Deliverable E

uOttawa

GNG 1103

Group D-1.4

Names :

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Bill of Materials :

Subsystem	Material description	Hyperlink	Quantity	Unit cost	Cost
Inlet	1 pack of 4 pcs 8”x4” insect grill	https://www.amazon.ca/Stainless-Panels-Insect-Control-Airbricks-A5/dp/B07Z61G7MV/ref=asc_df_B07Z61G7MV/?tag=googleshopc0c-20&linkCode=df0&hvadid=459373245774&hvpos=&hvnetw=g&hvrand=9818137929339673790&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000265&hvtargid=pla-844368574943&psc=1	1	12.99$	12.99$
	10”x10”x1” Air filter	https://www.grainger.ca/en/product/p/WWG491H17?gucid=N:N:FPL:Free:GGL:CSM-1946:tew63h3:20501231	1	1.23$	1.23$
	1 pack of 6 pcs neodymium 0.47” disc magnet	https://www.homehardware.ca/en/6-piece-47-neodymium-super-disc-magnets/p/1130000	1	10.99$	10.99$
	Duct tape		1	1.25$	1.25$
	Gorilla Epoxy Glue	https://www.amazon.ca/Gorilla-4200602-Epoxy/dp/B07W6C9R4K/ref=sr_1_1?gclid=CjwKCAiA6seQBhAfEiwAvPqu193dvZBw_0xDSTMiAAWpmG34HxiIWPj7WX6Lm7_IMjO4grKNIow0BoCaJgQAvD_BwE&hvadid=324838665839&hvdev=c&hvlocphy=9000265&hvnetw=g&hvqmt=e&hvrand=823464907698423653&hvtargid=kwd-298489663838&hydadcr=4672_9980052&keywords=epoxy+gorilla+glue&qid=1645390859&sr=8-1	1	9.12$	9.12$
	Shell Material (TBD)		/	/	/
Chamber box	Cardboard		1	0$	0$
	Concrete (TBD)		/	/	/
	Clay Dirt mix		1	0$	0$

Inner Pipes	PVC Pipes (the amount of this piping can decrease) PVC Elbows(potentially an overestimate based off the number of pipes)		8ft *6 12	93¢ /ft $1.68	$44.64 $20.16
Outer Pipes	PVC Pipe 1''	https://www.homedepot.com/p/JM-EAGLE-1-in-x-10-ft-PVC-Schedule-40-Plain-End-Pipe-531194/202280936	3ft*6 (18ft)	93¢ /ft	$16.74
	PVC Tee Joint Fittings 1''	https://www.homedepot.com/p/Charlotte-Pipe-1-in-PVC-Schedule-40-S-x-S-x-S-Tee-PVC024001000HD/203812199	1	$1.97	$1.97
	PVC Cross Fittings 1''	https://www.pvcfittingsonline.com/1-schedule-40-s-x-s-x-s-x-s-pvc-cross-420-010.html	5	$2.52	$12.6
	PVC Elbow Fittings 1''	https://www.homedepot.com/p/Charlotte-Pipe-1-in-PVC-Schedule-40-45-Degree-S-x-S-Elbow-Fitting-PVC023091000HD/203812165	5	$1.68	$8.40
Electrical parts	Arduino Uno R3 microcontroller	Electronics (makerstore.ca)	1	$17.00	$17.00
	Breadboard	Electronics (makerstore.ca)	1	$10.00	$10.00
	Jumper Cables (pack of 10)	Electronics (makerstore.ca)	1	$1.00	$1.00
	USB cable		1	$ 0	$ 0
	Resistor	Resistor, 30 Ohm, 3W, 1ea | NightFire Electronics LLC (vakits.com)	1	$0.65	$0.65
	Thermocouple temperature sensor	MAX6675 Module - SODIAL(R) MAX6675 Module + K Type Thermocouple	1	$11.62	$11.62

