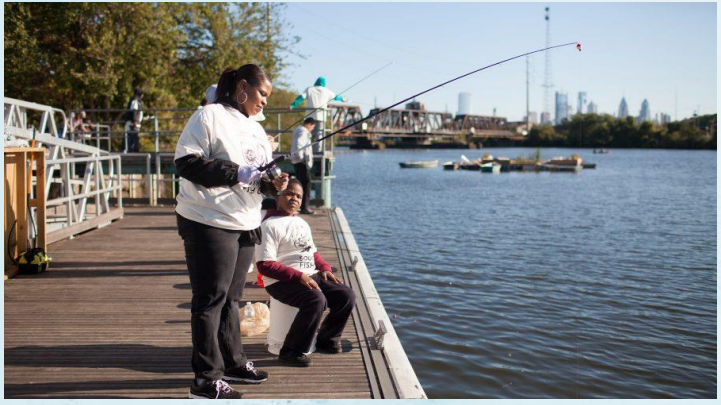
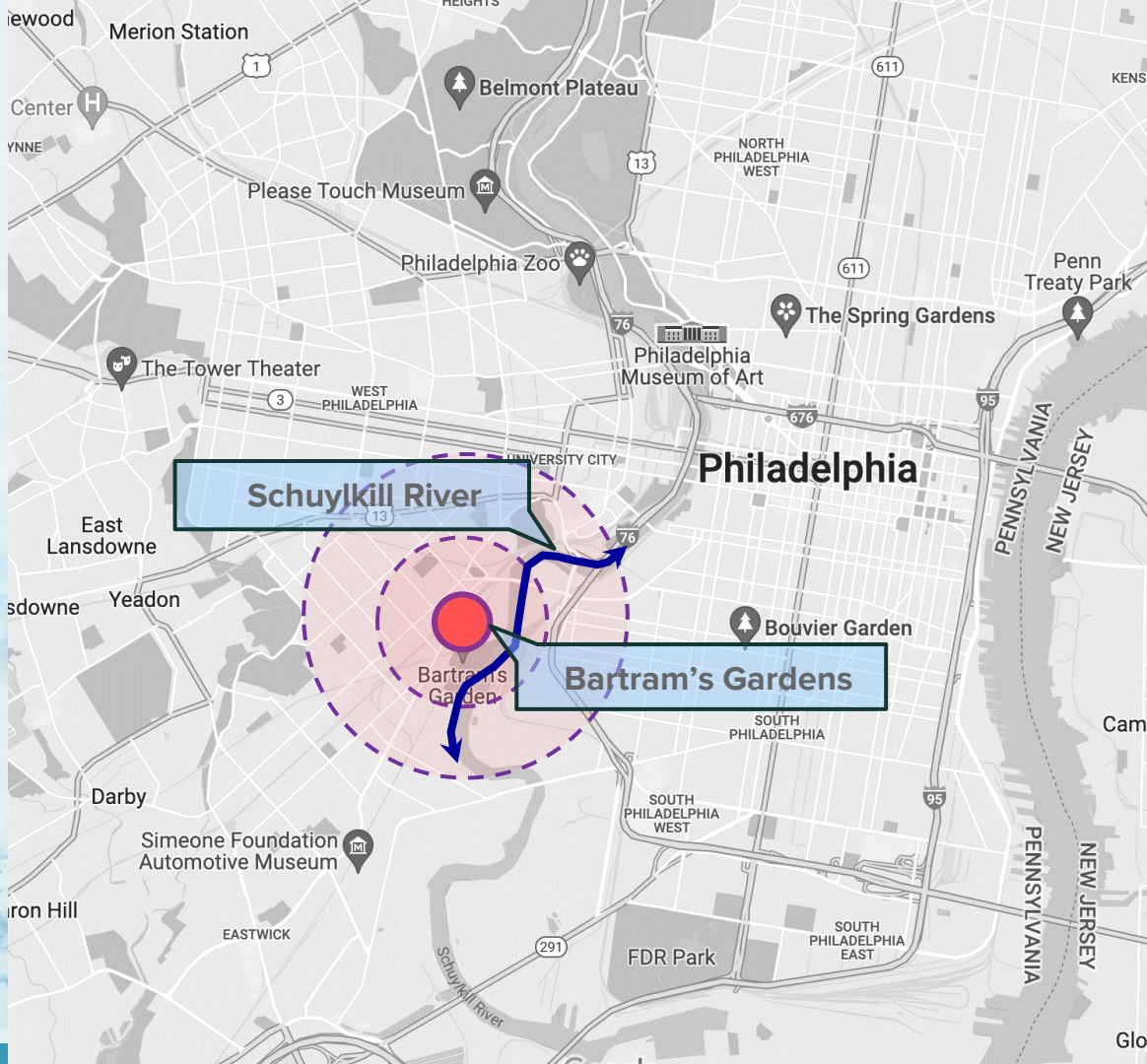
Schuylkill Sensor

Saffron Livaccari, Jie Wang
Jiali Yao, Yebei Yao

The Problem




Merion Station
Belmont Plateau
Center
Please Touch Museum
NORTH PHILADELPHIA WEST
Philadelphia Zoo
Penn Treaty Park
The Spring Gardens
Philadelphia Museum of Art
The Tower Theater
WEST PHILADELPHIA
UNIVERSITY CITY
Philadelphia
Schuylkill River
East Lansdowne
Yeadon
Bouvier Garden
Bartram's Garden
Bartram's Gardens
SOUTH PHILADELPHIA
Darby
SOUTH PHILADELPHIA WEST
Simeone Foundation Automotive Museum
EASTWICK
FDR Park
SOUTH PHILADELPHIA EAST
PENNSYLVANIA
NEW JERSEY

Our solution

- **Location:**

Bartram's Garden & its surrounding districts

- **Inputs(Data collection and storage):**

Multiple Arduino sets– Server –FireBase

- **Sensors:**

Rainfall intensity, temperature, turbidity,PH

- **Evaluation and classify:**

Threshold - from common sense, standards in Pennsylvania or other states.

