Automated Aquaponics System (MiniPonics)!

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Overview:

Basic aquaponics systems are currently popular among hobbyists and small-scale farmers, and while these systems are simple enough to keep functioning well with manual checks and effort, the kinds of systems that would be required for larger-scale systems will be too large and elaborate for efficient manual maintenance.

If you're an aquaponics farmer looking to expand your operation, you may want to consider at least partially automating your system. Homeostasis and stability are a hugely important part of hydroponics, and as your system gets larger it's going to be more difficult to accurately keep an eye on water flow rates, water temperature, water quality, tank levels, and even leaks.

This will make children more interested in farming and they get to learn to something new, which is the way to the future. This system will be extremely useful to people who is very enthusiastic in farming but doesn't have the time or this will be very convenient and easy to for the elderly because they can control everything using a app. The whole idea of doing this project was to automated the whole system.

Goals:

- Minimize cost by using open source components
- Reduce human error
- Automating every possible part of the system
- Monitoring and controlling the system using an Mobile Application

What is Aquaponics?

The simplest definition of **Aquaponics is the combination of aquaculture (raising fish) and hydroponics (the soil-less growing of plants)** that grows **fish** and **plants together** in one integrated system. The fish waste provides an organic food source for the plants, and the plants naturally filter the water for the fish.

The third participants are **microbes** (nitrifying bacteria). These bacteria convert ammonia from the fish waste first into nitrites, and then into nitrates. Nitrates are the form of nitrogen that plants can uptake and use to grow. Solid fish waste is turned into vermicompost that also acts as food for the plants.

Why Aquaponics is better than Organic?

- Bottom Line: There is no cheating on this with aquaponics, because we can't use chemical pesticides of any kind or our fish would die, period. Aquaponics recycles the water in the system; we can grow in droughts and areas with little water. Fewer pests to deal with since we are growing indoors. Plants Grows Twice As Fast! Due to the naturally fortified water from the fish.

- Even most approved organic pesticides would kill our fish. The fish act as the "canary in the coal mine", and force the aquaponics farmer to be honest. Even our tap water in Bend contains chloramines, which is an additive much like chlorine that would kill our fish.

- Aquaponics mimics the natural symbiotic relationship between fish & plants.

- Even traditional organic farms need to supplement their soil with fertilizers. These fertilizers can be bad for the over health of the soil and watershed.

- We are located right next to downtown Bend. You can come visit us and see how we grow and treat our plants and fish, to be sure that what you're eating is 100% chemical free!

- No G.M.O (genetically modified) organism. We do not grow any G.M.O. plants. Another advantage of growing indoors is that we don't have to worry about sprays from farms next door blowing in the wind over onto our crops. Or mysterious G.M.O. plants appearing in our crops like what happened in conventional farms.

How do you automate aquaponics system?

The first step is with an accurate series of sensors to test for things like water levels, temperature, pH balance, and water flow speed. These sensors are then run through a computer system with specialized software like this one, in order to alert you as to when something is out of balance, or even automatically fix problems.

For example, a liquid level sensor might detect that water levels in the system are low, signalling an alarm that will let you know to check for leaks and even automatically adding more water to compensate for the loss. Or, a temperature sensor might detect that the aquacultures tanks' water is too cold, triggering a heating system to bring it back into optimal range.

Basic understanding of why we need to move to Smart farming and stop the Conventional way of farming?

- The main difference with organically grown food and conventionally grown food is that organic foods are grown without the aid of synthetic pesticides or chemical fertilizers and was produced without the use of genetically modified organisms or chemicals food additives. Conventional farming is the complete opposite of organic farming, where we use chemicals and pesticides to increase growth rate or yield. This causes very little harm to us humans, but this is affecting the environment drastically.

- There are many alternatives to conventionally grown food, for example: Hydroponics, Aeroponics, Bioponics, Aquaponics and vertical farming. These types of farming are also known as Smart Farming

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- These 5 forms of farming are extremely safe to the environment.

- These different types of farming increases the yield, lesser growth rate, less pests/diseases, no weeding necessary, extremely easy to setup, you save ton of water (This is one of the main reasons of why we should to move we should grow smart farming), you have complete control over the system and you save a lot of space.

- Farmers are not exposed to the harmful pesticides and chemicals that are sprayed onto the plants (Safer environment).

Sensor list & Part List:

- PH Sensor with Analog Output – To get the ph value of the water present in the fish tank and grow bed.
- Temperature Sensor (Waterproof) - To get the temperature of the water.
- Liquid Level Sensor – To indicate the water level.
- Servo motors – To open the drain and control the pulley system.
- Water Pump – To pump water into the grow bed and fish tank.
- Air Pump - To supply oxygen to the fish tank.
- Ultrasonic sensor – To indicate the plant height
- Timer (RTC) – To control the light and feeder.
- Automated feeder – Automatic fish feeder.
- LDR sensor – To control the lights.
- Flow sensor – To current the water flow.
- Arduino Mega – Microcontroller
- Wifi module – To control the system from anywhere. (Mobile Application required)
- GSM module – Emergency warnings.

