Crash Course:
Measurements, Sensors and Data Logging

Orientation

Jordan Krell
jkrell@flintsciencefair.org

Who We Are

- Jordan Krell
  - FRSEF Fair Director
  - Motorsport Engineer @ Bosch Engineering

- Chris Bergsneider
  - Motorsport Engineer @ Bosch Engineering

- Kathy Dutton
  - FRSEF Outreach, Marketing, SRC
  - Teacher @ Homeschool Connections

Who We Are

- Tracy Zhang
  - Outreach Specialist @ MSU St. Andrews

- Clare Light
  - Project/Event Coordinator @ MSU St. Andrews

Who We Are

- Jacque Ekladyous
  – FRSEF

- Doris Hill
  – FRSEF

Safety

- Your safety is paramount
  - Please read our virtual handbook
  - If at any point you feel unsafe, logout immediately and contact the FRSEF.

- Read the FRSEF Virtual Programming Handbook
  - In your email

- Contact us in an Emergency or for Routine Assistance
  - Jordan: 248-330-4269   jkrell@flintsciencefair.org
  - FRSEF: 810-797-5290   kdutton@flintsciencefair.org

What is the FRSEF?

- Non-profit, all volunteer organization
- Internationally affiliated with Society for Science
  - Regeneron ISEF (Grades 9-12)
    - Broadcom MASTERS (Grades 6-8)
- Founded in 1957
  - Hosted first *International* Science & Engineering Fair in 1958
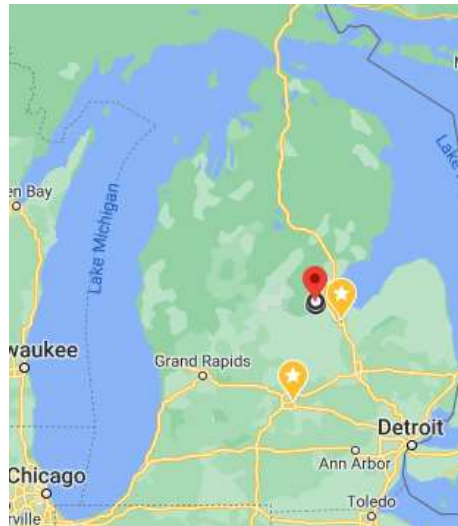- 2020 - 2021 Virtual FRSEF

2022 FRSEF

- Online preliminary round
  - Submit slide deck and quad chart
  - Entry Deadline: March 7

- In-person finalist round at UM-Flint
  - March 19
  - Awards on March 20

Michigan State University - St. Andrews

We are located in Midland MI

Research & K-12 STEAM education

https://standrews.msu.edu/

Family Astronomy Night,
Wednesday, November 3, 2021
at 7 PM EST – VIRTUAL EVENT

Monthly Astronomy Night

Summer research internship for High school seniors in areas of STEAM disciplines (science, engineering, programming, and writing)

Interns in Flint Science Fair in 2020

Congratulations to all participants in the Flint Regional Science & Technology Fair. Winners were announced last night and four of our students from the 2019 summer research program received awards:

The team of Grace Bremmer, Therese Joffre and Logan McNamara won one special award and 5th place in grand awards for their work on Fabrications of Scaffolds For Bone
Repair and Regeneration.

David Wang received a 6th place grand award for his Quantum Computing project.

Grace Bremmer
H.H. Dow High School

Therese Joffre
Midland High School

Logan McNamara
H.H. Dow High School

David Wang
H.H. Dow High School

Interns in Flint Science Fair in 2021

Designing and Constructing a 3D Printer for the Additive Manufacturing of Soft Matter Hydrogels

Henry Wolf

Abstract
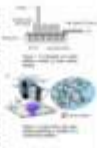
3D printing, a method of additive manufacturing, involves laying down thin paths of material using a moving extruder in order to slowly build up a three-dimensional form layer-by-layer. While 3D printers typically use thermoplastics to build rigid parts, the technique can be applied to a variety of different materials with niche uses. Hydrogel 3D printers are an emergent medical technology that could eventually facilitate the manufacturing of replacement human tissue structures; a 3D printer could recreate the intricate internal structure of a realistic organ where traditional gel molds cannot. The goal of this engineering project is to design, build, and test a 3D printer specifically designed to form models out of 88% hydrolyzed polyvinyl alcohol gel. The printer features several unique components, including a custom syringe pump extruder for dispensing measured quantities of gel and a Peltier-stage-cooled printing surface for initial layer adhesion. The device was capable of printing single-layer geometries out of gels of varying concentrations. However, additional layers were largely unsatisfactory due to the time required to freeze the gel solid. The printer was a successful proof-of-concept for the process of printing hydrogels using a cryogenic build plate, but requires still more adjustment.

