

SCIENCE



TECHNOLOGY



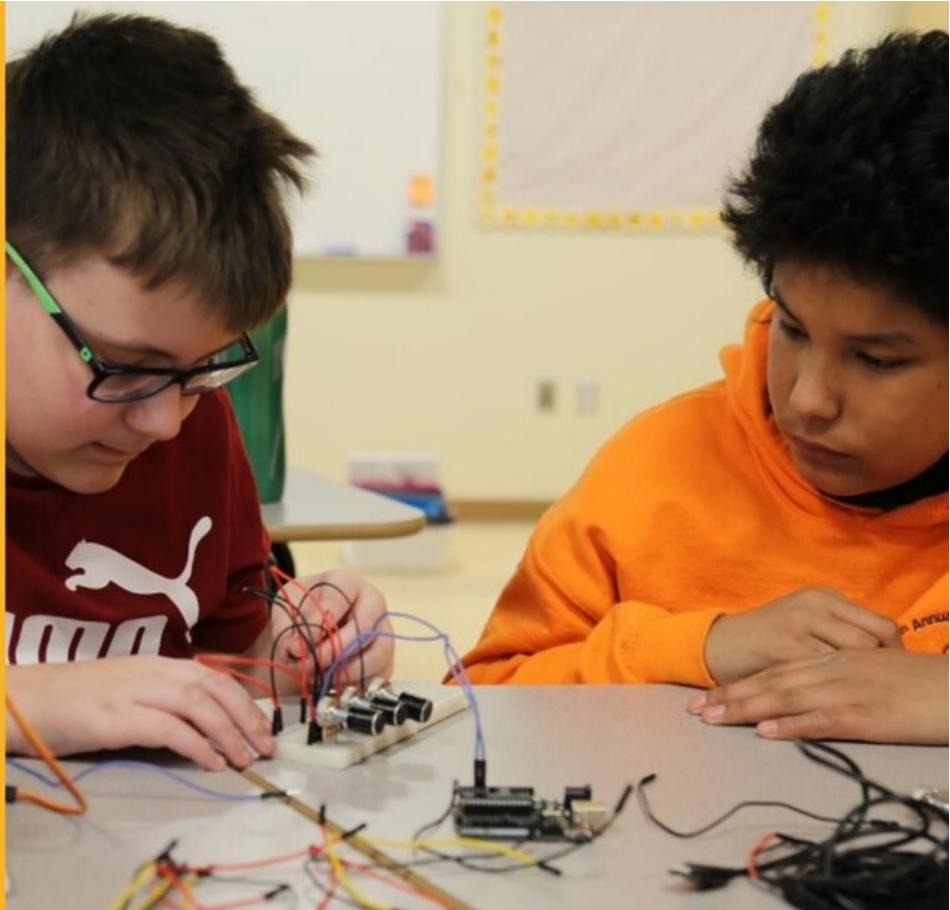
ENGINEERING



ARTS



MATH



SETTING UP YOUR GROBOT

October 2024

Ulnooweg Education Centre

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1.0 Acronyms & Terminology

- **CH** – Growth Chamber Box, referring to the lower box of the GroBot where the plants are grown.
 - *Note: During pre-production, the Growth Chamber Box was originally named the Chassis (i.e. CH for short), and this acronym was used during the laser cutting process. So, to keep things consistent, the Growth Chamber Box is referred to as CH (as seen on the GroBot's "walls" and "floors"), not GCB.*
- **EB** – Electronic Box, referring to the upper box of the GroBot which holds the electronics and cables.

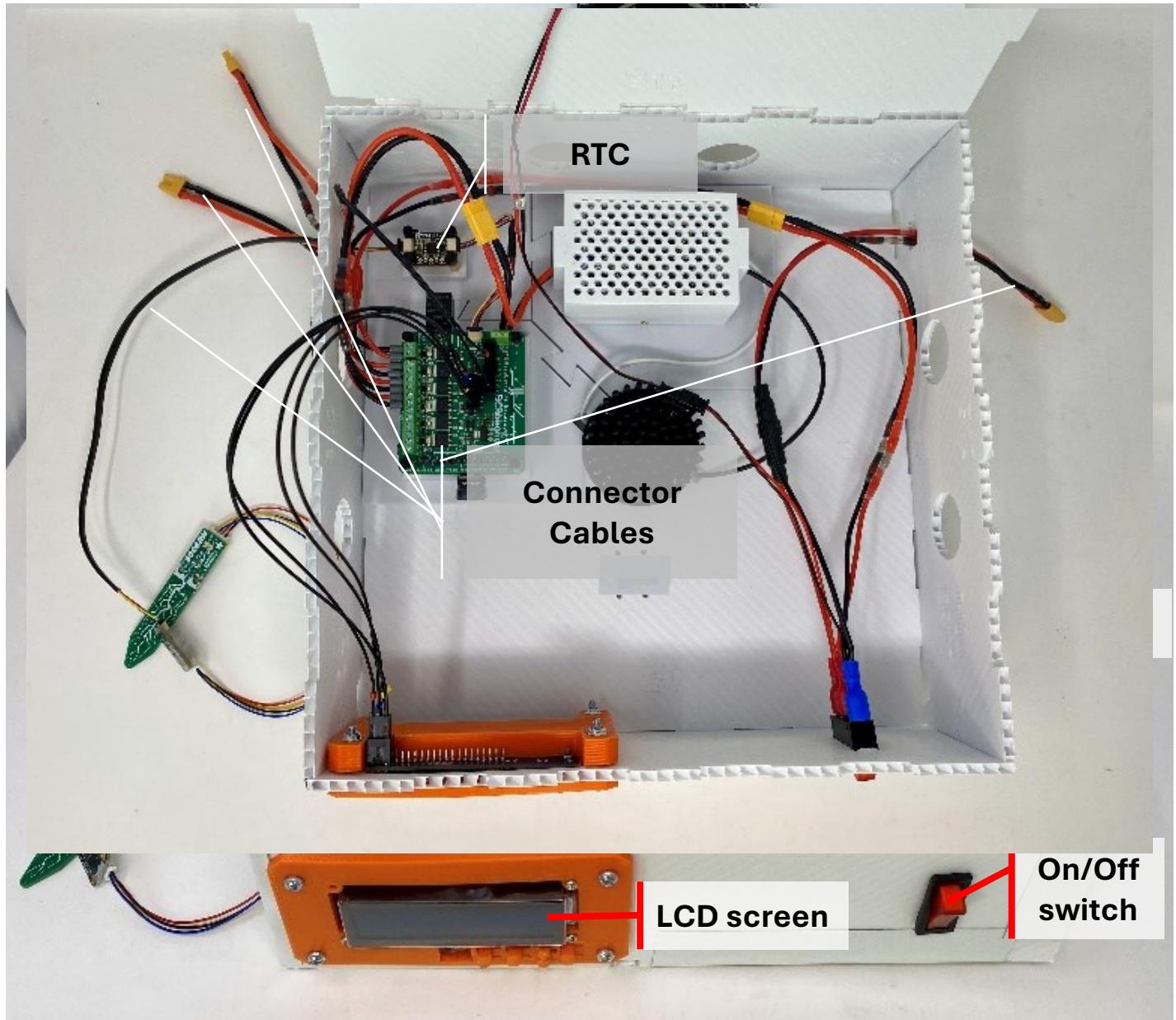
Warning terms:

| | |
|--------------------|--|
| NOTE | This step is easy to miss |
| ⚠ ATTENTION | Doing this step improperly can break something |
| ⚠ CAUTION | Not following this instruction can lead to someone getting hurt |
| 💀 DANGER | Not following this instruction can result in serious injury or death |

