Aquakno-H_20 Meter

By: Krish Shah

Problem Statement

Now that we have a little bit of experience with coding, circuits, and Arduinos, we are tasked with developing a design proposal for an Arduino project that solves a problem for a family member, friend, or ourself with materials that we could purchase if given the funds to do so.

Criteria and Constraints

- All sources used for research must be documented with links
- Photos should be used throughout the presentation to be used as visual aid
- Must provide cost of items in Step 3

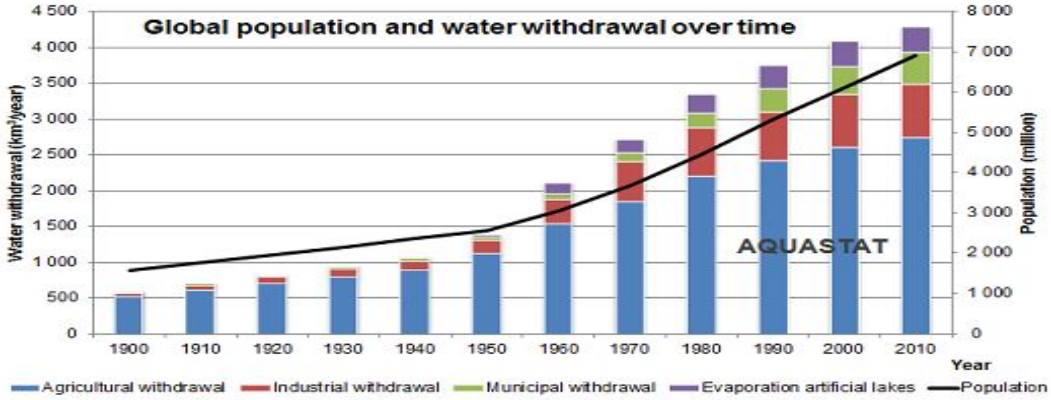
Project Purpose

To monitor and reduce water usage in homes and commercial establishments using a water meter

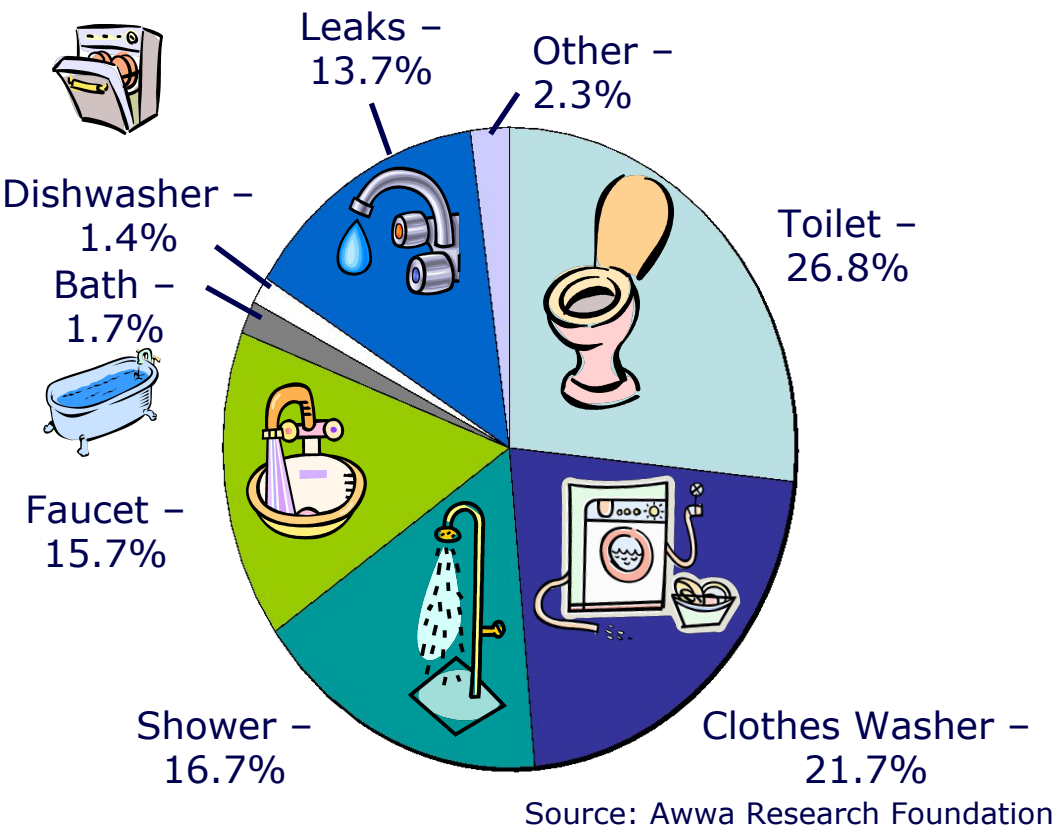
- To track the actual amount of water used and not just provide an estimate
- To help detect wastage of water through theft, or leaking/overflowing pipes by exposing impact on water bill
- To provide real time water consumption data anywhere at home, thereby making one aware of water used.
- To teach and inculcate the importance of water conservation among children from a very young age.
- To help and change the way water is used in hospitality industry. e.g. hotels etc. The more water saved, the less bill one pays

