

# NSTA National 2022 Houston, TX

## Python® Coding with Vernier Sensors

### Activities:

#### Connecting Go Direct Sensor via Bluetooth®

- Go Direct Light and Color

#### Using VPython for Color Matching

- Go Direct Light and Color

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# Vernier Go Direct Sensors and Python

## Part 1 - The Basics

1. Introduction to Python using IDLE - the Python editor
2. **Predict** what the program does by reading through the code. Share it with your coding partner and compare notes.
3. **Run** the program
  - a. Click on Run > Run Module
  - b. Or click F5
  - c. Compare what the results look like, compared to your prediction
4. **Modify** the program in the following ways:
  - a. Change the method for connecting to the sensor
  - b. Specify a sampling rate in the program
  - c. Specify the sensor channel in the code
  - d. Change the number of samples collected
5. **Make** your own program:
  - a. Allow the user to specify a sampling rate, but automatically adjust the number of samples so that the total duration of the experiment is 120 seconds.
6. Review PRIMM: Sue Sentence - PRIMM <https://suesentence.net/primm-project/>

## Part 2 Visual Python

1. Installing VPython:
  - a. Open command line tool
  - b. pip3 install vpython
2. Open ColorMatch
  - a. Apply **Predict** and **Run** from the PRIMM model
  - b. **Modify** to automatically connect your sensor and to select the R,G, and B channels
  - c. **Make** the program include a new object in vpython that is a rendering of the actual color of the object.

## Part 3 Demonstrations (Time Allowing)

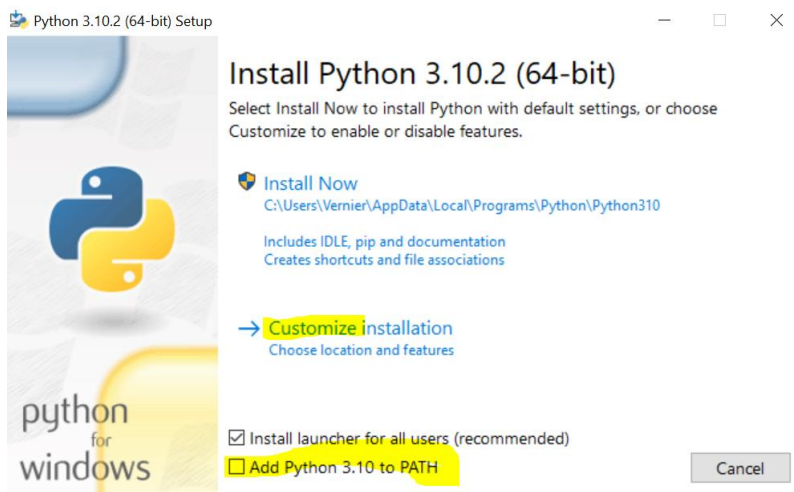
1. Mass on a spring
2. Free Body Diagram



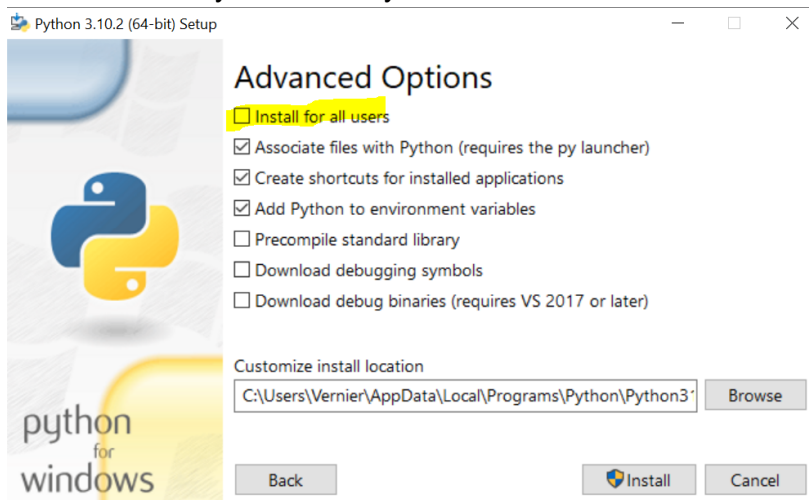
# Installing Python, and the GoDirect and Vpython Modules on a Windows Computer

Installing the software and making the connection to Vernier's Go Direct sensors will either go very smoothly or may take time to get all the pieces in place. There are instructions at <https://vernierst.github.io/godirect-examples/python/> that work for many situations. The following instructions were used to ensure proper installation for the Windows 10 computers used in this workshop. The step of adding the Python location to the variables path was required in order to install godirect and vpython modules correctly.

