Direct Air Capturer: Progress Report 2

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Materials and Methods

Materials

Over the last few weeks, we have been drafting our supply order form. We determined

that we needed a CO2 monitor, two ducting pipes, an electric air pump, sodium hydroxide, a

suction fan, a plastic container, an exhaust fan, and a protective plastic sheet. The first material

we determined we needed was the CO2 monitor. As we searched for a carbon dioxide monitor,

we came across various monitors that required manual entering of data and data evaluation. Also,

an important part of our data evaluation involves analyzing temperature levels. Instead of buying

two separate monitors, however, we thought it would be easier if there was a two-in-one device

(carbon dioxide level and temperature level monitoring). Therefore, we chose a CO2 and

Temperature Real-Time monitor that analyses its environment in as time passes (Figure 1). The

device also has a data evaluation software. We made the connection of this software to the

LoggerPro Vernier Software, where data is plotted in real time. The second materials we looked

into were the ducting pipes (Figure 2). We selected two ducting pipes; one to fit the dimensions

of the suction fan and the other to fit the dimensions of the exhaust fan. Therefore, we chose a

ducting pipe with a four-inch diameter and one with five inch diameter (Figure 3). The third

material is an air pump (Figure 4). In a reference video, we noticed that the experimenter used an

air pump to help pump the air through the system. We found it best to use an electric air pump so

that our procedure will not require working with Arduino and wires that can potentially be

damaged from the system. The fourth material is sodium hydroxide (Figure 5). We selected a

food grade version of powder sodium hydroxide. This was done to prevent any potential risks

that the chemical may cause as it is dissolved in to the water in the container. The fifth material is

a suction fan (Figure 6). The main aspect that compelled us to choose this item specifically were

its dimensions and suction rate of 3000 RPM, which fits with our expected methods. The sixth

material is a plastic container that would meet the requirements of our preferred dimensions

(Figure 7). The seventh material is an exhaust fan which will be used to release the chemically

altered air out of the system (Figure 8). We chose this because it is an electric fan and has

relatively small dimensions. The last material was a protective plastic sheets placed in the middle

of the container to prevent passage of chemically altered air from one compartment to the other.

We decided to purchase a sturdier material as opposed to some type of a cloth, which may not
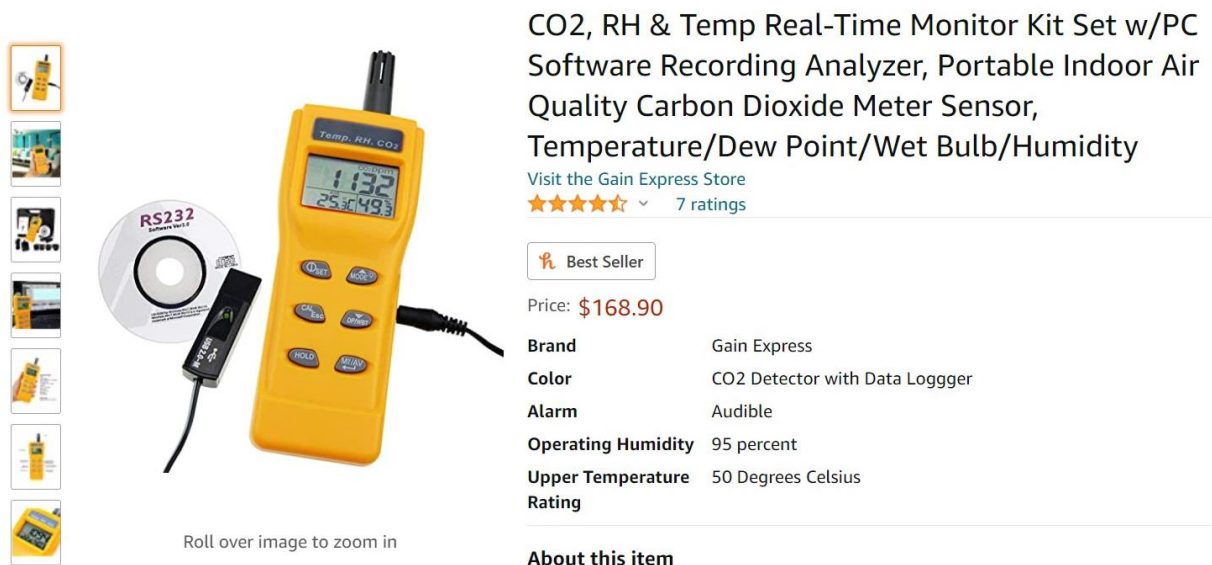
have been as protective.