Code for the system:

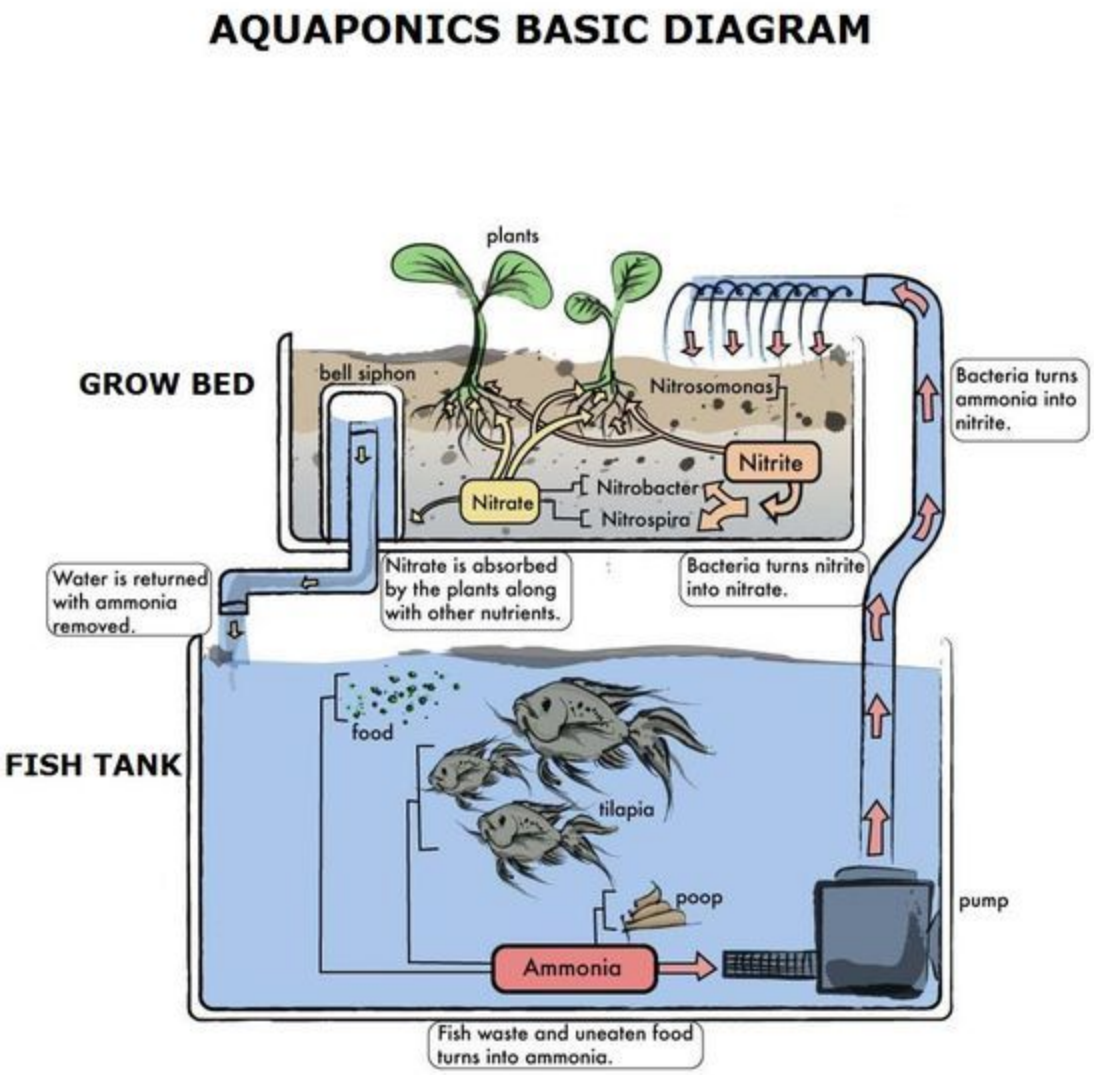
```
/* Aquaponics
 *  Version: 1.0
*/
#include<SoftwareSerial.h>
SoftwareSerial BTserial(0,1); // RX | TX
char data = 0;
int trig = 9;
int echo = 10;
float distance = 0;
int offset = 6;
int level = 0;
float percent = 0;
int xper = 0;
String x = "%";
String finalvalue = "";
String y = ";";

void setup()
{
  //Serial.begin(9600);
  BTserial.begin(9600);
  pinMode(trig, OUTPUT);
  pinMode(echo, INPUT);
  pinMode (2, OUTPUT);      //Sets digital pin 2,3,4,5 as output pin
  pinMode (3, OUTPUT);
  pinMode (4, OUTPUT);
```

```
 pinMode (5, OUTPUT);
}
void loop()
{
 long t = 0, h = 0, hp = 0;
 // Transmitting pulse
 digitalWrite(trig, LOW);
 delayMicroseconds(2);
 digitalWrite(trig, HIGH);
 delayMicroseconds(10);
 digitalWrite(trig, LOW);
 // Waiting for pulse
 t = pulseIn(echo, HIGH);
 distance= t *340/20000;
 level = distance - offset;
 percent = 37 - level;
 xper = (percent / 37) * 100;
 finalvalue = (xper + x);

 if (xper < 70){
  BTserial.print("Fill Tank");
 }
 else
 {
  BTserial.print(finalvalue);
  }
  delay(2000);
 //Serial.print(finalvalue);
 //BTserial.print(finalvalue);
```

```
// Sending to computer
//Serial.print(t);
// Serial.print(" cm\n");
//Serial.print("\n");
//BTserial.print("\n");
if(BTserial.available() > 0)  // Send data only when you receive data:
{
  data = BTserial.read();      //Read the incoming data and store it into variable data
  //BTserial.print(data);       //Print Value inside data in Serial monitor
  //BTserial.print("\n");       //New line
  if(data == '1')           //Checks whether value of data is equal to 1
    digitalWrite(2, HIGH);  //If value is 1 then 12V DC Water Pump turns ON
  else if(data == '2' || data == '9')      //Checks whether value of data is equal to 0
    digitalWrite(2, LOW);   //If value is 0 then 12V Water Pump turns OFF

    if(data == '3')           //Checks whether value of data is equal to 1
    digitalWrite(3, HIGH);  //If value is 1 then Air Pump 220-240 AC  turns ON
  else if(data == '4' || data == '9')      //Checks whether value of data is equal to 0
    digitalWrite(3, LOW);   //If value is 0 then Air Pump 220-240 AC turns OFF

    if(data == '5')           //Checks whether value of data is equal to 1
    digitalWrite(4, HIGH);  //If value is 1 then Water Pump AC 220-240 AC  turns ON
  else if(data == '6' || data == '9')      //Checks whether value of data is equal to 0
    digitalWrite(4, LOW);   //If value is 0 then Water Pump AC 220-240 AC  turns OFF

    if(data == '7')           //Checks whether value of data is equal to 1
    digitalWrite(5, HIGH);  //If value is 1 then Light AC turns ON
```

