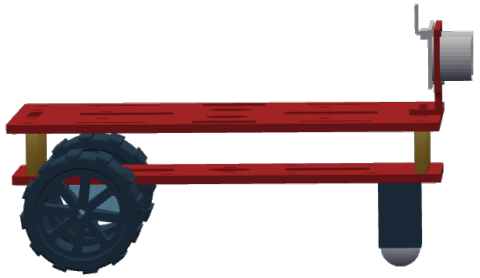
DISRUPTED LESSONS IN ENGINEERING ROBOTICS: AUTHENTIC LEARNING EXPERIENCES WITH VIRTUAL LABS AND OPEN-SOURCE HARDWARE

+ GUIDELINES FOR USE

SALTISE 2021

PART 2 SLIDES



ENGINEERING ROBOTICS POST-COVID USE CASE

Figure 2

Navigation Challenge Ported to a Virtual Lab Environment

```
#include <Servo.h>

Servo leftservo;
Servo rightservo;
const int pingPin = 5; // Trigger Pin of Ultrasonic Sensor
const int echoPin = 6; // Echo Pin of Ultrasonic Sensor

void setup() {
  leftservo.attach(9);
  rightservo.attach(10);

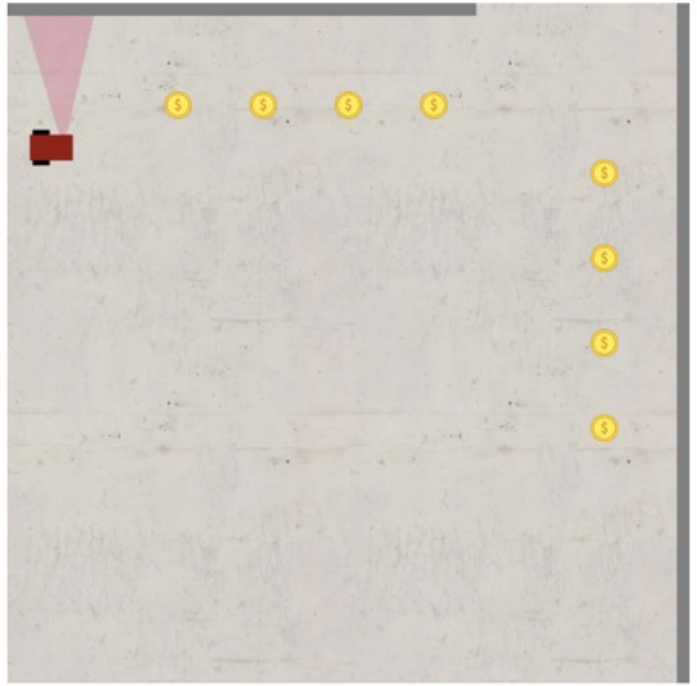
  //set up the Serial
  Serial.begin(9600);
  //setup the pin modes
  pinMode(pingPin, OUTPUT);
  pinMode(echoPin, INPUT);

  leftservo.write(90);
  rightservo.write(90);

}

void loop() {

  long duration;
  //clear the ping pin
  digitalWrite(pingPin, LOW);
  delayMicroseconds(2);
```



Instructions

The coins are approximately 110 cm away from the top wall and approximately 70 cm from the right wall. Use the data from the ultrasonic sensor to navigate the robot to collect all coins.

Surveys were administered by a research assistant during class time at the beginning and at the end of the sequence of labs.

Last 2 labs done after Covid-19 lockdown

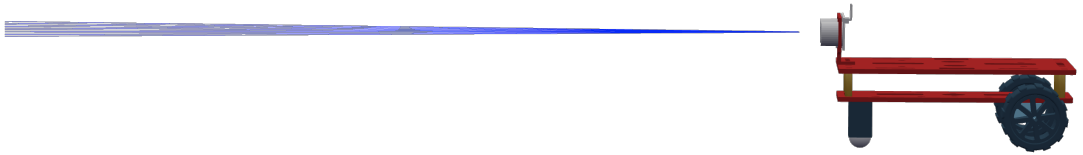
Video

Dawson College Engineering Robotics

Class Navigation Challenge Virtual Simulation

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

OUTCOMES FROM INITIAL STUDY



- We showed how a customized robotics learning activity in an engineering physics course provided **opportunities for students to learn, apply, and experiment with engineering competencies** that often overlap between college and undergraduate levels.

  "I think this was a great lab activity to do related to this class and it was very well modified for the COVID situation we are in. It taught me something I have never fully worked with and showed me something that I did not know I found interesting."

