



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

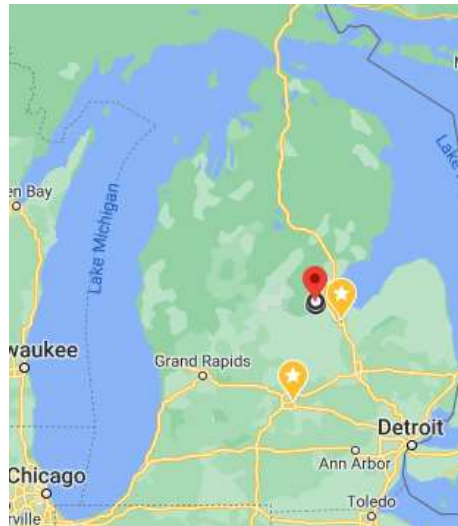
- Online preliminary round
 - Submit slide deck and quad chart
 - Entry Deadline: March 7
- In-person finalist round at UM-Flint
 - March 19
 - Awards on March 20





Michigan State University - St. Andrews

**We are located in
Midland MI**



**Research & K-12 STEAM
education**

**STEM Resources for
Great Lakes Bay Region
K-12 Schools**

MSU St. Andrews offers a variety of online STEM education programs for teachers, students, and families. We look forward to face-to-face events soon, but for now, we hope you will take advantage of our online offerings. The programs listed below are offered at no cost. MSU St. Andrews Virtual Programs Virtual Talks & Activities. Invite a scientist(x) to your classroom for a...

<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

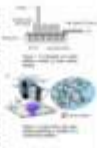
Designing and Constructing a 3D Printer for the Additive Manufacturing of Soft Matter Hydrogels



Project SP-PT01-1440
Physical sciences
and engineering
Research Division

introduction

It is important that the research community, the public, and the media understand that the use of the term "epidemic" is not a scientific statement about the nature of the disease and its spread, but a statement about the magnitude of the disease and the need for public health action. The term "epidemic" is a relative term, and its use should be based on the magnitude of the disease and the need for public health action.



Engineering Goal

The goal of this engineering project is to design and construct a 3D printer capable of manufacturing objects out of wax.

The summer should be busy for

- Repeat and correct steps of movement constantly
- Develop controlled quantities of gas
- Train dependent material in place throughout cycling
- First two development generations of work type
- Address in place type of gas together
- First two stages of development of multiple tasks



Methodology: Printer Features

1. *Chlorophyll a* is the primary photosynthetic pigment in most plants.



Methodology: Cryoped Tests

Adults appear to be largely self-reliant and independent, even at night, if the young are not in danger from the heat of the sun. The adults of both departments usually do not move from one place to another during the day, but may move from one place to another at night.

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Methodology: Printed Parts



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0891-2243/00/6804-0511\$15.00/0

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Methodology: Control

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Methodology: Cell Samples

Abstract: *Staph. aureus* is the most common cause of skin infections. It is known that the use of antibiotics is increasing, and this has led to the development of resistance. The aim of this study was to determine the prevalence of *Staph. aureus* in the skin of patients with skin infections in a tertiary care hospital. A total of 100 patients were included in the study. The results showed that the prevalence of *Staph. aureus* was 100% in the skin of patients with skin infections. The most common site of infection was the face, followed by the trunk and the extremities. The results of this study are in line with the results of other studies conducted in the same hospital and in other hospitals in the country.

$$y_1 = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ 1 \end{pmatrix}, y_2 = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -1 \end{pmatrix}, y_3 = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ i \end{pmatrix}, y_4 = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -i \end{pmatrix}, y_5 = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ 0 \end{pmatrix}, y_6 = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

