Arduino Uno Case

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Introduction:

For this Assignment, I have decided on creating a screwless and simple case for a Arduino Uno with a Velleman RGB LED shield. This case/enclosure consists of two parts, a base and cover. There are holes for the power and data ports, three holes on top for the LED indicators, and screw mounts inside the enclosure. The enclosure uses tabs to join both sides together.

Purpose of Device:

The purpose of the device would be for measuring Humidity and Temperature.

The Three LED's on the top would be used to indicate the current Humidity and Temperature by sequences of light.

For example, if the Humidity of the Arduinos current area was 80%, the LED could flash Its Red LED.

If the humidity was between 30% and 50%, the green light could have a slow flashing sequence.

Both of these could be accompanied by the Blue LED, it would shine or light up in the same sequence to indicate that the LED is currently shining to communicate humidity levels.

For temperature, the process would be similar, although this time all the LED's could be used, but, the LED that would be indicating the current temperature could flash.

For example, (in degrees Celsius) the Red is for temps over 25, green is between 25 and 10, blue is 10 and below.

If it was between 25 and 10, the green LED would flash while the red and blue would remain solid colours. Although, if the temperature was 25-40, the red LED would flash slowly. If the temperature was 40 or above, the red LED could flash at a much faster pace to indicate a warmer temperature. The same method would be used for the Blue LED.

Extra:

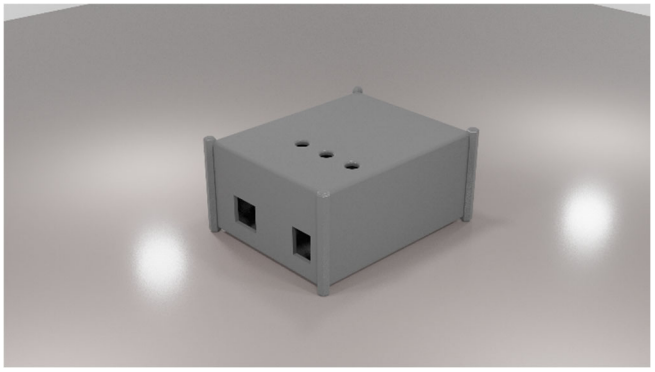
A speaker may accompany this device, and when the device reaches extreme temperature or humidity, it would let out beeps or a tone through a miniature speaker. Such as the one found on desktop computers. Although, since there are no buttons on the case, this would require a rotation sensor on the inside. If the Arduino is upright (90degrees), the sound would play when the temperatures are reached. When laying flat there would be no audio played, only RGB indicators.

Target Audience:

An example of a target audience for this Project, would be a could be a gardener or even 3d printing enthusiast.

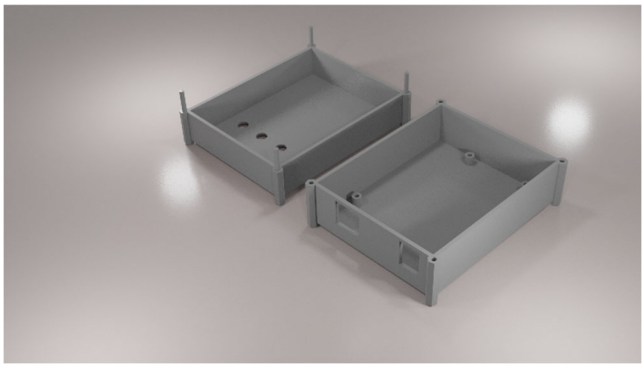
Both of these may require temperatures to be at a correct level for their occupation or hobby projects to be successful. As well as humidity and if it needs to be monitored constantly.

About the Design:



The design process began with brainstorming and attempting to set standards for the size requirements. For example, a set wall thickness of 1.6mm was decided on the case. This was chosen due to “Wall Thickness” option in Ultimaker Cura, a 3D printer slicing software, showing a wall thickness of 0.8mm.

With this information, I decided on creating walls of 1.6mm, allowing for there to be double walls/layers creating a more durable enclosure. As well as the first created standards.

