DIY girls

Invent Girls

Mechatronics, Sensors and 3D Printing

Southern California Linux Expo

Pasadena

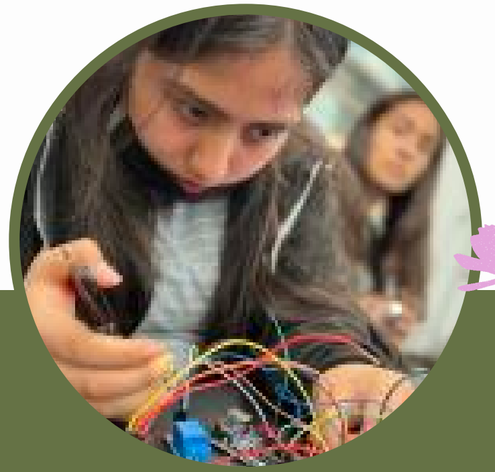
3.16.24

TEAM

Adanelly

Kimberly

Cynthia



Alexa

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diygirls.org

Mission

DIY Girls mission is to increase girls' and gender-expansive youth's interest and long-term success in technology, engineering and making through innovative educational experiences and mentor relationships.

Impact

92% of our high school students feel confident in being successful in a STEM career

64% of our Alumni are pursuing STEM in college

63% of our college graduates hold a STEM degree

Breakdown

01 Introduce the Project

02 How to DIY

03 Final Design

04 Q&A

Introduction to INTELLIPLANT

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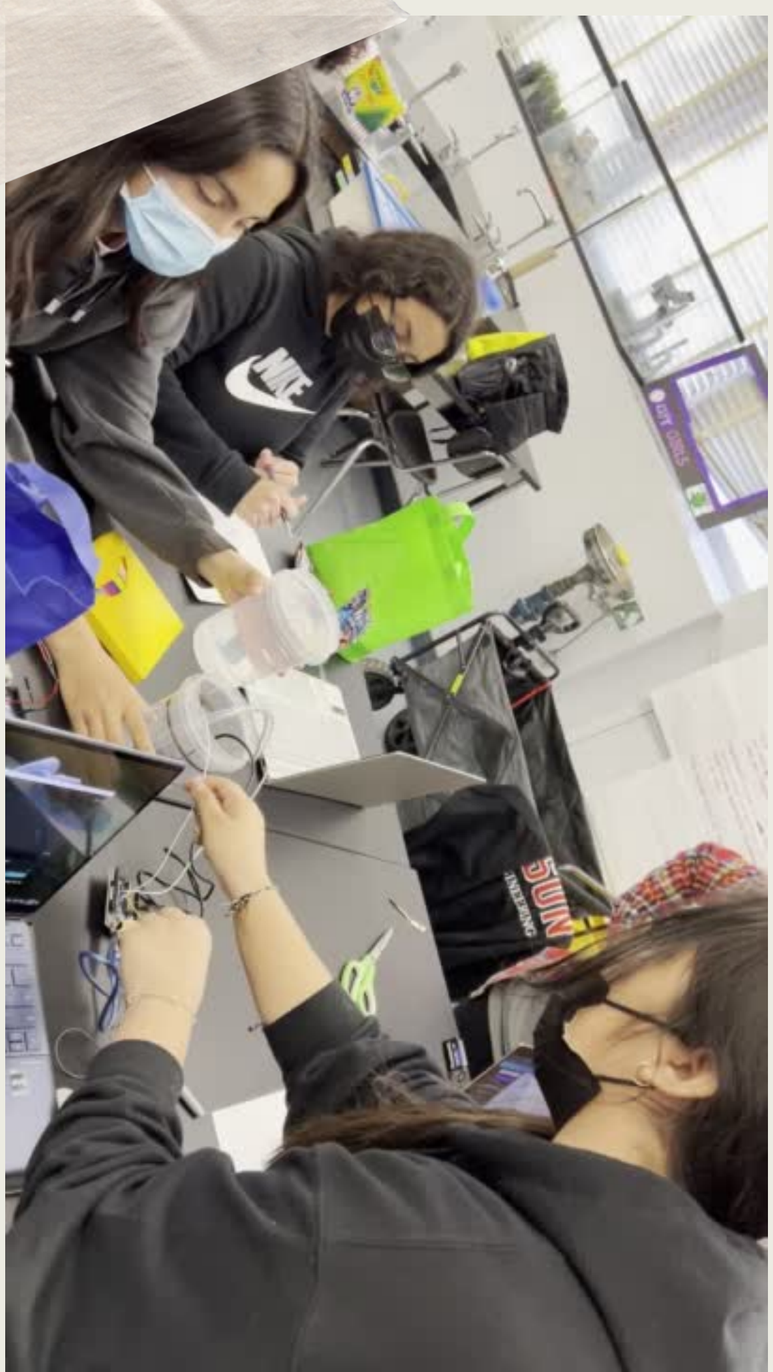
An Arduino-powered self-watering plant pot that monitors the soil moisture, sunlight intake, and provides visual feedback.



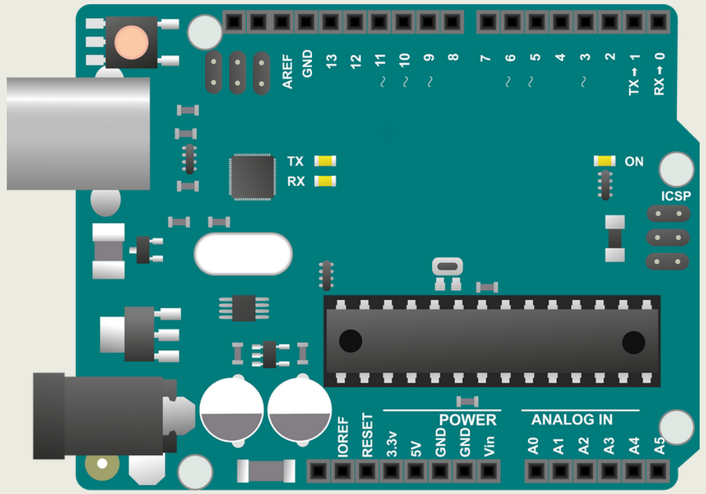
Mechatronics OBJECTIVE

The mechatronics team was in charge of creating the self-watering system for the plant. We had to find the most efficient way to water the plant without causing the pump to burn out. The goal of our system was to have it switch on and off depending on if the plant needed to be watered at that time.