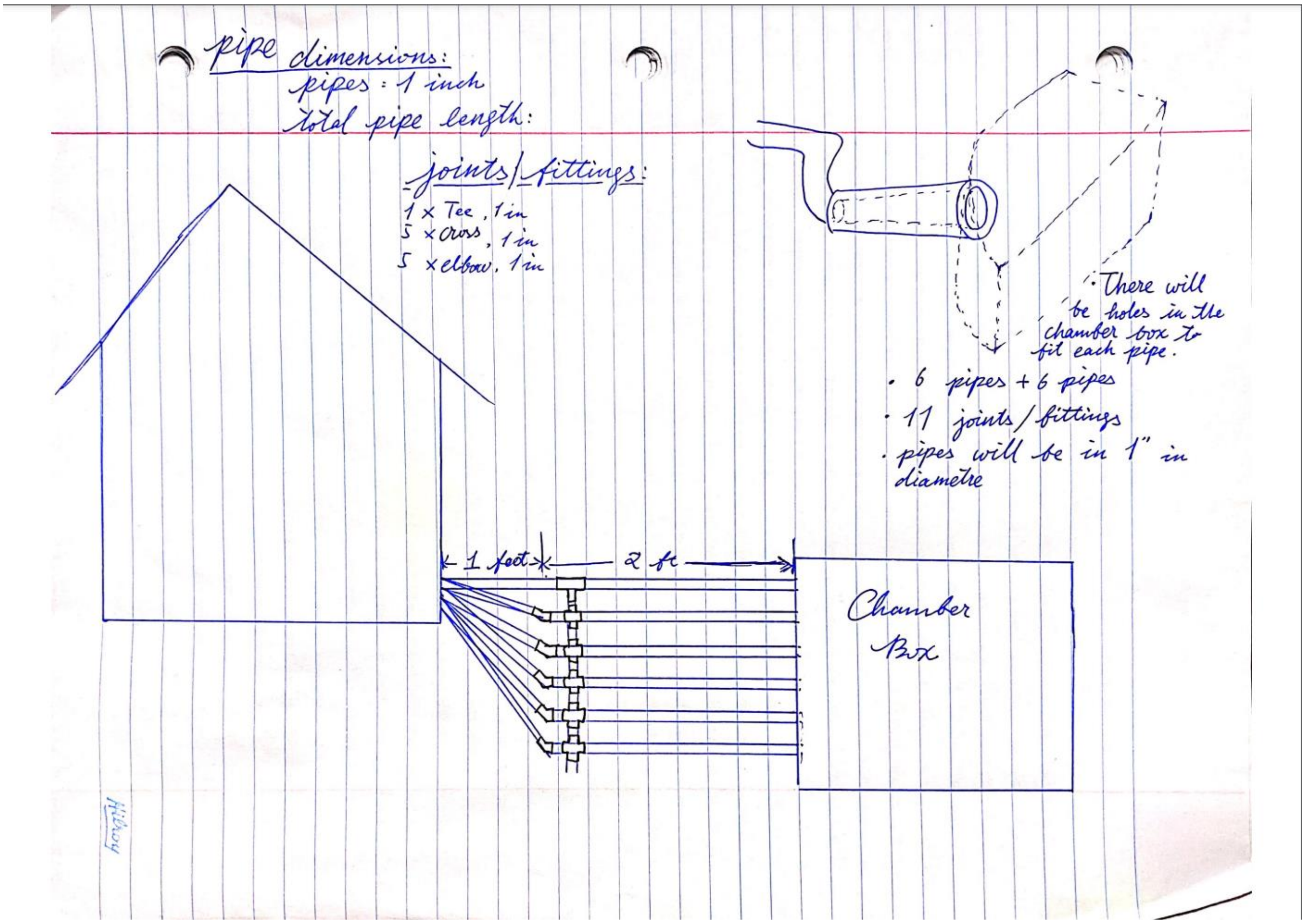
		[Sensor Module for Arduino : Amazon.ca: Electronics]			
	Thermostat (TBD)	/	/	/	/
	Furnace Blower (TBD)	/	/	/	/

Equipment:

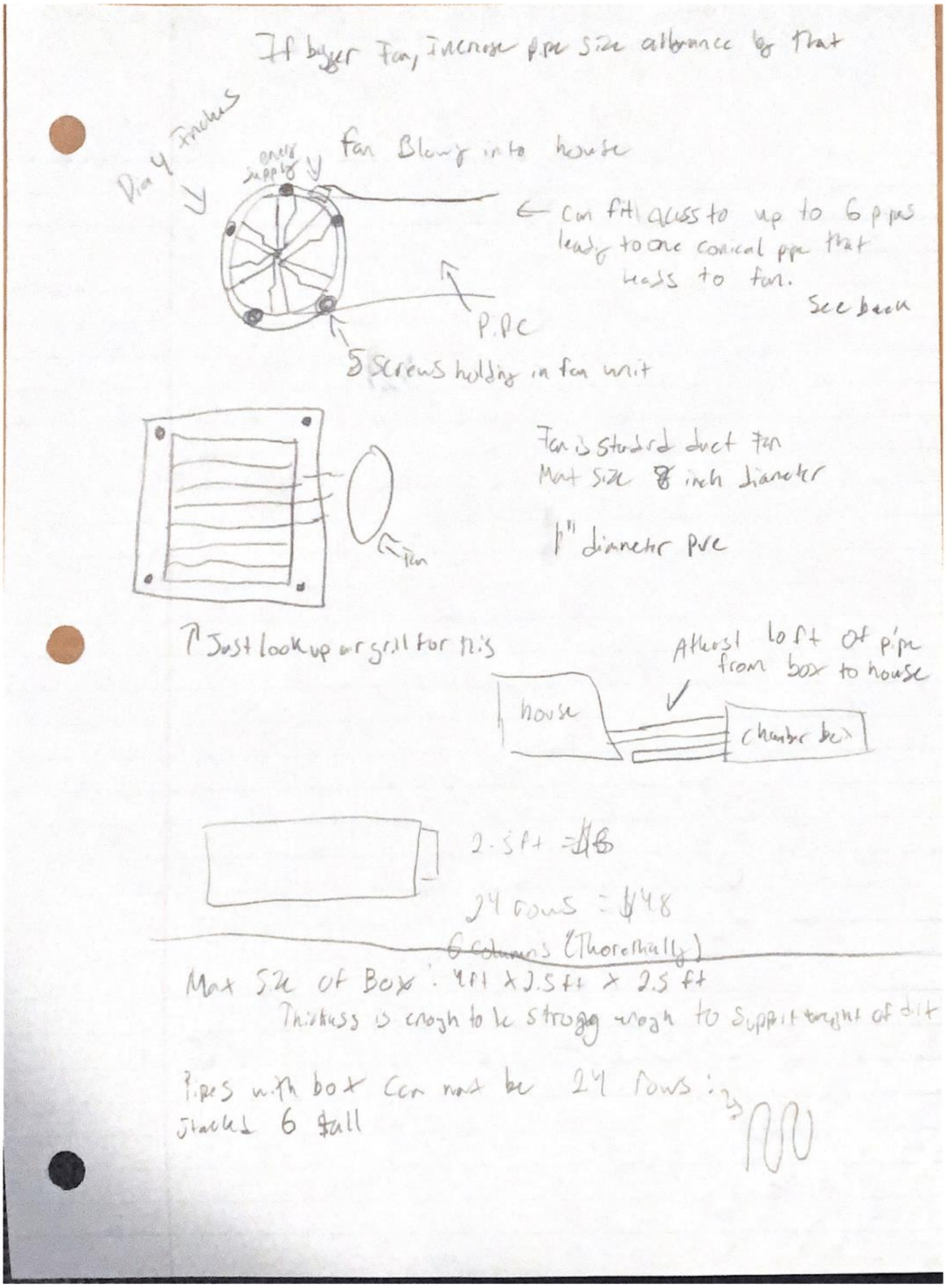
Item name	**Type**	**Description**	**Source**
Breadboard	Equipement	Allows to connect electronic components to the prototype	Makerlab
Onshape	Software	Used for 3D modeling of the prototype	https://www.onshape.com/en/
Arduino board	Equipement	Hardware component that can read inputs and return outputs	Makerlab
Arduino	Software	Used for programming sensors and commands	https://www.arduino.cc/
Drafting supplies	Equipement	Used to make sketches / drawings	Store
Scissors	Equipement	Used to cut and for shaping	Makerlab
Screwdrivers	Equipement	Used to drive screws in the prototype	Makerlab
Drills	Equipement	Used to make holes in the prototype	Makerlab
Glue	Equipement	Used to glue components together in the prototype	Makerlab
Tape	Equipement	Used to fix components to the prototype or to fix parts together	Makerlab