1000

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Results

The scores achieved by correct results were considered out of various other



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

Henry Wolf

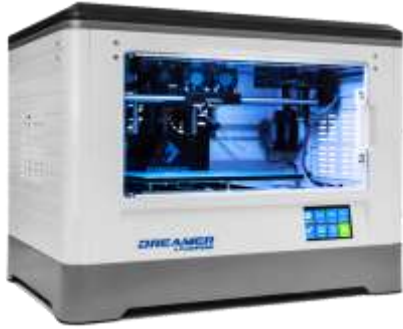
Abstract

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

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

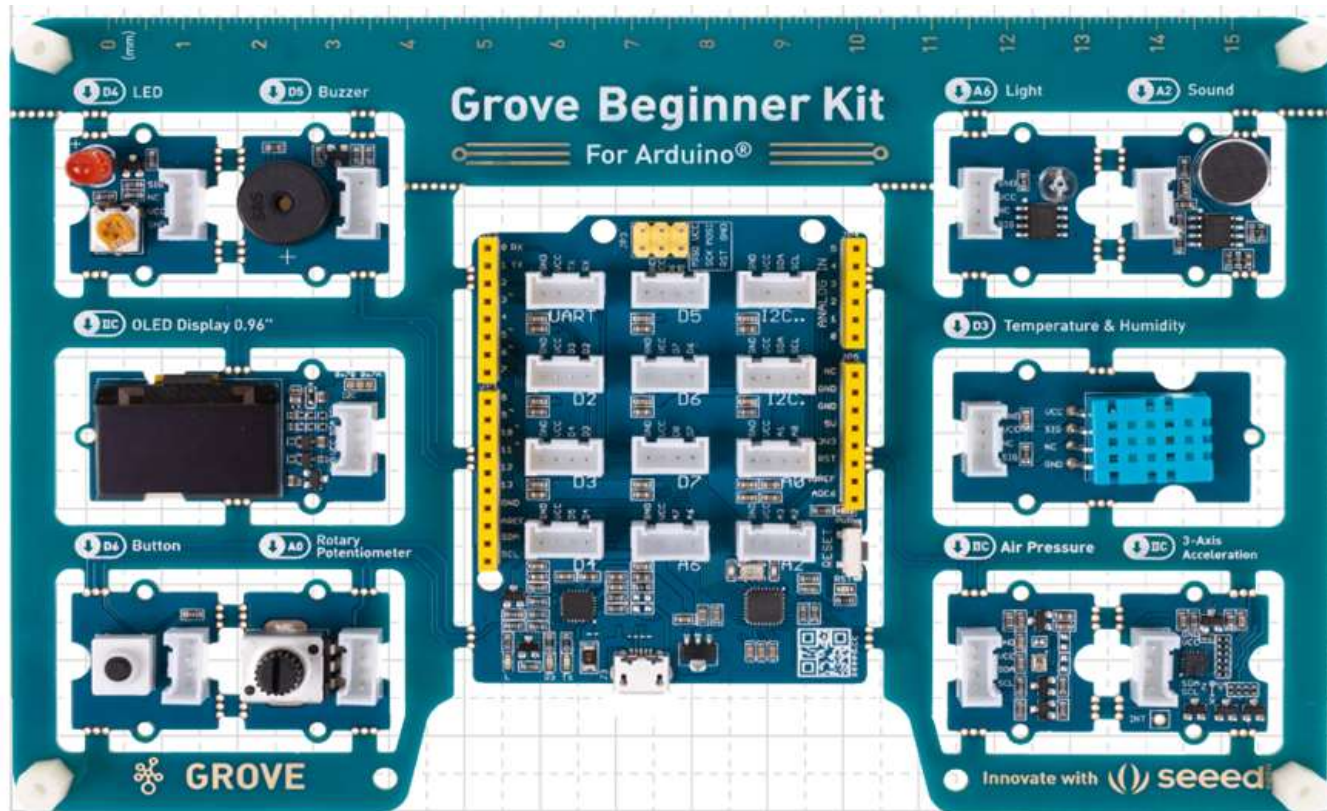


Check Your Kit

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

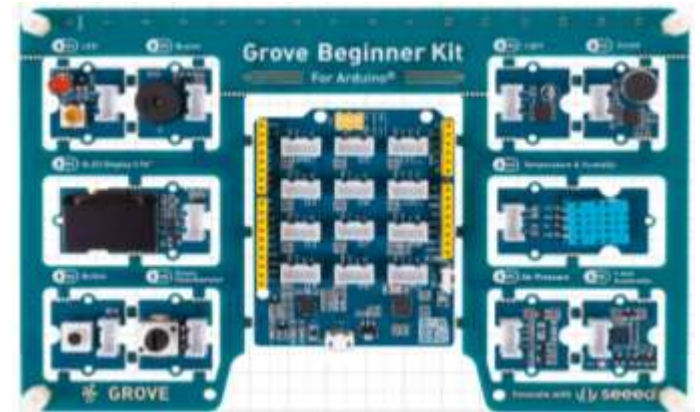


“Get to Know” the Grove



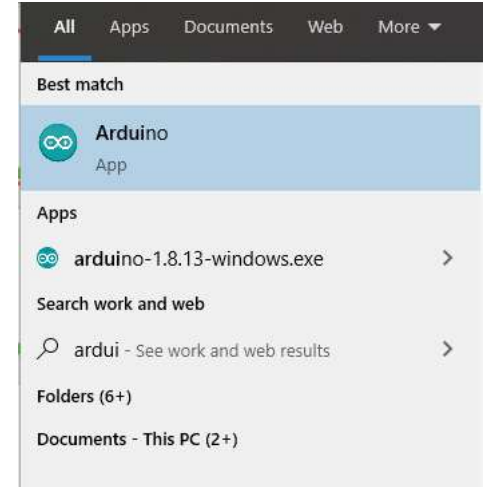
“Get to Know” the Grove

- 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



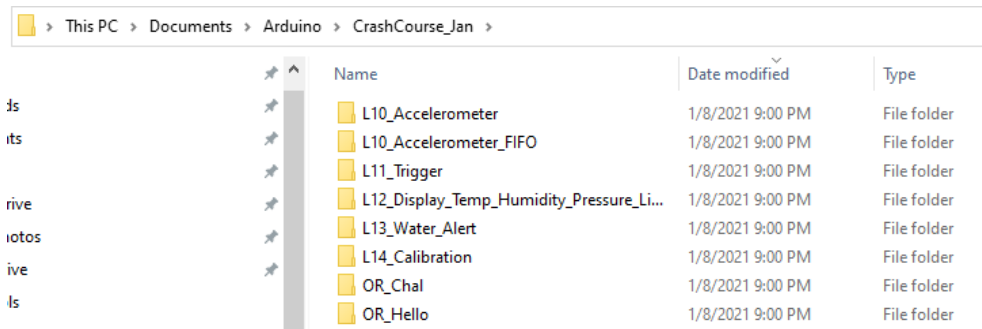
Arduino IDE & Arduino Create

- 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

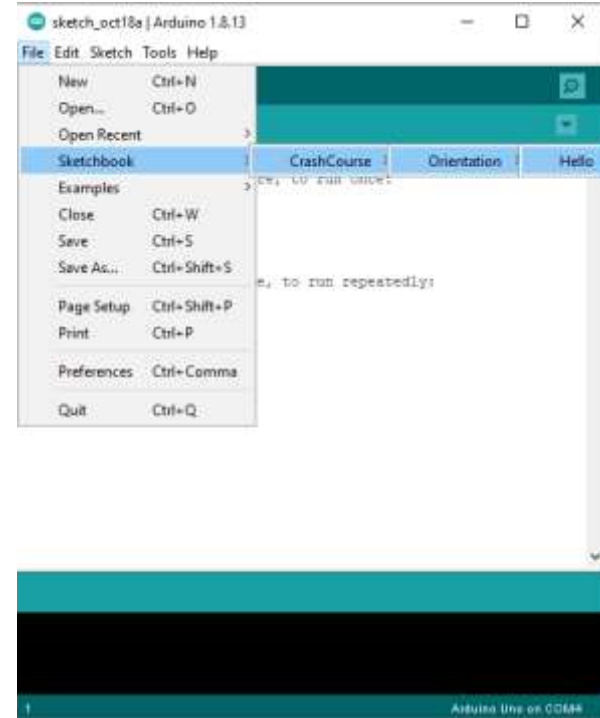
- File structure – Mac / Windows
 - There is a folder named *Arduino* created during install
 - Copy and unzip the *CrashCourse_Jan.zip* file in the *Arduino* folder