Presented by

Henry

Institution

Saginaw Arts and Sciences Academy

Our 3D Printing Lab
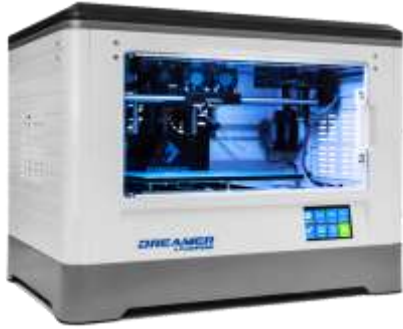
Flashforge Dreamer (12)

Fusion3

Raise3D Pro2 Plus

Original Prusa i3 MK3S 3D printer

Prusa SL1 3D printer

3D Scanner

EinScan Pro 2X Plus

Professional 3D Digitizing Solution for
Versatile Applications in an Easy Way

Who Are You?

- Name

- Grade

- School

- Status of Install

- What You Want to Learn

- Favorite candy

Expectations

- Be respectful of all participants and helpers
  - Good Zoom etiquette

- Course
  - Understanding of different sensor options.
  - Ability to determine what types of sensors you'll need to collect data.
  - Understand factors that affect data logging.
  - Base understanding of Arduino

- Be open and provide us with feedback also.

Timeline & Communication

- 5 Weeks for 1 hour, 15 minutes
  - If you are going to miss, it's understood. Please reach out ahead of time!
- Office Hours
  - 45 minutes each week.
  - Monday @ 7:00 PM

- Email Communications
  - Contains Zoom link and password (same link as this meeting)
- Website will have all project materials
  - https://www.flintsciencefair.org/crash-course-measurements-sensors-and-data-logging-january-session/

Timeline & Communication

- Orientations
  - Oct 16 @ 10:00 AM
  - Oct 18 @ 7:00 PM
  - Oct 19 @ 6:00 PM
- Sessions
  - Oct 21 @ 7:00 PM
  - Oct 28 @ 7:00 PM
  - Nov 4 @ 7:00 PM
  - Nov 11 @ 7:00 PM
  - Nov 18 @ 7:00 PM

- Office Hours (optional)
  - Oct 25 @ 7:00 PM
  - Nov 1 @ 7:00 PM
  - Nov 15 @ 7:00 PM
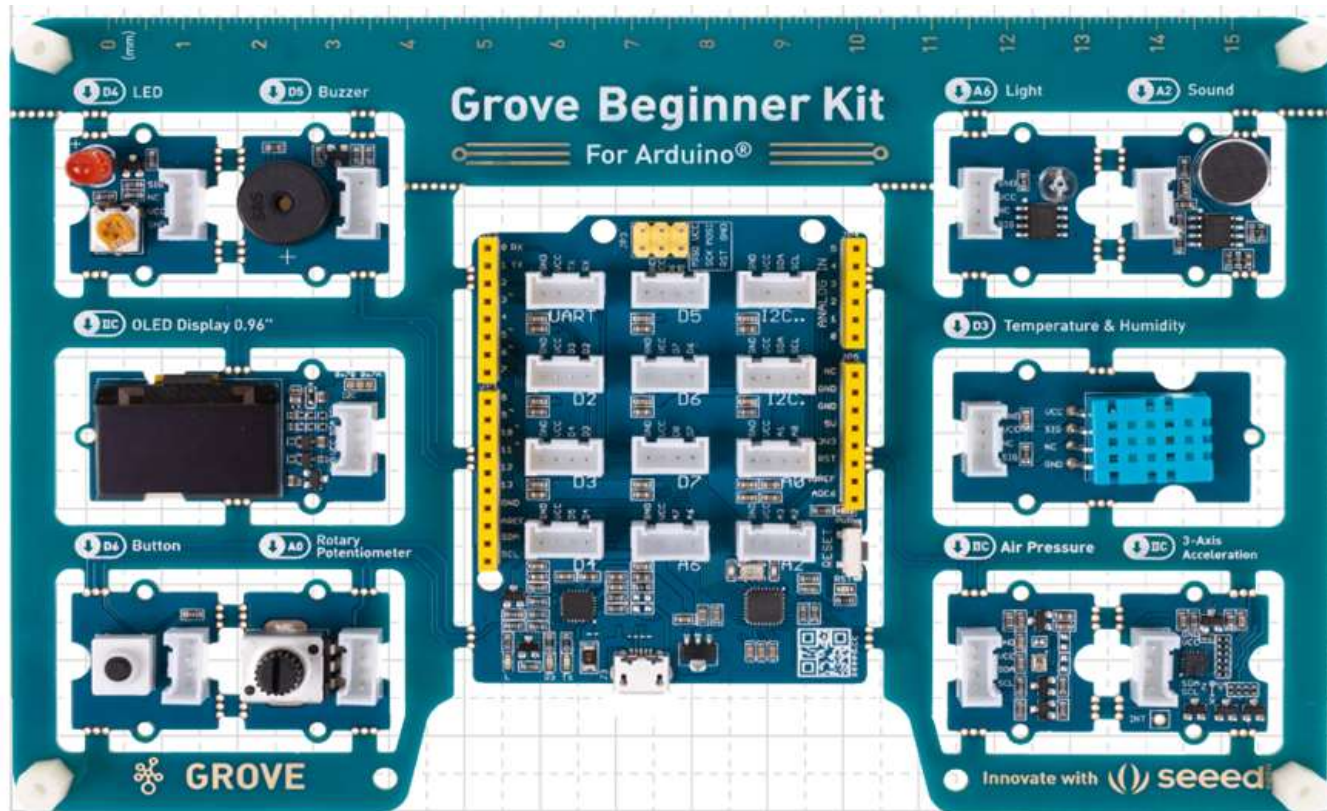
Check Your Kit