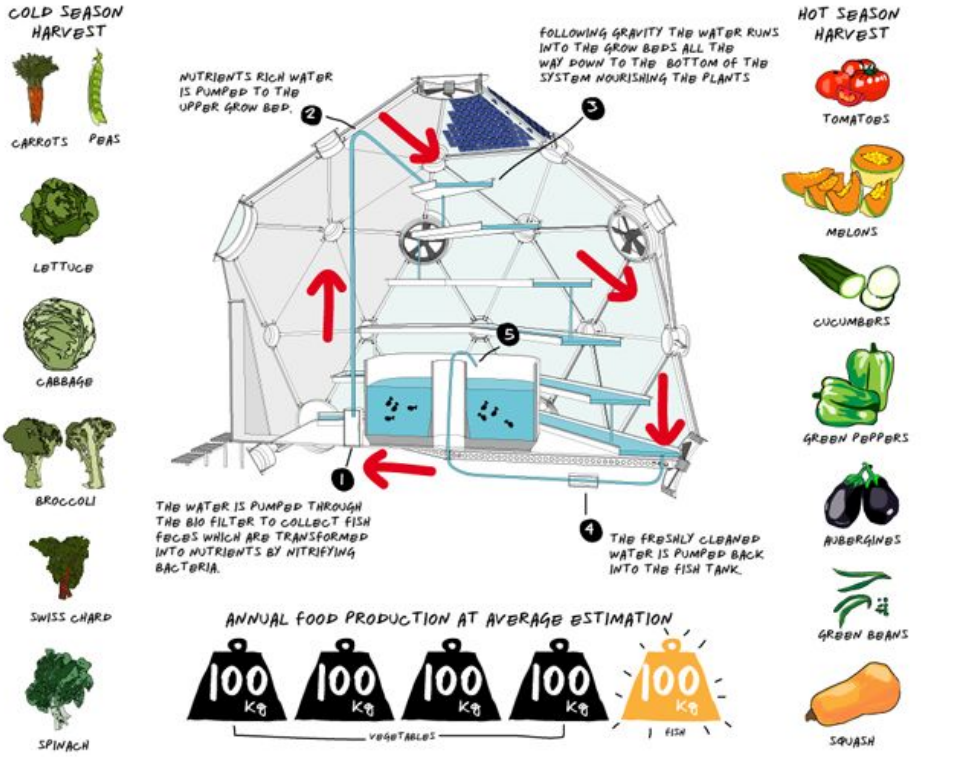
```
  else if(data == '8' || data == '9')       //Checks whether value of data is equal to 0
    digitalWrite(5, LOW);   //If value is 0 then Light AC turns OFF

 }
}
```

