uOttawa

University of Ottawa
GNG 1103: Engineering Design

Project Deliverable G: Prototype II and Customer Feedback

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October 13, 2022

Abstract

In the following deliverable, an updated prototype version is presented. Our team worked on improving the previously created design with better materials and more functionality. Sensors were set up and tested. Housing for the node mcu module was built. The cell for sensors to live in was put together and tested. Our set up and findings were presented to our client for feedback, which is analyzed and discussed here as well. Updated test plan for the future prototypes is included.

Wrike Snapshot (Our Wrike is not functioning).

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1. Introduction

When brewing beer, there are many factors at play. Depending on how these factors are adjusted, the result may produce different flavors. One of the biggest challenges is keeping track of specific gravity of the brewing liquid. This measurement allows the user to determine at which stage the wort is currently. With this project, our team is hoping to create a device that would simplify and automate some of these measurements. In the previous deliverables, we presented the first prototype consisting of household materials of what our device is intended to look like. In the following deliverable, we reworked and improved our device. This version includes better materials and more functionality. We analyzed client's feedback on our previous deliverable and made sure to incorporate it.

2. Client's Feedback

Our latest client meeting is where we presented our ideas generated from previous client feedback along with our first prototype of our specific gravity measurement device. Once again, the client's reaction to our presentation was very positive and therefore didn't give us a lot of criticism to improve our design. The client did voice their concern over the size of the sensors and whether or not the device will realistically fit to the tank. We used our prototype and device drawing to answer our clients' questions and reassure them that the sensors will work with their model of tank. This client meeting also allowed us the opportunity to ask some last-minute questions that ensure that our design goals are realistic and fit the client's needs. Our question was about the pressure in the tank, we asked this to ensure that our device and method of sealing the tank will be able to withstand the pressure that is found within the tank. Overall, the client meeting provided feedback that helped reinforce our ideas and confirmed that we were taking our client's needs into account. The feedback from the client and class didn't indicate any need for specific changes or concerns over our ideas or prototype.

3. Prototype II

For prototype II, our team prepared and verified each section of the final prototype. For sensors, a temperature sensor was set up and tested. Due to time constraints and products arriving late, we were not able to code and set up the tilt sensor on time. The cell housing was set up and tested to be buoyant and sealed with the wire. We also created a layout of the box for the node mcu to live in that will be laser cut and assembled this week. Our goal for the next prototype is to assemble all the pieces into one final and functional version.

