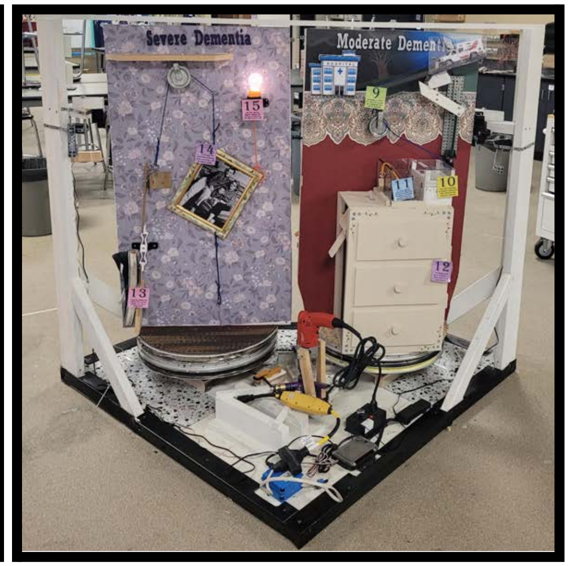
New Berlin Eisenhower



MACHINE PURPOSE

Our goal is to motivate audiences to invest in advancing Alzheimer's technology research by showcasing every stage of the disease. Through our machine demonstration and presentation, we aim to ignite enthusiasm for integrating innovative solutions into the fight against Alzheimer's.

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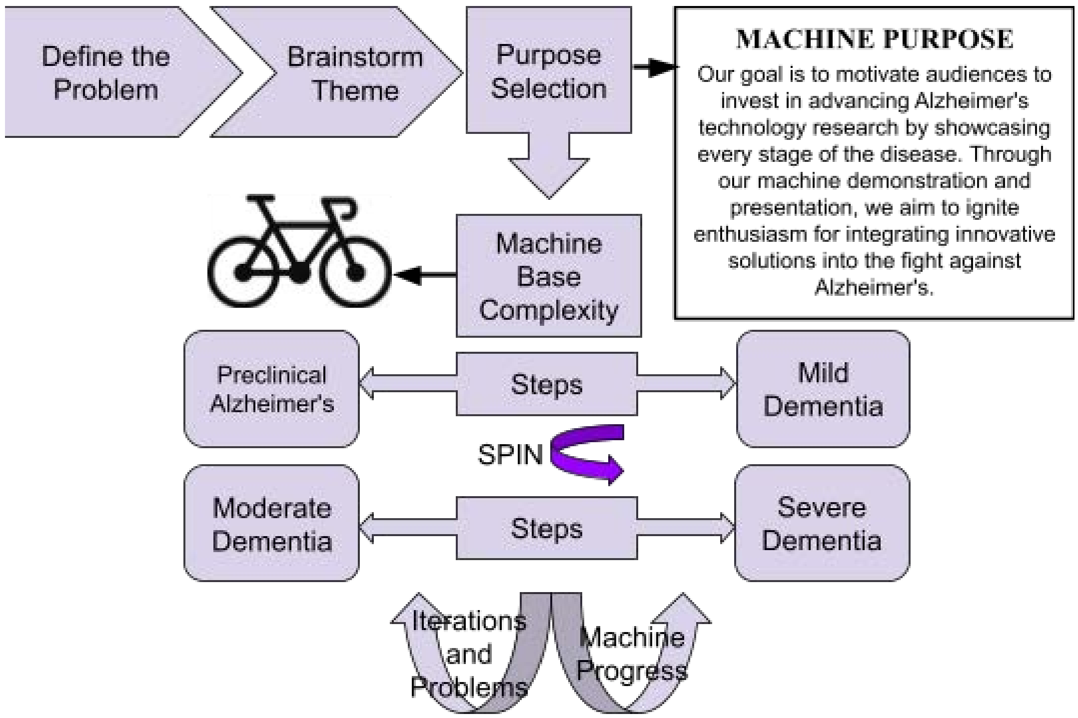
Planned Machine Design Sketch and Description

To plan our machine we used the following process.



Brainstorming Theme

Brainstorming

- CPR Dummy
- *Wall Rotation*
- Mechanical spinning mechanism car instead of a motor
- Drill Instead of gravity system
- Hand-controlled 3D Printed Hand (pneumatic?)
- CyBorG GreK
- Diabetes dog (bear?) (Rufus)
- Spinning the outside of the body to the inside of the body
- Outside > inside > inside an organ (ex: heart)
- 3D printed heart
- Artificial pancreas
- Type 3 diabetes?
- MRI Scans
    - PET scans
- Ultrasound machine
- Exoskeletons
- Neuromorphic Tech
- Prosthetics
- Sythnoid (Star Trek)
- Nueralink
- Brain diseases
    - Alzheimer's
    - Dementia
- Medicine of the Future
    - Our world today/medicine of the past on one side of the machine, future innovations (cyborgs, etc) on the other.
- Industrial feel
    - Black pipes and spruce wood and cool-looking stuff
- **ALZHEIMERS**

We started by brainstorming the theme. Our goal was the quantity of ideas as a group. On a shared doc we created a list of ideas.

Research Information

Synthoid:

Synthoids, as first introduced in a Star Trek series, are highly advanced robots designed to closely mimic the appearance and behavior of humans. They possess an external human-like appearance but are purely technological constructs on the inside. The concept of synthoids in science fiction often raises questions about the boundary between humans and artificial beings.

Neuralink:

Neuralink Corp., founded in 2022 by Elon Musk and a team of seven scientists and engineers, is a pioneering American neurotechnology company headquartered in Fremont, California. The primary focus of Neuralink is the development of implantable brain-computer interfaces (BCIs) that have the potential to revolutionize the way humans interact with technology. These BCIs aim to directly link the human brain to computers, enabling the translation of thoughts into actions. This technology holds promise for a wide range of applications, from medical treatments to enhancing cognitive abilities.

Exoskeletons:

Exoskeletons are wearable mechanical devices designed to provide support and enhance the physical abilities of the human body. These devices can assist with mobility, increase strength, and even rehabilitate individuals with physical disabilities. Exoskeletons have applications in healthcare, military, industrial settings, and beyond, and they represent a significant advancement in human-machine interaction.

Prosthetics:

Prosthetics are artificial body parts created to replace the function of body parts that have been lost or are non-functional. Common examples include prosthetic limbs such as arms, legs, and hands. Prosthetic technology has come a long way, incorporating advanced materials and technology to provide individuals with improved mobility and functionality, allowing them to regain a sense of normalcy and independence.

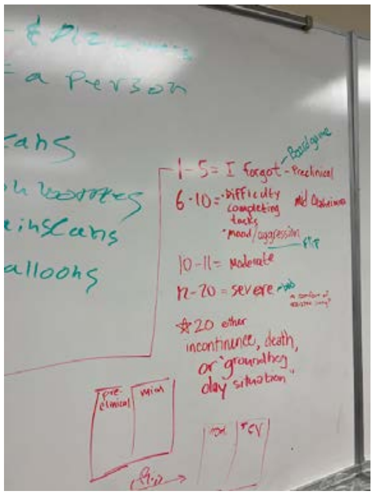
Neuromorphic Technologies:

Neuromorphic technologies leverage the principles of neural networks and artificial intelligence to create systems that mimic the functioning of the human brain. This approach has the potential to enhance human cognition and enable machines to process information in ways more akin to human thought processes. In 2018, a significant milestone was achieved when a person with a brain implant was able to control drones using their thoughts, showcasing the potential of neuromorphic technologies in the field of brain-computer interfaces and human-computer interaction.

Next, students did further research on topics that they were most interested in. They presented each topic to the team.