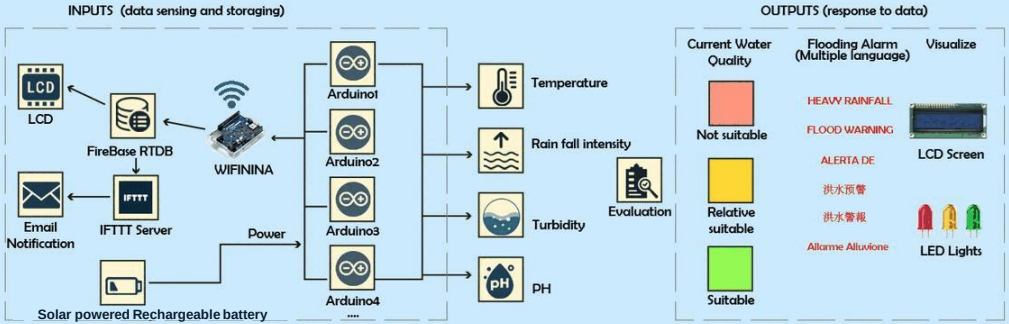
- **Threshold**

Safe Values

PH: 6.5 – 8.5

Turbidity: 50 NTUs

Rainfall Intensity: > 0.3 in/hour is heavy rainfall



Prototypes

- **Garden/Park**

  - Interactive screen board
  - Flooding alarm animation

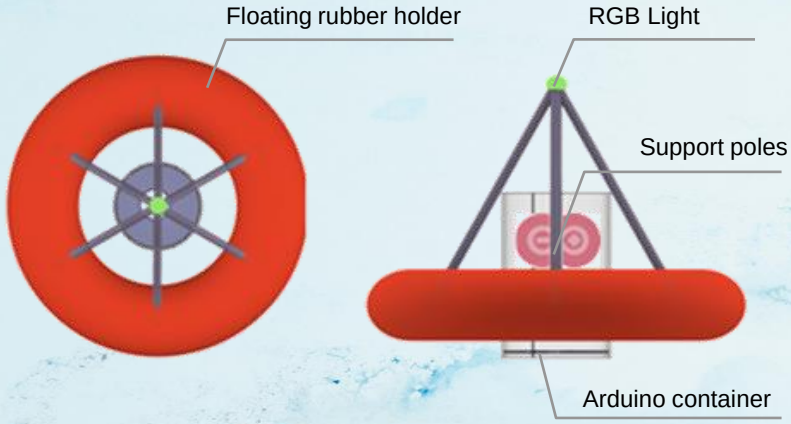
- **Linear Trail**

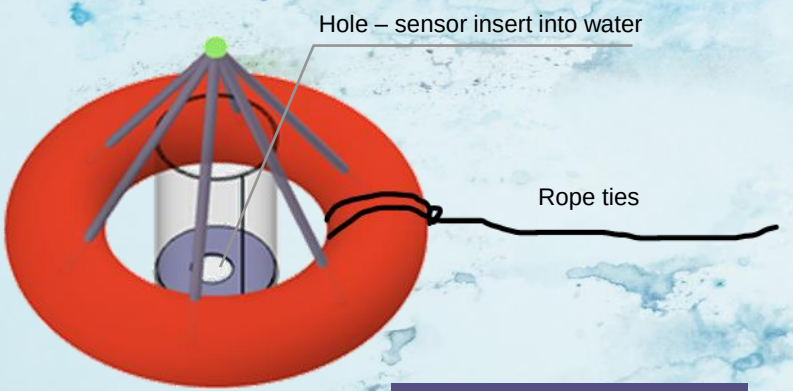
  - Realtime vapor reflect to turbidity
  - Dynamic fluorescent light

- **Bridge/Crossing**

  - Water-light graffiti board

Sensor Status



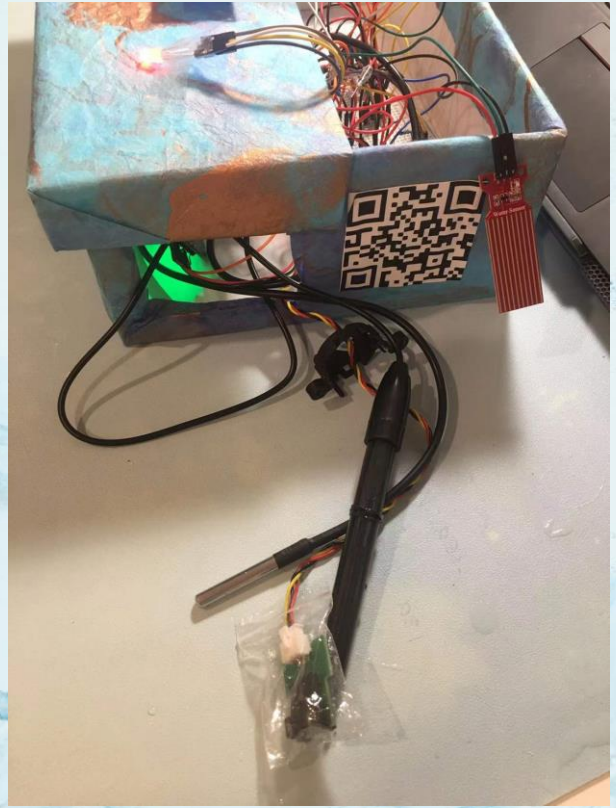


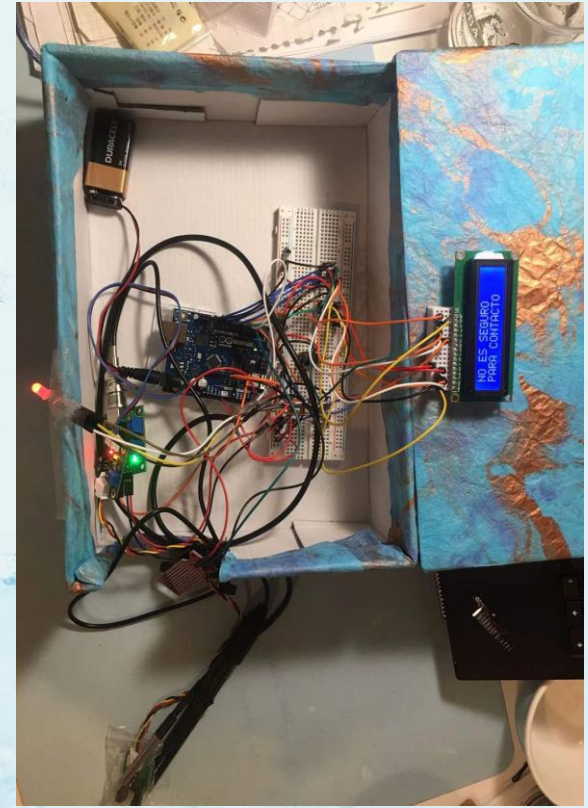
Arduino Sensor Kit

Images of our Project

Prototype:
Sense water quality under multiple environments.

