

From the real to the virtual:
Piloting AI Competencies Through Authentic
Learning Experiences in Virtual Labs

CEWIL Webinar: Exploring Simulation, Virtual, Augmented and
Mixed Reality (VR/AR/MR) in the COVID-19 Context and Beyond



Joel Trudeau | Dawson College

June 25, 2020



Overview

- **Education 4.0:** Learning solutions for 4IR
Arduino microcomputing as use case
- **Engineering Robotics:** Active, hands-on learning in and out of the classroom
Piloting AI competencies: our virtual COVID-19 pivot

Arduino 101

- Arduino is an open-source microelectronics platform based on easy-to-use hardware and software.
- Arduino microcontroller boards can read inputs and turn them into outputs.
- Arduino is composed of two major parts:
 1. Hardware microcontroller
 2. IDE software to program the microcontroller

Arduino 101: how it works

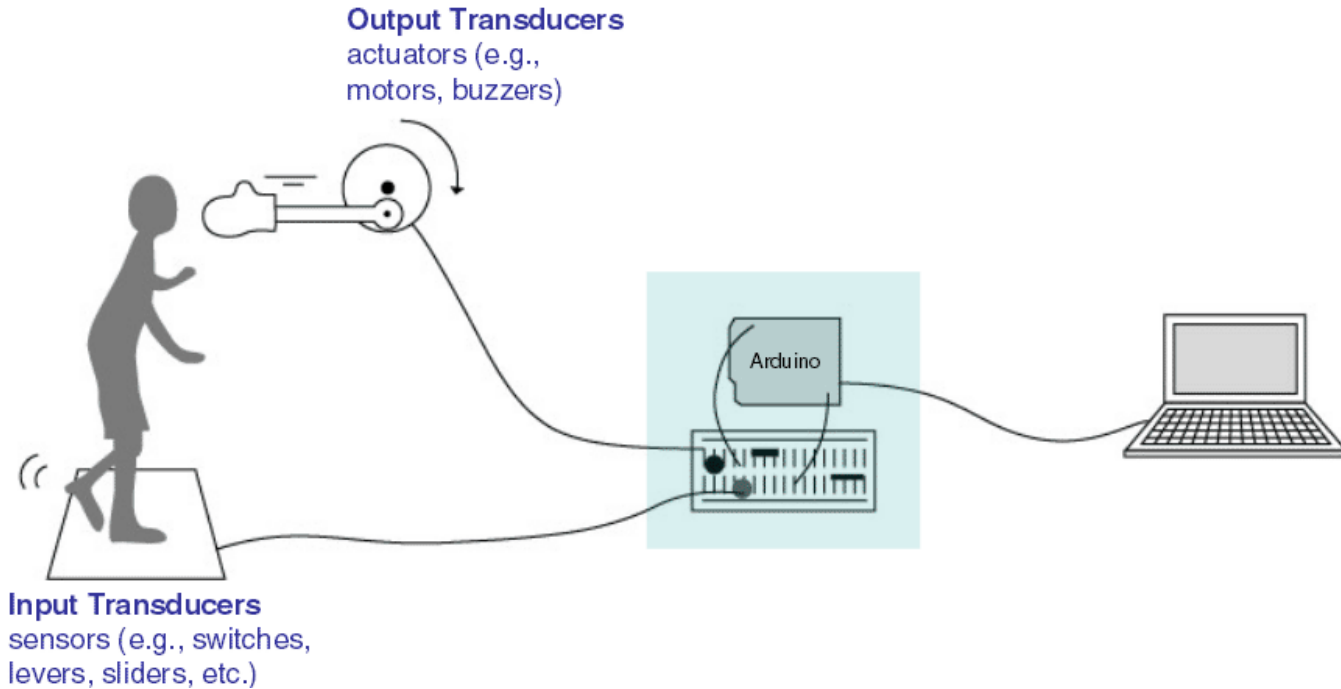
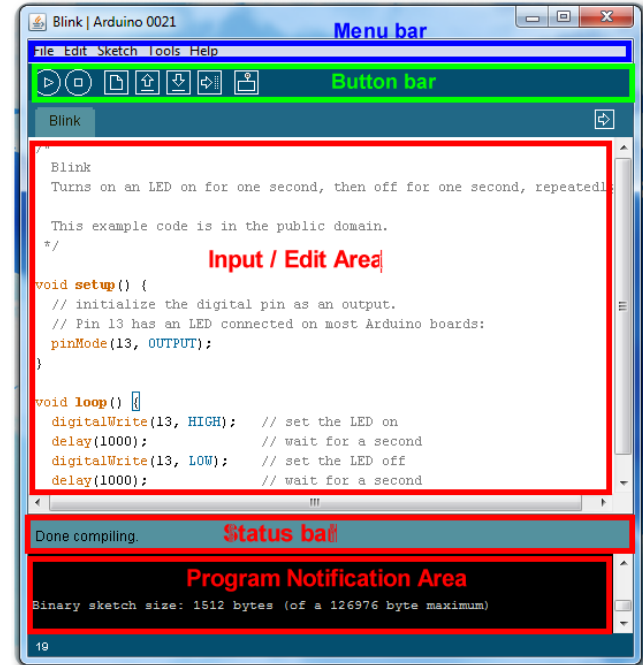