ALZHEIMERS

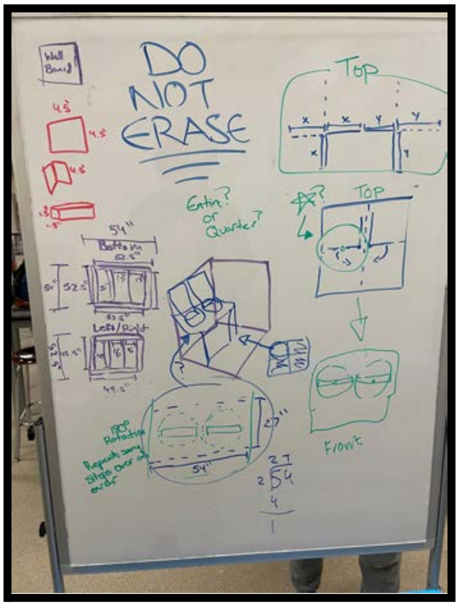
- DO THE SAME STEP OVER AND OVER AND HAVE IT AS ONE STEP BECAUSE YOU "FORGOT" YOU DID THAT STEP
  - BUCKETS ARE PRESCRIPTION BOTTLES/CONTAINERS
- HOW IS THIS HUMAN TO TECH TRANSFER???????
  There is certain technology used to help people with Alzheimer's so we can include some things like that
- LIFE OF A PERSON FROM BIRTH TO DEATH (CHILDHOOD DIABETES THEN ALZHEIMERS AS AN OLD DUDE)
- ELDER IS TURNED INTO A CYBORG
- MACHINE IS 73-78 SECONDS LONG BECAUSE IT RELATES TO THE AVERAGE AGE OF HUMAN IN THE USA



On our third meeting, we landed on Alzheimer's as the story we would tell.

We also developed the purpose of our machine:
Our goal is to motivate audiences to invest in advancing Alzheimer's technology research by showcasing every stage of the disease. Through our machine demonstration and presentation, we aim to ignite enthusiasm for integrating innovative solutions into the fight against Alzheimer's.

Brainstorm and Build Machine Base Complexity



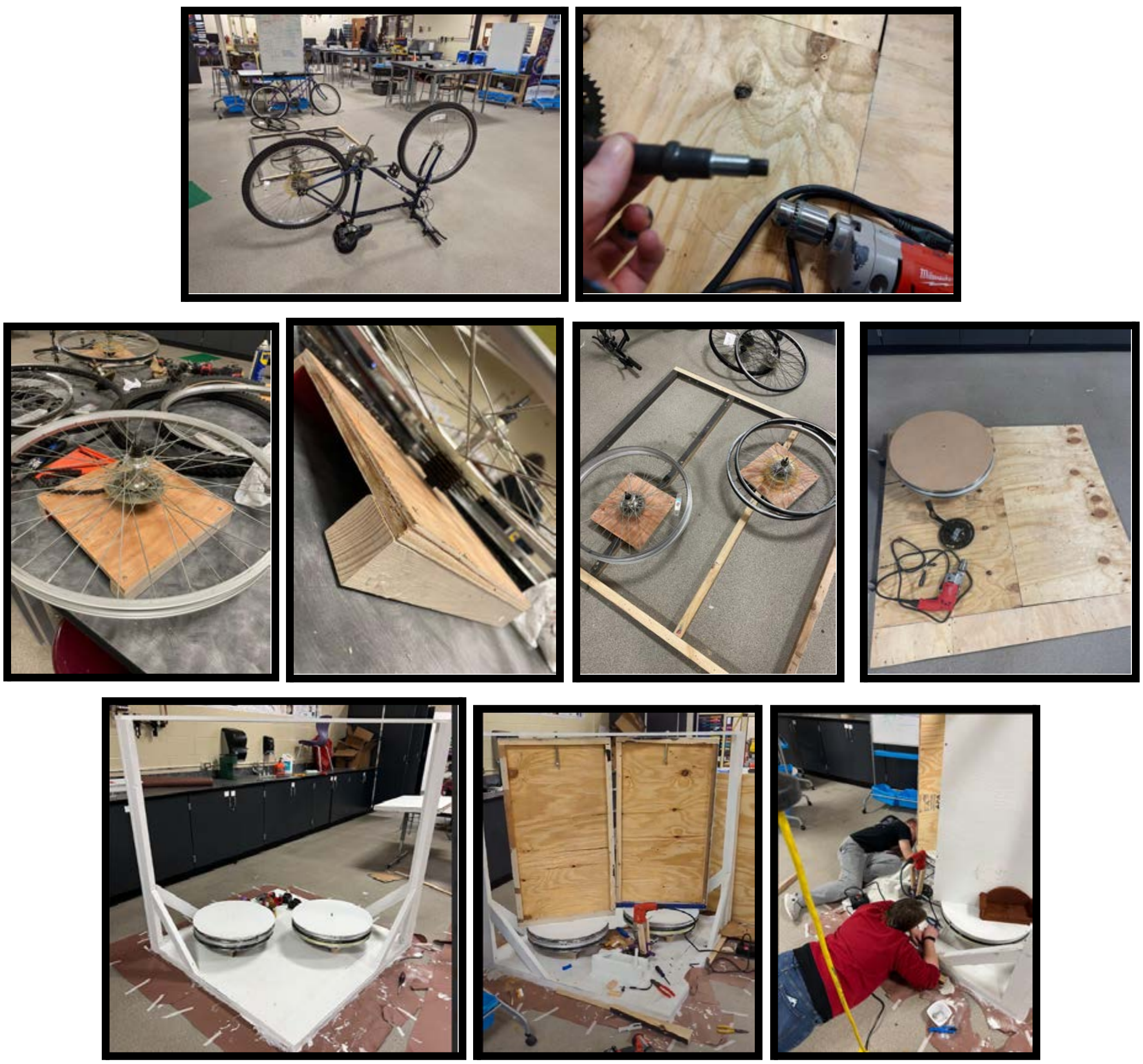
We started the brainstorming process by discussing the Machine Design and Operation rubric. This year we wanted to make sure our machine was complex from the start. We discussed how we could even make the base of the machine complex! We talked about a standard two-wall system, a two-level system, a curtain hiding the machine, one wall turning, and two walls turning.

For inspiration, we watched many videos of other machines and found an amazing team from Purdue University. In 2018 they made a machine that was spinning.

Milwaukee Bicycle Collective

After looking at Purdue's machine we learned we do not have the same equipment and supplies to build a base just like theirs. However, we knew we wanted to make a machine with similar complexity. Therefore, we brainstormed other things that spin and were big enough to support the base of our machine. A bicycle wheel and sprocket system!! We worked with the Milwaukee Bicycle Collective to obtain the three bikes we needed. The Milwaukee Bicycle Collective is a volunteer-driven, 501(c)(3) non-profit organization that helps provide individuals, groups, and events with refurbished bicycles. We asked them for three bikes that could not be refurbished so we could take them apart to make our machine work!

Pictures of building the machine spinning base

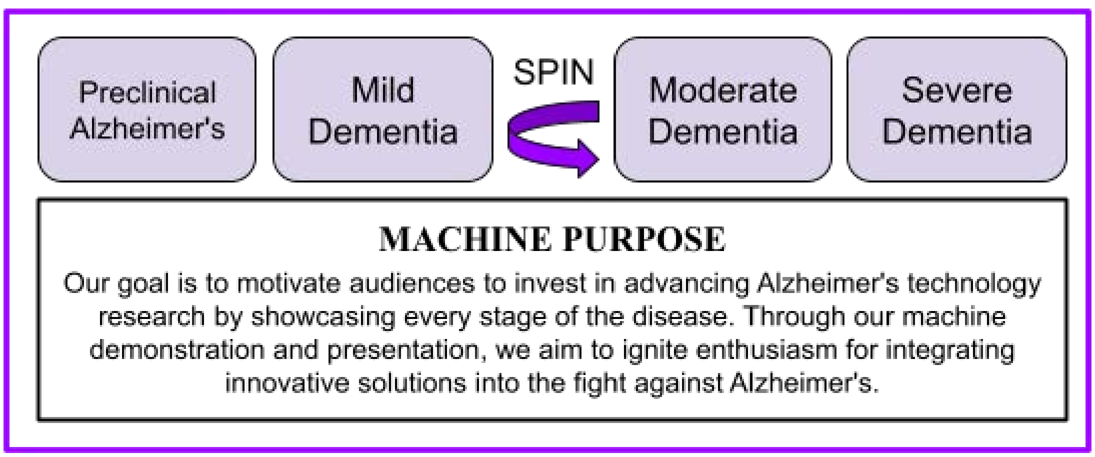


Brainstorming Machine Steps

From the start, our team wanted to create a machine that could bring awareness to the issue of dementia. Worldwide, around 55 million people are living with this affliction, and the numbers are only increasing. As medicine advances and lifespan increases, the brain is beginning to deteriorate faster than the human body. This leads to memory loss and hindered thinking abilities, symptoms that have had a great impact on the lives of many. However, technology has been essential to improving the quality of life of those affected by dementia and other cognitive degenerative diseases; they can find themselves again through the assistance of modern healthcare and remnants of the life they have forgotten.