Figure 1: The image above is the ordered Carbon Meter with a thermometer setting and an
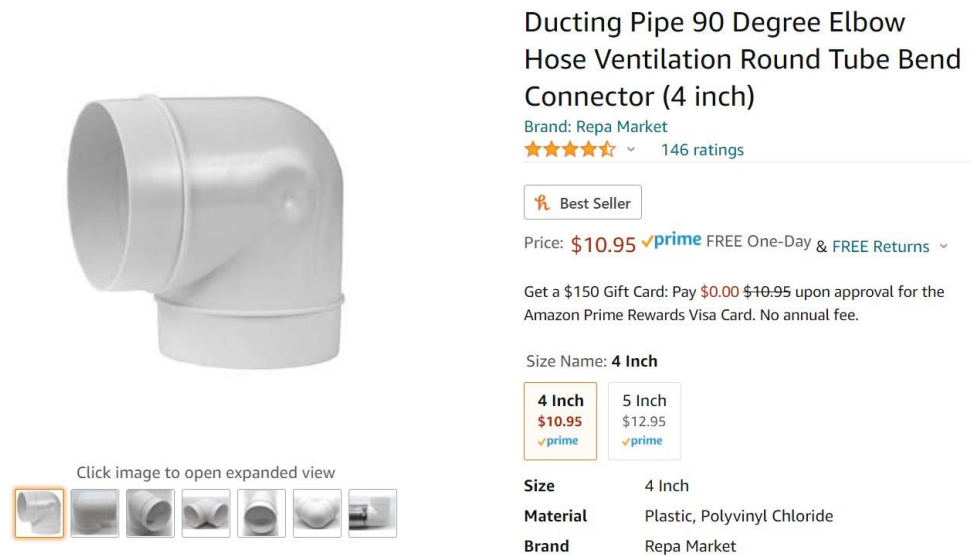included software to evaluate the taken data.

Ducting Pipe 90 Degree Elbow Hose Ventilation Round Tube Bend Connector (4 inch)

Brand: Repa Market

★★★★☆ ∨   146 ratings

ℏ Best Seller

Price: **$10.95** ✓prime FREE One-Day & FREE Returns ∨

Get a $150 Gift Card: Pay $0.00 $10.95 upon approval for the Amazon Prime Rewards Visa Card. No annual fee.

Size Name: **4 Inch**

| 4 Inch $10.95 ✓prime | 5 Inch $12.95 ✓prime |

Size	4 Inch
Material	Plastic, Polyvinyl Chloride
Brand	Repa Market

Click image to open expanded view

Figure 2: The image above is the ordered ducting pipe for the connection to the suction fan. It is

4 inches to match the radius of the fan.

Ducting Pipe 90 Degree Elbow Hose Ventilation Round Tube Bend Connector (5 inch)

Brand: Repa Market

★★★★☆ ∨   146 ratings

ℏ Best Seller

Price: **$12.95** ✓prime & FREE Returns ∨

Get a $150 Gift Card: Pay $0.00 $12.95 upon approval for the Amazon Prime Rewards Visa Card. No annual fee.