Image: *Theory and Practice of Tangible User Interfaces* at UC Berkley

Arduino 101: hardware/software



Arduino Uno and Nano microcontrollers



Arduino IDE

Autonomous Navigation Challenge

4-lab sequence in two Engineering Physics final semester courses culminating with class challenge: *Using sensor feedback program a robot to navigate along a complex path in the shortest possible time.*

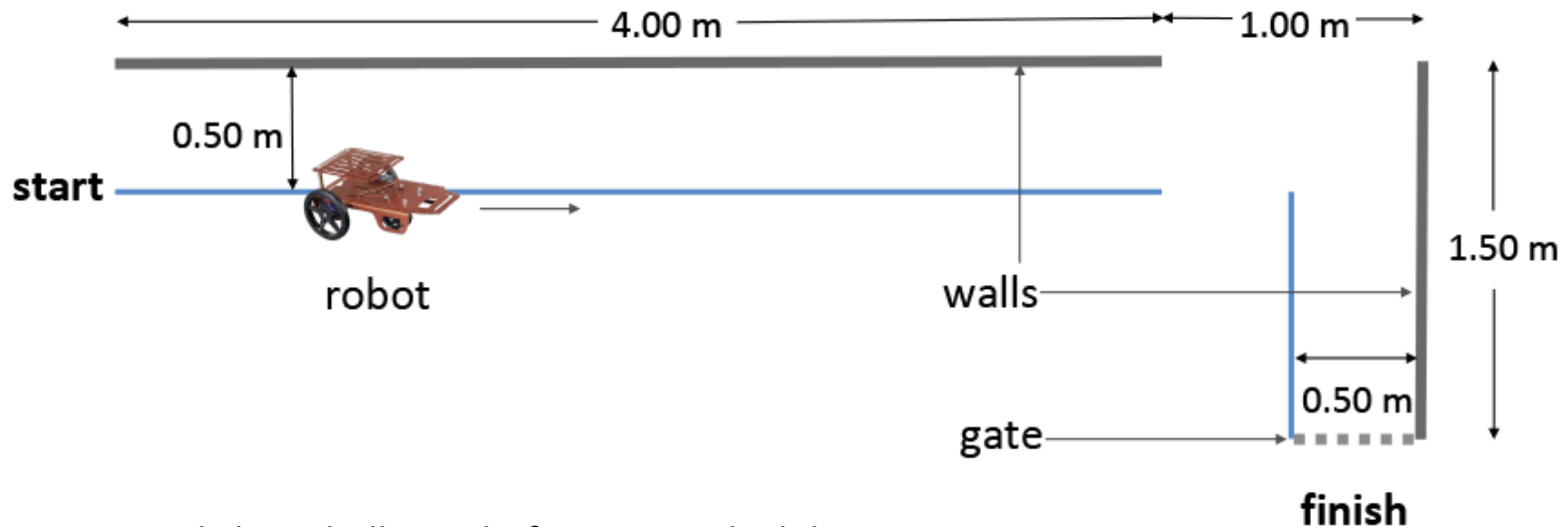
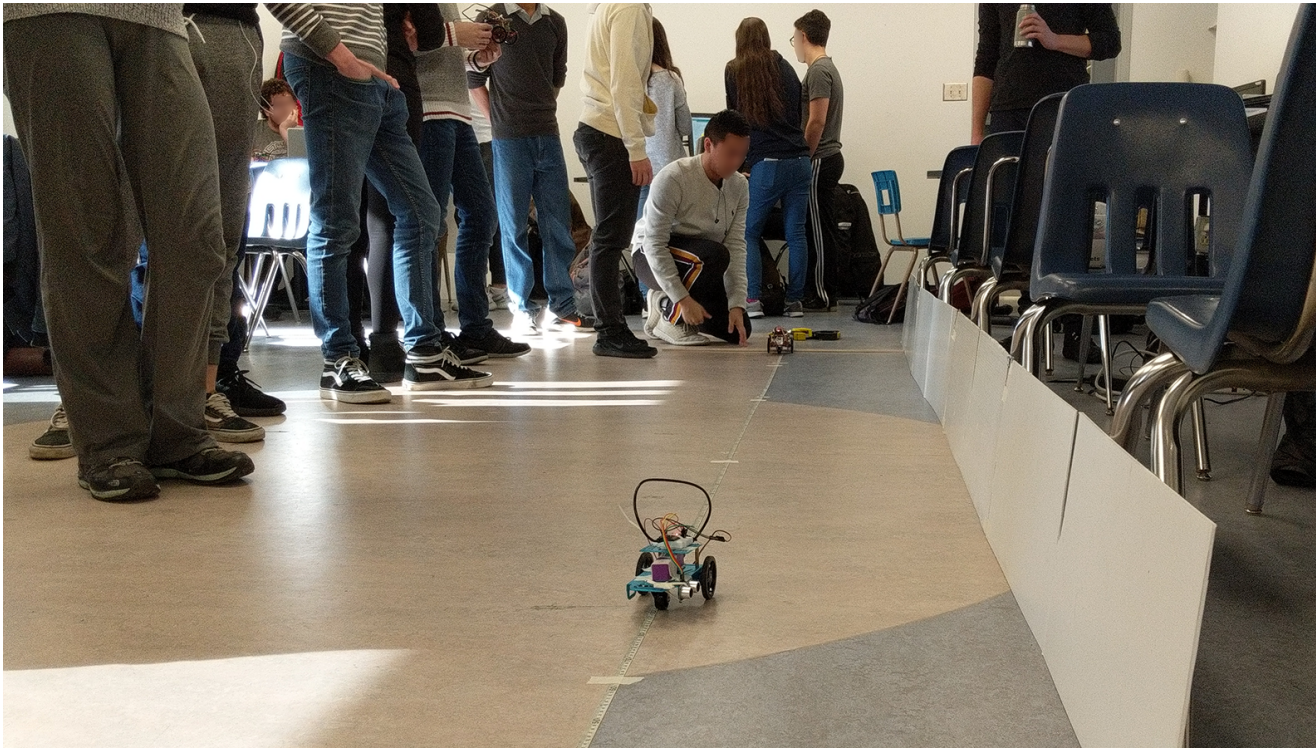