1. **Mechanical Parts :**

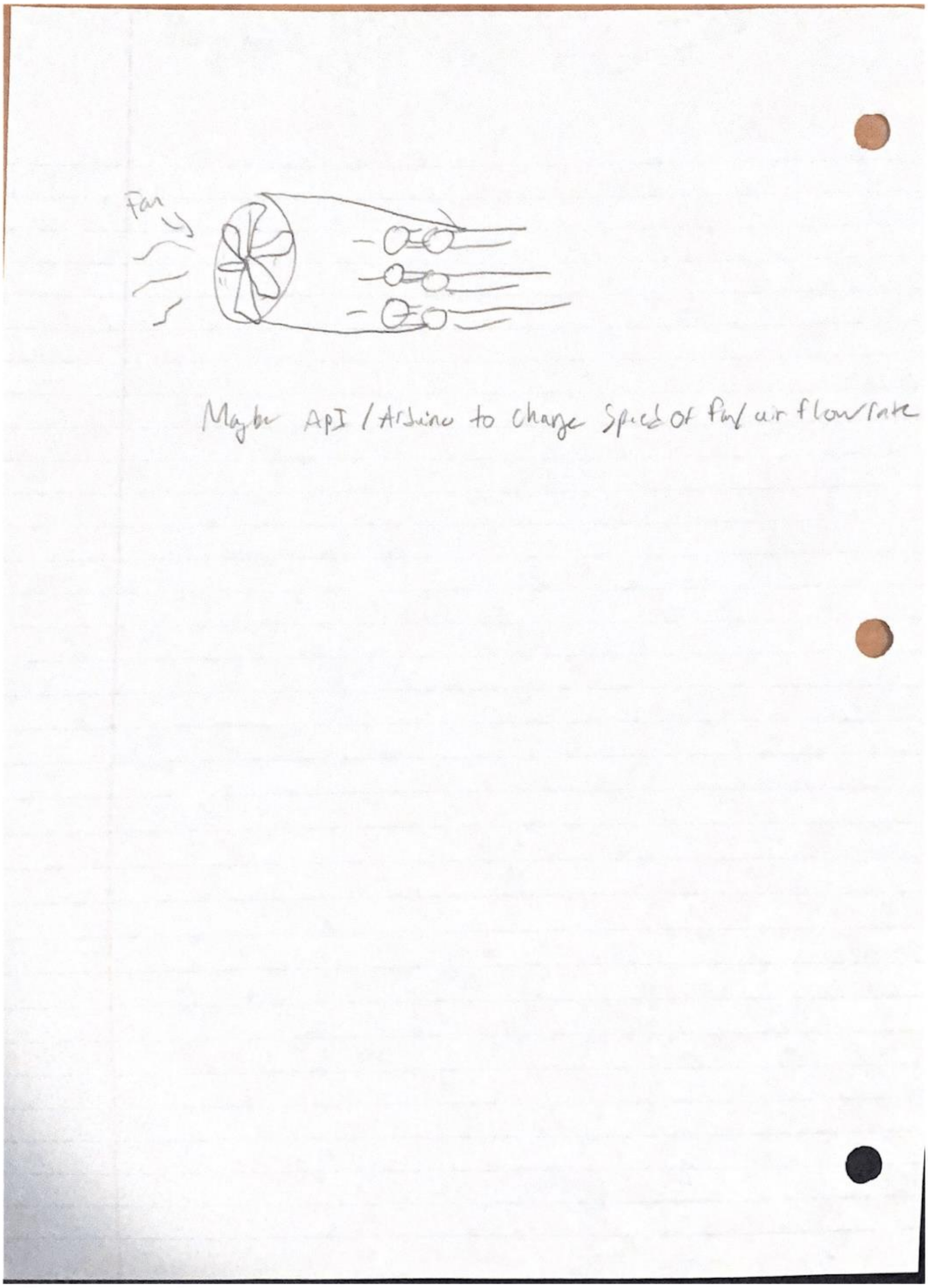
Outer Pipes :