Size Name: **5 Inch**

| 4 Inch $10.95 ✓prime | 5 Inch $12.95 ✓prime |

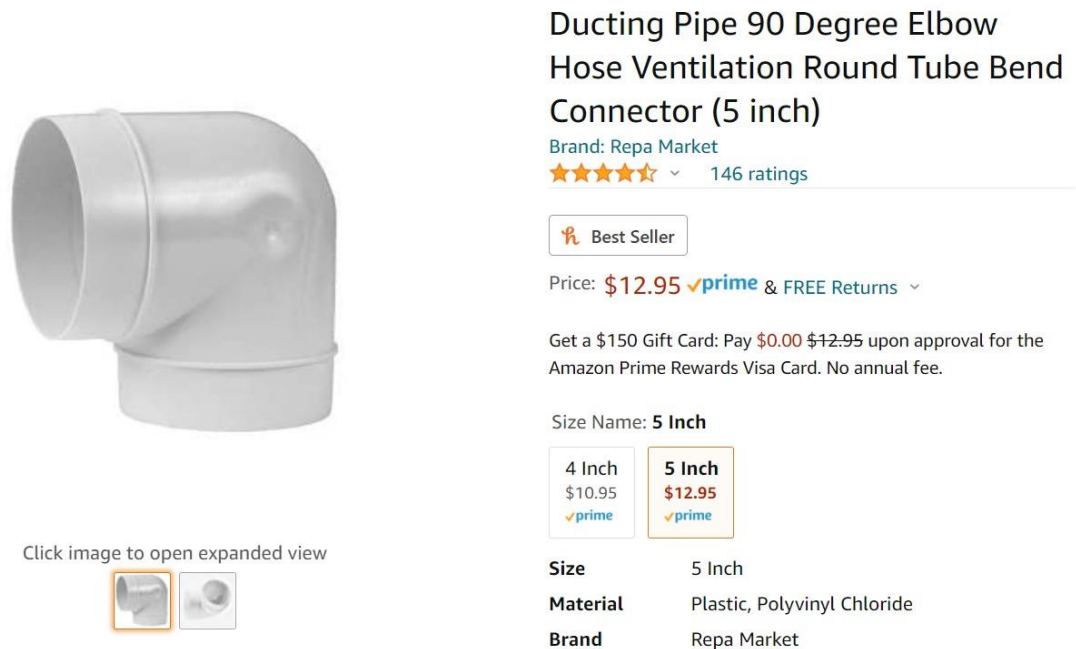| Size | 5 Inch |
| Material | Plastic, Polyvinyl Chloride |
| Brand | Repa Market |

Click image to open expanded view

Figure 3: The image above is the ordered ducting pipe for the connection to the exhaust fan. It is

5 inches to match the radius of the fan.

Figure 4: The image above is the ordered air pump, and it will be used to increase the flow of the

system.

Figure 5: The image above is the Sodium Hydroxide, and it will be used to initiate the chemical

alteration of the CO_2 that will be taken in.

Figure 6: The image above is the suction fan that will take in the CO_2.

Figure 7: The image above is the storage container that will be used to represent our modeled

environment.

VIVOSUN 4 Inch 195 CFM Inline Duct Ventilation Fan Vent Blower for Grow Tent
Visit the VIVOSUN Store
★★★★☆ ∨   8,877 ratings
#1 Best Seller in HVAC Fans & Circulators

Price: $34.99 & FREE Returns ∨

Electric fan design	Blower
Power Source	Corded Electric
Room Type	Kitchen
Recommended Uses For Product	Basements
Included Components	Cord
Brand	VIVOSUN

∨ See more

Figure 8: The image above is the exhaust fan to release the air that will be as a result of the

reaction.

3 Pack 11x14" PET Sheet, IVARSOYA 0.03" Clear Acrylic Sheet for Poster Frames, Crafting Projects, Protective Film, Pet Barriers, Shatterproof PETG Plastic Sheets
Brand: IVARSOYA
★★★★☆ ∨   250 ratings | 9 answered questions

Price: $9.99 ($3.33 / Item) Get Fast, Free Shipping with Amazon Prime & FREE Returns ∨

Size: 11x14"

| 5x7" | 8x10" | 11x14" |

Number of Items: 3

| 10 | 5 | 3 |

- [High Transparent PET Sheets] Crystal clear PET material resembles acrylic in clarity and functions, our plastic sheets offer superior visual clarity to make it easier to see through, no toxic and eco-friendly, bendable and shatter-proof, good alternative to glass and ordinary plastic sheet.
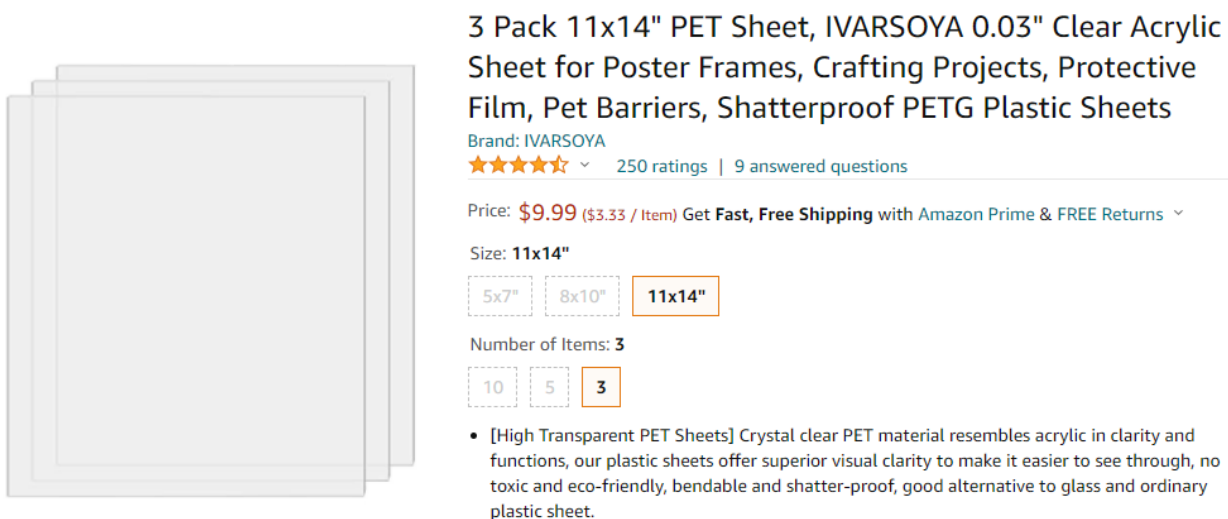
Figure 9: The image above is the plastic sheets that will be used to prevent ambient air from