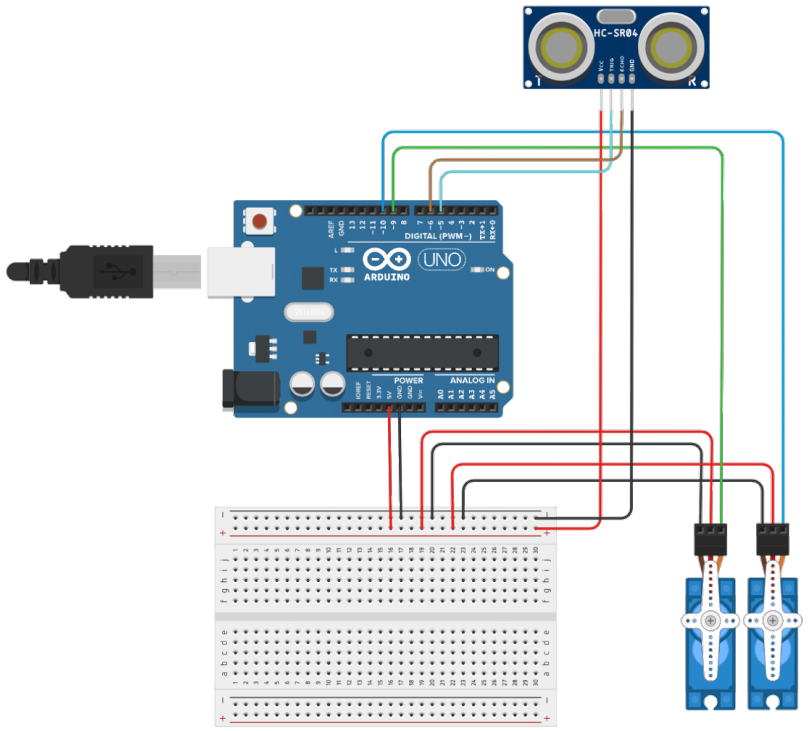
- We posit that the knowledge and skills needed to successfully complete computing-based modules have the **potential to generalize to other learning environments.**

