James Dyson Foundation Undergraduate Bursary 2018/19
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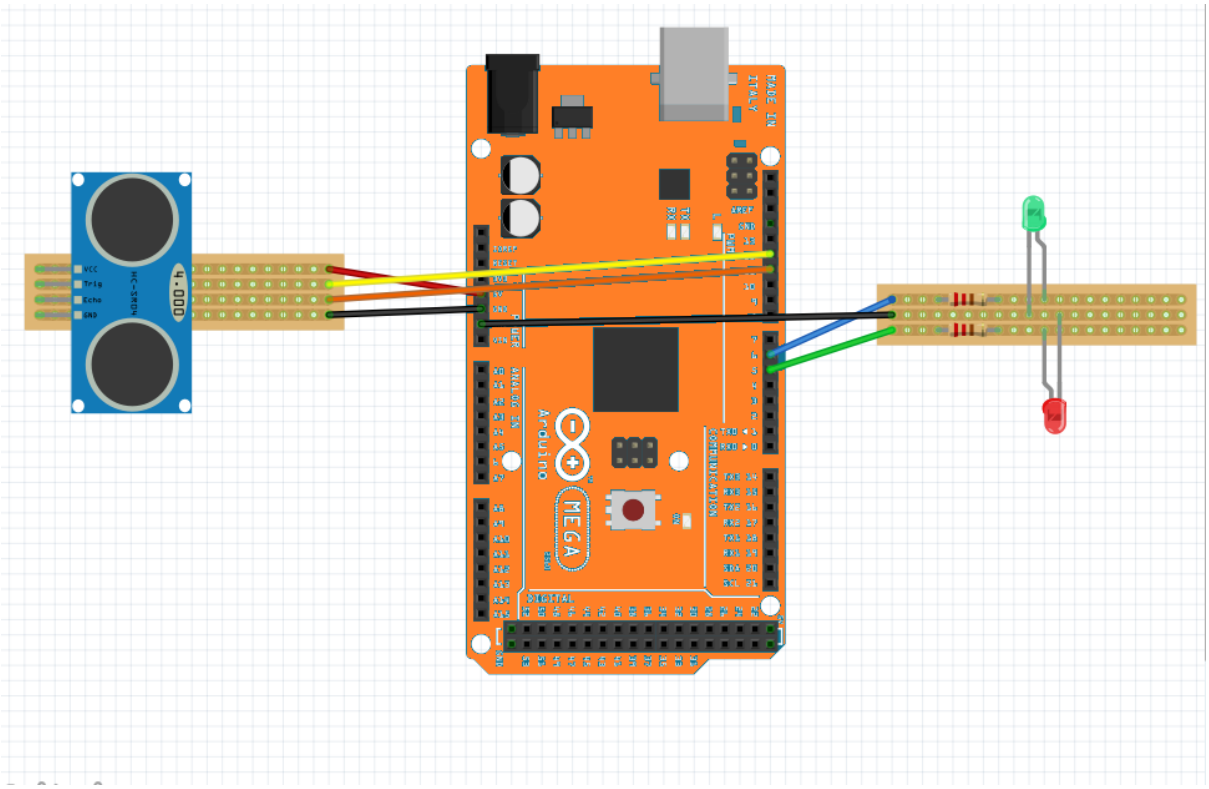
Outreach Report
Coding a Distance Sensor with Arduino

This activity required students to build a distance sensor using an Arduino and ultrasonic range sensor. The hardware required for the activity was pre-assembled for the students and the software was mostly complete with a few key lines removed. The students were guided through the process of understanding the hardware, existing software, and making modifications to the code by a comprehensive handout. The hardware setup for the activity, shown below, consists of an Arduino (Orange Pip) connected to red and green LEDs as well as an ultrasonic range sensor.



The activity started with a short 10-minute presentation in order to familiarise the students with the task and equipment in addition to the wider applications of microcontrollers and embedded computing systems. The students were then required to complete four tasks, each requiring a couple of lines of code to be added to an existing program.

The tasks were as follows:

1. Calculate the distance to an object based on the time difference between the transmission of an ultrasound pulse and the arrival of its echo.

2. Turn on a red LED when the measured distance was below 20cm.

3. Change the brightness of the red LED depending on the measured brightness. The closer the object, the brighter the LED.

4. Introduce a green LED whose brightness increases as the object gets further away.

The last two tasks required the students to form an expression for the LED brightness based on the measured distance. Whilst challenging, this was completed by most with the assistance of the handout.

The handout details the process of compiling and running code for the Arduino platform using the IDE as well as basic information on how LEDs and ultrasonic range sensors work. The handout also described the tasks in detail, providing a structured guide for the students.

The activity went well with the students seemingly engaged and enjoying themselves throughout the duration of the task. Almost all students were able to complete tasks 3 and 4 by the end of the session suggesting the level of difficulty was appropriate.

Many students were taking GCSE computer science which enabled them to complete the tasks quickly. Since the activity already has a modular structure, it should be simple to come up with further extension activities that extend the functionality of the device and increase the difficulty for the student.

This activity was a collaboration between Dyson bursars Philip Salmony, Folajimi Babasola and myself in addition to EIETL chief technician Dave Patterson.