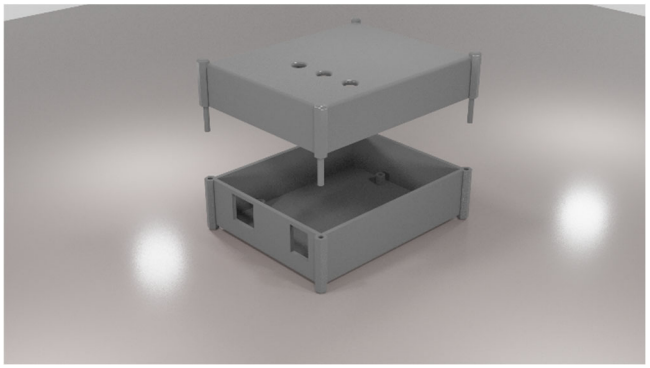


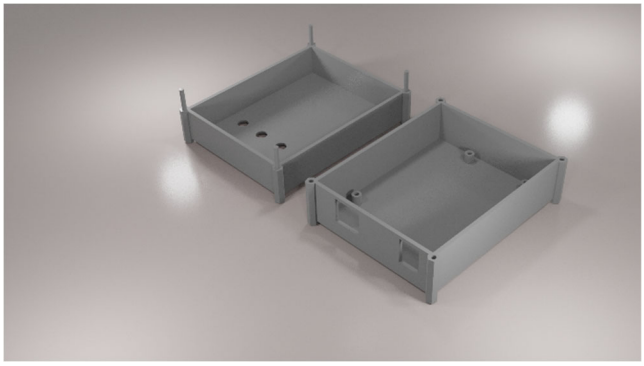
Next, I had to decide on the system I will use for securing the top of the enclosure to the bottom/base.

For this I decided to simplify the process and potential expenditiure on external supplies by implementing tabs. These tabs as seen on the image to the left, are at 4 separate corners. These fit into holes on the base/shell which in return hold the arduino top in place.These tabs are reliant on friction to hold and like most items, can wear over time.

Although with the purpose of the device in mind, as well as the target audient, the device is not meant for often dissasembly, rather a close and leave strategy.

The hole placement, as well as mounting points for the arduino, counter in the fact that there will be space left around the arduino for ease of mounting and takeing out the arduino from its case. Around the perimiter of the arduino, there is 1.4mm left. This space is sufficient for some extra space, while not being un-needed and a waste of materials and time.





The mounting points for the Uno, located on the inside of the case, are 4mm high. This measurement, as well as the 1.6mm wall thickness was countered in while calculating the Arduino height, shield height and how these would fit into the enclosure.

To this, as visible on the image, there are 4 pentagons added to each corner of the Arduino enclosure. These were added for impact abrasion as well as the mounting points of the top shell. They go out 1.4mm, allowing for airflow to pass under the Arduino potentially giving better passive cooling performance.

Lastly, to add some visual aesthetics/ roundness on the model , a bevel was added to the top and bottom of the case, as well as the LED hols located on the top shell. The latter is intended for better light distribution.

About the Process:

Ideas and calculations:

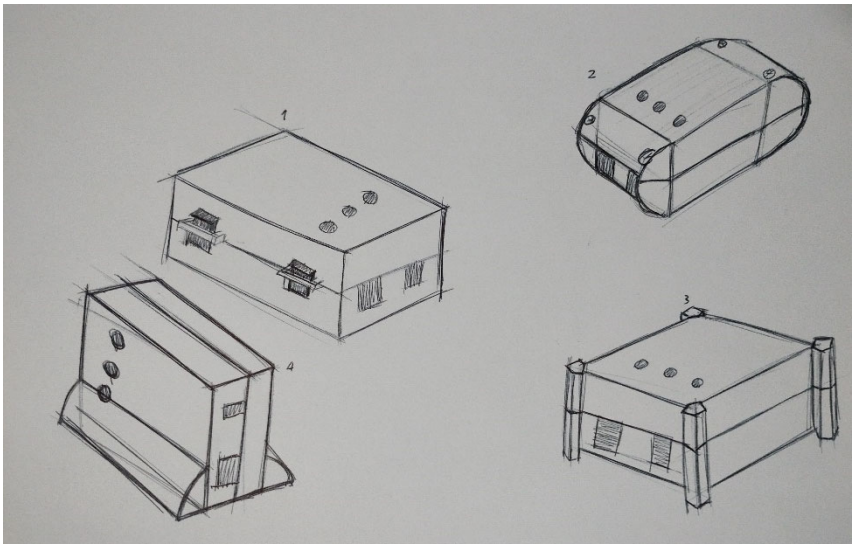
For Ideas, there were 4 concepts considered.

1: Clips easy to Break, too simplistic design.

