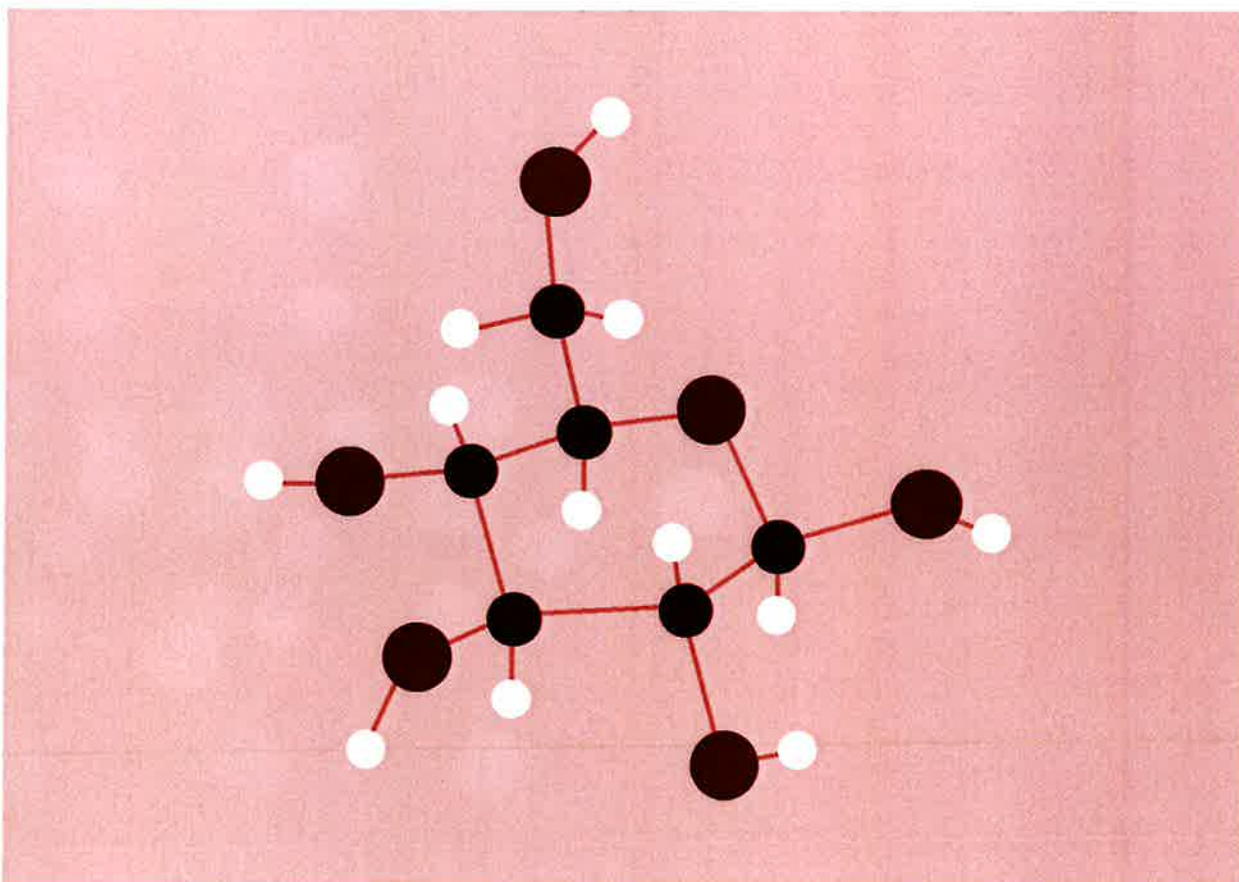


# The Scientific Amputees

*8th grade Students-Saint Francis de Sales Catholic School, Spooner, WI*

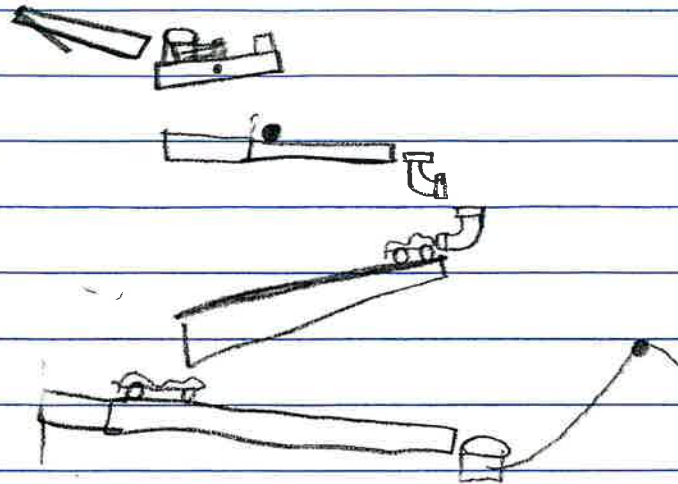


- Leah Hellendrung
- Abigail Lambert
  - Nolen Larson
  - Lily Paulson
  - Kylee Snider
- Svendson Udem
- Elizabeth Zwisler
- Tech Ed. Teachers Barry Melcher, Jen Barton and Jeff Kludt