Research

- Water Scarcity currently affects 2.8 billion people around the world, on all continents
  - More than 1.2 billion people people lack the access to clean drinking water.
- The world's water resources are rapidly running dry, creating a global crisis for every living being on the planet
- In the 20th century, population grew 3 fold, but water demand grew 6 fold



Residential Indoor Uses of Water



Source: Awwa Research Foundation

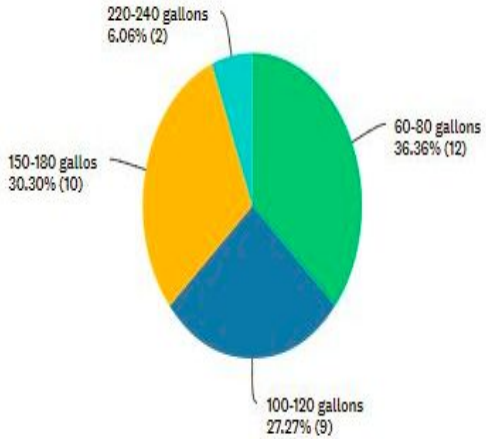
As shown in the chart the toilet uses the most water in the household followed by the washer, shower, faucet, and leaks. The least is used by other, dishwasher, and bath. The large usage of water by leaks, faucets, and showers can be prevented or slowed down by the use of my *Aquakno* which attached to these items.

Family Surveys (1 of 5)

1

How many gallons of water do you think does an average American family of four consumes in a day inside their house (excluding water sprinklers)?