2.0 Components List

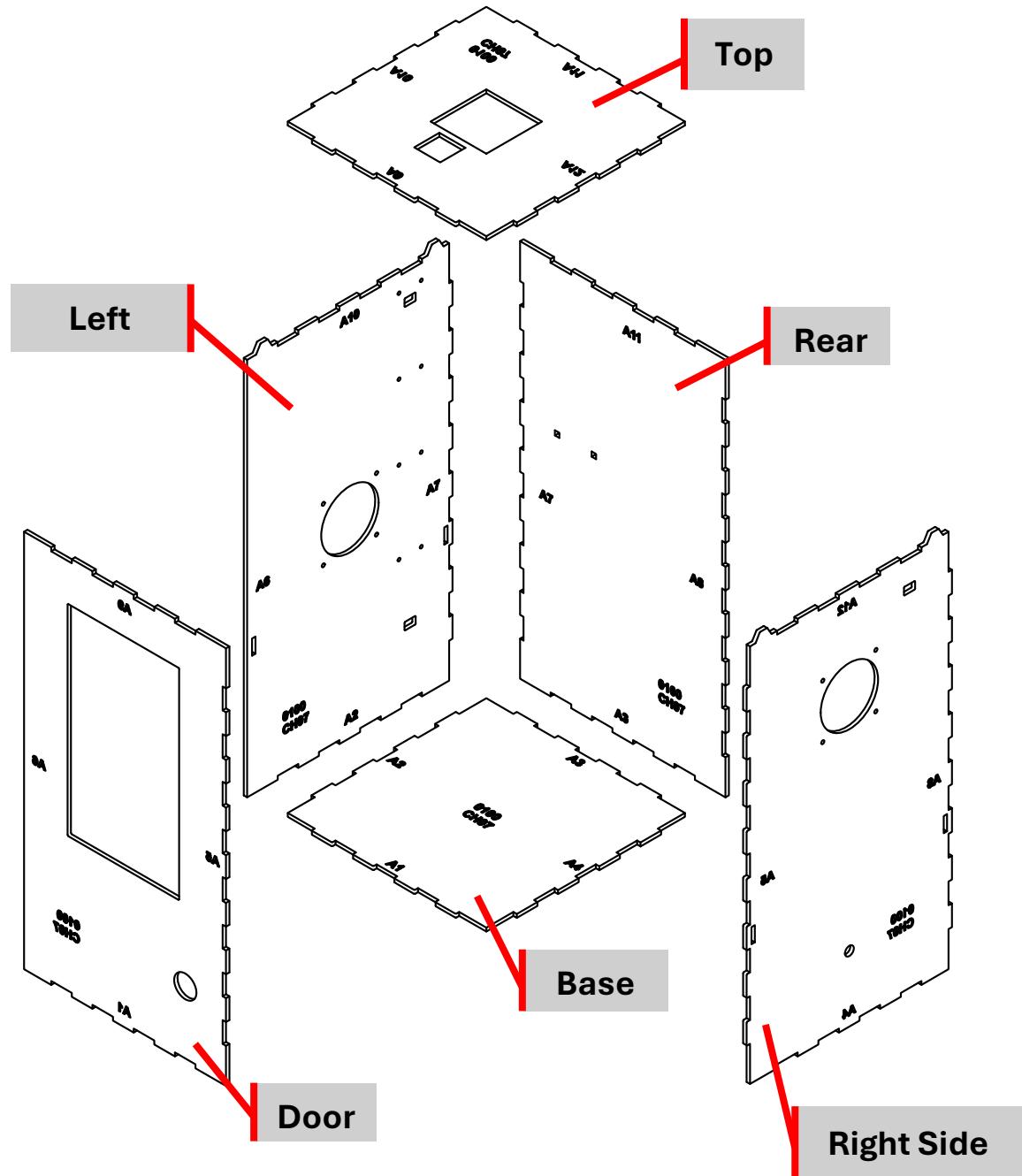
2.1 What's in Your Kit

1. Electronic Box (EB), with the following pre-attached components.

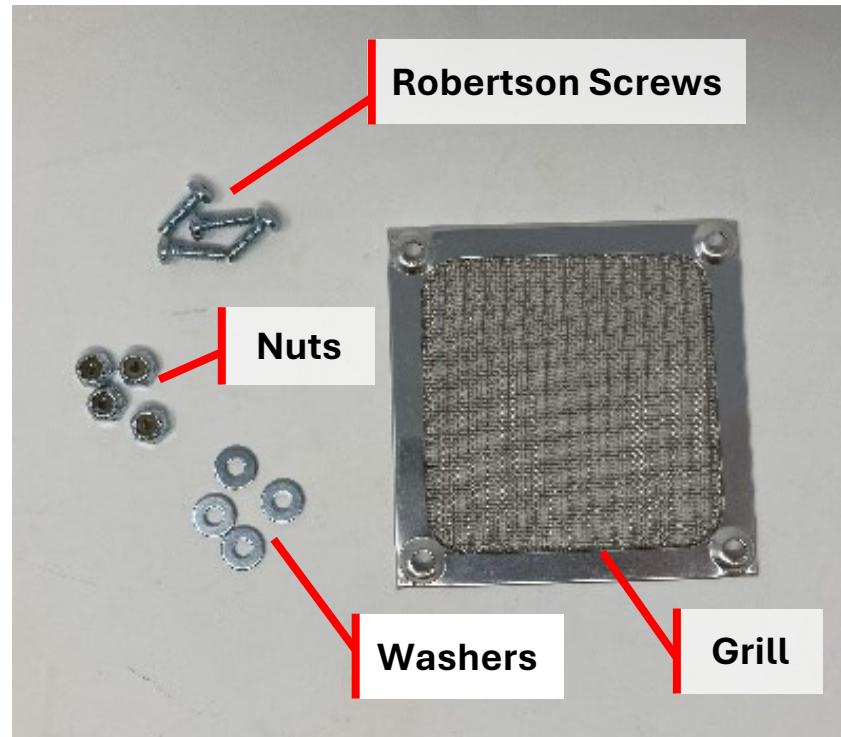


Note: Yellow connectors, with single (I) and double (II) black markings, should be threaded through the EB's left rear hole. Connector with a triple (III) marking should be threaded out through the EB's right rear hole.

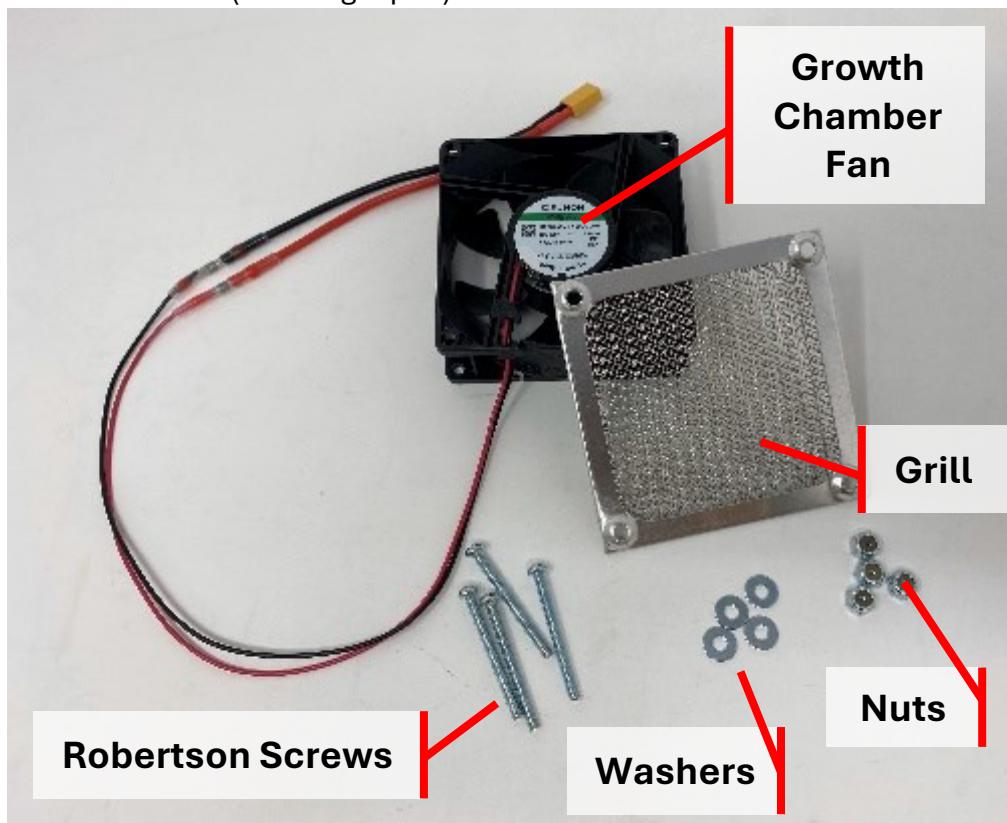
2. Six 'CH07' labelled sides (A) of base growth chamber box.
(Note: recall that Growth Chamber Box is abbreviated as "CH".)



3. Bag 1: Grill with 4 x ½" Robertson machine screws with no.6 washers and nuts.



4. Bag 2: Fan grill with 4 x 1½" Robertson machine screws with no.6 washers and nuts.
5. Growth Chamber fan (masking taped).

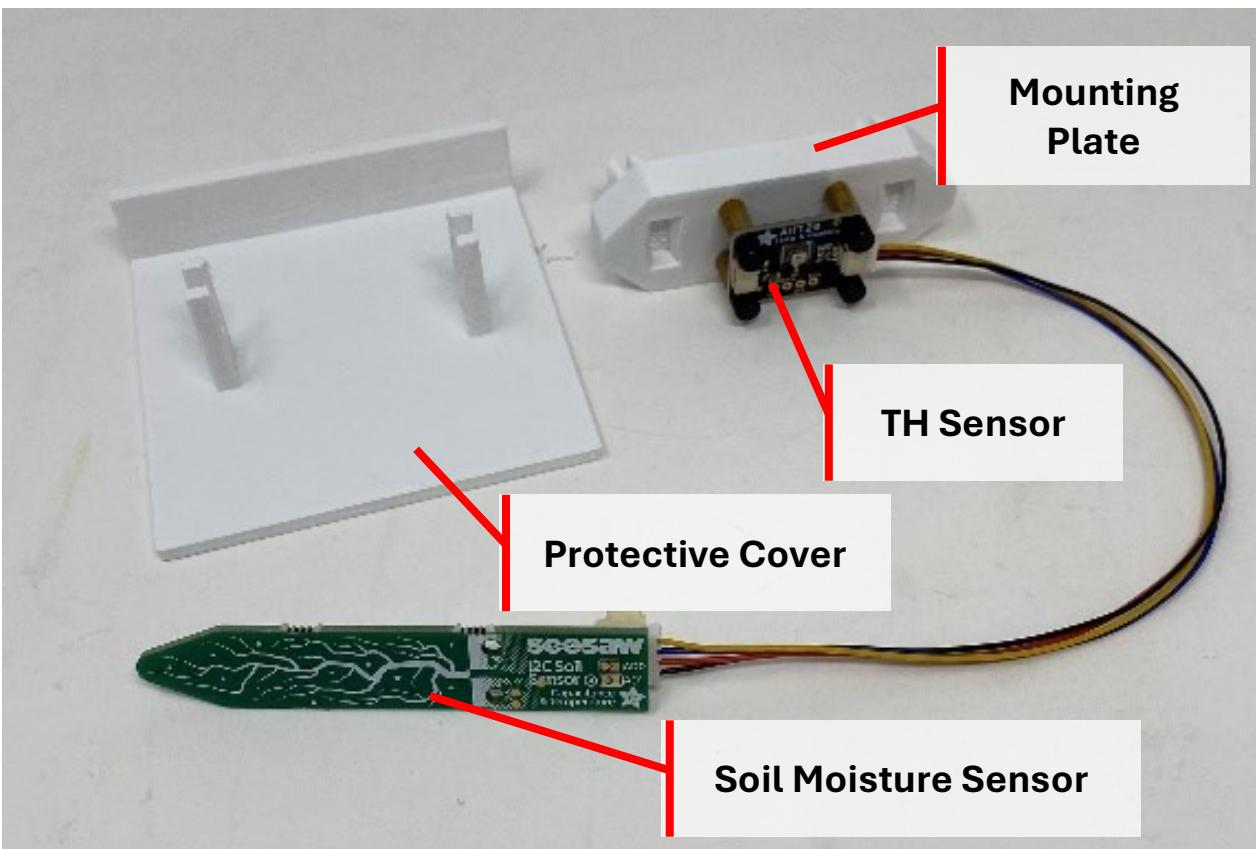


6. 2 x wooden soil tray slats.

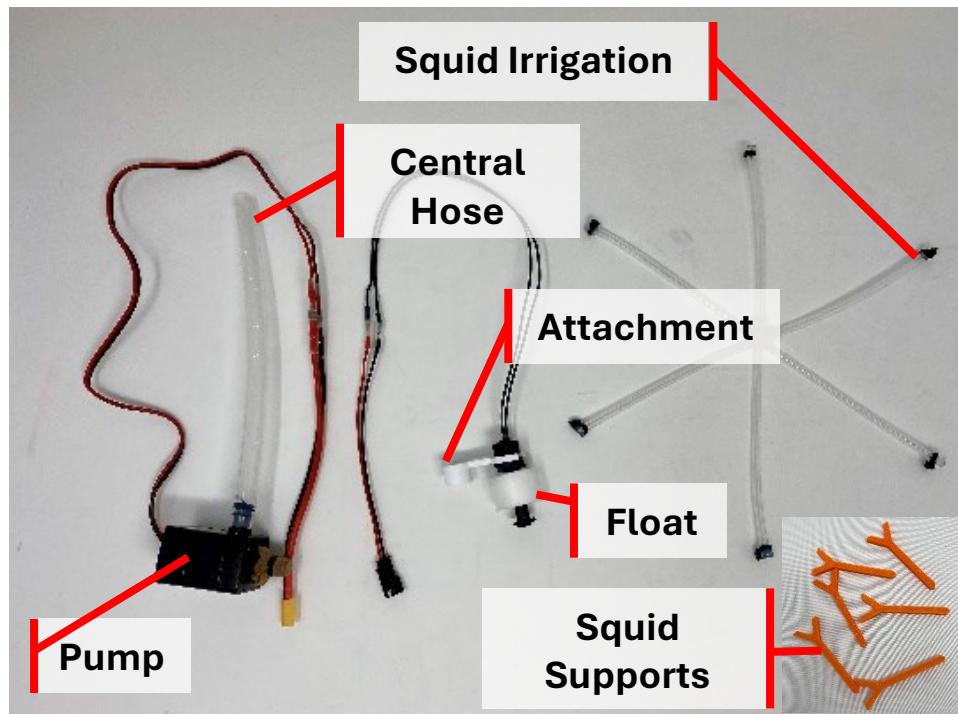


7. Soil Moisture sensor + Cord.

8. TH Sensor + mounting plate + protective cover.



9. Bag 3: Pump with pre-attached filter, central hose.
10. Bag 4: Squid supports, Float switch and attached 3D printed float switch attachment.
- 11.