part 1

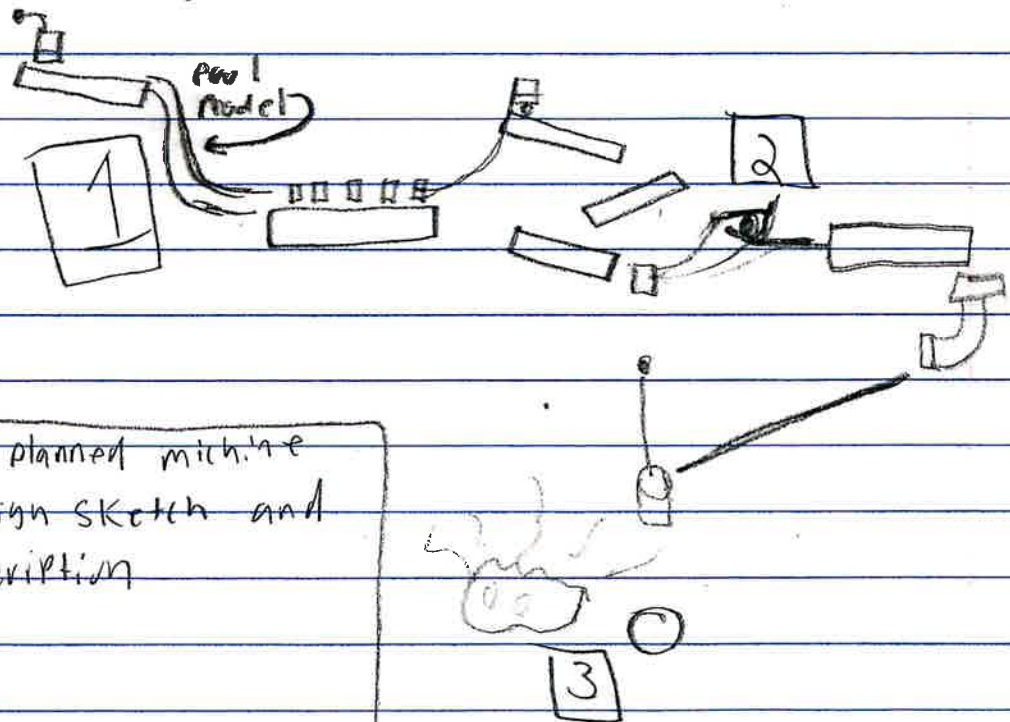
Blueprint  
created

Jan 11, 2024



initial concept

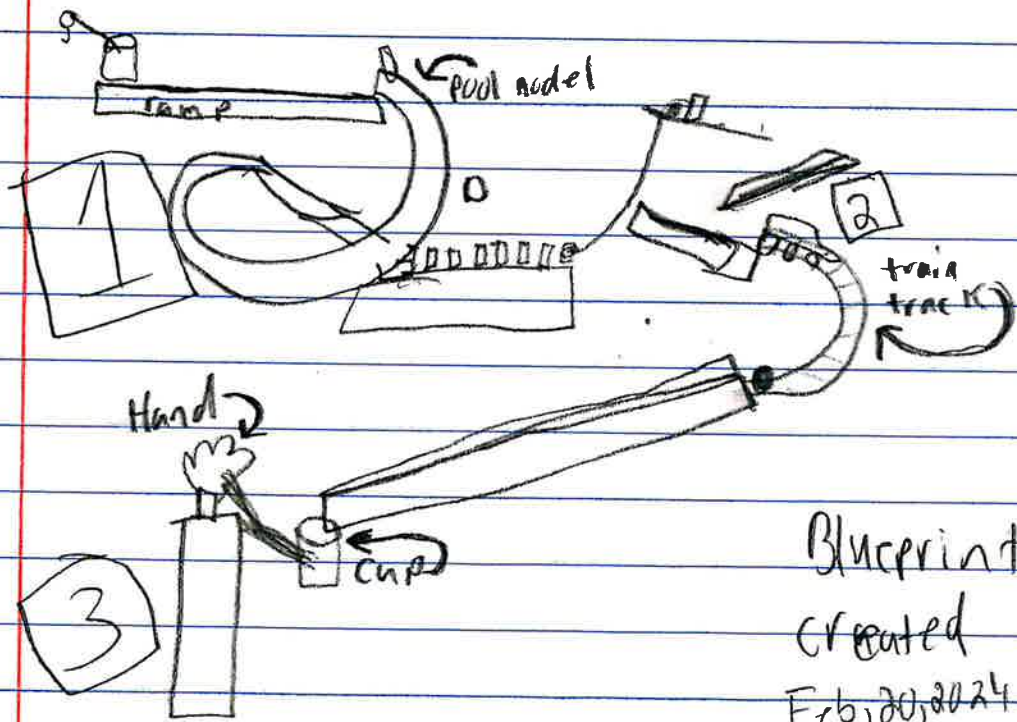
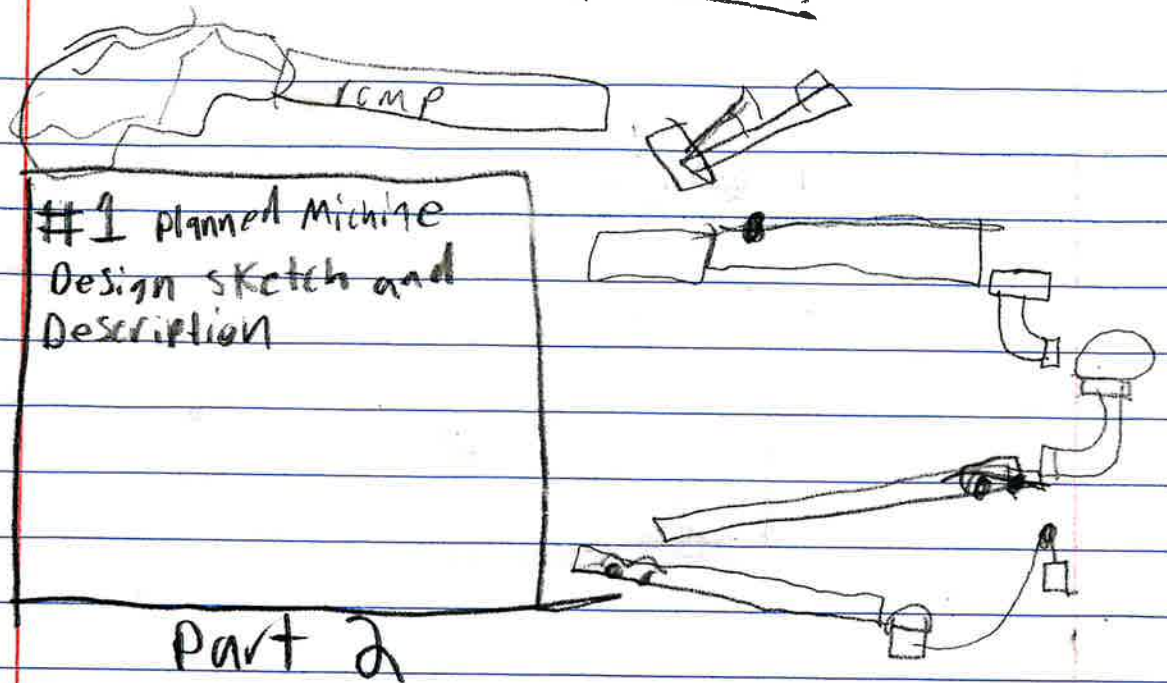
part 2



