Project Schedule And Cost

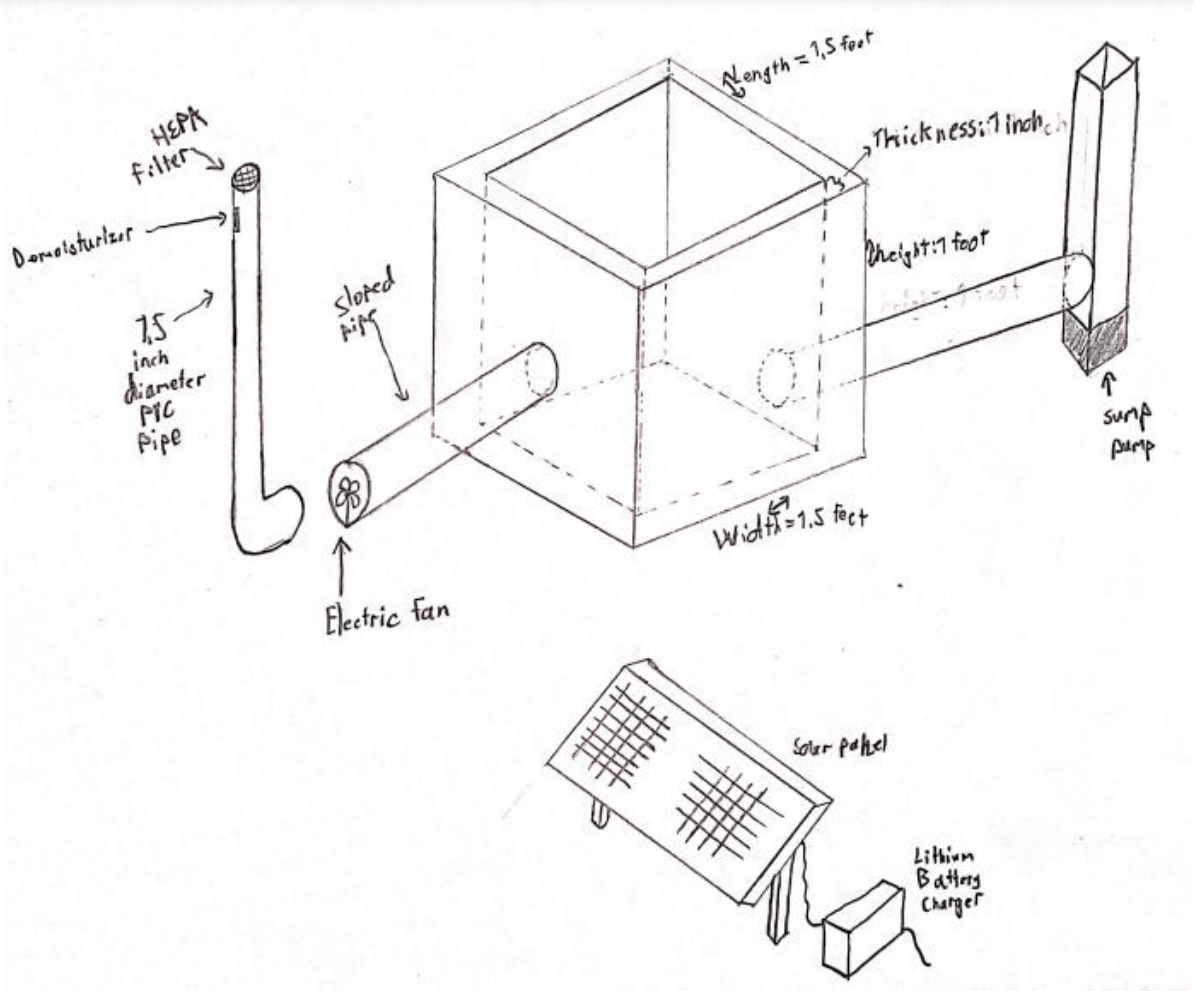
Concept Overview

Our chosen concept features a sensor system to measure the temperature in the pipes, detect vulnerabilities in the pipes, and automatically monitor the fan, shutter, and solar power systems. This sensor system will ensure that the air in the pipes has stabilized to the appropriate temperature before entering the house and will also alter the fan's speed or run time based on how much heat the house requires. Our electronic system will be connected to a main user interface that will allow the user to monitor conditions within the system. We will use solar panels to sustainably harvest power; excess power will be stored in a Lithium-Ion battery. Additionally, we will implement PVC pipes in our system. These pipes are cost-efficient, durable, and will not rust or breed bacteria from stagnant water buildup. To ensure cleanliness, our pipe network will be sloped to collect stagnant water from condensation, which will then be removed through a sump pump. All stabilized air leaving the system will go through a HEPA filter with fine mesh, protecting against insects and small animals. Finally, our main box unit will be constructed from concrete, which is durable and able to withstand underground conditions for decades.

