Deliverable H: Prototype 3 & Customer Feedback

Ah Chuen, Kate; Ayed, Evanna; Eid, Ziad; Onusko, Belle; Watt, Kymani

Group 1

GNG1103 - B01

TA: Kaleb Mannion

University of Ottawa
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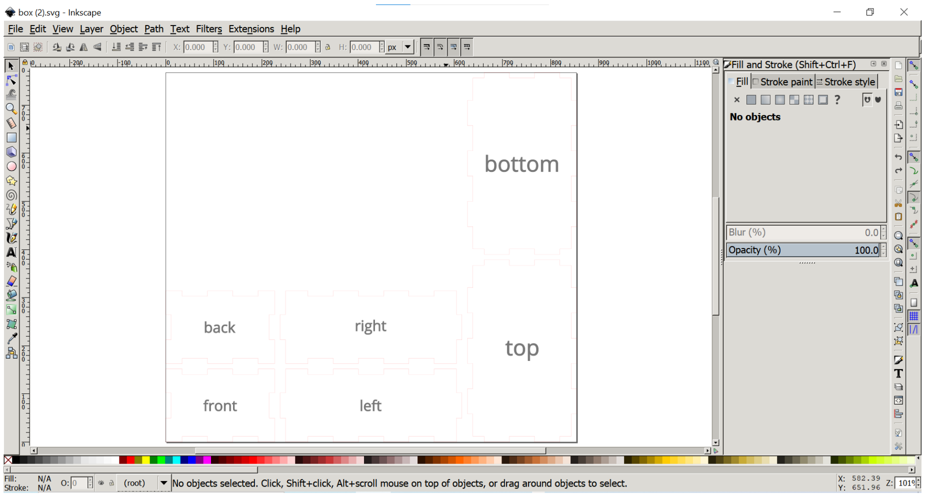
In this deliverable, we will be documenting the planning and construction of our third prototype, based on the feedback we received on our second prototype, and devising a test plan for the construction of our final device.

1. Our second prototype was a 10cm x 6cm x 4cm acrylic case. Upon testing that prototype, we realized that the sensors were unable to accurately detect motion and heat, the black colour on the outside absorbed a lot of heat which could hinder the reading and that all of the circuit components barely fit in the case. This caused us to modify the design for our second prototype to include a hole that would allow the sensors to be exposed to the air, change the outside color of the box's material and to increase the length and width measurements of the box. Here is the new **prototype** that we developed to achieve the objectives that were set up in our last deliverable. We first made a digital prototype on Makercase and Inkscape and then printed the 15cm x 12cm x 4cm MDF case in the laser cutting machine at the campus' Maker Lab. The laser cutting process was fairly quick which will be beneficial when the client is mass producing the device.



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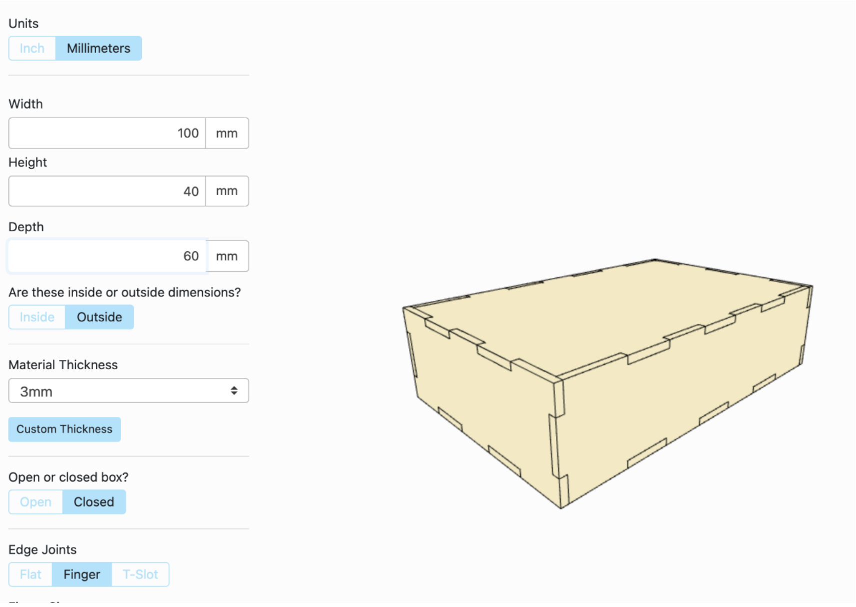