#1 planned machine  
Design sketch and  
Description

part 1

final Blueprint

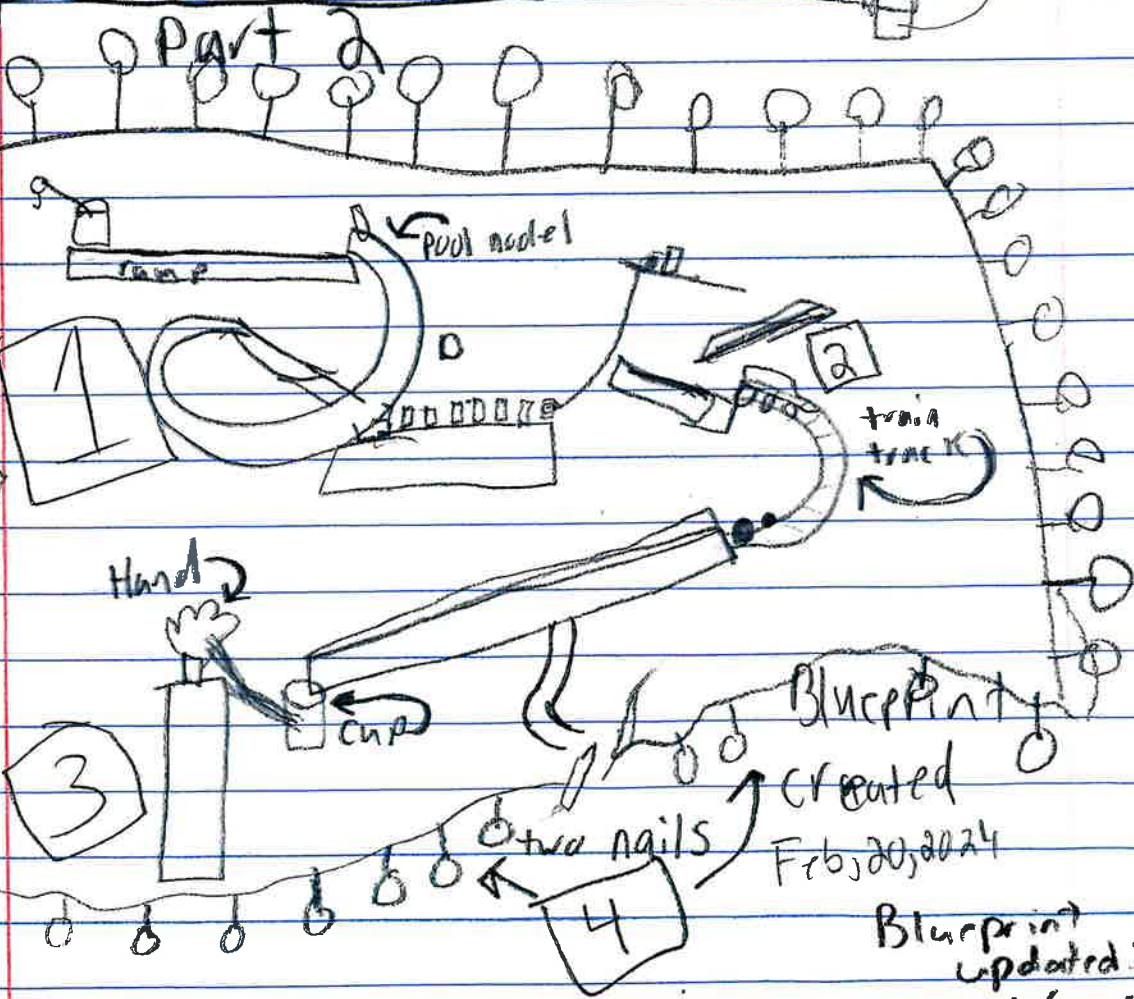
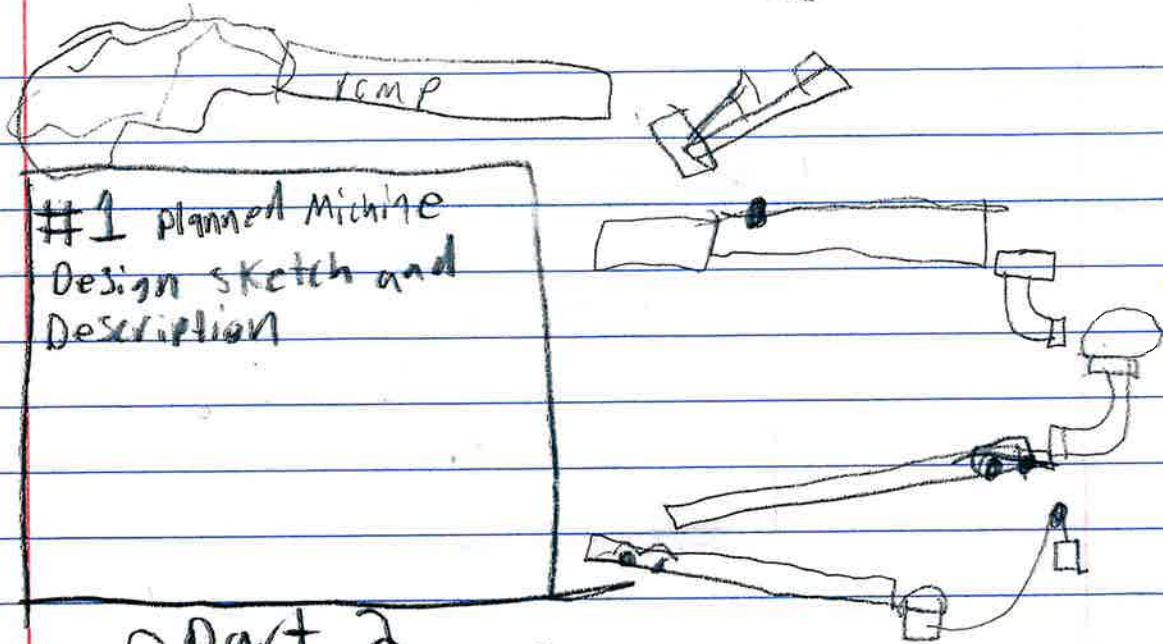


Blueprint  
Created  
Feb 20, 2024

part 1

final Blue print

#2



Blueprint updated:  
4/10/24

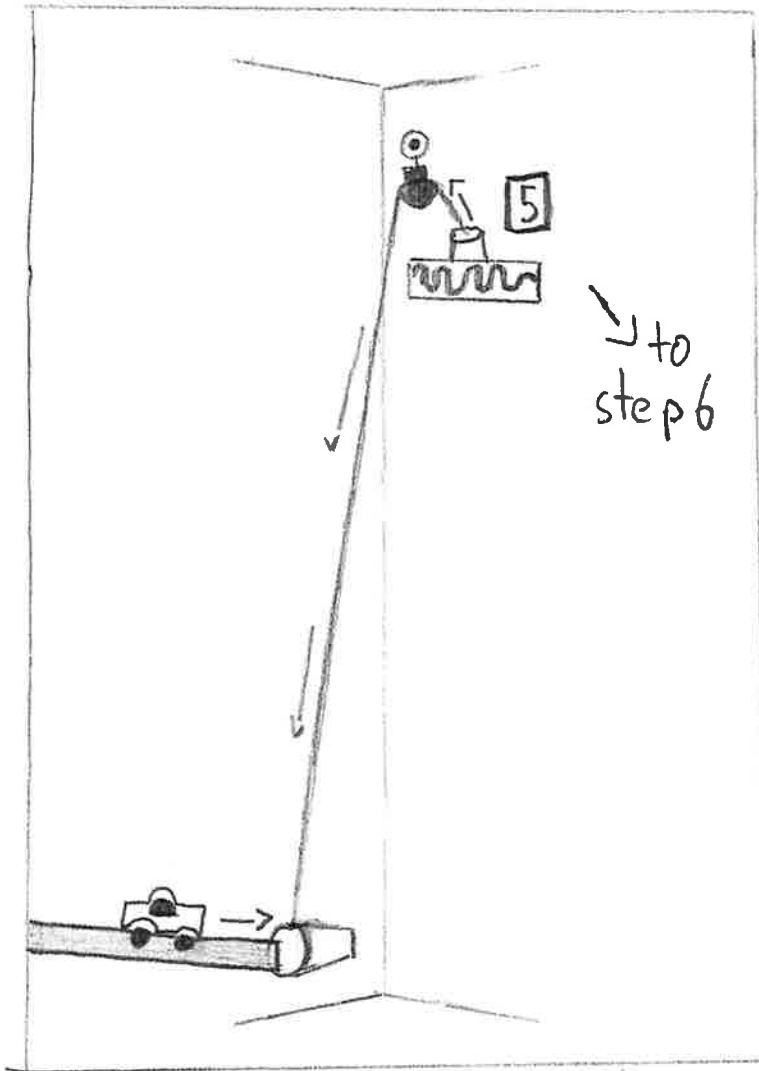
## Original Blueprint Vs. Final Blueprint

### #1 Planned Machine Design Sketch and Description

1. We wanted to incorporate a pool noodle at #1 on the blueprint, but the pitch of the pool noodle was too steep. So we made the pool noodle into a spiral shape, which both slowed down the speed of the noodle and added depth to our machine.
2. Number 2 represents our pulley. At first we thought we would put the pulley on the right side of the machine. However, as our machine build continued, we decided that the pulley would be better in the middle of the machine so that we could get from the very bottom to the top. This also allowed us to maximize the potential of the work the pulley could do.
3. Our ending was going to be a brain lighting up, but we decided a hand closing would be better because it was difficult to get the electrical to work and the hand was easier and just fit our concept better.

