

**University of Ottawa**

**GNG 1103B: Engineering Design**

**Project Deliverable D:**

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**1. Introduction**

In this deliverable, we brainstormed together possible methods of measuring specific gravity, and possible subsystems for a final solution. We picked our top three potential solutions with their subsystems and presented the pro’s and con’s of each solution.

**2. Ideal Solution**

Ideal solution has three subsystems.

1st stage: Pressure sensor within fermentation tank.

2nd stage: Pressure is recorded, data is transferred to a computer, using fluid density formula, with depth manually inputted, density is used in specific gravity formula.

3rd stage: Data is stored and displayed.

Pros: Little cost, easy to install

Cons: Manual input

**3. Other Potential Solutions**

**First Other Potential Solution**

The next solution has 3 subsystems.

1st stage: Pressure sensor & hypersonic sensor within fermentation tank.

2nd stage: Pressure is recorded, data is transferred to computer, using fluid density formula, and depth measured with hypersonic sensor, density is used in specific gravity formula.

3rd stage: Data is stored and displayed.

Pros: Very little potential human error

Cons: Expensive, have to modify tank unless budget is increased for wireless ultrasonic sensor.

**Cost for Parts:**

Arduino Uno:

<https://3dprintingcanada.com/products/arduino-uno-r3-with-usb-cable?variant=14108869001259&ab_version=A&gclid=Cj0KCQjw166aBhDEARIsAMEyZh5s8r77U55WWtbn67Xr_Pjd5ZFPTpeuqUimcWwUOjPX1f9XfN3N4d8aAlnyEALw_wcB>

Is $16.95 for a cloned version at 3D printing Canada.

Laser Cutting Material:

<https://makerstore.ca/shop/ols/products/mdf/v/M003-1-8-18-NCH>

MDF sheets are $3. Is much cheaper than 3D printing plastic.

Wires:

<https://makerstore.ca/shop/ols/products/jumper-cables-per-10>

Wires come in 10 packs for a dollar on the Makerspace store.

Pressure sensor:

[https://www.amazon.ca/Pressure-Transducer-0-5-4-5V-Transmitter-0-10PSI/dp/B07KJHRPLG/ref=asc\_df\_B07KJHRPLG/?tag=googleshopc0c-20&linkCode=df0&hvadid=459373244838&hvpos=&hvnetw=g&hvrand=7623527019706849480&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-680768994210&psc=1](https://www.amazon.ca/Pressure-Transducer-0-5-4-5V-Transmitter-0-10PSI/dp/B07KJHRPLG/ref%3Dasc_df_B07KJHRPLG/?tag=googleshopc0c-20&linkCode=df0&hvadid=459373244838&hvpos=&hvnetw=g&hvrand=7623527019706849480&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-680768994210&psc=1)

Pressure sensor on Amazon. Is $30. Is made for measuring pressure in liquids so we will not have to worry about compatibility with our problem.

Water Proofing Material:

[https://www.amazon.ca/Gorilla-Waterproof-Flexible-Rubberized-104058/dp/B093CCJ5QT/ref=asc\_df\_B093CCJ5QT/?tag=googleshopc0c-20&linkCode=df0&hvadid=459346807567&hvpos=&hvnetw=g&hvrand=16455699946412004230&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-1361105076162&psc=1](https://www.amazon.ca/Gorilla-Waterproof-Flexible-Rubberized-104058/dp/B093CCJ5QT/ref%3Dasc_df_B093CCJ5QT/?tag=googleshopc0c-20&linkCode=df0&hvadid=459346807567&hvpos=&hvnetw=g&hvrand=16455699946412004230&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-1361105076162&psc=1)

Gorilla waterproof spray on amazon for $20.

Ultrasonic Sensor:

[https://www.amazon.ca/HC-SR04-Ultrasonic-Distance-Arduino-MEGA2560/dp/B01COSN7O6/ref=asc\_df\_B01COSN7O6/?tag=googleshopc0c-20&linkCode=df0&hvadid=292950548836&hvpos=&hvnetw=g&hvrand=11215646517062772435&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-493075951829&psc=1](https://www.amazon.ca/HC-SR04-Ultrasonic-Distance-Arduino-MEGA2560/dp/B01COSN7O6/ref%3Dasc_df_B01COSN7O6/?tag=googleshopc0c-20&linkCode=df0&hvadid=292950548836&hvpos=&hvnetw=g&hvrand=11215646517062772435&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-493075951829&psc=1)

Wired ultrasonic sensor on amazon for $14.

