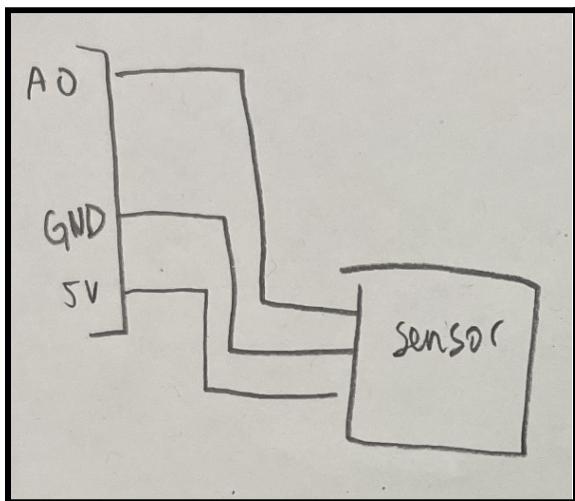


Above: Digital Schematic

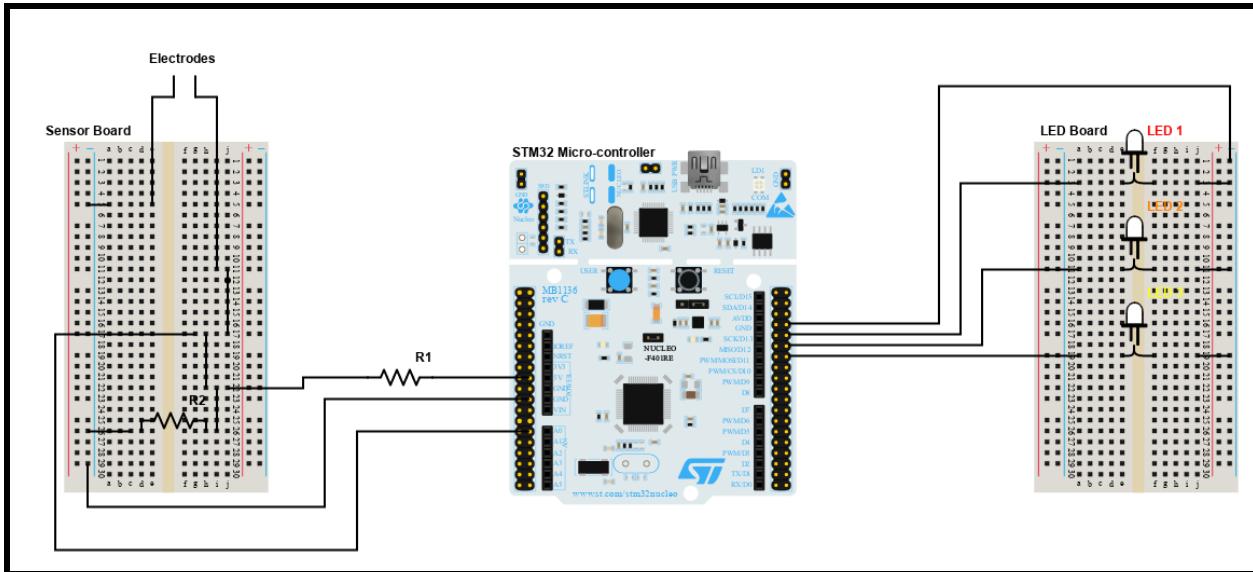


Above: Circuit Schematic

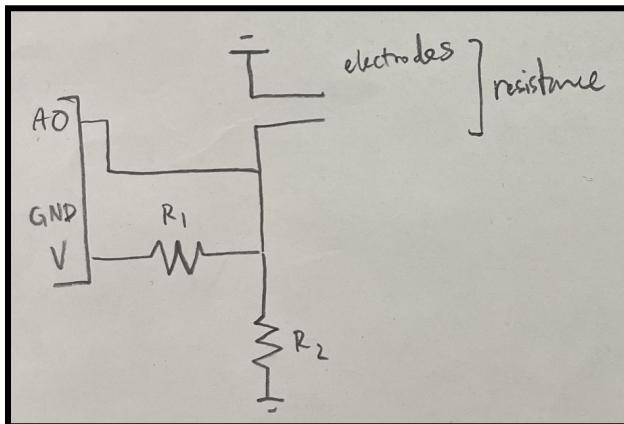
Version 1.0 (initial test)