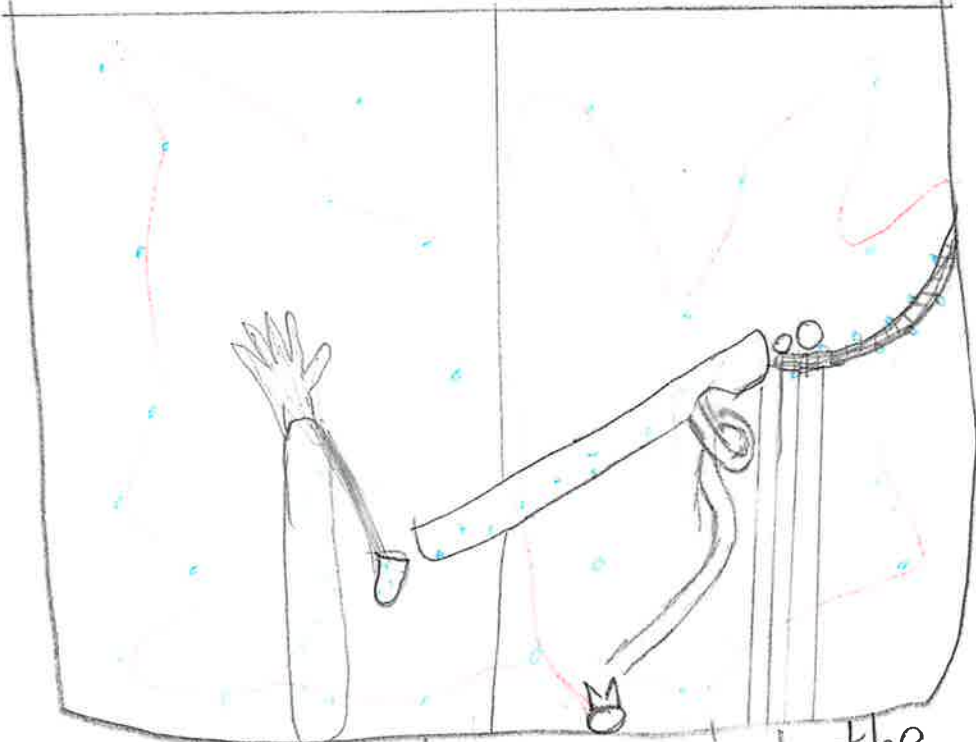
This next number is from after the regional competition and when we are preparing for the final competition.

4. Number 4 represents our complex step that was added to our machine for the championship. Initially the golf ball rolled into the cup to close the hand. We cut a hole in the cardboard tube, added a plastic tube to the hole for the steel ball to roll through and fall to the bottom to come in contact with the nails, opening the circuit for the lights.



This image represents step 5 on our machine. The car rolls down the ramp and into a cup. The string is pulled down, which makes the cup at the top raise. This releases a marble which travels on to step 6.

This diagram represents the final step of our machine. Two balls roll down the ramp, one golf ball, one steel ball. The golf ball rolls into the cup and activates the hand. The steel ball falls through a hole in the cardboard tube through a plastic tube to the bottom where there are two nails. When the steel ball comes in contact with the nails, the circuit is connected and the lights come on.

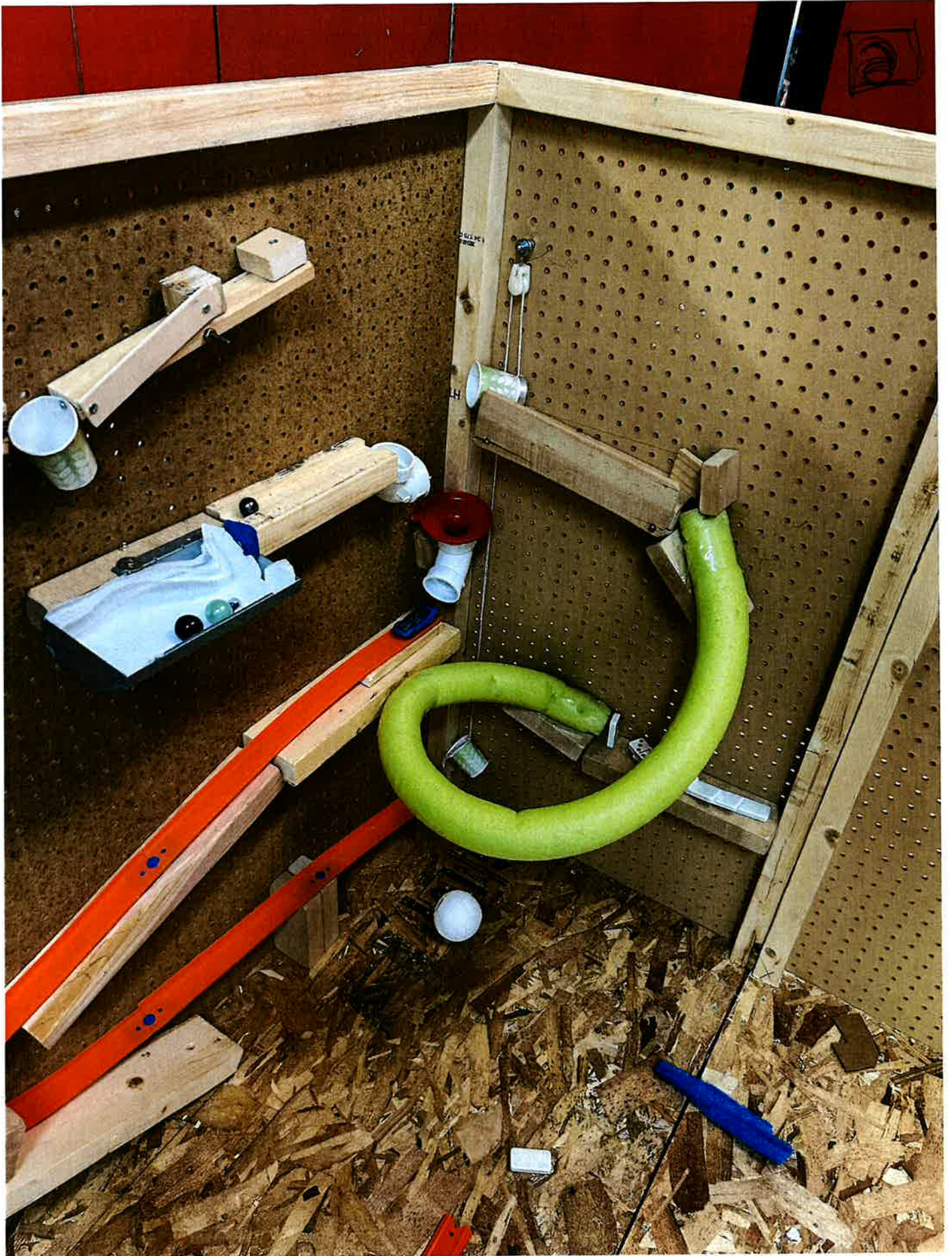


The blue dots represent the lights on our machine. The red lines represent the wiring.