Units
Inch | Millimeters

Width
100 mm

Height
40 mm

Depth
60 mm

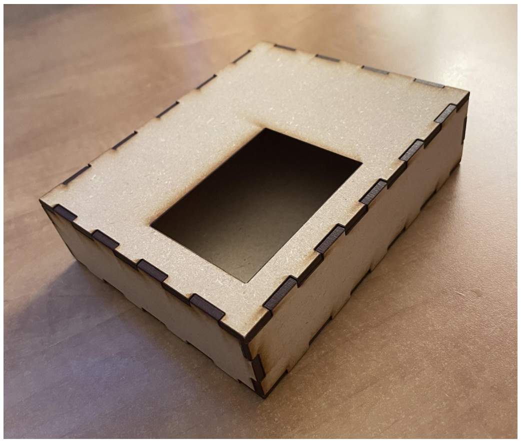
Are these inside or outside dimensions?
Inside | Outside

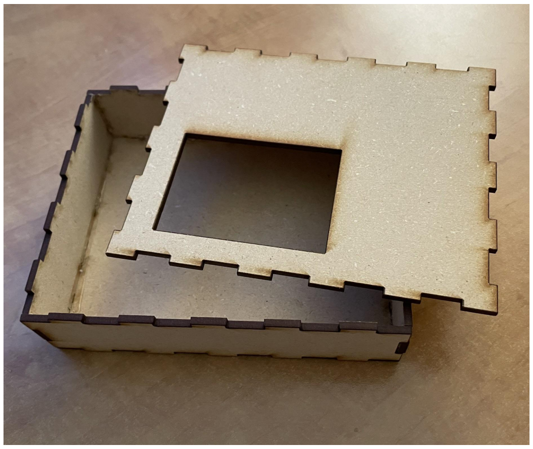
Material Thickness
3mm

Custom Thickness

Open or closed box?
Open | Closed

Edge Joints
Flat | Finger | T-Slot



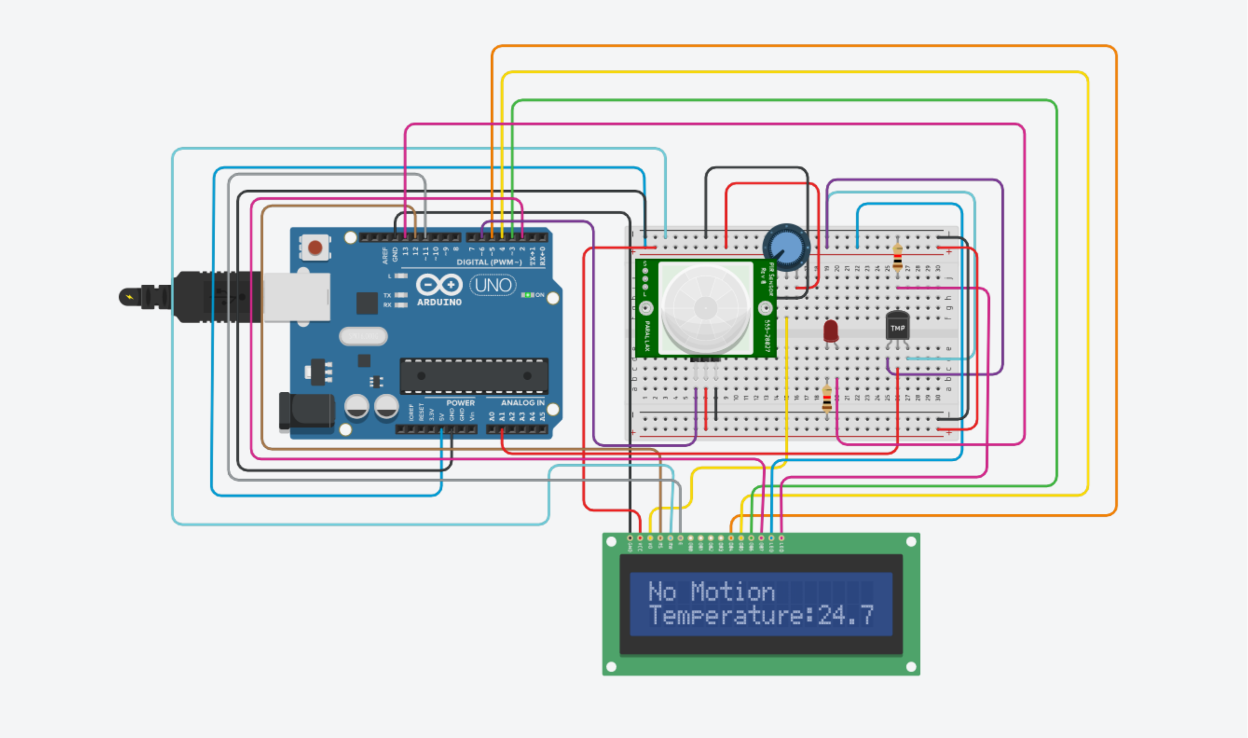


The following link is for the virtual circuit that we built on Tinkercad of the hardware that will be in this box:
https://www.tinkercad.com/things/gq5RUTNA27w-copy-of-temperature-sensor-display-with-lcd-in-arduino/editel?sharecode=qvcSwXFhrJ8E5N4I1usfjwY-ynNYQhIniefTWjJ3wAE