October 29th, 2022

- Sensor will be developed later



Above: Digital Schematic



Above: Circuit Schematic

$$\frac{1}{R_{eq}} = \frac{1}{R_2} + \frac{1}{R_3} \rightarrow \text{electrode resistance}$$

$$R_2 R_3 = R_{eq} (R_2 + R_3)$$

$$R_{eq} = \frac{R_2 R_3}{R_2 + R_3}$$

$$I = \frac{V}{R_1 + \frac{R_2 R_3}{R_2 + R_3}}$$

$$V_{out} : V - R_1 \left( \frac{V}{R_1 + \frac{R_2 R_3}{R_2 + R_3}} \right)$$

$$\frac{V - V_{out}}{R_1} = \frac{V}{R_1 + \frac{R_2 R_3}{R_2 + R_3}}$$

$$R_1 + \frac{R_2 R_3}{R_2 + R_3} = \frac{VR_1}{V - V_{out}}$$

$$R_2 R_3 = \left( \frac{VR_1}{V - V_{out}} - R_1 \right) (R_2 + R_3)$$

$$R_3 \left( R_2 - \frac{VR_1}{V - V_{out}} + R_1 \right) = \frac{VR_1 R_2}{V - V_{out}} - R_1 R_2$$

$$R_3 = \frac{\frac{VR_1 R_2}{V - V_{out}} - R_1 R_2}{R_2 - \frac{VR_1}{V - V_{out}} + R_1}$$

$$P = \frac{R_3 A}{L}$$

$$\sigma = \frac{1}{P} = \frac{L}{R_3 A}$$

$$TDS = k \cdot E_C$$

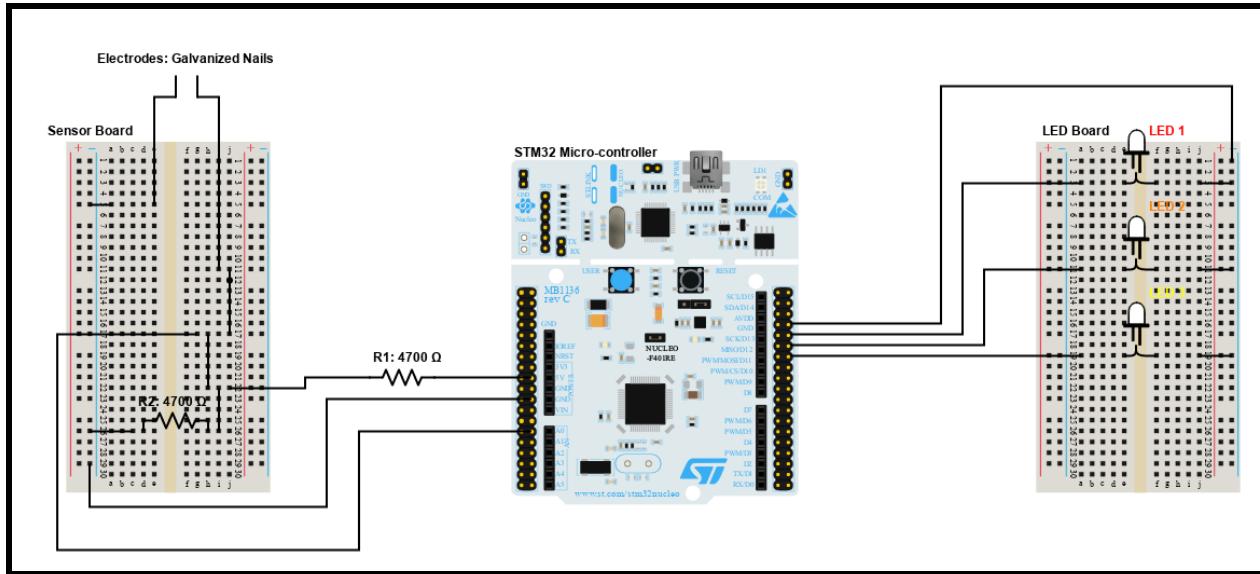
Above:  $R_3$  (resistance of the electrodes) derivation, TDS (total dissolved solids) derivation

Version 2.0 (Sensor development model)

November 9th, 2022

Changes:

- Developed sensor using electrodes
  - Works with resistors, electrodes, and a breadboard
  - Utilizes Kirchhoff's circuit laws,  $V=IR$ , the resistivity formula, and the total dissolved solids formula
- Added names of the devices
- Split breadboard into two in the diagram for easy visual comprehension

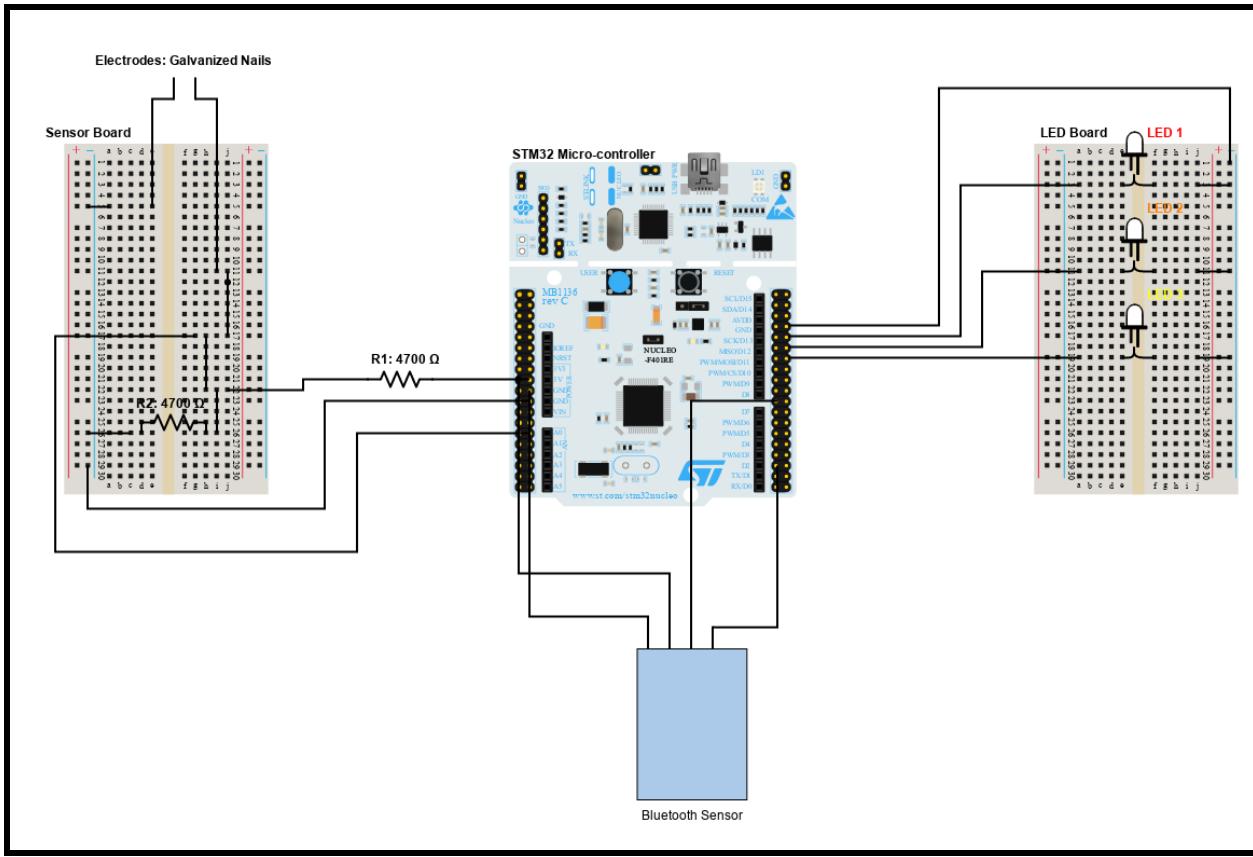


Version 2.1 (Sensor development model)

November 14th, 2022

#### Changes:

- Added values for R1 and R2.
  - R1 is a resistor of 4700 Ohms.
  - R2 is a resistor of 4700 Ohms.
- Added the material of the electrodes.
  - The electrodes will be made of galvanized nails.
- Note that the breadboard is still split into two for easier visual comprehension



Version 3.0 (Sensor development model)

November 20th, 2022

#### Changes:

- Added the bluetooth sensor.
- Connects to GND, 5V, D2, and D7 pins.