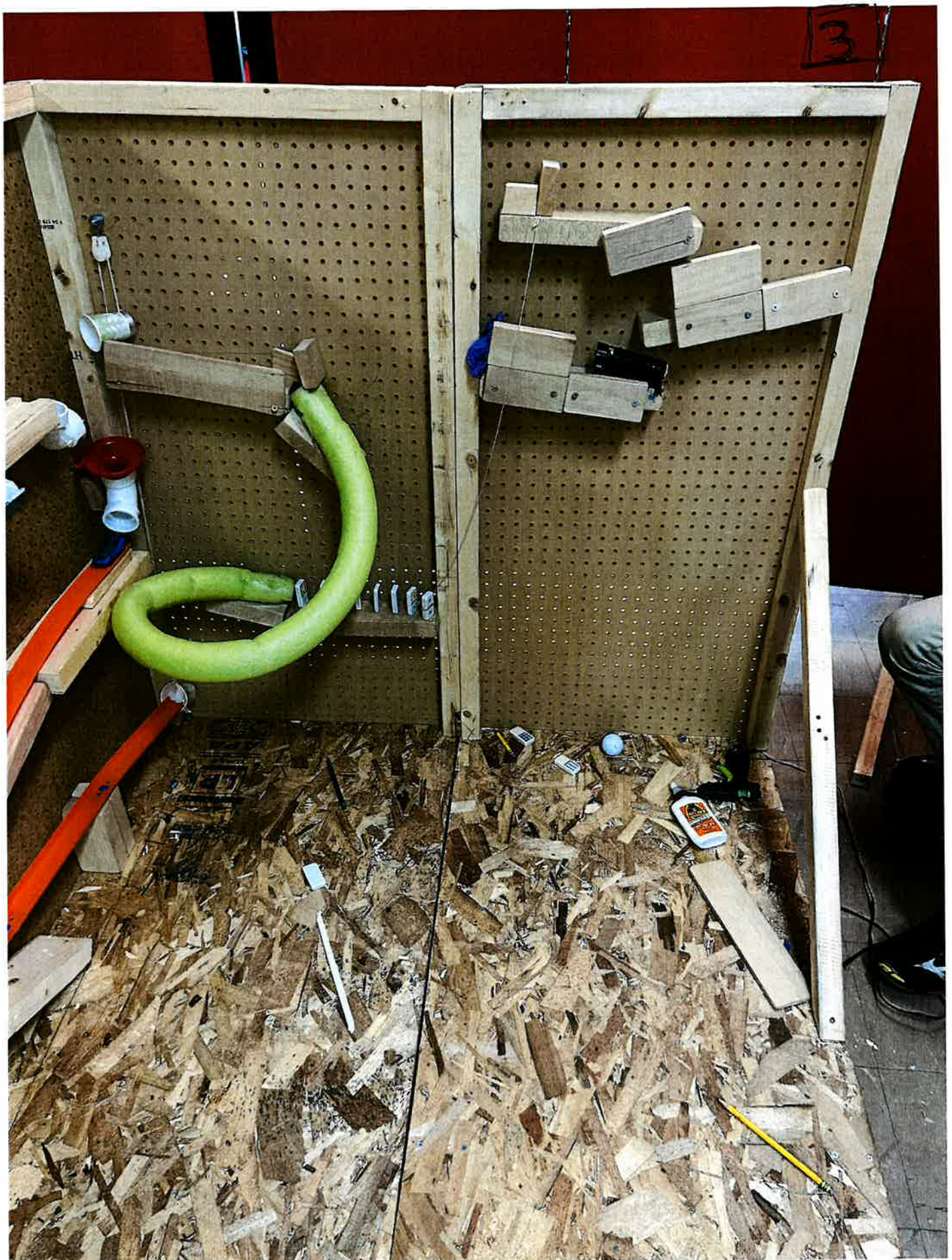


#2 final (or near final) machine Design Drawing



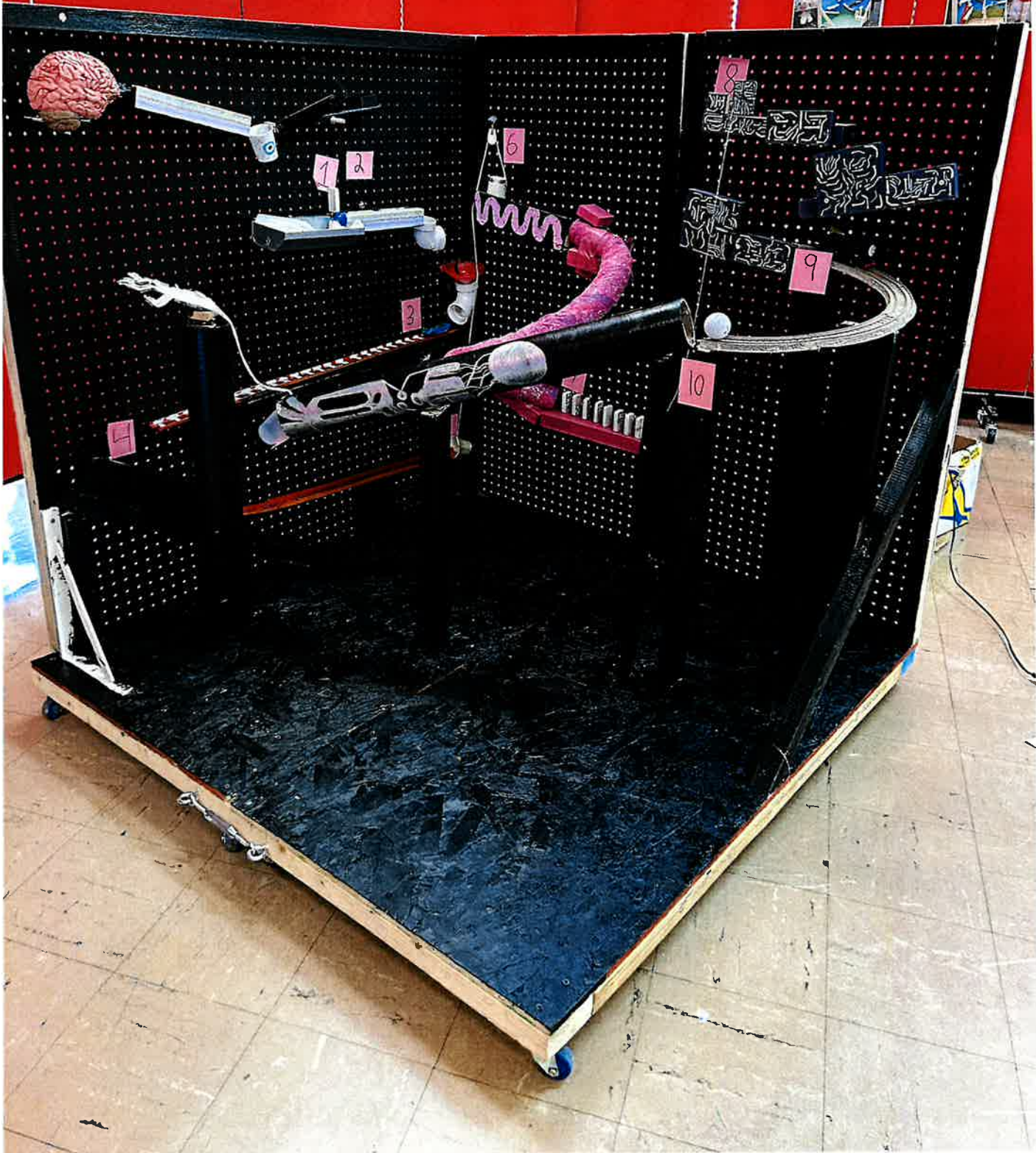


3

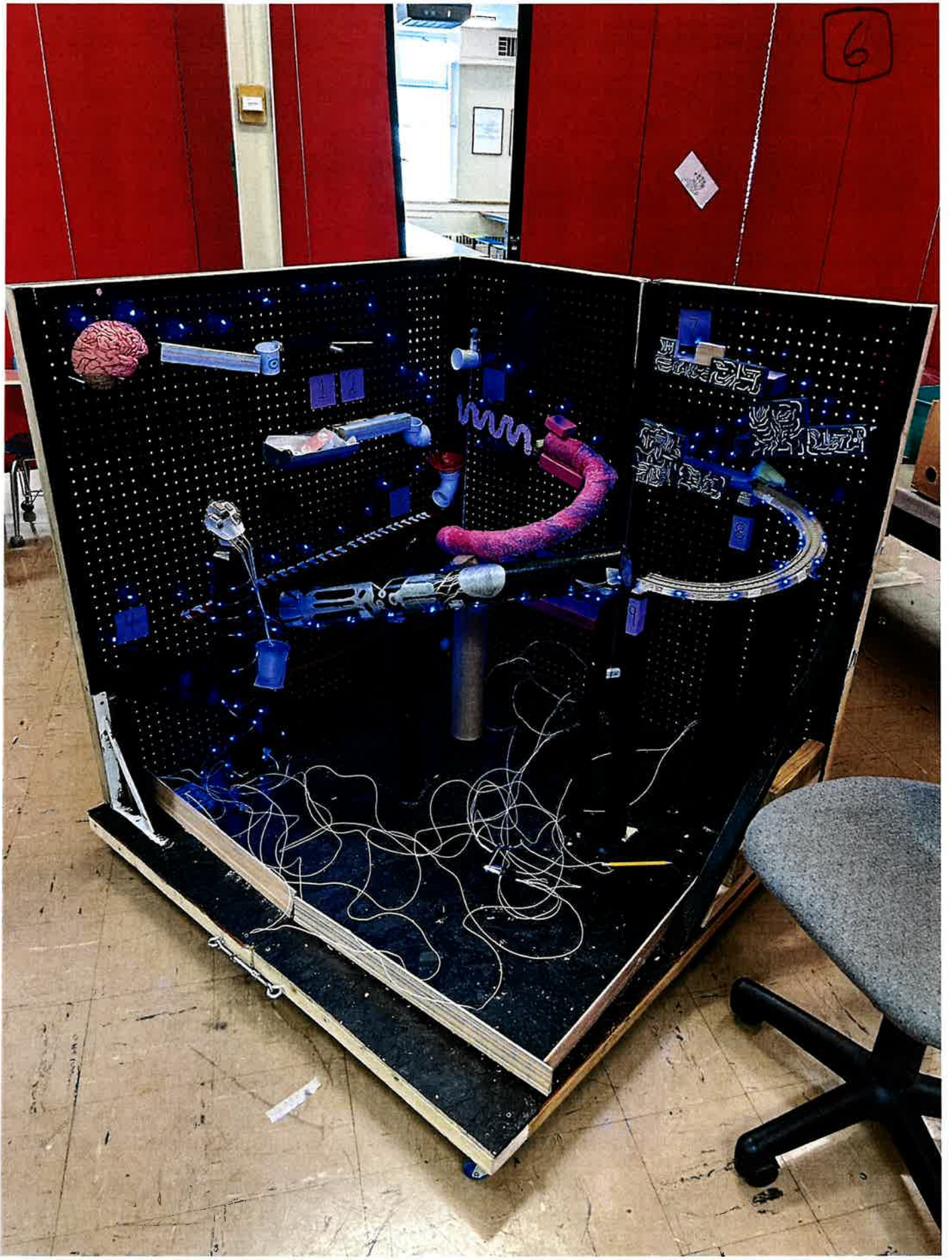




5



6



Picture 1: In this picture we have the brain with a marble rolling out that represents the electrical impulse. The marble then drops into a cup on a pendulum that spins and drops the marble onto a ramp and then the marble goes down a funnel and hits a car that goes down a race track

Picture 2: In this picture we have added the pulley which will release a marble when the car goes into the bottom cup and pulls down on the pulley. The marble then goes down a pool noodle which will knock the dominoes down.

Picture 3: We attached a string to a domino and a piece of wood that will get pulled out of the way when the dominoes get knocked over and the wood gets pulled out of the way, the wood will release a marble that hits a train that will go down a track which will be in the next picture.