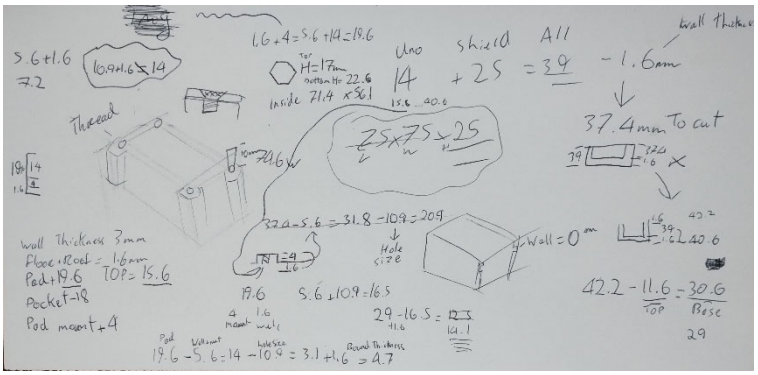
2: No major issues. Harder to store and place vertically.

3: Chosen Design, bumpers on all sides, good visibility of LED, easy to store

4: Too large, covers of LED's, cannot place on all sides.



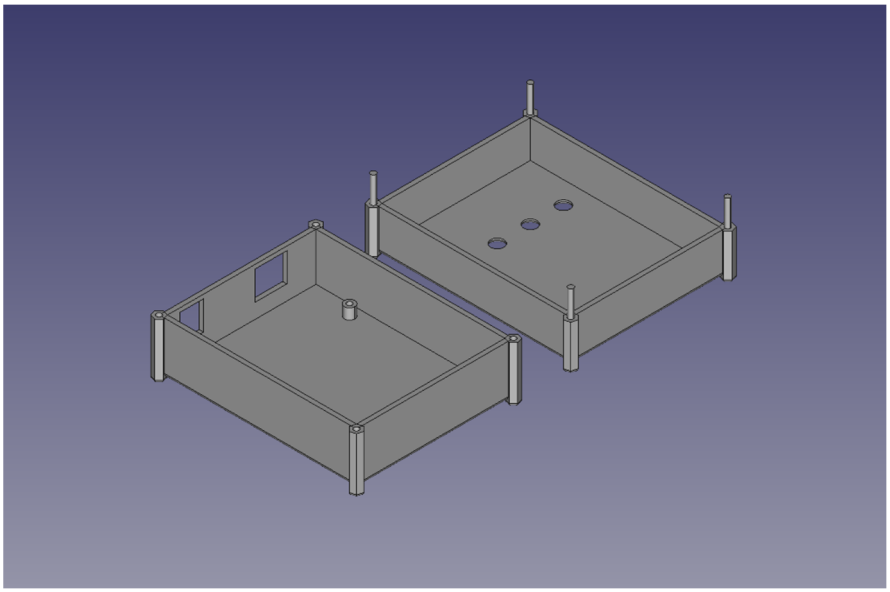
Extra: rough work of calculations and idea's for enclosure.



About the Development:

Through trial and error as well as constant calculations and checks, There have been many live adjustments made to the constraints to ensure they are well made. Screen Shots of the progress are included in the project files as there are 20 images to showcase.

The process involved creating sketches on the XY plane (top down), using the sketcher and Part Design sections. The walls were decided to be 1.6mm and the spare distance between the uno and walls to be 3.0mm. The mounts are 4mm higher, this is reflected on the holes/other measurements.



Materials to be Used:

The material chosen to be used was ABS.

ABS is the chosen plastic for its strength and durability. It has excellent impact resistance and toughness.

To this, it has Heat resistance which means the enclosure would not get damaged easily from the suns heat. Also ABS is resistant to many chemicals and organic solvents, which would make it ideal to be outdoors monitoring temperatures by plants, or thrown where it's needed.

Lastly, ABS is easy to fabricate in more ways then 3D printing, such as injection moulding and thermoforming (thermoforming not entirely applying to this enclosure). It is also very accessible and already widely used in many different everyday products, such as keyboard and kitchen appliances.

Why not PLA or TPU?

Although PLA and TPU are also durable plastic types, Like mentioned above, ABS is more durable then PLA and has a higher melting point. It is also more resistant to chemicals and can be easily post processed.

For this case, TPU would not be suitable as the enclosure needs to be solid for its integrity as well as TPU being more expensive.