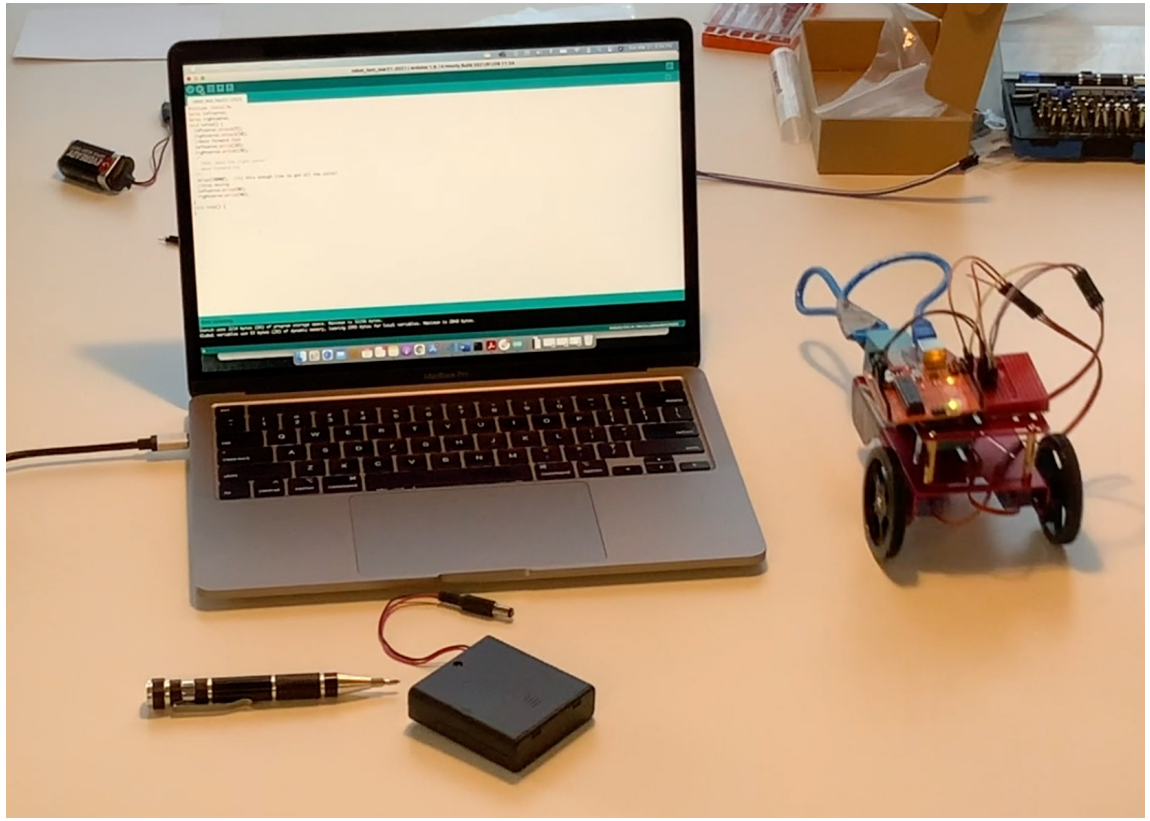
OUTCOMES FROM INITIAL STUDY

"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."

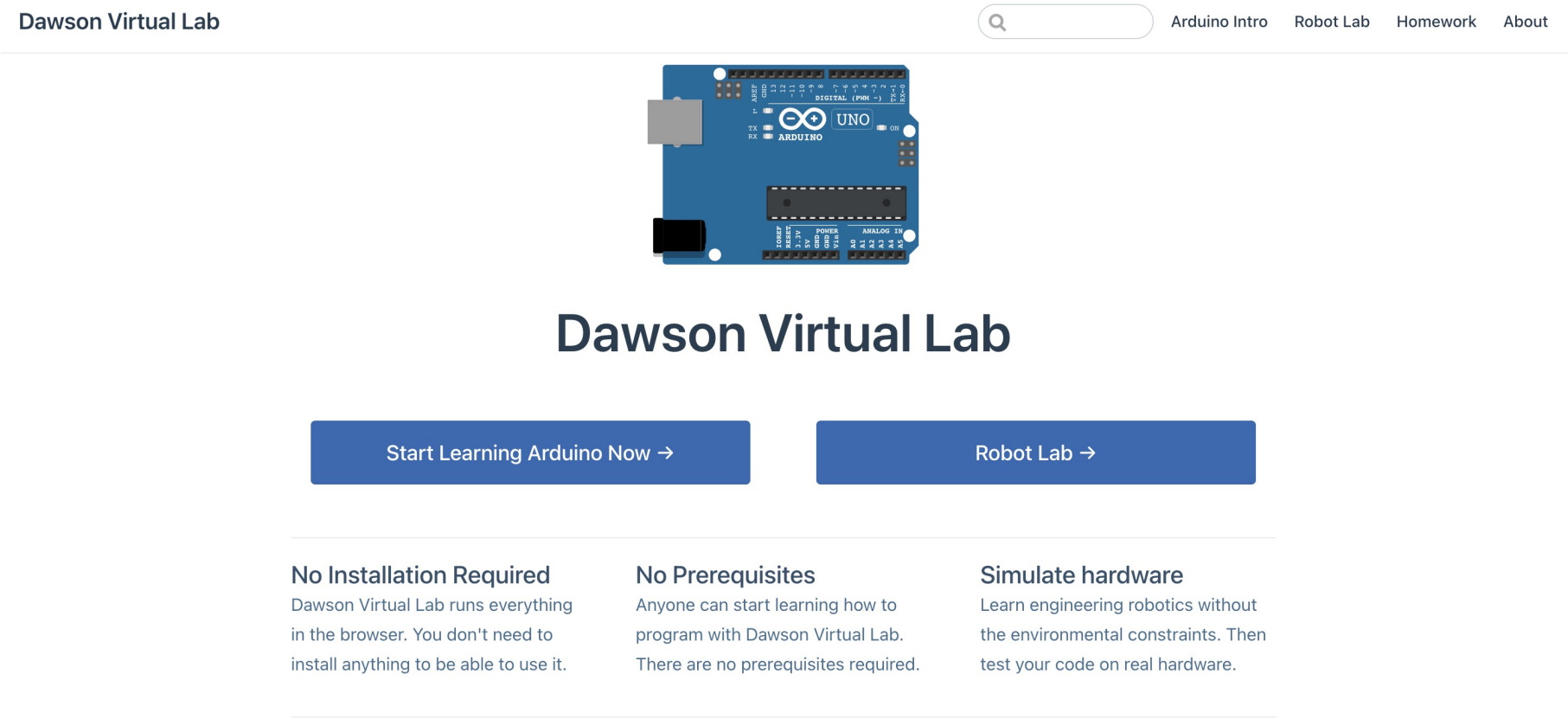
WORK-IN-PROGRESS





- Recently we have reintroduced robotics hardware designed for home use and expanded the 4-lab engineering robotics sequence studied here to 6 labs.
- Future work will report on outcomes of these authentic blended learning experiences.

