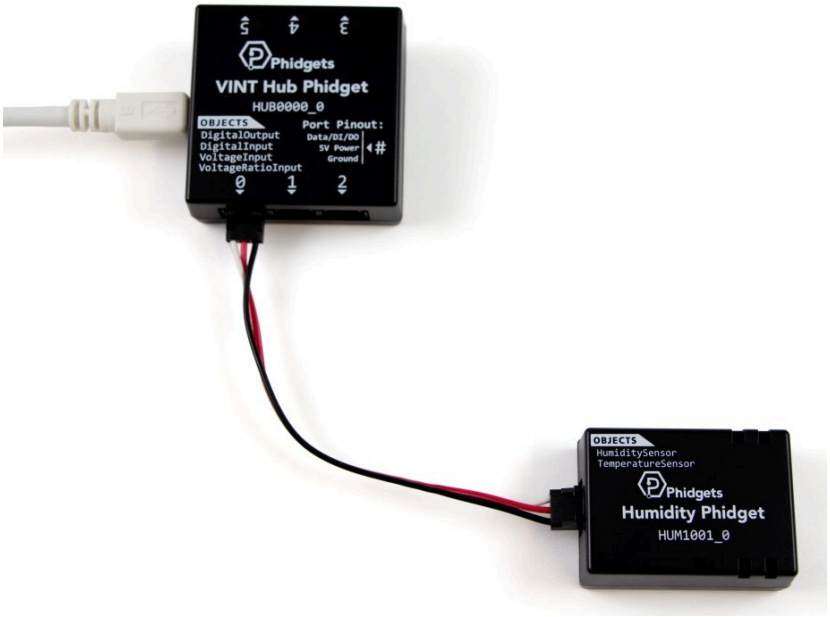
Phidget Sample Coding

Introduction

This is a free resource for teachers and students and is part of the Callysto project, a federally-funded initiative to foster computational thinking and data literacy in Canadian Grade 5-12 classrooms.

Phidgets are a collection of hardware sensors that teachers and students use to learn about programming with real physical devices. These devices include lights and switches, temperature and humidity sensors, motors and controllers and more.



A Phidget VINT Hub and a Humidity Sensor

During this free-form lesson, our focus will be on creating software that can read data from these Phidget devices. These small sensors, manufactured by the Phidget company in Calgary AB (www.phidgets.com), can collect environmental data such as temperature, humidity, and light levels as well as measure position and spatial location of the devices.

The code includes just the basics, so students can learn how to access the data themselves and move to incorporate the devices in their own projects. We use Jupyter notebooks as the basic software framework to access the devices and their data.

For a more complete example of how Phidgets can be used in a full data analytics framework, we refer you to the Callysto Plants lesson plan and the related notebooks.

To complete this lesson, you will need:

- A Phidgets VINT Hub and some related sensors for temperature, humidity, light or sound level, and so on, as suits your interests. Your school may provide this or you can buy directly from https://www.phidgets.com/education/buy/
- A desktop computer or laptop with an available USB port (unfortunately a tablet will not work)
- The Chrome, Chromium, Opera or Edge browser on your computer
- Access to the Callysto hub at https://hub.callysto.ca

To log in to the Callysto Hub you and your students will need a Google or Microsoft account. This can be a school division-provided account or a personal account. Callysto does not collect any personal information about accounts.

Grade Level and Audience

Grades 7 - 12

Necessary Background Knowledge

1. Teachers and/or students should already have the Phidgets VINT Hub and a few sensors. A good place to start is with the Phidgets starter kit, having it assembled and tested using the Phidgets online tutorial. https://makecode.phidgets.com/docs/tutorials/buildkit.html
2. Students should know how to log in to the Callysto Hub as well as run a notebook prior to interacting with it. Teachers, to get started with Callysto notebooks and running material on the Callysto Hub, see our Starter Kit.
3. Students should be familiar with the basics of programming in Python. There will be a small amount of Javascript code in the material, but the students do not need to be familiar with the Javascript programming language.

Learning Outcomes

- Understanding computer hardware
    - How is the computer different from the sensors and devices attached to it
    - How does a computer communicate with a sensor
    - How does a program on the computer initiate communication
- Understanding computer software
    - What is a programming language?
    - What is Python? What is Javascript?
    - How can one modify computer code to change what it does
- Understanding physical sensors
    - How is environmental data measured and recorded as a number?
    - What is a temperature sensor and what is a humidity sensor?
    - What does a sound sensor measure? What does a light sensor measure?
    - How does a sensor react to its environment

Required Materials

Required materials

1. A charged computer.
2. Access to the internet.
3. An installed internet browser, it must be Google Chrome, Chromium, Edge or Opera..
4. A Google or an Outlook email account to login to the Callysto Hub.
5. A Phidgets starter kit with a USB connection cable, and other Phidget sensors are desired.

Curriculum Connections

Through this lesson students will be introduced to some basic vocabulary in Cree, which is an indigenous language spoken in Canada. Students will be introduced to counting in the Cree language.

- Alberta Physics 20, 30: Scientific Inquiry, Light and Sound

In-Class Activities

Activity 1 : Learning about the available sensor
60 mins

In this activity, students will learn about several different types of sensors that are available for experiments with Phidgets. Here are the eight different physical attributes we can measure

- Temperature
- Humidity
- Light level
- Moisture level
- Sound level
- Linear position / slider distance
- Sonar distance
- Spatial orientation

Students and teachers can discuss together what are these physical attributes, what units they can be measured in, how these measures can be represented by numbers suitable for a computer. They can read more about the devices on the Phidgets webpages concerning sensors, here: Phidget Sensors

Activity 2 : Running code to read the sensor
60 mins

There are eight notebooks, one for each type of sensor. Students can run these notebooks on the Callysto Hub to read data from the sensors. The code also shows how to link the data to Python variables that can be used in other parts of the notebook.

Link to the notebooks: (UPDATE WITH THE CALLYSTO HUB LINKS, WHEN AVAILABLE)

- humidity.ipynb
- light.ipynb
- moisture.ipynb
- slider.ipynb
- sonar.ipynb
- sound.ipynb
- spatial.ipynb
- temperature.ipynb

Extension Activity 3 : Using the data devices in a notebook
60 mins

This is a free-form exercise. Given the data devices available, what kind of notebook can you create to make use of the data? Some ideas:

- Record the temperature each hour and save in a database, to monitor the comfort levels in the classroom.
- Use the slider to control a software sound generator to make some interesting music or sound effect.
- Use the sonar distance device to measure the size of a classroom.
- Use the sonar distance device to measure the height of a person.
- Use the sonar distance device or sound device to determine whether there are people in a room.
- Use the spatial position sensor to control a 3D visualization on the computer screen.

Students are encouraged to create their own notebooks, following the models in Activity 2, to get a complete project together.

Reflections

- *What do we mean by environmental data or physical attributes?*
- *What do we mean by physical units in a measurement?*
- *How do physical measurements get translated into numbers that can be recorded?*
- *How accurately can we measure any physical quantity with a given device?*
- *Given access to data, what can we do with itt?*
- *If you measure something (like temperature) every second, how many data points do you collect in a day? Are all these points useful?*

Next Steps

For more information, you can check out our YouTube videos, online courses, or callysto.ca for learning modules, tutorials, lesson plans, exercises and events.

Contact

If you encounter any issues or have any suggestions, please get in touch with us at contact@callysto.ca or twitter.com/callysto_canada.