Soil Moisture Sensor

Project Intermediate #3

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Design Problem

Develop a practical moisture sensor that meets the needs of the client. It is essential that the design is practical, portable, and safe to use in outreach programs.

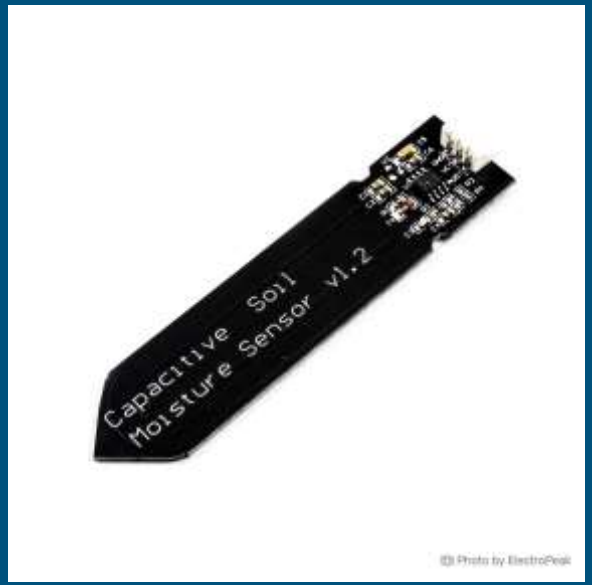
Background Research

Which Sensor to Use?

Resistive sensor

Vs.

Capacitive sensor



Which Filament to Use?

ASA

- UV, temperature, chemical, impact, water resistant
- Least hygroscopic
- Anti-static
- Food safe (for particular brands)
- Challenging to print
- Most expensive

OR

PLA

- Anti-static
- UV & chemical resistant
- Easiest to print & coat
- Relatively strong material
- Food safe
- Cheapest filament
- Hygroscopic
- Not impact, and heat resistant

How will this Sensor be used?

Initial Drawings, Models, and Designs

2 Parts:

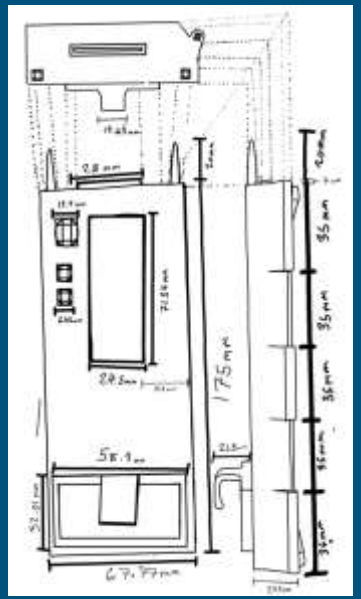
Case Top

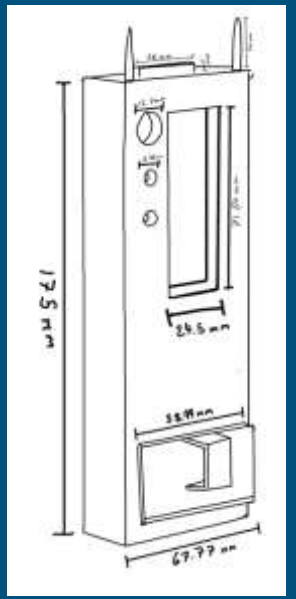
Case Base

Initial hand drawn Isometric drawings for top

Flaws:

- Battery holder
- Cramped
- Brittle
  - Top heavy: may compromise stakes and then sensor
- Not kid friendly
  - Battery pack outside and exposed

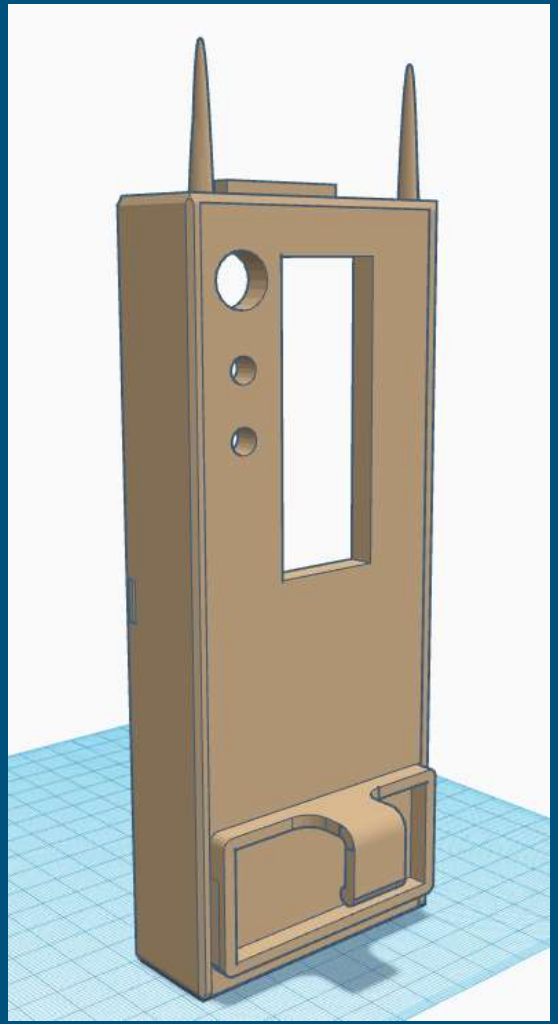




Initial 3D rendering of top of case

This would hold:

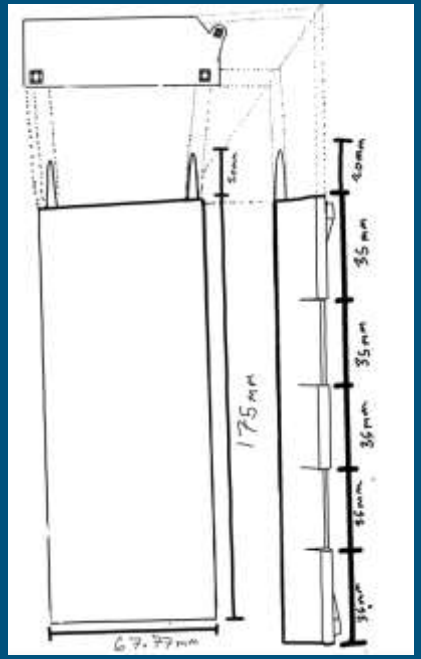
- LCD
- Buzzer
- LED
- Potentiometer
- Battery
- Wiring
- Moisture sensor

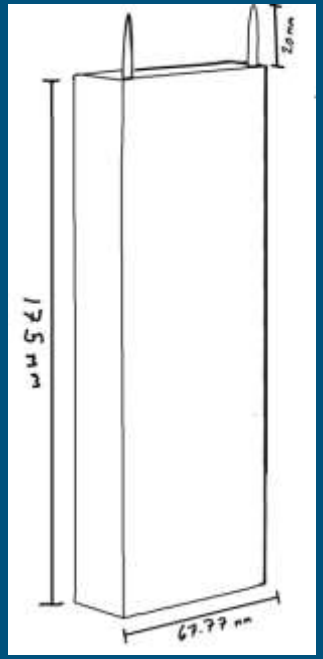


Initial Hand drawn drawings for base

Flaws:

- Brittle
- Small
- Hinges
- Not kid friendly

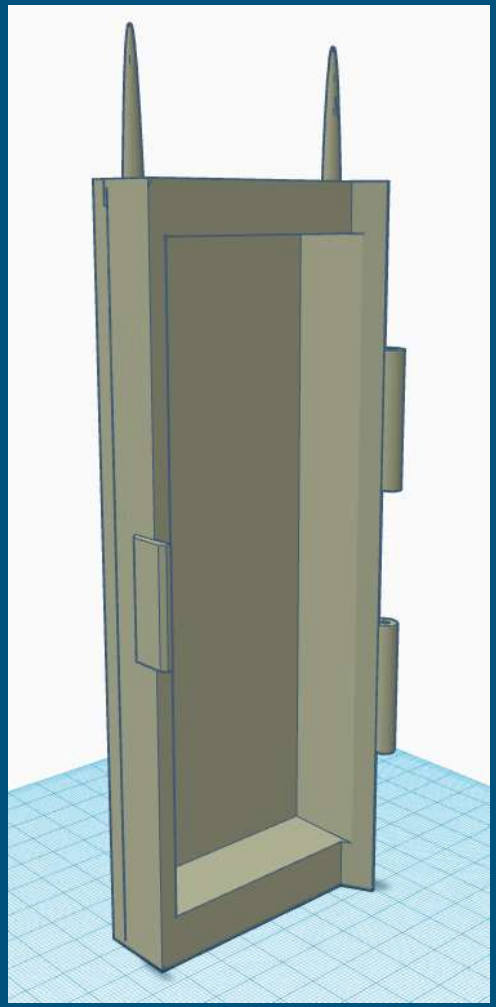




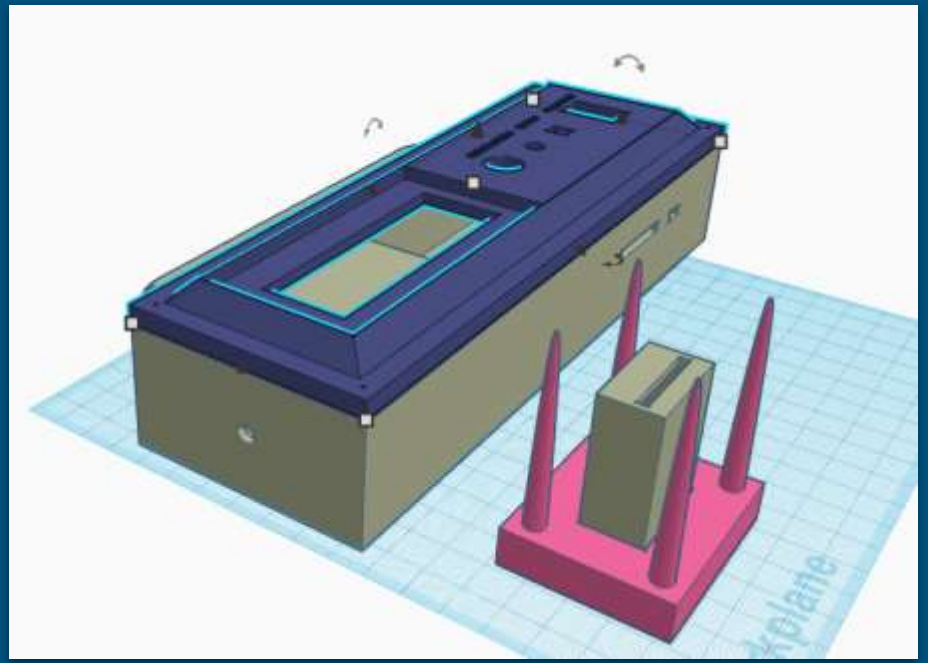
3D rendering of base of case

This would hold:

- Breadboard
- Deeper to hold Bulk of wiring



What we changed



Previous Drawings, Models, Designs, and Changes

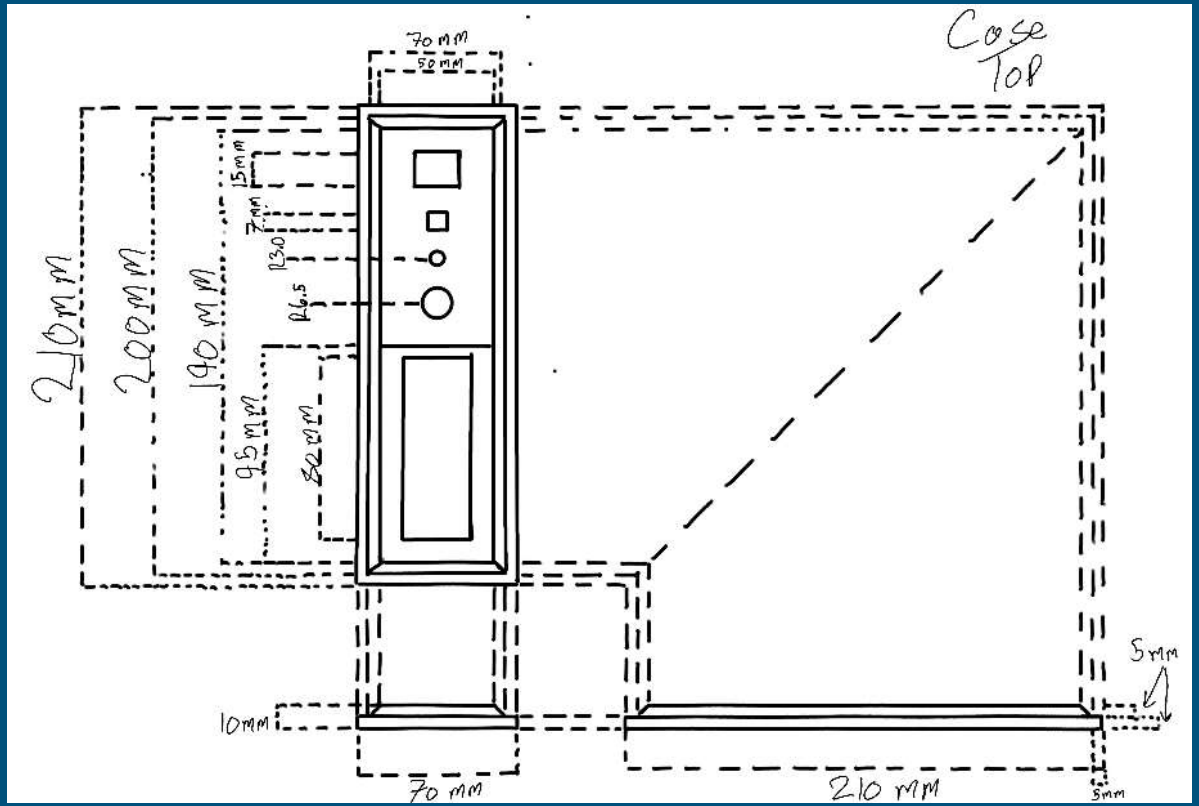
4 Parts:

Part 1: Arduino Housing Top
Part 2: Arduino Housing Base
Part 3: Sensor Housing Base
Part 4: Sensor Housing Top

Orthographic sketch of Arduino Housing Top

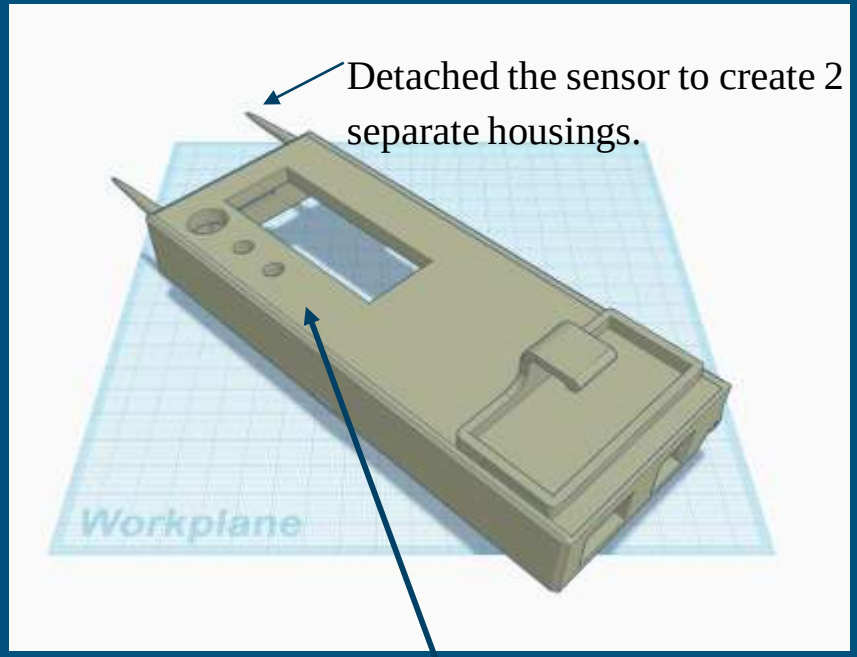
This will house:

- LCD screen
- LED
- Buzzer
- ON/OFF switch
- Read Rate Button



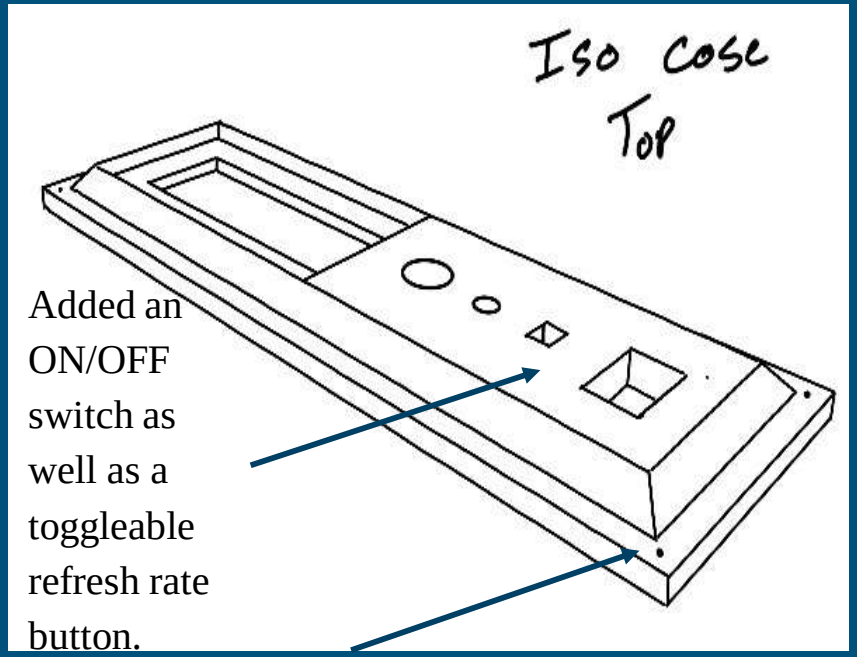
Isometric sketch of Arduino Housing Top

Before



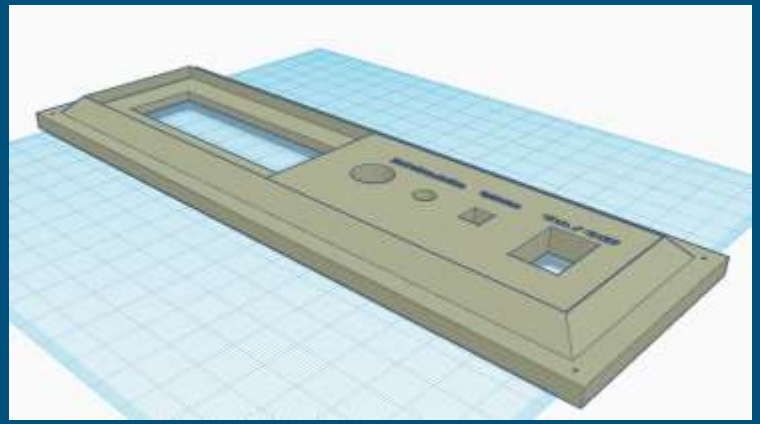
Moved around the location of the LED, LCD, Buzzer, and Battery.

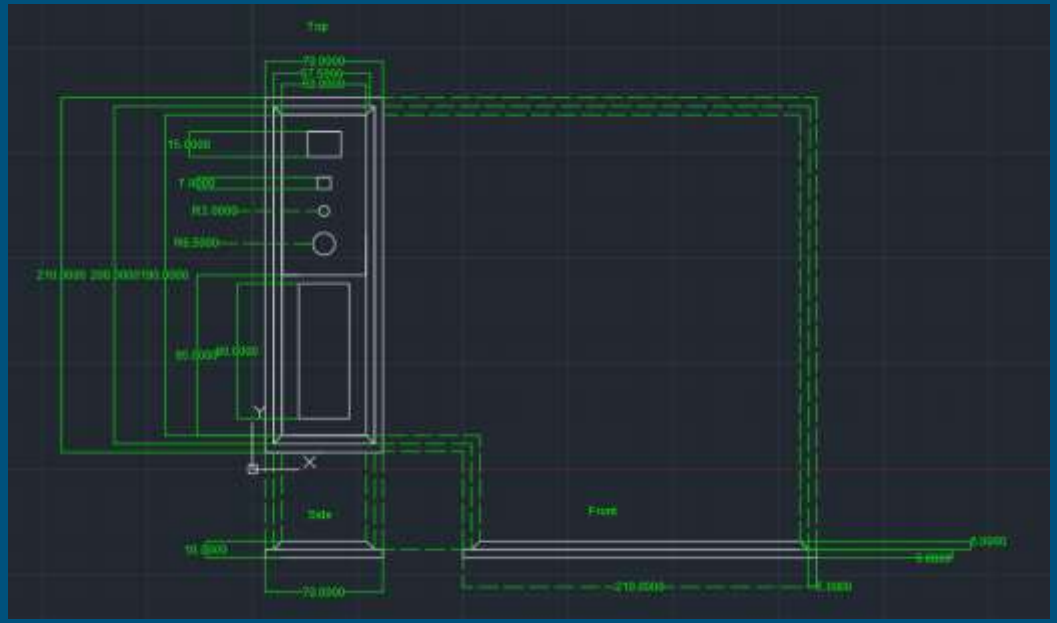
After



Replaced the hinges with screws for better waterproofing.

AutoCad drawing And 3D Model of Arduino Housing Top

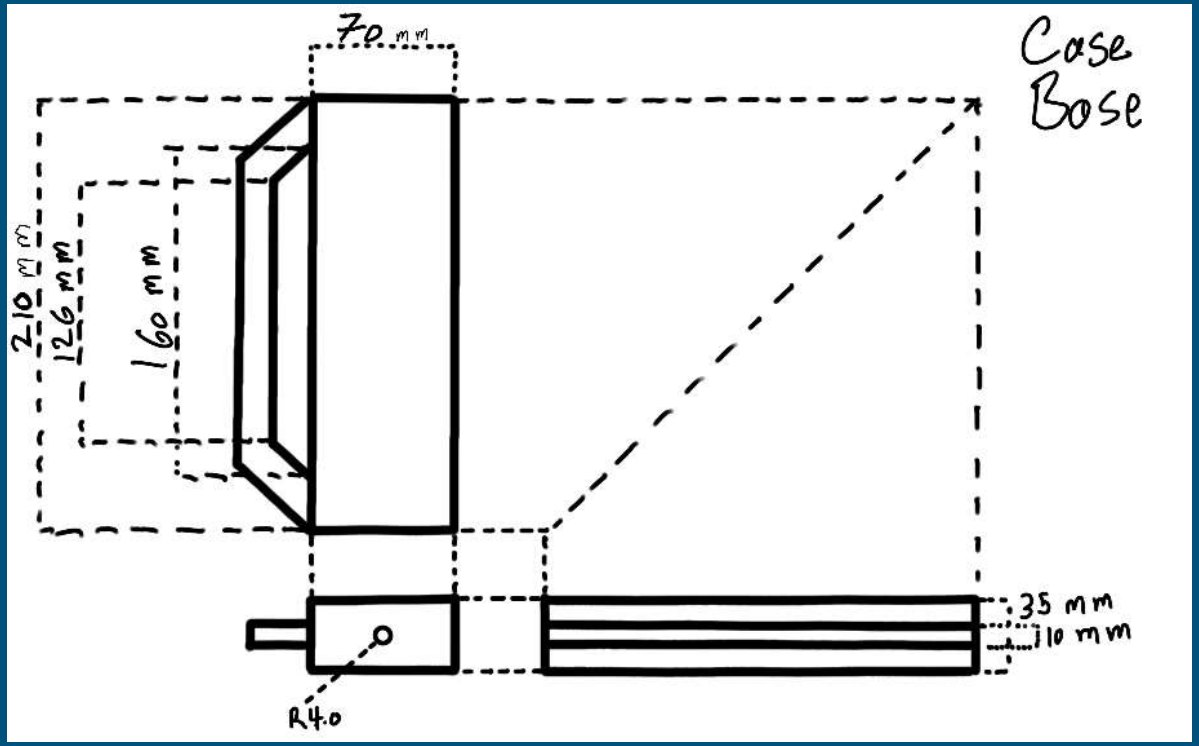




Orthographic sketch of Arduino Housing Base

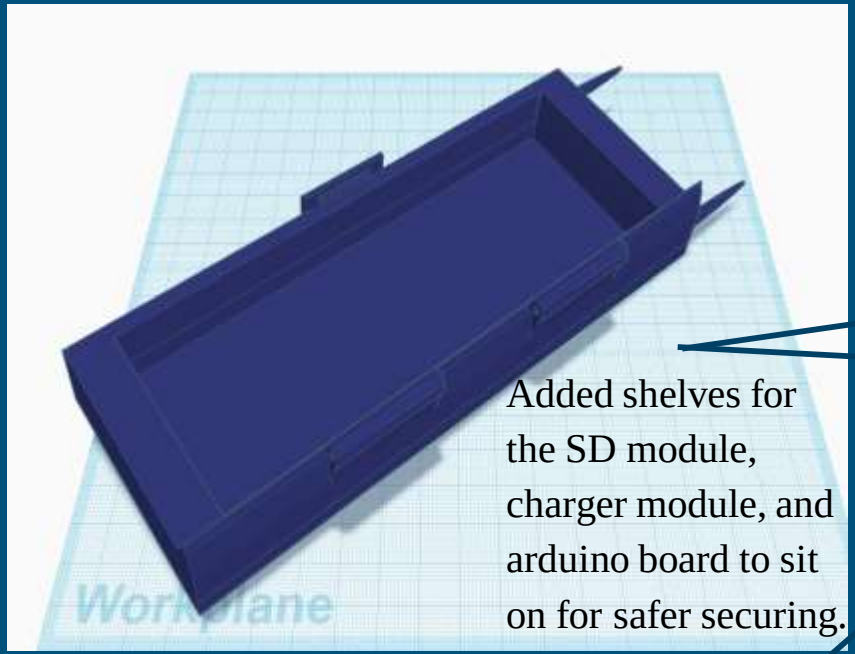
This will house:

- Battery
- Arduino
- Breadboard
- Charger module
- SD card module
- Wiring



Isometric sketch of Arduino Housing Base

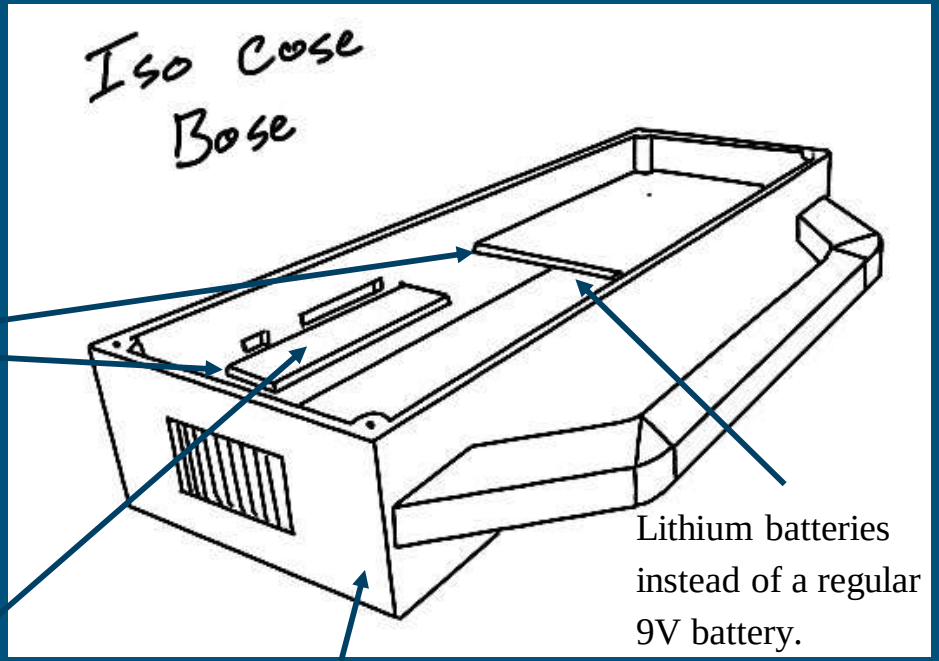
Before



Added shelves for the SD module, charger module, and arduino board to sit on for safer securing.

Added a charging port (rechargeable batteries), and SD card reader slot, ventilation, and a sizable handle.

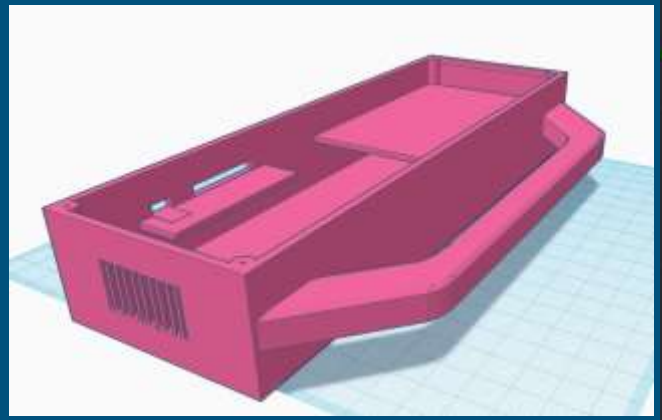
After

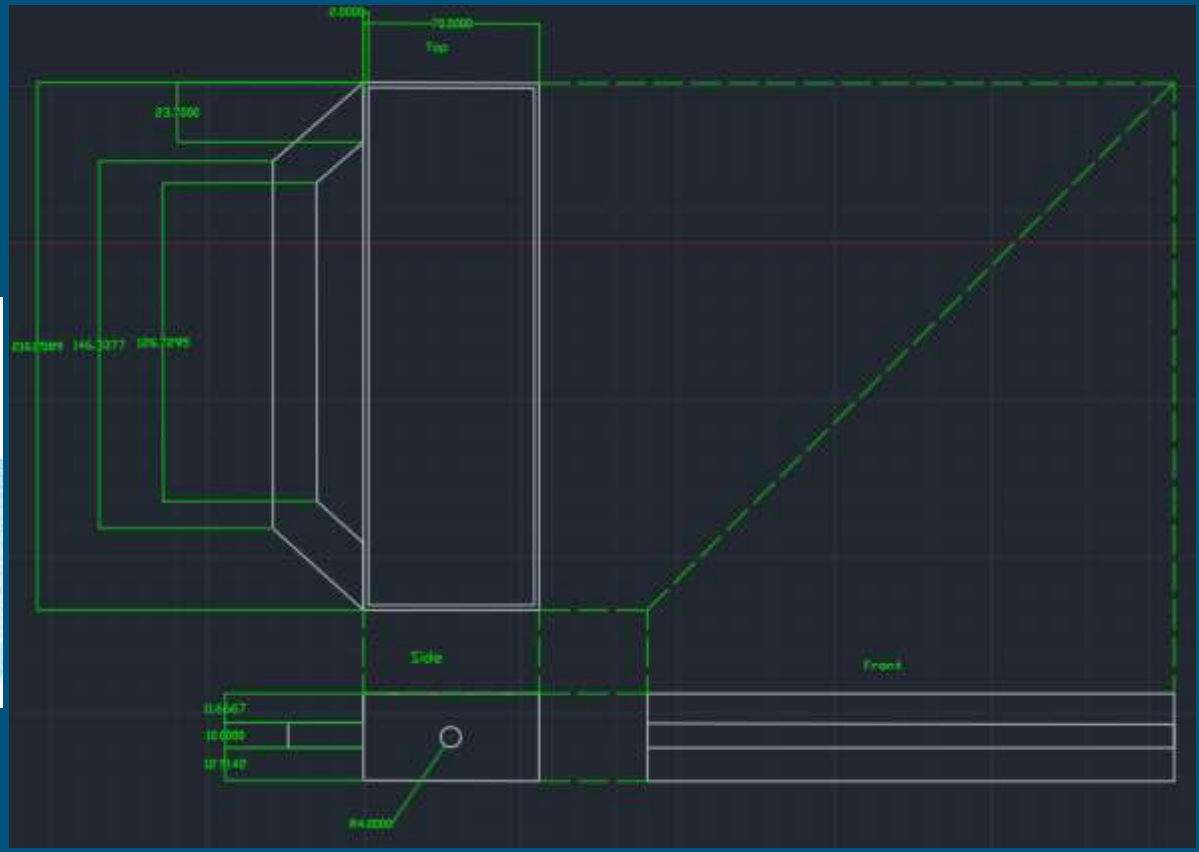


Lithium batteries instead of a regular 9V battery.

Made the housing compartment larger to accommodate for more components.

AutoCad Drawing And 3D Model of Arduino Housing Base

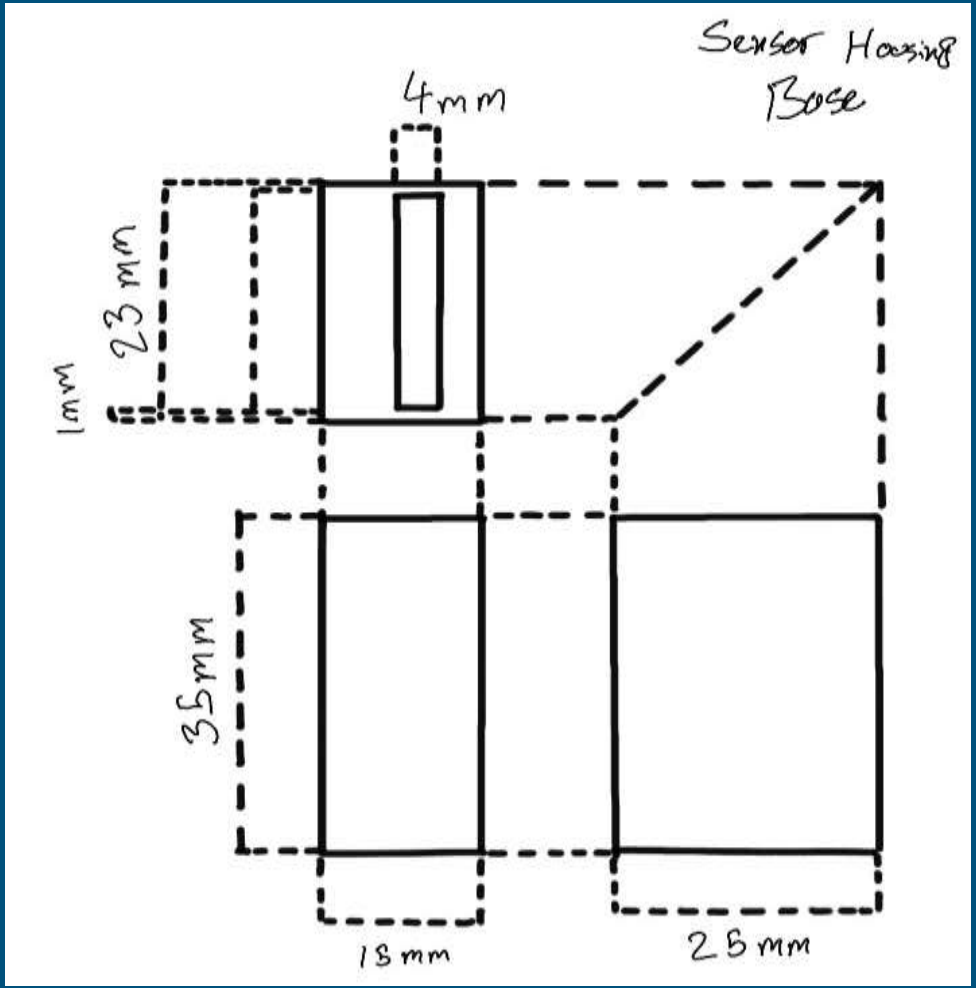




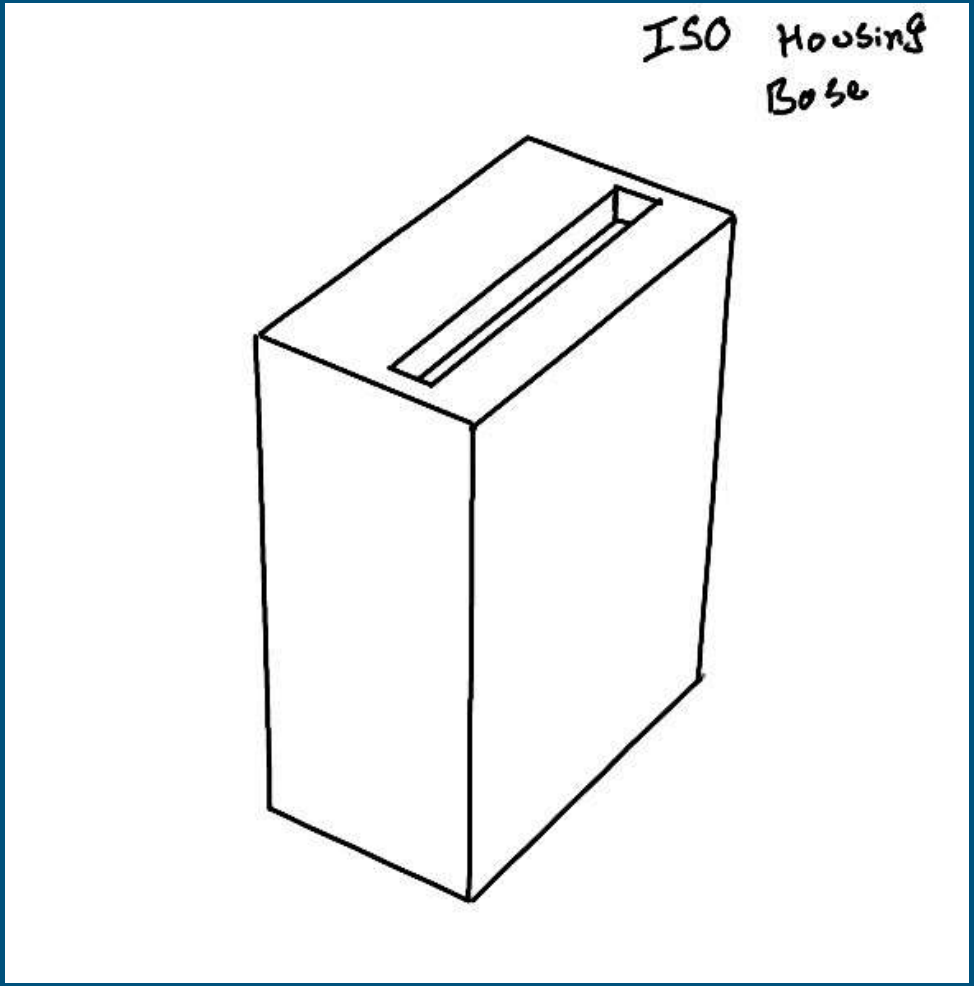
Orthographic sketch of Sensor Housing Base