Introduction to MECHATRONICS

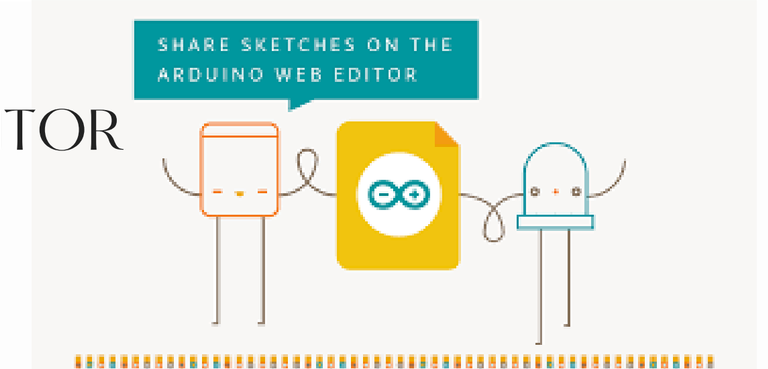
APP

An Arduino is a microcontroller, that uses open-source hardware and software



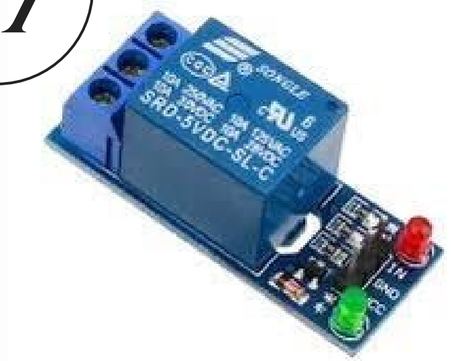
Its IDE (integrated development environment) is easy to use for beginners and advanced students.

WEB EDITOR



COMPONENTS

01



Relay

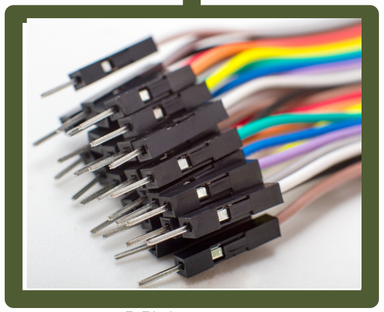
02

Water Tank

03

Water Pump
5V

Copper Tape



Wires

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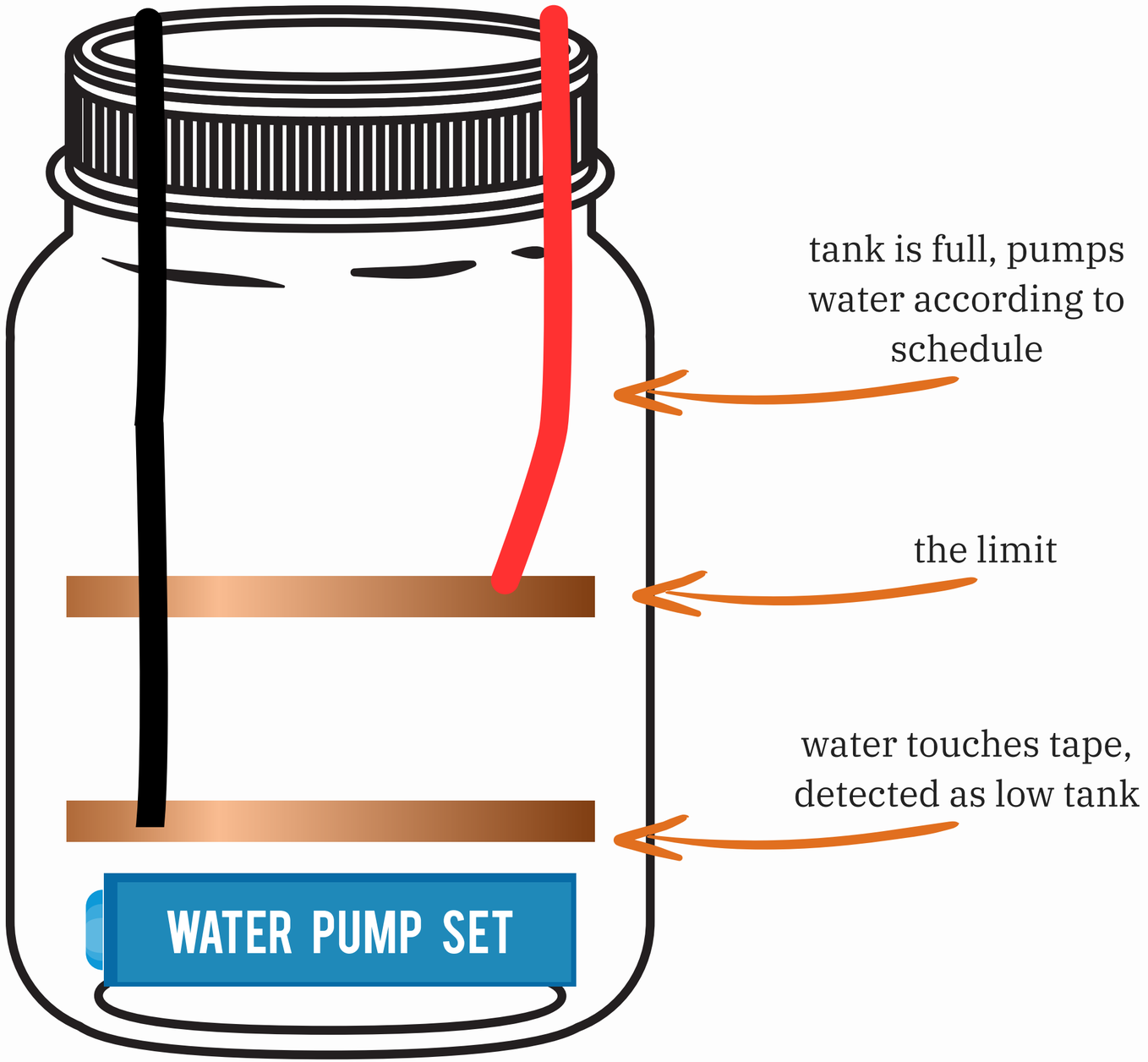
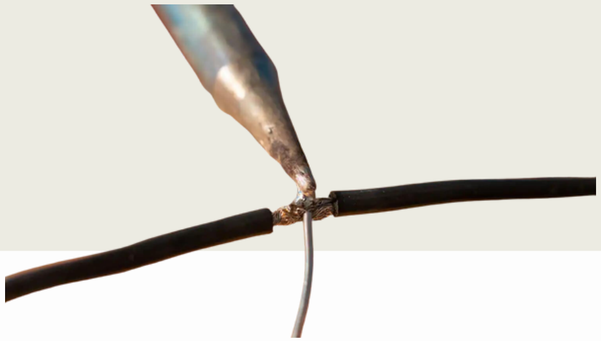
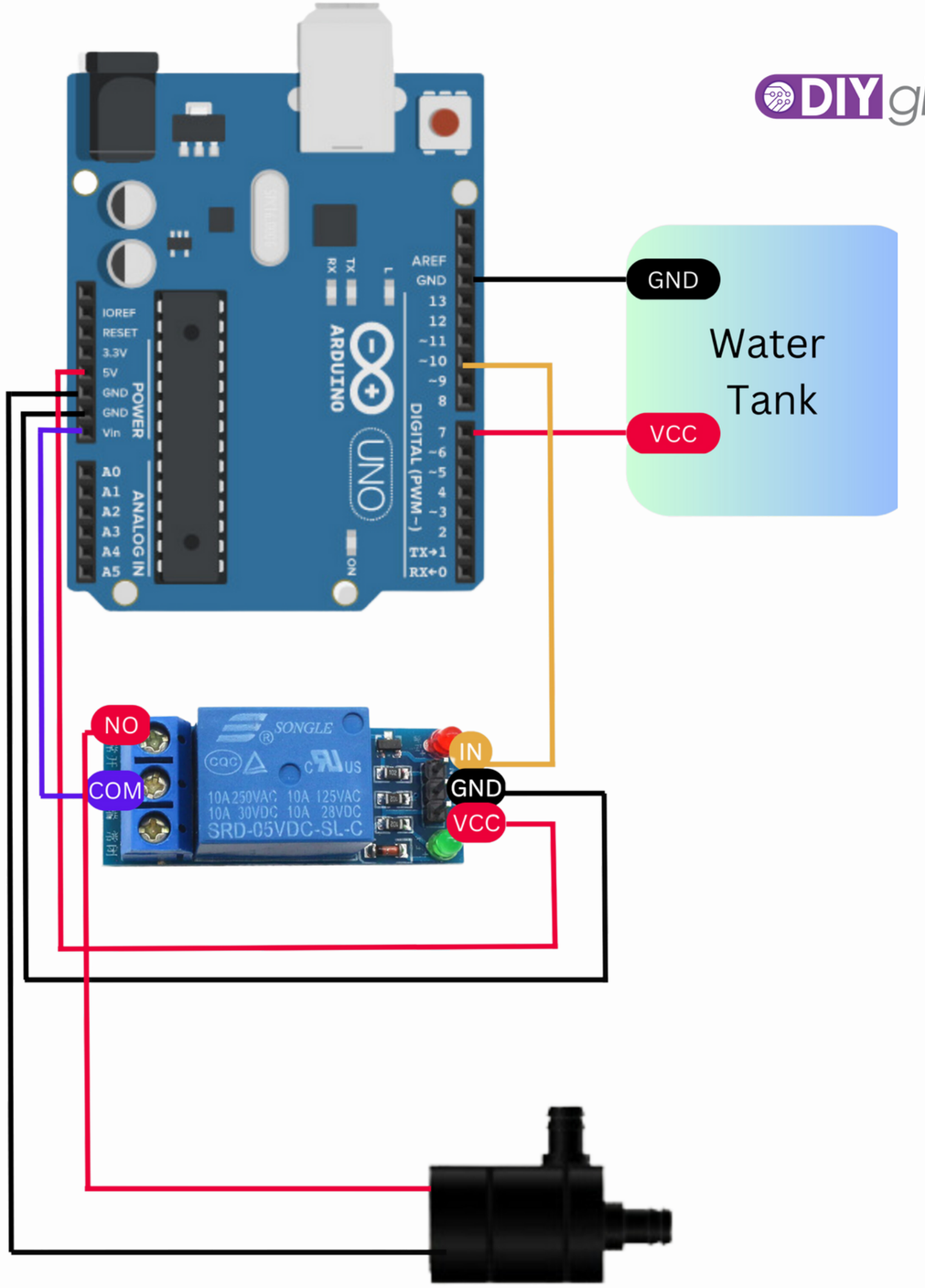
Mechatronics FUNCTIONALITY