Manufacturing of:

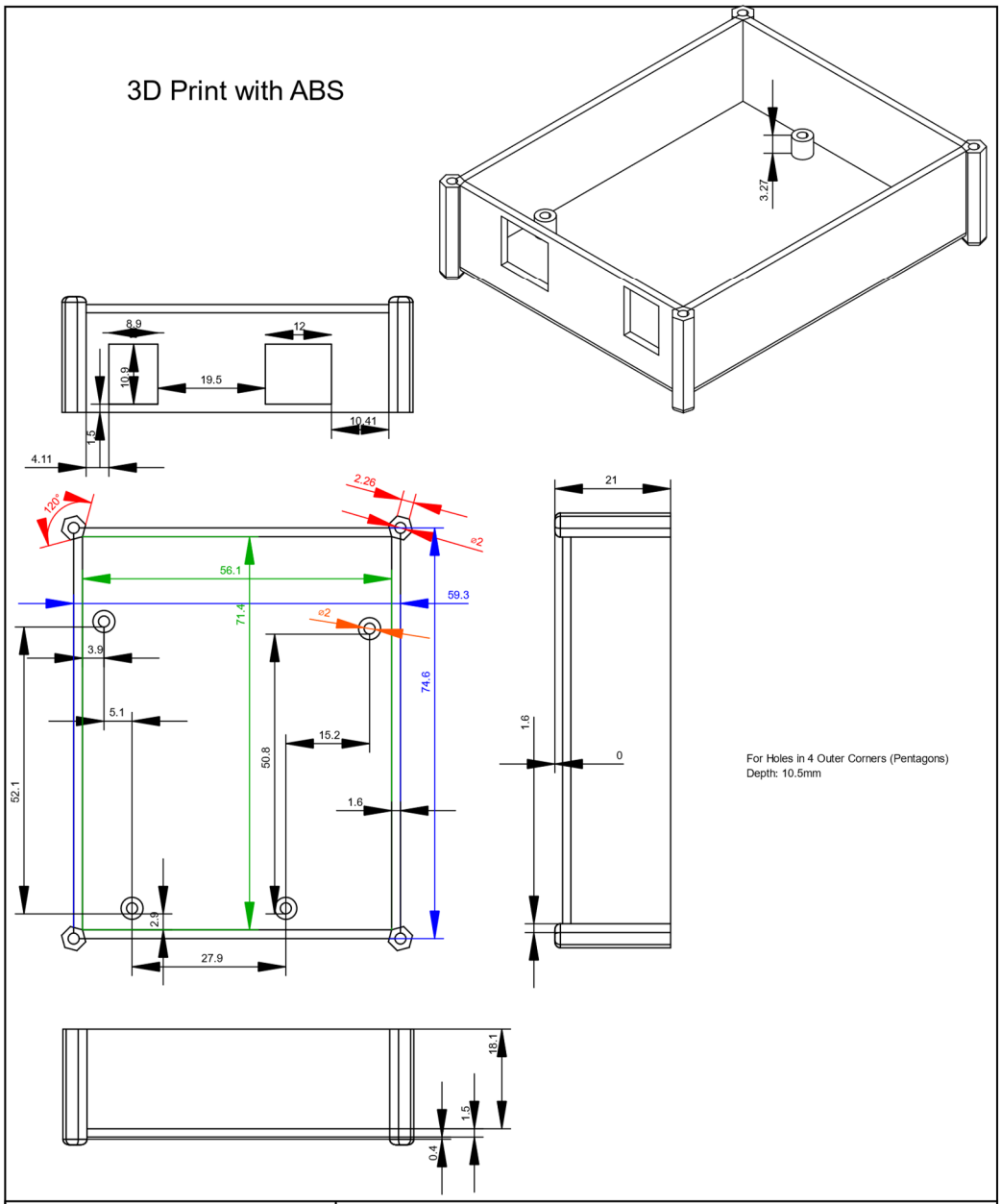
The manufacturing process has many potential options such as FDM Printing, resin Printing or injection moulding.

The chosen process for this enclosure is FDM (Fusion Deposition modelling) 3D printing. Dependant on the printers capabilities, they are capable of printing very fine layers and models with numerous types of plastics.

Each layer of ABS plastic is extruded through a nozzle (can vary in size for wall thicknesses), creating a layer on top of a layer, which in the end would result in a finished product.