This will house:

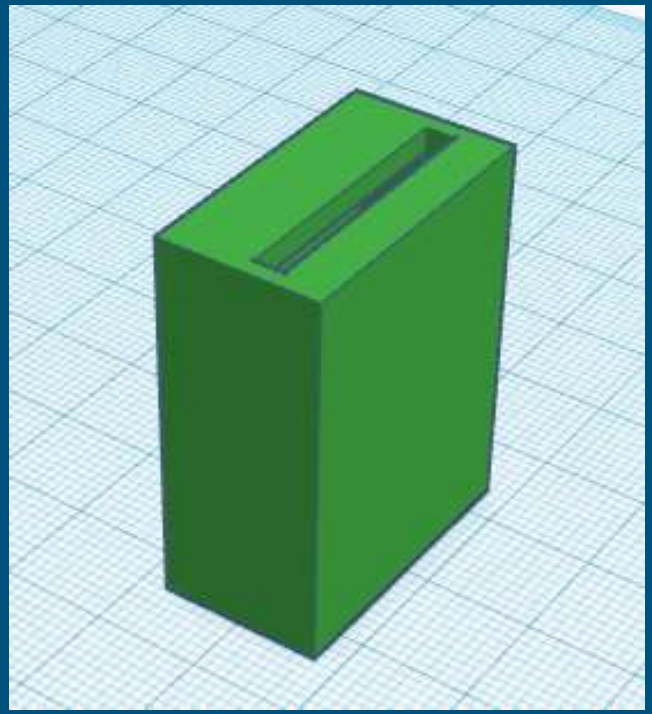
- The capacitive soil moisture sensor

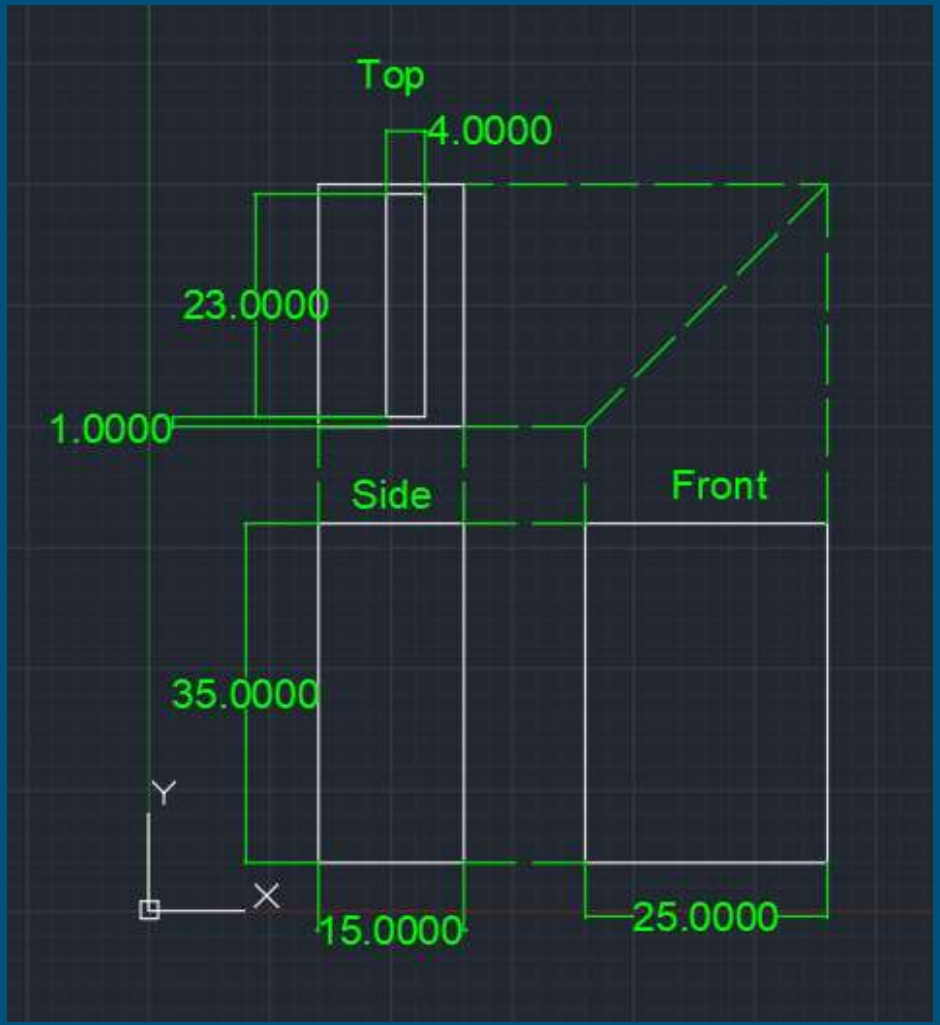


Isometric sketch of Sensor Housing Base:



AutoCad drawing And 3D Model of Sensor Housing Base

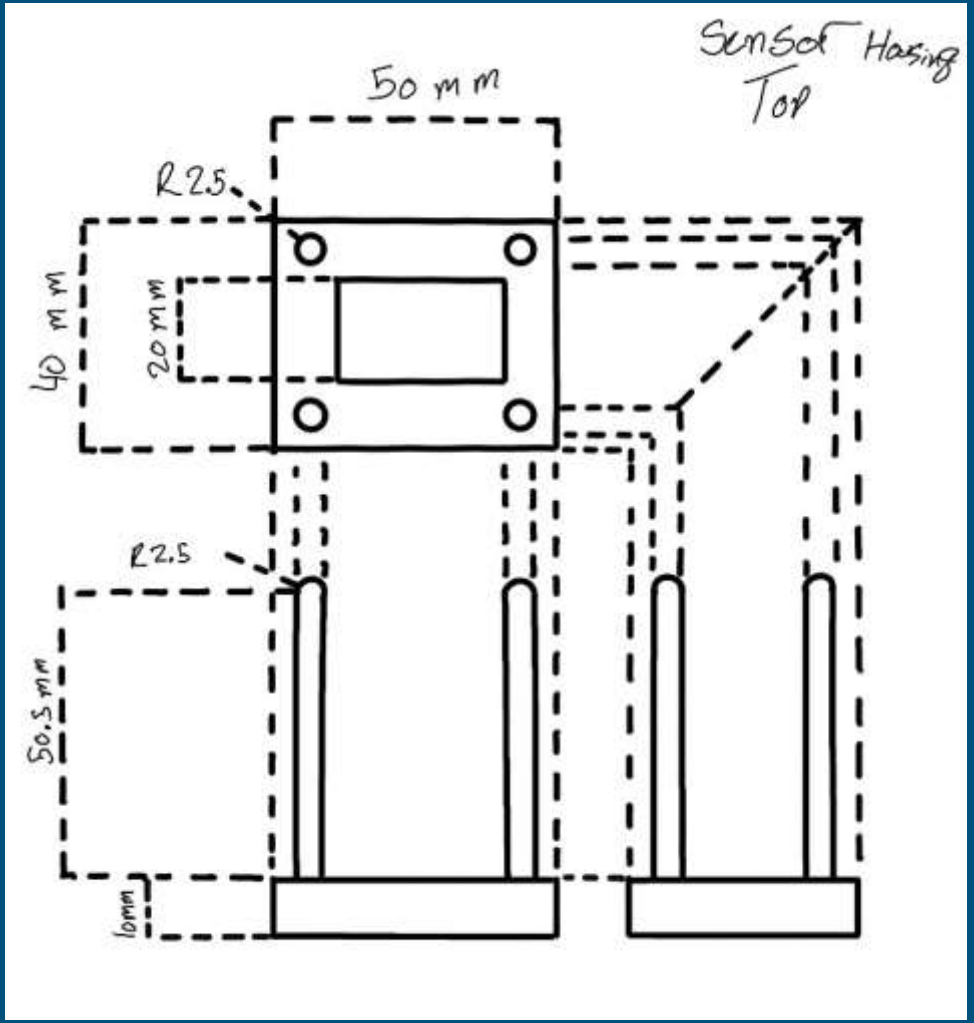




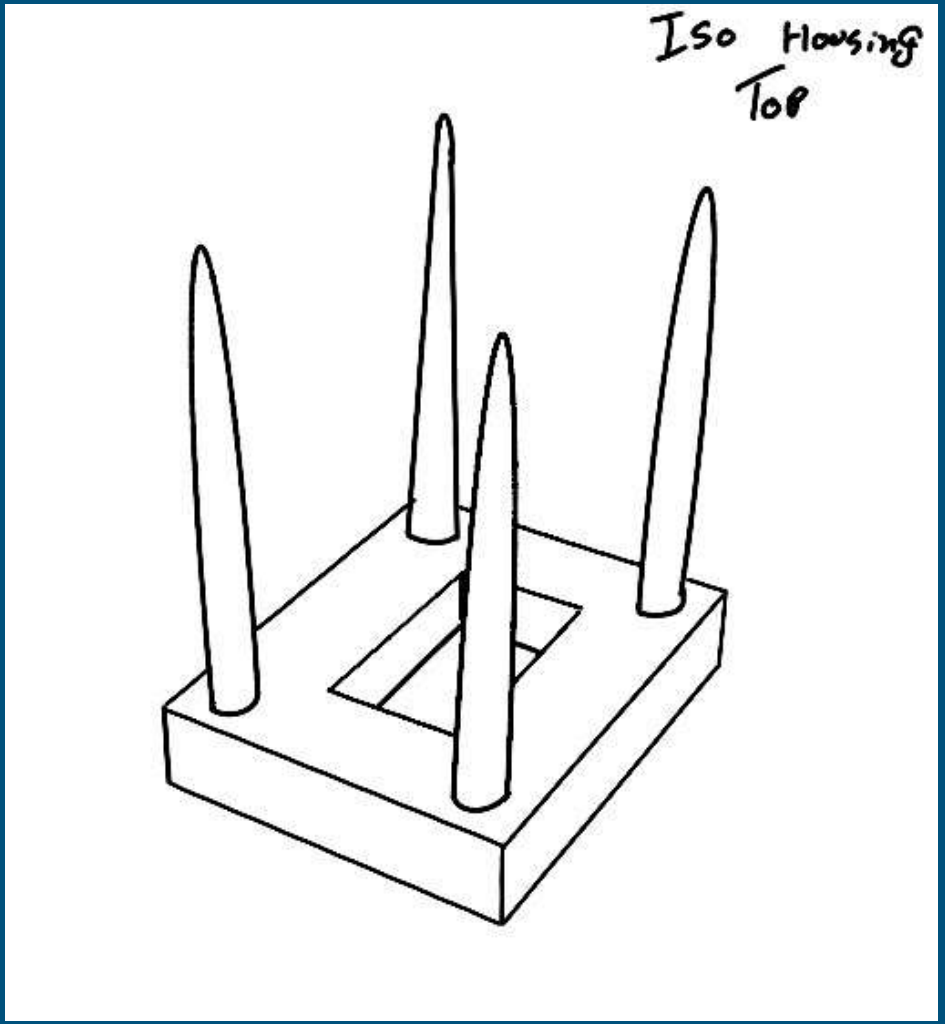
Orthographic sketch of Sensor Housing Top

This will serve as:

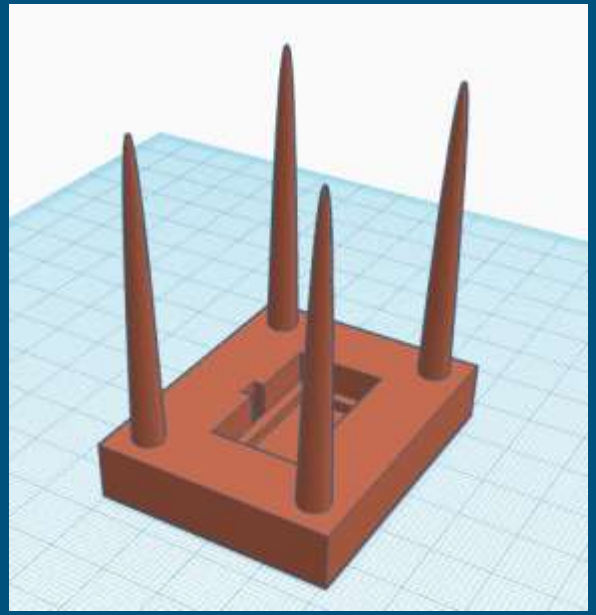
- A cap for the Sensor

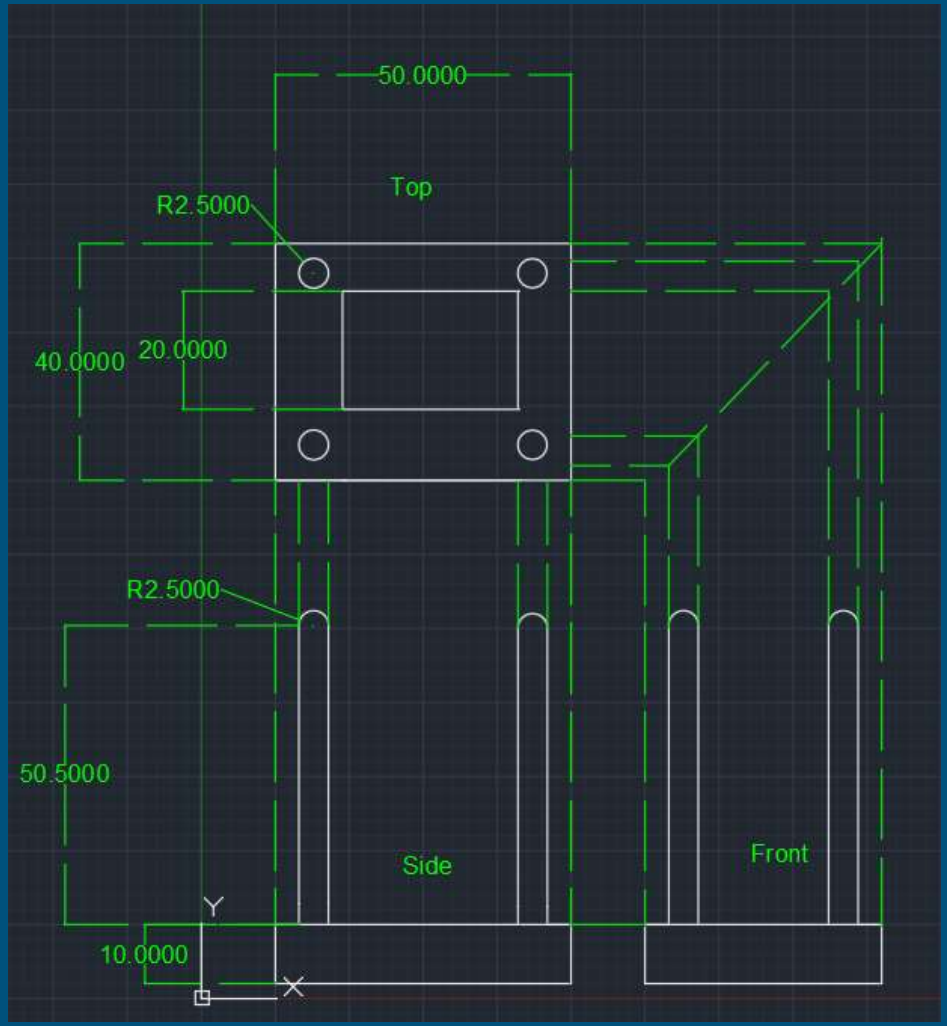


Isometric sketch of Sensor Housing Top:



AutoCad drawing And 3D Model of Sensor Housing Top:





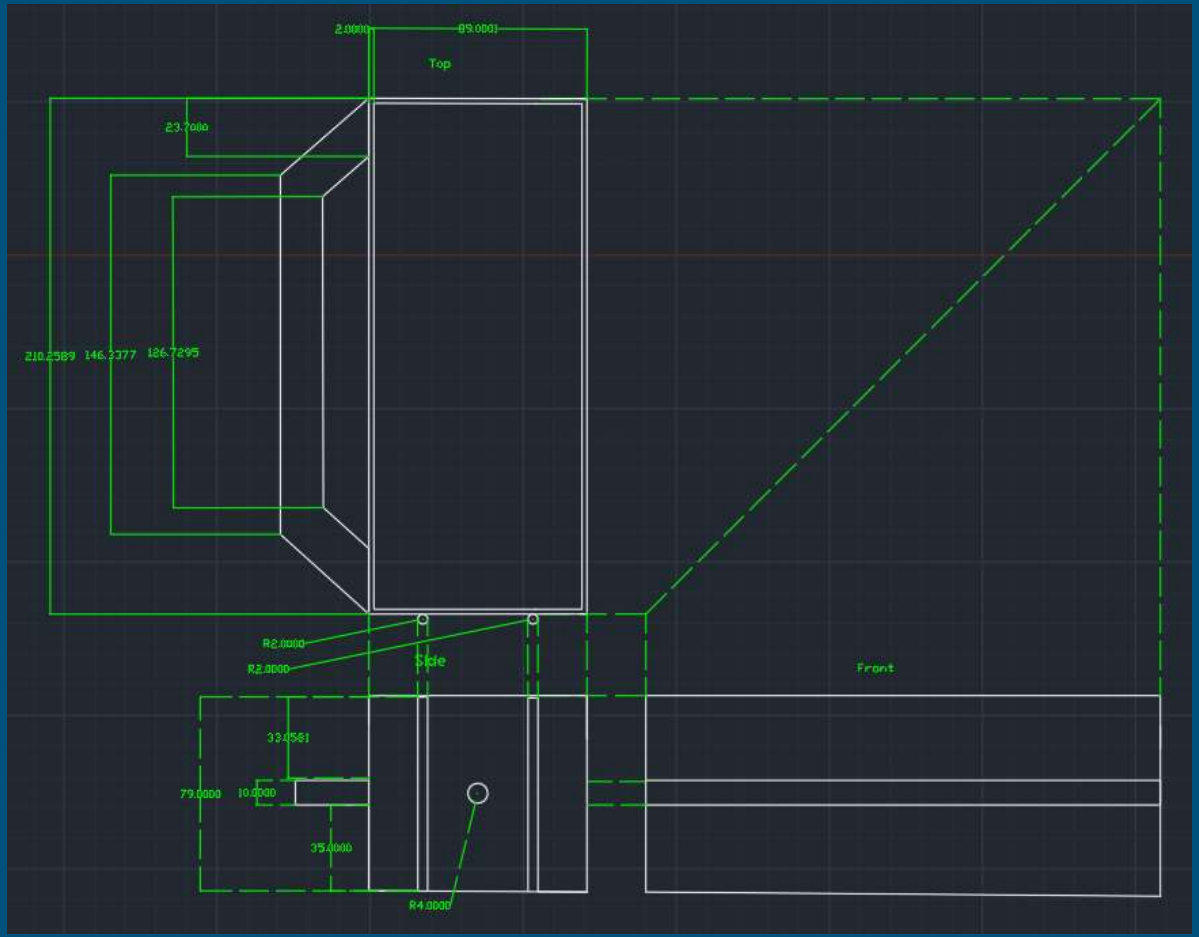
Current Drawings, Models, Designs, and Changes

Part 1: Arduino Housing Base
Part 2: Arduino Housing Top
Part 3: Arduino Housing Shelf
Part 4: Sensor Housing Base
Part 5: Sensor Housing Top

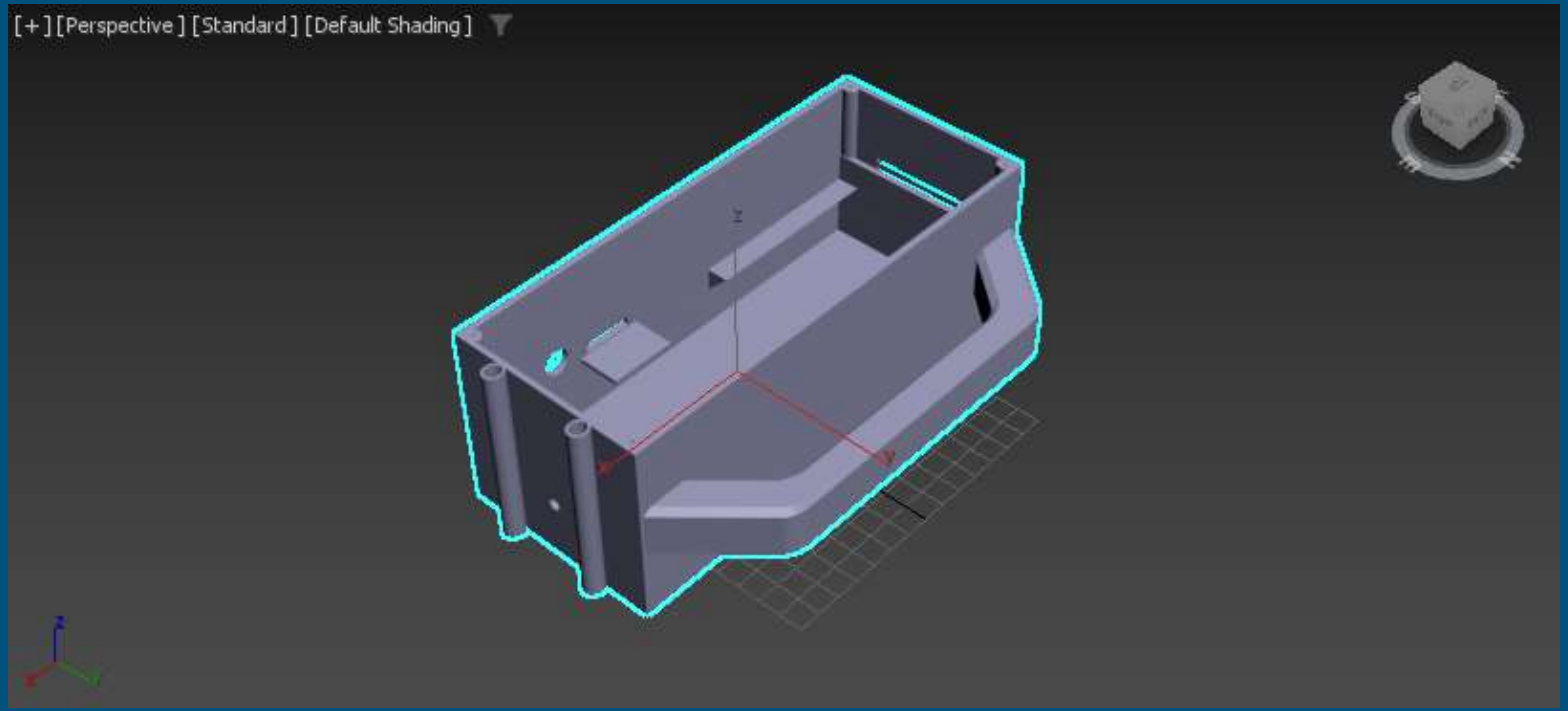
Arduino Housing Base CAD sketch:

Updates:

- Wider to compensate for a bigger battery since we will be recording for up to 12 hours.
- Taller for better cable management.
- Removable shelf (see in future slide).
- Added storage rails for the sensor housing units to rest in.
- Changed from a usb-c port to a barrel connector for charging for easier use.