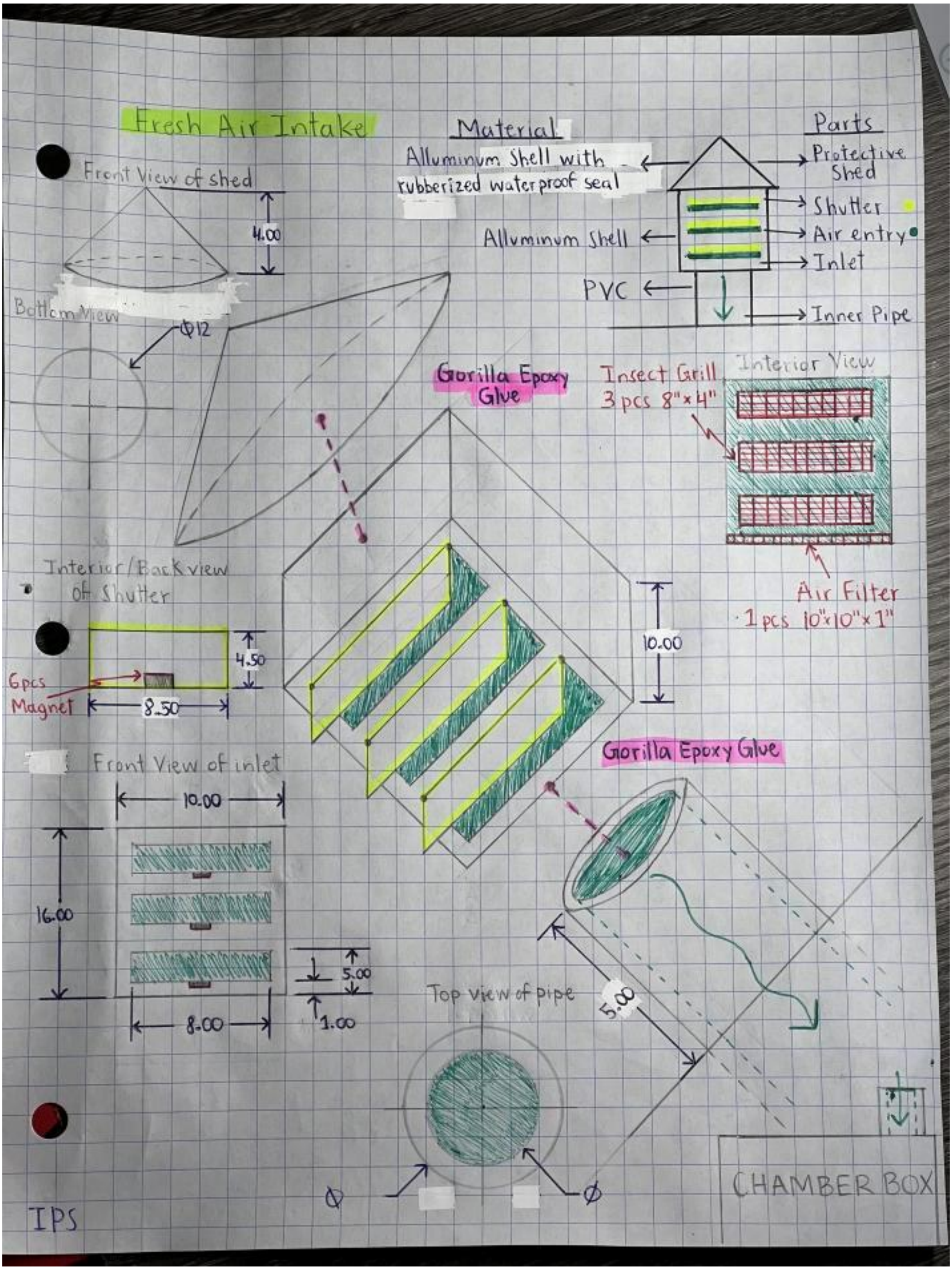
Inner Pipes :