- All Contents
  - Grove Board
  - Sensors & Actuators
    - Water Sensor
    - Moisture Sensor
    - Ultrasonic Sensor
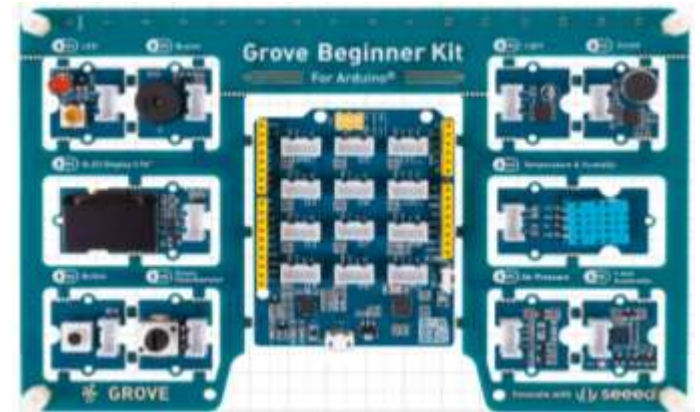 - SD Card
 - Battery
  - Logger Shield

"Get to Know" the Grove

"Get to Know" the Grove

- Power on the board
  - Plug it in via PCB

- Check the board (to change the sensor, hold down the pushbutton until a beep, rotate the potentiometer and repress the button)
  - Display
  - Push Button & LED
  - Light Sensor
  - Accelerometer
  - Air Pressure Sensor
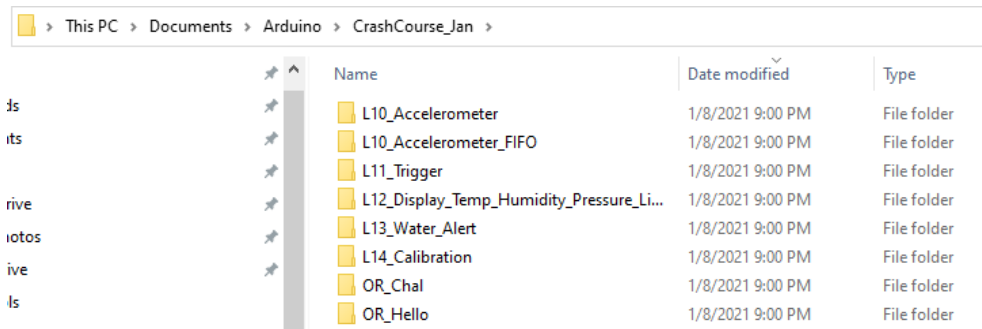 - Temp & Humidity Sensor
  - Sound Sensor

Arduino IDE & Arduino Create

• Installed?

• Open the program
– Windows: *Arduino* app from the Start menu
– Mac: *Arduino.app* from the applications folder
– Chromebook: Launch *create.Arduino.cc*
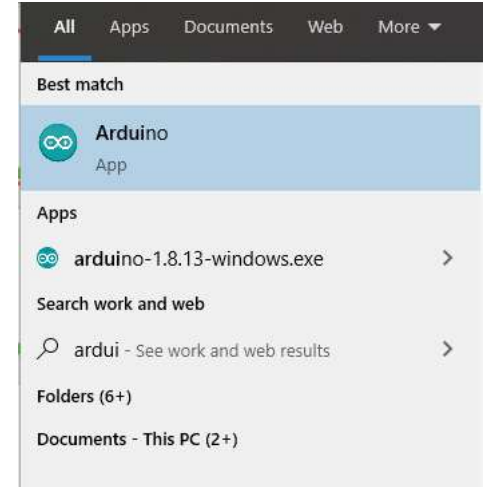
# Arduino IDE – File Structure & Loading a Sketch