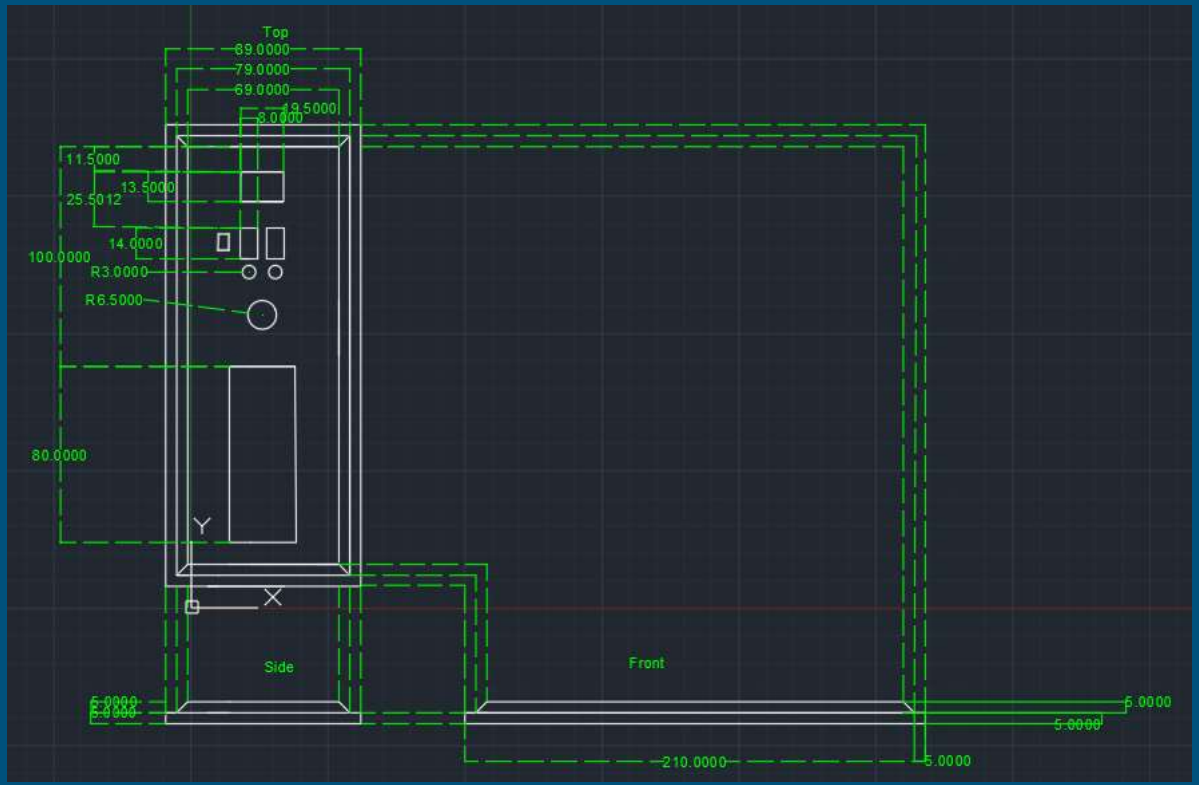
Arduino Housing base
3d Model:

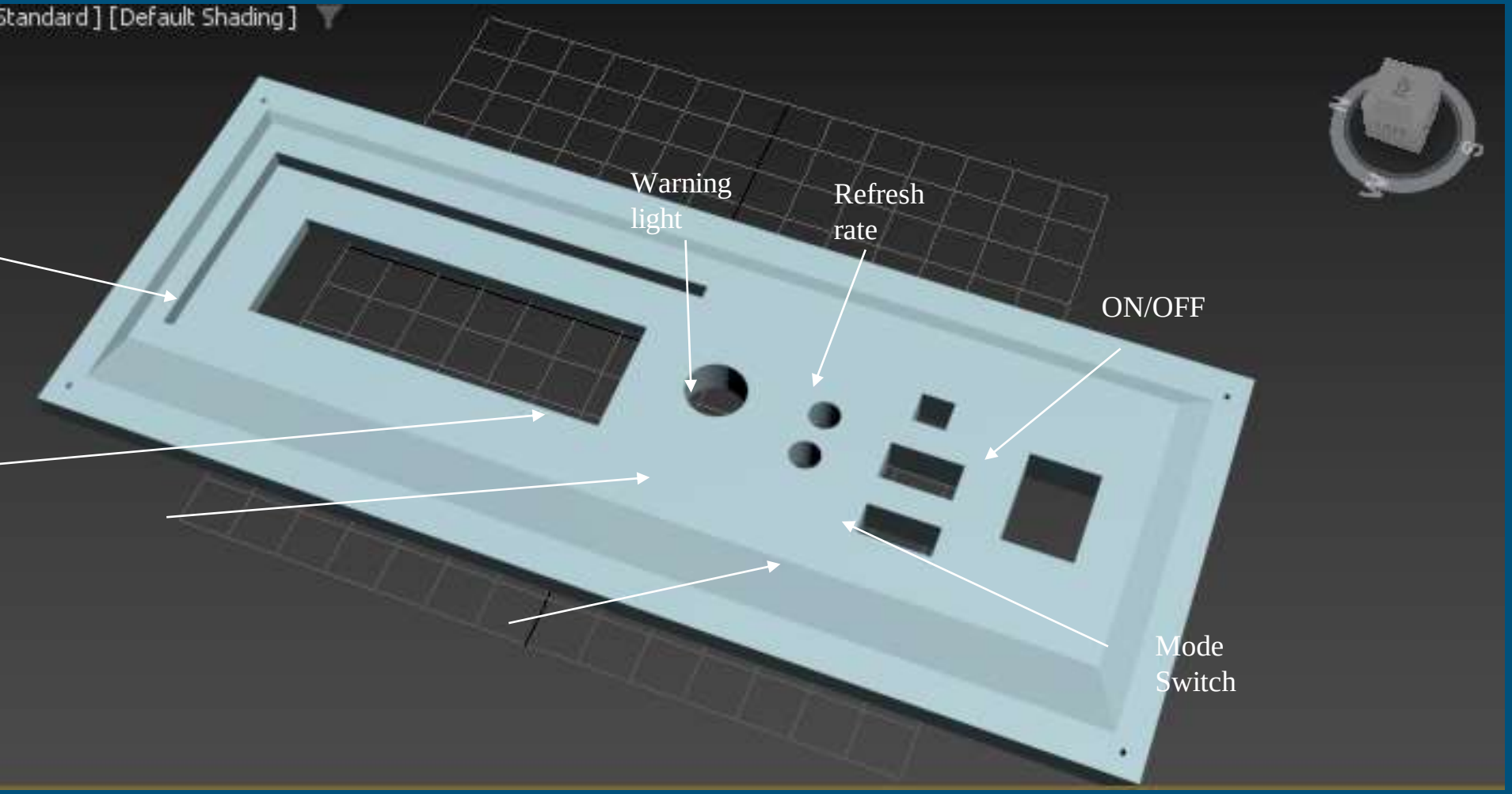


Arduino Housing Top CAD sketch:

Updates:

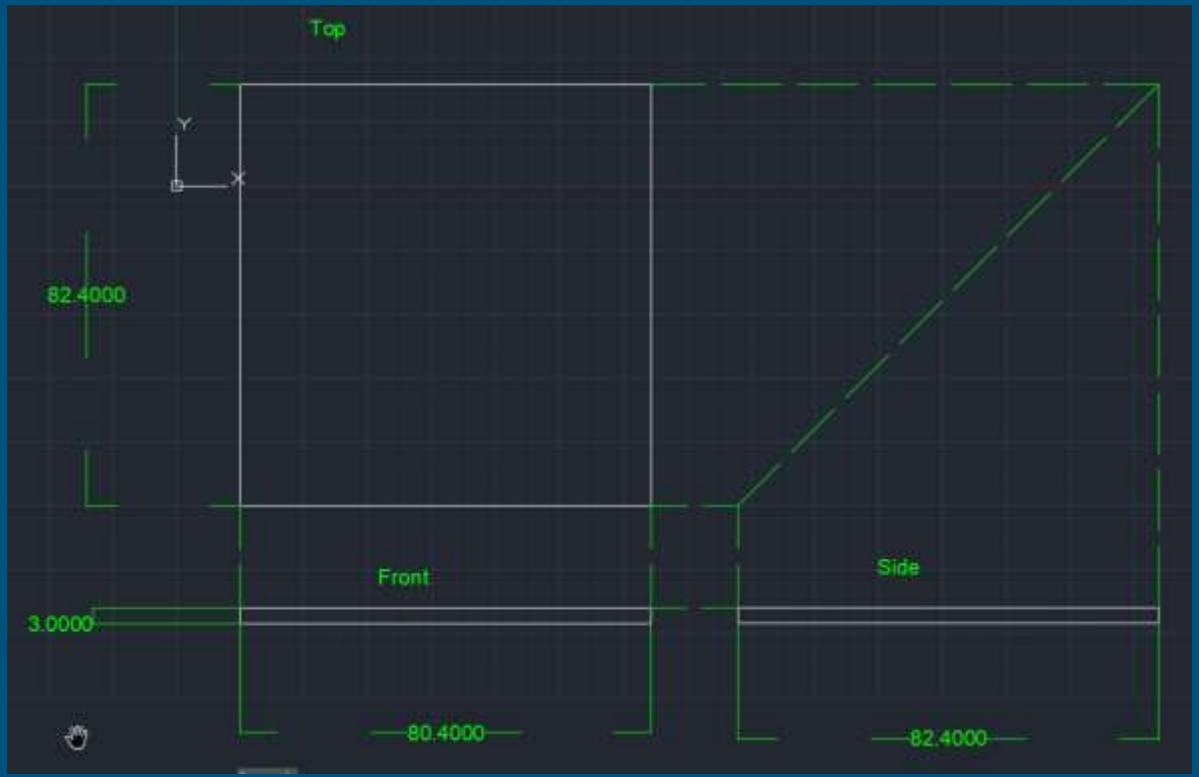
- Added recording state switch
- Added an additional LED which works in parallel to the recording state.



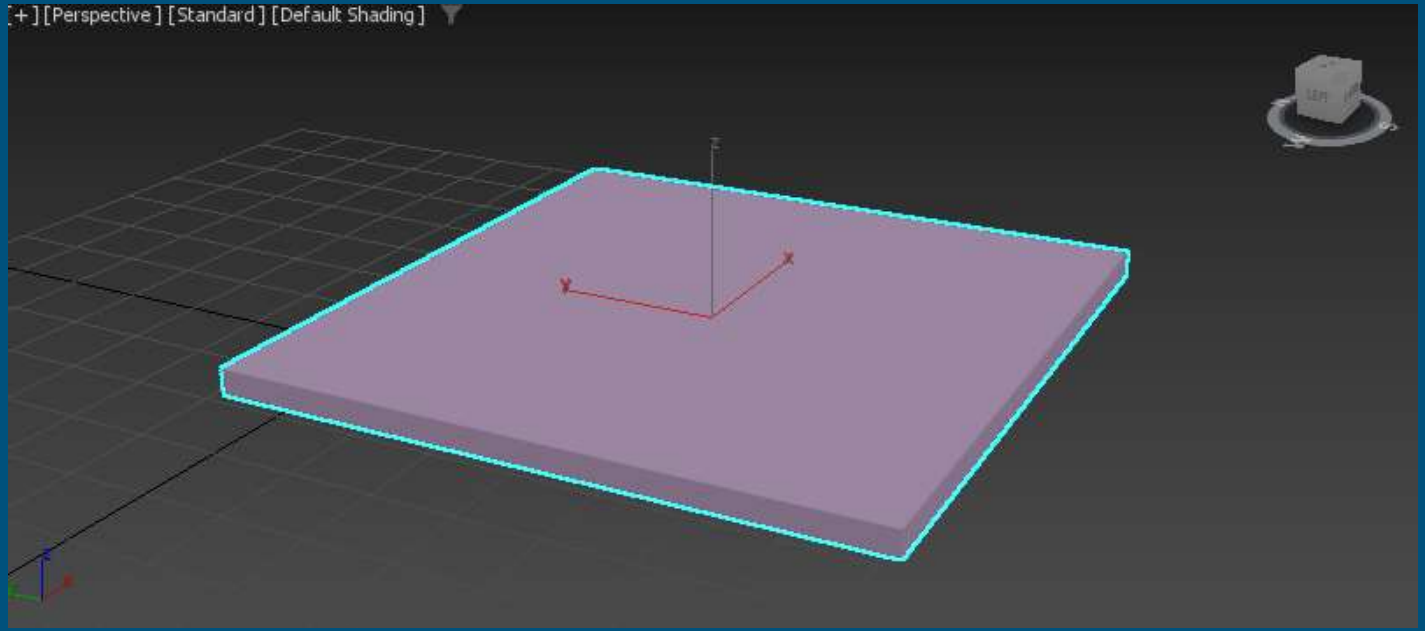

Standard] [Default Shading]
Warning light
Refresh rate
ON/OFF
Mode Switch

Arduino Housing Shelf CAD sketch and 3D model:

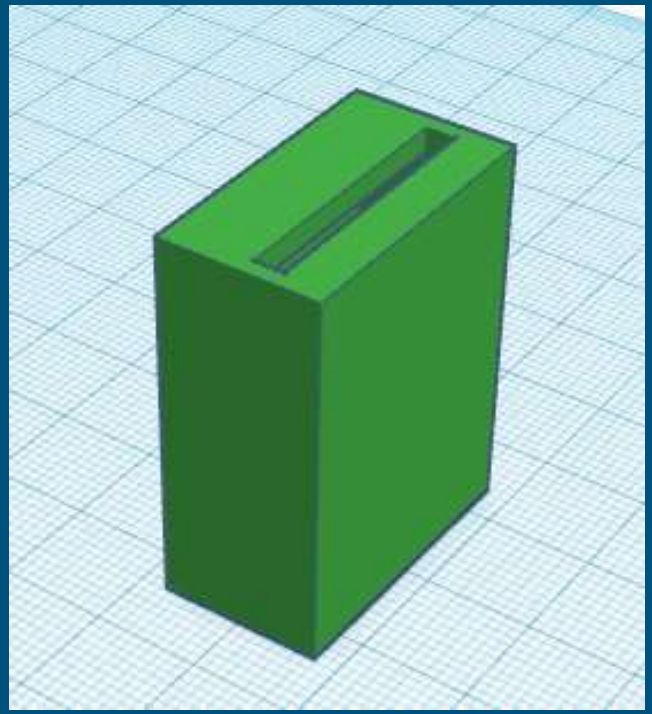
This will be a removable shelf which the arduino will sit and or mount to.