Throughout our machine, we wanted to tell a story addressing the many difficulties people with dementia face in their daily lives. They often repeat the same tasks without realizing it, forget to do things, and cannot always recognize their loved ones. We planned to incorporate steps that represent these issues in our machine.

Now it was time to brainstorm our steps. Each step is needed to enhance our theme! We started by learning more about Alzheimer's. We learned that there are stages to Alzheimer's disease. According to the *Mayo Clinic,* there are 5 stages. The *Alzheimer's Association* states there are 3 stages and *Penn Medicine* states there are 7 stages. We settled on 4 stages to summarize Alzheimer's.



Some key things we wanted our machine to do.
The preclinical Alzheimer's panel should take the longest as this is the longest stage. The shortest panel should be severe dementia as this stage moves the fastest. Each panel should highlight the symptoms of this stage of Alzheimer's.

Preclinical Alzhimer's (Steps 1-5)

Preclinical (Simple): Fluid Power

[Link to info source]

Information

Alzheimer's disease begins long before any symptoms become apparent. This stage is called preclinical Alzheimer's disease. It's usually identified only in research settings. You and those around you won't notice symptoms during this stage. This stage of Alzheimer's can last for years, possibly even decades. Although you won't notice any changes, new brain imaging technologies can identify amyloid plaques and neurofibrillary tangles. The tangles develop when tau proteins change shape and organize into structures. These are hallmarks of Alzheimer's disease. The ability to identify these early changes is especially important for clinical trials. Ongoing trials are looking at whether treating people with preclinical Alzheimer's may delay or slow the onset of symptoms. The imaging technologies also are important as new treatments are developed for Alzheimer's disease.

Ideas

1. A car goes down a ramp and hits some keys (going home)
2. Keys go down a zipline, disappear into a wall, and hit a button, releasing the next step (forgetting keys/things)
3. A pneumatic system with a wheel drops a lot of marbles in a delay onto a marble track, and the marbles roll into pill bottles consecutively (repeating the same action, taking meds)
4. The last marble lands on a light sensor, starting the next section.

- Blood tests to identify biomarkers
- Coming up with the right word/name
- Misplacing/losing objects
- Remembering the names of new people
- Forgetting material that was just read
- Increased trouble with planning/organizing
- Difficulty with tasks in social/work settings
- Judging the amount of time needed for a task or order of steps

Mild Dementia (Steps 6-10)

Mild: Chemical

Link to info source

Symptoms

- **Memory loss of recent events**
  - Individuals may have a hard time remembering newly learned information. They may ask the same question over and over.
- **Trouble with problem-solving, complex tasks, and sound judgments**
  - Planning a family event or balancing a checkbook may become overwhelming. Many people experience lapses in judgment, such as when making financial decisions.
- **Changes in personality**
  - People may become subdued or withdrawn, especially in socially challenging situations. They may be irritable or angry when that's not typical for them. Reduced motivation to complete tasks also is common.
- **Trouble organizing and expressing thoughts**
  - At this stage, people may not be able to find the right words to describe objects. They may have trouble clearly expressing ideas.
- **Getting lost or misplacing belongings**
  - Individuals have increasing trouble finding their way around, even in familiar places. It's also common to lose or misplace things, including valuable items.

Moderate Dementia (Steps 11-15)

Moderate: Simple Machines

Link for everything about symptoms

Symptoms

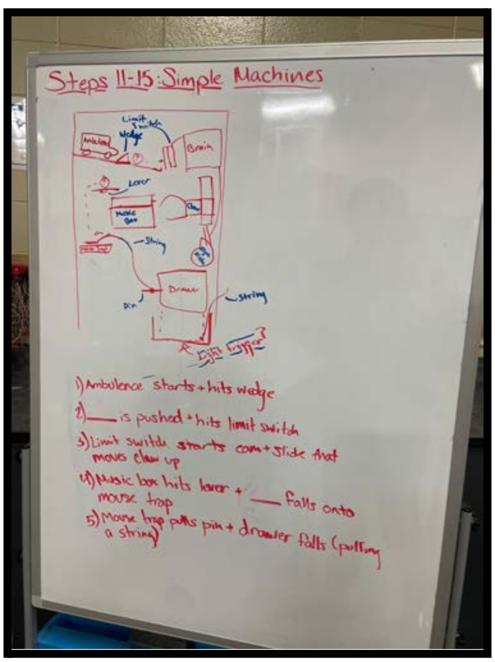
- **Show increasingly poor judgment and deepening confusion.**
  - Individuals lose track of where they are, the day of the week, or the season. They may confuse family members or close friends with one another or mistake strangers for family.
    They may wander, possibly in search of surroundings that feel more familiar.
    These behaviors make it unsafe to leave them on their own.
- **Experience even greater memory loss.**
  - People may forget details of their personal history, such as their address, phone number, or where they attended school. They repeat favorite stories or makeup stories to fill gaps in memory.
- **Need help with some daily activities.**
  - They may need help choosing proper clothing for the occasion or the weather. People in this stage also may need assistance with bathing, grooming, using the bathroom, and other self-care. Some may occasionally lose control of their bladder or bowel movements
- **Undergo significant changes in personality and behavior.**
  - It's not unusual for people in the moderate dementia stage to develop unfounded suspicions. For example, they might become convinced that friends, family, or professional caregivers are stealing from them. Or they may accuse a spouse of having an affair. Others may see or hear things that aren't there.
    Individuals often grow restless or agitated, especially late in the day. Some people may have outbursts of aggressive physical behavior.

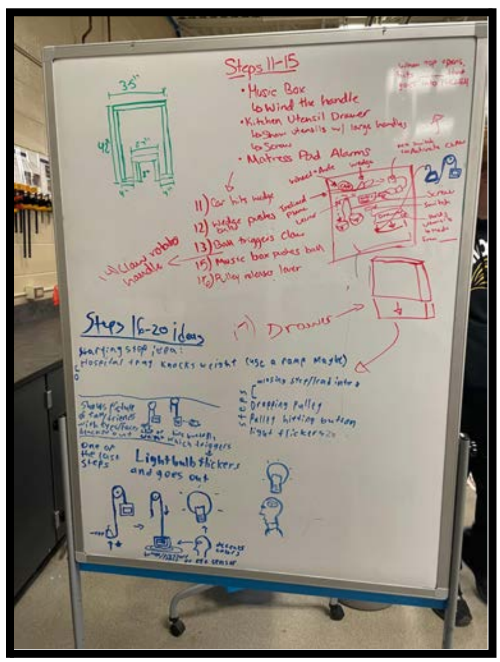
Ideas

As a transition into our steps there could be a car to hit something that starts our steps as people in the moderate stages of Alzheimer's usually stop driving in this stage

1) Music box that **winds** up on one step; music helps people with Alzheimer's remember
   a) Wheel and Axle
   b) Use VEX parts
      i) Claw to rotate handle
         (1) Must clamp, rotate, release, and move backwards
2) Kitchen drawer opening/closing showing larger utensils w/ handles
   a) Screw
3) Pulley can lift a weight or something off of a "bed" triggering an alarm possibly could be put back down stopping the alarm

If you don't know what I mean search up Mattress Pad Alarms





Severe Dementia (Steps 16-20)

Final Plan

1) Ambulence hits wedge + pushes ball into limit switch
2) Limit switch moves claw up, opening music box
3) Music box hits lever
4) ______hits mouse trap + pulls pin
5) Pin releases drawer that falls

