A Data-Driven Interface to Optimize Presentation of Water Quality Metrics

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January 2021

Background

Water Quality:

- According to unesco.org, one in nine people worldwide uses drinking water from unimproved and unsafe sources
- Many people want to know what is in their water without having to buy expensive meters and tools
- There are not many interfaces that display water quality data in the market that are easy to use and read

Background (cont.)

Arduino:

- An easy to use microcontroller that uses the Arduino IDE software
- There are many Arduino-compatible sensors on the market for any project

Problem Statement

- Water quality plays an essential part in our world
- Due to the lack of a low cost, easy to use system, many people don’t have access to water quality data

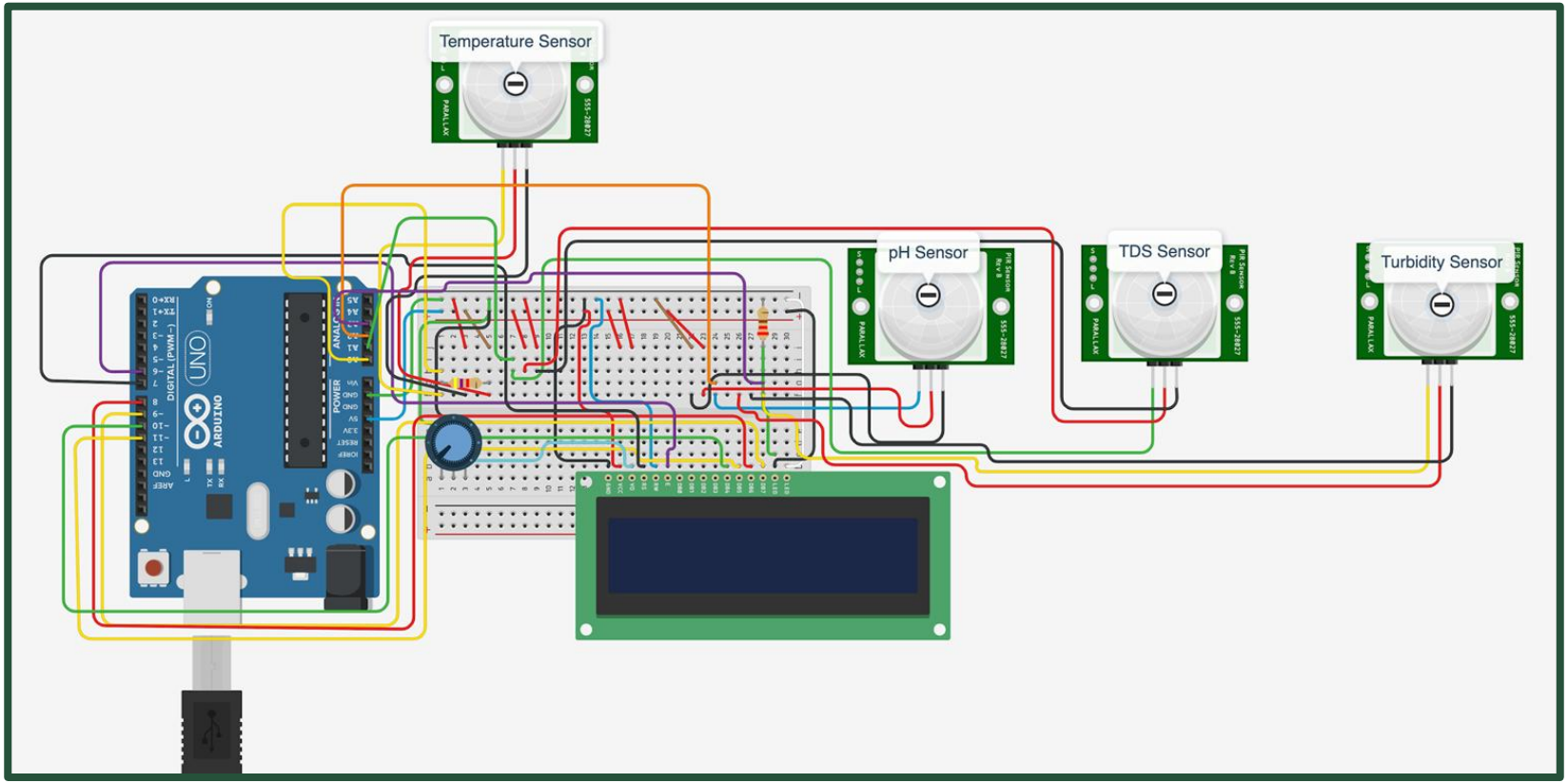
Design Objectives

- Use Arduino to test water quality and gather water quality data
- Prototype a user-friendly app to easily read and interpret data from the Arduino device