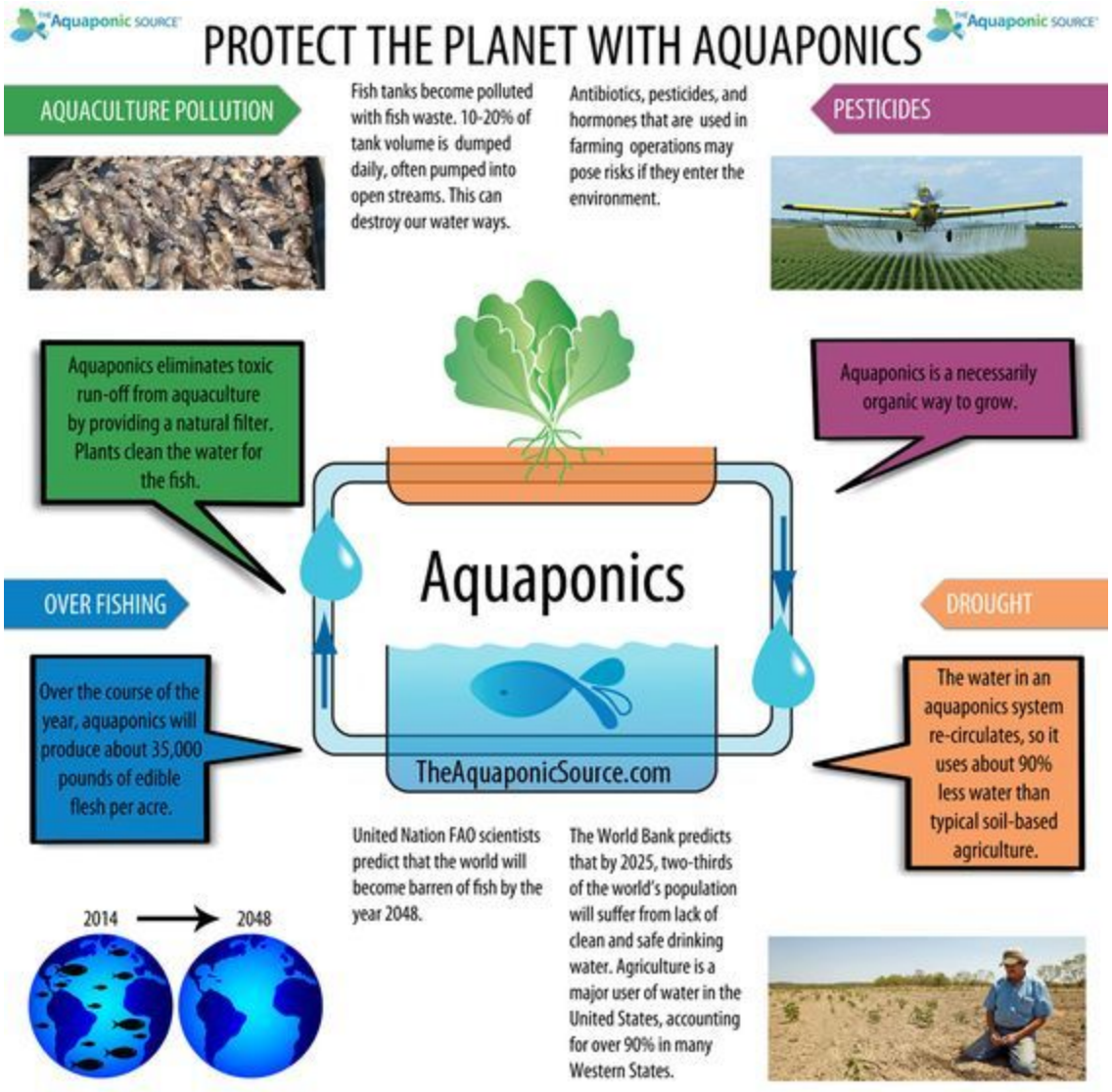
Picture's of the system and Diagrams:

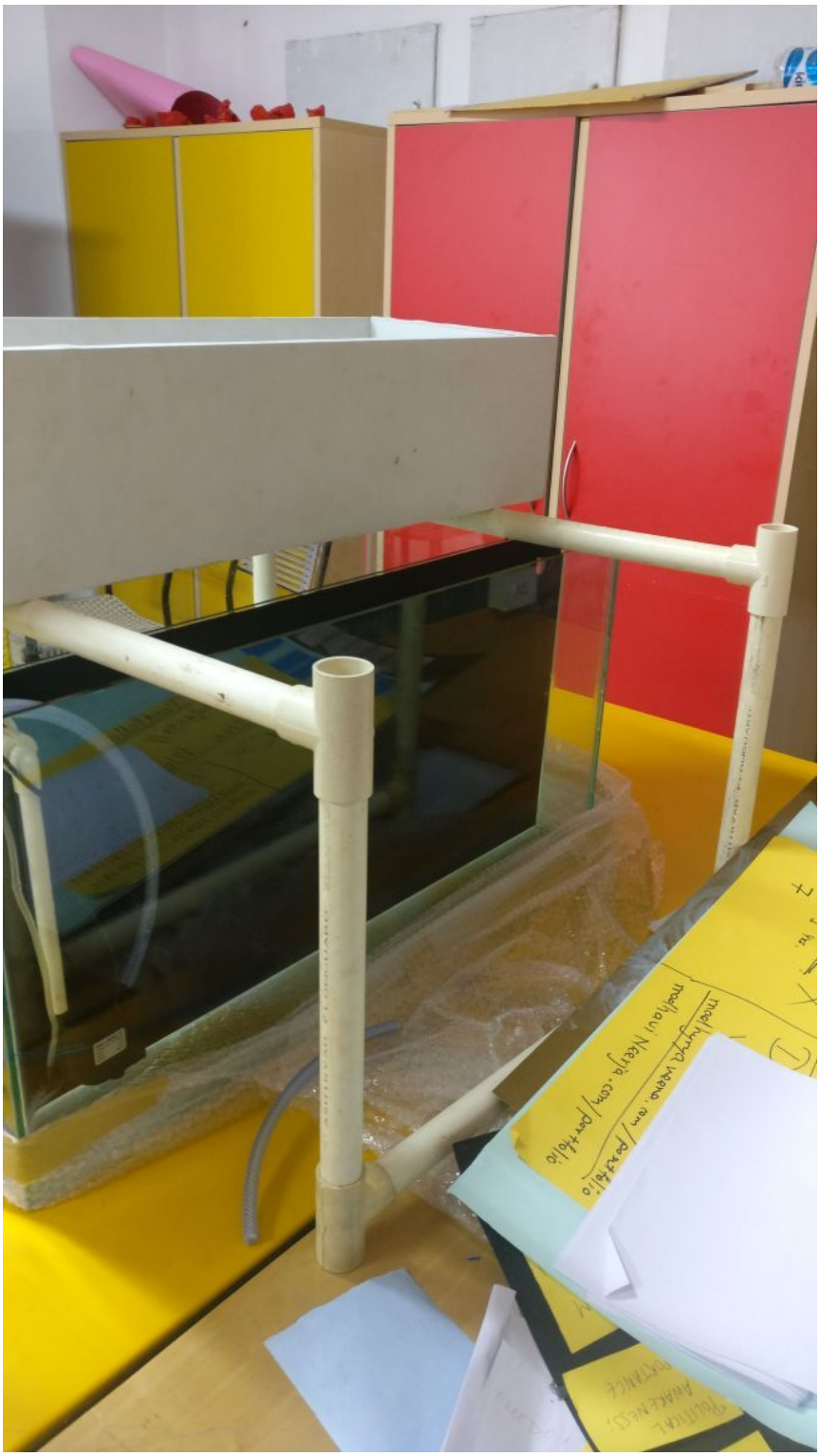


❷ THE GLOBE - AQUAPONIC SYSTEM

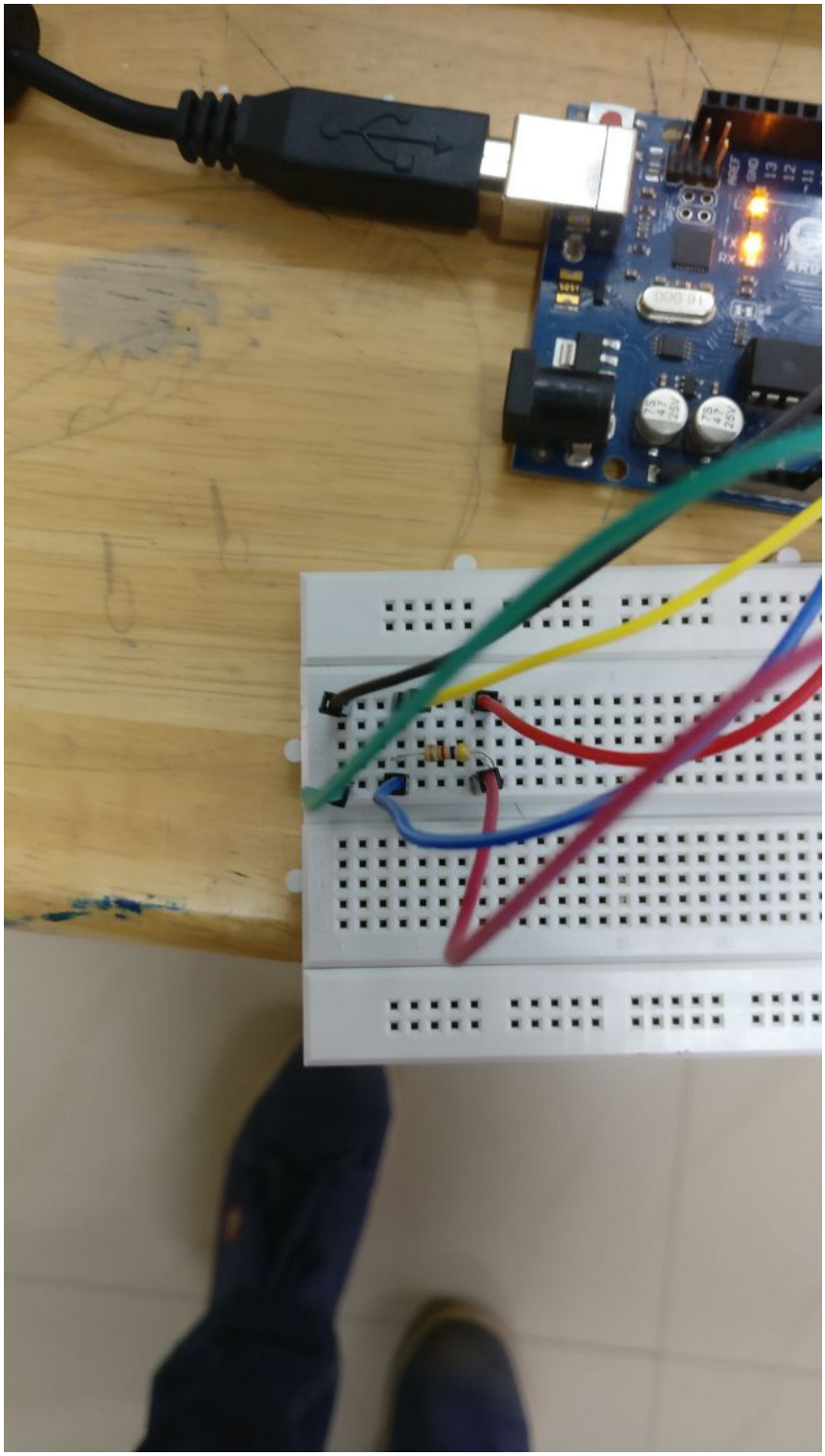
AQUAPONIC FARMING IS A TECHNIQUE THAT COMBINES THE CULTIVATION OF FISH WITH THE GROWING OF VEGETABLES. THE FISH PROVIDE RICH FERTILIZER FOR THE PLANTS AND IN RETURN, THE PLANTS CLEAN THE WATER FOR THE FISH. THE FISH AND THE PLANTS CO-EXIST IN A SYMBIOTIC RELATIONSHIP.