**Picture of Concept Design:**

<https://drive.google.com/file/d/1f0FeJvM_3weWOxAuqqg6ie6VdAvhTXuV/view?usp=sharing>

**Second Other Potential Solution**

The last solution has 3 subsystems.

1st stage: Pressure sensor within a sample section attached to fermentation tank.

2nd stage: Pressure is recorded, data is transferred to computer, using fluid density formula, with depth of sample section, density is used in specific gravity formula.

3rd stage: Data is stored and displayed.

Pros: Easy to use, no waste

Cons: Harder to clean, expensive, harder to install

Pressure sensor ($15-$20) [https://www.amazon.ca/RP-S40-ST-Accuracy-Pressure-Intelligent-Induction/dp/B07FCLV5BJ/ref=asc\_df\_B07FCLV5BJ/?tag=googleshopc0c-20&linkCode=df0&hvadid=292953501307&hvpos=&hvnetw=g&hvrand=11232756650727439014&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-618017233412&psc=1](https://www.amazon.ca/RP-S40-ST-Accuracy-Pressure-Intelligent-Induction/dp/B07FCLV5BJ/ref%3Dasc_df_B07FCLV5BJ/?tag=googleshopc0c-20&linkCode=df0&hvadid=292953501307&hvpos=&hvnetw=g&hvrand=11232756650727439014&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-618017233412&psc=1)

Pump ($14-$17)

[https://www.amazon.ca/WayinTop-Submersible-Flexible-Fountain-Aquarium/dp/B07TMW5CDM/ref=asc\_df\_B07TMW5CDM/?tag=googleshopc0c-20&linkCode=df0&hvadid=293004366202&hvpos=&hvnetw=g&hvrand=12880445979950975127&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-810827634213&psc=1](https://www.amazon.ca/WayinTop-Submersible-Flexible-Fountain-Aquarium/dp/B07TMW5CDM/ref%3Dasc_df_B07TMW5CDM/?tag=googleshopc0c-20&linkCode=df0&hvadid=293004366202&hvpos=&hvnetw=g&hvrand=12880445979950975127&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-810827634213&psc=1)

[https://www.amazon.ca/Gikfun-Submersible-Fountain-Aquarium-EK1893C/dp/B07BKXJXK1/ref=d\_pd\_sbs\_sccl\_3\_1/136-9149179-8188024?pd\_rd\_w=9AnA3&content-id=amzn1.sym.cd949bb3-28b2-48f4-9c3b-7259e3470a97&pf\_rd\_p=cd949bb3-28b2-48f4-9c3b-7259e3470a97&pf\_rd\_r=FNJCEX8MQ779YGJBR0VB&pd\_rd\_wg=db7Er&pd\_rd\_r=3cc1e802-2b2d-4969-a49a-39a8b2008f74&pd\_rd\_i=B07BKXJXK1&psc=1](https://www.amazon.ca/Gikfun-Submersible-Fountain-Aquarium-EK1893C/dp/B07BKXJXK1/ref%3Dd_pd_sbs_sccl_3_1/136-9149179-8188024?pd_rd_w=9AnA3&content-id=amzn1.sym.cd949bb3-28b2-48f4-9c3b-7259e3470a97&pf_rd_p=cd949bb3-28b2-48f4-9c3b-7259e3470a97&pf_rd_r=FNJCEX8MQ779YGJBR0VB&pd_rd_wg=db7Er&pd_rd_r=3cc1e802-2b2d-4969-a49a-39a8b2008f74&pd_rd_i=B07BKXJXK1&psc=1)

Load cell weighting sensor ($13-$16)

[https://www.amazon.ca/Weight-Electronic-Kitchen-Weighing-Geekstory/dp/B079FQNJJH/ref=asc\_df\_B079FQNJJH/?tag=googleshopc0c-20&linkCode=df0&hvadid=335157143702&hvpos=&hvnetw=g&hvrand=254990251822397826&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-421323923408&psc=1](https://www.amazon.ca/Weight-Electronic-Kitchen-Weighing-Geekstory/dp/B079FQNJJH/ref%3Dasc_df_B079FQNJJH/?tag=googleshopc0c-20&linkCode=df0&hvadid=335157143702&hvpos=&hvnetw=g&hvrand=254990251822397826&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-421323923408&psc=1)

[https://www.amazon.ca/Half-bridge-Weight-Weighting-Amplifier-Bathroom/dp/B07B4DNJ2L/ref=asc\_df\_B07B4DNJ2L/?tag=googleshopc0c-20&linkCode=df0&hvadid=459481149503&hvpos=&hvnetw=g&hvrand=254990251822397826&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-823819574599&psc=1](https://www.amazon.ca/Half-bridge-Weight-Weighting-Amplifier-Bathroom/dp/B07B4DNJ2L/ref%3Dasc_df_B07B4DNJ2L/?tag=googleshopc0c-20&linkCode=df0&hvadid=459481149503&hvpos=&hvnetw=g&hvrand=254990251822397826&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-823819574599&psc=1)