The code for the arduino:

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(12,11,5,4,3,2);
float value;
int tmp = A1;

void setup(){
                pinMode(tmp,INPUT);
  pinMode(6, INPUT);
  Serial.begin(9600);
  lcd.begin(16,2);

                  pinMode(LED_BUILTIN, OUTPUT);


}

void loop()
{

                  value = analogRead(tmp)*0.004882814;
                  value = (value - 0.5) * 100.0;
                  lcd.setCursor(0,1);
                  lcd.print("Temperature:");
                  lcd.print(value);
                  delay(1000);

  int a = digitalRead(6);
  Serial.println(a);


  if(a==0){
  lcd.setCursor(0,0);
  lcd.print("No Motion");
  delay(1000);
  }
  if(a==1)
  {
  lcd.setCursor(0,0);
  lcd.print("Motion Detected");
  delay(1000);

lcd.clear();
  }

  }
```

An image that shows our set up on Tinkercad



(The thermistor detects the temperature and is coded to display it on the LCD screen. The motion sensor shown above detects movement and displays this on the LCD screen.)

We are planning on adding a transistor that will help in the continuous signaling to the app.

We hope that we will be able to build this virtual circuit in person for our next prototype.

3.a) & 6) Prototyping test plan:

Tues. Nov. 23 2021	Client Meeting - Team shows the client the prototype that was built for Deliverable G that is a semi-functioning version of the final device - 15 min (All) - Client gives his feedback on what he likes/doesn't like, what can be improved/what should stay - 10 min - Team takes notes and reconvenes after the meeting to talk about the changes that will be made and what will be kept for Prototype 3 - 1 hour (All)
Thurs. Nov. 25 2021	Deliverable H due (Prototype 3) - Prototype 3 created - In-person: - Kymani & Ziad: Help Evanna make the finishing touches to the existing code and test the new codes on

	the Arduino board - 5 days - Belle & Kate: Work on refining the outside aesthetic of the project and can help with coding if needed - 5 days - Testing: - Testing the code to make sure that the sensor can detect a certain range and that when it does, it releases a sound - Have a teammate breathe very rapidly and very slowly and listen for a noise output - Testing the outer design of the project to make sure it is waterproof, sturdy, 'kid-proof' and comfortable
Tues. Nov. 30 2021	Client Meeting - Team shows the client the prototype that was built for Deliverable H that is a fully-functioning version of the final device - 15 min (All) - Client gives his feedback on what he likes/doesn't like, what can be improved/what should stay - 10 min - Team takes notes and reconvenes after the meeting to talk about the changes that will be made and what will be kept for the final device - 1 hour (All)

3.b) **Prototype analysis:**

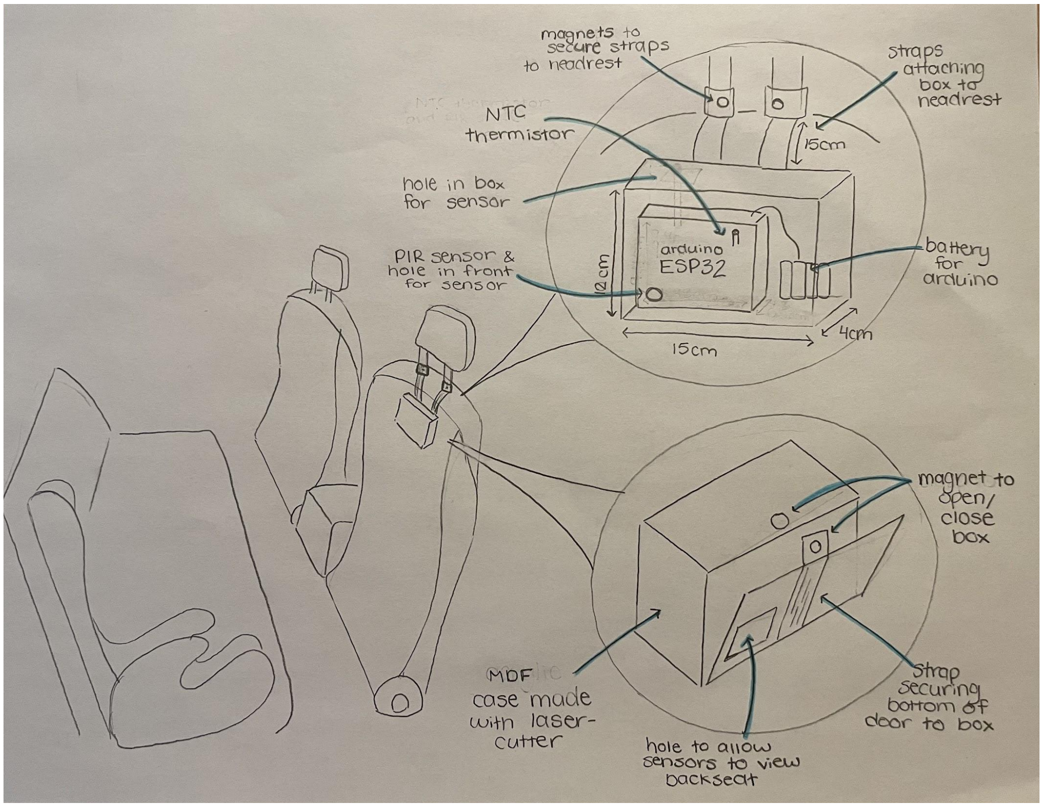
Component:	Observations:	Future plans:
Acrylic case	- The black coloured acrylic would absorb too much heat. This would make our temperature sensor inaccurate.	- For our next prototype, we will also cut two holes in the back of the box, so that our straps can loop through to create a stronger bond.
Straps & clasps	- These are currently missing from our prototype, as we are still waiting for them to arrive.	- They will secure the case to the headrest. - They will also be placed on our case door (as shown in design drawing).