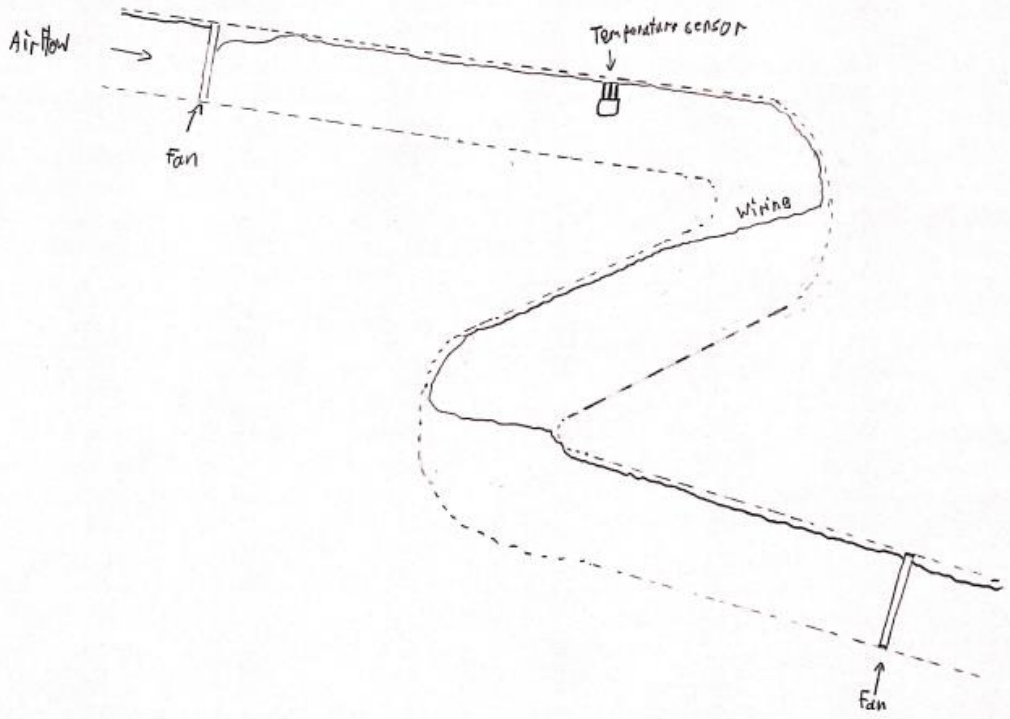
Materials and Schematics

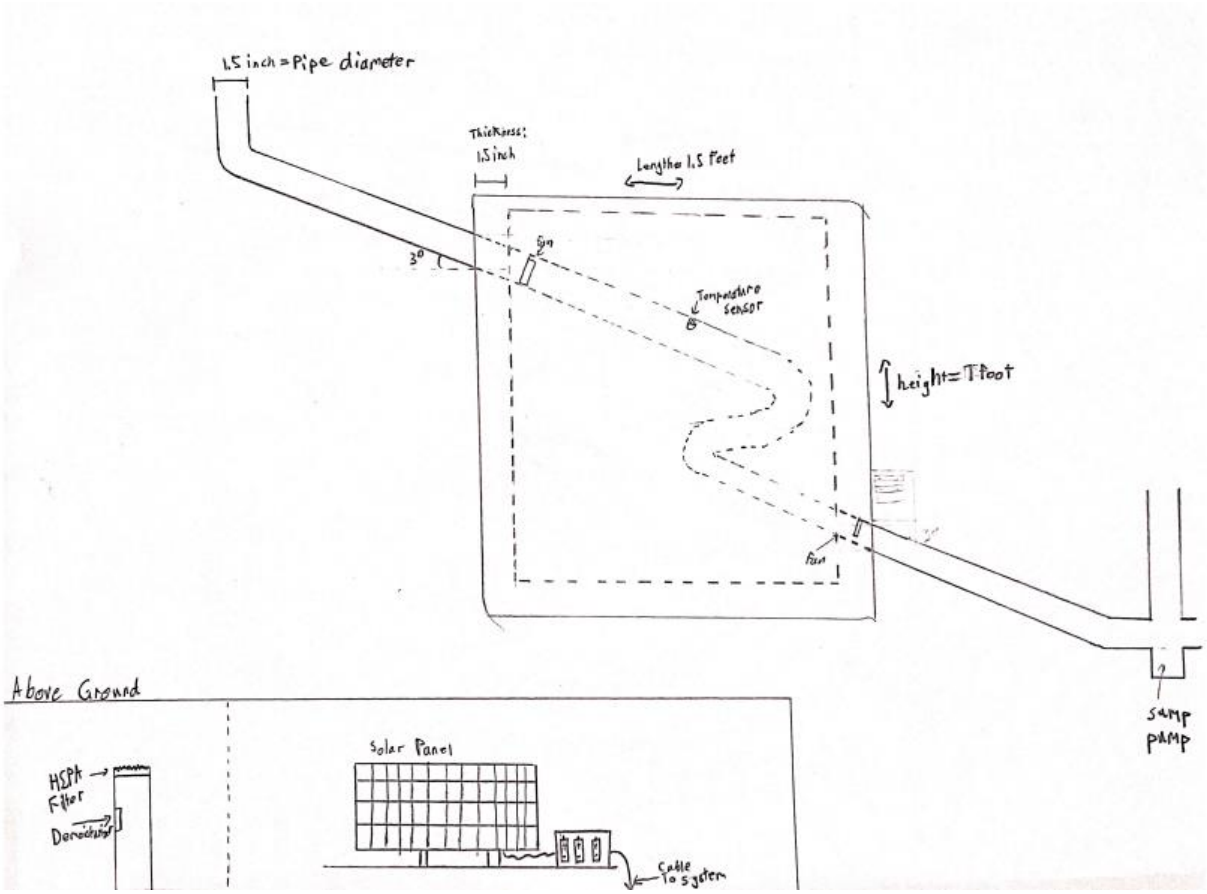
Mechanical

Diagram of main box unit and pipes


HEPA
Filter
Dehumidifier
7.5
inch
diameter
PVC
Pipe
Slotted
pipe
Length = 1.5 foot
Thickness: 1 inch
Height: 1 foot
Width = 1.5 feet
sump
pump
Electric Fan
Solar panel
Lithium
Battery
Charger

Pipe system (Inside box)