Email content:
Send email about flood warning to whomever signs up for the notifications





Safety Evaluation Scoring System

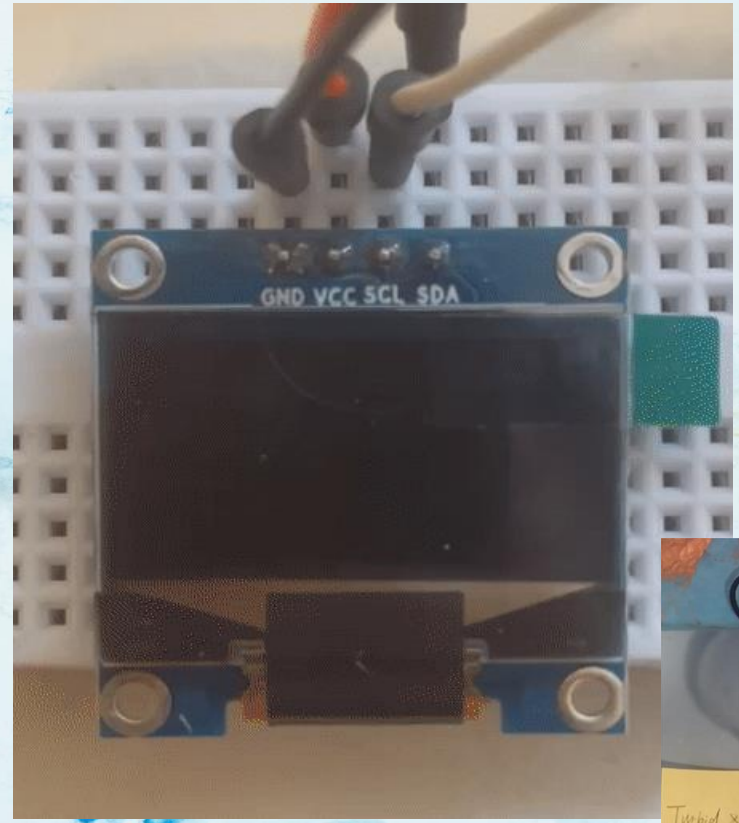
INPUT		OUTPUT	
PH	Turbidity	Safety Score	Meaning
PH <= 6.5 OR PH >= 8.5	> 50 NTUs	2	Not safe any for contact
PH <= 6.5 OR PH >= 8.5	<= 50 NTUs	1	Safe for Indirect contact
6.5 <= PH <= 8.5	> 50 NTUs		
6.5 <= PH <= 8.5	<= 50 NTUs	0	Safe for Direct contact

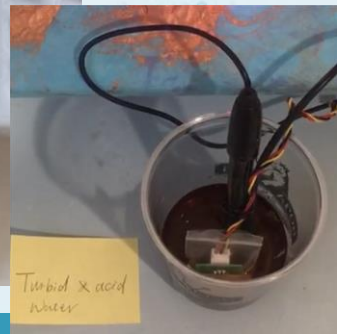
Function that determines the safety of the water

```
void safety_LCD(int value) {
  display.invertDisplay(false); // set up display to be black
  display.setTextSize(2);
  display.setTextColor(WHITE);

  if (value == 2) {
                    i=0;
                    while (i<2) {
                    display.clearDisplay();
                    display.drawBitmap(0, 20, no_fishing, 128, 40,
WHITE);
                    display.display();
                    delay(1000);
                    display.clearDisplay();
                    display.drawBitmap(0, 20, no_swim, 128, 40,
WHITE);
                    display.display();
                    delay(1000);
                    display.clearDisplay();
                    display.drawBitmap(0, 20, no_boat, 128, 40, WHITE);
                    display.display();
                    delay(1000);
                    i++;
                    }
                    i=0;
                    while (i<8) {
                    display.invertDisplay(false);
                    display.clearDisplay();
                    display.drawBitmap(0, 20, do_not_enter, 128, 40,
WHITE);
                    display.display();
                    delay(400);
                    display.invertDisplay(true);
                    display.clearDisplay();
                    display.drawBitmap(0, 20, do_not_enter, 128, 40,
WHITE);
                    display.display();
```

If the water is not safe, the screen displays:





Function that determines the safety of the water

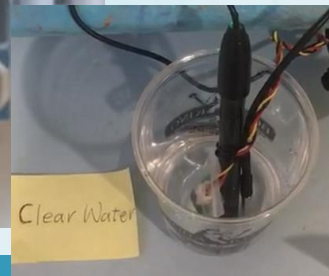
```
else if (value == 1) {
                    i=0;
                    while (i<2) {
                    display.clearDisplay();
                    display.drawBitmap(-30, 20, fishing, 128,
40, WHITE);
                    display.drawBitmap(40, 20, good, 128, 40,
WHITE);
                    display.display();
                    delay(1000);
                    display.clearDisplay();
                    display.drawBitmap(-30, 20, boat, 128, 40,
WHITE);
                    display.drawBitmap(40, 20, good, 128, 40,
WHITE);
                    display.display();
                    delay(1000);
                    display.clearDisplay();
                    display.drawBitmap(0, 20, no_swim, 128,
40, WHITE);
                    display.display();
                    delay(2000);
                    i++;
                    }
  }
```

If the water is only safe for secondary contact:

Function that determines the safety of the water

```
else if (value == 0) {
                    i = 0;
                    while (i<2) {
                    display.clearDisplay();
                    display.drawBitmap(-30, 20, fishing, 128, 40,
WHITE);
                    display.drawBitmap(40, 20, good, 128, 40, WHITE);
                    display.display();
                    delay(1000);
                    display.clearDisplay();
                    display.drawBitmap(-30, 20, boat, 128, 40, WHITE);
                    display.drawBitmap(40, 20, good, 128, 40, WHITE);
                    display.display();
                    delay(1000);
                    display.clearDisplay();
                    display.drawBitmap(-30, 20, swim, 128, 40,
WHITE);
                    display.drawBitmap(40, 20, good, 128, 40, WHITE);
                    display.display();
                    delay(1000);
                    i++; }
                    display.clearDisplay();
                    display.setCursor(37,20);
                    display.println("ENJOY!");
                    display.display();
                    delay(1000);
                    display.clearDisplay();
                    display.drawBitmap(0, 20, sun, 128, 40, WHITE);
                    display.display();
```