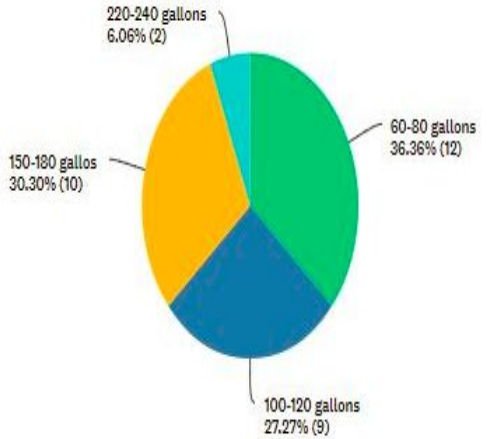
Answered: 33 Skipped: 0



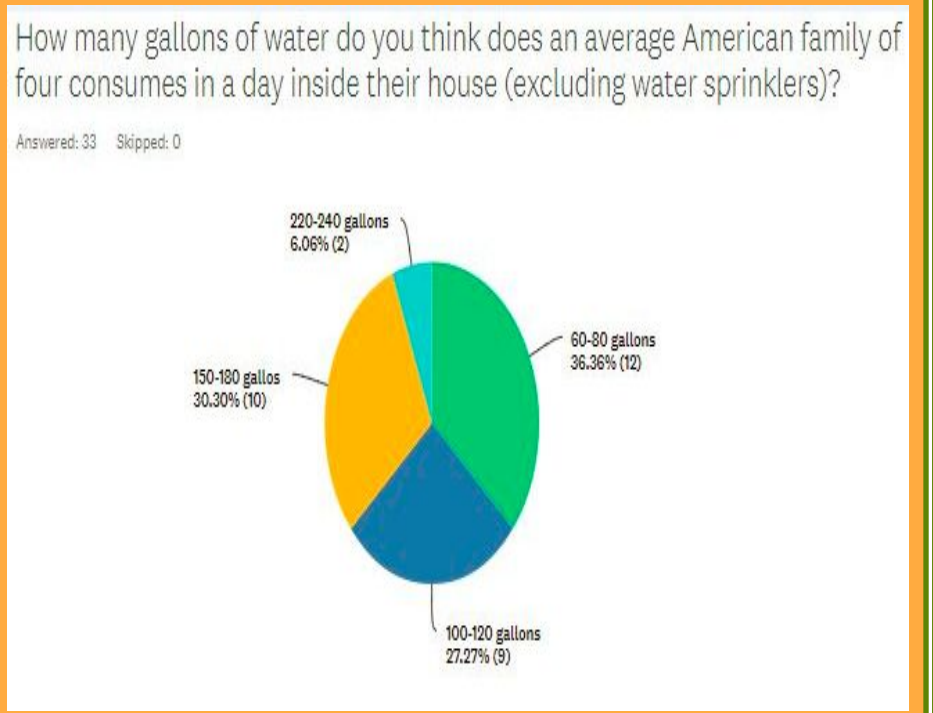
2

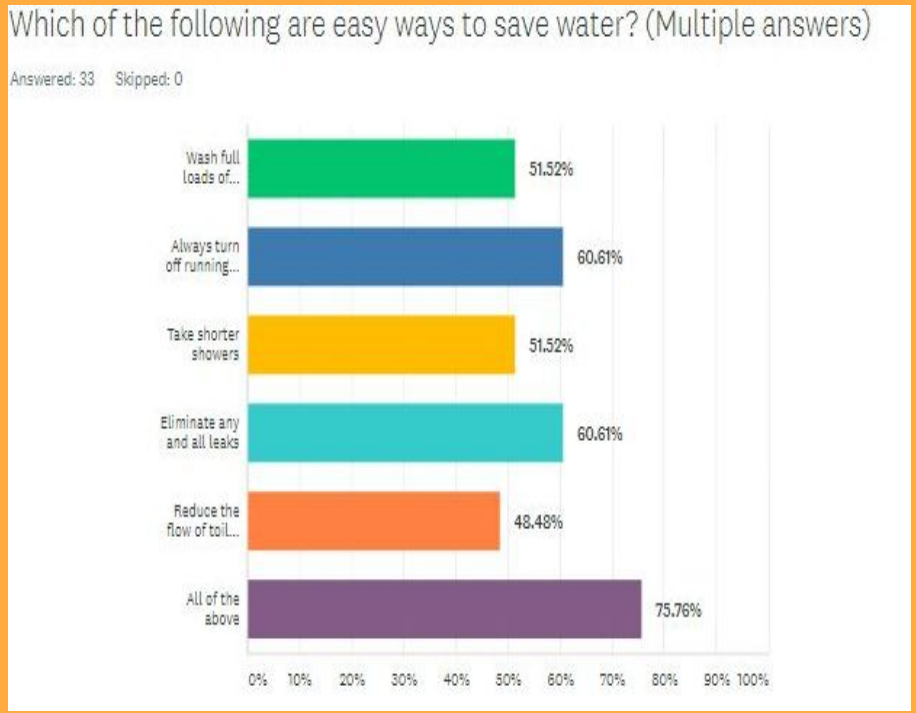
How many gallons of water do you think does an average American family of four consumes in a day inside their house (excluding water sprinklers)?