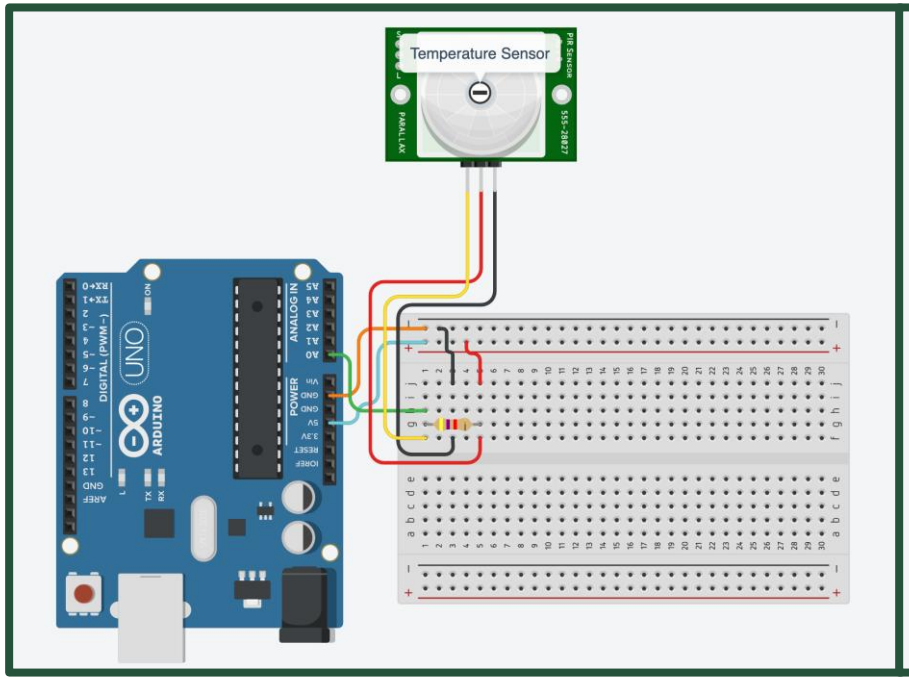
Materials

- Arduino Uno
- Arduino IDE Software
- Breadboard
- 20x4 LCD Display
- DS18B20 Temperature Sensor
- pH Sensor
- TDS Sensor
- Turbidity Sensor
- Data Logging Shield v1.0
- SD Card
- 10k Ohm Potentiometer
- 220 Ohm Resistor
- 4.7k Ohm Resistor
- Jumper Wires
- Soldering Iron Kit