Squid irrigation system.

12. Soil tray (with center hole, slotted).

13. Water tray.

Note – tray colors change with each kit!



14. External power supply - with (III) connector.



15. White gorilla tape.



2.2 Tools List

The following tools are required to assemble your GroBot. They are not included in your kit.

- Robertson CR-V 51 bit
- 8mm socket or adjustable wrench



2.3 Other Supplies Needed

- Soil
- Seeds of Your Choice
- Newspaper
- Water

3.0 Assembly Process

These instructions are for users receiving a partially-assembled GroBot from Ulnooweg Education Centre. If you are building your own kit from scratch, please refer to our *Complete Assembly Guide* for more information.

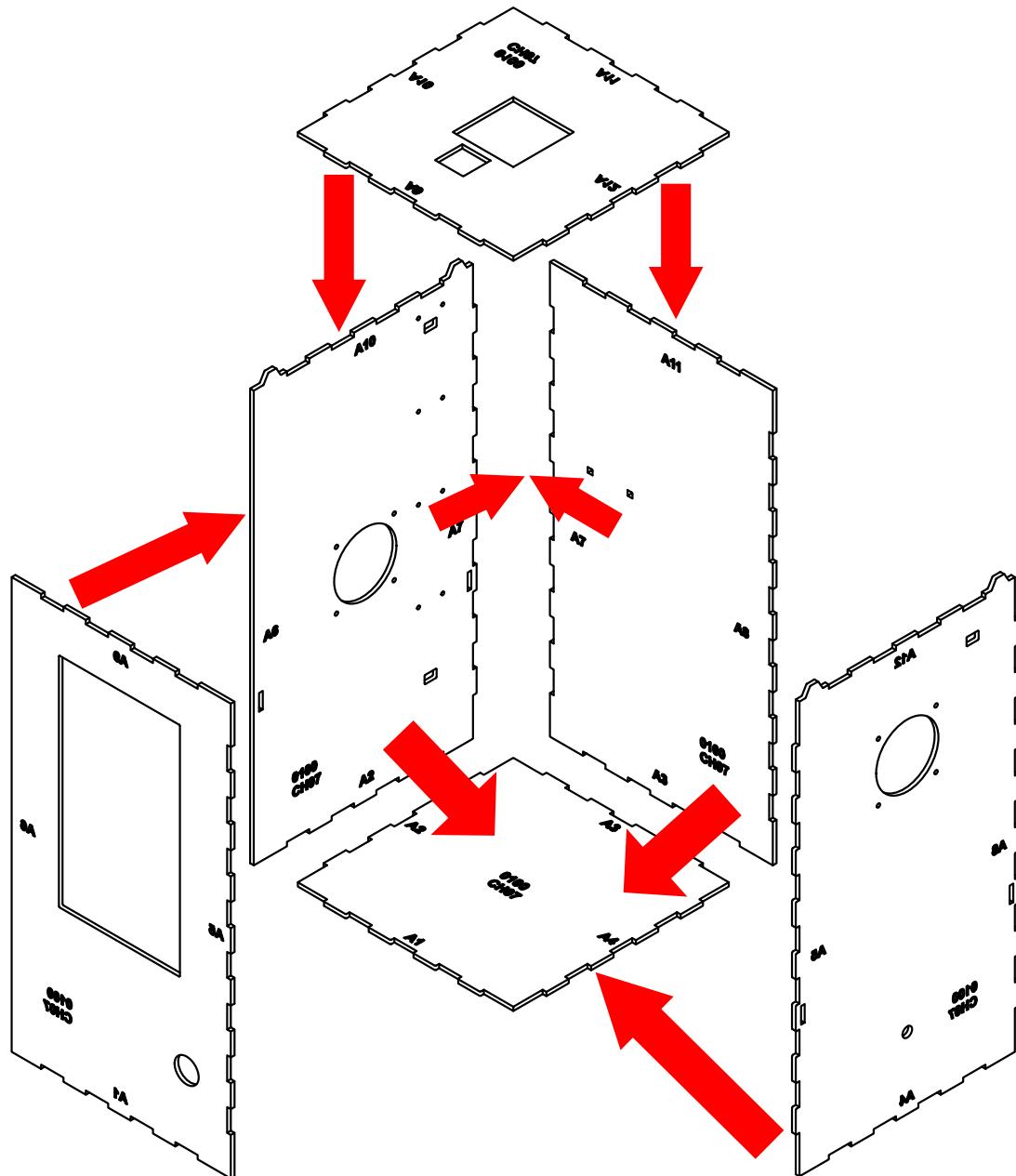
Step 1. Unwrap your GroBot kit. Using the [Component List](#) (see above), ensure all components are present and have arrived safely. Some components are stored for shipment within the top electronic box. Carefully, remove these unattached components.



Step 2. Assemble the base Growth Chamber (CH) box – marked with “A#” on all inner edge pieces, and identified with CH007.

Tools required: white gorilla tape

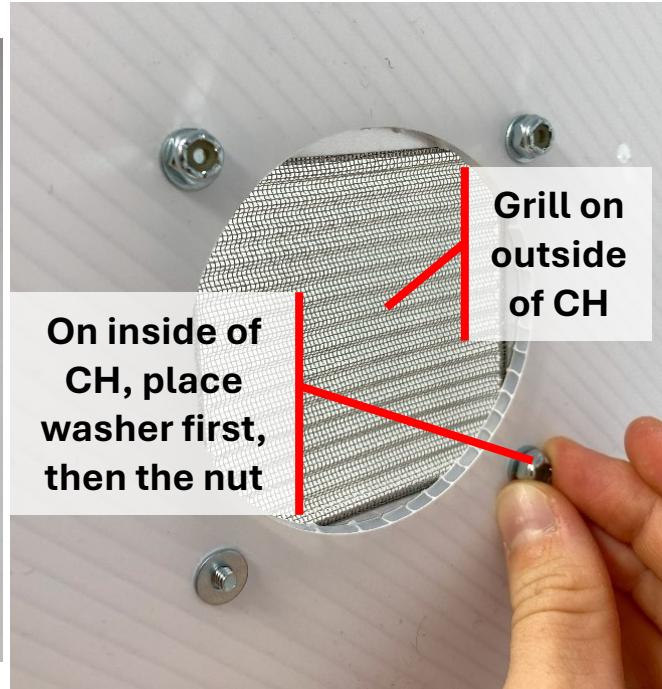
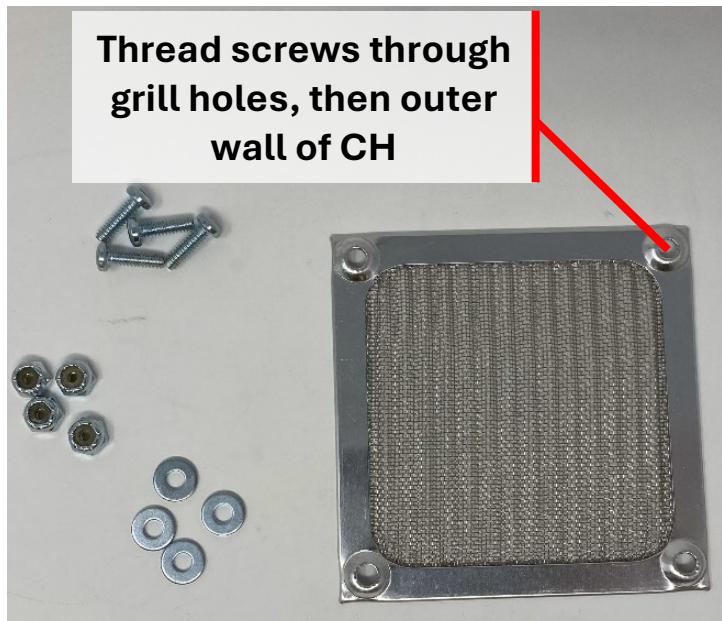
- a) Match all numbered edges to their corresponding counterpart (i.e. A1 – A1).
- b) Use provided white Gorilla tape to secure each edge, but **leave A1, A5, and A9 open; so you can open the GroBot door** (i.e., only tape the straight edges).



Step 3. Install side grill on the Growth Chamber's (CH) left side. Use four 1/2" Robertson machine screws, with associated washers and nuts from Bag 1.

Tools required: Robertson CR-V51 bit; 8mm socket.

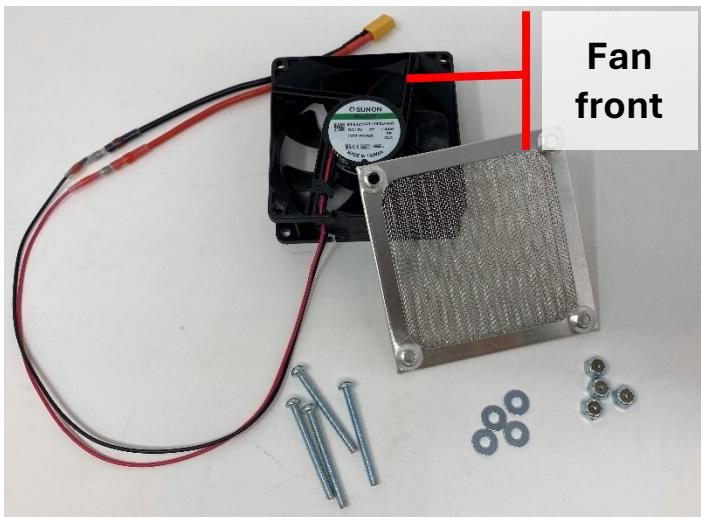
- Tighten using Robertson screwdriver and socket.