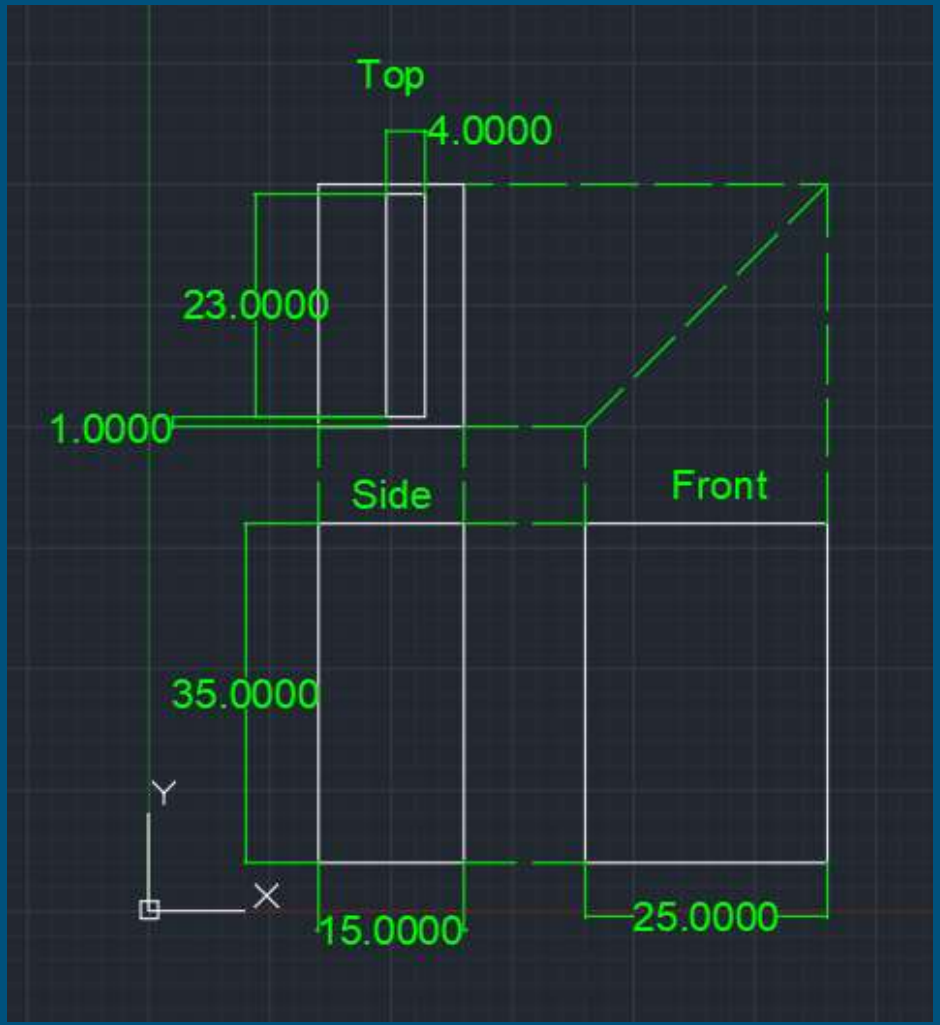


Arduino Housing Shelf
3d Model:

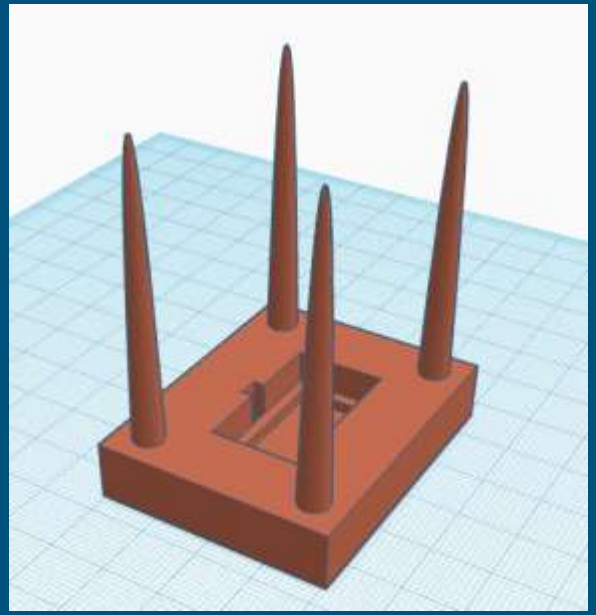


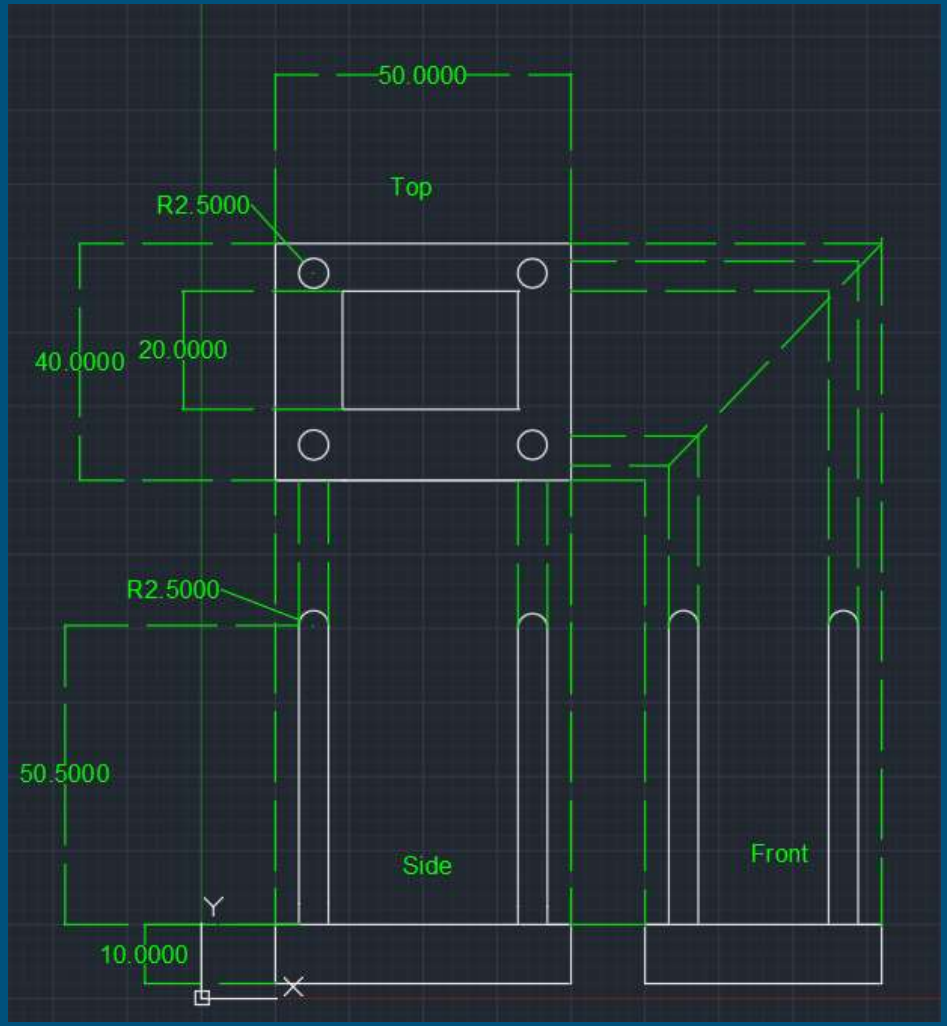
AutoCad drawing & 3D Model of Sensor Housing Base





AutoCad drawing & 3D Model of Sensor Housing Top:



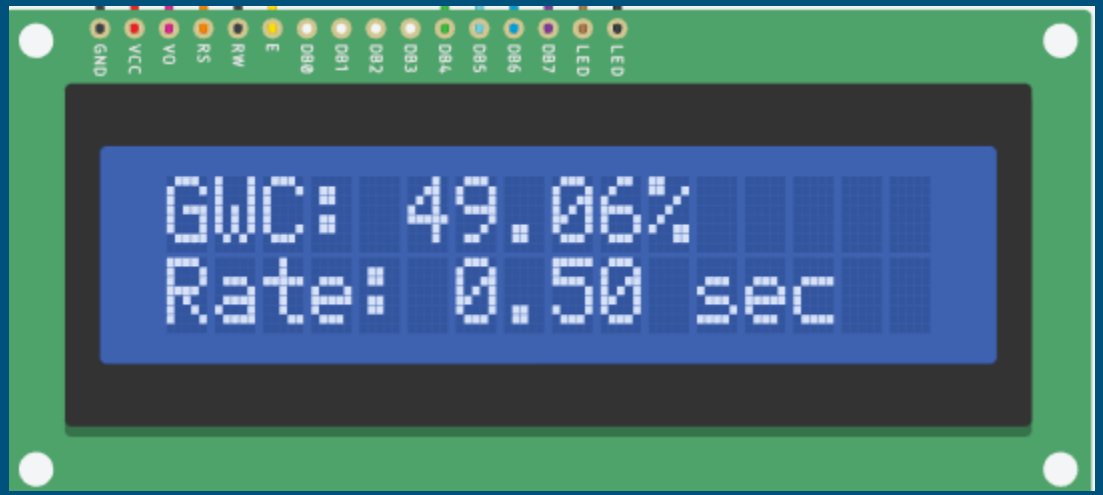


Prototype Functionality

Input device descriptions and interactions

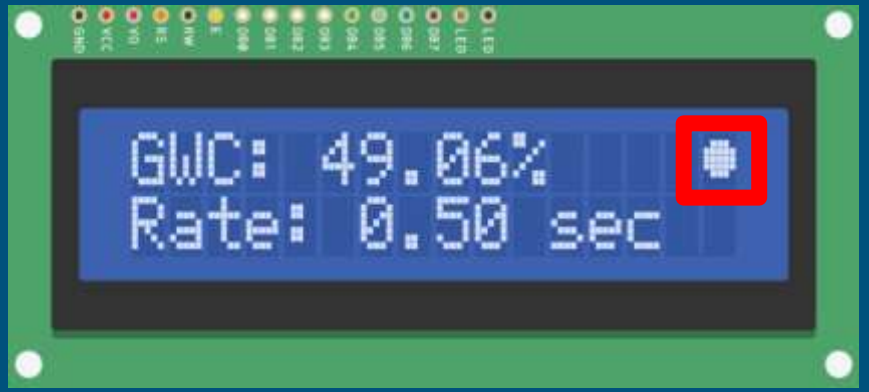
Refresh Rate Button

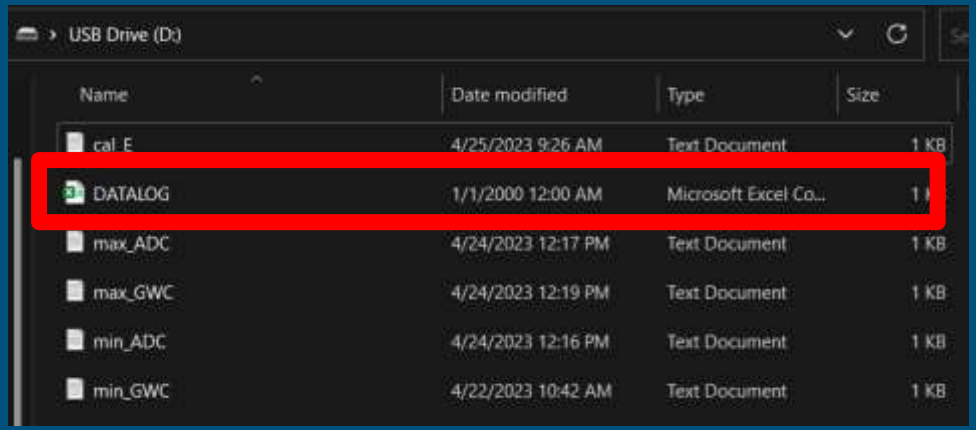
- A toggleable button with five options
- Affects LCD and data logging file