If bigger Fan, Increase pipe size allowance by that
Dia 4 Inches
energy supply
Fan Blowing into house
← can fit across to up to 6 pipes leading to one conical pipe that leads to fan.
See back
P.P.C
5 Screws holding in fan unit
Fan is standard duct fan
Max size 8 inch diameter
1" diameter pvc
← fan
↑ Just look up air grill for this
Atleast 10 ft of pipe from box to house
house
chamber box
2.5 ft = $8
24 rows = $48
6 columns (Theoretically)
Max Size of Box: 4 ft x 2.5 ft x 2.5 ft
Thickness is enough to be strong enough to support weight of dirt
Pipes with box can now be 24 rows :
Stacked 6 tall

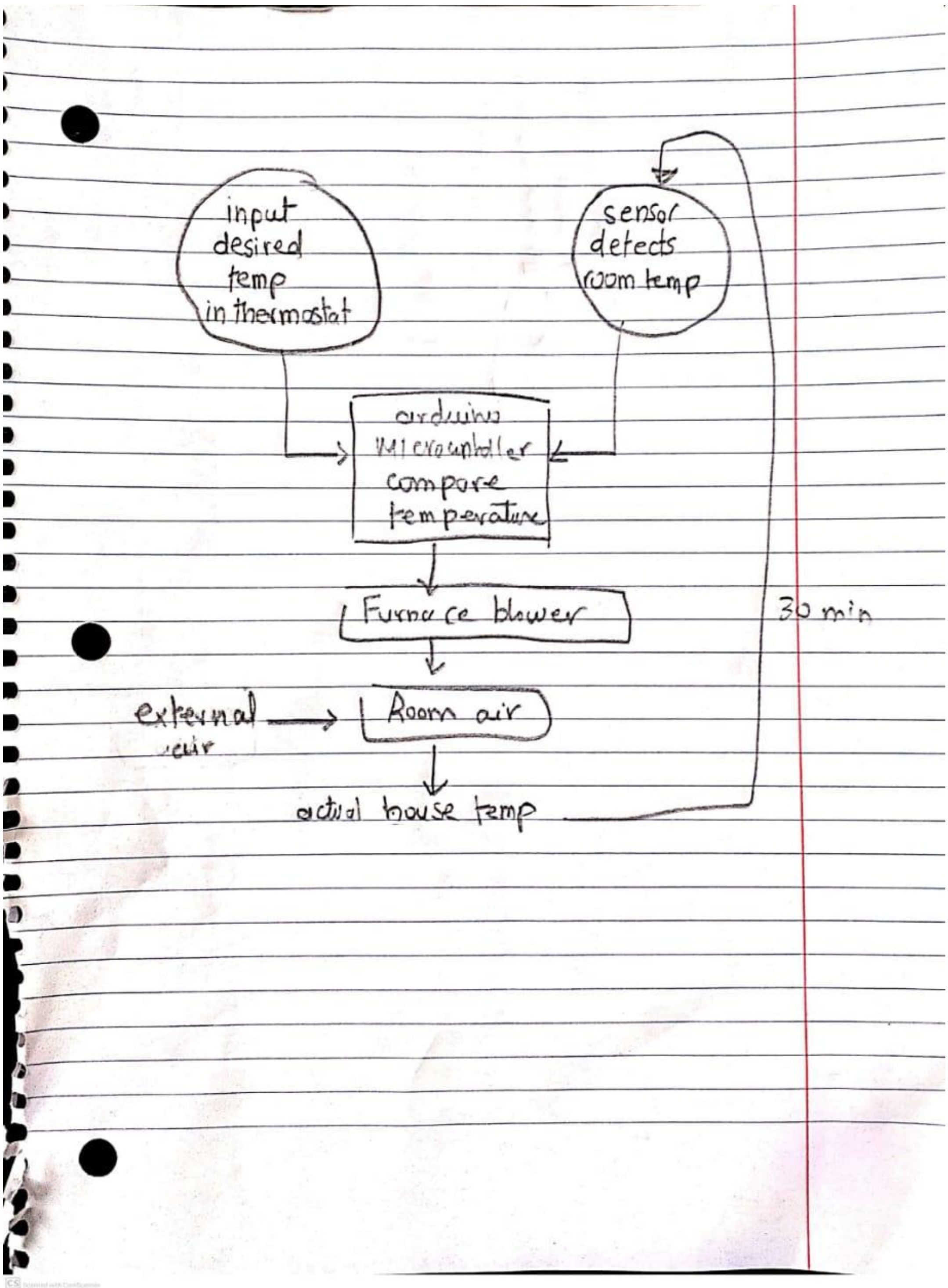
Air blower :