Image: Original class challenge before COVID lockdown

Autonomous Navigation Challenge



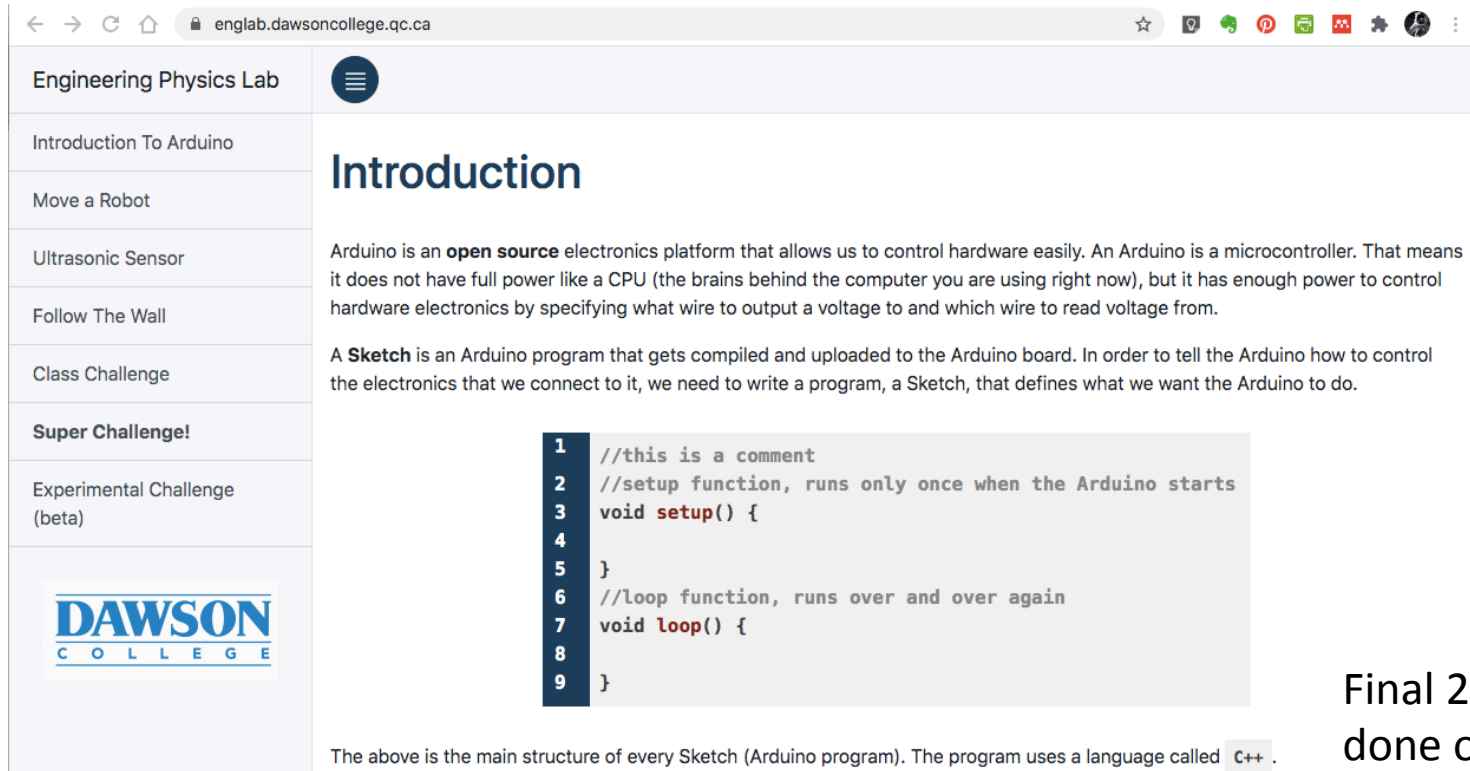
2 labs done in class

Image: Testing solutions in the classroom



Testing solutions in the classroom: *presentation video*

Engineering Robotics Virtual Labs



The screenshot shows a web browser at the URL englab.dawsoncollege.qc.ca. The page title is "Engineering Physics Lab" and the main heading is "Introduction". The left sidebar contains a menu with items: "Introduction To Arduino", "Move a Robot", "Ultrasonic Sensor", "Follow The Wall", "Class Challenge", "Super Challenge!", "Experimental Challenge (beta)", and the Dawson College logo. The main content area explains that Arduino is an open source electronics platform and defines a Sketch as a program for the Arduino board. A code block shows the structure of a Sketch:

```
1 //this is a comment
2 //setup function, runs only once when the Arduino starts
3 void setup() {
4
5 }
6 //loop function, runs over and over again
7 void loop() {
8
9 }
```

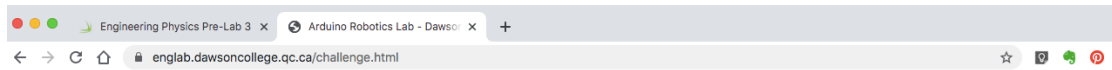
The text below the code block states: "The above is the main structure of every Sketch (Arduino program). The program uses a language called C++ ."