- File structure – Chromebook
 - Create a folder named *Arduino*
 - Copy and unzip the *CrashCourse_Jan.zip* file in the *Arduino* folder



	Name	Date modified	Type
js	L10_Accelerometer	1/8/2021 9:00 PM	File folder
its	L10_Accelerometer_FIFO	1/8/2021 9:00 PM	File folder
	L11_Trigger	1/8/2021 9:00 PM	File folder
rive	L12_Display_Temp_Humidity_Pressure_Li...	1/8/2021 9:00 PM	File folder
otos	L13_Water_Alert	1/8/2021 9:00 PM	File folder
ive	L14_Calibration	1/8/2021 9:00 PM	File folder
ls	OR_Chall	1/8/2021 9:00 PM	File folder
	OR_Hello	1/8/2021 9:00 PM	File folder

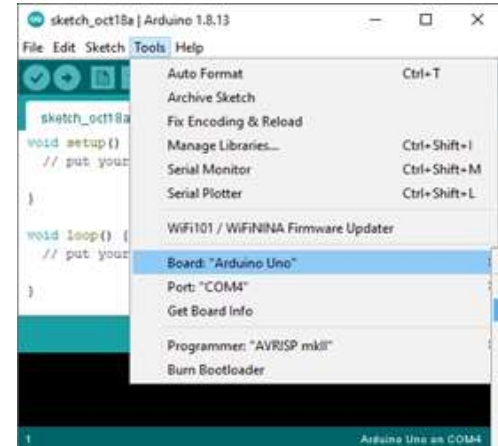
Arduino IDE – File Structure & Loading a Sketch

- 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*



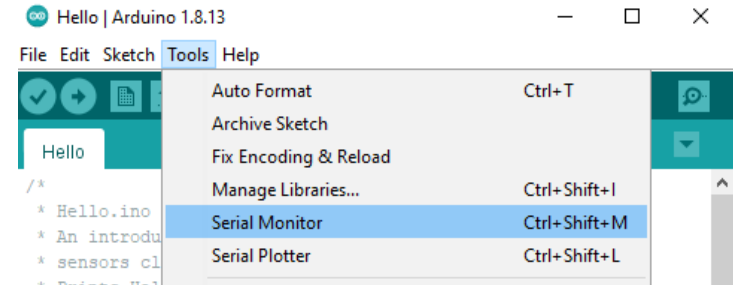
Arduino IDE – Uploading "Hello World"

- Click on **Upload** or **Program**
- 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_Chall*



1st Week

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