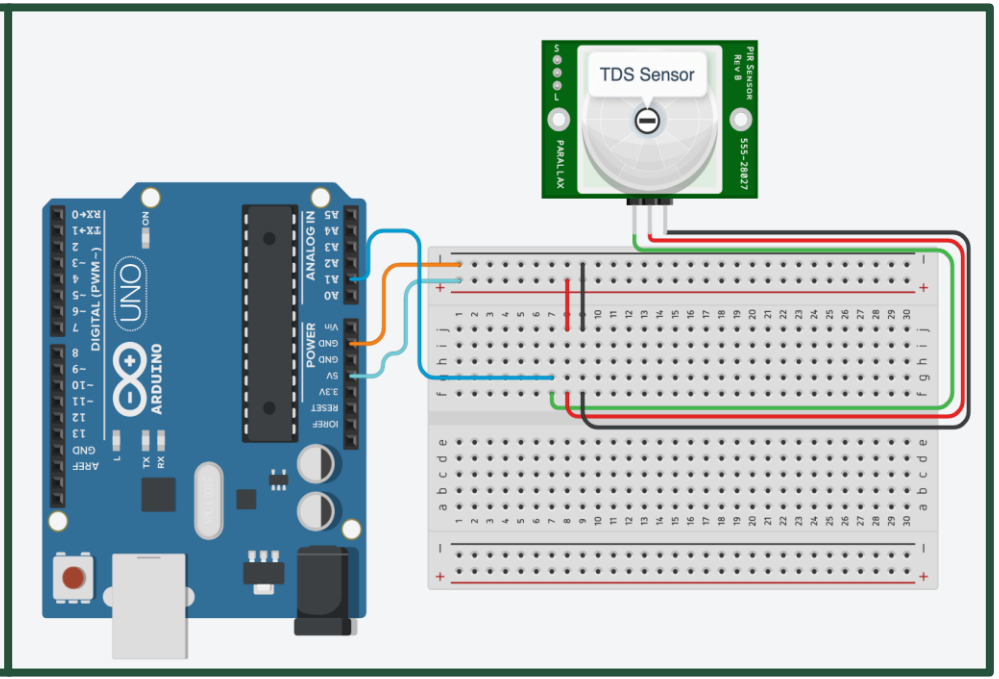
Circuit Diagram



Circuit Diagram Breakdown

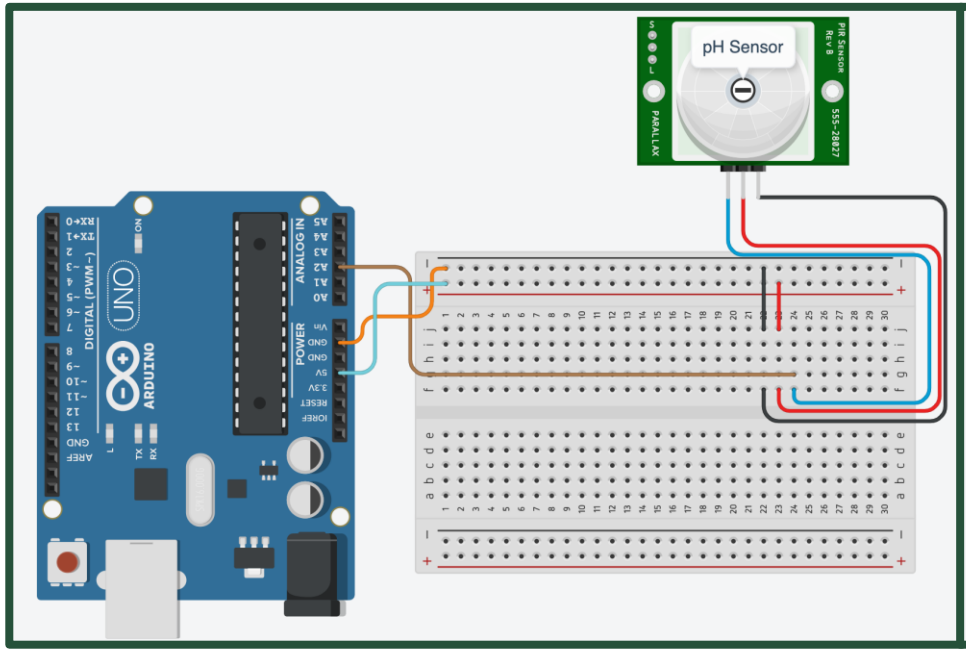


Temperature Sensor Circuit

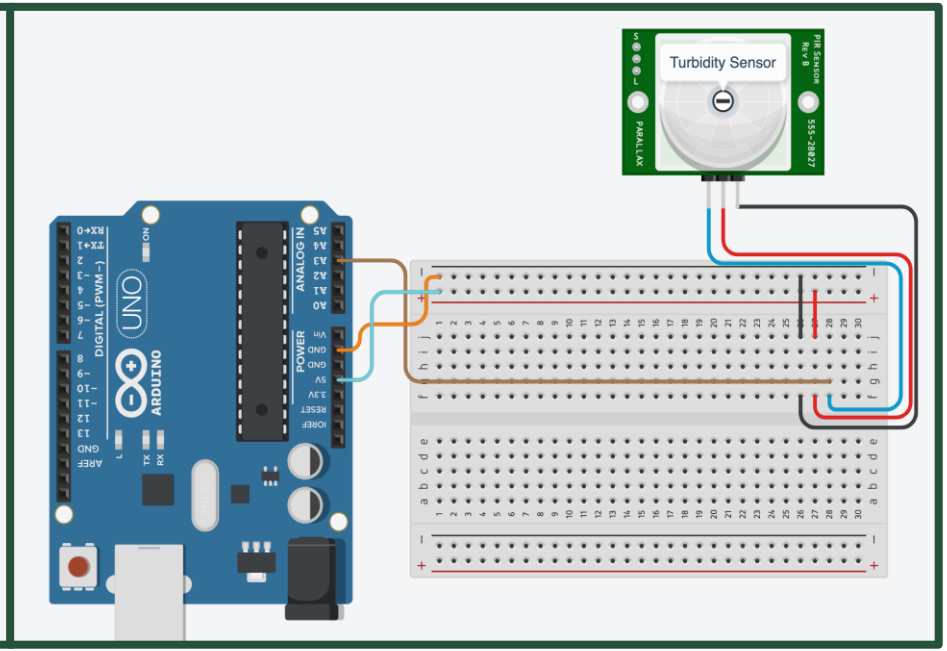


TDS Sensor Circuit

Circuit Diagram Breakdown (cont.)