Mechatronics CIRCUIT DIAGRAM

It’s important to note that soldering would be required for this step. Wires connected to 5V and GND must be soldered together, respectively, as there are only 2 and 3 input pins on the Arduino.





Mechatronics CODE

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If-Else Statements:

If- water tank equals 1 the relay pin is HIGH so the water pump will stop pumping.

Else- the water tank value equals 0, the relay pin is LOW so the water pump remains on

```
if (waterTankValue == 1) {
digitalWrite(relayPin,HIGH);
Serial.println("Water Pump off");
delay(1000);


} else {
      Serial.println("Water Pump on");
      digitalWrite(relayPin, LOW);
      delay(1500);
      digitalWrite(relayPin, HIGH);
      delay(3000);
     }
```

```
int waterLevelPin = 7;
int waterTankValue = 0;
int relayPin = 10;

void setup() {
  Serial.begin(9600);

  pinMode(relayPin, OUTPUT);
  pinMode(waterLevelPin, INPUT_PULLUP);
  //digitalWrite(relayPin,LOW);
}

void loop() {

  //checking the resevoir levels to make sure there is enough water:
   waterTankValue = digitalRead(waterLevelPin);

  Serial.print("Water Tank Value= ");
  Serial.println(waterTankValue);
  //digitalWrite(relayPin, LOW);

 if (waterTankValue == 1) {
digitalWrite(relayPin,HIGH);
Serial.println("Water Pump off");
delay(1000);
```

Sensors OBJECTIVE

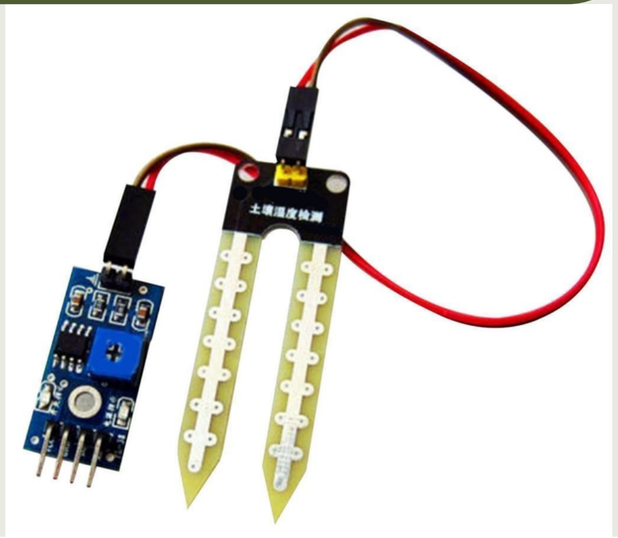
The sensors team was in charge of connecting and programming the sensors that monitor the plant's sunlight and water intake. Our main goal was to define the plant's threshold values that determined at which point the plant had too little or too much sun and water.