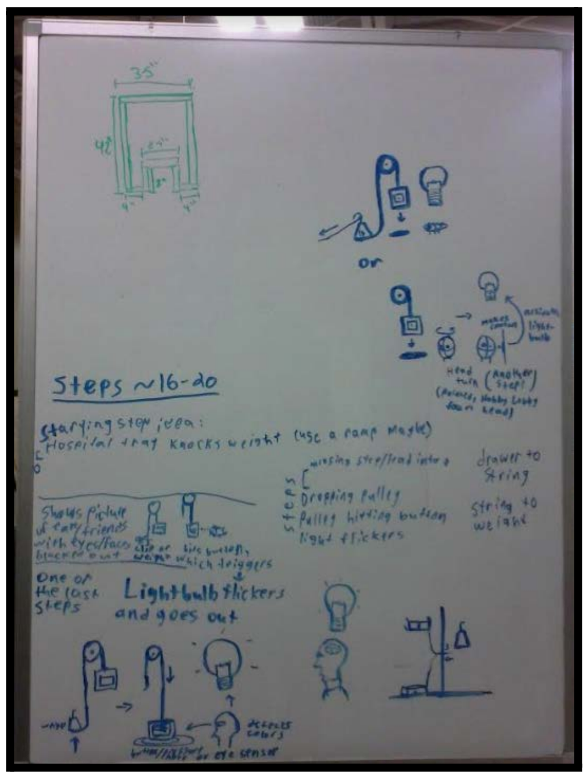
Severe: Electrical

- Inability to communicate
- No awareness or surroundings/experiences
- Weight loss
- Seizures
- Poor physical health
- Groaning, moaning, grunting
- Increased sleeping time
- Loss of bowel and bladder control

Short attention span
Difficulty organizing thoughts
Inability to learn new things
Impulsive behavior

Electrical Step Ideas (Severe Alzheimers):

- A lightbulb above a head (like in cartoons, lights up when there's an idea), it flickers and fizzles out



Problems and Iterations

When building the machine we consistently ran into problems. The machine had many iterations. We would like to highlight three problems we had to overcome: wall rotation collision, medicine drop, and

Wall Rotation Collision Calculations

These calculations were made to figure out how far off the machine's spinning walls we could build without damaging other parts of the machine. The walls have already been constructed and do not collide at any point during rotation. Both walls are at a slight slant away from the other. Since the equation will not factor in this distance between the two walls (which is about 2 inches at the center), objects built near the top of a wall will likely be able to extend further than the equation says it should.

Because the walls have an axis of rotation that passes directly through the center of the top and bottom, this wall will have a circular path. Since we are concerned with the distance objects can be built off of a singular wall at a time, we can create a general equation that will apply to all four wall surfaces. As we will only be interacting with one surface at a time, which is half of a wall, we can use the formula for a semicircle as the starting point for our equation.

Semicircle Formula: $y = \sqrt{r^2 - x^2}$

Variables that must be defined for the equation:

y = The total length we can build off of the wall at a given width x away from the center of the wall.

r = The radius can be modeled by the formula r = d/2 (radius equals half of the diameter) which means that the radius is 13.5 inches. (the variable d, diameter is defined below)

x = The distance to the point we want to attach an object to the surface of the wall relative to the imaginary line created by the axis of rotation at the center of the wall, splitting it in half.

Other Variables:

WT = The thickness of the wall, which remains constant at 2.125 inches.

WW = The width of the wall. Both walls measure 27 inches long.

*The height of the walls is 48 inches but this value is unnecessary for the equation because it is on the same axis as the one the wall is being rotated about, and the other dimension measurements remain constant, so in principle, this equation could work for a wall with a height between the values of zero and infinity.

d = Diameter. Because the Wall Width (WW) is spinning in a circular path, the width can be defined as equal to the diameter of the object being spun. (d = WL) (d = 27 inches)

Y_0 = The initial distance that can be built off of the surface of a wall at any point without colliding with the opposite wall. This value is 5.75 inches, and will only apply to building

objects off of the wall if the other wall does not have any objects on it at the same height near the edge. In all other scenarios, the equation will be used to calculate the distance that can be built off the wall.
R = A radius that is smaller than the radius of rotation as it must take into account wall thickness in order to make sure that the collision is not affected by the slight tilt on the wall outwards.

Deriving the Equation

$y = \sqrt{R^2 - x^2}$

$R = r - (\frac{WT}{2}) = 13.5 - (\frac{2.125}{2}) = 13.5 - 1.0625 = 12.4375 \approx 12.25$

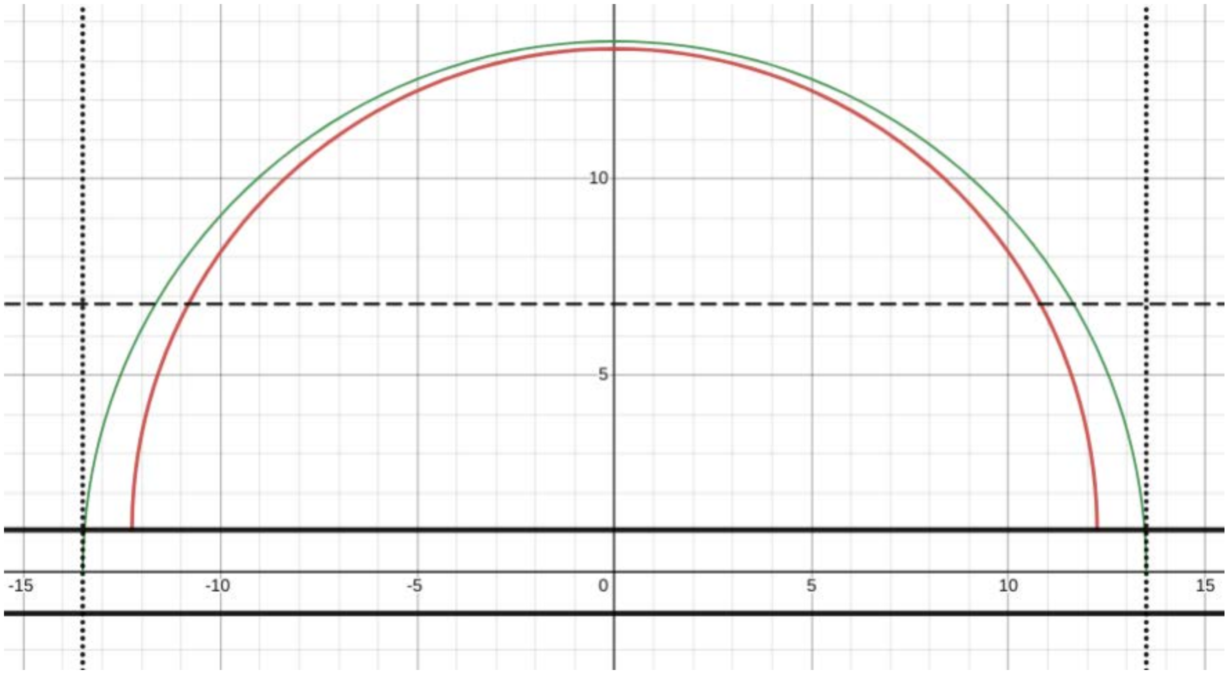
The radius R has a value of 12.4375 inches. We considered this value too precise to work with, so we rounded it down to 12.25 to give us room for any unforeseen error that could affect the machine.

$y = \sqrt{R^2 - x^2} - (\frac{WT}{2}) = \sqrt{12.25^2 - x^2} - (\frac{2.125}{2})$

The formula for the semicircle assumes that the thickness of the surface of the wall would be the infinitely small value of dx. Because the wall has a tangible thickness, we subtract half the wall thickness from whatever value the semicircle formula has given us, in order to account for the length the base of the object already is from the axis of rotation.

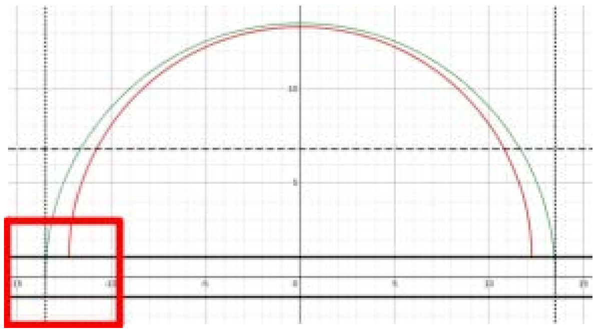
$y = \sqrt{150.0625 - x^2} - 1.0625$

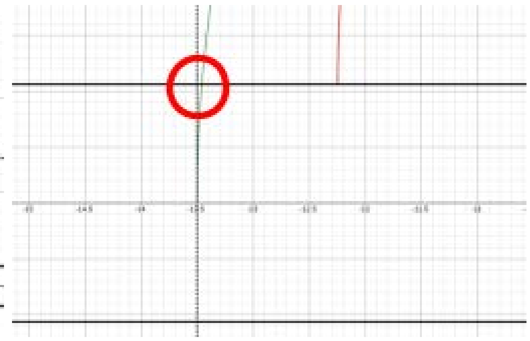
This is the finalized equation. It only will apply to a certain interval on the wall. We can model the work we have done with a xy plane to better explain how we can use the equation to help us build our machine.