If the water is safe for fishing, boating, and swimming:



If it rains heavily

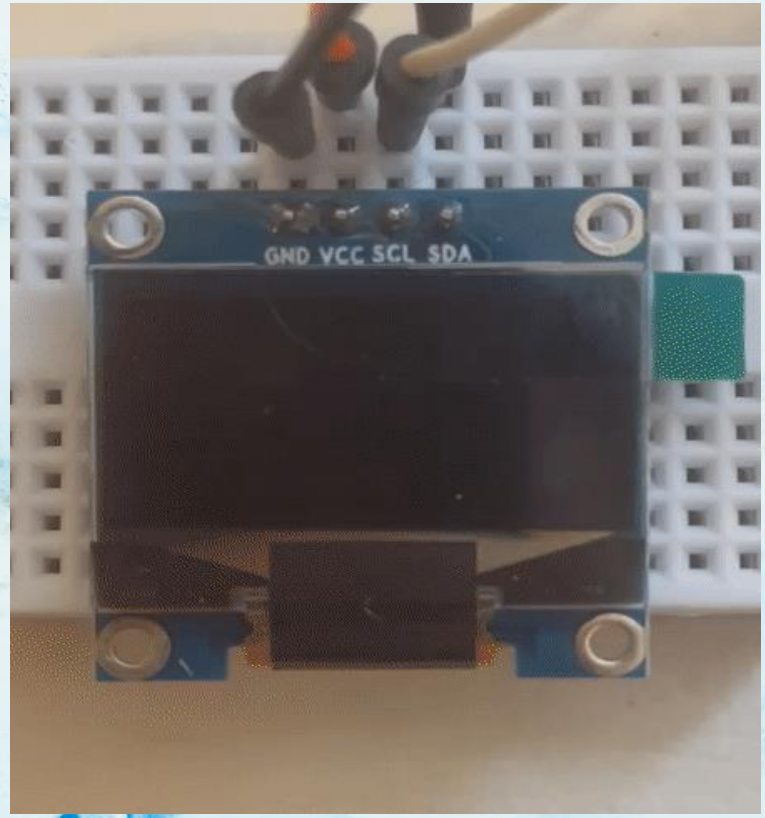
It is raining heavily, then the alarm will be on the screen constantly for **24 hours:**

```
// if water level hits >= fullySubmerged, get the time and
// calculate speed
  if (level >= one_half_Inches){ // fullySubmerged reading
                                  //is roughly 1.5 inches

    intensity = intensity_converted(timer0_millis);
    Serial.print("Intensity (in/millis): ");
    Serial.println(intensity);

    if (intensity >= heavyRain){ // if the rainfall speed is
                                 // greater than .3 in/hour
      int i = 0;
      while (i<13500) { // if this function loops 13,500 times,
                        // it will last a full day
        Flood_Warning()
        i++;}
      }

    else { // If it isnt heavy rainfall
      noInterrupts ();
      timer0_millis = 0; // reset timer back to 0
      interrupts ();
      // If there is no heavy rainfall, just print out normal
          // readings on the OLED Screen
      PrintLED(ph_act, ntu, temp, safety_value);
```



Persona

A Hispanic father

Dan 42 Manager in a restaurant

Characteristic

Enjoy family time | *Concern fish safety* | *Going Fishing* | *Familiar with Spanish*

Learn about how water quality influence the edible safety of fish from River.
Learns that water quality differs everyday.

> *"The alarming project makes me concern about water quality wherever I am."*

Benefits/ Discorage

Screen display Spanish brings him a sense of home.
Get to know water quality and monitor fish safety.
Introduce water safety to his child.

An aged Retired Chinese

Grandpa Jason 68 Retired, used to be a lawyer

Characteristic

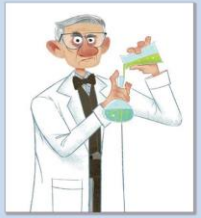
Wander | *Kayake* | *Worse hearing* | *Action slow*

Try Kayake like young people.
Less accessible to internet, mobile phone, with no e-mail.

> *"The display on the screen is useful and clear!"*

Benefits/ Discorage

Informed water quality by texts on screen and instruction lights.
More protected and know about the water quality beforehand.



Biological Professior

Bruce 65 a biology professor at Drexel

Characteristic

Doing research | *Pretty familiar with river* | *Dazes on the bank*

Already has greate success about "the river health".
Has many publications on freshwater biology.
Tends to think critically.

> *"I don't believe the result, because it is an **over-simplification** on river safety."*

Benefits/ Discorage

It can tell people to swim when it is, in fact, not good for swimming.
This project is meant for learning and sparking an interest for the people who will use the river regardless.

Family of Four

Mother	*Pamela*	*36*	*Retirement Home Server*
Father	*Alex*	*39*	*Mechanic*
Children	*John*	*10*	
	Alisa	*6*	

Characteristic

Picnic | *Enjoy weekend* | *Happy education* | *Water-related Sports*

Have fun and get together with family.
Make chance to teach children something interesting.

> *"The magic behaind Arduino Sparks my child!"*

Benefits/ Discorage

Get to Know the River Health Condition.
Spark the Interest to Arduino.
Enjoy Kayak !!

