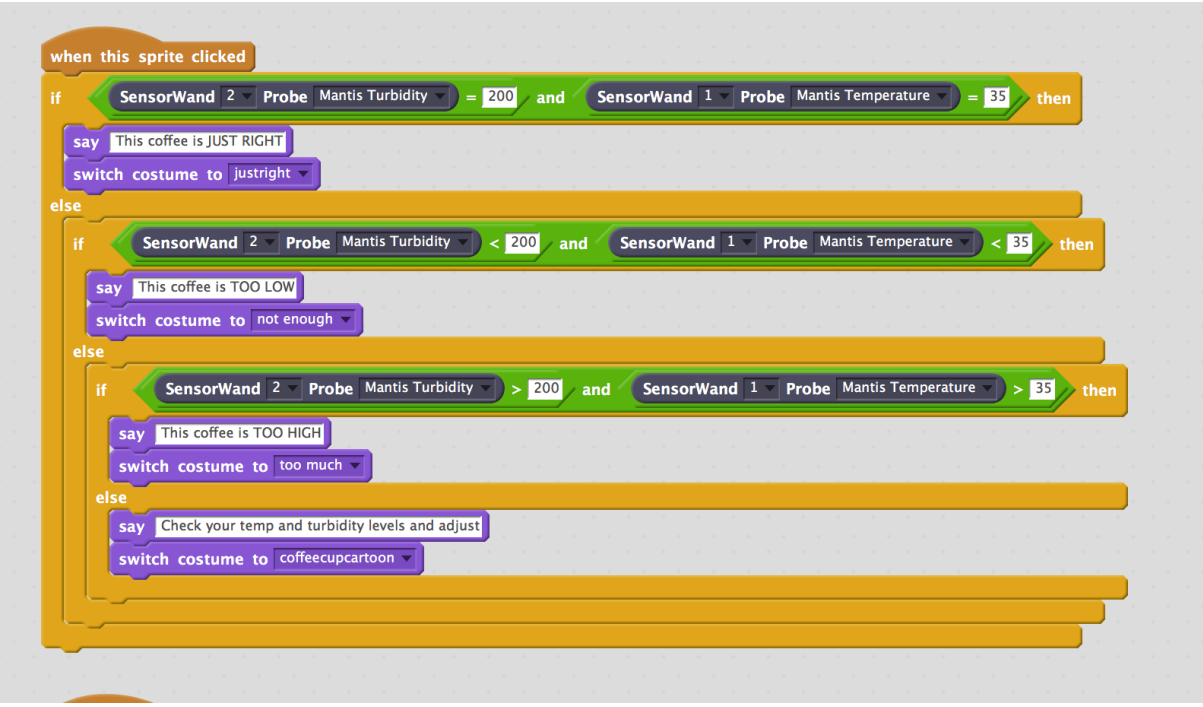


Remember it is up to you to set the x and y coordinates of the sprites to where you'd like them to be.

Running the Goldilocks Activity

It is now possible to simultaneously evaluate the temperature and the amount of cream in a cup of coffee. Goldilocks requires the temperature to be not low nor too high but just right. She also requires the amount of cream to be just right. The amount of cream in the coffee is measured by the Turbidity probe.

The following code blocks report on the state of the coffee:



The Goldilocks lesson and supporting documents are located at:

http://www.cpalms.org/Public/PreviewResourceLesson/Preview/176009