COMPONENTS + FUNCTIONALITY

Photoresistor

The photoresistor is used to measure how much light is being emitted on the plant. This data is used to determine whether the user would have to move the plant or not.

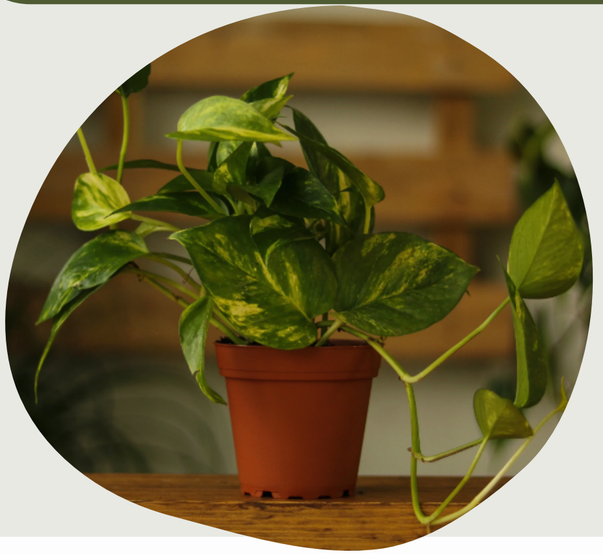
Soil Moisture Sensor



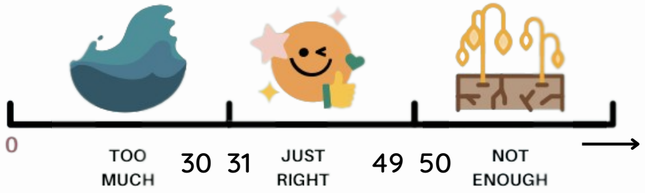
The soil motion sensor is used to determine the amount of moisture of the soil of the plant. This data is then taken into consideration when triggering the watering system.

PLANTS RESEARCHED

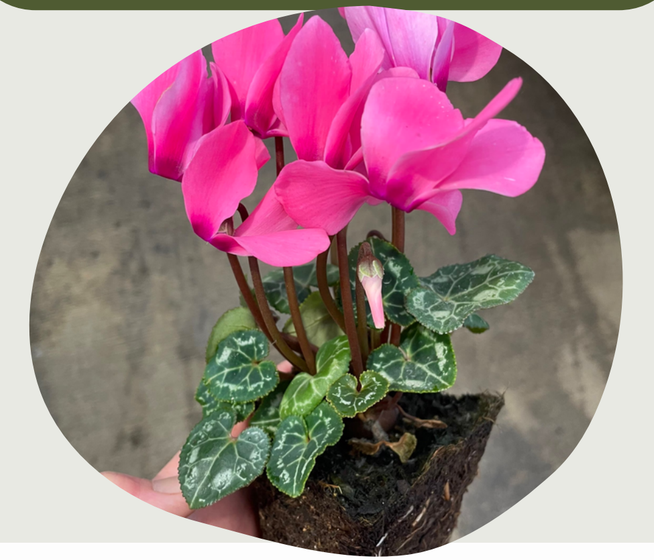
Pothos Plant



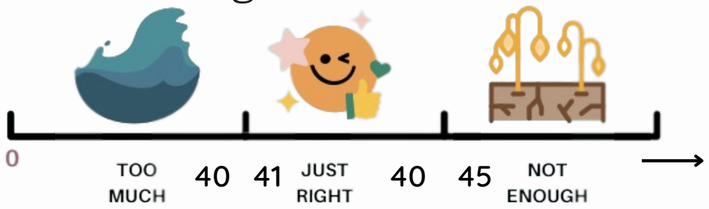
A pothos plant should be placed in a bright room for at least 12 hours a day.



