Smart Aquarium

Team #35
Team Members:
Eduardo Meraz
Huanjia Liu

April 24, 2020

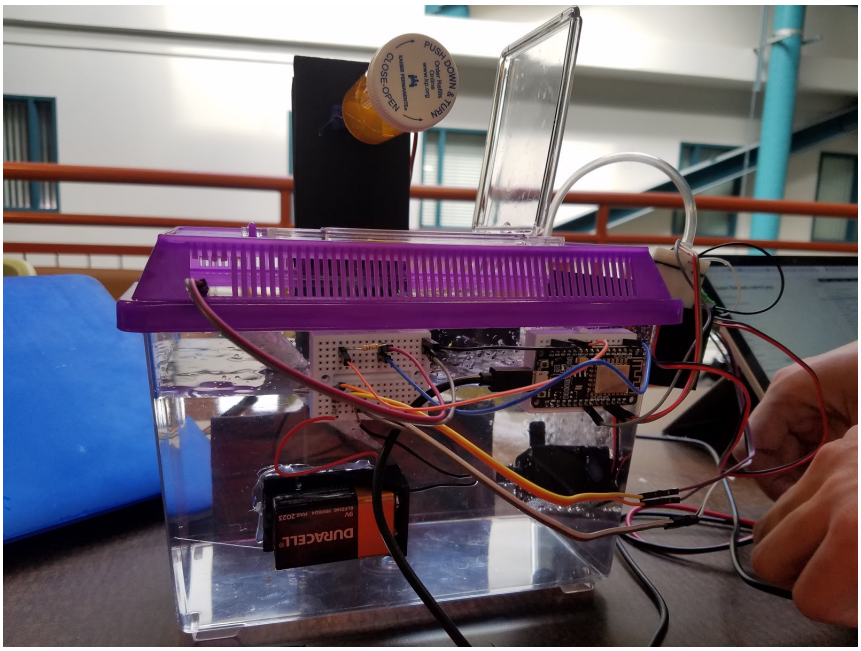


Figure 1: project result

Contents

1 Summary:

For our project we will create a smart fish tank system. Huanjia first proposed the idea and then Eduardo decided to join him. In our fish tank it will have a automatic fish feeding system, temperature system, a water oxygen circulation system, with a built in wifi module.

2 Background:

In the beginning of the semester our team planned on making a smart aquarium tank that could be controlled through an app/website. Within that app/website you can control the speed of the water oxygen system, the time interval of your fish feeder, and control the water temperature of the fish tank. Furthermore, it will have a resistor inside the fish tank to record and tell you the current temperature of the tank. Inside our system it will also include a built in wifi module. The idea was first brought up from Huanjia because he was interested on make his own fish tank. Eduardo then decided to join Huanjia because we wanted to create something that would be fun to build and something to catch a person's attention. Once the team had got together they quickly started planning on designing on the fish tank. After Huanjia explained his idea about the tank we knew it was going to become a huge project. We later decided to split up the project into four parts to try to make the deadline. On our individual time we decide to research different ways to make this project in order to fit our time schedules and budgets.

3 Procedure/Testing:

At our first meeting, we were just going over the layout of the project. Huanjia knew how big of a project it was and he planned to split up the amount of work so we could design and order the necessary parts for our project. Eduardo later mention that since it's a big project we should focus on the main parts of our tank just in case we ran out of time. After careful consideration, we decide to slip the project into three parts. Huanjia job was to start with the website. Eduardo job was to build the fish feeder and then on a later week we would both work on the water oxygen system. Therforthe, we split the project into three parts. Eduardo was in charge of the first part, which in this case it was to build the auto fish feeder. For Huanjia his job was to create the website for the fish tank. For the final part, we decided to meet together and work on the water oxygen system together.

4 Result:

4.1 Hardware

4.1.1 PCB part

In our project, we decide to design our own pump driver. Actually, water pump and air pump can be regarded as DC motor, so we can use PWM from Arduino to control it. But the voltage of air pump and water pump is 12 volt, we chose tip122 to use small current control big current.