Final 2 labs
done online.

<http://englab.dawsoncollege.qc.ca/>

Class Navigation Challenge

Using sensor feedback program the robot to collect all coins in the shortest time.



Evaluation Scheme

- Teams scored based on the degree of completion of the task with time limit.
- Strategies presented and critiqued
- Reports submitted with code and discussion.

<http://englab.dawsoncollege.qc.ca/>
<https://space365.dawsoncollege.qc.ca/>

```
1 #include <Servo.h>
2
3 Servo leftservo;
4 Servo rightservo;
5 const int pingPin = 5; // Trigger Pin of Ultrasonic Sensor
6 const int echoPin = 6; // Echo Pin of Ultrasonic Sensor
7
8 void setup() {
9   leftservo.attach(9);
10  rightservo.attach(10);
11
12  //set up the Serial
13  Serial.begin(9600);
14  //setup the pin modes
15  pinMode(pingPin, OUTPUT);
16  pinMode(echoPin, INPUT);
17
18  leftservo.write(90);
19  rightservo.write(90);
20
21 }
22
23 void loop() {
24
25   long duration;
26   //clear the ping pin
27   digitalWrite(pingPin, LOW);
28   delayMicroseconds(2);
```

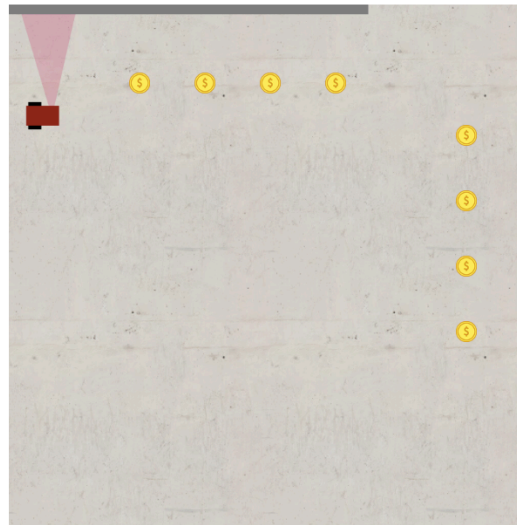


Image: Class navigation challenge ported to simulation.

Outcomes: virtual pilot

- Students surveyed before and after activity.
Analysis in progress.

“I really appreciate the online simulation we got to play around with. It allowed for individual exploration and a deeper understanding.”

“ It was a really fun project to participate in, although I'm a bit sad that we could not do it in reality due to the unfortunate circumstances. However, I appreciate the teachers doing everything they can to [...] create something very similar and very fun.”

Outcomes: further work

- Designing experiential learning solutions to develop *4IR* competencies, targeting the overlapping levels of highschool, college and undergraduate
- Generalizing the Arduino-based modules to other hardware and customizable environments
- Developing a support model for custom curriculum implementation and instruction

Thanks!



Éducation
et Enseignement
supérieur



Social Sciences and Humanities
Research Council of Canada

Conseil de recherches en
sciences humaines du Canada

Canada

Jean-François Brière

Tanya Chichekian

Tawfiq Jawhar

Hélène Nadeau

Jaime Sandoval

Ursula Sommerer

Andrew Stewart

Chris Whittaker

Work with us!



Éducation
et Enseignement
supérieur



Social Sciences and Humanities
Research Council of Canada

Conseil de recherches en
sciences humaines du Canada



Joel Trudeau jtrudeau@dawsoncollege.qc.ca

Physics Department | Dawson College

DawsonAI Artificial Intelligence Project Lead

SPACE (Sciences Participating with Arts and Culture in Education) Coordinator