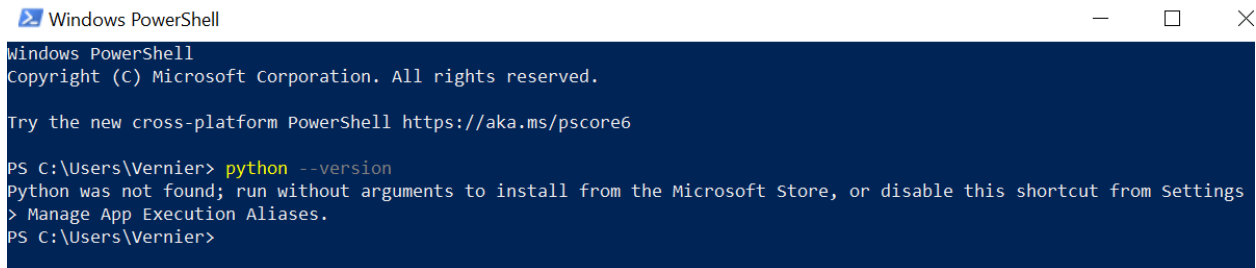
1 - Install the latest version of Python. Add Python to PATH, if that is an option. Choose Custom Installation



2 - click "NEXT" in the first dialog box to get to the Advanced Options. Check "Install for all Users" and verify that "Add Python to environment variables is checked."



3 - Open a command line editor (Powershell is shown here) and check for the version of Python installed. Regardless of whether Python is found or not, proceed to the next step.

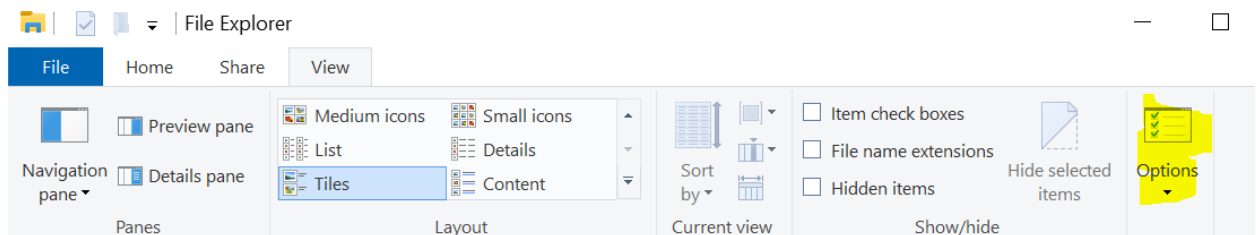
A screenshot of a Windows PowerShell window. The title bar says "Windows PowerShell". The text inside the window reads: "Copyright (C) Microsoft Corporation. All rights reserved.", "Try the new cross-platform PowerShell https://aka.ms/pscore6", "PS C:\Users\Vernier> python --version", "Python was not found; run without arguments to install from the Microsoft Store, or disable this shortcut from Settings > Manage App Execution Aliases.", "PS C:\Users\Vernier>".