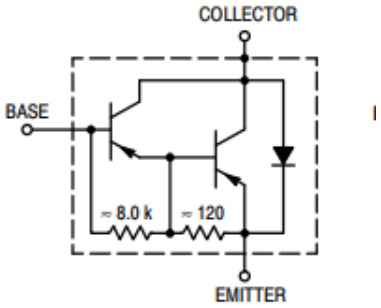


Figure 2: Tip 122

Here is our circuit of motor driver, 1N4001 is our protect element, because DC motor will product current while rotating. Without 1N4001, current may damage the circuit when turning off the power. As for R_3, we need use it to adjust current I_B, which can make tip 122 work in active region.

$$R_3 = \frac{V_{in} - V_{BE}}{\frac{I_C}{\beta}}$$

For tip 122, $\beta = 2500$, $V_{BE} = 0.7$V. As for, our air pump and water pump, working current of them are 0.3A and 0.4A. And output voltage of NodeMCU is 3.3 V (V_{in}).

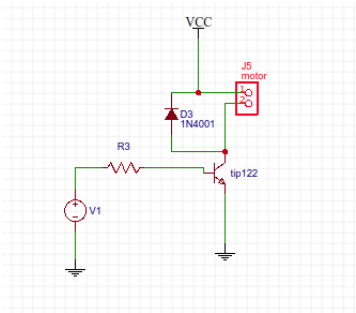


Figure 3: Circuit of motor driver

Here is our final PCB circuit.

For tip 122, $\beta = 2500$, $V_{BE} = 0.7$V. As for, our air pump and water pump, working current of them are 0.3A and 0.4A. And output voltage of NodeMCU is 3.3 V (V_{in}).

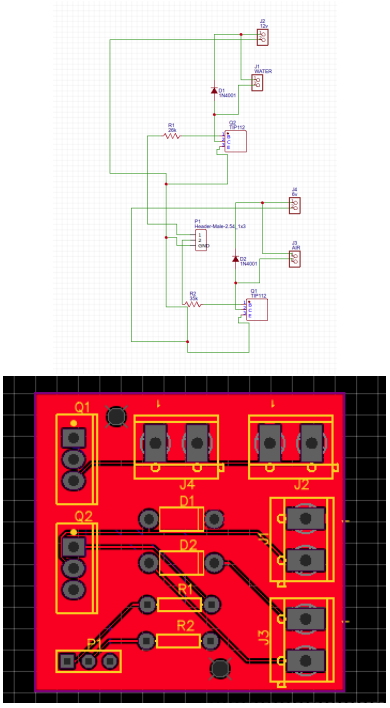


Figure 4: PCB circuit of motor driver

4.1.2 Microcontrollers

One NodeMCU and one Arduino Uno. One of it control WiFi system, temperature control system, another one control water oxygen circulatory system and feeding system.

4.1.3 Thermistor part

The thermistors we would use is NTCLE100E3.

Connecting the circuit likes Figure 2, use analogRead to get the voltage between node A and node B. We could find the voltage of node B is 2.5V. AnalogRead canc get 5 volts in 1024 units, so each units equals to 0.0049 volts.

