Phidgets in the Classroom

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Date: Fall 2022

Duration: Two to three hours

Introduction

This lesson 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.

This lesson focuses on using the Phidget starter kit, which is a small box containing some buttons, lights, and a temperature/humidity sensor that can be accessed from a Jupyter notebook using a USB cable connected your your laptop. .

The Phidgets Starter Kit.

To complete this lesson, you will need:
-   A Phidgets starter kit. 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 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 through 12

Necessary Background Knowledge

1. Teachers and/or students should already have the Phidgets starter kit, and have assembled and tested it 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 is a 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 sensor
  - What is a switch and what is a light?
  - What is a temperature sensor and what is a humidity sensor?

        ○   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.
4. A Google or an Outlook email account.
5. A Phidgets starter kit with a USB connection cable.

Modifications

If the students have more Phidget sensors, they can try accessing the devices using similar code to these examples. This website gives an overview of some of the devices that are available: https://www.phidgets.com/education/learn/device-tutorials/

Preparation

Include any setup that is needed prior to the lesson

In-Class Activities

The class activities can be organized as either the teacher demonstrating the code project with just one Phidget Starter Kit and computer, or as a group project for the class where small teams of students work together with their own computer and Phidget Starter Kit to learn how to code with them. This will depend on the number of Kits available to the class, as well as the number of computers to work with.

The five activities listed below can be completed in one afternoon, or over several days as a series of projects. It is best to work through them in the order presented here, in order to build on the students' knowledge as they work through the activities.

Activity 1: Phidgets in a Jupyter notebook (20 minutes)
- Introduce them to the first notebook, which runs JavaScript to display humidity

- Run the following notebook on the Callysto hub, with the Phidgets Starter Kit connected to the computer. Complete instructions are in the notebook.
- Phidgets_1_humidity.ipynb

Activity 2: Adding code to a notebook - (20 minutes)

- Show them how to add code to also display temperature with humidity
- Run the following notebook on the Callysto hub, with the Phidgets Starter Kit connected
- Notebook Phidgets_2_humidity_temp.ipynb

Activity 3: Connecting Python to JavaScript (40 minutes)

- Show them how to grab data from the sensors and put into Python displays
- Make an appealing visual display with live gauges and graphs
- Try the following notebooks on the Callysto hub, with the Phidgets Starter Kit connected
- Phidget_3_slider.ipynb
- Phidget_4_gauges.ipynb
- Phidget_5_graphs.ipynb

Activity 4: Accessing other sensors (20 minutes)

- Create new code to control the LEDs and the push buttons on the Phidget starter kit
- Run the following notebook on the Callysto hub, with the Phidgets Starter Kit connected
- Phidget_6_buttons.ipynb

Activity 5: Making a game (40 minutes)

- Create a game where the player pushes buttons in response to the LED lights
- Run the following notebook on the Callysto hub, with the Phidgets Starter Kit connected
- Phidget_7_game.ipynb

Reflections

Some suggested questions:
- *What went well? Why?*
- *What was tricky? How did you overcome it?*
- *What would you do differently? What would you do the same? Why?*
- *What connections can you make between what you learned from this lesson and your other coursework, lessons, or experiences?*

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](#).