Interactive Visualization

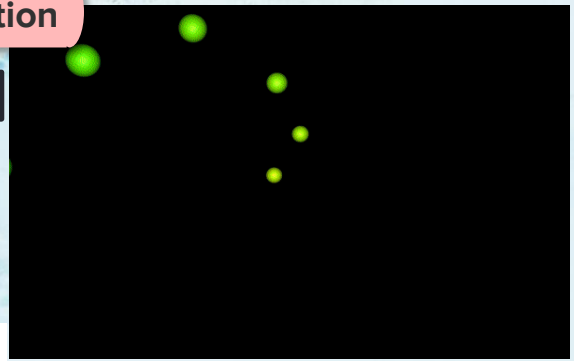
Garden/Park

Visualize the Current river status with dynamic screen Board

Dynamic scrolling Screen Board

Flooding Alarm Animation

Flooding Alarming



https://github.uconn.edu/pages/rkv14001/3D-spheres/

Interactive Visualization

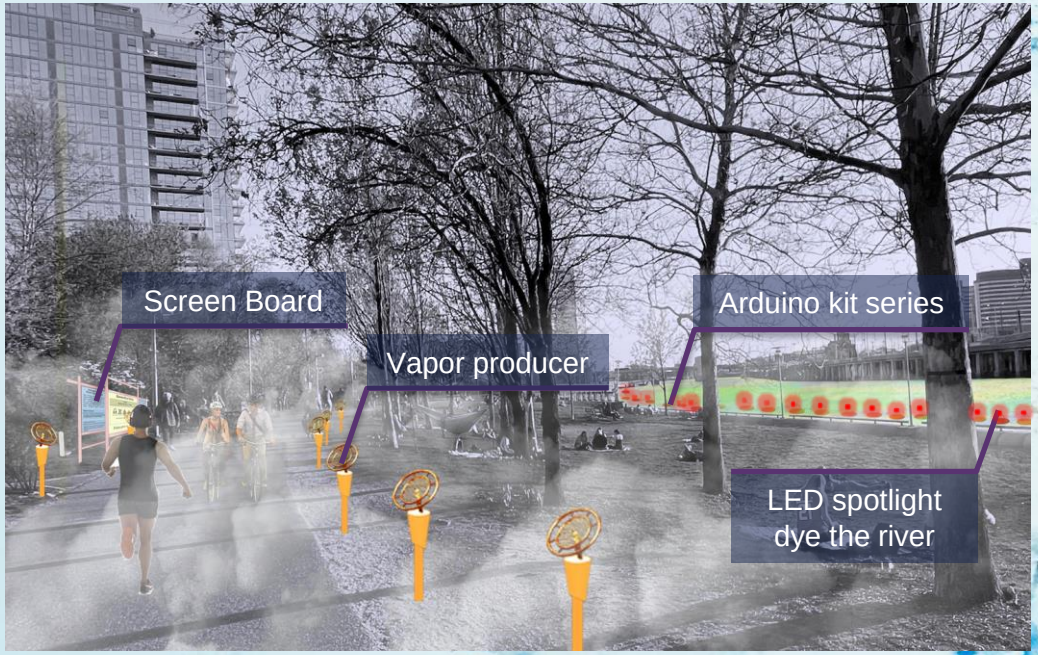
Linear Trail

Interactively visualize the water quality with fluorescent light and vapor along the trail.

Interactive Device produce vapor and connects to Arduino

Vapor reflect to temperature

LED spotlight reflect to safety metrics



Interactive Visualization

Bridge/Crossing

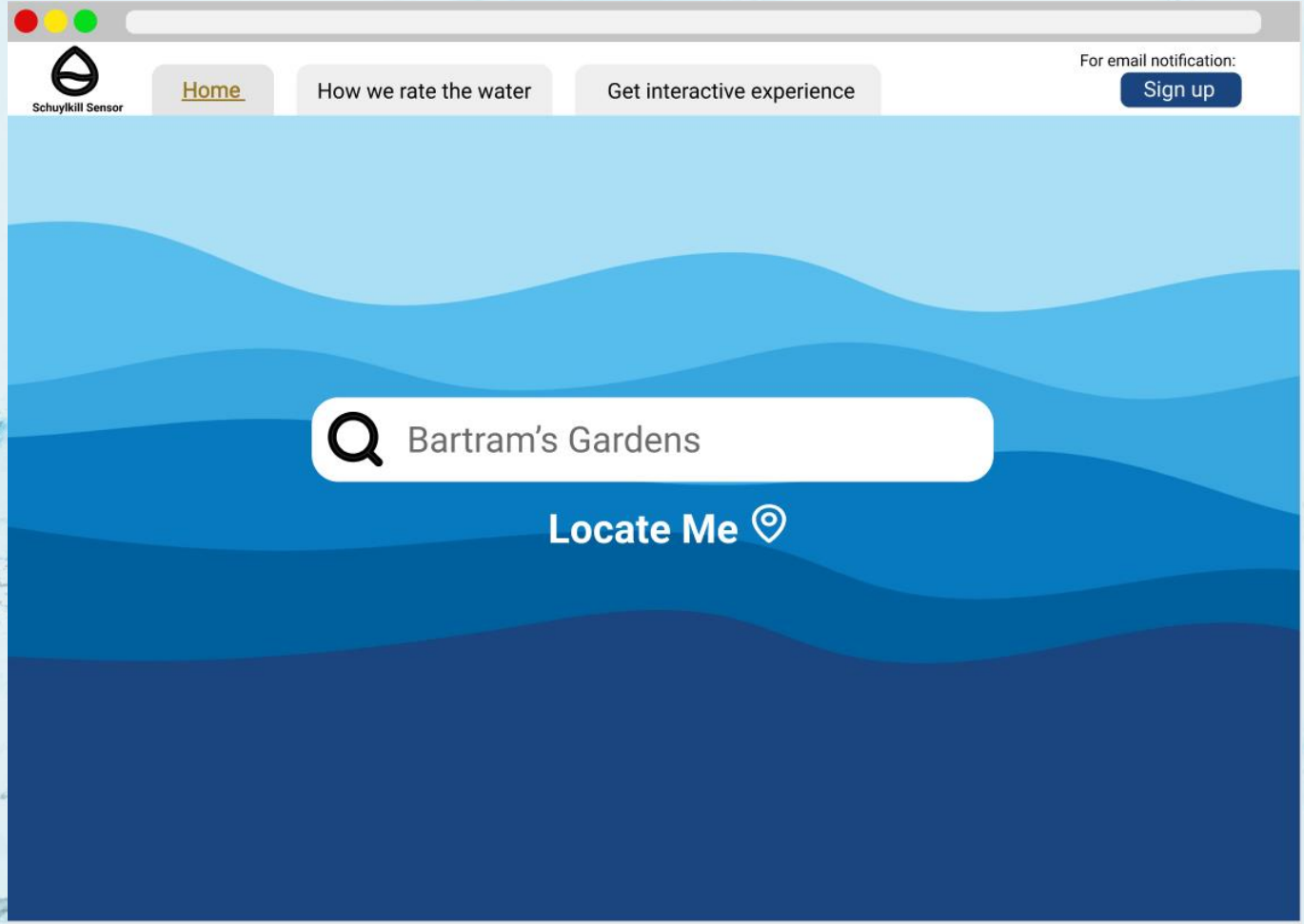
Water-Light Graffiti Board

Two Sensor kits on both end

http://www.waterlightgraffiti.com/

Website

Start sensing!