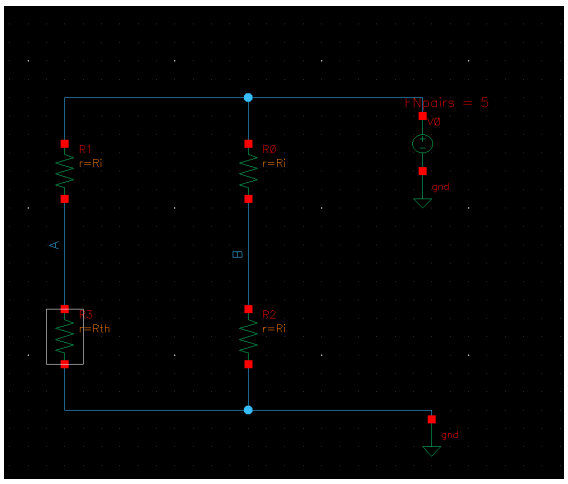


Figure 5: Themistor circuit

Therefore, from the circuit we could get the value of Rth is $(\frac{2*V_a}{V_b}\text{-}1)*R_i$ Ohms.(V_{ab}= $Analog_{ab}$*0.0049 V). Because different have different Ref in 25 $^{\circ}C$, R_i will be determined after getting the value of Ref in Thermistor.

Then we can use the formula in figure to get temperature.

For the script of this part we will introduce it in software part.

$$T_{(R)} = \left(A_1 + B_1 \ln\frac{R}{R_{\text{ref}}} + C_1 \ln^2\frac{R}{R_{\text{ref}}} + D_1 \ln^3\frac{R}{R_{\text{ref}}}\right)^{-1}$$

Figure 6: Formula

4.1.4 Feeding part

For the feeding system, we will use servo motor as a switch, and use Autodesk 3dsMax to design our own structure, then use 3D printer to build it.

4.1.5 WIFI part

we use ESP8266 in NodeMCU, and connect it one of Arduino, which will send UDP package to our own server. .

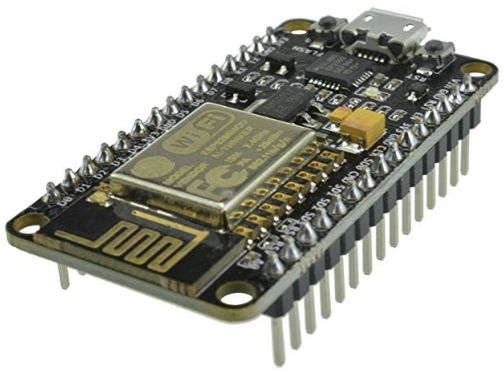


Figure 7: NodeMCU

For the script of this part we will introduce it in software part.

4.1.6 Water oxygen circulatory part

oxygen circulatory micro air pump(12v 4.8w)

water circulatory micro water pump(6v 12w)

4.2 Software

4.3 Network part

There are two WIFI in our campus: csu-eid and csu-guest, csu-eid is a WPA2 enterprise WIFI. At first, we want to use cloud server in Digitalocean as our project server. But we find in Aggie village, we can't send UDP packet, and in engering building we can send UDP packet to server, but we can't return back UDP packet from cloud server, because of intranet. So we have to set a raspberry pi in BC infill as our server, and connect NodeMCU and raspberry pi in a same hotspot.

4.3.1 3d model part

Blender 3D model software made by Blender Foundation. One of the professional 3d software in the world. We use it in Linux system.

4.3.2 Code part

we have submited our code to Github (We have write the comment in each code file). Fishtank.h and fishtank.cpp is our Arduino library written by ourselves, and mainfish.ino is our arduino main file. Fishtank.html is the webpage of our server. As for webpage, we use HTML combine with PHP.
Here is the github link:
`https://github.com/HuanjiaLiu/Arduino/tree/master/fishtank/mainfish`