exiting the enclosure before reacting with the solution.

Supply Order Form

Student/Group Name/Number: Nawah Ahmad, Jennine Farque, Sejal Sharma

Junior/Senior (Circle one):   **Teacher:** Dr. Psaker

Company Name	Item #	Description (Please include a hyperlink, if possible)	Price	Quantity Needed	Total Price
Amazon	B07G96DWYQ	CO2 Meter	$168.90	1	$168.90
Amazon	B0822W31TL	Ducting Pipe 4 Inches	$10.95	1	$10.95
Amazon	B08241WWBX	Ducting Pipe 5 Inches	$12.95	1	$12.95
Amazon	B07XP4TMVW	Hygger Mini Aquarium Pump	$12.99	1	$12.99
Amazon	B07KNR9SVF	Sodium Hydroxide	$14.49	1	$14.49
Amazon	B08FCMH3V	Solder Smoker Suction Fan	$26.58	1	$26.58
Amazon	B00M0I1QP8	Sterilite 16 Quart Storage Box	$22.86	1	$22.86
Amazon	B01M7S46YZ	VIVOSUN 4 Inch Exhaust Fan	$27.99	1	$27.99
Amazon	B09B3J845J	3 Pack 11/14" Plastic Sheets	$9.99	1	$9.99
				Total:	$307.70

Students, If at all possible, please try to select US based vendors, as it takes much longer for Items to be received from overseas and they are difficult to track. Thank you.

Figure 10: The image above is the supply order form with all the included supplies we will be

using in our system.

Methods

Building

Using the plastic storage container (Figure 7) as our enclosed system, we will cut four

holes of different diameters onto the lid by drilling with a hole saw. The rightmost hole will have

a diameter of 4 inches, and the corresponding 4-inch ducting pipe (Figure 2) will be inserted into

it. The suction fan (Figure 6) will then be connected to the 4-inch pipe. The leftmost hole will

have a diameter of 5 inches, and the corresponding 5-inch ducting pipe (Figure 3) will be

inserted into it. The exhaust fan (Figure 8) will then be connected to the pipe. The third hole will

have a diameter of 4 mm, and the air pump (Figure 4) will be attached onto the lid feeding into

the container on the right side. The fourth hole will be cut to the size of the wire of the CO_2

meter (Figure 1). The CO_2 meter will be connected to the inside of the container on the left side by Velcro strips so it can be removed when taking data. We will then cut a plastic sheet (Figure 9) to fit the dimensions of the box, also adjusting for the slight bump-outs at the top. It will be attached to the center of the container, staying 3 inches above the bottom. The suction fan, exhaust fan, and air pump require electricity to function, so they will be connected to a separate power outlet outside of the environment.

Testing

Water will be poured into the container and NaOH (Figure 5) will be mixed in. The carbon meter will be attached to the left section of the container and connected to the computer to record the CO_2 levels throughout testing. The suction fan will take in ambient air, which will then react with the aqueous NaOH solution. The air pump will speed up the reaction process by agitating the solution, and the CO_2-free air will exit the container through the exhaust fan. Before beginning actual experimentation, a round of preliminary testing will be conducted to ensure the system is working as intended and that the CO_2 is reacting properly with the sodium hydroxide (NaOH). The carbon meter will be collecting data on the CO_2 levels in the container throughout the testing. Additionally, we will determine how long the solution is able to capture CO_2 before becoming too saturated, and how often it should be changed. After the system is fully functional, the temperature along with the CO_2 levels will be measured throughout experimentation.