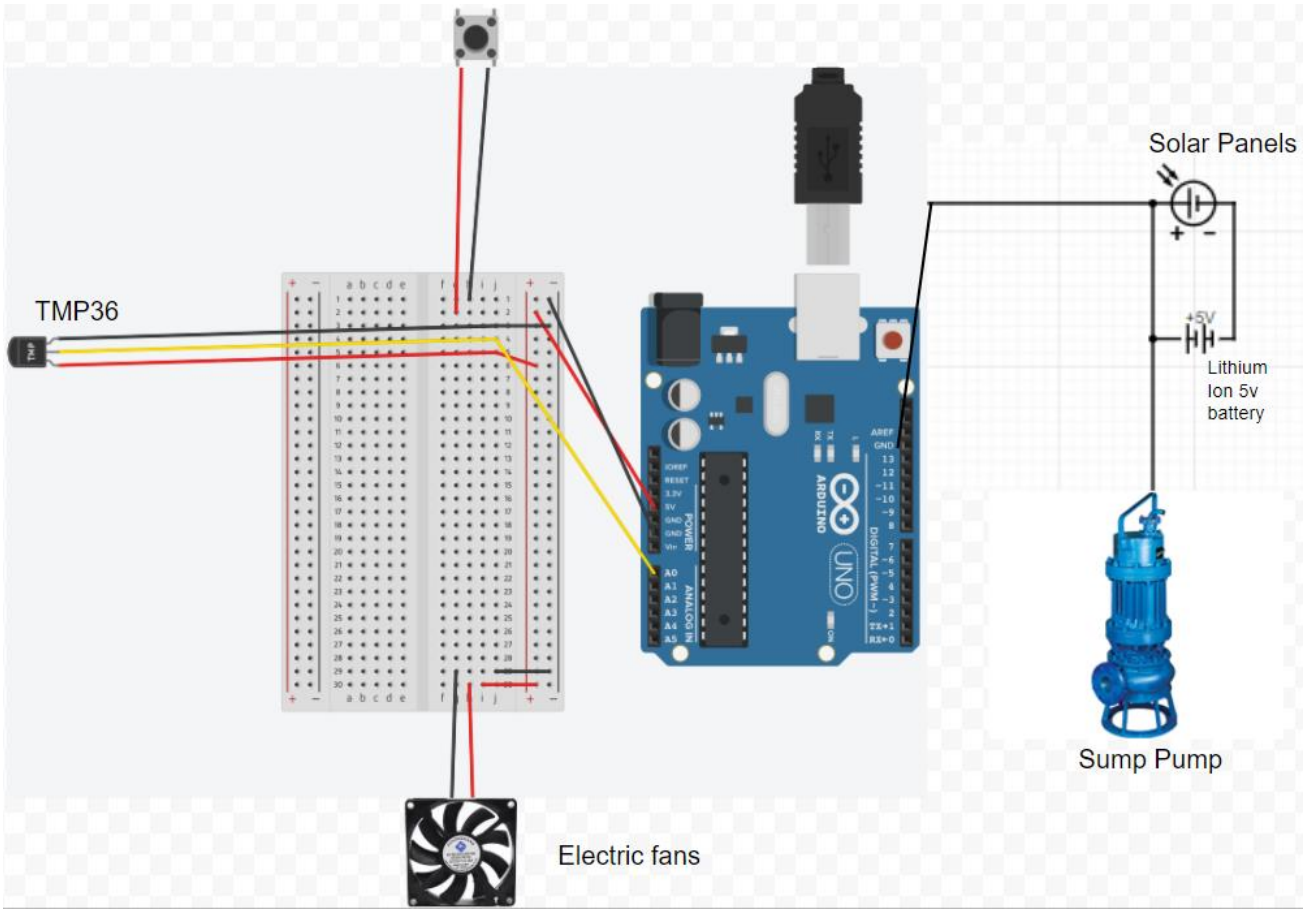


List of Materials

- PVC piping
- Concrete (enough for roughly 1.1 ft^3)
- Pipe glue
- Air filters

Electronics

Diagrams of electronic systems

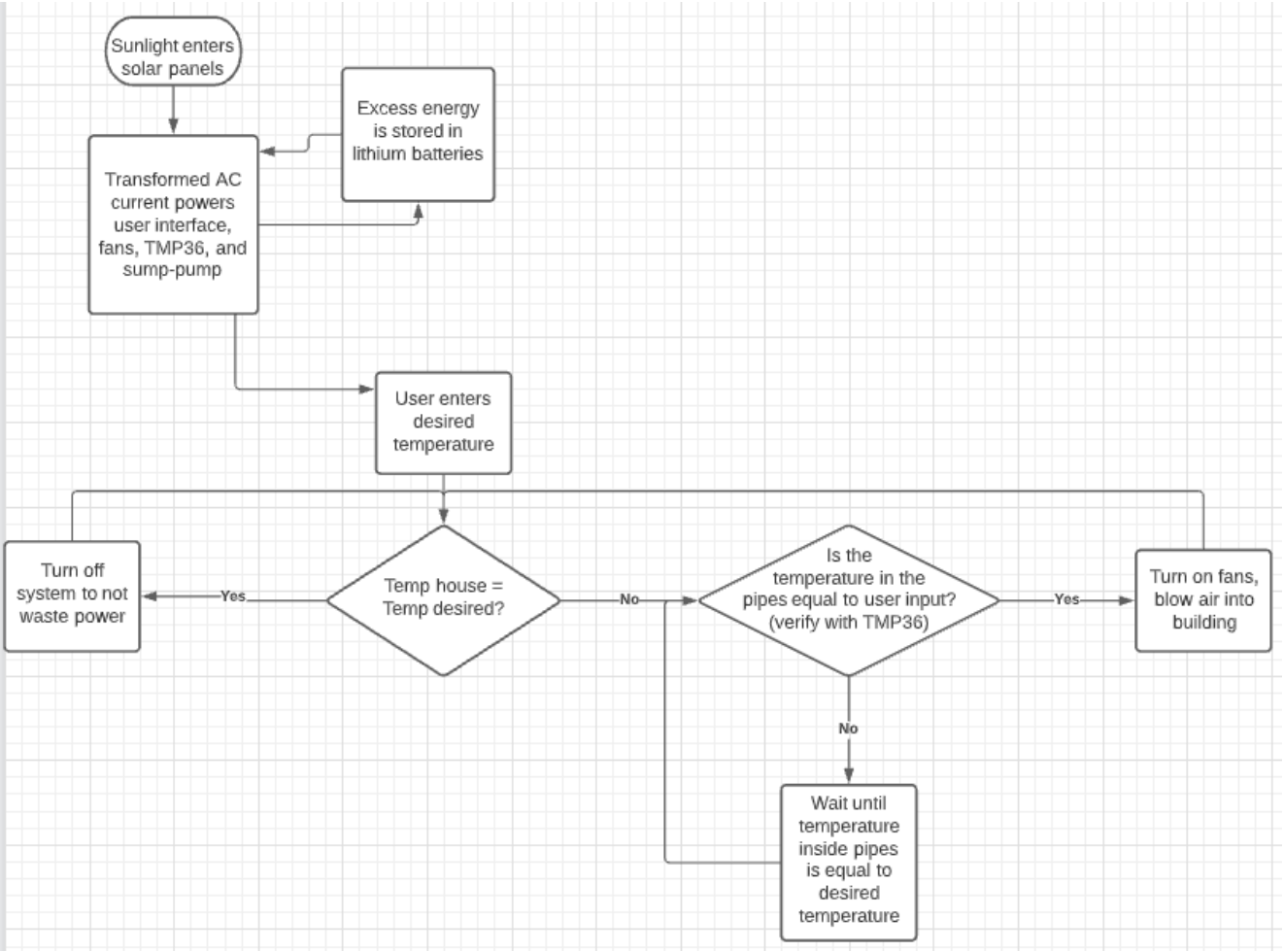


List of Materials

- Tmp36 (temp sensor)
- Jumper cables
- Breadboard
- Button
- Battery Clip
- Solar panel
- Sump pump
- Fans
- Lithium-Ion battery

Software

Flowchart of software process



List of Materials

- Tinkercad.com
- Onshape
- Arduino IDE
- Arduino libraries that are relevant to sensors that will be used in the prototype.
- Solidworks
- Autocad

Bill of Materials:

Item Name	Model	Units of Measure	Cost ($)	Amount	Total cost	Link:
PVC pipes	1/2 in. PVC DWV Pipe	Feet/inch	16.61/6ft	1	18.77	https://www.homedepot.ca/product/sys
Concrete	SAKRETE	kg	5.38	1	6.08	https://www.homedepot.ca/product/sa
Vinyl pipes	Everbilt 1/2 in.	feet/inch	5.1 / ft	1	5.94	https://www.homedepot.com/p/Everbil
Pipe glue	Oatey Medium Clear PVC Cement	#	8.65	1	9.77	https://www.oatey.com/products/oatey
Cardboard	thick cardboard	feet^3	TBD	1	TBD	tbd
Fans	GDSTIME 5V Fan	#	10	1	11.3	https://www.amazon.ca/GDSTIME-70mn
Sump pump	Vipe mini micro submersible motor pump	#	7.99	1	9.03	https://www.amazon.com/Vipe-Micro-S
Arduino	Unos	#	TBD	1	TBD	https://www.alibaba.com/product-deta
Breadboards	BB830	#	9.6	1	10.85	https://www.amazon.ca/BusBoard-Prot
Electrical wires	Regular wire that are compatible with arduino	#	0.8	TBD	TBD	https://edu-makerlab2021.odoo.com/sh
Solar panels	CANADUINO 5V	#	3.3	4	14.91	https://www.amazon.ca/CANADUINO-Sc
5v converter	VXO7805-500	#	3.39	1	3.83	https://www.digikey.ca/en/products/de
Lithium-Ion battery	DMEGC inR18650-26E	#	2.39	1	2.7	https://liionwholesale.com/collections
Jumper cables	Maker Lab	#	1	1	1.13	https://makerstore.ca/shop/ols/produc
Battery clip	2Pack 9V Battery clip	#	8.99	1	10.16	https://www.amazon.ca/Battery-Connec
TMP 36	TMP36GT9Z	#	2.49	3	8.44	https://www.digikey.ca/en/products/de
Button	PTS636 SK50 LFS	#	0.15	2	0.3	https://www.digikey.ca/en/products/de
Air filter	POTAUTO MAP 1013W	#	8.27	1	9.36	https://www.amazon.ca/POTAUTO-Repl
Insect Screen	Everbilt 1/2 in.	#	12.42	1	14.02	https://www.homedepot.ca/product/ev
TinkerCad	N/A or Current	N/A	0	1	0	https://www.tinkercad.com/dashboard
Onshape	N/A or Current	N/A	0	1	0	https://www.onshape.com/en/
Arduino IDE	N/A or Current	N/A	0	1	0	https://www.arduino.cc/en/software
Arduino Libraries	N/A or Current	N/A	0	1	0	https://www.arduino.cc/en/software
Solidworks	N/A or Current	N/A	0	1	0	N/A (computer program)
Circuit-diagram	N/A or Current	N/A	0	1	0	https://www.circuit-diagram.org/editor/
		Total Product Cost (without taxes/shipping)			102.91	
		Total Product Cost (with taxes/shipping)			133.42	

Links (in order):

https://www.homedepot.ca/product/system-15-1-1-2-inch-x-6-ft-pvc-dwv-pipe/1001101784

https://www.homedepot.ca/product/sakrete-concrete-mix-30-kg/1000109060

https://can01.safelinks.protection.outlook.com/GetUrlReputation

https://www.oatey.com/products/oatey-medium-clear-pvc-cement-112086757

https://www.amazon.ca/GDSTIME-70mm-15mm-Brushless-Cooling/dp/B08B5Z6CW3/ref=sr_1_77?keywords=pc%2Bfans&qid=1644975389&refinements=p_36%3A12035760011&rnid=12035759011&s=pc&sr=1-77&th=1

https://www.amazon.com/Vipe-Micro-Submersible-Motor-Water/dp/B01N0X3CW4/ref=sr_1_101?keywords=mini+sump+pump&qid=1644973260&sr=8-101

https://www.alibaba.com/product-detail/The-new-uno-R3-development-board_1600365773038.html?spm=a2700.details.0.0.34723d09Kx5nRc