Image 3.1: Prototype II Sensors

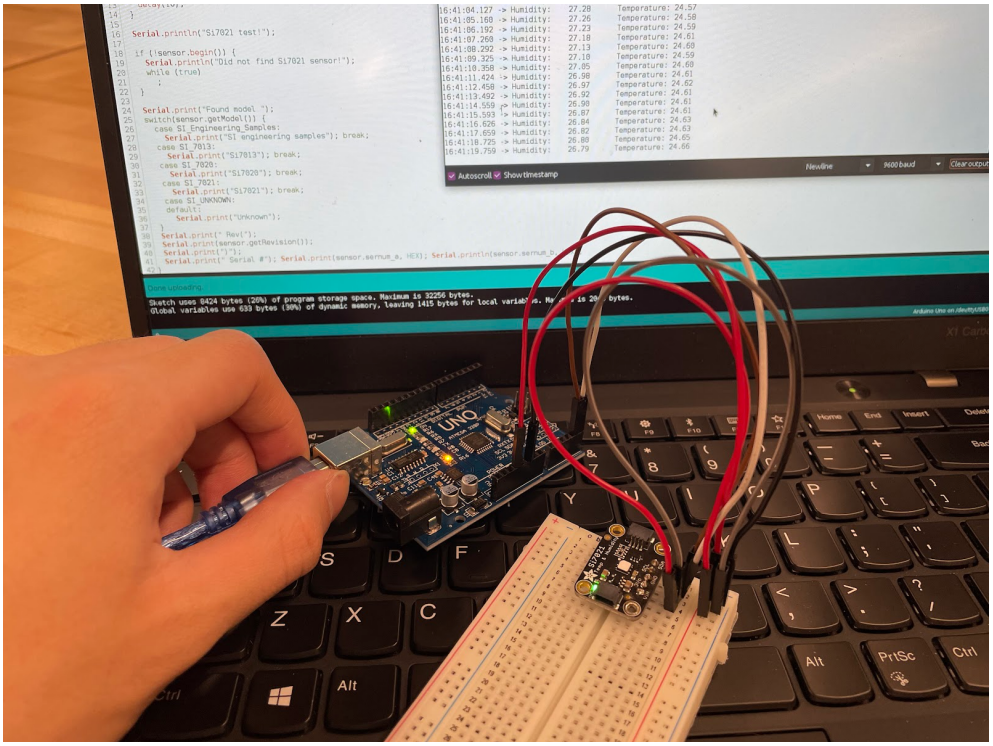


Image 3.2: Prototype II Cell Set Up

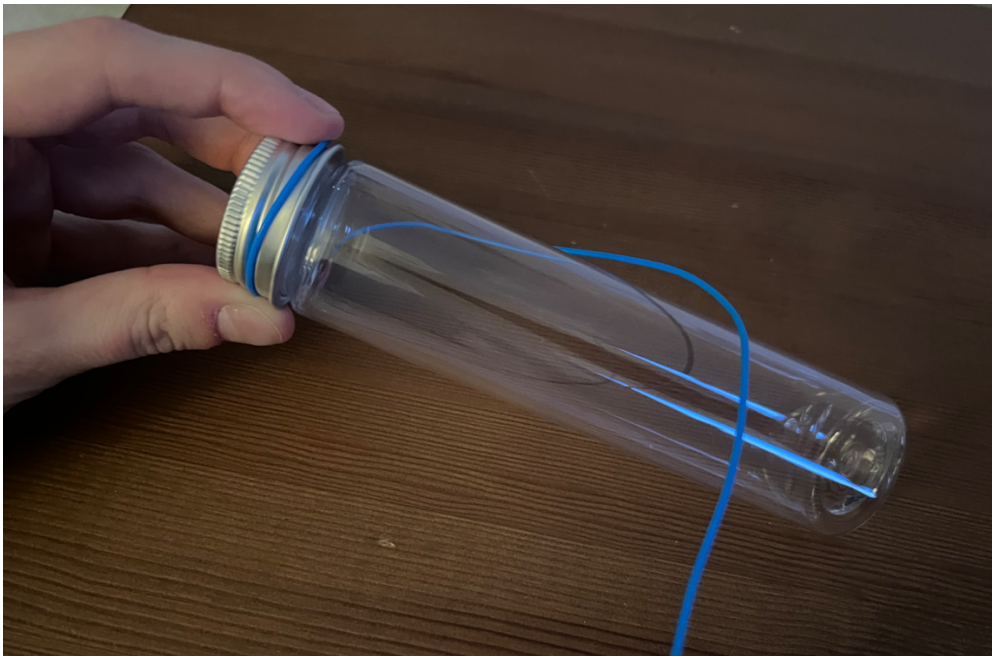
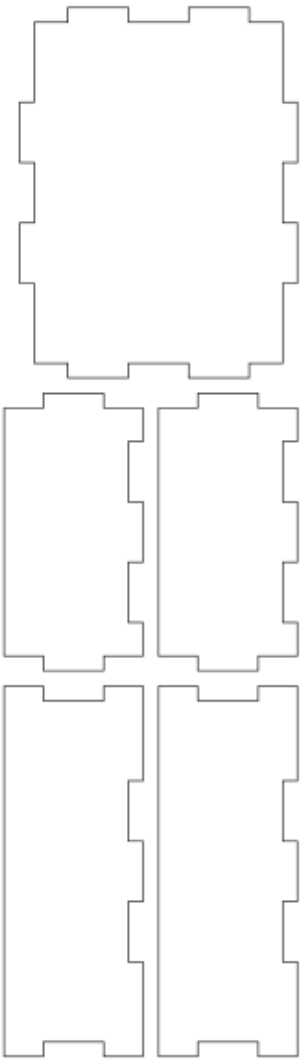


Image 3.3: Prototype II Node MCU Module Housing



4. System Analysis

In this prototype, the function of the code was to read the temperature and also the tilt of the sensors and display it for the user to see. The code will start a serial connection to communicate the data, then it will gather the temperature and angle using the attached temperature and gyroscope sensors. It will then display it to the serial monitor and repeat this loop. During this prototype, we were able to read the temperature and display it to the serial monitor but were unable to get the accelerometer/gyroscope to work due to time constraints. We were able to solder header pins to the accelerometer/gyroscope but were not able to get it to function on time.