Cyclamen Plant

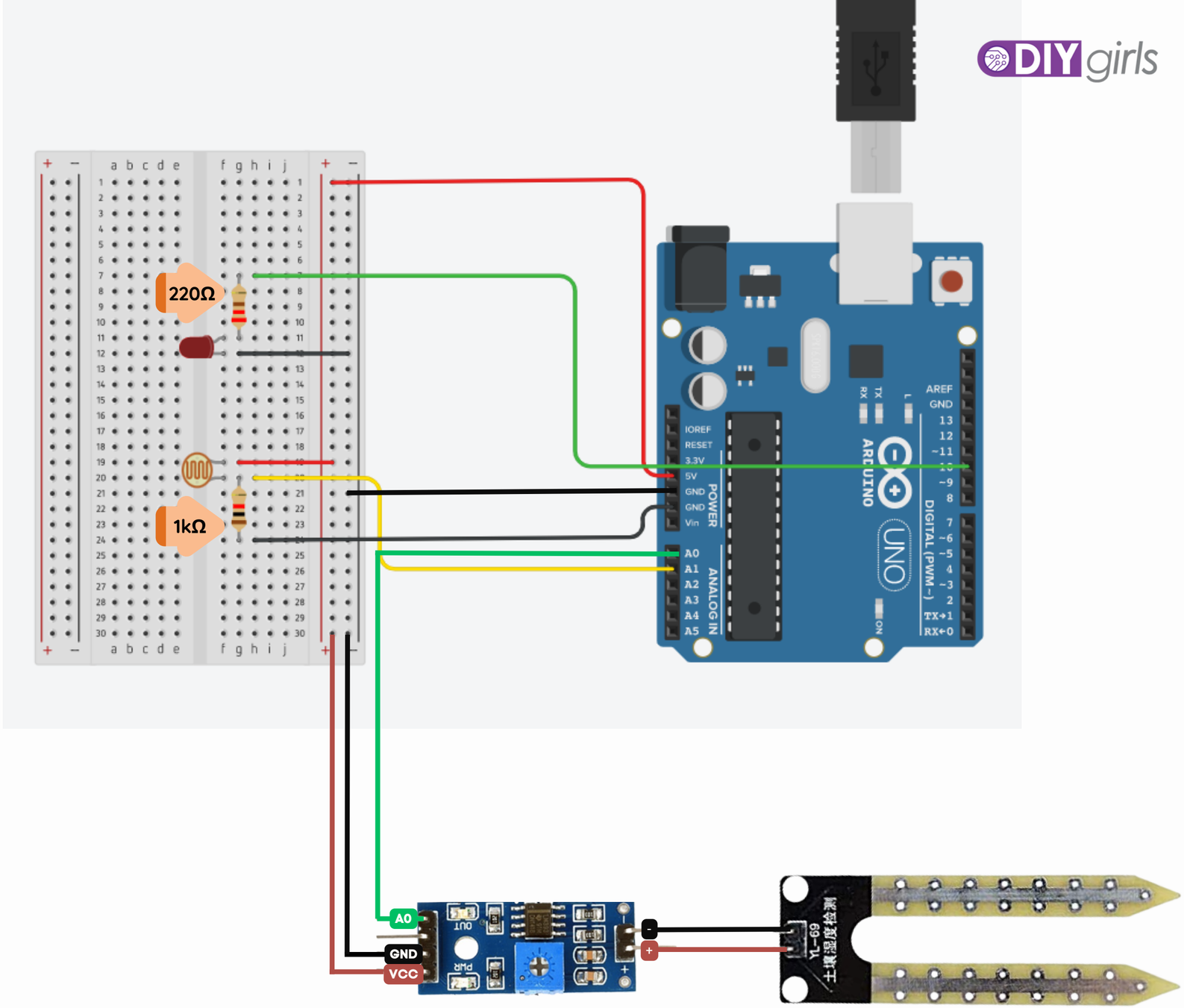


A cyclamen plant should be watered weekly and not watered again until the soil dries out.



Sensors CIRCUIT DIAGRAM

It’s important to note the type of resistors you need by testing their resistances. Here we have two different resistances.



Sensors CODE

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If/else Statements

If/else statements are one of the simplest forms of decision-making statements

This format will be used when we combine all of the components

Primary conditional statements:

-if: Executes a block of code only if a specified condition is true

-else if: Specifies a new condition to test, if the first condition is false

-else: Executes a block of code, if the first two conditions are false

soil_test.ino

```
1  int soilSensorPin = A0;
2  int moistureValue = 0;
3
4  void setup() {
5    Serial.begin(9600);
6  }
7
8  void loop() {
9    moistureValue = analogRead(soilSensorPin);
10
11   moistureValue = map(moistureValue, 0, 1023, 0, 100);
12
13   // print the soil moisture value
14   Serial.print("Soil Moisture Value : ");
15   Serial.println(moistureValue);
16
17   // print the status of the soil
18   // values based on pothos plant
19   if (moistureValue > 50) {
20     Serial.println("Status: Soil moisture is too dry - time to water!");
21   } else if (moistureValue < 30) {
22     Serial.println("Status: Soil is too wet");
23   } else {
24     Serial.println("Status: Soil moisture is perfect");
25   }
26   delay(2000);
27 }
```

Sensors CODE

Code Overview:
The Photoresistor sensor code will allow us to detect how much light intake each plant is receiving

Main Takeaways:

- pinMode() function - configure a specific pin to behave either as an input or an output
- analogRead() function - read the sunlight value through the photoresistor and store it in 'lightValue'
- analogWrite() function - change the brightness of the LED based on the sunlight value read by the photoresistor
- The LED is a temporary component that will be later replaced by the LED Matrix
- The circuit & code will change once we are able to put both together.

photoresistor_test.ino

```
1  int ledPin = 10;
2  int photoresistorPin = A1;
3  int lightValue = 0;
4
5  void setup(){
6    Serial.begin(9600);
7
8    pinMode(ledPin, OUTPUT);
9    pinMode(photoresistorPin,INPUT);
10 }
11
12 void loop(){
13   lightValue = analogRead(photoresistorPin);
14
15   lightValue = map (lightValue, 0, 1023, 0, 255);
16
17   // print the sunlight value
18   Serial.print("Sunlight Value: ");
19   Serial.println(lightValue);
20
21   // change LED brightness based on value read by the photoresistor
22   analogWrite(ledPin, lightValue);
23 }
24
```

Design OBJECTIVE

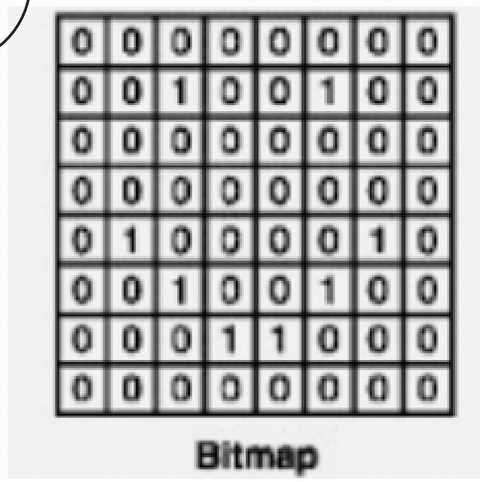
The design team was in charge of the different design aspects for the intelliplant. These design aspects involve the casing for the LED matrix and deciding its portability.

COMPONENTS

01

LED Matrix

02



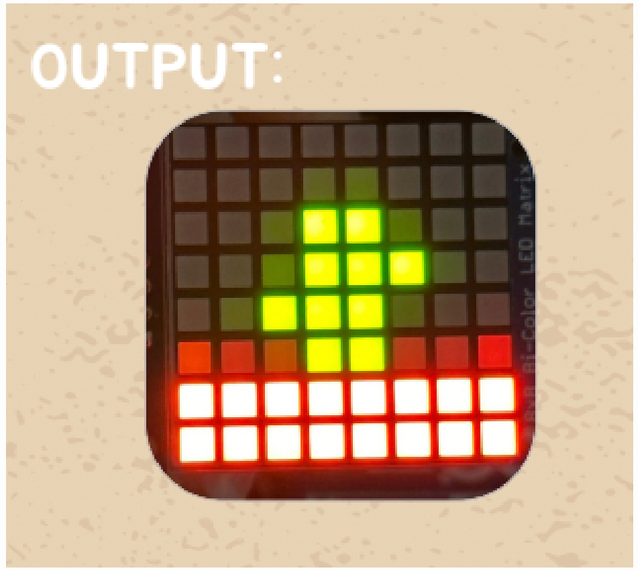
LED Matrix Code

03

LED Matrix Casing

LED Matrix FUNCTIONALITY

Cactus = Soil Too Dry



What is it?