https://www.amazon.ca/BusBoard-Prototype-Systems-BB830-Solderless/dp/B0040Z4QN8/ref=asc_df_B0040Z4QN8/?tag=googleshopc0c-20&linkCode=df0&hvadid=292998806807&hvpos=&hvnetw=g&hvrand=11540056653537089415&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-420088669616&psc=1

https://edu-makerlab2021.odoo.com/shop/product/connector-cables-145?search=wire#attr=257

https://www.amazon.ca/CANADUINO-Solar-Panel-100mA-500mW/dp/B07GD96FKZ/ref=sr_1_52?crid=1TCZUXEYEE16H&keywords=solar+panel&qid=1644975609&refinements=p_36%3A12035760011&rnid=12035759011&s=lawn-garden&sprefix=solar+panel%2Caps%2C82&sr=1-52

https://www.digikey.ca/en/products/detail/cui-inc./VXO7805-500/7350288?utm_adgroup=DC%20DC%20Converters&utm_source=google&utm_medium=cpc&utm_campaign=Shopping_Product_Power%20Supplies%20-%20Board%20Mount_NEW&utm_term=&productid=7350288&gclid=Cj0KCQiAu62QBhC7ARIsALXijXSRtD7skvlpIDb45INi1wUvCJoYU6_X6yfX7Ukpjx8x_Mhe-AvjPvsaAuO4EALw_wcB

https://liionwholesale.com/collections/batteries/products/dmegc-inr18650-26e-18650-15a-flat-top-2600mah?variant=39353214468165

https://www.digikey.ca/en/products/detail/cui-inc./VXO7805-500/7350288?utm_adgroup=DC%20DC%20Converters&utm_source=google&utm_medium=cpc&utm_campaign=Shopping_Product_Power%20Supplies%20-%20Board%20Mount_NEW&utm_term=&productid=7350288&gclid=Cj0KCQiAu62QBhC7ARIsALXijXSRtD7skvlpIDb45INi1wUvCJoYU6_X6yfX7Ukpjx8x_Mhe-AvjPvsaAuO4EALw_wcB

https://www.amazon.ca/Battery-Connector-Holder-Arduino-Baterries/dp/B07T7VX2SF/ref=asc_df_B07T7VX2SF/?tag=googleshopc0c-20&linkCode=df0&hvadid=335455954923&hvpos=&hvnetw=g&hvrand=14020449502065669158&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-833492588045&psc=1

https://www.digikey.ca/en/products/detail/analog-devices-inc/TMP36GT9Z/820404

https://www.digikey.ca/en/products/detail/c-k/PTS636-SK50-LFS/10071720

https://www.amazon.ca/POTAUTO-Replacement-Filter-compatible-PONTIAC/dp/B01G6PD6HG/ref=sr_1_54?crid=118EUCVG111KJ&keywords=car+ac+air+filter&qid=1644973614&sprefix=ac+car+filter%2Caps%2C117&sr=8-54

https://www.homedepot.ca/product/everbilt-36-inch-w-x-40-inch-h-aluminum-insect-screen-in-silver/1000409561

https://www.tinkercad.com

https://www.onshape.com/en/

https://www.arduino.cc/en/

https://www.circuit-diagram.org/editor/

Risk Analysis

Risk	Contingency Plan

Breakage in concrete	- Cracks in concrete cannot be repaired with concrete itself; instead, a concrete repair mix must be used
Leaks in piping	- Ensure that enough PVC glue was used - Apply sealant in conjunction with glue to prevent future leaks
Failure to reach desired temperature	- Troubleshoot issues in the software, electronic system, or location of the temperature sensor – modify system components as required
Malfunction of electronics system (due to poor installation or water exposure)	- Check wiring system; check for water leakage near electronic system - Relocate system if necessary
Contamination in the air intake pipe (debris, insects, fungus, bacteria)	- Check state of air filter; check for any holes or damage by animals - Replace filter, possibly with finer mesh wiring - Check sump pump - Sanitize pipe system using the shock chlorination technique