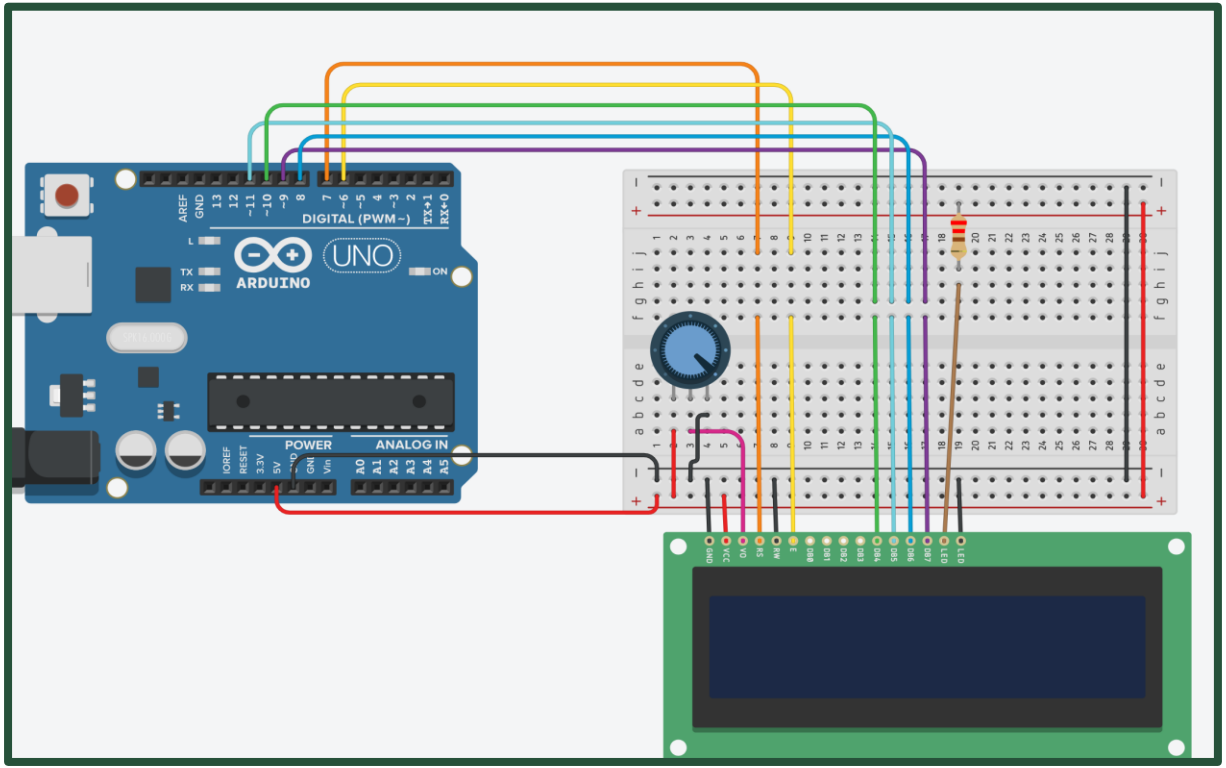


pH Sensor Circuit



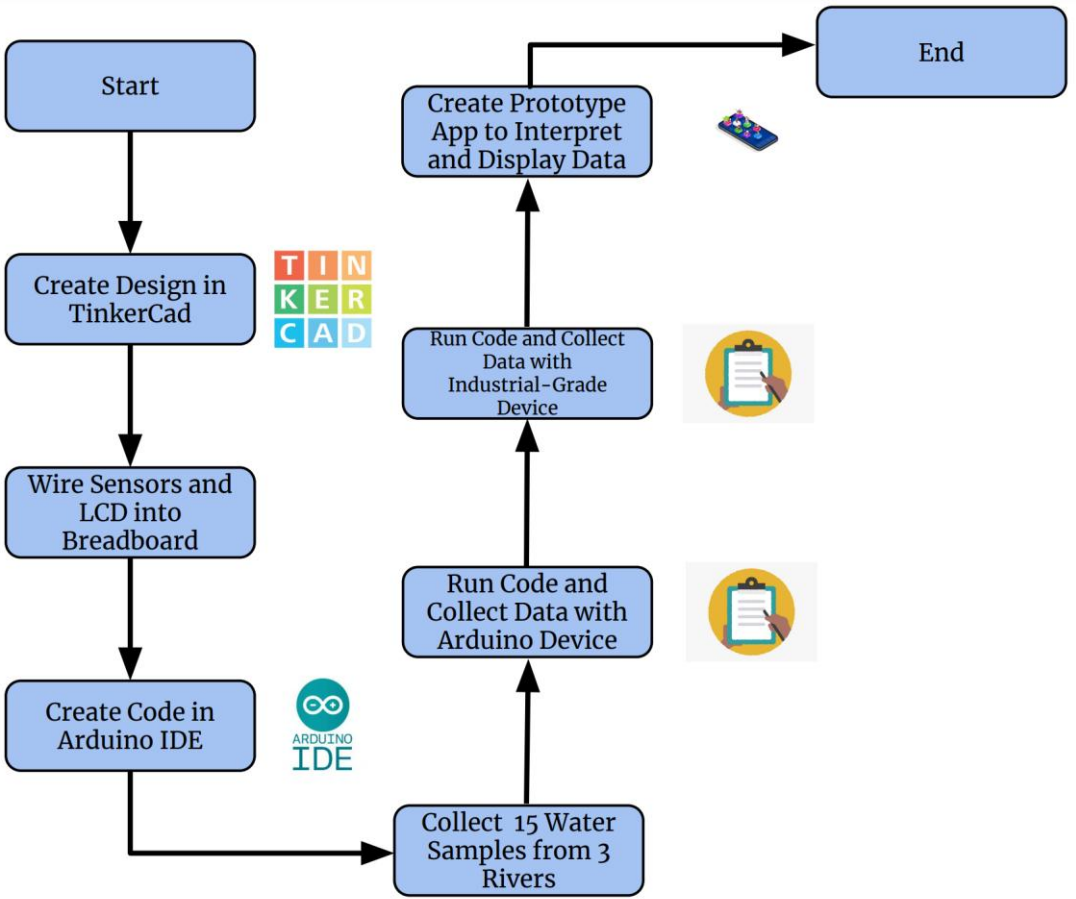
Turbidity Sensor Circuit

Circuit Diagram Breakdown (cont.)