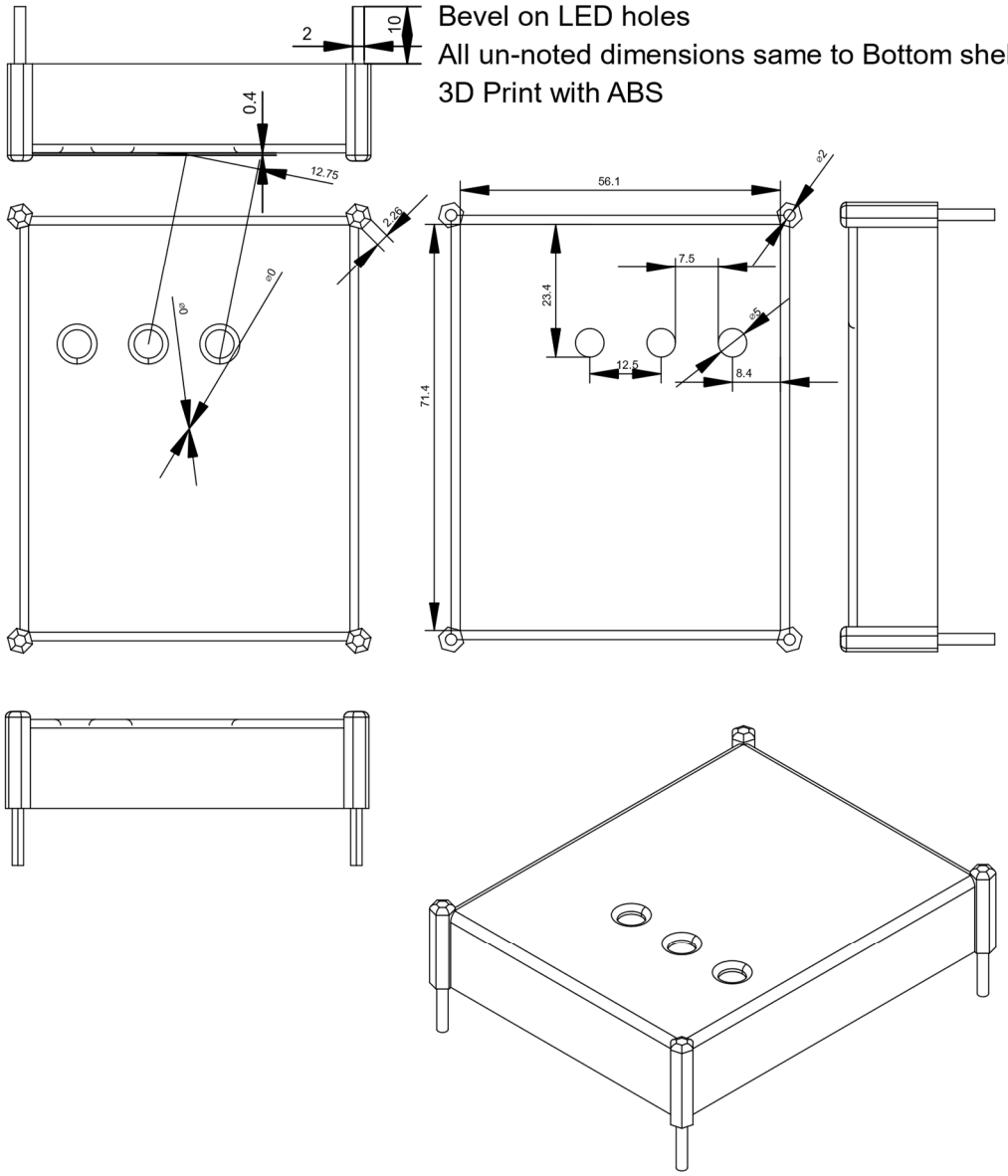
The simplicity and availability of this equipment (at FabLabs or at homes), this enclosure has the potential to be printed at ease and low cost.

Dimensioned Drawings:



Created by: Oskar L ID:20278551	Title: Arduino Uno Case			
Supplementary information: Bottom Shell for Arduino	Size: A4	Sheet: 1/2	Scale: 1:1	
	Part number: 01 Drawing number: 1			
	Date: 24/04/2023		Revision: REV A	

Bevel on LED holes
All un-noted dimensions same to Bottom shell.
3D Print with ABS



Created by: Oskar L ID:20278551	Title: Arduino Uno Case		
Supplementary information:	Size: A4	Sheet: 2/2	Scale: 1:1
Top Shell for Arduino	Part number: 02 Drawing number: 1		
	Date: 24/04/2023		Revision: REV A