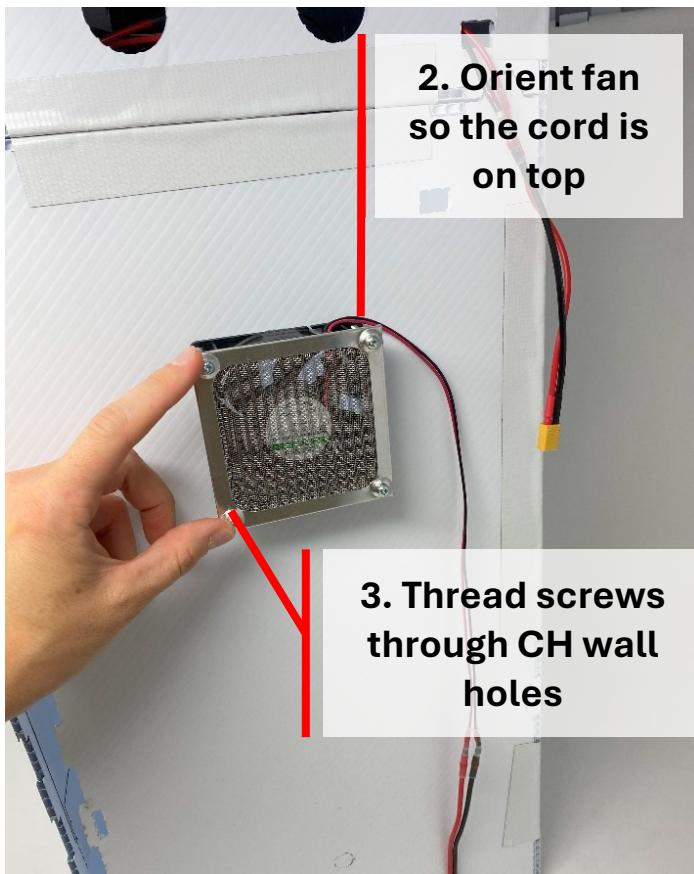
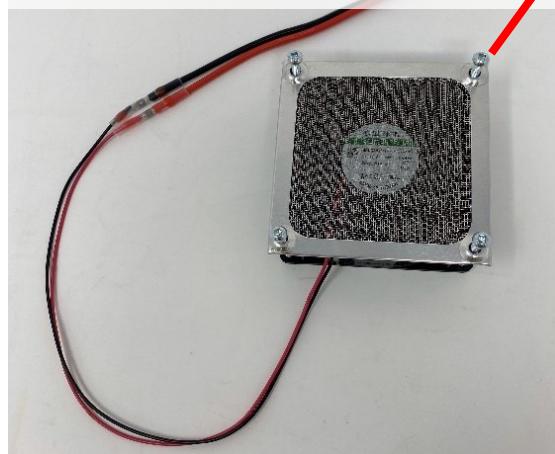
Step 4. Install CH fan on Growth Chamber's right side. Use four 1½" Robertson machine screws, with associated washers and nuts in Bag 2.

Tools required: Robertson CR-V51 bit; 8mm socket.

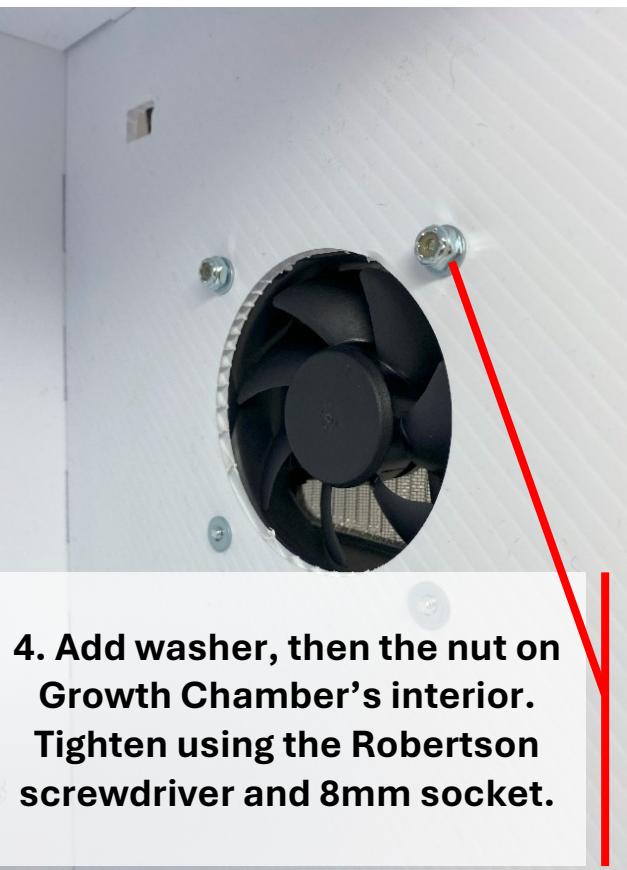
NOTE: The fan orientation, and where its cable should be routed, once attached.



1. Thread screws through the grill and fan holes

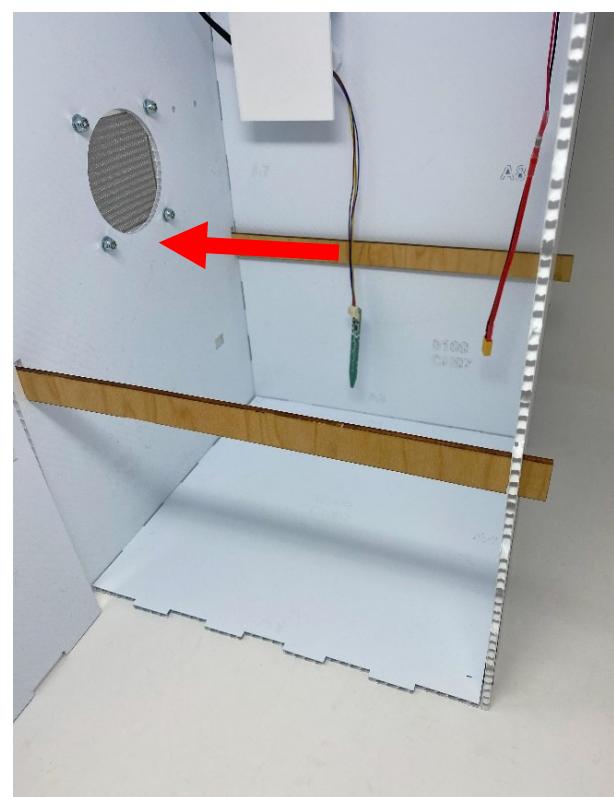
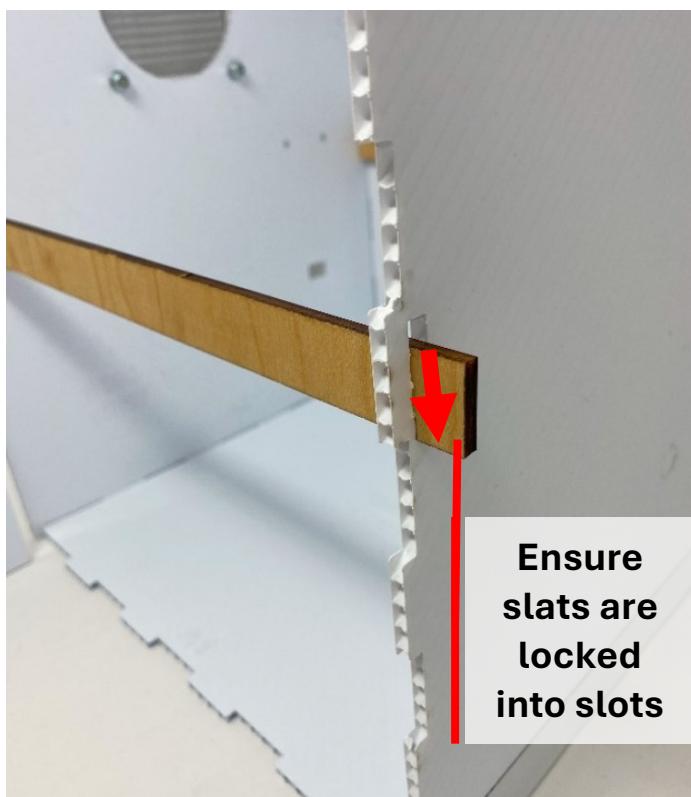
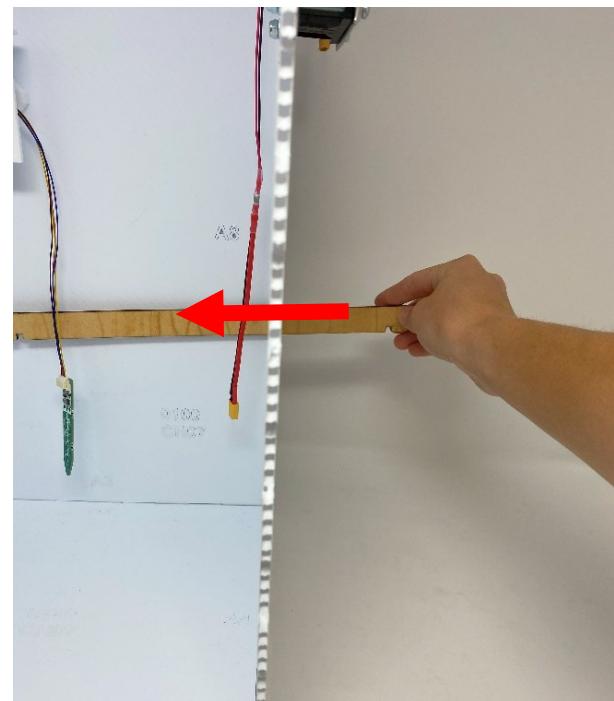