- 8x8 LED pixel square
- Colors appear based on the code, which can be modified

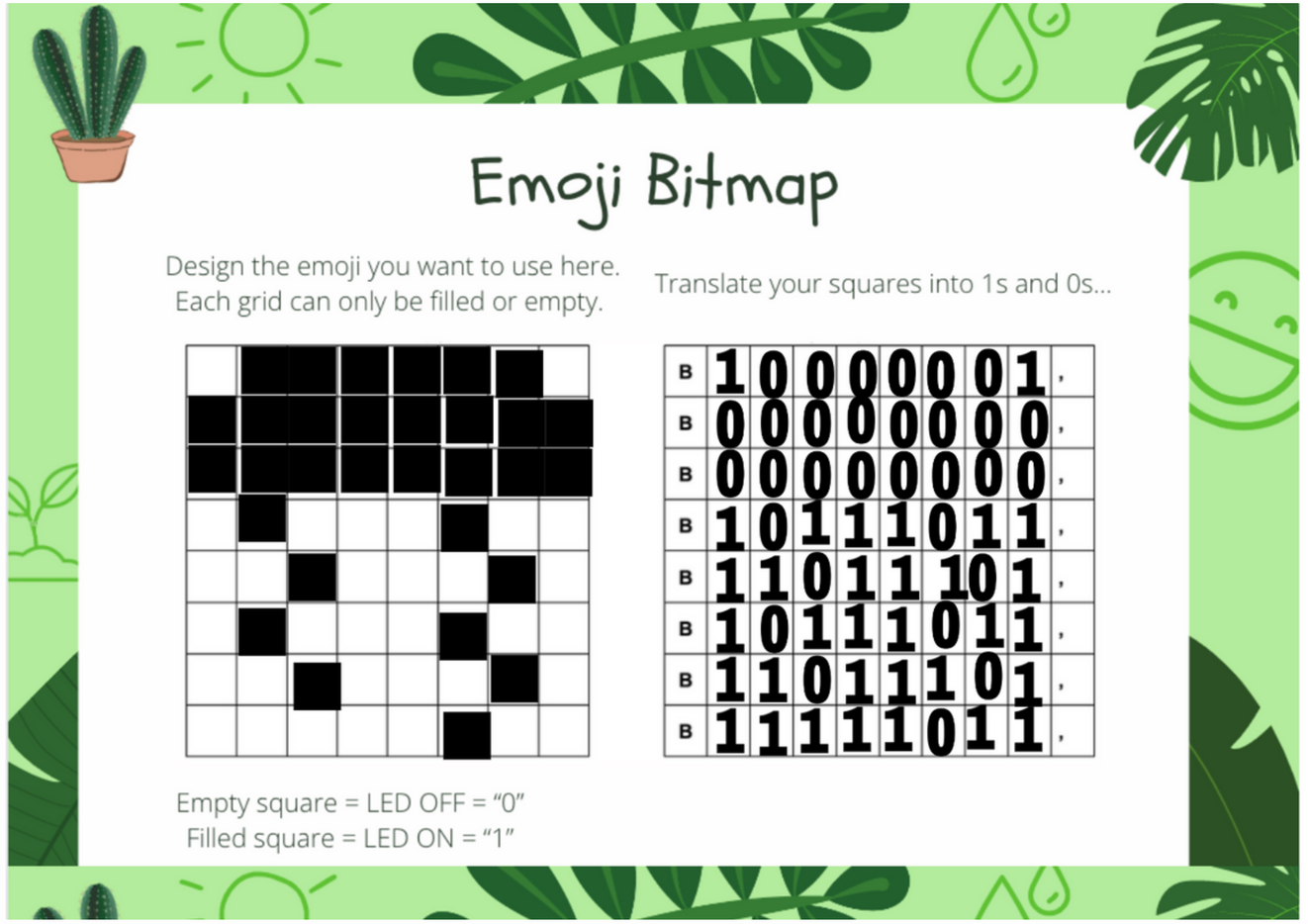
How it works:

- Makes symbols based on the needs of the plants
- Less/More Water
- Less/More Sun
- Low Water Tank
- HAPPY state

LED Matrix CODE

Binary Code:

- "0"= LED OFF
- "1"= LED ON



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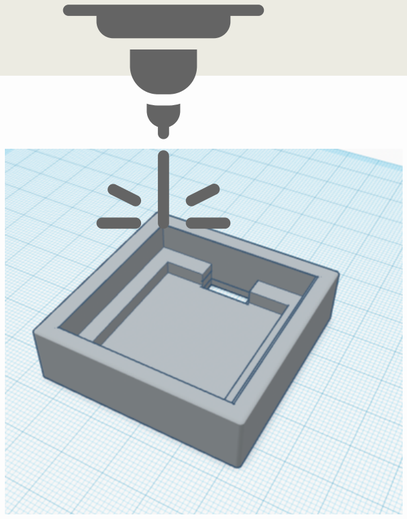
Examples

LED Matrix CASING

3D Design + Printing

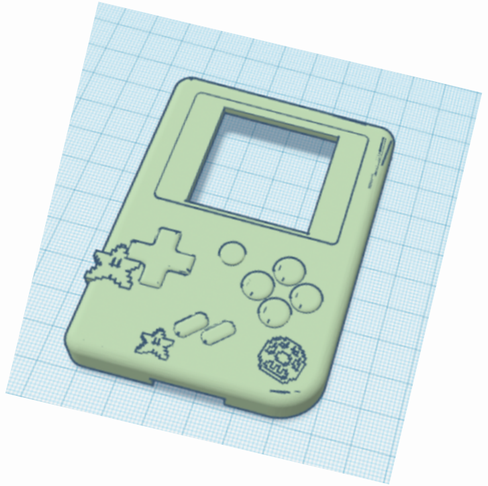
The design team was in charge of creating the template for the LED Matrix's back casing through a program called Tinkercad, designing the case from scratch for the team to then use.

A free open-source platform that uses computer-aided design (CAD) to model designs.