WORK-IN-PROGRESS

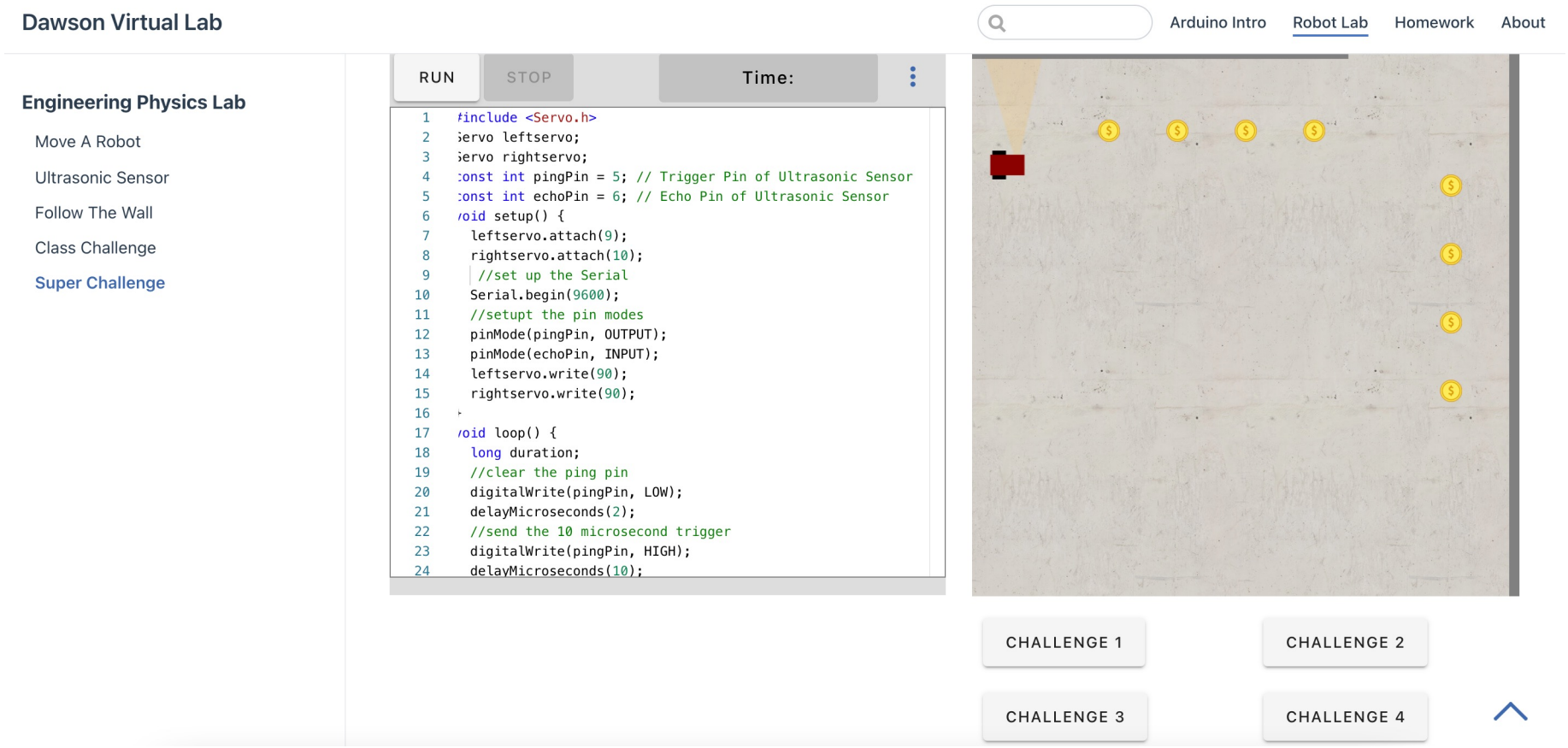


Several learning activities have been created to introduce skills and knowledge (programming and microcomputing) while developing computational thinking and problem-solving prowess.

FUTURE WORK

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

WORK WITH US



Video of SALTISE 2021 presentation at https://englab.dawsoncollege.qc.ca/saltise2021

THANK YOU!

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DAWSON COLLEGE

THANK YOU!



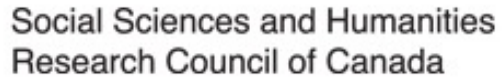


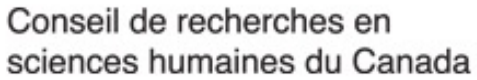














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