3. Thread screws through CH wall holes



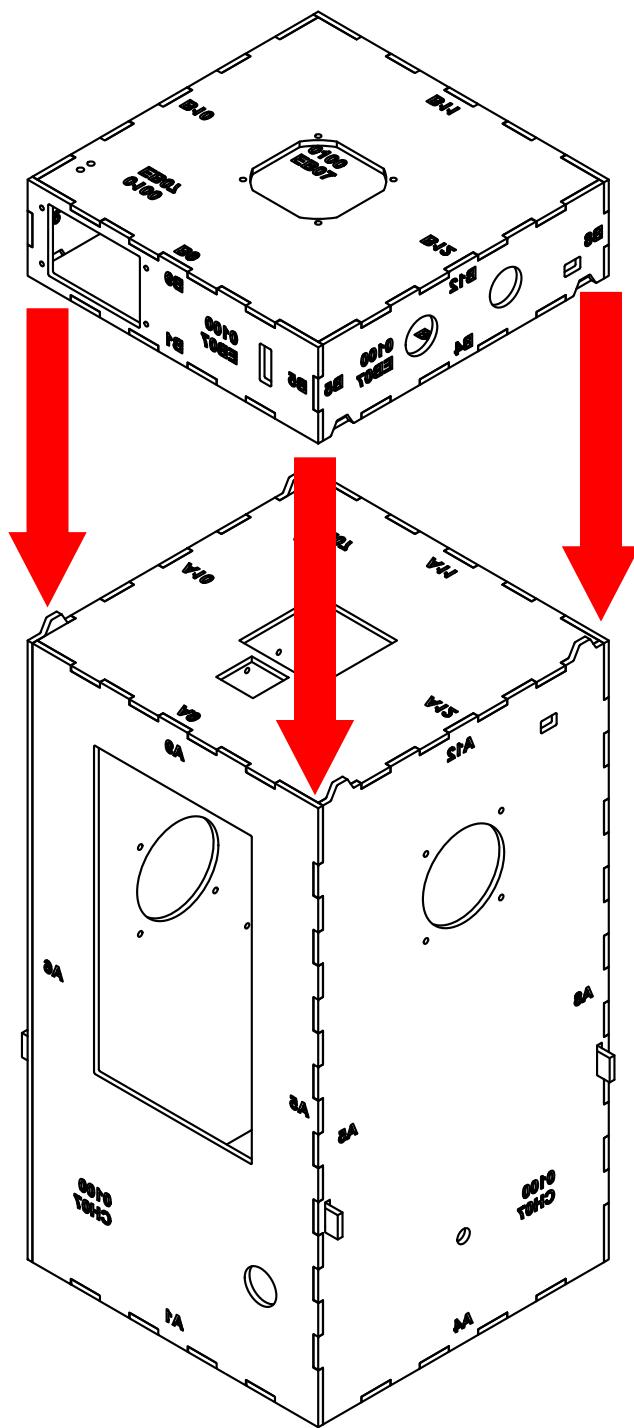
4. Add washer, then the nut on Growth Chamber's interior. Tighten using the Robertson screwdriver and 8mm socket.

Step 5. Insert wooden soil tray slats into pre-made holes, on either side of the growth chamber box.



Step 6. Place the pre-assembled top electronic box (labelled with EB#) on the base growth chamber unit (CH), so that the two boxes line up with guides.

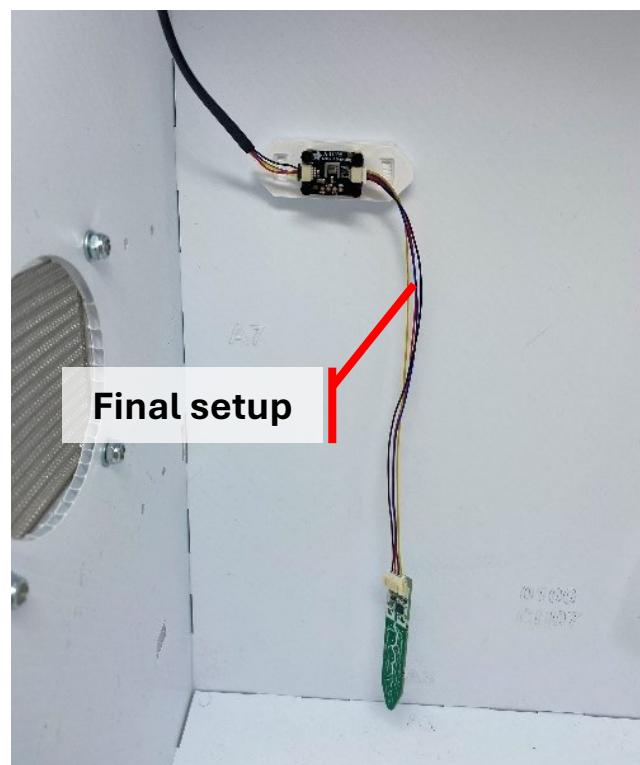
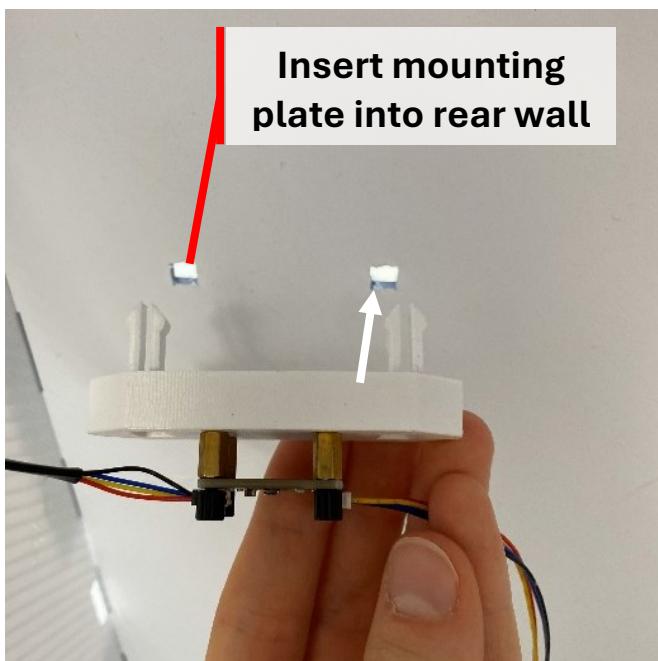
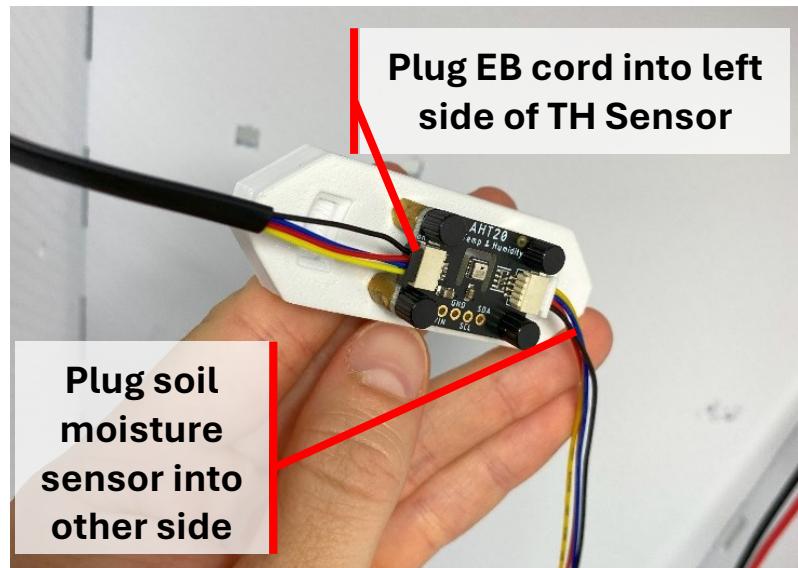
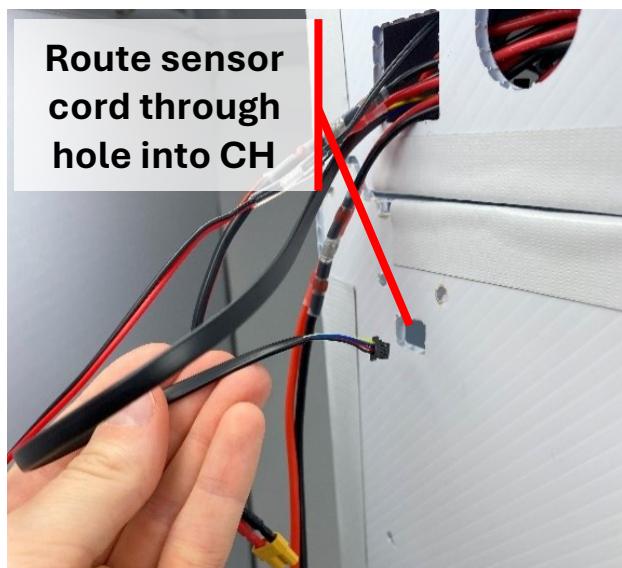
DANGER Failure to correctly align the boxes is dangerous! The light from the LED is intense enough to melt plastic placed too close to it.



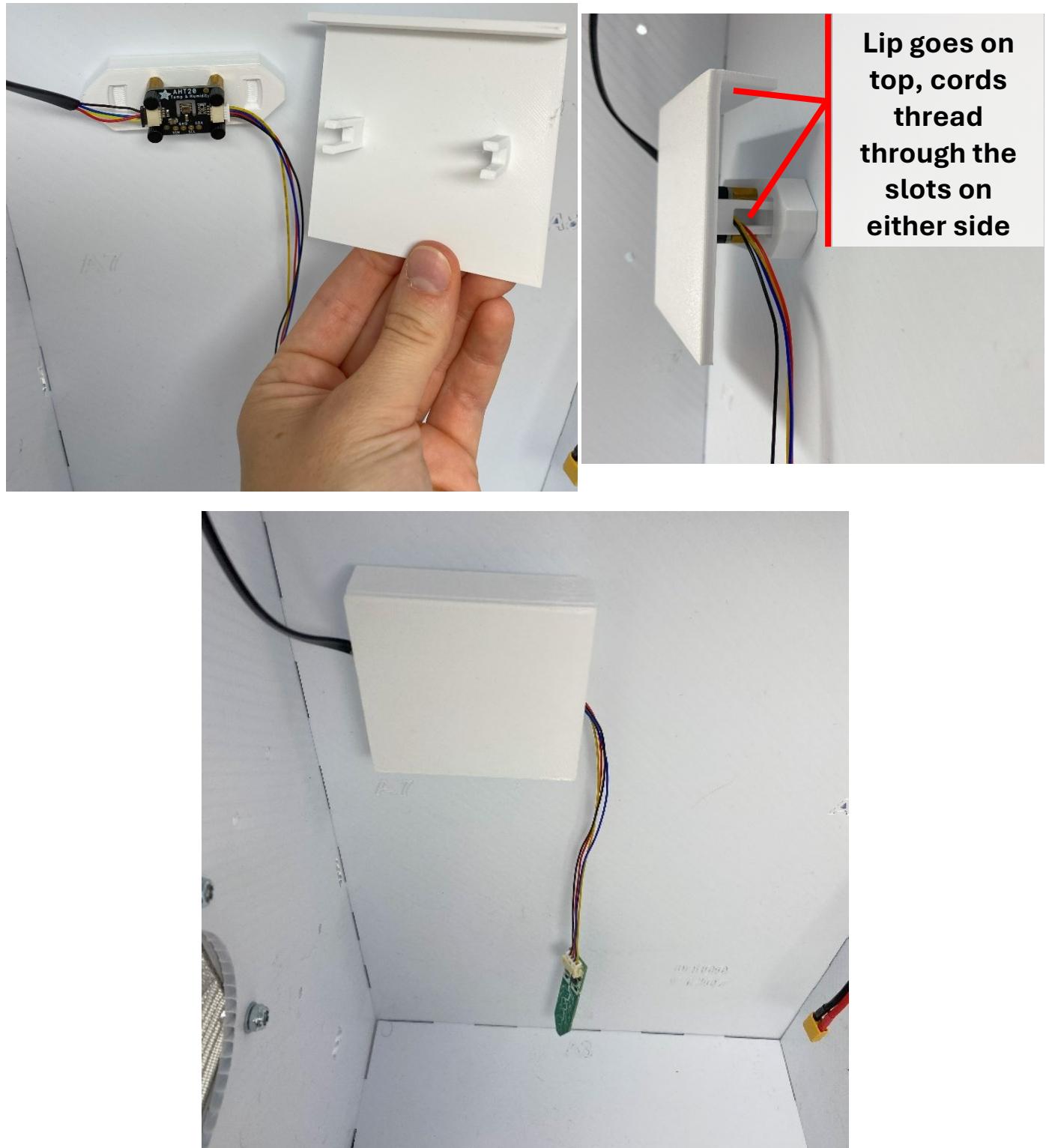
Step 7. Connect and mount the TH and Soil Moisture sensor units.