5. Project Updates

For this prototype, we worked on improving the materials' quality and functionality. We put together a cell set up, within which the sensors will be attached. This cell is intended to swim inside the tank and collect measurements. The cell housing has been added to the updated bill of materials below. Additionally, we explored different port options, but settled on the metal cap which should fit around the port entrance based on our measurements. We researched various options, but due to budgeting constraints, this felt like the right fit. It has also been added to the updated bill of materials below.

Table 5.1: Updated Bill of Materials

Material	**Quantity**	**Total Cost (CAD)**	**Source**
MDF	2x2 feet	-	MakerLab Store
Wood Glue	2 mL	-	MakerLab Store
Accelerator/Gyroscope	1	11.00	Amazon Link
Node mcu Wi-Fi Module	1	6.33	MakerLab Store
USB Cable	1	7.00	MakerLab Store
USB-AC Adapter	1	7.00	MakerLab Store
Temperature Sensor	1	13.44	MakerLab Store
Silicone	1	16.35	Amazon Link
Wire	5 feet	5.00	MakerLab Store
Pill Cell	1	1.63	Amazon Link
Port	1	8.83	HomeDepot
	Total	**$76.58**	

6. Prototype test plan

For the sensor part of the prototype, we were only able to get the temperature sensor to work due to time restraints and shipping delays. We were able to connect the temperature sensor to an Arduino Uno and were able to read and display the temperature to the serial monitor. We tested it by first letting it read the temperature of the room which was 24 degrees Celsius and then by putting my hand on it to try and raise the heat. The result was achieved and the temperature did rise and was displayed. We also soldered heater pins to the accelerometer/gyroscope to allow us to test and make it function during the next prototype.

For the cell portion of the device, we tested a few different housing options. In the end, we settled on a plastic test tube with a screw top. There were a few benefits to this option. First off, its shape allows for great distribution of weight across the device to keep it as straight as possible when in the water. Secondly, the entrance to the tube allows for easy deposit of sensors. Other bottles of such size required cutting additional openings, which significantly impacted the aesthetic look of the device. The screw top of the tube seals very tight, so the components within the tube are secure and waterproof. Additionally, the screw top was easy to work with to create an opening for the wire to go through. We sealed this opening with food grade silicon to keep the device waterproof. To test the cell, we added a couple of lightweight screws to mimic the sensors and submerged it in the water. The device was buoyant as expected due to its lightweight nature and proper seal. With the next prototype, both sensors will be inputted and securely attached. Test plan for prototype III and test schedule are outlined below.

The Mode CNU will also be encapsulated in a wooden box for aesthetic purposes and to ensure the safety of the device in working conditions.

Table 6.1: Prototype III Test Plan and Schedule

	Test	**Objective**	**Schedule**
Test 1	Device assembly.	Last verification step that all parts are put together aesthetically but also correctly.	November 20th. Test duration: 5 minutes.
Test 2	Code testing.	Last verification of the code using node mcu module and PC that it runs smoothly.	November 20th Test duration: 10 minutes
Test 3	Sensors testing to verify their performance.	Device to be placed in the water to receive measurements.	November 20th. Test duration: 30 minutes.
Test 4	Verification of device fitting set design criteria.	Verify design compared to set parameters and client's feedback.	November 20th. Test duration: 15 minutes.

7. Conclusions

In conclusion, there are different stages to producing beer. The best way to track these stages is using the specific gravity measurement. Our team came up with a design that would help simplify the measurement process for our client. From prototype I to prototype II, we improved materials' quality and functionality of our device. We tested and ensured that cell housing was buoyant and sealed. We also tested temperature and tilt sensors to ensure proper work. Our client provided us with feedback for prototype I, which we analyzed and incorporated into prototype II to ensure his needs and objectives being met. Our team is confident with the progress that has been made thus far. We believe that we are on track to produce a functional and aesthetically pleasing device by Design Day that would fulfill our client's objectives and needs.