Answered: 33 Skipped: 0



Family Surveys (2 of 5)

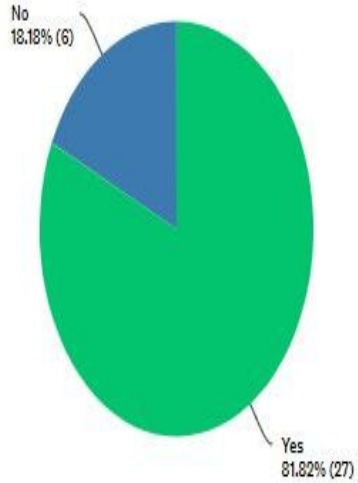




Family Surveys (3 of 5)

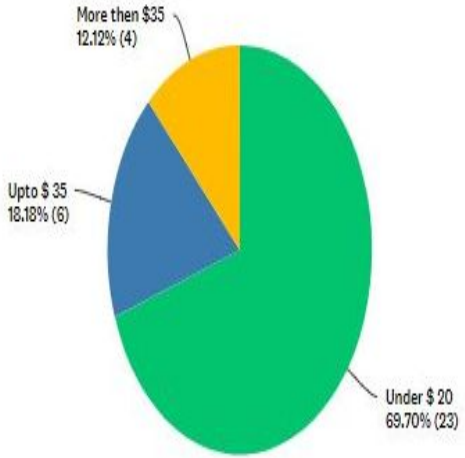
Would you consider installing a water consumption tracker in your shower?

Answered: 33 Skipped: 0



How much will you be willing to spend on a water consumption tracker? (This is per tracker, irrespective of where you put it)

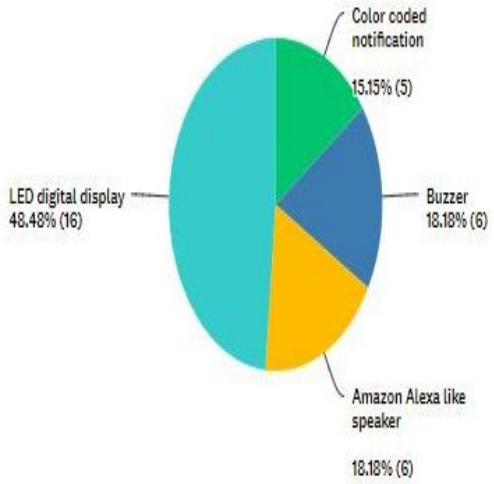
Answered: 33 Skipped: 0



Family Surveys (4 of 5)

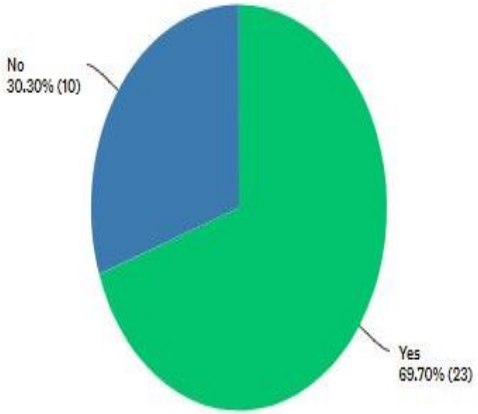
What kind of notification would you prefer to track your water consumption?