⚠ CAUTION The connector cable can only be plugged into the TH sensor in a certain orientation. Take a look to see which side the 3 prongs are on. Failure to insert correctly may break the part[s].

- a) Use the black connector cord from the EB box, to plug into the left side of the TH Sensor. Route the cord as shown below. The Soil Moisture sensor should be plugged in, on the opposite side.
- b) Mount the TH Sensor to the rear wall, using the clips and rear holes in the CH.

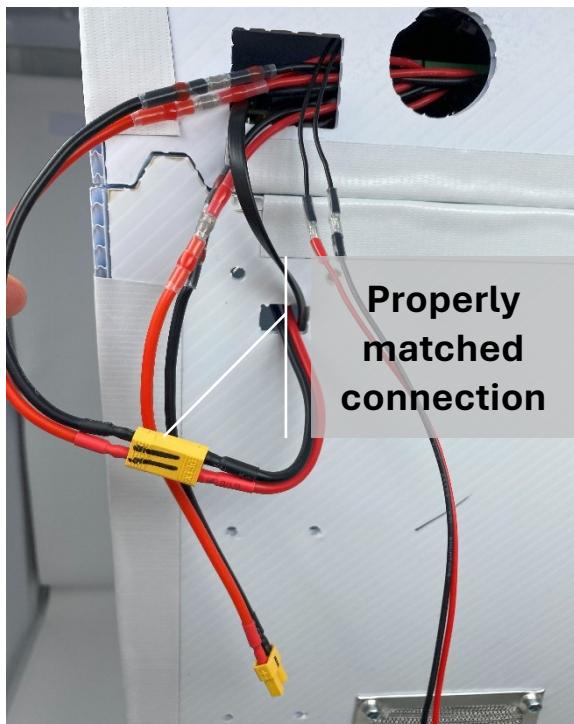
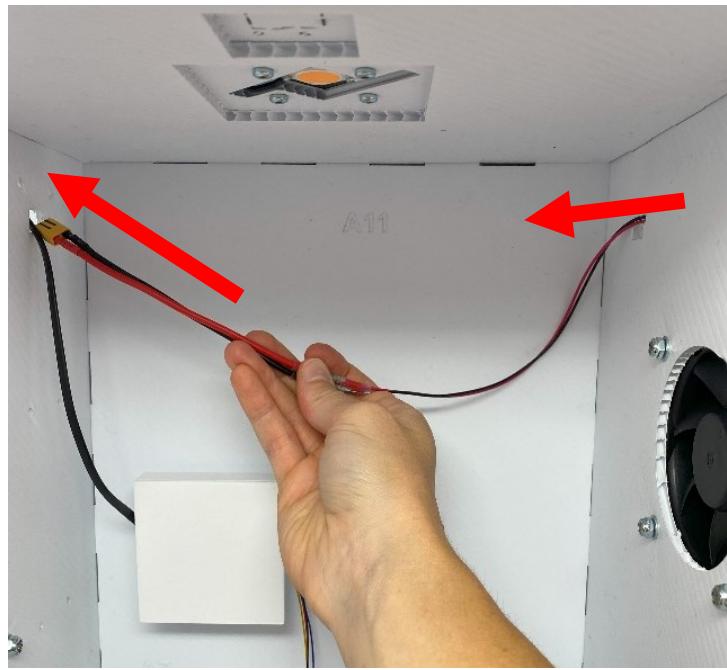
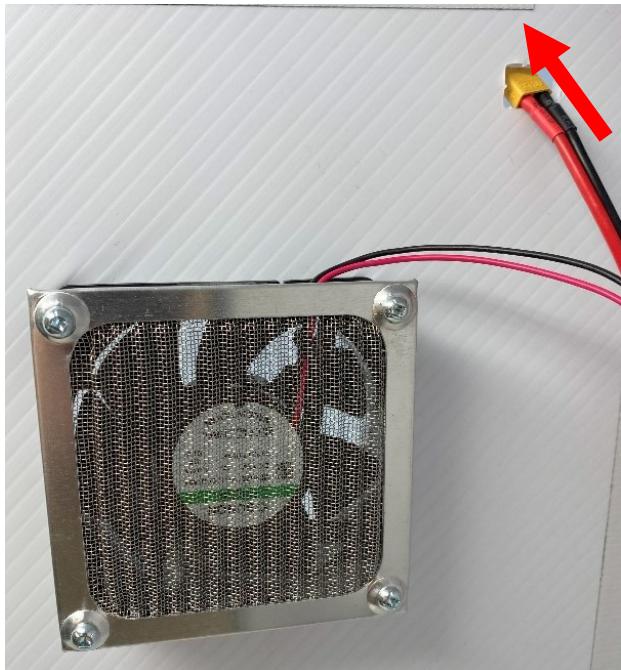


Step 8. Clip the protective cover on over the TH Sensor. The green soil moisture sensor will go into the soil tray.



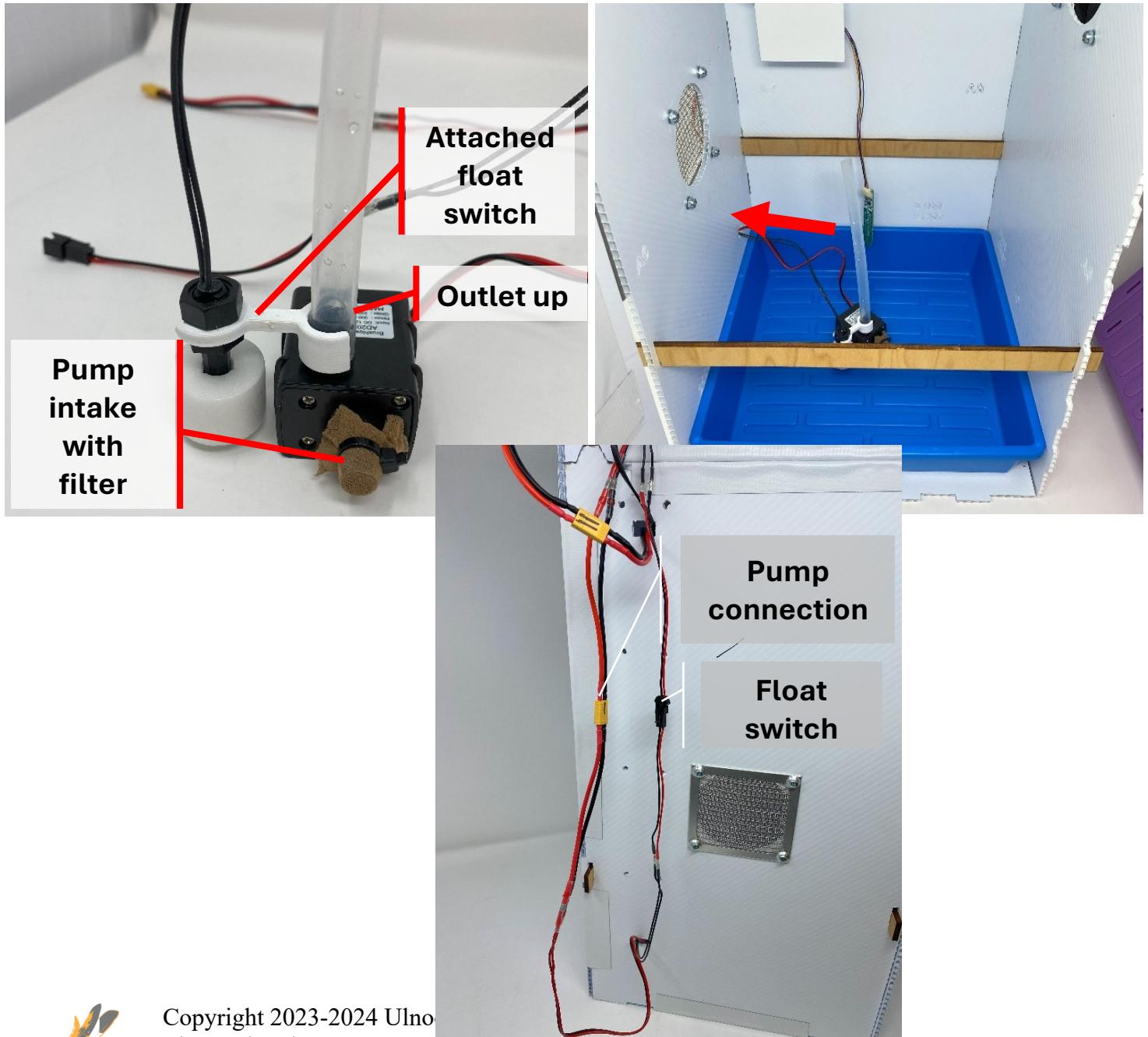
Step 9. Connect the CH Fan.

- a) Thread the Fan cord (marked with 2 dash lines II), from the fan box you previously installed in Step 4, into the Growth Chamber, through the right rear hole.
- b) Continue out the opposite side, through the left rear hole.
- c) Match to the associated marked yellow connector, so the (II) markings and the wire colors line up.