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

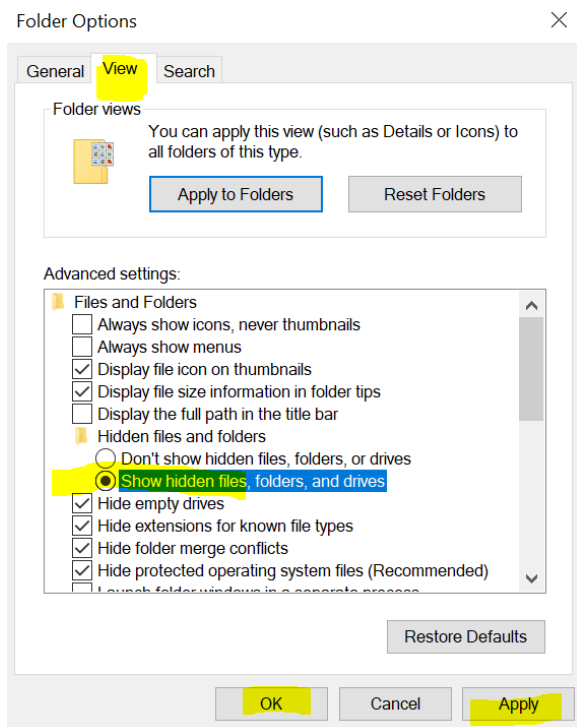
Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\Vernier> python --version
Python was not found; run without arguments to install from the Microsoft Store, or disable this shortcut from Settings
> Manage App Execution Aliases.
PS C:\Users\Vernier>
```

4 - Add the location of the Python installation to PATH. To start this process open the File Explorer app. Click on View and open the Options dialog.

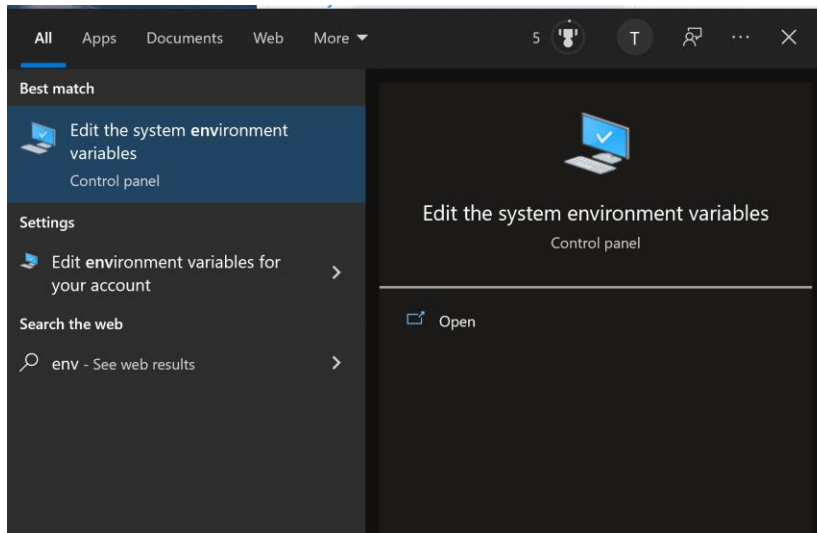


5 - Click on View and click on the radio button for “Show hidden files, ...” This will allow you to see the hidden files where Python is installed. Click “Apply” and then “OK”.

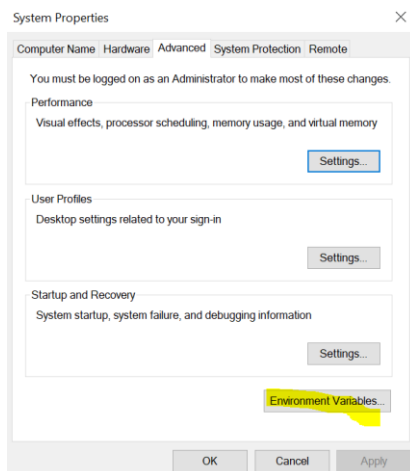


6 - In this step you will need to know the actual location of these installed. When you clicked “OK” in the last step, you should end up back at the Files Explorer app. Navigate to your installation of Python. It will vary depending on how your computer is set up, but it will be some variation of this path: C:\Users\YOURNAME\AppData\Roaming\Python\Python310. Copy this path.

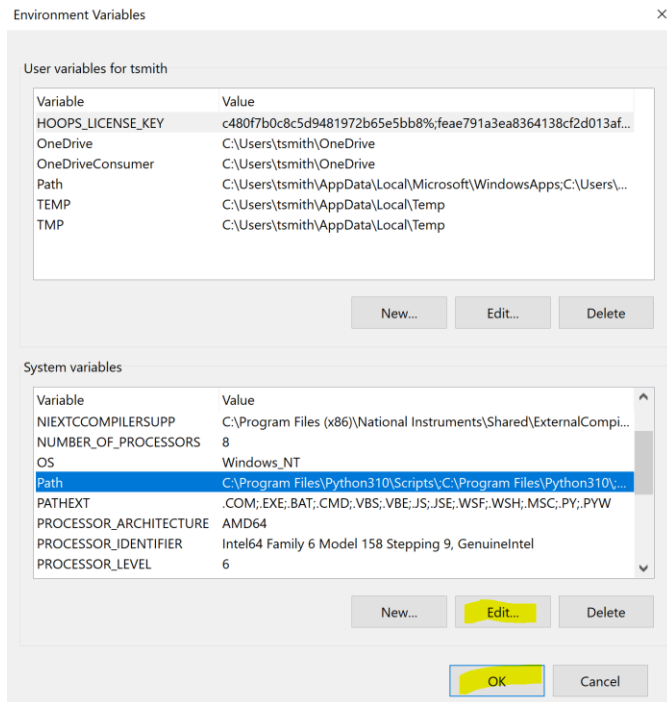
7 - Open the “Edit the system environment variables” tool in your control panel (you can search for this using the Windows search tool).



8 - Click on “Environment Variables”.



9 - Once there, highlight the Path option from the list under System Variables, and click Edit.



10 - Add two New variables to the list - one with the path for the version of Python and another with the path to the Scripts folder a layer below. Note that these paths need to end with a "\". Click OK to close out the dialog boxes.

11 - Go back to the command line editor and again search for Python to confirm it is installed and accessible.

12 - Install the godirect module using the command: `pip3 install godirect`

13 - Install the vpython module using using the command: `pip3 install vpython`

14 - verify that these installations were successful using the commands: `pip3 show godirect` and `pip3 show vpython`