The origin point (0,0) represents the axis of rotation that the wall spins about. The black solid horizontal lines represent the two sides of the wall at y = -1.0625, and y = 1.0625 that add up to the wall thickness of 2.125 inches. The dashed and dotted lines represent some of the parameters we needed to stay aware of. The black dotted vertical lines represent where the surface of the wall ends at x = -13.5 and x = 13.5, which add up to the wall width of 27 inches. The black dashed horizontal line represents the 5.75 inches that can be built off the wall at any point as long as the other wall has nothing on it at that height. Since this does not take into account wall thickness, we must add 1.0625 to get the accurate length relative to where the wall begins on the plane. The sum of these values gives us a line at y = 6.8125 inches.

The green function represents the circular path that the wall will take as it spins. It is modeled by the equation $y = \sqrt{(13.5)^2 - x^2}$. It is important to note that this function does not represent the maximum distance that the wall can extend. Because the wall has a tangible thickness, the corners of that wall will always be slightly outside of this equation. This can be seen when looking at the point (-13.5, 0), where the green function begins. At that point, the corners of the wall are 1.0625 inches from the center point of the edge of the wall, which will be the point that follows the path of the green function as the wall rotates about the origin. Upon a closer look at the corner of the wall created by the black dotted vertical line and the upper black solid horizontal line, it can be seen that they create a corner slightly beyond the line of the green function.



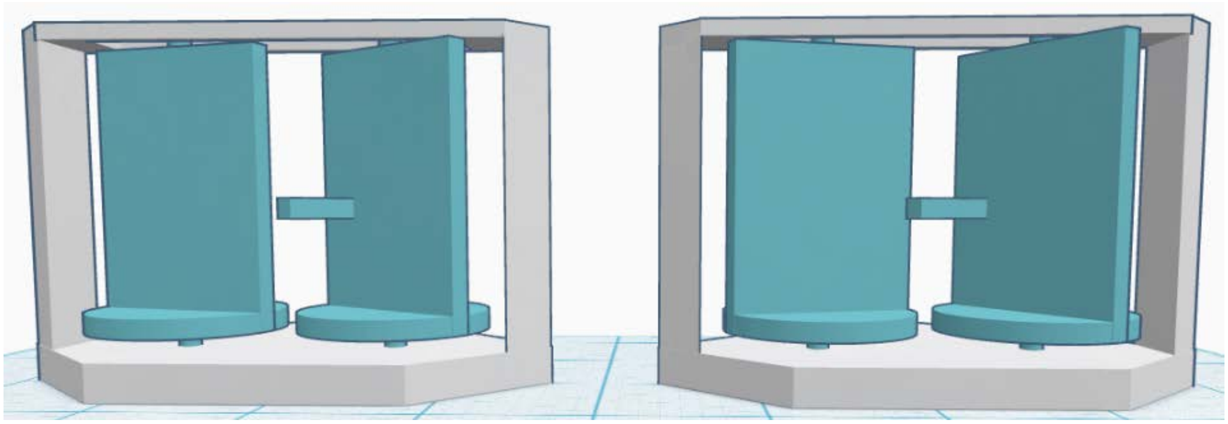


Because the semicircle equation does not account for these corners, we built the rotating walls 2 inches apart so that there are no collisions. If we were to account for these corners mathematically, we would have to create a tangent line for every point that extends 1.0625 inches in both directions. We would then have to find a semicircle equation that meets the ends of the lines at every point.

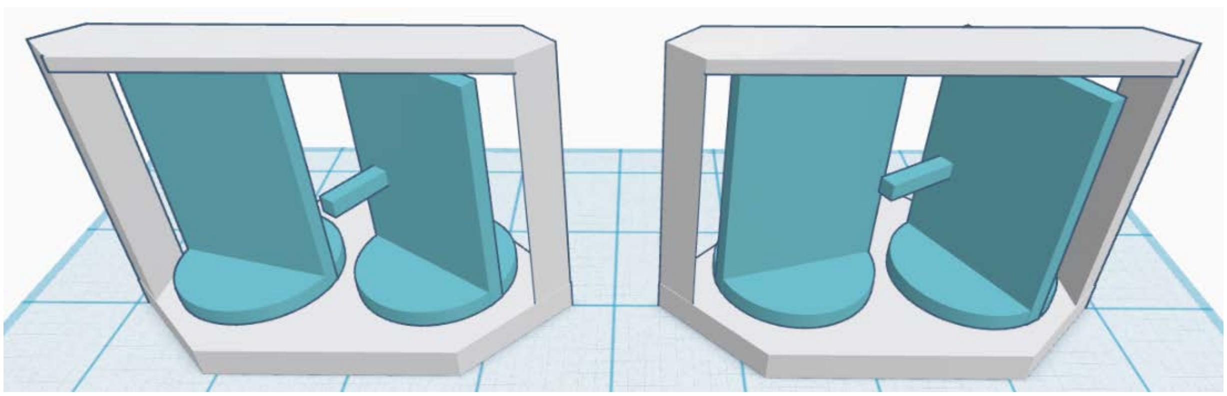
The red function is the finalized equation. The difference from the green function to the red function is more prevalent near the edges, as it is more likely we build something too close to the edge that causes a collision, than something so far out in the center that it causes a collision. The final equation only works on a set interval, however, as it does not reach either black vertical dotted line. The interval this equation can be used for is from [-12.25, 12.25] where 0 is the center of the wall. When doing measurements for this equation, it is important to remember the negative input values will have the same output value as their positive counterparts. For example, inputting negative 5 inches (5 inches to the left of the center) is the same as inputting positive 5 inches (5 inches to the right of the center). This works because every value within the interval is squared, so negative values are made positive when they are entered into the equation.

For the intervals from [-13.5, -12.25] and [12.25, 13.5], we will use the value of 5.75 inches away from the wall. However, we must be careful that we only use this value when there is nothing on the other side, or if there is, test it to ensure that a collision will not occur. On the intervals from [-12.25, -10.817] and [10.817, 12.25], the 5.75-inch value is above the red function. In these intervals, if there is something on the other wall, then the finalized function should be used. If the other wall is empty at the corresponding space, then the 5.75 value can be used.

In order to show these calculations visually, we made a basic CAD model and animation that shows how slightly shortening the length of an object can stop the walls from colliding. The two machines are completely identical, except the one on the left has a shorter block extending off of it so the walls will not have a collision.



This shows a frame where all walls were pushed so that they would spin clockwise, just as they would on our machine. In this frame, the right walls have stopped due to a collision. The left wall is still spinning and did not have any issues during trials.



This is another view of the machines that shows the same frame. Here it is easier to see that the walls on the right machine are unable to continue spinning, while the walls on the left machine are able to move. With this we are able to conclude that the wall spin calculations are accurate and will help us build the machine correctly.

Medicine Drop Iterations

We wanted to delay the machine to make it appear that a person forgot to take their medicine over and over.

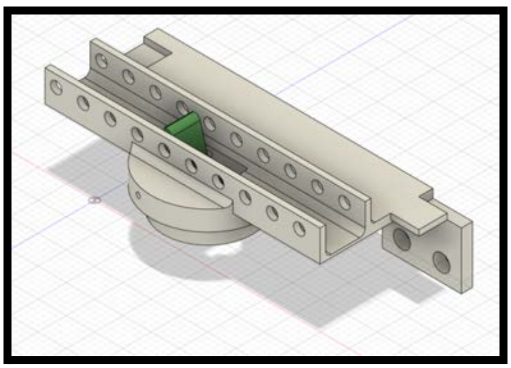
To remake the medicine cap to work as a declined plane was a bigger feat then one would think.