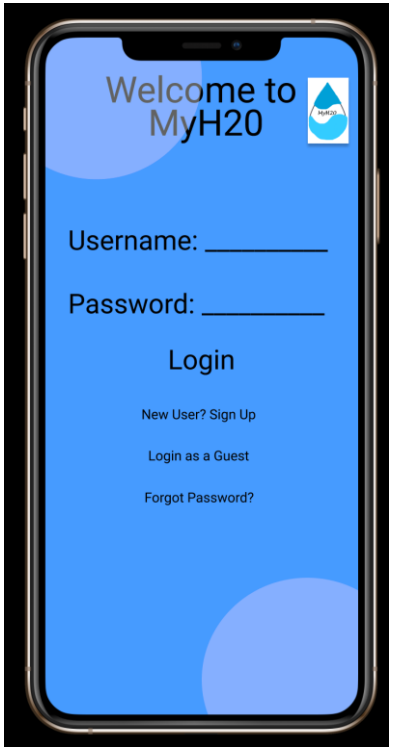


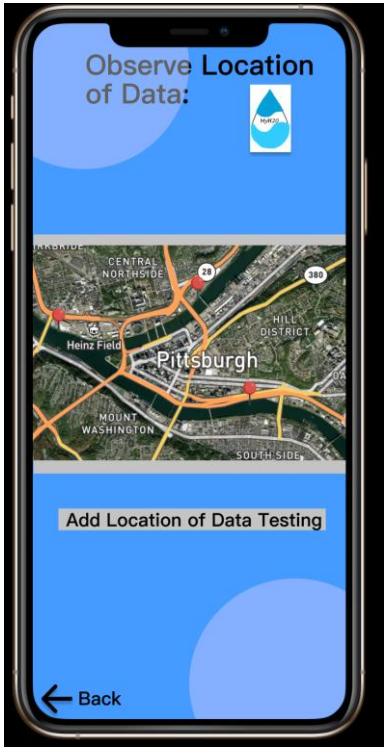
LCD Display and Potentiometer Circuit

Procedure

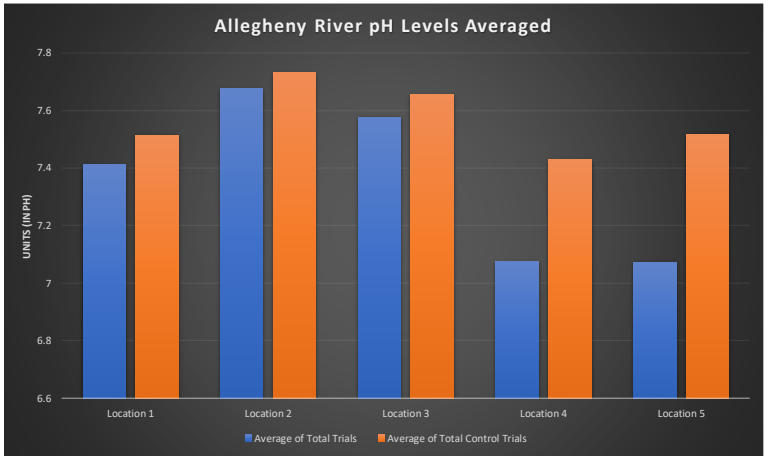

Start
Create Design in TinkerCad
Wire Sensors and LCD into Breadboard
Create Code in Arduino IDE
Collect 15 Water Samples from 3 Rivers
Run Code and Collect Data with Arduino Device
Run Code and Collect Data with Industrial-Grade Device
Create Prototype App to Interpret and Display Data
End

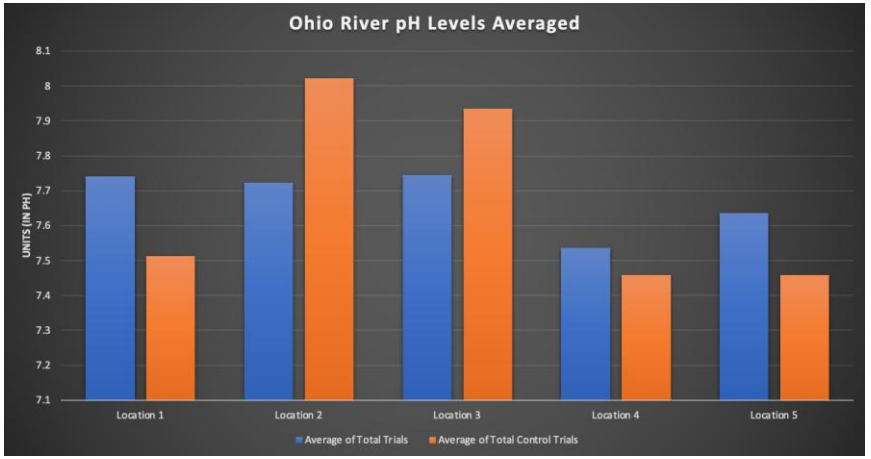
Results (1 Instance)