Answered: 33 Skipped: 0

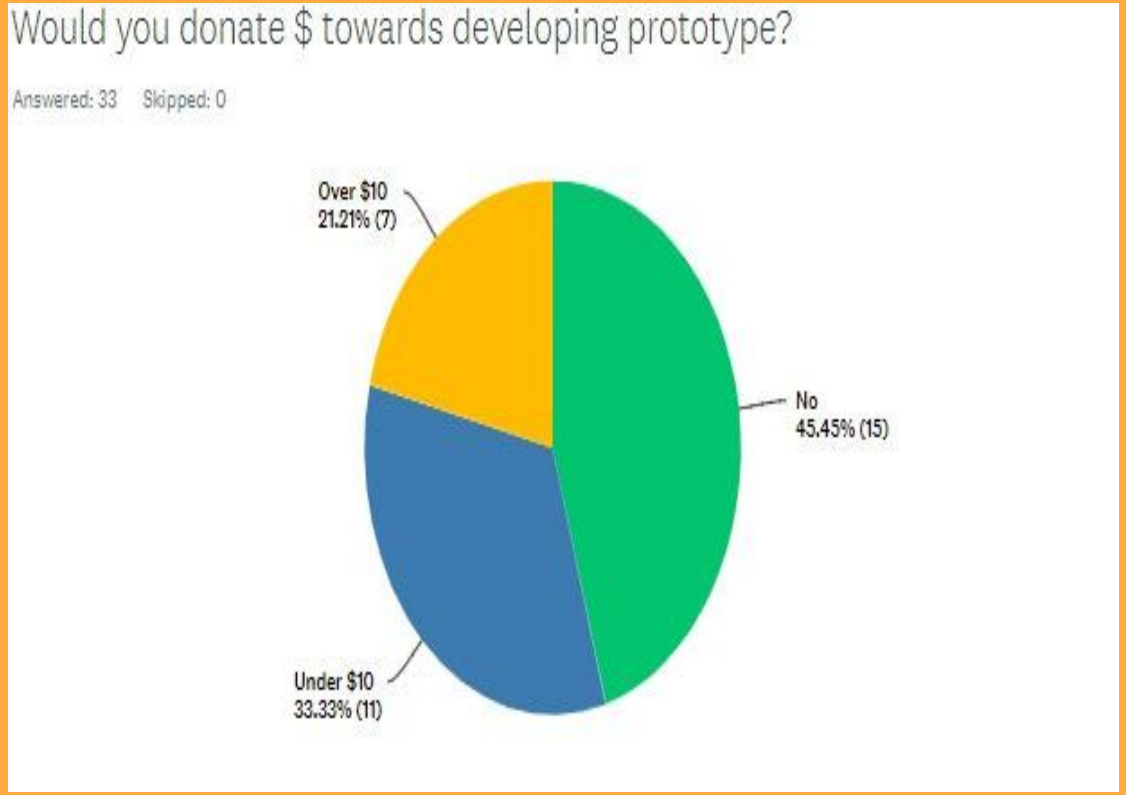


Would you be open to sharing your water consumption data with a local social group so that it can be used to encourage members to adopt smarter water consumption ways?

Answered: 33 Skipped: 0



Family Surveys (5 of 5)



What can Arduinos be used for?

- Arduino is an open-source electronics platform based on easy-to-use hardware and software.
  - A circuit board that can be connected to various items via pins and can be coded via the Arduino IDE located through different platforms.
  - Arduinos can take inputs and provide outputs based on code made and uploaded in the Arduino IDE.
- Thousands of projects have been made with Arduinos and there is no limit to the creativity the board provides.
- There are multiple versions of Arduino.
  - There are about 20 different arduino boards
  - There are also 15 different add-ons or shields for arduinos

Bibliography (Key Sources)

- **American Water Works Association -** water utilization and conservation methodologies

  https://www.awwa.org/
- **NEEF -** Use of Water in Residential Areas

  https://www.neefusa.org/weather-and-climate/weather/home-water-use-united-states
- **AQUASTAT-** Correlation between population and water scarcity

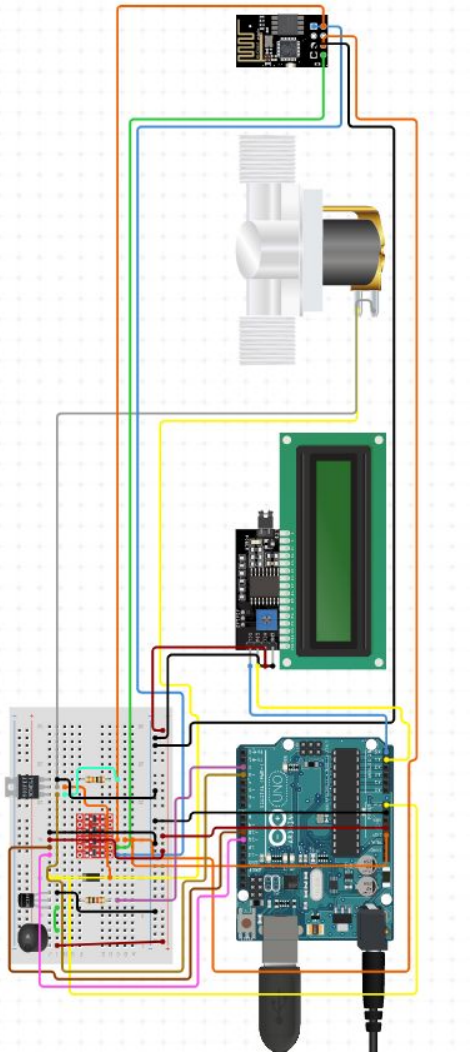
  http://www.fao.org/aquastat/en/overview/methodology/water-use
- **What is an Arduino?**