- File structure – Mac / Windows
  - There is a folder named *Arduino* created during install
  - Copy and unzip the *CrashCourse_Jan.zip* file in the *Arduino* folder

- File structure – Chromebook
  - Create a folder named *Arduino*
  - Copy and unzip the *CrashCourse_Jan.zip* file in the *Arduino* folder

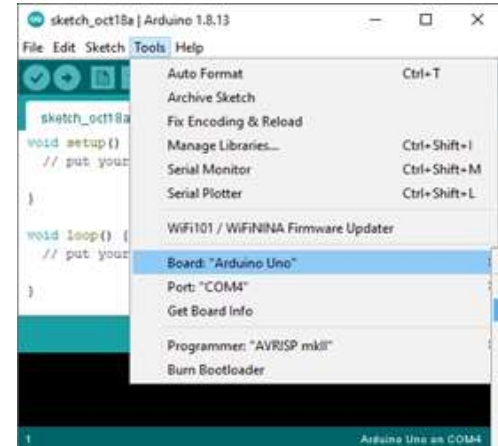# Arduino IDE – File Structure & Loading a Sketch

- Open the program OR_*Hello.ino*
  - *File -> Sketchbook -> CrashCourse_Jan -> OR_Hello*
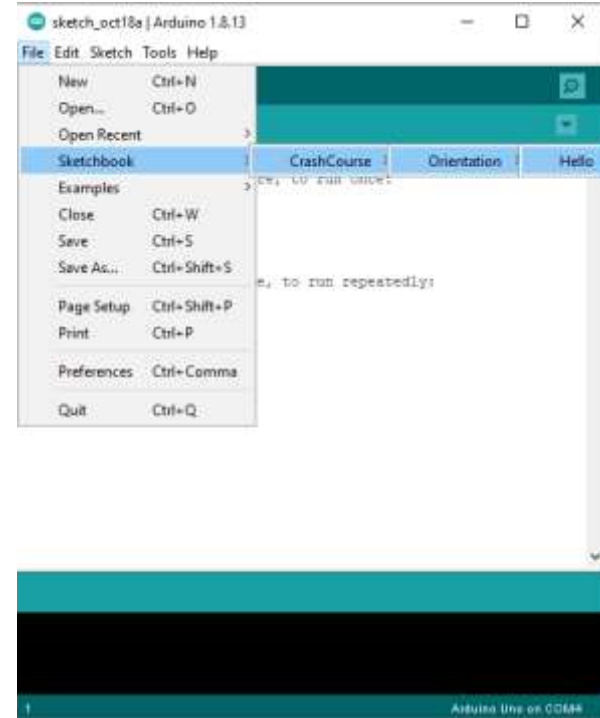
Arduino IDE – Selecting Your Board & Finding the Port

- *Tools* menu
- Board: *Arduino / Genuino Uno*
- Port
  - PC: *COMx (yours may be different than 4)*
  - Mac: *Port -> dev/cu.SLAB_USBtoUART*
  - Chromebook: *CP2102N USB to UART Bridge Controller*
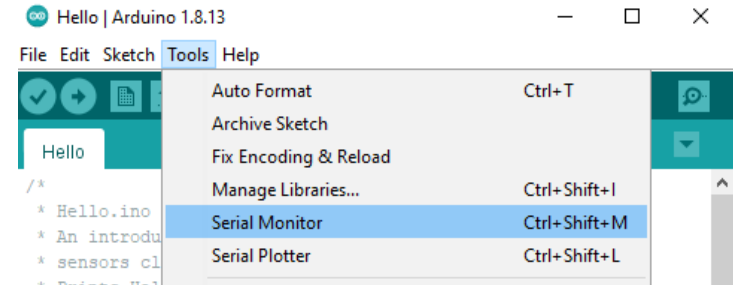
Arduino IDE – Uploading "Hello World"

- Click on **Upload** or **Progam**

- LEDs will toggle on and off
  – Large red LED and small green LED

Serial Monitor "Hello World"

- Arduino IDE - Serial Monitor
  - Magnifying glass button
  - Ctrl+Shift+M
  - Tools -> Serial Monitor

Challenge

- Each week we will have two challenges
  - 1 debugging an existing sketch
  - 1 completing a sketch
    - Look for the ***** in the sketch. That is where you need to complete it.

- Challenge for Week 1 (complete before session)
  - *Or_Chal*

1st Week

- October 21st is our first session
  - Join the Zoom call 10 minutes early (6:50)
  - Challenge: *OR_Chal*

- Reach out with any questions

- Make sure you've been able to flash the first program.
  - Don't be afraid to ask / speak up!!

Q&A

Thank You!

Reach out anytime:

Jordan Krell
jkrell@flintsciencefair.org