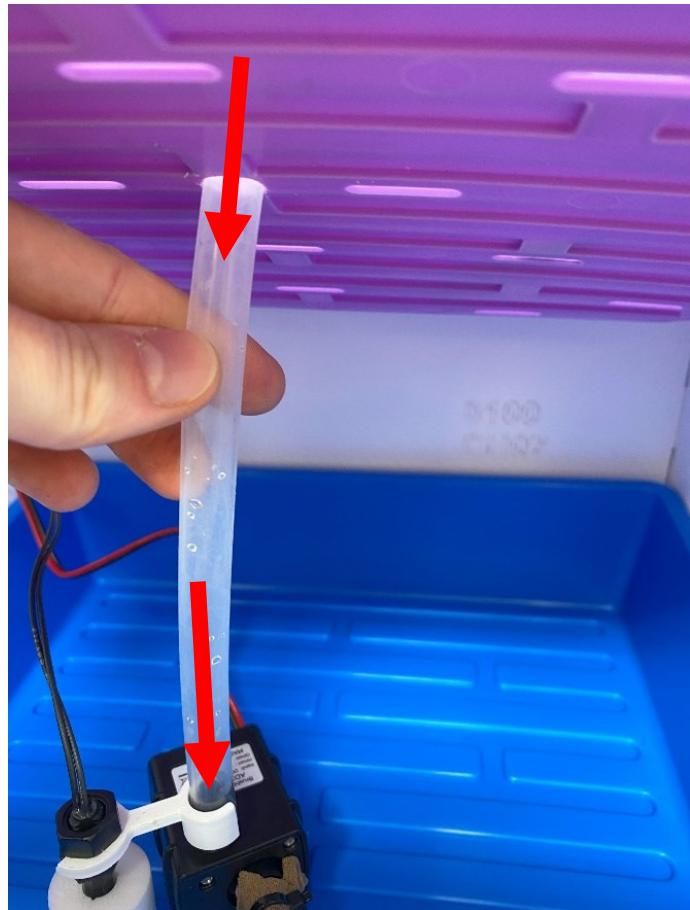
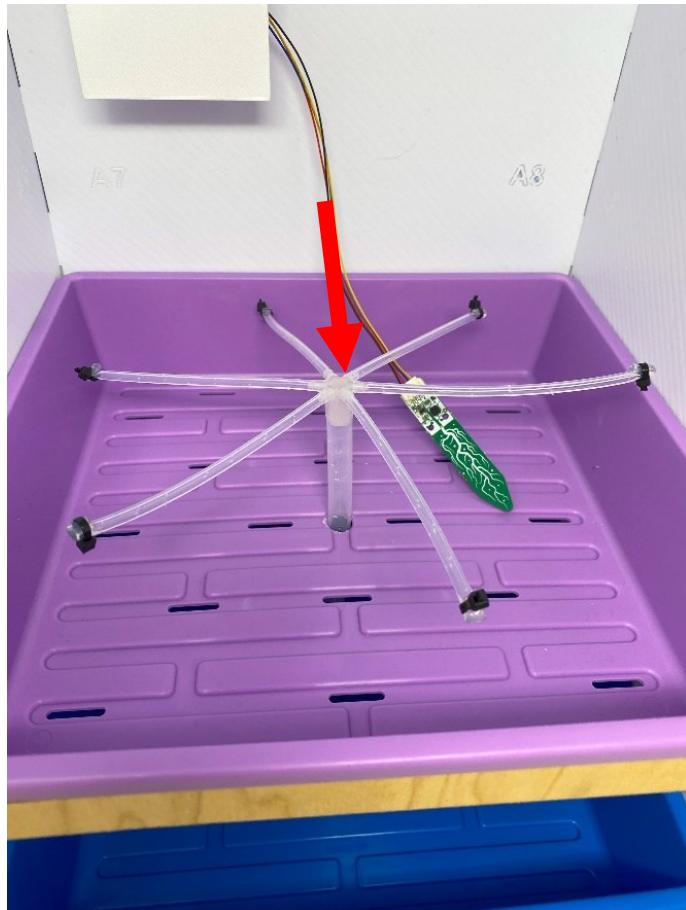
Step 10. Connect the pump.

- a) Attach the float switch to the pump, using the attached clip. Place the pump in the water tray in the base of the chamber, with the outlet facing directly upwards.
- b) Thread the pump cord (marked with (I)) and float switch cord through the lower left rear hole.
- c) Attach pump cord to the power supply coming from the EB, also marked with a (I).
- d) Connect float switch cord to the matching connector cord from the EB.



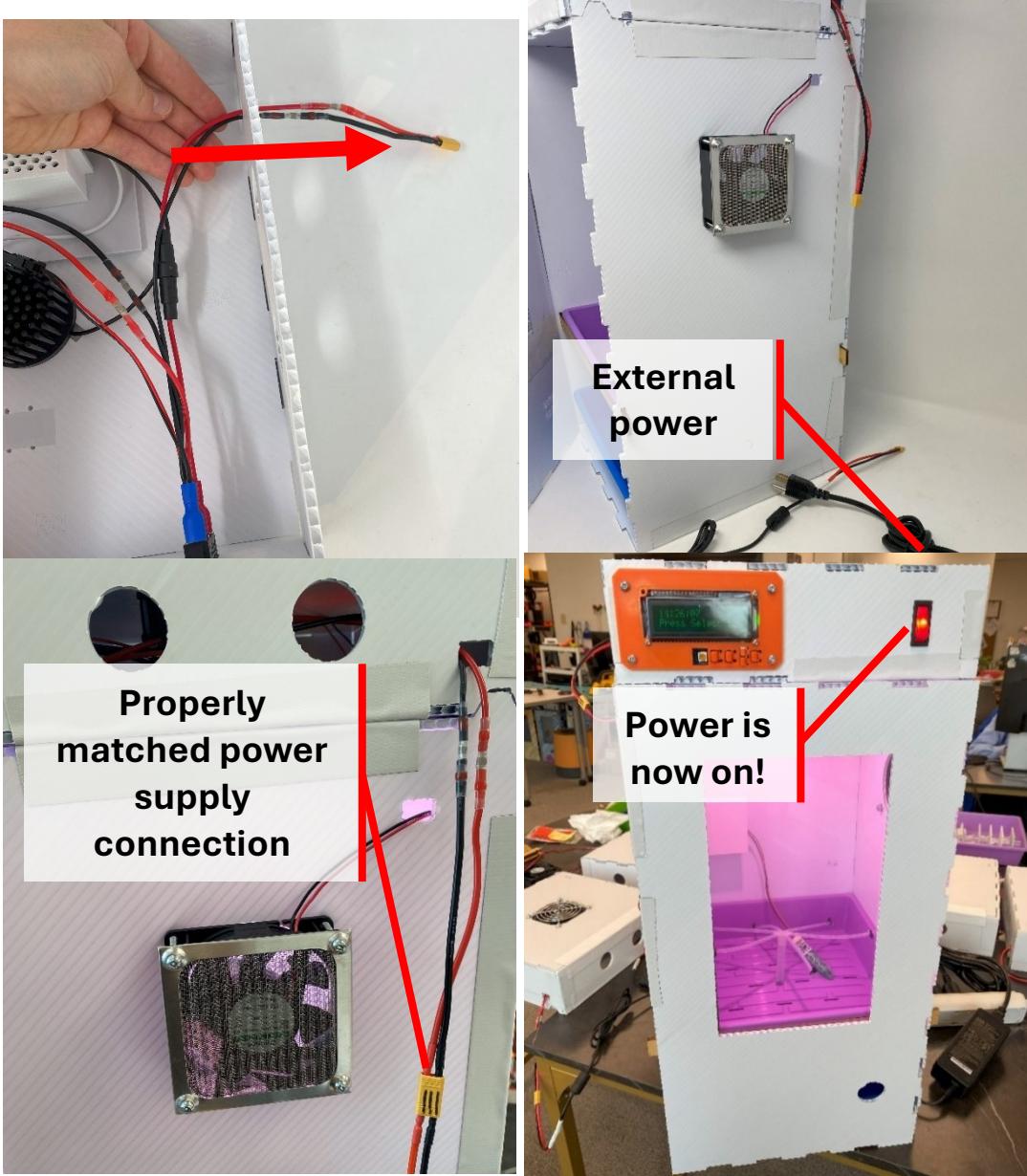
Step 11. Set up the Squid irrigation system.

- a) Attach the Squid irrigation system to the central hose.
- b) Placing the slotted soil tray on the slats, thread the Squid irrigation system's main hose through the soil tray's center hole.
- c) Attach Squid irrigation hose to upper pump spout, below the soil tray.



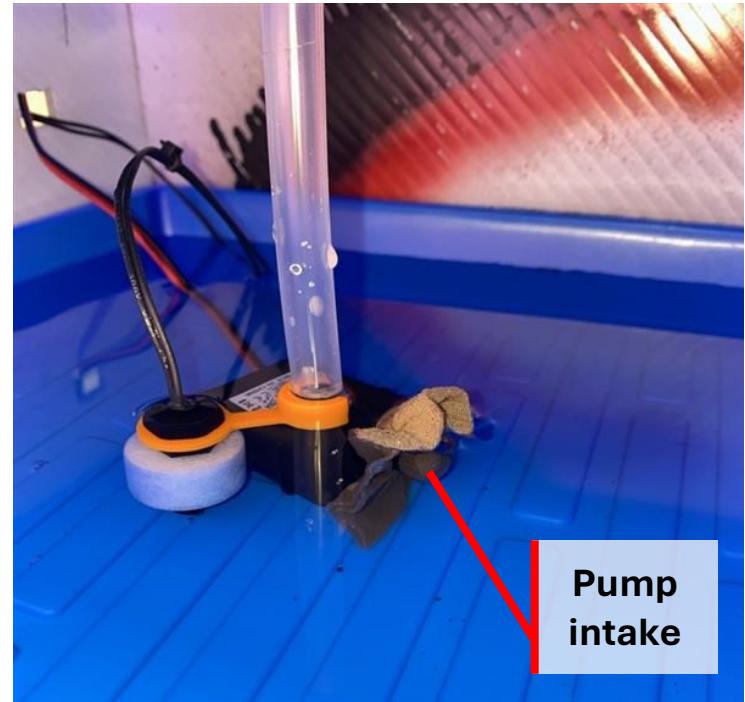
Step 12. Power up your GroBot!

- a) Ensure the On/Off switch's main power supply cable is routed through the rear right panel hole.
- b) Connect the external power supply, matching the (III) lines on the yellow connector.
- c) Plug your GroBot into an outlet, using the external power supply.
- d) Turn on your GroBot, using the red switch located on the front of the EB.



Step 13. Prepare your GroBot for testing and planting.

- a) Line the slotted soil tray with newspaper around the squid central hose.
- b) Fill the soil tray with soil. Use the Squid supports under the end of each Squid hose, to keep soil from clogging the irrigation holes.
- c) Fill the water tray, so the pump's intake is fully submerged.