  https://learn.sparkfun.com/tutorials/what-is-an-arduino/all
- **Talked to Aqua Water Management Facility**
- **Some family members own hotels so I talked to them**

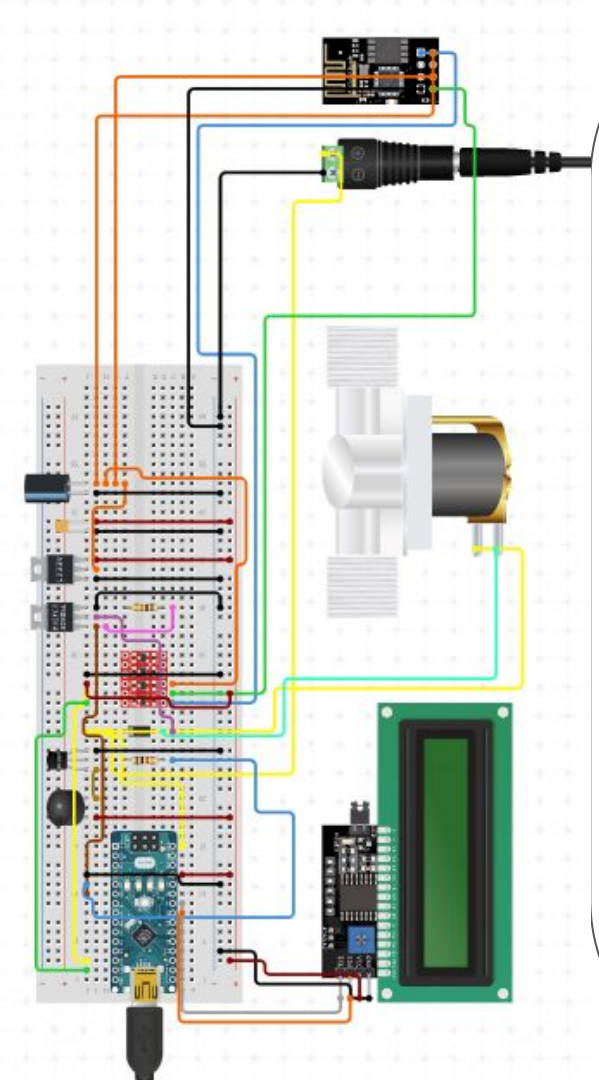
Developing Ideas

Goal of the *Aquakno*

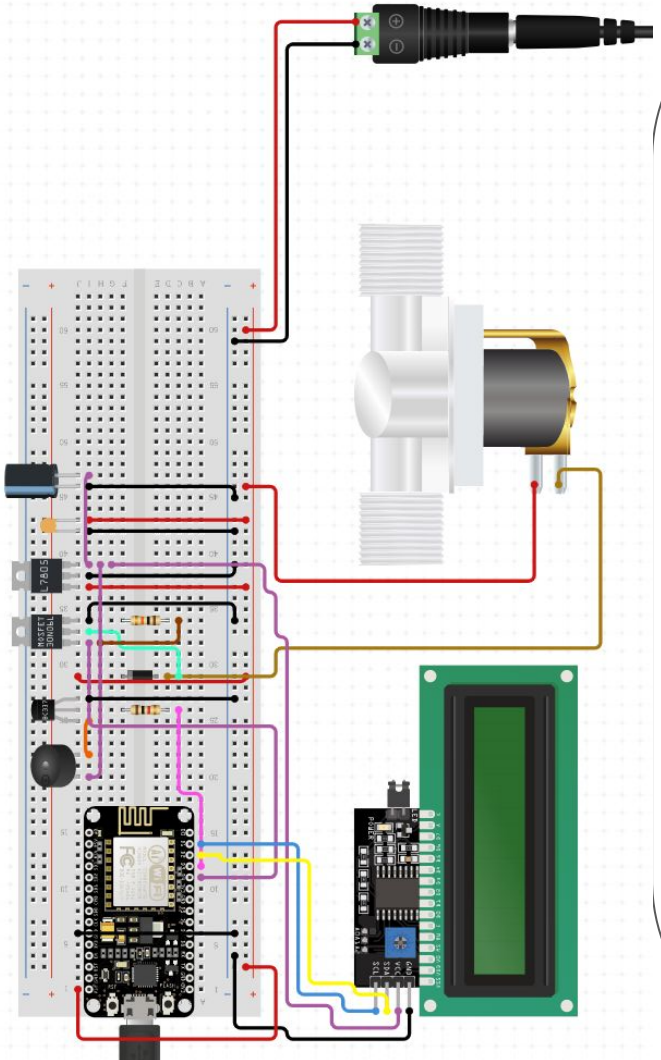
- Make the Aquakno Waterproof and able to text device
- Make the Aquakno make a beeping noise when you use too much water
- The Aquakno should measure the amount of water based on the number of rotations of the fan within the device
- An arduino board, which is an electronic device is customized to capture the amount of water flowing through the flowmeter
- The LED board reads the data from the arduino board and displays the metrics that we are interested in
- This can be used residentially or commercially.