4.4 Conclusion

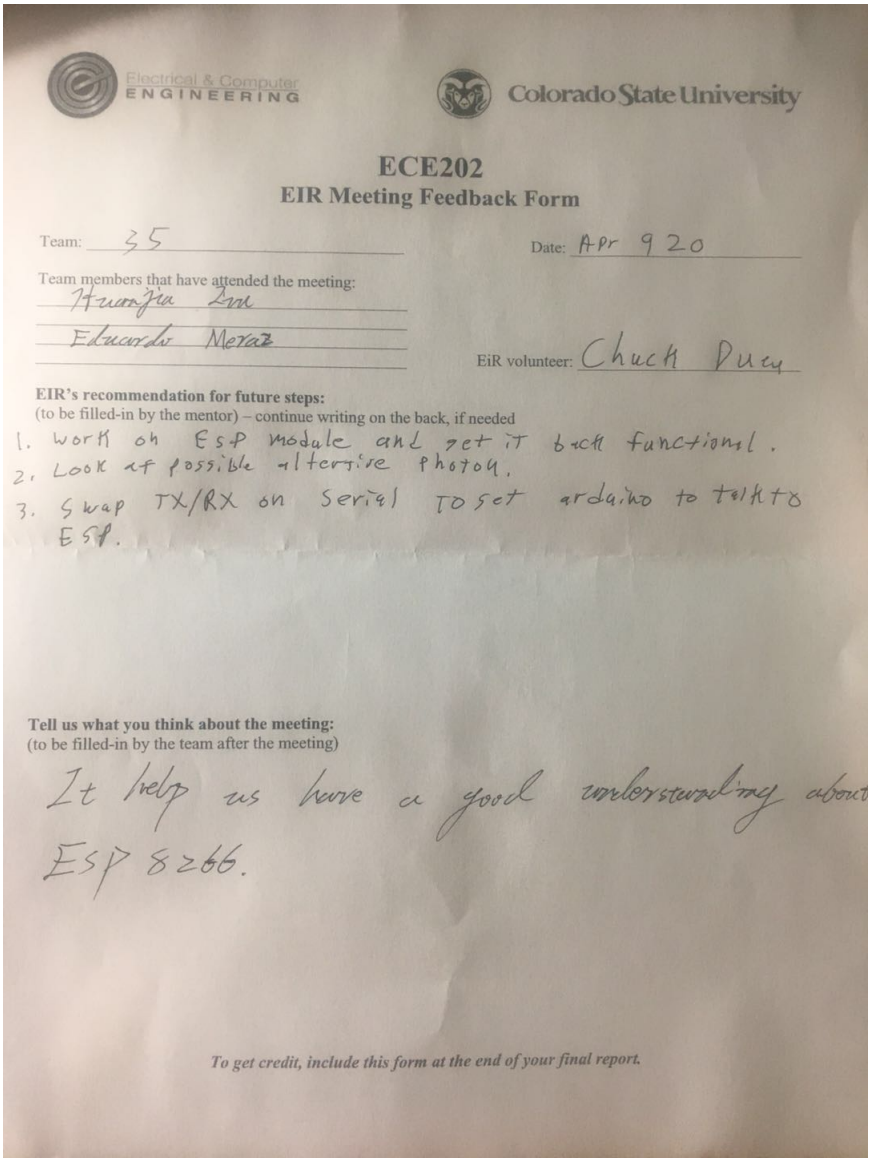
This is an unforgettable life experience. Through this project, we have mastered a lot of new knowledge and have the opportunity to apply what we have learned in practice.

5 Bibliography

Tip122:https://www.onsemi.com/pub/Collateral/TIP120-D.PDF

NTC Thermistors:https://cdn.sparkfun.com/datasheets/Sensors/Temp/ntcle100.pdf

NodeMCU:http://www.handsontec.com/pdf_learn/esp8266-V10.pdf



Electrical & Computer ENGINEERING

Colorado State University

ECE202

EIR Meeting Feedback Form

Team: 35

Date: Apr 9 20

Team members that have attended the meeting:

Huanjia Zou

Eduardo Meraz

EiR volunteer: Chuck Ducy

EIR's recommendation for future steps:
(to be filled-in by the mentor) – continue writing on the back, if needed

1. Work on Esp module and get it back functional.
2. Look at possible alternative photos.
3. Swap TX/RX on Serial to set arduino to talk to Esp.

Tell us what you think about the meeting:
(to be filled-in by the team after the meeting)

It help us have a good understanding about Esp 8266.

To get credit, include this form at the end of your final report.

Figure 8: Feedback Form