Top Case:

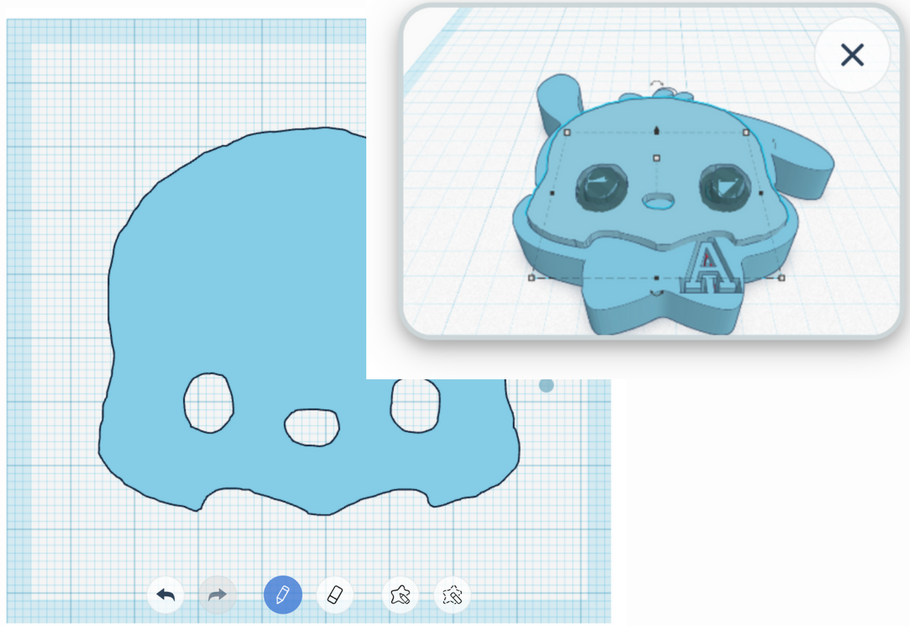
For the top case, the team was given the creative liberty to print out the front design of their choice with the Design team providing the dimensions for the LED-Matrix's screen.