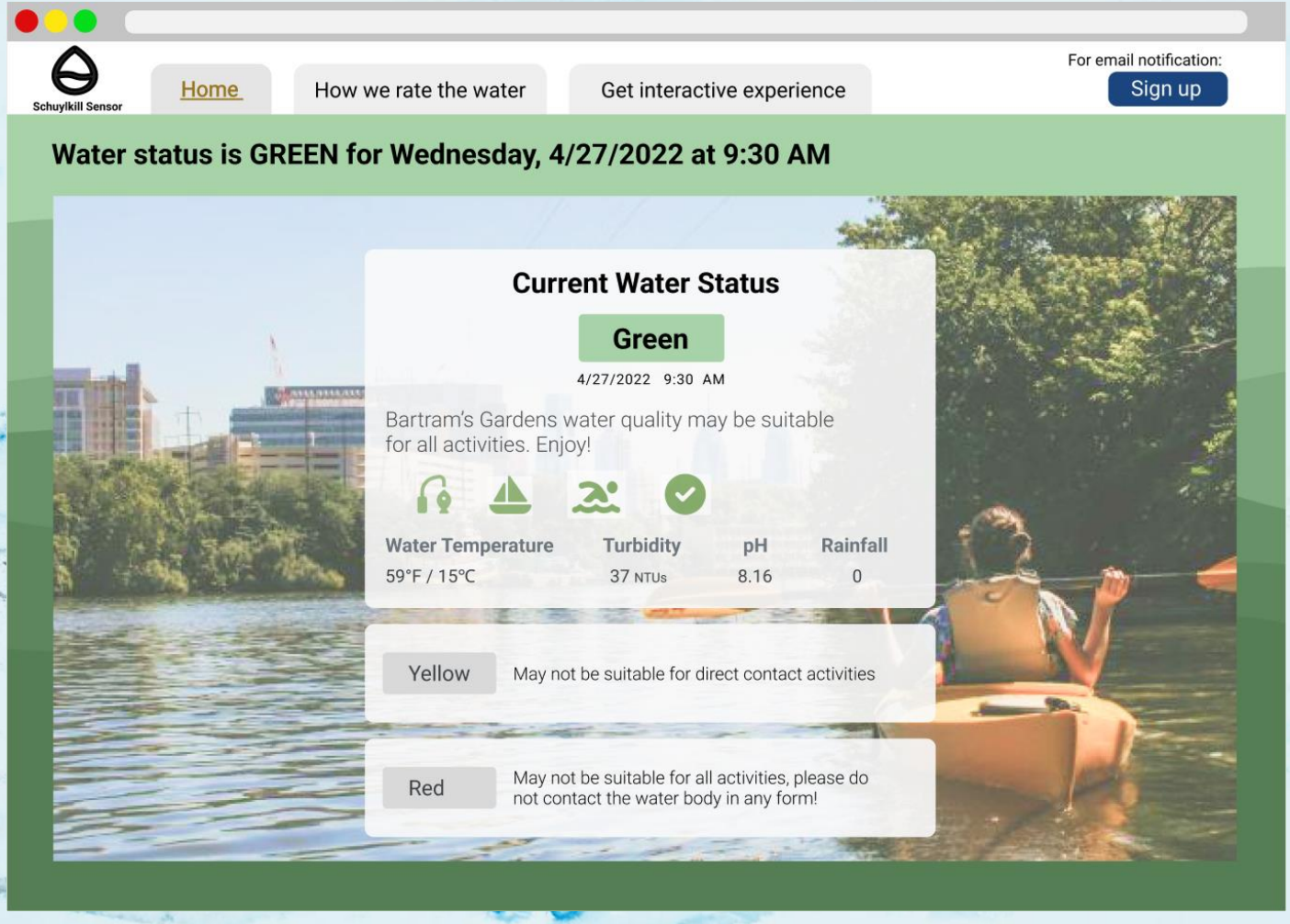


Website

The water status page displays all the information that our sensors collect along with our suggestions

Update three times a day:

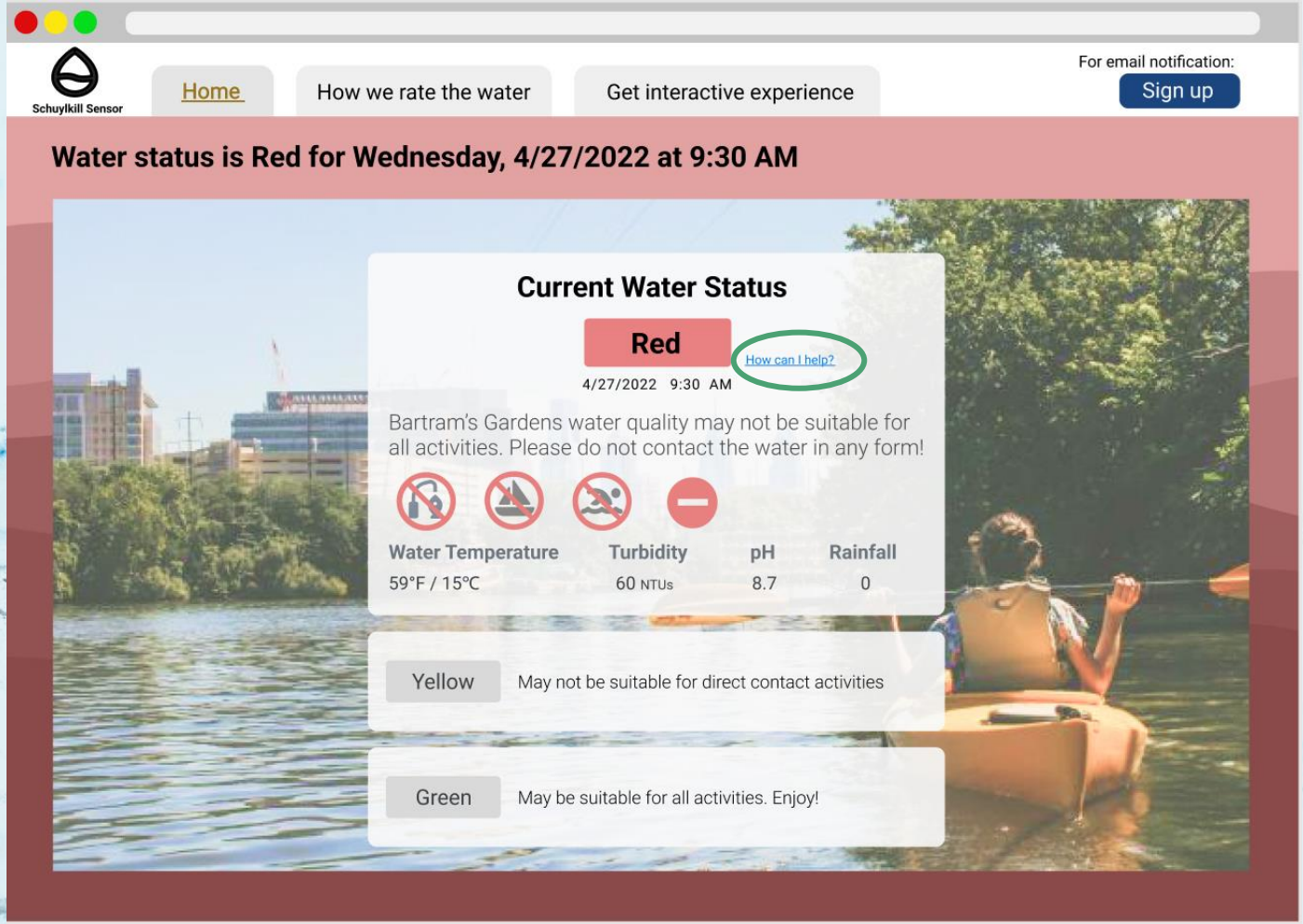
9:30 AM
2:30PM
7:30PM



Website

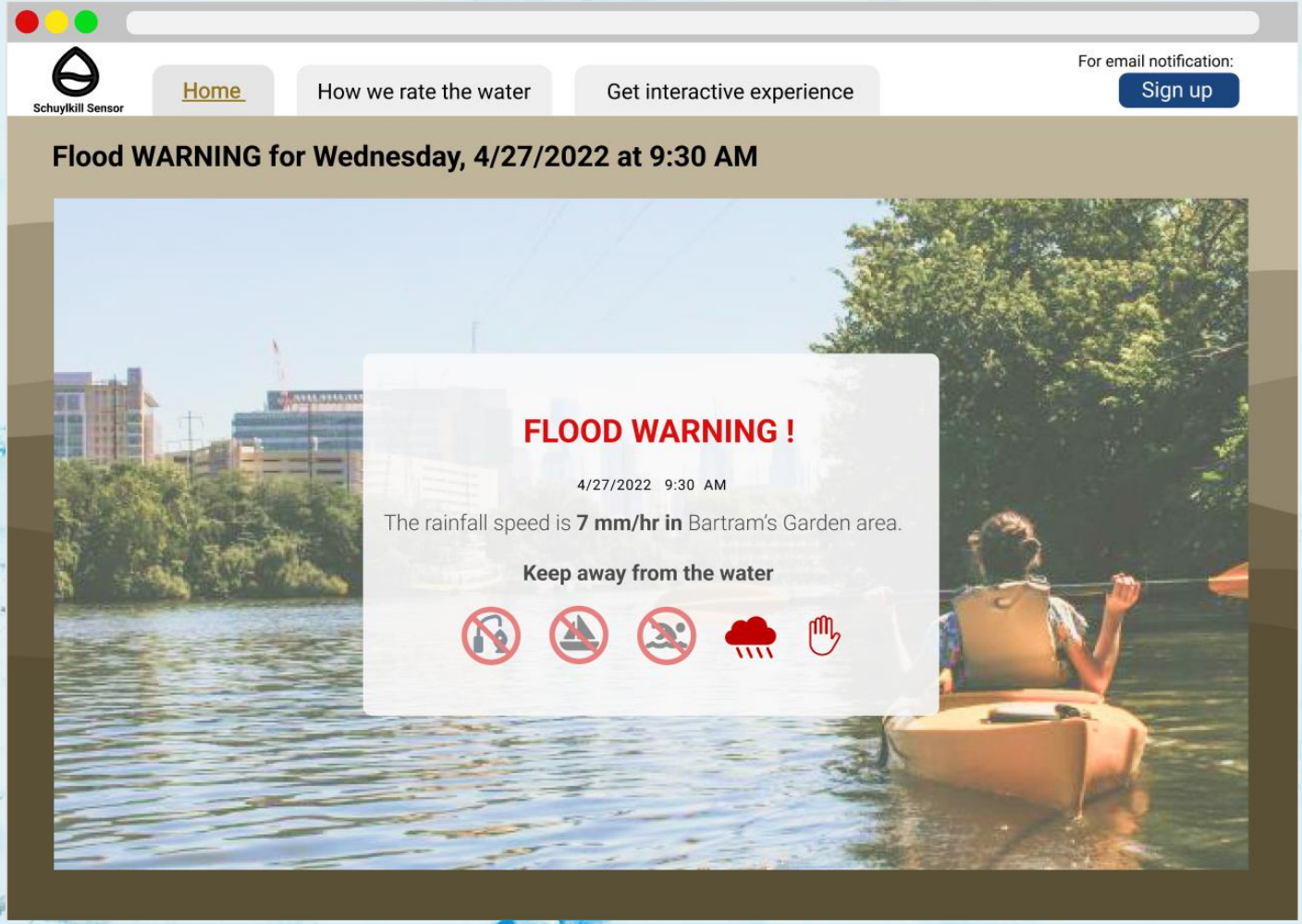
When it is red, the water quality is bad.

in addition to suggest people not to get into the water, there also is a link about water protection.