Picture 4: Here's the final of the machine without being painted. We have added the train track, the train goes down the train track and hits a golf ball which will fall into the cup and activate the hand to close.

Picture 5: Here is the final machine. We painted the machine and added a couple things. Ready for competition!

Picture 6: This picture was taken after regionals. We added another step to the machine. In that step we put a hole under the tube and a steel ball falls through that hole into a plastic tube and triggers the switch that turns the lights on that we added to our machine.

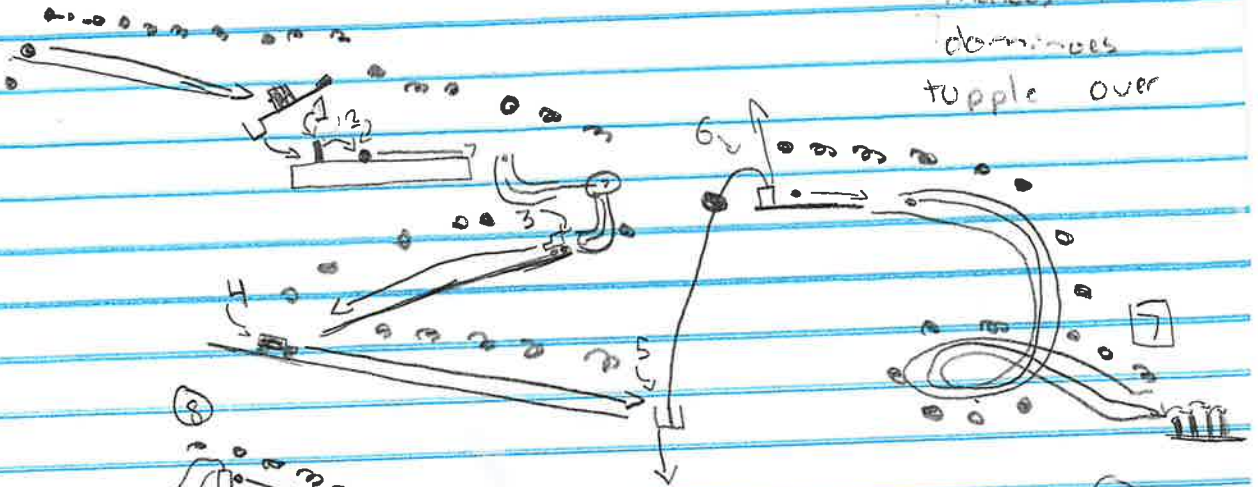
# Last design of the machine

## #3 List of Machine Steps

7 The marble rolls down the pool noodle which makes the dominoes topple over

1

Ball rolls Down the ramp making the pendulum swing hitting the dominoes.



