

## Prototype Description

We prototyped an autonomous snowmaker. This prototype includes code and Arduino aspects that facilitate the automation of our many parts. Our prototype is a much smaller version of what the device would have to be in real life, mainly to confirm the code and component ideas are accurate. The prototype includes a motor connected to our pump which will send air through the system connected by tubing, and push a water and air mixture through the storage tanks (2-liter bottles) which leads to our nozzle. We have incorporated a servo between the storage tanks, and the nozzle which will open and close when appropriate, to build up the pressure throughout the system and create a mist. The nozzle is attached to another servo, which will oscillate while the fan behind it blows the mist to cover more surface area.

## Prototype Photos:



Figure 1: Whole System Together



Figure 2: Frame and Fan System

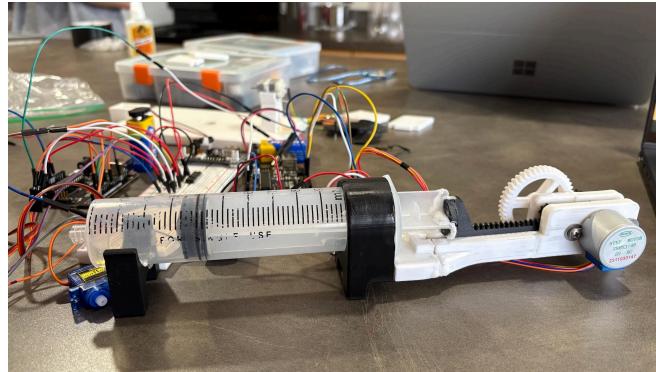


Figure 3: Syringe Pump System

#### Iteration:

We had several versions of our device before we arrived at the final prototype. One of the first iterations we made was to our pump. The rubber plunger inside of it had too much friction with the pump which made it difficult to build up enough pressure throughout the system, this caused us to remove one of the rings that contacted the pump to make it move easier. In our original design, our mist nozzle was going to be stationary. We saw a potential improvement with the nozzle if we were to connect it to a servo which will oscillate to cover more surface area. A very last-minute change we made was to add another servo right before the mist nozzle which closes off the system to build up pressure throughout it. Finally, we took the back two legs off of our stand to give the nozzle a higher-angled trajectory.

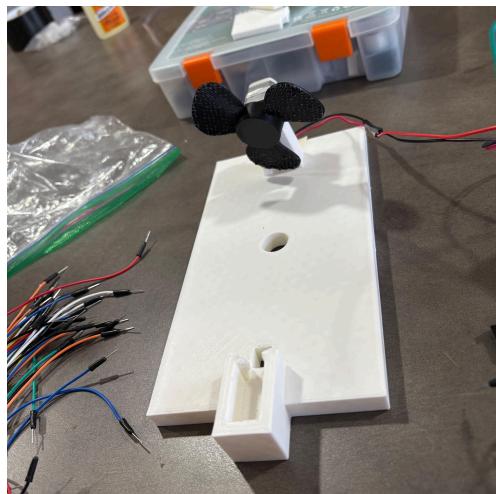


Figure 3: Frame Body, After Being Split Into 5 Pieces

#### Reflection On Challenges / What We Would Do With Time/Money :

With more time and money we would implement tanks and a more structurally sound tubing connection system. We would also consider various environmental concerns like containing our circuits in a weatherproof container, and making a weatherproof sensor holder for our DHT11 sensor (so it still gets accurate data but is protected from the elements). We also want to consider a solution to water freezing in

the tanks and tubing system. Implementing a Bluetooth system would also be critical to eliminate the necessity of having a computer outside and connected.

### **Bill Of Materials:**

Part	Quantity	Price	Link	Note
Syringe W/ Tubing	1	\$8.99	<a href="#">LINK</a>	Non-Fabricatable Mechanical Material
Check Valve	1	\$6.99	<a href="#">LINK</a>	Non-Fabricatable Mechanical Material
Hose Junction	1	\$6.99	<a href="#">LINK</a>	Non-Fabricatable Mechanical Material
Disposable Soda Bottle	3	0	N/A	Non-Fabricatable Mechanical Material
Glue	–	0	N/A	Non-Fabricatable Mechanical Material
String	–	0	N/A	Non-Fabricatable Mechanical Material
Tape	–	0	N/A	Non-Fabricatable Mechanical Material
DC Motor	1	0	N/A	Electronic Hardware
Stepper Motor	1	0	N/A	Electronic Hardware
Micro Servo Motor	2	0	N/A	Electronic Hardware
DHT11 (Temp & Humidity Sensor)	1	0	N/A	Electronic Hardware
Arduino	2	0	N/A	Electronic Hardware
9V Battery	3	0	N/A	Electronic Hardware
ULN2003 Stepper Motor Driver Module	1	0	N/A	Electronic Hardware
L293D	1	0	N/A	Electronic Hardware
Power Supply Module	1	0	N/A	Electronic Hardware
Wires	–	0	N/A	Electronic Hardware
Fan Blade	1	0	N/A	Fabricated Material
Air Compressor Parts	1	0	N/A	Fabricated Material
Mist Nozzle	1	0	N/A	Fabricated Material
Frame Body	1	0	N/A	Fabricated Material
Frame Legs	4	0	N/A	Fabricated Material
45 Tooth Gear	1	0	N/A	Fabricated Material

External Syringe Support	1	0	N/A	Fabricated Material
Intermediate Base Fixture	1	0	N/A	Fabricated Material
Motor Fixing Pins	2	0	N/A	Fabricated Material
Pinion	1	0	N/A	Fabricated Material
Pinion Axle Support	1	0	N/A	Fabricated Material
Rack	1	0	N/A	Fabricated Material
Rack Slider Slot	1	0	N/A	Fabricated Material
Syringe Receptacle	1	0	N/A	Fabricated Material
Motor-Driven Gear	1	0	N/A	Fabricated Material
Syringe Boundary	1	0	N/A	Fabricated Material
Syringe	1	0	N/A	Fabricated Material