Website

Warning for the flooding risk



Website

Know the system better

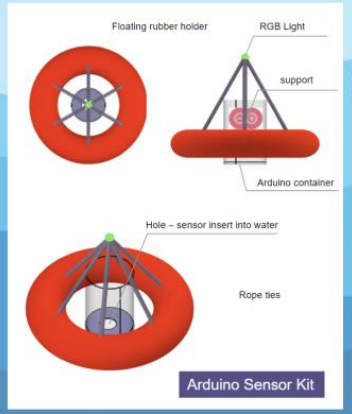
Schuylkill Sensor

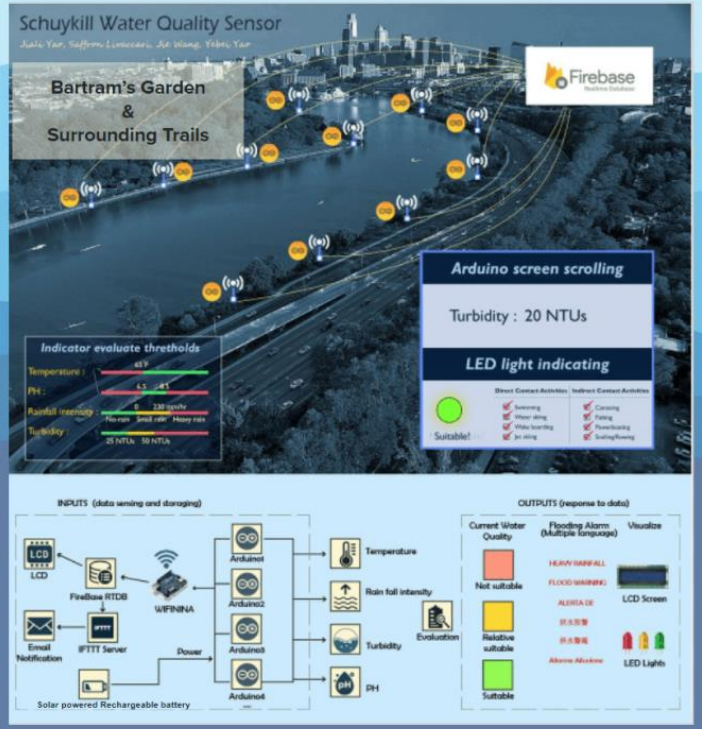
Home | How we rate the water | Get interactive experience

For email notification: Sign up

Behind the scene

We used arduino to control all sensors and classify the different situation according to our evaluation system

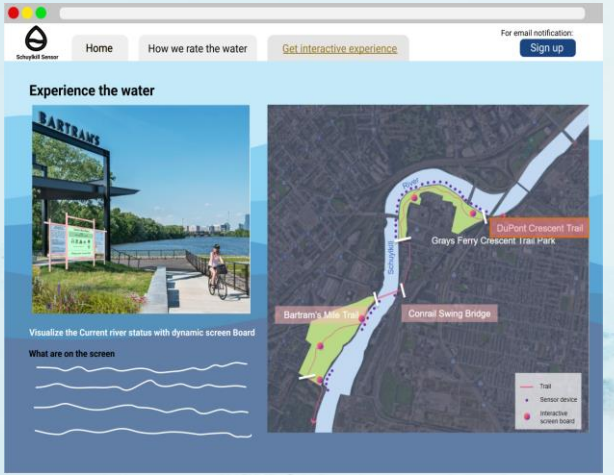


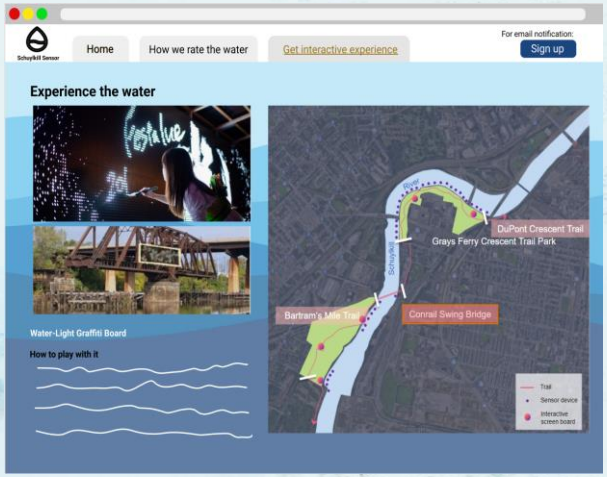


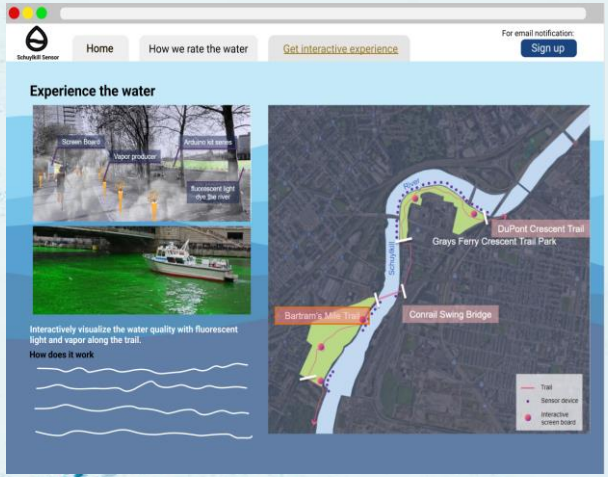
Evaluation System

INPUT		OUTPUT	
PH	Turbidity	Safety Score	Meaning
PH <= 6.5 OR PH >= 8.5	> 50 NTUs	2	Not safe any for contact
PH <= 6.5 OR PH >= 8.5	<= 50 NTUs	1	Safe for Indirect contact
6.5 <= PH <= 8.5	> 50 NTUs		
6.5 <= PH <= 8.5	<= 50 NTUs	0	Safe for Direct contact

Website


Schuylkill Sensor
Home
How we rate the water
Get interactive experience
For email notification:
Sign up
Experience the water
BARTRAM'S
Visualize the Current river status with dynamic screen Board
What are on the screen
DuPont Crescent Trail
Grays Ferry Crescent Trail Park
Schuylkill
River
Bartram's Mile Trail
Conrail Swing Bridge
Trail
Sensor device
Interactive screen board


Schuylkill Sensor
Home
How we rate the water
Get interactive experience
For email notification:
Sign up
Experience the water
Water-Light Graffiti Board
How to play with it
DuPont Crescent Trail
Grays Ferry Crescent Trail Park
Schuylkill
River
Bartram's Mile Trail
Conrail Swing Bridge
Trail
Sensor device
Interactive screen board


Schuylkill Sensor
Home
How we rate the water
Get interactive experience
For email notification:
Sign up
Experience the water
Screen Board
Vapor producer
Arduino kit series
fluorescent light dye the river
Interactively visualize the water quality with fluorescent light and vapor along the trail.
How does it work
DuPont Crescent Trail
Grays Ferry Crescent Trail Park
Schuylkill
River
Bartram's Mile Trail
Conrail Swing Bridge
Trail
Sensor device
Interactive screen board

Conclusion


River
Schuylkill
DuPont Crescent Trail
Grays Ferry Crescent Trail Park
Bartram's Mile Trail
Conrail Swing Bridge
Trail
Sensor device
Interactive screen board