2

The dominoes topples over hitting the weighted ball.

3

The ball rolls down the board through the two pipes hitting car #1

4

The car accelerates down the track hitting car #2

5

Car #2 races down the track and pulls the pulley down

6

The second cup of the pulley is pulled up by Car #2 a marble is then released

and

rolls down a ramp

8

Once the dominoes

● = are the lights that we added for our electrical component

topple over there is a

dominoe attache to a string which is pulled down which releases a marble

12

We added step 12 for championships

We added a chemical component there is now a hole in the cardboard tube which is another tube is attached and a ball rolls down it flipping a

9

The marble hits the train and the train rolls down the tracks

10

The train hits the golfball sending it down the tube

11

The ball rolls down the tube into a cup and closes the handle

switch lights

turning on the lights

## Cost of Machine and Percent of Recycled Materials Used

### Lumber:

8ft 2x4=\$39.04

32ft 2x2=\$24.00

Press board ½ 4x8=\$11.89

Peg board 4x8=\$43.49

Lumber total price \$118.42

### Paint:

Artistic Blue QT=\$19.99

Black QT=\$23.99

Metallic Silver Spray Paint=\$7.99

Black Spray Paint=\$5.99

Red Spray Paint=\$5.99

Ink Blue Spray Paint=\$7.99

Paint Total Price \$71.94

### Latches and Wheels and lights:

Latches=\$13.81

6 battery powered LED controllers @\$3.45 each

Wheels=\$15.92

Latches and Wheels Total Price \$50.43

### Recycled materials:

2- 1 ½ glue elbow

1 plastic tube

3 4oc Dixie cups

2 nails

1 golf ball

1 steel ball

String

Car track

2 cars

1 train

1 8oc cup

2 large cardboard tubes

Brain from human model

Pulley

1 Pool noodle

Random wood

Screws

1 Support bracket

Dominos

Marbles

1 Weighted ball

Total cost of machine: \$240.79

73 % of materials were recycled

Total cost of machine minus lumber:\$101.67

\* All lumber was donated to us from Arrow Building Company \*



## #5: Applied STEM Process

Here are some of the places we used the STEM process.

The second pipe challenge is about making the marble go into that pipe because when we tried it would hardly go into the pipe. The marble would over shoot the pipe. We thought for a while and looked around the room to find a way to solve our problem. We found a piece of a marble set. We tried putting the marble set piece into the pipe but it was too big. We decided to cut it so it would fit. It fit perfectly the first time we cut it! We tested and it greatly improved the success rate of the marble falling into the pipe. After we put the machine back together we decided to screw the marble set into the machine.

We took a while to figure out what we wanted to do after the pulley. We had an idea that we wanted to use a pool noodle or a big, clear tube. A marble would roll into the tube or pool noodle. We didn't have a big clear tube but we did have a pool noodle. We got a tube but the marble wouldn't fit into the tube. If we wanted a tube we would have to buy one. We didn't want to do that. We just took the pool noodle and screwed it into the machine. We put it into a spiral shape, so we would have more space on the machine to do more steps. We tested it and it didn't really work. We had to move pool noodle around to get it in the right spot. It took a lot of testing to get it just right. The marble would roll over the pool noodle, under the pool noodle, and basically everywhere but in the tube! We put little pieces of wood and pieces of pool noodle to stop the marble rolling off and to make it go into the pool noodle. Now the marble goes into the pool noodle 100% before it only went in only about 40% of the time.

For the end we have constructed a cardboard hand. We had to figure out what material would work best to make a hand and to make it move. We traced one of our own hands to get an idea of how big the hand would be. We then cut out a shape of our hand out of cardboard and added straws. We put string inside the straws so the string wouldn't all tangled. Also we need to have control of each finger. When we put the hand on top of the cardboard tube, we found out that we needed some leverage so the hand would open and close nicely. Otherwise it was a struggle to make the hand close. We added some extra cardboard underneath the hand. Now we had another problem. We needed the golf ball to go into the cup. If we got lucky it would go into the cup. We needed to find a way to make the golf ball go into the cup all of the time. We brainstormed some ideas. We took the easiest one and it worked. We put the cup into the end of the slanted cardboard tube. So now we know if the cup is inside the tube, then the ball will always go into the cup.

The final challenge we faced was getting an advanced step into the machine. We brainstormed many different ideas for an advanced component. We thought about using a chemical reaction or having an electrical component. We had no possible way to have a way to start a chemical reaction.

\*For championships\*

For the championships we wanted to add an advanced component. We decided to add lights. We put them on the machine. We needed to find a way to turn on the lights without turning it on with our hands. We knew we could put the wires together so we could have something hit it to turn on. Our first idea was to have a marble hit a switch to turn the lights on. We couldn't figure out a way to connect the wires to the switch. We asked our janitor if he could help. He is a licensed electrician. He helped us connect the wires. He also found a way to turn on the lights without touching it with our hands. We are going to have a tube and two nails will be poked through. Then a steel ball will land on the two nails making a connection. Then the lights will turn on. It took a lot of testing to get the lights to turn on at the same time as the hand closes. We had to spiral the tube so the ball would slow down. We tested several times to find the right place to put nails. We needed them to be close enough to make a connection but not too close so the nails don't make a connection on their own. We would time how fast the golf ball would roll down the cardboard pipe. Then we matched that time with the steel ball. To make the steel ball match the time we put in a spiral shape. So it would slow down. It took a long time to slow it down. Then we had it going too slow. We then had to have fewer spirals. It was really hard to decrease the amount of spirals we have. We had to be careful so we wouldn't pull any of the wires out of place. We got it to work after many attempts. Now the ball rolls down the tube and makes a complete connection to turn on the lights.

## Reflection

Included in our reflection we kept a weekly progress journal. It is attached after this document.

To start this project we sat at a table. We had two main ideas that we couldn't agree on. We put it to a vote. The concept that won was about the nervous system and would include prosthetics. Next, we went to our local businesses and asked if they had anything we could use for our machine. After a few weeks we built the frame. We added a pendulum. We had some trouble putting it on the board. We have a wooden block at the end of the pendulum. We had to think of the right materials to make it swing and which ones would prevent it from swinging. We tested and tested until we got it in the right spot. We added two elbow pipes. A weighted ball would go into the first pipe and then into the second. Our problem was that the weighted ball would miss the second pipe. We used a funnel piece and cut it so it would fit into the pipe. Now it works much more often than in the beginning.

Next we have the pulley. We added it really late because we wanted to use as much space as we could. We had a lot of challenges with the pulley. We couldn't get the cup to move. We didn't have much room for the pulley to move. When the cup moved up, the ball would roll backwards. We thought maybe the cup wasn't heavy enough. We had to run the machine multiple times to see what was happening. The cup would push the ball backwards. So we put a candle on top of the cup to keep it down. That fixed the problem.

Next we have a pool noodle in a spiral shape. It's like that so we have more space to work. The marble wouldn't roll down the noodle. So we had to find the right position so the marble would roll down the noodle. It took a lot of testing to get it just right.