Fresh Air Intake :



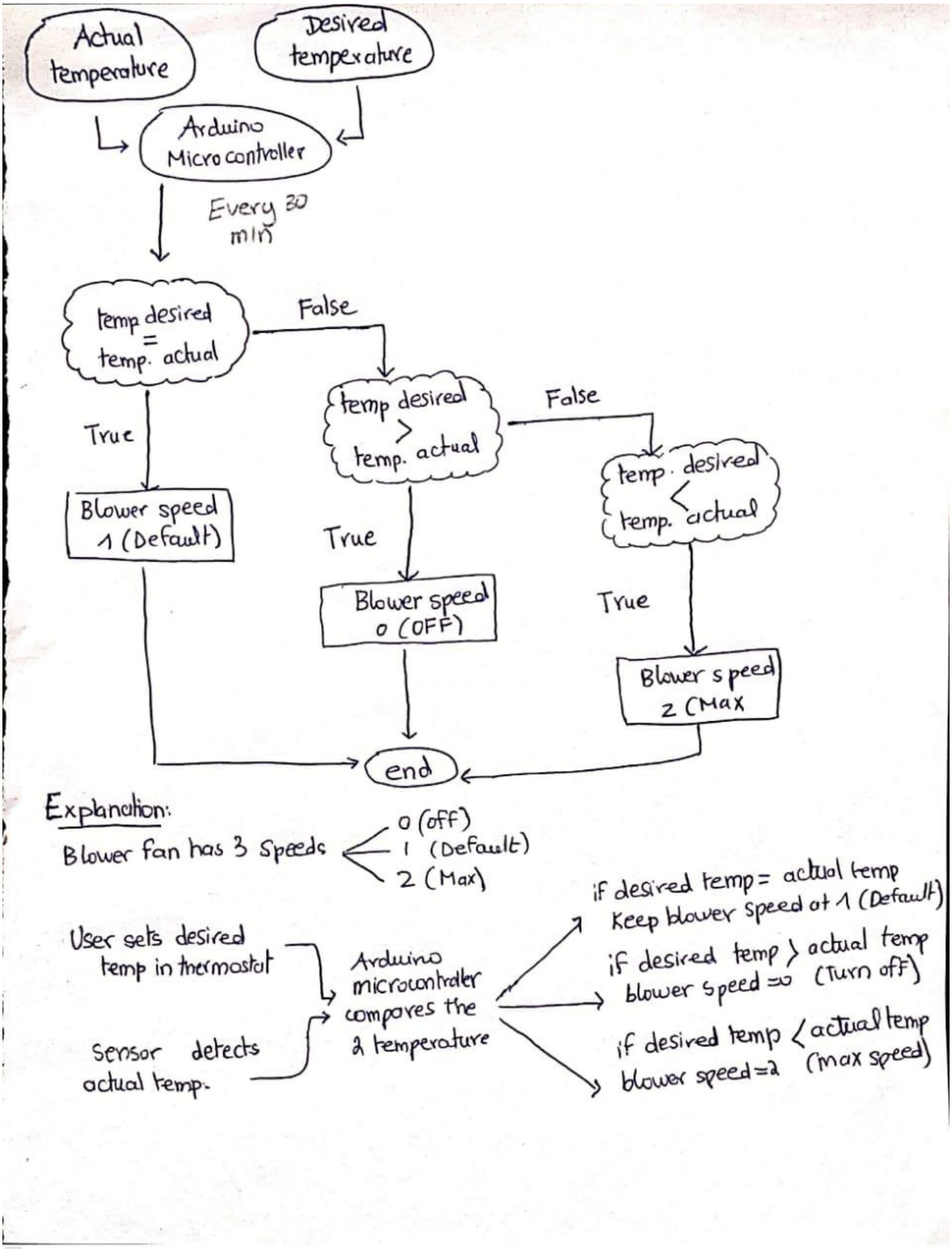
2. Electrical Parts:



Blower fan information:

- Voltage : 115 V (from benchmarking)
- Current (Amp) : 3.9 A (Benchmarking : 4.8 / 7.8 / 5.9 A => a lot)
- Resistance : $R = \frac{V}{I} \Rightarrow R = \frac{115}{3.9} = 29.48\ \Omega$
- Capacitor : 5 MFD / 370 V (from benchmarking)
- RPM : 1075 (from benchmarking)
- Power : $P = V \cdot I$ (typical power for blowe fan = 400 W)
  $P = (115)(3.9) = 448.5\ W$ (close to 400 W)
- kWh = W x hr / 1000 ⇒ 448.5 x 1 hr / 1000 = 0.4485 kWh.
- Total power per day (24 h max) : 0.4485 x 24 = 10.764 kWh
- Total power per day (12 h min) : 0.4485 x 12 = 5.382 kWh
- Total power per month
  - → max : 10.764 x 30 = 322.92 kWh
  - → min : 5.382 x 30 = 161.46 kWh
- Total power per year
  - → max : 322.92 x 12 = 3875.04 kWh.
  - → min : 161.46 x 12 = 1937.52 kWh

3. Software Part :



Project Risks :

Firstly, risks are anticipated regarding the exact dimensions of parts and features. The measurements may not correspond or add up at the assembly. The first detailed design contains many estimated dimensions and might not take into account required offsets where certain parts are connected/inserted. This will prevent a proper fit, cause insertion issues and result in a destabilized structure. It is essential to identify sensitive measurements which have some uncertainties and require higher accuracy so it can be tested at the prototype phase and the metrics can then be adjusted accordingly before the final conception.

To continue, another risk to be noted is the sizing and configuration of the inner pipes. The team has to figure out optimal sizes, such as length, thickness and diameter that will allow a maximum air flow and an output heat at the desired temperature. The prototype will determine if our first calculated dimensions are suitable and capable of achieving the goal. If changes are required, we will be doing further calculations to fix the issues for the 2nd prototype. The placement of pipes inside the chamber box and outside also has to be strategic to minimize the amount of material and remain on the budget of 100$.

Furthermore, there are risks associated with the connection of different parts together such as via adhesives and fasteners. Some adhesive might not be as efficient on certain materials so consider other options. Glue for instance wouldn't be as strong as screw/bolt fasteners but there is also a question of costs. In addition, the design of holes and screws are more susceptible to cause dimension errors and would require higher precision. The method of joining parts would have to be decided based on hands-on tests.

Another risk to expect is the placements of electrical components and wires which were not considered in an accurate way in the drawings. The wiring system for all the electrical parts, such as sensors, arduino board, motors, power supplies and solar panels will have to be highlighted in the actual prototyping phase and see how it can be insulated and placed within the parts. The wiring system across the entire THEC system can become complex and messy in drawings so it is hard to create a representation and plan ahead. The team expects to configure all the wiring and placements of electric parts by the 2nd prototype and solve any issues on site.

Moreover, there is also the possibility of software coding errors on Arduino components. Some sensors or the desired output command might not function as expected. This can be easily solved by editing codes or using the internet to correct and find the proper formats.

In conclusion, these are only a few of the many possible risks ahead in the project. A lot of the risks will have to be solved and discussed in the 1st prototype phase/lab as we get to perform tests and have our first perspective of reality. The team expects by the end of the 2nd prototype to encounter and resolve most of the risks and by prototype 3, we should arrive at the final solution.