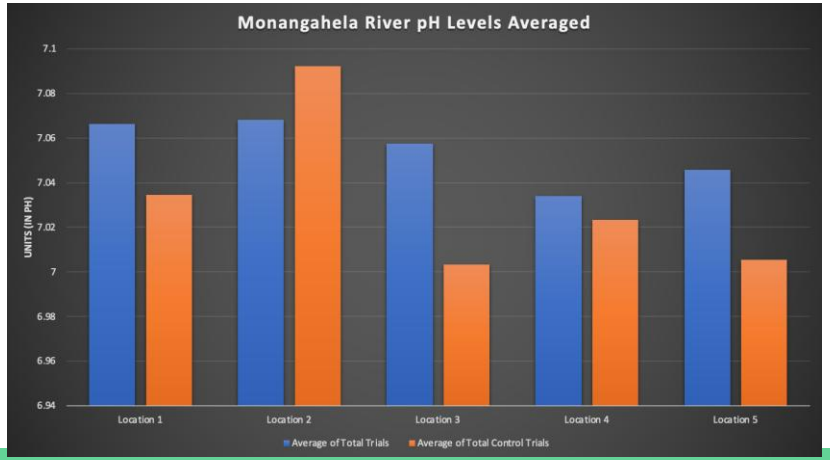




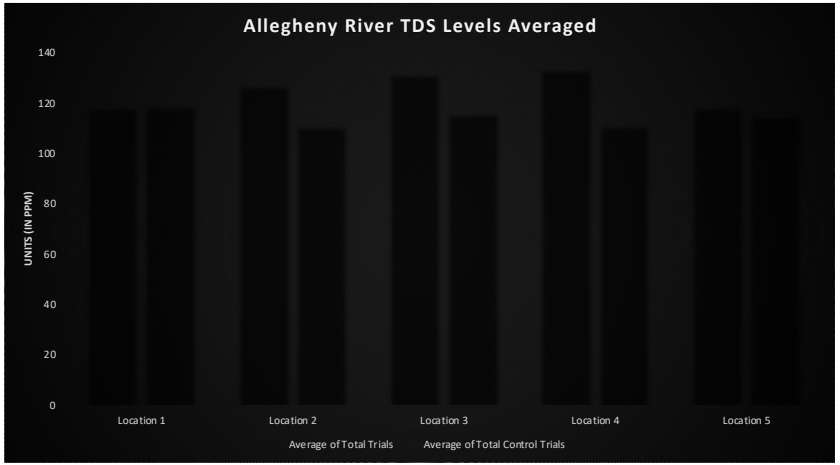
Results for pH Levels

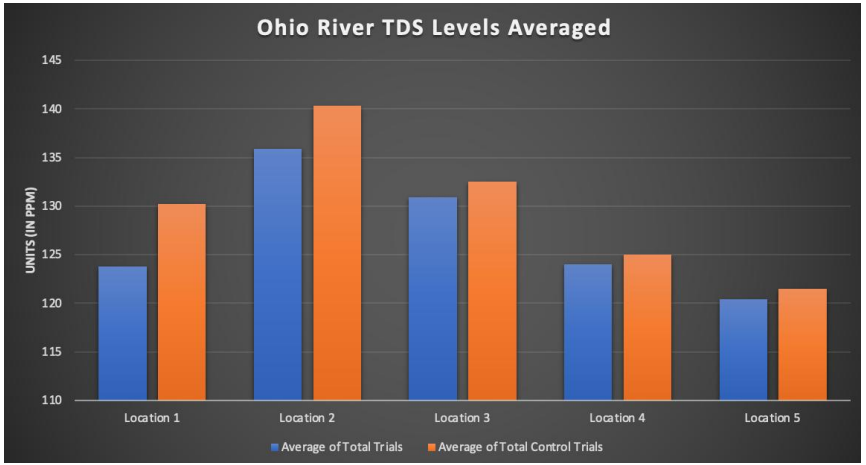


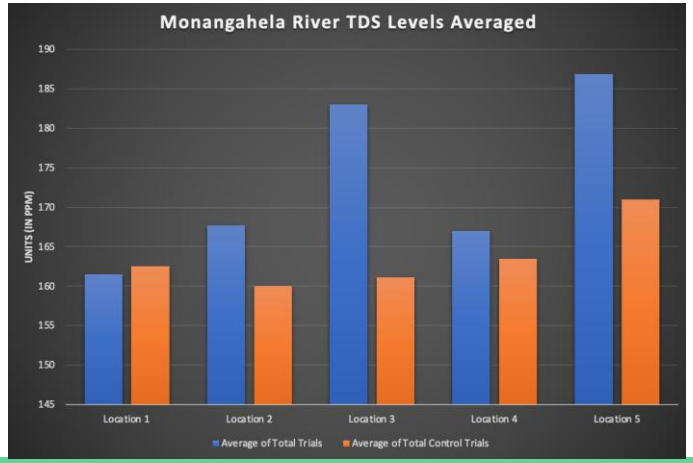




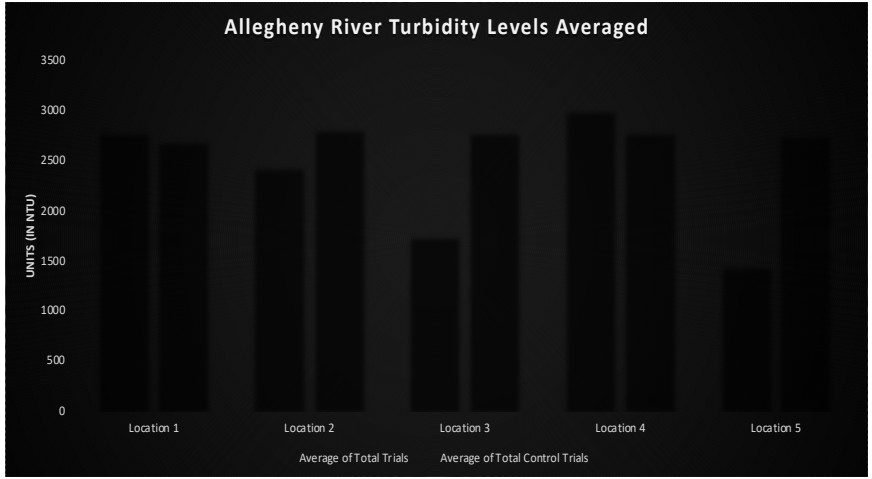
Results for TDS Levels

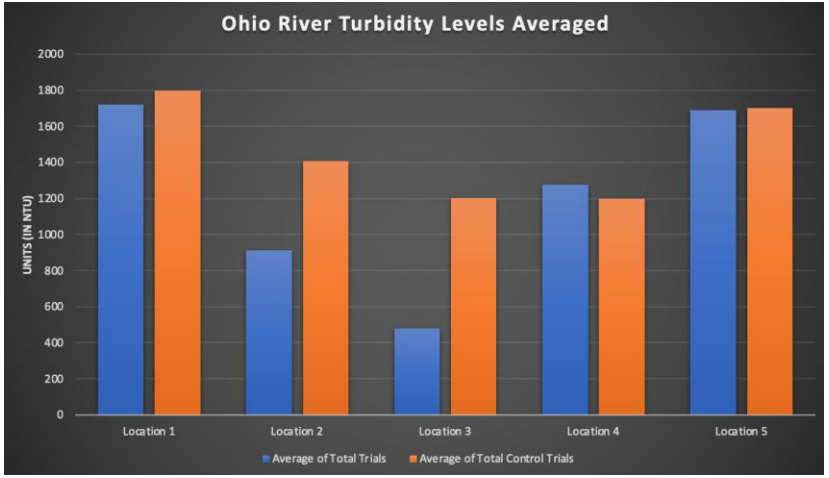


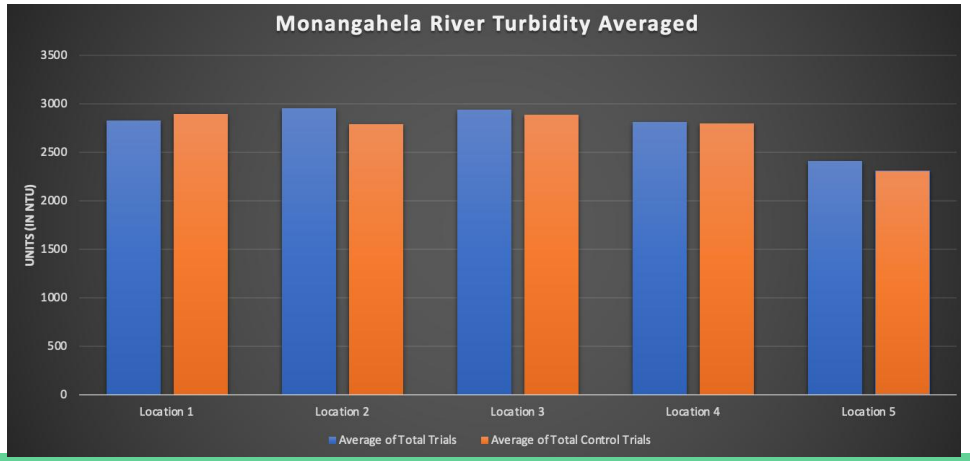




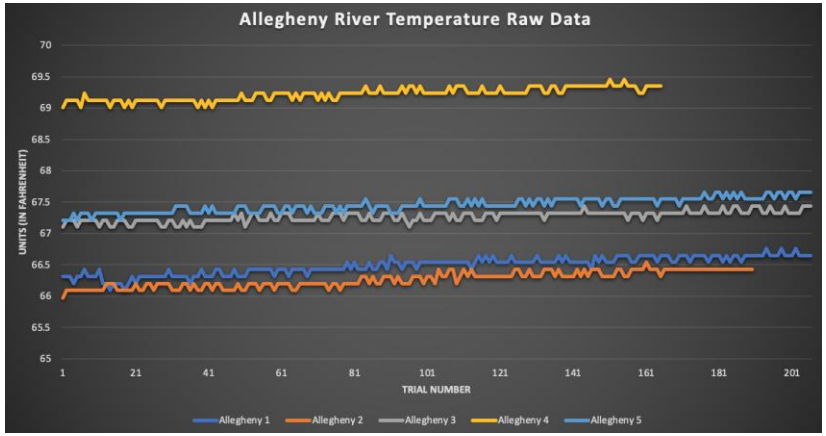
Results for Turbidity Levels

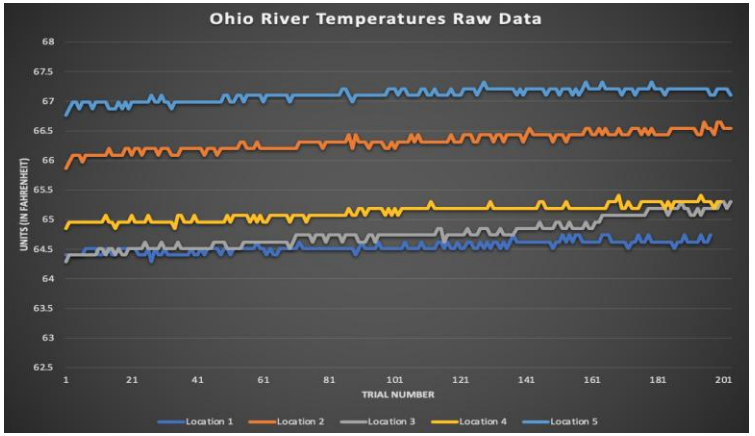


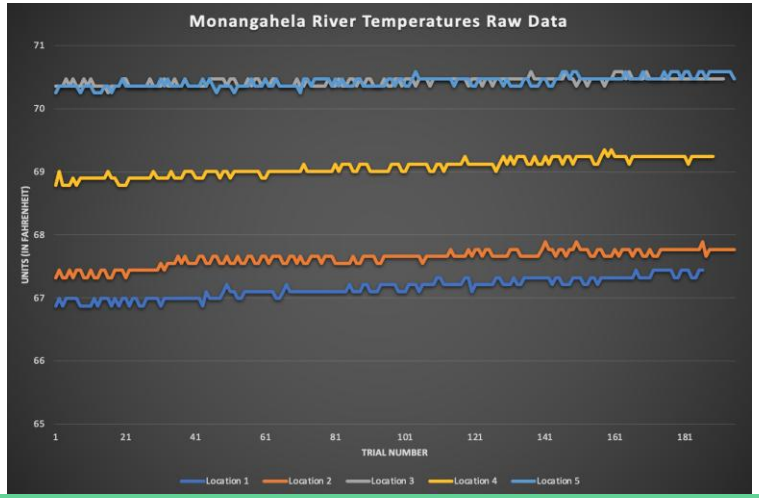




Results for Temperature Levels







Conclusion

- The Arduino device collected water quality data efficiently and was easy to use
- The website created with Figma displayed the data neatly and was easy to read and use

Limitations

- Device needed to be plugged into the computer to run
- Sensors needed to be calibrated once in a while
- Device is not very portable
- Code needed to be compiled and uploaded if device is not plugged into computer

Extensions

- Make device wireless
- Use a Bluetooth module to be able to immediately send data from the device to website
- Make the device more portable by using a smaller microcontroller (Arduino Nano, Arduino Micro)
- Include more parameters for water quality testing (Dissolved oxygen, electrical conductivity)
- Use an I^2C Module for the LCD to decrease the amount of wires

Acknowledgements

My mom for her support!