Sensors	- We currently do not have a way to detect the presence of a child.	- We will purchase a PIR sensor to detect a person in the car.

4. **Feedback:**

Comments:	Possible solutions:

- The acrylic box that we laser cut is black and we received some feedback from a friend that the black colour may affect the thermistor's temperature reading because the box will absorb more heat than the actual car.	- Different material that doesn't absorb as much heat - Painting the box a light color
- The box was filled with components to the max	- Making the box bigger - Using less/smaller components
Still need to find a way to attach it to a car	- Straps - Lay on the seat (not too safe)

Updated design drawing:


magnets to secure straps to headrest
straps attaching box to headrest
NTC thermistor
15cm
hole in box for sensor
PIR sensor & hole in front for sensor
arduino
ESP32
12cm
battery for arduino
15cm
4cm
magnet to open/ close box
MDF case made with laser-cutter
hole to allow sensors to view backseat
strap securing bottom of door to box

Our updated design drawing now shows the addition of a larger hole in the front of our box (5cm x 7cm). Our box is also no longer made of acrylic, as this material was not cost-efficient. Instead, we used MDF which is cheaper, and allows glue to stick better. This is good for attaching our fabric and our magnets. On this topic, we also chose to use magnets to secure our straps and door rather than clasps. These will be easier to glue on, and easier for the user to work with.

Updated BOM:

Cost Estimation and Bill of Materials:				
Component	Description	Amount	Unit Cost($)	Total Cost($)
Wires	Always in need of wires.	4	0.10	0.40
The Arduino case- laser- cut MDF	Plastic casing that covers the arduino, outer case will be laser-cut	1	2.50	2.50
ESP32 - Arduino+	Containing the arduino board, breadboard,some wires and transistors.	1	10.94	10.94
NTC Thermistor	Probes used to measure changes in temperature.	2	0.83	1.66
Batteries	Used to power the system.	4	1.00	4.00
PIR motion sensor	Inside case, to detect motion of child	1	4.86	4.86
Magnets (pack of 6)	To secure straps to headrest, and close / open box	1	1.25	1.41
Fabric for straps	Glued to outer casing to attach to headrest	1	Free (using recycled material)	0
			Overall Cost :	$37.73
			Allocated Budget:	$50.00
			Money left (in case of emergency):	$12.27

1. Esp32 - Basically an arduino board with wifi/bluetooth capabilities.
   https://edu-makerlab2021.odoo.com/shop/product/esp32-111?search=esp#attr=233
2. Ntc Thermistor - Probes that are used to measure surrounding temperatures
   https://edu-makerlab2021.odoo.com/shop/product/ntc-thermistor-138#attr=
3. Batteries - Used to battery.
   https://edu-makerlab2021.odoo.com/shop/product/battery-90?category=5#attr=167
4. Magnets https://canada.michaels.com/en/default/10307908.html
5. Strap fabric
   https://canada.michaels.com/en/solid-cotton-fabric-by-loops-and-threads/M10411660.html?dwvar_M10411660_size=18%22%20x%2021%22&dwvar_M10411660_color=Pink

6. PIR sensor - sense the presence of a child to activate system
   https://edu-makerlab2021.odoo.com/shop/product/pir-sensor-46#attr=

Building the third prototype was a memorable and very educational experience and we're looking forward to building our final device based on the client and public feedback that we received. We can't wait to create the best product for our client.