  - Our device could be used in kitchens, bathrooms, at home and in hotels, etc.



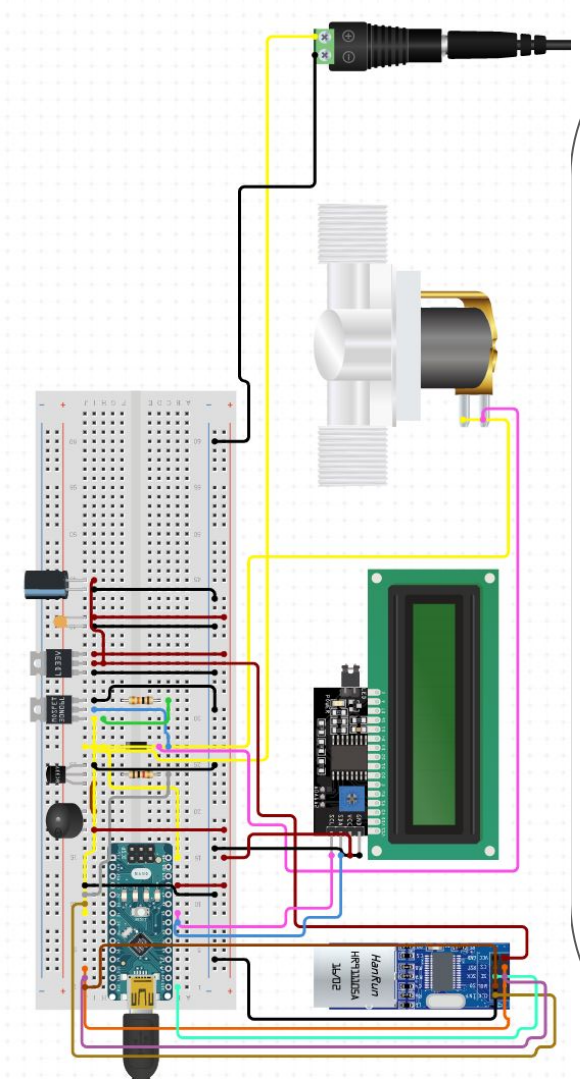
As shown in the image on the left, there is an Arduino Uno is connected to a breadboard which is connected to a Wall Adapter, 12V Solenoid Valve, 16x2 LCD Display, Piezo Buzzer, and ESP8266. The Arduino Uno is the brain of the operation as it holds the code and sends out signals to each part through jumper wires. The Wall Adapter is used to power the device and the Solenoid Valve detects the amount of water (liters) flowing and shuts the water supply if max limit is reached. The piezo buzzer makes a noise when the max limit is reached and the ESP8266 messages phone when max is reached. Finally, the LCD Display, displays the amount of liters used and how much is left.