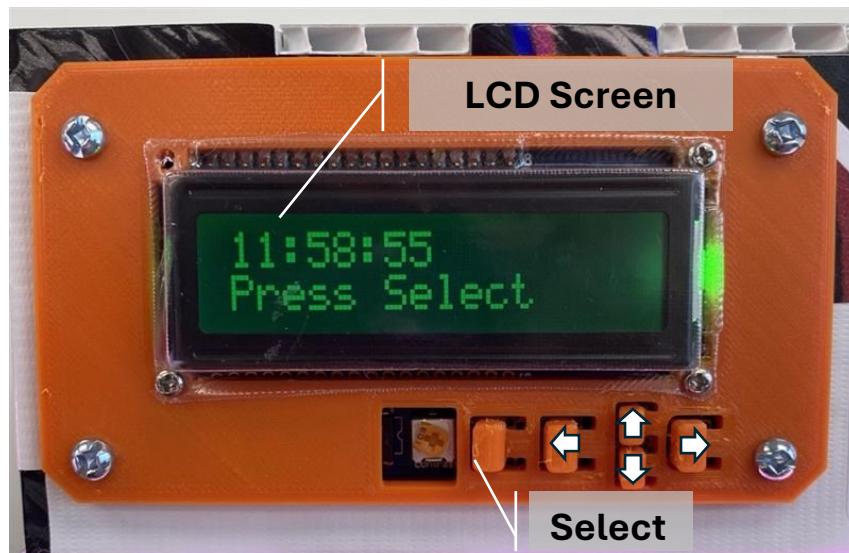


4.0 Testing Your GroBot

4.1 Buttons

Test that all of the buttons are working on your GroBot's front panel.

- Flip the red On/Off switch on the front of the Electronics Box.
- Wait for the GroBot to boot up. This may take 1-2 minutes. The screen will turn green if everything works, or red if there is an error.
- The 5 buttons on the frame of the LCD Screen are your “select” and “scroll” buttons. They will be used to adjust your settings and check the status of your GroBot.
- “Up” and “Down” buttons will scroll through the menu options, as well as increase or decrease numerical values or Hours.
- “Left” and “Right” buttons will increase or decrease Minute values for timing options.

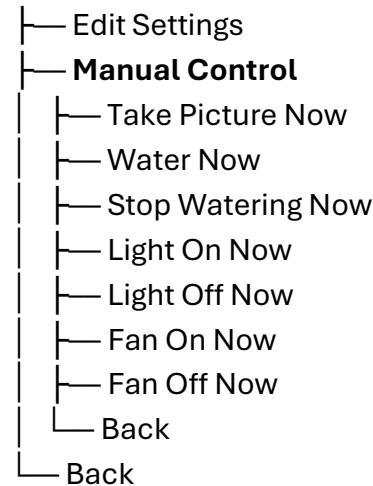


4.2 Manual Controls

To ensure you have connected everything properly, we will now manually test all the actuators in the GroBot. Do this by scrolling up or down to the “manual control” menu.

The following options can be accessed within this menu:

Main Menu



- Test the pump and irrigation system, by selecting “Water Now”.
 - ⌚ **ATTENTION** Ensure there is enough water in the water tray, to cover at least the pump intake.
 - Note that water should immediately spray out of the Squid irrigation system – be prepared for this as to not get wet!
- Test the light by selecting “Light On Now”.
- Test the Growth Chamber fan, by selecting “Fan On Now”.
- Note that your GroBot is not currently equipped with a camera; however, one may be added at a later time. For more information please contact engineering@ulnoowegeducation.ca

5.0 GroBot Settings

Your GroBot is designed to be fully customizable! The following settings can be modified using the **Edit Setting** menu, to better suit your plant, or to test how any of the metrics affects plant growth. You can change each of your GroBot's settings, using the buttons on the LCD Screen panel.

5.1 Light

Set the sunrise and sunset time, to change when the lights turn on and off each day. Keep in mind the following standards, for what constitutes full sun or shade when plants are growing outdoors. These light requirements are considered to be the **minimum** for the plant to thrive. More light or of different intensity may be required, for a plant to flower or produce fruits.

| | | |
|----------------|-------------------|-------|
| Light Settings | Full Sun | >6 h |
| | Partial Sun/Shade | 4-6 h |
| | Shade | <4 h |

5.2 Irrigation

Soil Moisture Threshold (%)

The soil moisture sensor reads soil moisture as a percentage from 0 – 100%. It should be noted that the sensor uses capacitive measurement to read soil moisture as a raw value from 0 – 1000, which is then converted to a percentage for ease of use. When the sensor detects a moisture value *below* the threshold at Watering Time, the irrigation system will activate; watering your plant to bring the soil moisture up.

When setting your soil moisture threshold, keep the following guidelines in mind.

| | | |
|------------------------|----------|------------|
| Soil Moisture Settings | Very Wet | 80 - 100 % |
| | Wet | 60-80 |
| | Moist | 40-60 |
| | Dry | 20-40 |
| | Very Dry | 0-20 |

Note, also, that soil moisture settings will change depending on soil type[s] used in the plant

tray. A clayey soil will hold water much more tightly than a sandy soil. Typical potting soil is designed to allow water to drain easily. The default soil moisture threshold is set to 75%.

Watering Volume (Rainfall, mm)

This is the amount of water that will be dispensed by the irrigation system at watering time. To make this more intuitive, we have converted watering volume into mm of rainfall. For reference, over a given year, Kjipuktuk (Halifax, NS) averages 4mm of rain per day. Keep in mind that our soil tray holds a very shallow volume of soil compared to the Earth – therefore, it will need less ‘rain’ than average! The default watering volume is 1mm, and the values are adjustable in 0.1 mm increments.

Watering time

This is the time of day that the GroBot will check your soil’s moisture. If moisture is *below* the threshold, the GroBot will automatically water as per your watering volume specifications. If the moisture level is *above* the threshold, the GroBot will not water your plant. The default time setting for watering is 10:30 AM.

5.3 Temperature and Humidity

The TH Sensor measures both temperature (in degrees Celsius, °C) and relative humidity (%). If either value exceeds the threshold set in “Temp Setpoint” or “Humidity Setpoint”, the Growth Chamber fan will turn on, until either or both values returned to below the threshold. The default settings are 25 °C and 90% humidity.

6.0 Growing Plants in Your GroBot

6.1 Planting Setup

Your GroBot settings should allow you to grow any number of plant species. Although the GroBot is constrained in its ability to grow plants – mainly by its size, it is a great space to start seeds for transplanting to a bigger pot (or outside). The main modifiable growth factors within the GroBot are:

- Soil texture and pH (manually modifiable)
 - Soil moisture level (automatically maintained or modified)
 - Watering amount (automatic)
 - Amount of sunlight (automatic)
1. Choose a plant to grow in the GroBot.
 2. Take a look at the Growing Guide table below, which provides information on the plant's preferences for light, soil type, pH, and moisture. We have also included some information on traditional uses and other things to note! If your plant is not already listed, do some research to set up your GroBot – or just choose some GroBot settings, and run an experimental trial!
 - a. Select or mix your soils to create the proper soil texture for your plant.
 - b. Add pH amendments for your plant's soil as needed or wanted.
 - c. Moisten your soil before filling the soil tray. Ensure the Squid irrigation system is properly installed, and clear of soil and obstructions for watering.
 - d. Modify the GroBot's settings, to create the ideal growth conditions for your plant:
 - i. Set the sunrise and sunset time to determine hours of light per day.
 - ii. Set the soil moisture threshold.
 - iii. Set the watering volume.
 - iv. Set the watering time – preferably for a time when you will be nearby to see it in action!
 - v. Set the GroBot's temperature and humidity thresholds.
 3. Plant your seeds evenly within the soil tray, ensuring they are not directly underneath the irrigation system, which may disturb the soil and seeds. Cover seeds gently with soil.
 4. Ensure the water tray is filled up, and all the GroBot's functions are working properly, using the manual override settings.
 5. Close the door to the GroBot, recording your starting conditions and metrics.
 6. Sit back and watch your plants grow!

6.2 Growing Guide

| Name(s) | Light | Soil pH | Soil Texture | Soil Moisture | Traditional Uses | Notes |
|--|--|----------------|---|-----------------|--|---|
| St. John's Wort <i>Hypericum perforatum</i> | Full sun is best, semi-shade tolerant. | Slightly basic | Tolerates most soil types, including sandy, loamy, and clay soils, but prefers well-drained soil. | Dry - moist | St John's wort has been used in traditional medicine for centuries, often as a cure-all or panacea. Relieves symptoms of anxiety and depression, rheumatic and arthritic pain. | Typically flowers around June 24th, St John's Day |
| Mugwort <i>Artemisia vulgaris</i> | Full sun | 4.8-8.2 | Well drained, sandy soils | Poor, dry soil, | Historically, Mugwort was referred to as the "mother of herbs" and has been globally used in traditional medicine. Mugwort was traditionally used to treat delayed menstruation and digestive disorders. | Sow seeds shallowly and keep moist. |

| Name(s) | Light | Soil pH | Soil Texture | Soil Moisture | Traditional Uses | Notes |
|---|-----------------------|--|---|--------------------|--|---|
| Boneset <i>Eupatorium perfoliatum</i> | Full sun - part shade | | | Moist-wet | The dried leaves of Boneset have been used to make a tonic (tea), thought effective in treating colds, coughs, and constipation. Also used to treat stomach ulcers, arthritis, and for a relaxing and sound sleep. | The stem appears to be growing through the leaf. To early herb doctors, this indicated the plant would be useful in setting bones, so its leaves were wrapped with bandages around splints. Must be dried prior to use. |
| 1000 Year Old Tobacco tmawei <i>Nicotiana rustica</i> | Full sun | | Can tolerate less fertile, well-drained soil. | Moist | One of the sacred medicines. Used in ceremony and as an offering. | Sow shallowly, give light and consistent moisture. Transplant outside in June. |
| Garden Sorrel <i>Rumex acetosa</i> | Full sun-part shade | Can grow in very acidic - mildly basic soils | Sandy-loamy, well drained soil. | Prefers moist soil | Leaves have a yummy lemony-like flavour and can be eaten raw or cooked, in moderation (contains oxalic acid). | |

| Name(s) | Light | Soil pH | Soil Texture | Soil Moisture | Traditional Uses | Notes |
|---|----------|-----------------|---|---------------------------------|---|--|
| Mullien <i>Verbascum Thapsus</i> | Full sun | | Grows best in dry, sandy, or gravelly soils | Tolerant to very dry conditions | Mullien is traditionally used to treat a variety of respiratory conditions, including asthma, chest colds and coughs, and bronchitis. The fuzzy leaves can be smoked or steeped in water. If drinking tea, the liquid must be strained through a fine cloth to remove any irritating hairs. | Transplant outdoors about 6-8 weeks after starting in late spring or summer. |
| Window Box Red Micro Cherry Tomato <i>Solanum lycopersicum</i> <i>var. cerasiforme</i> | Full sun | Slightly acidic | Sandy or loamy | Evenly moist | | |
| Sugar Magnolia Pea | full sun | | Tolerant of poor soil. | Moist-wet | | |

| Name(s) | Light | Soil pH | Soil Texture | Soil Moisture | Traditional Uses | Notes |
|-------------|----------|---------|--------------|---------------|------------------|--|
| Microgreens | full sun | | | Moist | | Plant seeds under a shallow layer of soil. |
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CONTACT US

For any questions, comments, or assistance
please contact us at info@ulnooweg.ca