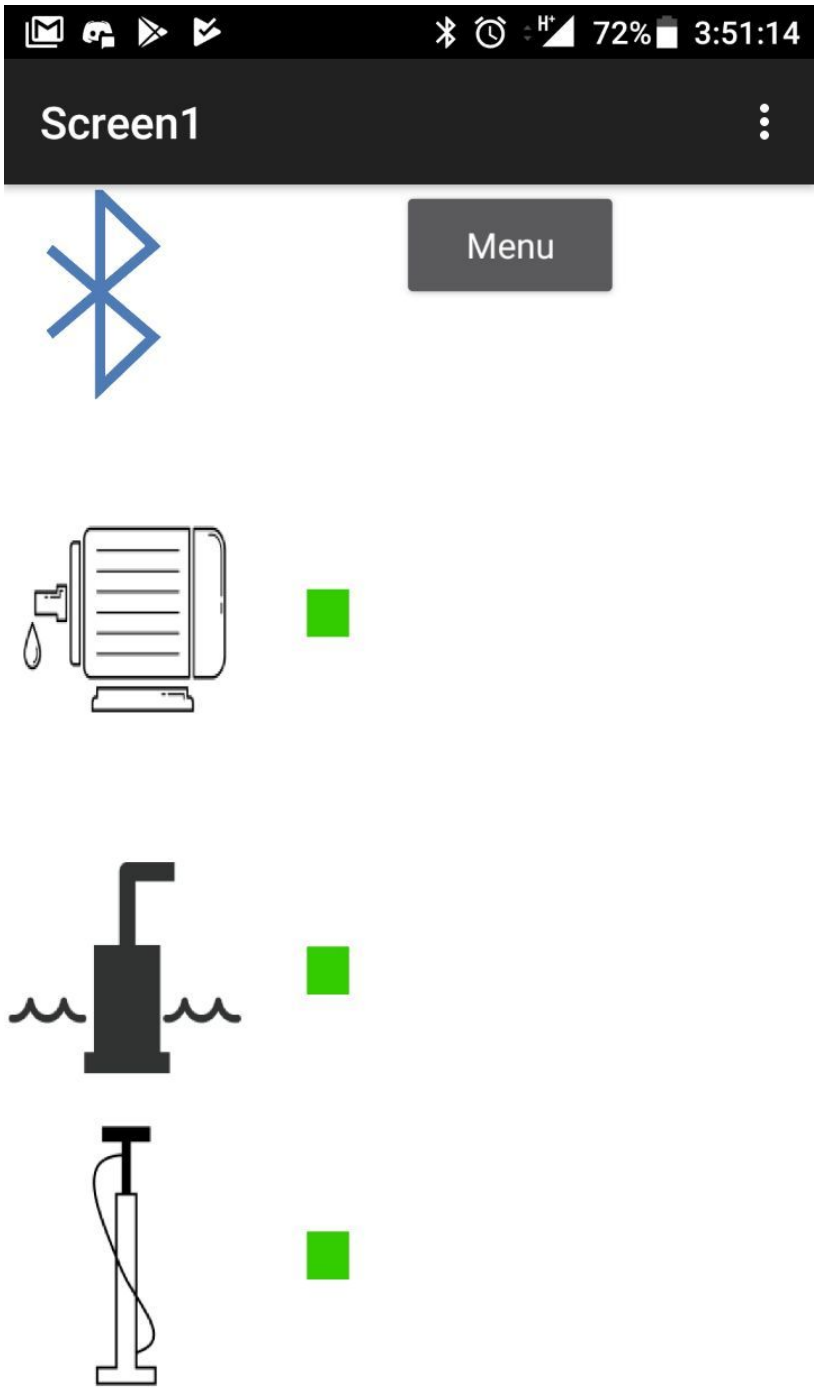


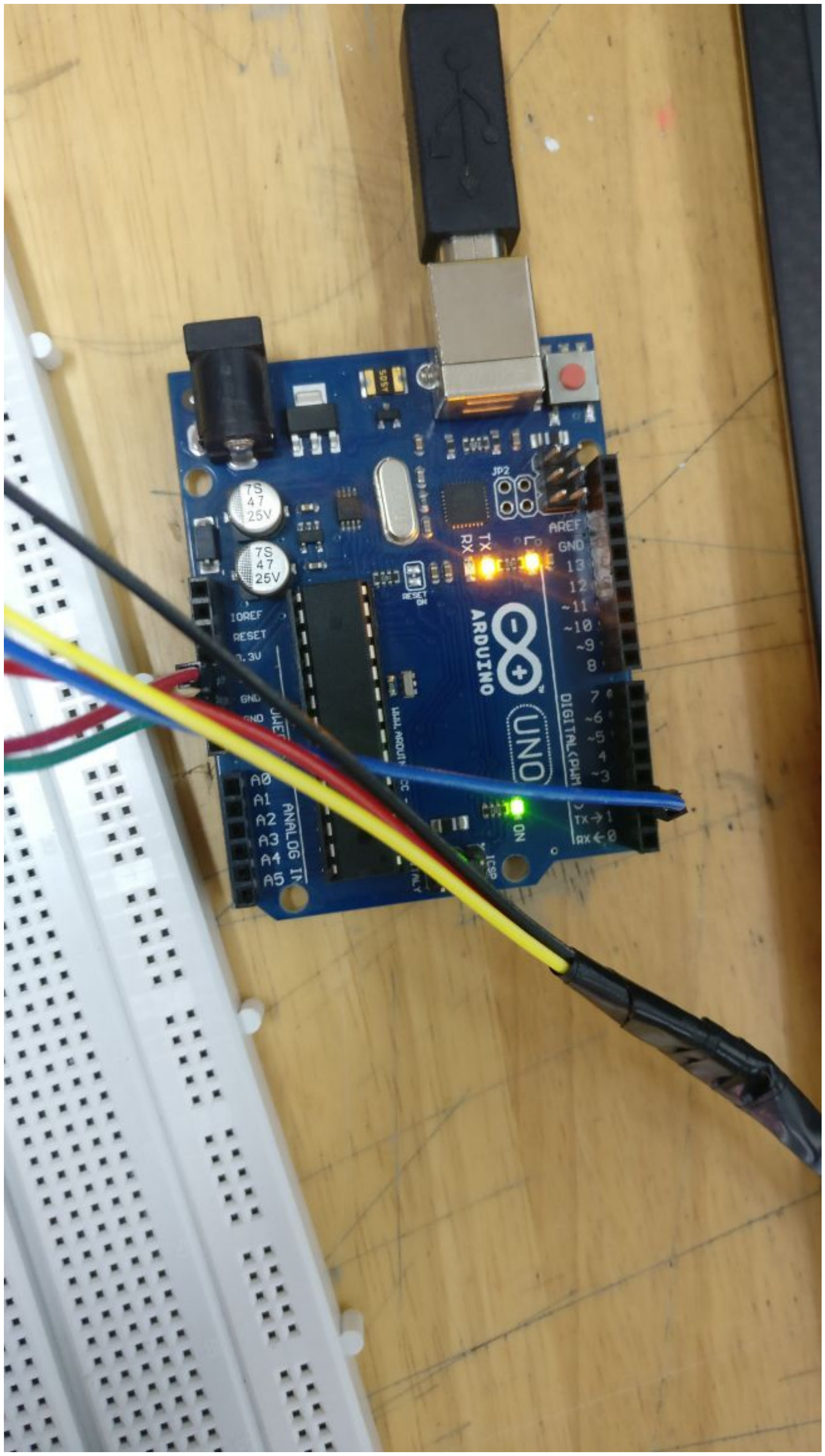

PROTECT THE PLANET WITH AQUAPONICS
AQUACULTURE POLLUTION
Fish tanks become polluted with fish waste. 10-20% of tank volume is dumped daily, often pumped into open streams. This can destroy our water ways.
Antibiotics, pesticides, and hormones that are used in farming operations may pose risks if they enter the environment.
PESTICIDES
Aquaponics eliminates toxic run-off from aquaculture by providing a natural filter. Plants clean the water for the fish.
Aquaponics is a necessarily organic way to grow.
Aquaponics
TheAquaponicSource.com
OVER FISHING
Over the course of the year, aquaponics will produce about 35,000 pounds of edible flesh per acre.
DROUGHT
The water in an aquaponics system re-circulates, so it uses about 90% less water than typical soil-based agriculture.
2014
2048
United Nation FAO scientists predict that the world will become barren of fish by the year 2048.
The World Bank predicts that by 2025, two-thirds of the world's population will suffer from lack of clean and safe drinking water. Agriculture is a major user of water in the United States, accounting for over 90% in many Western States.