The track needed to be built in parts as the 3D printer maxed out at 6in.

After creating the lever pass we found that it was at the wrong angle to accept the marble then let one pass the next time.

Another big change was the reservoir did not have a large enough capacity. Therefore, we changed the reservoirs.

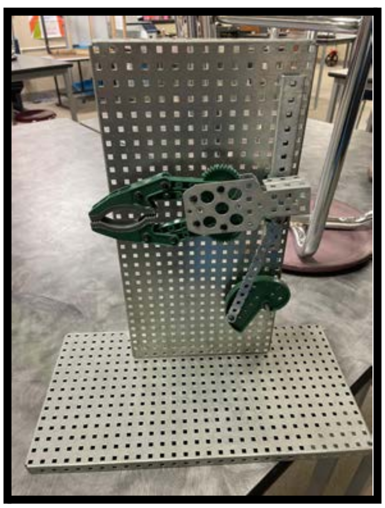
We also originally designed the system to use steel marbles. We found the weight of a steel marble falling shook the machine too much. We tried dampening the shake with foam; then found a lighter marble worked best.



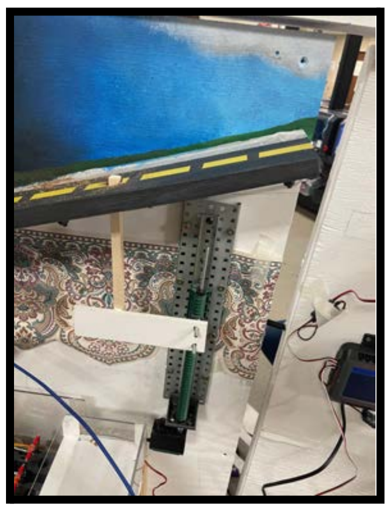
Mechanical Selection and Iterations

To make the ambulance fall we knew we needed linear movement; however, we wanted to use a motor so we could start it. As we discussed more as a team we had no demonstration of a lead screw. Therefore, we select to take this step that was originally a cam and follower and switch it to a lead screw. While building the lead screw we had some difficulties with it falling off the track.

- Version 1 - This was the original idea. We changed it to ensure we had a screw in the machine.
- Version 2 - We are using the lead screw kit we have around our classroom. This caused us to have a long lead screw placed off to the side of the music box. Then we found out that when the lead screw was lowered it did not allow for the box to open.
- Version 3 - Final design. This part was angled up for the music box to open. We also added a foam block under it to hold the stick in the hole. The cool part about this design is that it will reset itself.



Version 1

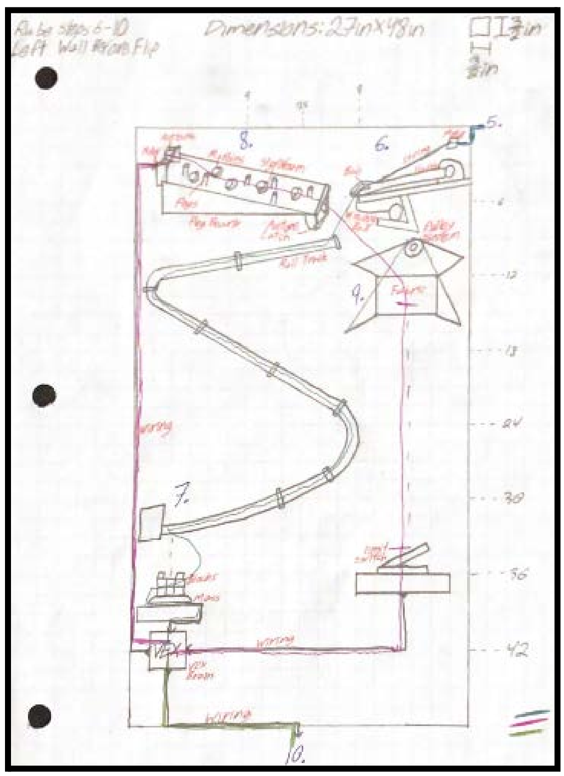


Version 2

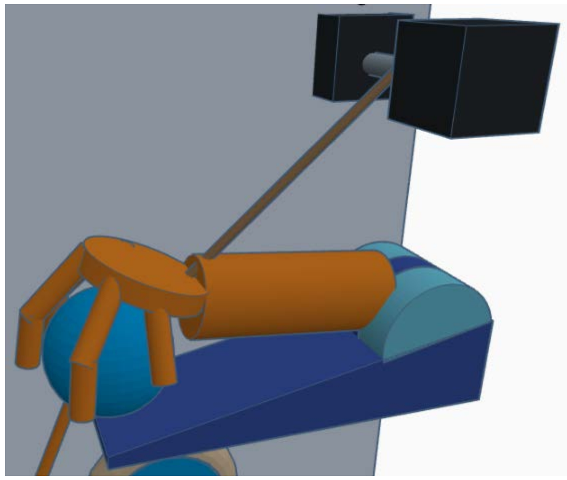
Version 3

Chemical Steps Iterations

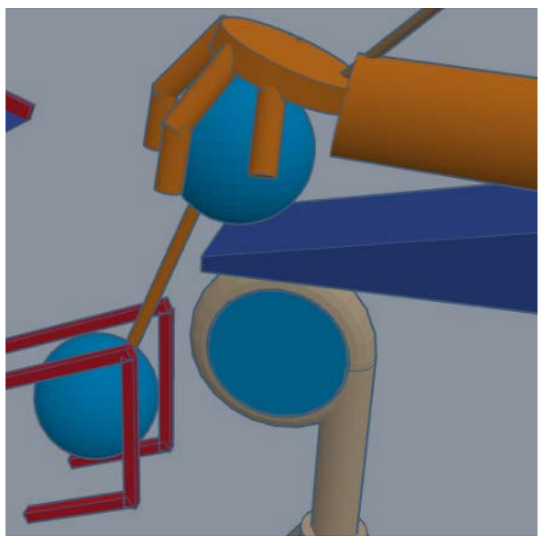
This idea was eventually scrapped and replaced with other ideas. The team made this decision for a couple of reasons. First, some of the things needed to construct the objects for this wall would have been non-recyclable, which would be a problem because we have a huge emphasis on using recyclable materials. Second, the group that was working on the wall had spent a lot of time on the design, and did not have anything actually built as the deadline got closer. Third, even if the group was able to build it in time, there would not be enough time to test the machine for accuracy and fix any unforeseen issues in the steps. Fourth, the chemical step involving styrofoam and a chemical solution would have added too much prep work and had too many parts to it that could fail. Lastly, some of the steps brainstormed for the second wall just happened to utilize concepts similar to other parts of the machine. For example, the rail-and-wrecking ball step was just a more complicated version of the key step on the first wall. Another example was the use of a pulley system, which was already on the fourth wall. After it was decided that these steps had some flaws in their design, we came up with another set of steps that worked well and followed the theme much better.



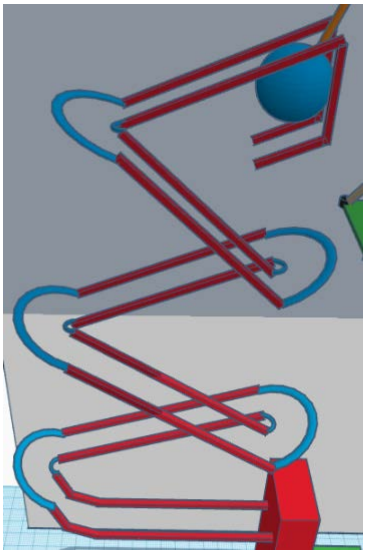
This is a scale drawing for the initial steps planned for the second wall on the machine. We also made a CAD drawing to show what the wall would look like from a three-dimensional view. The CAD drawings will be shown as the steps are explained.