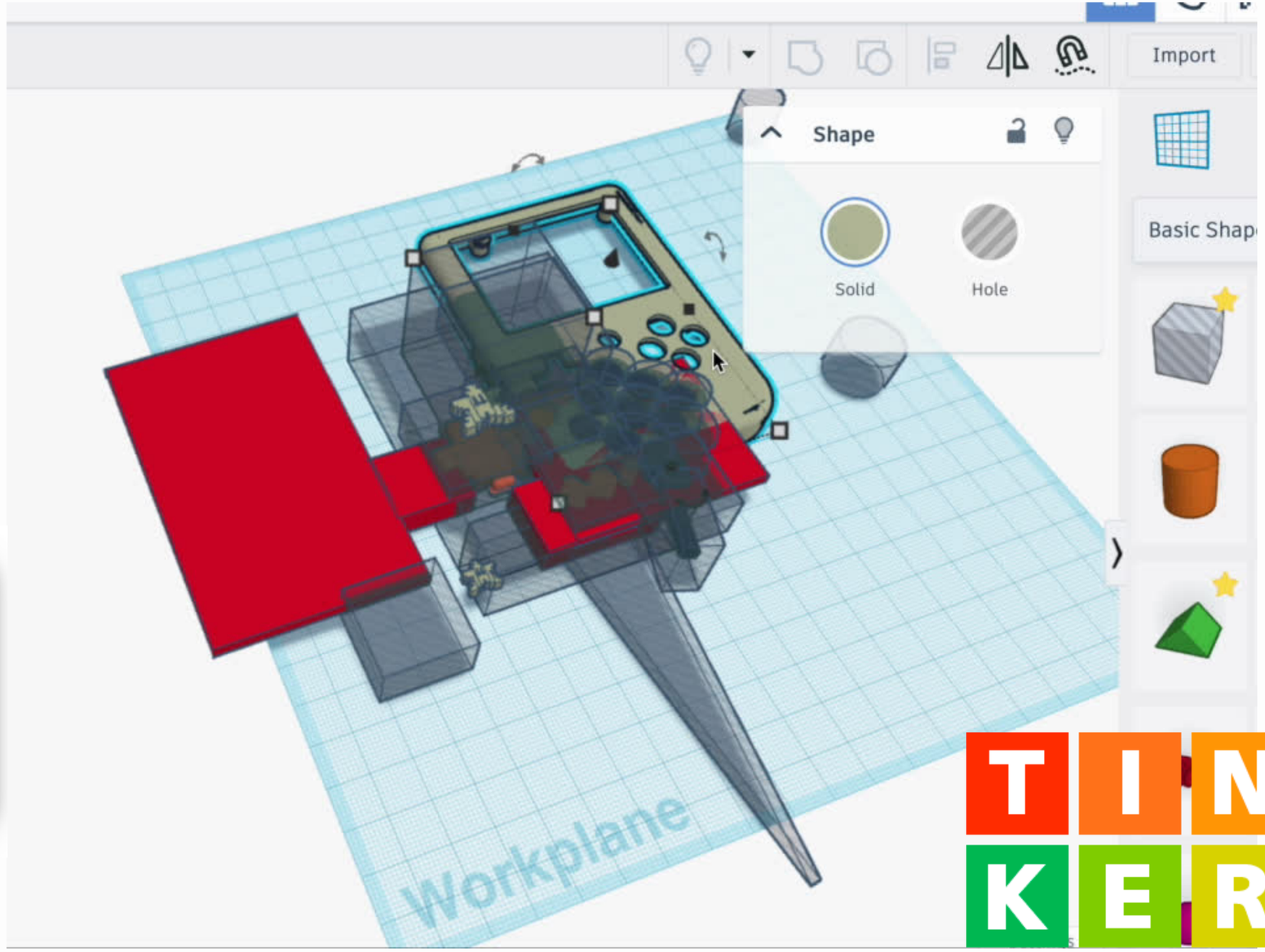


Tinkercad CAD

Open source design, modeling, and circuit simulator platform

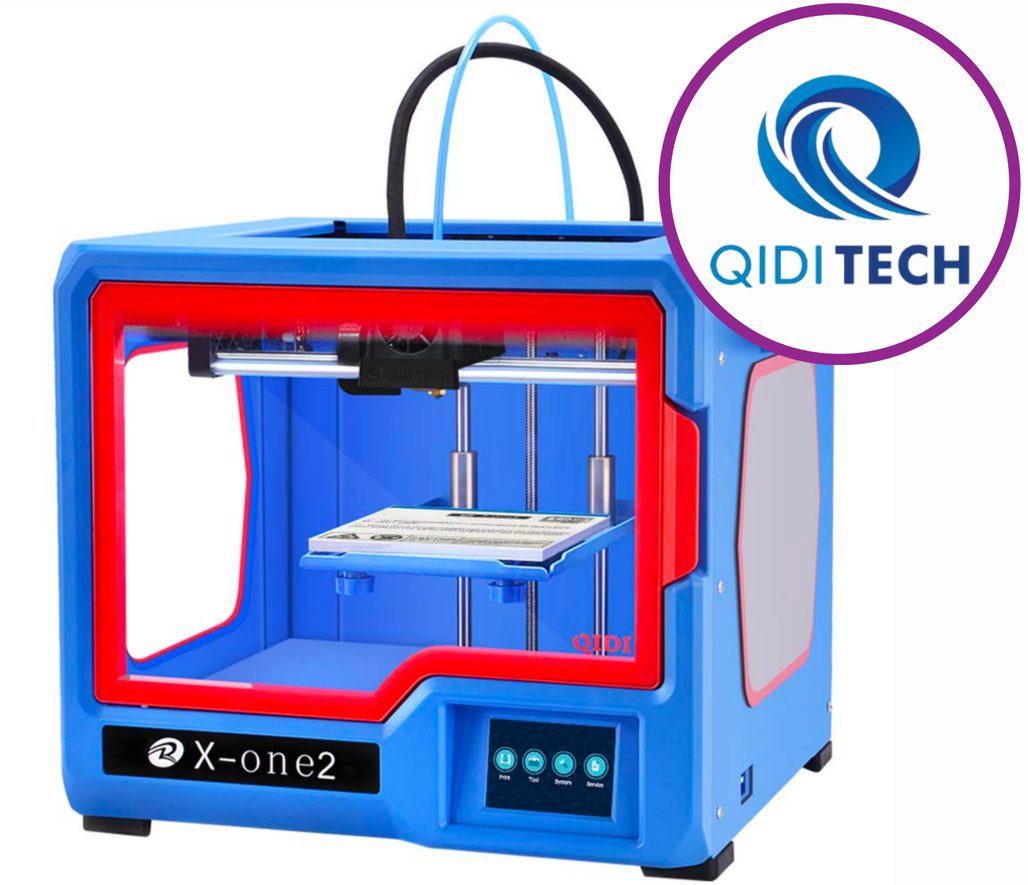
Students are also able to use a ***scribble*** tool which is a free-hand designing method





Design 3D PRINTERS

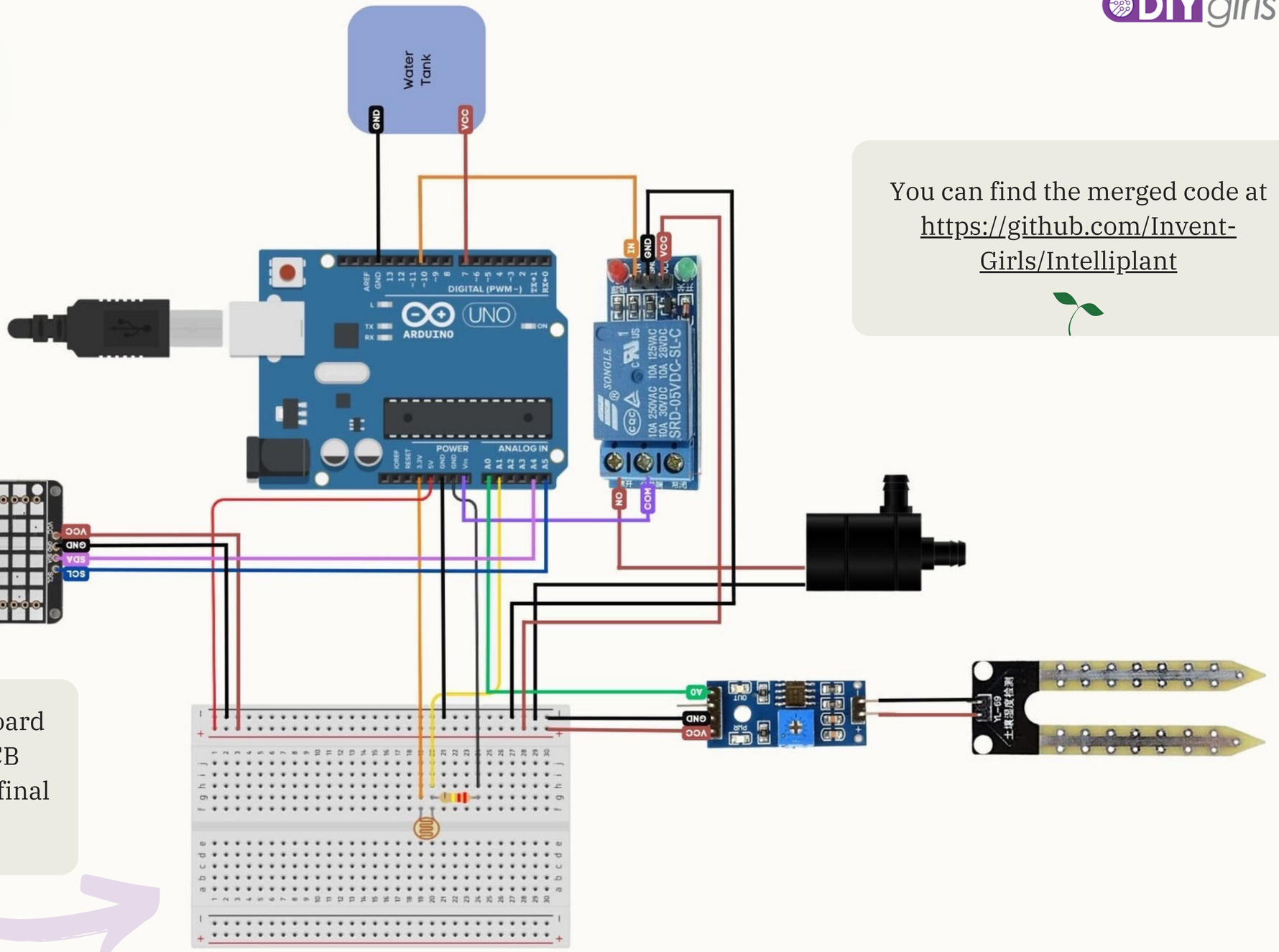
FLASHFORGE INVENTOR II



QIDI X-ONE 2

Intelliplant

CIRCUIT DIAGRAM



You can find the merged code at https://github.com/Invent-Girls/Intelliplant

keep in mind that the breadboard is replaced by a soldered PCB (printed circuit board) for the final design

Engineering Design Process +ADJUSTMENTS

Problem

Brainstorm

Design

Build

Share Solution

Build

Test & Evaluate

Re-Design

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Thank You

Questions?