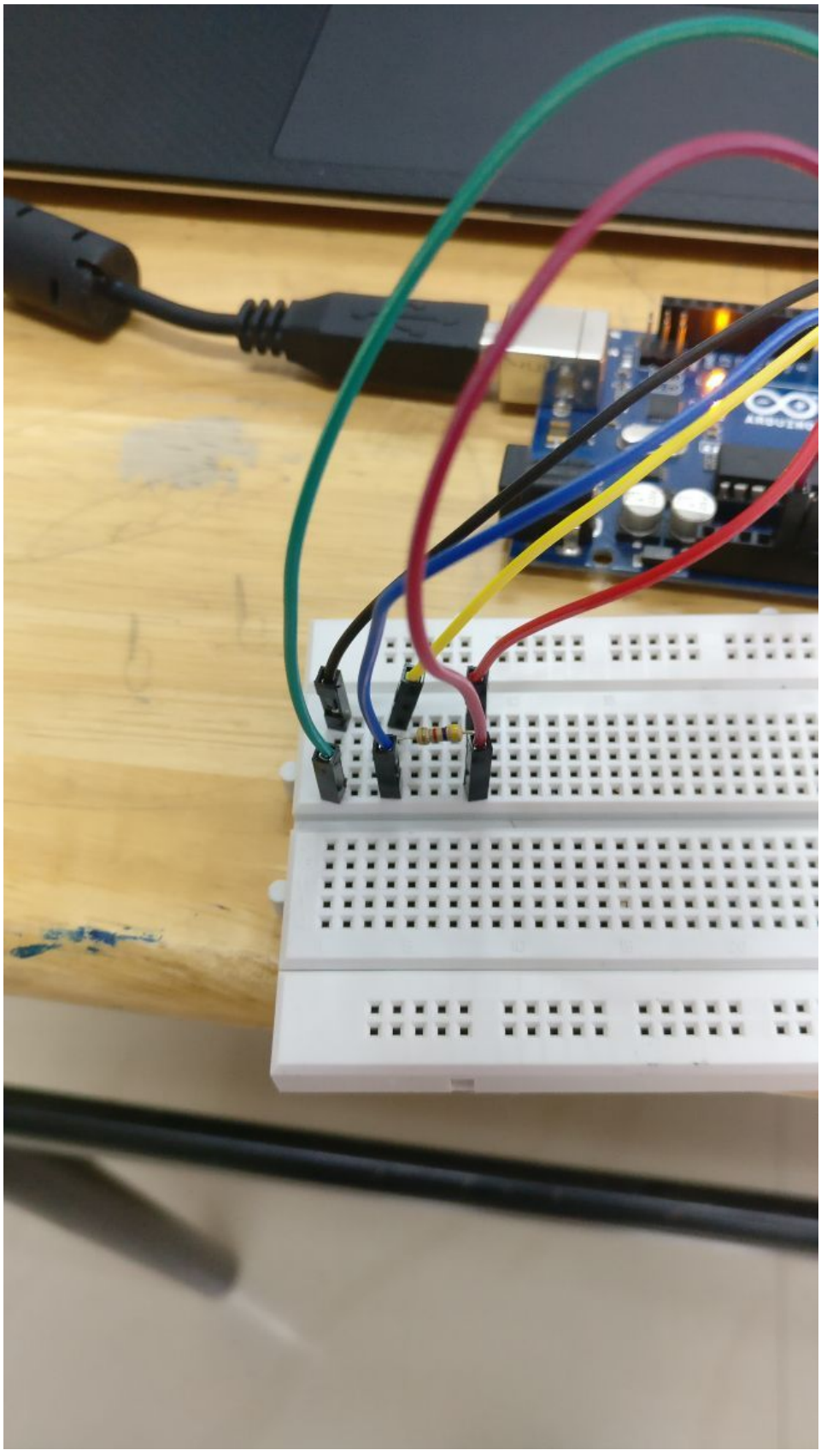


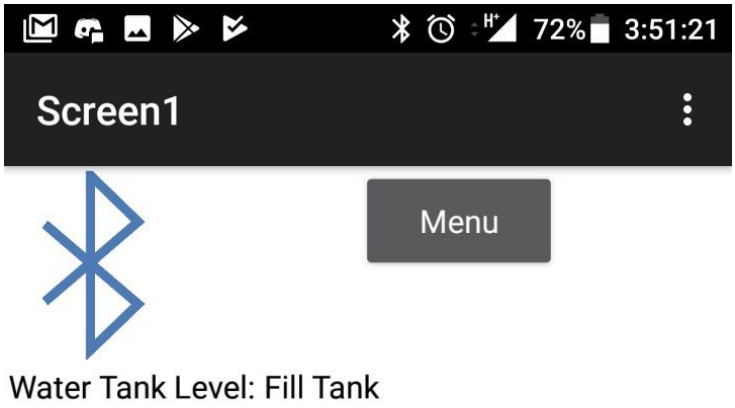
Picture's of our app:




72%
3:51:14
Screen1
Menu


ARDUINO
UNO
TX
RX
ON
IOREF
RESET
AREF
GND
A0
A1
A2
A3
A4
A5
7S 47 25V




72%
3:51:21
Screen1
Menu
Water Tank Level: Fill Tank