Rationale

- Water quality is an area that impacts everyone on this planet
- Arduino can be used for projects like collecting and storing data
- Figma is a site that can create wireframes, which can act as websites or apps
- How I use Arduino to create a device to collect and store water quality data and create a website using Figma to interpret this data in a user-friendly way

Procedure

- Device was sketched out in TinkerCad for planning
- Header pins were soldered onto LCD to fit into breadboard
- Temperature (with 4.7k ohm resistor), TDS, pH, and Turbidity sensors were wired into Arduino and breadboard
- LCD(with 220 ohm resistor) and bluetooth module were wired into breadboard and Arduino
- Code was written in Arduino IDE
- 5 samples from different spots were taken from each of five rivers and creeks, and data was recorded
- User-friendly mock-interface was made to show and interpret data

Hypothesis

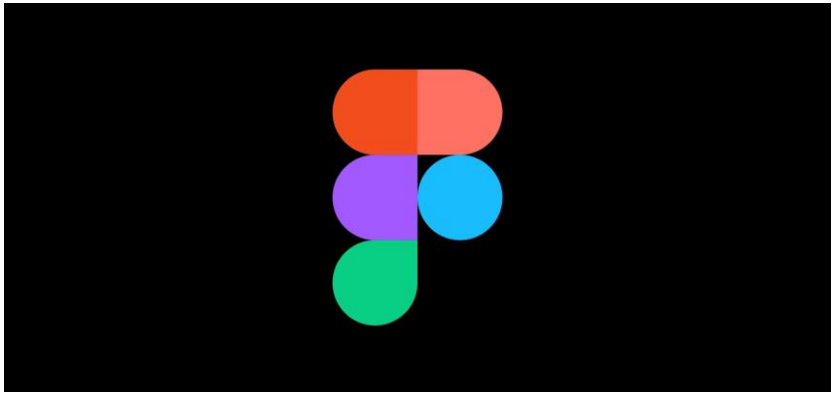
- Null Hypothesis: The Arduino-based device is not accurate and the app created using Figma does not display the data in a user-friendly way

- Alternative Hypothesis: The Arduino-based device is accurate and the app created using Figma displays the data in a user-friendly way

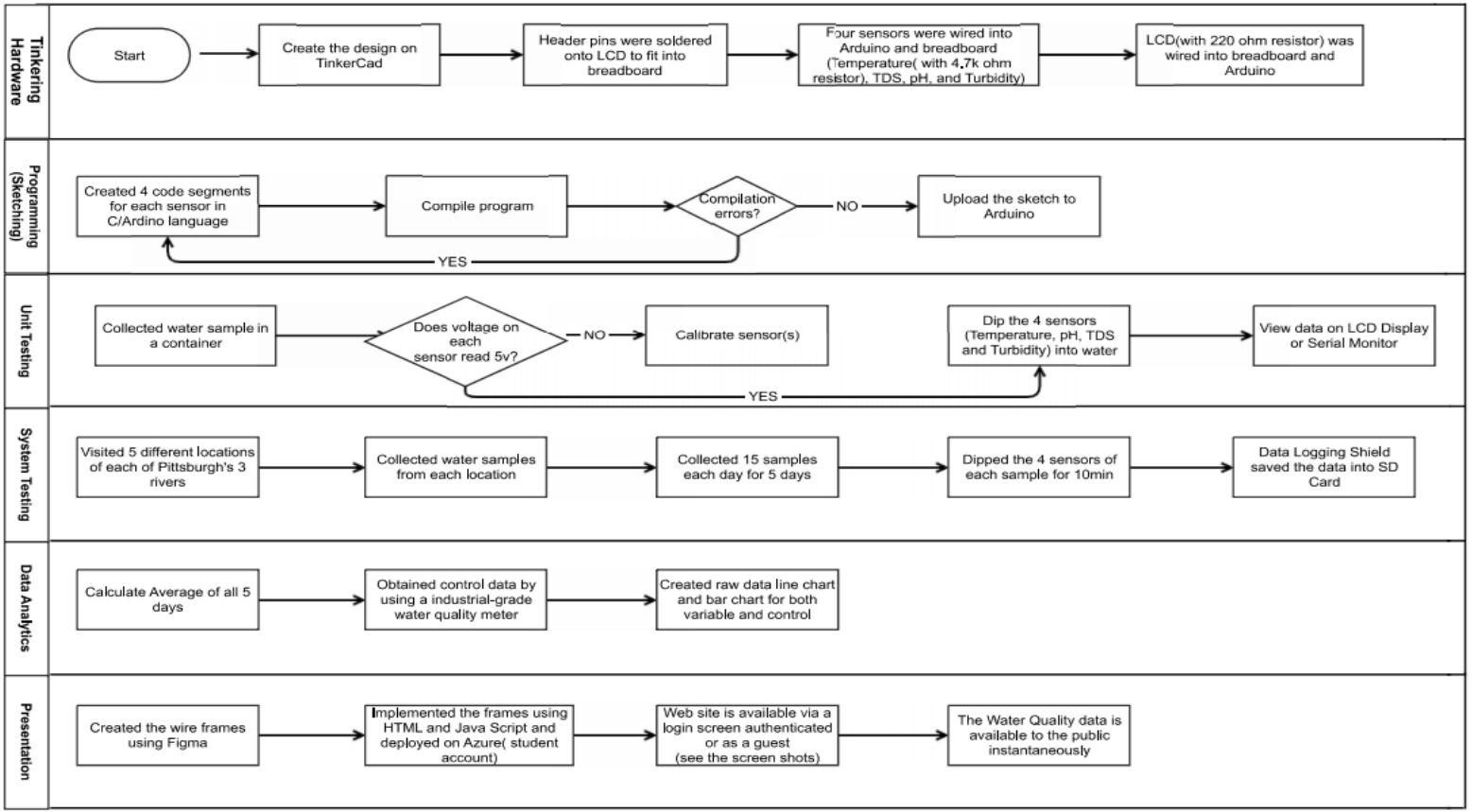
Background (cont.)

Figma:

- Figma is a web-based prototyping tool that allows users to create any graphics that they desire
- Figma has the ability to create representations of apps and websites using wireframes



Procedure to build the Water Quality Monitoring device and send the measurements to a website/app



Component Diagram