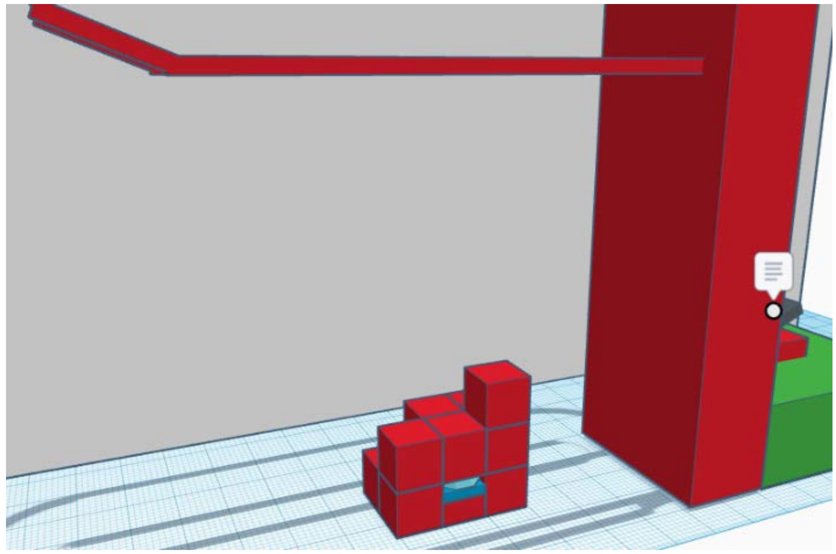


It begins on the top right, where the final step from the first wall sends a signal to a motor. This motor would spin an axle, winding up the string attached to it. The other side of the string would be attached to the wrist of a fake human arm. The elbow end of the arm would be connected to a lever. The hand is holding a ball down on the edge of the ramp. When the motor winds up the string, the hand is pulled up. The ball would be released and it would roll off the ramp and start rolling down the rail that begins in the center of the wall near the top.

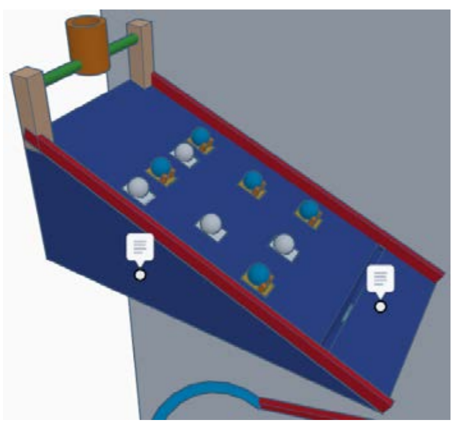


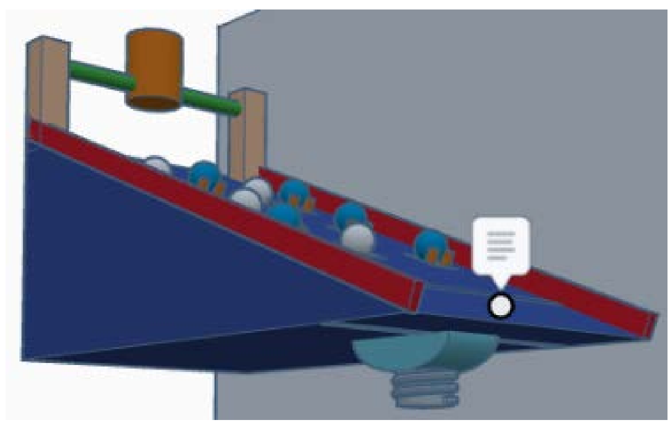
The ball is also attached to a string that would have some object on the other end of it. It would be pulled by the ball off of the surface it was resting on, and begin to follow the ball down the rail from beneath it.



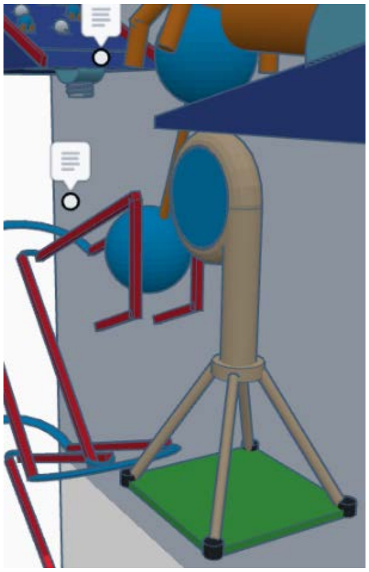


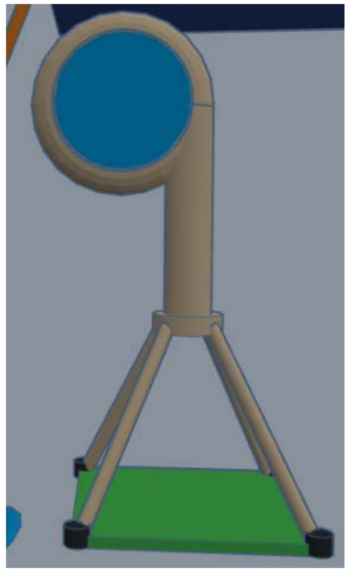
When the ball reaches the bottom of the rail it would be stopped by a wall. Beneath the rail before the wall, there would be a button that is being pushed down by some blocks. When the ball hits the wall, the object hanging below it will knock the blocks off of the button like a wrecking ball, allowing the button to raise itself to its off position. This button would then send a signal to the top left step which would have been our chemical step.

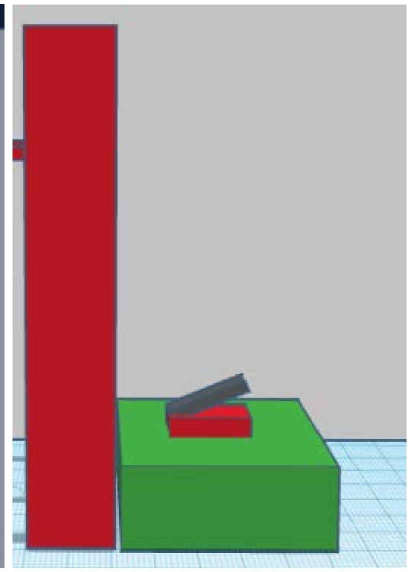




The chemical step is on a ramp with walls on the sides. There are two columns that support an axle holding a cup with a chemical solution that is able to dissolve styrofoam. The axle is attached to a motor. There are rectangular holes in the ramp that small pieces can be inserted into. The white pieces cannot be melted by the solution. The blue spheres are marbles and each is being held in place by two styrofoam cylinders. The styrofoam fit into small holes in the yellow pieces. When the solution runs down the ramp, it will break down the chemical composition of the styrofoam, allowing the marbles to roll down the ramp. The dissolved styrofoam and chemical solution will then flow down the ramp into a hole near the base of the ramp which would collect it so it could be properly disposed of after the machine was done.

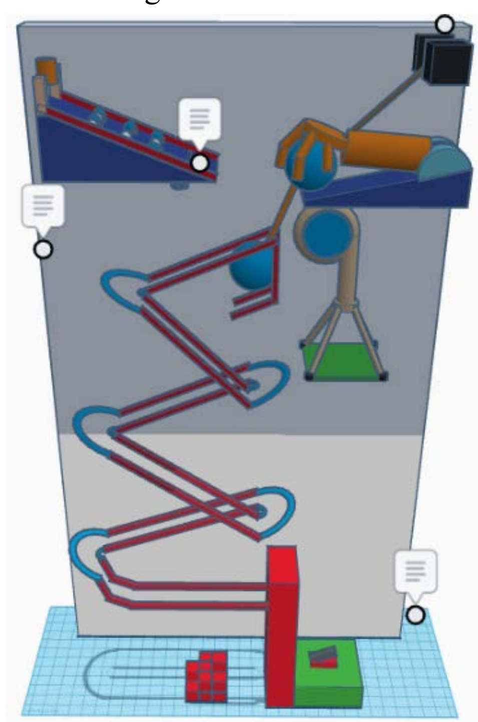






The marbles would roll off of the ramp and fall onto the green fabric being supported by the pulley. The black magnets on the outside would provide enough mass to keep the fabric flat, but once the marbles fall in the center, they provide enough mass to make the sides close and the magnets snap together around the marbles like a bag. The extra mass would also make the bag start falling until they land on a limit switch below. This limit switch would send a signal which would cause the walls to flip, thus ending the steps for the second wall.