Data and Results

We had initially planned to work with the LabView software for our CO_2 collection and

analysis. However, after researching the CO_2 meter we will use, we found it came with a

software to use directly. The RS232 software is a standard software for serial communication,

and for our purposes, it will be used to connect the CO2 meter to a USB on our PC. We want to

use the software from the meter to log the data over time in our trial periods with our given

variables (including the co2 and temperature changes as a result of the sodium hydroxide). We

will research this software after the CO2 meter comes in, as it is on a CD to be connected to the
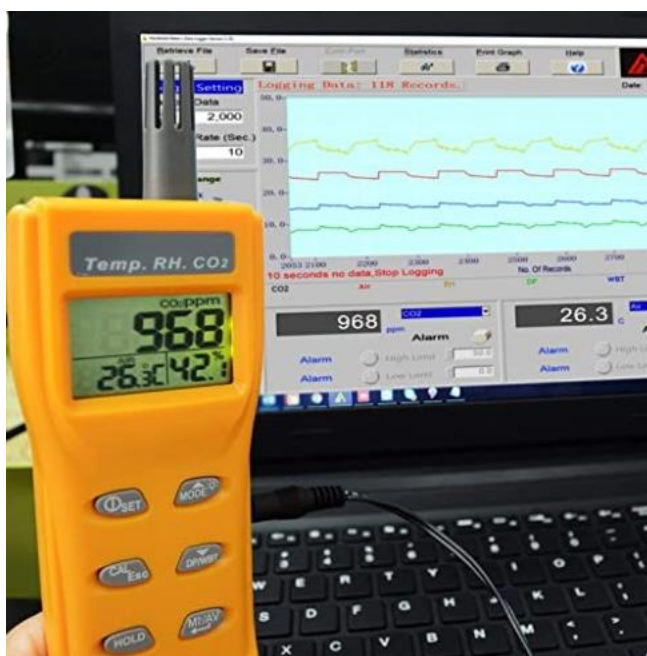
meter itself upon starting.

Figure 11: The image above is a sample set of data found with the CO_2 meter on the Amazon

cite. We plan to use this similar set up once we receive the item.

In conclusion, we plan to host preliminary testing to test the ratio of Sodium Hydroxide

and water needed for the environment to function properly. The equation we plan to use is

evident in Figure 12, and we want to optimize the conditions of our environment with this

alteration. In the event that the system does not work in with our intended effects in the pre-

testing, we will purchase liquid CO_2 to test in the environment. We will analyze and explore this

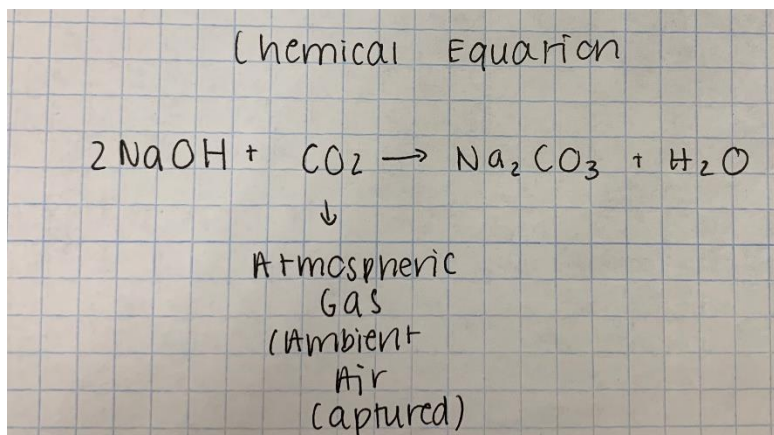data by recording the CO_2 and temperature values.

Figure 12: The image above is the chemical formula for the alteration of the CO_2 gas.

References

Carbon Dioxide Meter and Software. (n.d.). Amazon. Retrieved December 7, 2021, from

https://m.media-amazon.com/images/I/71gyCRioupL._SL1500_.jpg.

Dm, K. [Karthik Dm]. (2019, February 12). *Carbon Capture Machine | Carbon dioxide Absorber*

| Reduce CO2 level in Atmosphere [Video]. Youtube. https://youtu.be/MO3xM9jpwHs