 **4. Extras**

* Temperature sensors: As a extension of the system. Tells the temperature and display on the screen.
Options:
[Waterproof DS18b20 Temperature Probe](https://www.pishop.ca/product/water-proof-ds18b20-temperature-probe/) $8.95
[5M DS1820 Stainless steel package Waterproof DS18b20 temperature probe temperature sensor 18B20 For Arduino](https://www.aliexpress.us/item/1005003017313835.html?_randl_currency=CAD&src=google&src=google&albch=shopping&acnt=631-313-3945&slnk=&plac=&mtctp=&albbt=Google_7_shopping&albagn=888888&isSmbActive=false&isSmbAutoCall=false&needSmbHouyi=false&albcp=17315617610&albag=137715062355&trgt=1657626342641&crea=en1005003017313835&netw=u&device=c&albpg=1657626342641&albpd=en1005003017313835&gclid=Cj0KCQjw166aBhDEARIsAMEyZh4e4GfSDF7MGYT7gZ5pVUW6YOQsM6-U223YfVsHYq6q3DpK_WLD6roaAjQaEALw_wcB&gclsrc=aw.ds&aff_fcid=1dc3c579784f43b489a6723fcd60c0c5-1665947955921-04934-UneMJZVf&aff_fsk=UneMJZVf&aff_platform=aaf&sk=UneMJZVf&aff_trace_key=1dc3c579784f43b489a6723fcd60c0c5-1665947955921-04934-UneMJZVf&terminal_id=4d07bb6195074a1f8d2a0a5ff94a212e&afSmartRedirect=y&gatewayAdapt=glo2usa&_randl_shipto=CA) $4.55
[DS1820 Stainless steel package Waterproof DS18b20 temperature probe temperature sensor 18B20 for arduino](https://www.aliexpress.us/item/1005003966241048.html?spm=a2g0o.productlist.0.0.24af1a89XwnW94&algo_pvid=3d4b0cc6-29aa-4728-8f9d-9764c87f35c1&algo_exp_id=3d4b0cc6-29aa-4728-8f9d-9764c87f35c1-0&pdp_ext_f=%7B%22sku_id%22%3A%2212000027589712776%22%7D&pdp_npi=2%40dis%21CAD%211.36%211.36%21%21%211.85%21%21%40210318c216659480074484235e636e%2112000027589712776%21sea&curPageLogUid=gjpF3uDPQxCJ) $1.36
* Bluetooth/WiFi transmitter/receiver:As a extension of the system. Avoid problems such as cluttered lines.
[NEW HC-05 HC 05 hc-06 HC 06 RF Wireless Bluetooth Transceiver Slave Module RS232 / TTL to UART converter and adapter](https://www.aliexpress.us/item/1005002168332848.html?spm=a2g0o.productlist.0.0.343e21a7BjjFTP&algo_pvid=4d32069f-cced-48df-b6d8-18eec9eb7503&algo_exp_id=4d32069f-cced-48df-b6d8-18eec9eb7503-1&pdp_ext_f=%7B%22sku_id%22%3A%2212000018925700214%22%7D&pdp_npi=2%40dis%21CAD%213.44%212.75%21%21%211.46%21%21%402103143616659488953107598e2487%2112000018925700214%21sea&curPageLogUid=51yLxdJgnSfF) $3.44
[1Set UNO R3 Official Box ATMEGA16U2 / UNO+WiFi R3 MEGA328P Chip CH340G For Arduino UNO R3 Development Board WeMos ESP8266](https://www.aliexpress.us/item/32848546164.html?spm=a2g0o.productlist.0.0.343e21a7BjjFTP&algo_pvid=4d32069f-cced-48df-b6d8-18eec9eb7503&algo_exp_id=4d32069f-cced-48df-b6d8-18eec9eb7503-26&pdp_ext_f=%7B%22sku_id%22%3A%2212000022881268343%22%7D&pdp_npi=2%40dis%21CAD%2114.44%2111.26%21%21%215.15%21%21%402103143616659488953107598e2487%2112000022881268343%21sea&curPageLogUid=NEFixwdjDEoq) $10.03

**5. Conclusion**

In conclusion we have an ideal solution with its pros and cons. With 2 other potential solutions and price tags for all major components.