As shown in the image on the left, there is an Arduino Nano is connected to a breadboard which is connected to a Wall Adapter, 12V Solenoid Valve, 16x2 LCD Display, Piezo Buzzer, and ESP8266. The Arduino Nano is the brain of the operation as it holds the code and sends out signals to each part through jumper wires. The Wall Adapter is used to power the device and the Solenoid Valve detects the amount of water (liters) flowing and shuts the water supply if max limit is reached. The piezo buzzer makes a noise when the max limit is reached and the ESP8266 messages phone when max is reached. Finally, the LCD Display, displays the amount of liters used and how much is left. This is different than the previous prototype as this has a smaller factor due to the Arduino Nano being half the size of the Arduino Uno. There are extra resistors and capacitors shown to regulate power for no short circuiting.



As shown in the image on the left, there is an Nodemcu 1.0V is connected to a breadboard which is connected to a Wall Adapter, 12V Solenoid Valve, 16x2 LCD Display, and Piezo Buzzer. The Nodemcu 1.0V is the brain of the operation as it holds the code and sends out signals to each part through jumper wires. The Wall Adapter is used to power the device and the Solenoid Valve detects the amount of water (liters) flowing and shuts the water supply if max limit is reached. The piezo buzzer makes a noise when the max limit is reached and the LCD Display, displays the amount of liters used and how much is left. The previous two prototypes have a ESP8266 connected to them which connects to wifi and texts a phone but with the Nodemcu this is built in. There is no need to an extra device which means less cables and clutter.



As shown in the image on the left, there is an Arduino Nano is connected to a breadboard which is connected to a Wall Adapter, 12V Solenoid Valve, 16x2 LCD Display, Piezo Buzzer, and LAN Module. The Arduino Nano is the brain of the operation as it holds the code and sends out signals to each part through jumper wires. The Wall Adapter is used to power the device and the Solenoid Valve detects the amount of water (liters) flowing and shuts the water supply if max limit is reached. The piezo buzzer makes a noise when the max limit is reached and the LCD Display, displays the amount of liters used and how much is left. This is different than the previous prototype as this has a smaller factor due to the Arduino Nano being half the size of the Arduino Uno. There are extra resistors and capacitors shown to regulate power for no short circuiting. The LAN module will be used in order to connect the Arduino Nano to the internet in order to send texts. This is an alternative to using the ESP8266 chip.

Best Plan (Iteration 3)

Iteration 3	
Parts	**Cost ($)**
Nodemcu 1.0V	$3.54 x Qty: 1
LCD Display Screen 16x2 I2C	$4 x Qty: 1
Water Flow Sensor G1/2"	$5.50 x Qty:1
Wall Adapter Power Supply - 12VDC 2A	$15.77 x Qty: 1
Misc (Capacitors, Resistors, etc.)	$16.28
Total	**$45.09**

The third iteration is the best one based on performance, size, and cost. The third iteration is the best based on performance because the Nodemcu is based on wifi so it connects seamlessly with little to no lag and there is no extra chip needed. Not only does the Nodemcu have a bigger and faster ram capacity it is only only half the size. Lying in at a mere 49 mm by 24.5 mm, the Nodemcu is smaller than the Arduino Uno. The LCD 16x2 I2C is great for visualizing data values. This screen is both great for viewing at multiple angles and great for compact designs. The Flow Sensor is both a combination of a water sensor that detects the amount of water passed through but it is also a solenoid that will close when the water value is at its maximum. The wall adapter is used to power the device. Power is important or the device will not function properly. Finally, we have a need for Miscellaneous items such as Capacitors, resistors, Jumper Wires, etc. Cost is important for consumers and manufacturers and currently based on Circuit.io, the cost of the *Aquakno* is $45.09 but this can be reduced in the future if we manufacture in bulk. This is cheap compared the previous iterations with Ethernet or with the Arduino Uno.