Recording Switch

- Allows program to log data
- Starts on a clean slate for every new recording





Mode Switch

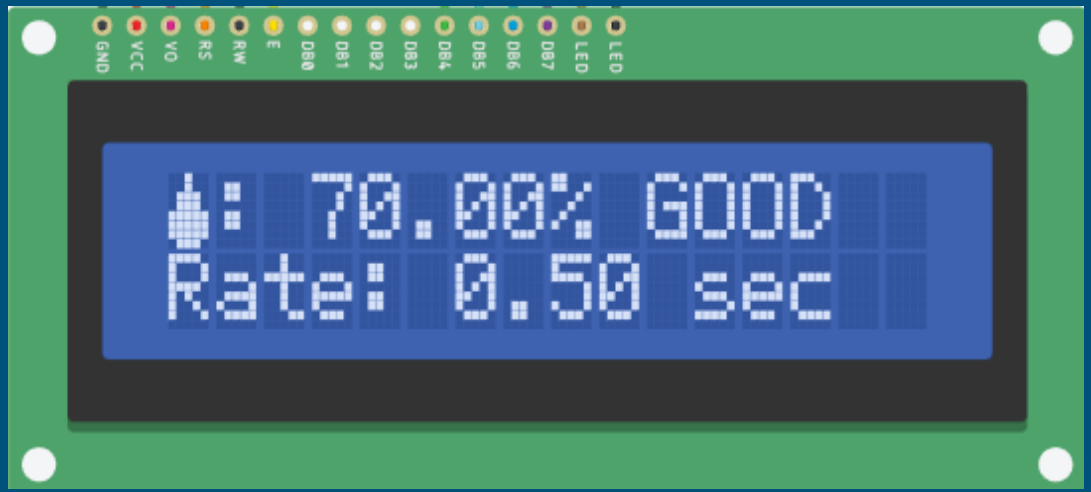
% Moisture Mode

OR

Calibration Mode

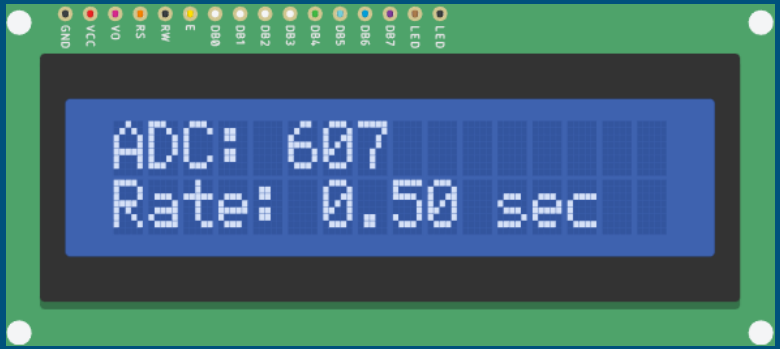
% Moisture Mode

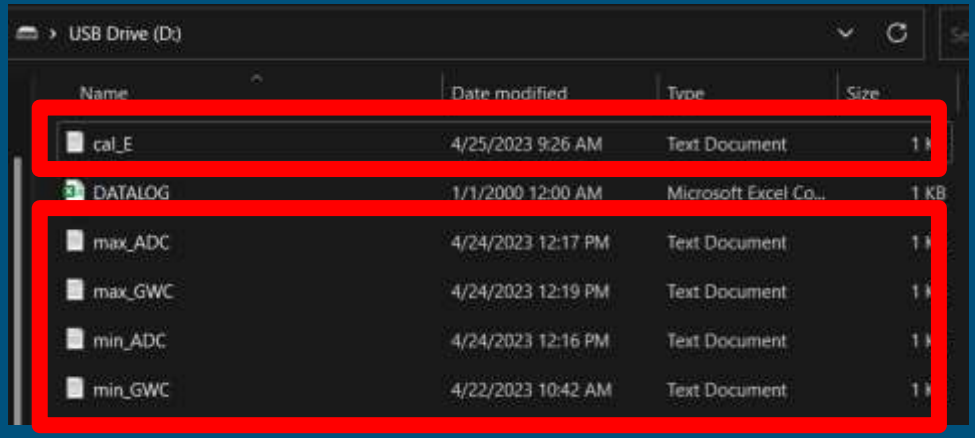
- Displays qualitative readings based on the moisture value
- Less accurate but no calibration needed.



Calibration Mode

- Represented by ADC/GWC
- Can change calibration formula via SD card
- More accurate but calibration is needed.



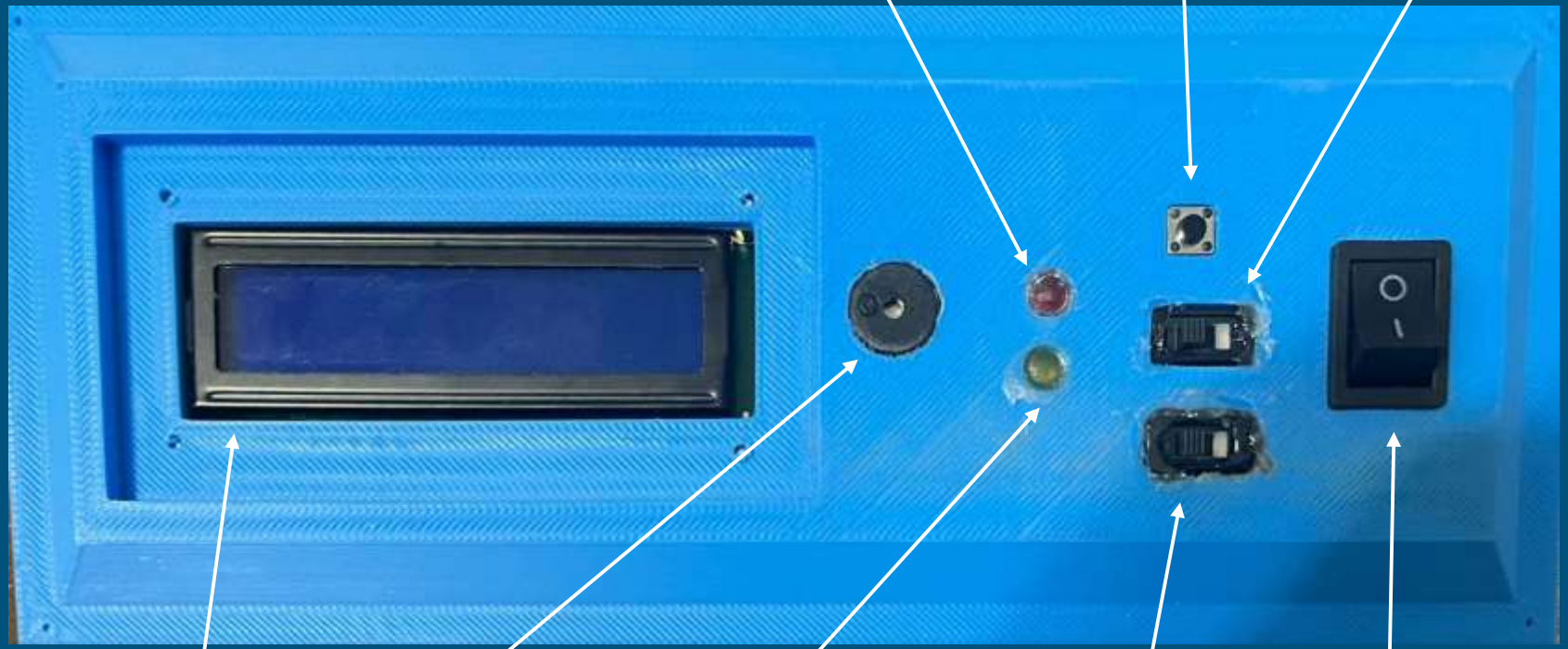


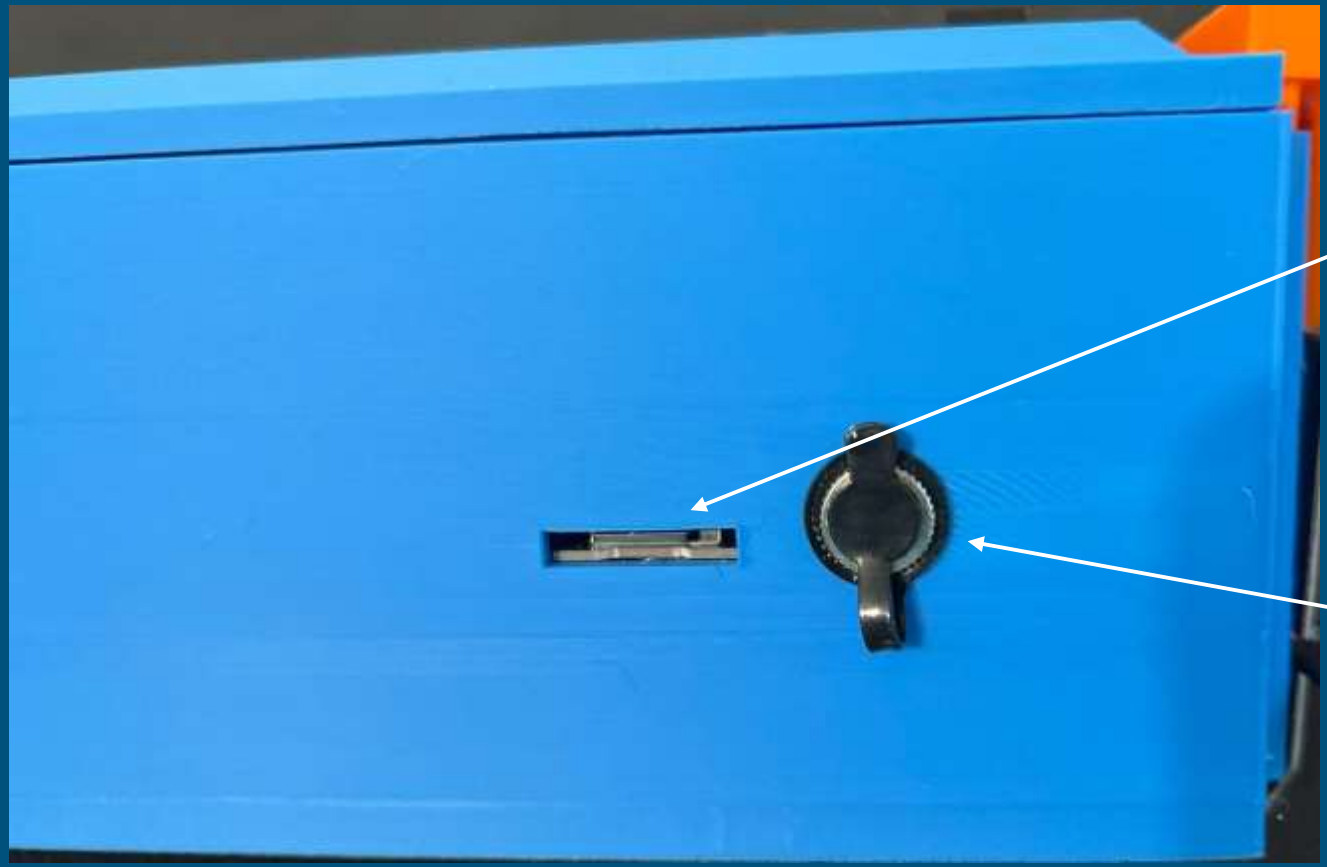
Demonstration of Prototype

For more information, contact bjh25383@email.vccs.edu, rjb24732@email.vccs.edu, or ja81988@email.vccs.edu

For professor: check speaker notes

Questions?


Warnin
g Light
Refresh
Rate
Mode
Switch
LCD
Screen
Active
Buzzer
Record
Light
Recording
Switch
ON/OFF
Switch


Micro SD Port
Charging Port