The hand was a very complicated step for us to build. We wanted the fingers to move. Have strings to pull them down. We attached the ends of the string to a cup. We had to find a way to make the golf ball roll into it more consistently. In the beginning we just had the ball roll down the tube and the cup sitting below, it hardly worked. The cup was the perfect size to fit into the end of the tube, so we put it into the tube. Now it has a much higher success rate.

For the championship we added an advanced component. We added electrical work. We have lights at every step and the lights show where all the energy goes throughout the board. We had to brainstorm where we could possibly put an advanced component. We decided that it would best fit before the hand and after the golf ball. We still wanted the hand so we had to find a way to have two steps at the same time. We have the train hit the golf which hits a steel ball which goes down the tube. The golf ball and the steel ball go down the tube at the same time. We have a hole cut out at the bottom of the tube to have the ball go down into a pipe. In the pipe we have two nails. Connected to the nails are the wires connected to the lights. So when the steel ball lands between the nails it makes a connection and the lights go on. We thought it was a really good idea to have two steps at once. We believe it will really help our machine do well in the championship.

Building these machines plays an important role in future careers. Construction was used a lot in building this machine. For art we painted the machine, drew sketches, took pictures, and sculpted. It was helpful in the field of literature, because we worked on communication, critical thinking, and lots of writing. To conclude, all of these jobs require teamwork, which is a key skill to learn; we tried different careers, which is helpful for us to see if we are interested in pursuing it or not.

# Science Journal

## Week 1

Our team name is ~~the Scientific Amputees~~ <sup>U.S.A.</sup> We have seven people in our group. Leah, Lily, Kylee, Elizabeth, Abigail, Nolan, and Johnny.

Today we worked on ideas for the machine. We don't have a clear idea yet but we want the idea to have something to do with the nervous or respiratory system.

## Week 2

Today we continued on searching for ideas. We still have the ideas for using the nervous system. We chose this week to use the nervous system. We want to use something electrical in the machine. We want to use a bionic hand maybe we use a signal from the brain to close the hands.

## Week 3

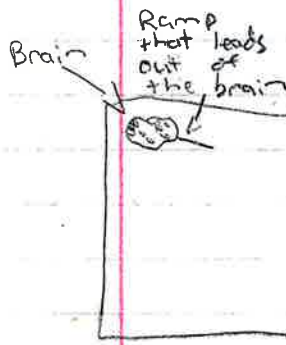
We started making our frame we decided to use pegboard for the frame. The frame is 4x4 but we cut it in half to make it more movable. So it is a 2x4 with fence hooks to keep it together. We also screwed on wheels to move it easier too.

## Week 4

We finished the frame this week. We still want something to do with the nervous system. We want it to start with the brain and have it flow through the nervous system and have a hand close.

## Week 5

We have been thinking of using a nervous reaction. It starts as the brain sending a sign through the nervous system. It makes a nervous reaction that closes a hand.



## Week 6

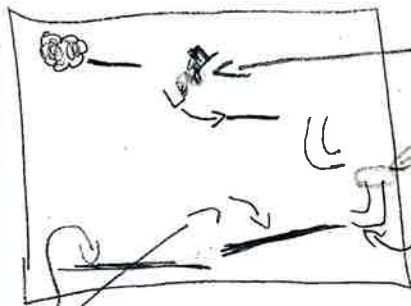
Today we worked on putting some stuff onto the frame. We have been working on a spring powered button.



Today Lily worked on the blueprint. The painters Kylee, Leah, and Elizabeth are working on gathering paint supplies and setting up their painting area.

## Week 7

Today we worked on adding more stuff onto the machine. A marble comes out of the brain goes down a ramp that makes that piece swing.



Today we added on another pipe piece. We also put a funnel on the second pipe to increase the chance of hitting the tube.

## Week 8

We started off this week by putting some hot wheels track at the end of the pipe. We then put a second track after the first one.

## Week 9

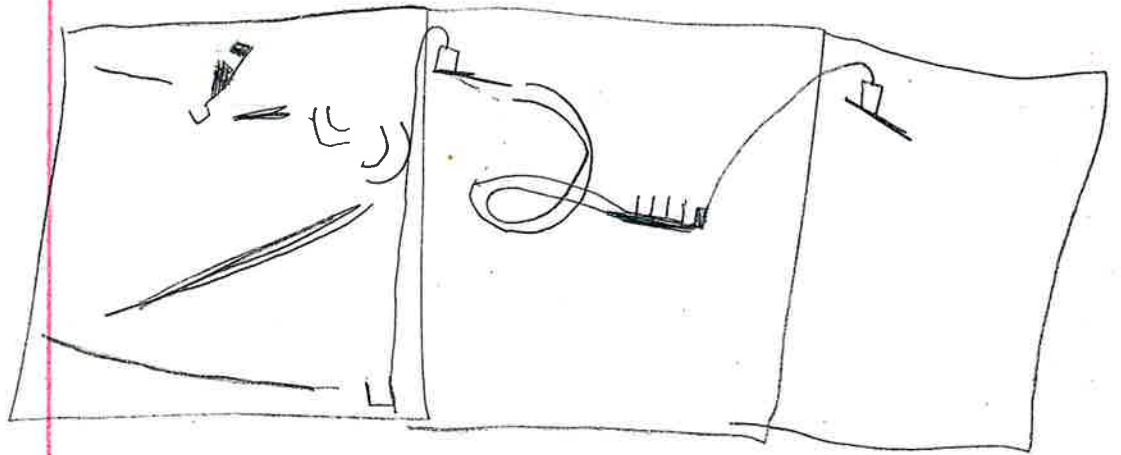
Today we worked on the pulley. We had a lot of problems with consistency. But in the end we got it more consistent. Now it works everytime.

## Week 10

We finally made the pulley work. It works about 90% of the time. We have been brainstorming about our next step for the rest of the week. Today we decided on tubing for the next step.

## Week. 11

We have made so many advancements and the week isn't even over. We have added a pool noodle that swirls around. Which hits dominoes. When the dominoes fall over it pulls a cage which releases a marble.



## Week 12

We have almost finished the building part of the project. The last few steps will be the marble hitting the train sending it down the tracks. We have decided on using the hand for the final step.

## Week 13

Today we finished the project. For the finish we planned on a hand closing. The marble hits the train the train hits the golfball then the ball rolls down the tube the ball then goes into a cup which is attached to string which pulls the hand to close the hand.

## Week 14

Today we started our second to last week of the project. We had to take almost everything off the board so the artistic people could paint all the pieces. Its looking pretty good Leah, Kylees and Elizabeth are doing a great job.



## Week 15

We have finished the project. We have finished everything. We just need to put the machine back together now. We are excited for the competitions.

Today we put the whole machine back together. We are finished and ready for the competitions.

This was for regionals. We are now adding on the steps for the finals.

## Week 16

We are now adding an advanced step to our machine to take it to the next level. We are thinking about adding an electrical component.

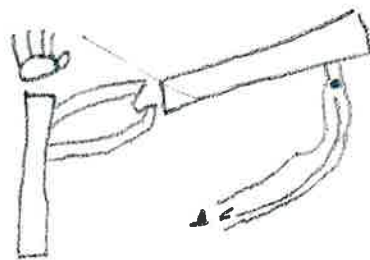
We are doing something with lights. The lights are going with the machine as the machine is running.

## Week 17

The lights are representing the signal going through our machine. We are working on the wiring this week.

## Week 18

We finished the wiring.



The ball rolls down another tube we put in it flips a switch which turns the lights on.

# References

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