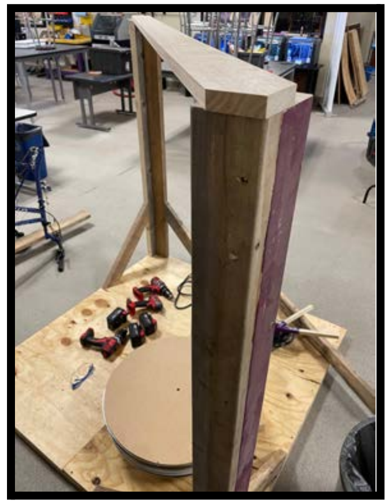
This is a full picture of the CAD drawing of the wall.



Progress and Check-In Pictures

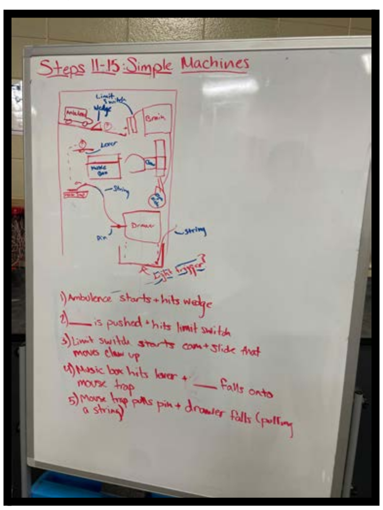
October:

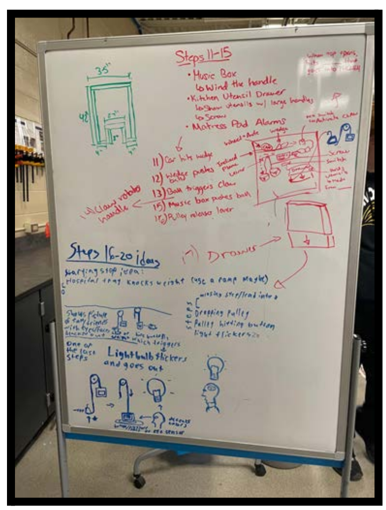
The team members were selected in early October. Next was a phase of researching the theme. Beginning ideas were shared and the basic idea of the machine was decided. Late October was the construction of the machine's base and starting to make decisions on the steps of the machine. Some of the team also worked on trying to get sponsors.



November:

November was the start of the main construction of the machine. It started by building a wheelbase for spinning walls. After wheelbases were built, the walls were built and screwed onto the wheelbases. The team was divided up into small groups to each work on a section of the machine (4-5 steps each)





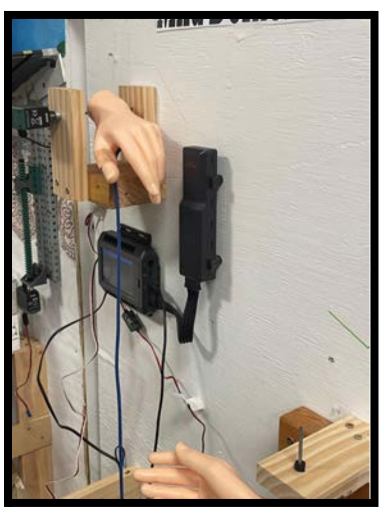
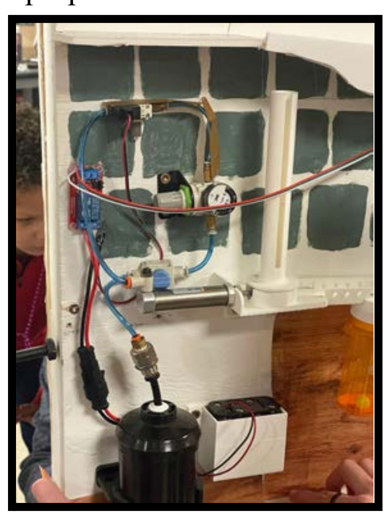
December:

Step ideas became more thought out and developed in December. Some of these steps were also starting to be created or prototyped. A drill was added to the machine to spin the walls. A bike chain was also added to spin the walls at the same time as the drill. The drill was also hooked up to a relay and speed controller to have a more controlled spinning of the walls. The team was able to secure a $600 donation to purchase a pneumatics kit



January:

Step ideas were beginning to be created and added to machine walls. Microcontrollers were added to the machine to help control electrical steps as well as the spinning walls of the machine. January was also the beginning of development on the chemical reaction step by working with chemistry teachers as well as student knowledge. The pneumatics system was installed with custom additions added to serve the purpose needed for the machine.

February:

Steps were finished up and the machine worked fluidly with all steps connecting. The team then focused on decorating the machine and making the machine visually appealing. Additionally, much of the second half of February was focused on touching up the machine's steps and making everything work consistently.

March:

During late February and early March the team worked on the portfolio, speech, and practice setup. The team spent the time before the competition preparing to present the machine. As well as preparing, the team added wallpaper to make the machine look more presentable and practiced running and resetting the machine over and over.

Final Machine

Final Machine Design Sketch and Description

<table>
<tr><th>Storyline description</th><th>Sketch or image with labeled components</th></tr>
<tr><td>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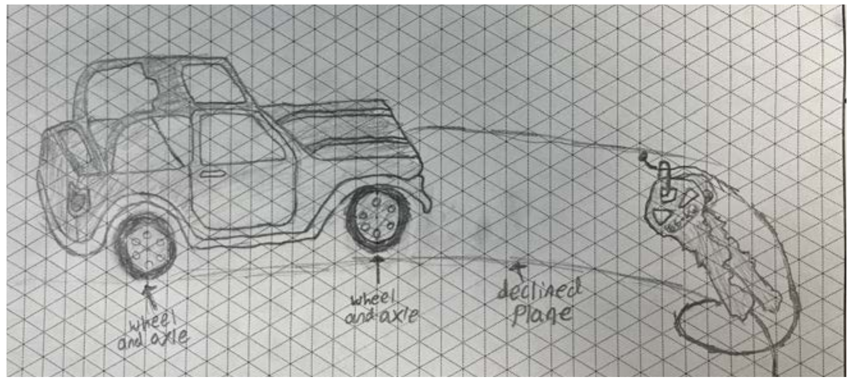

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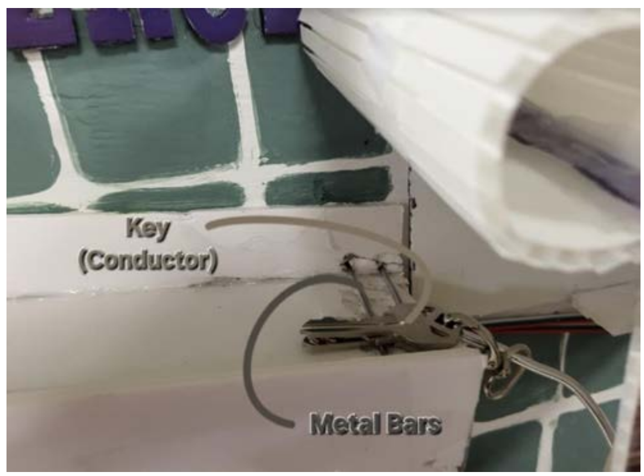

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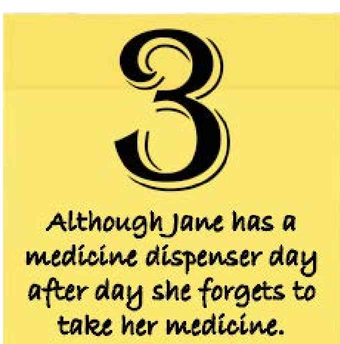

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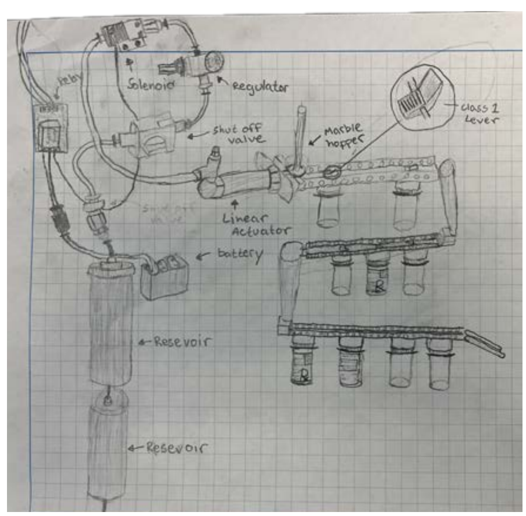

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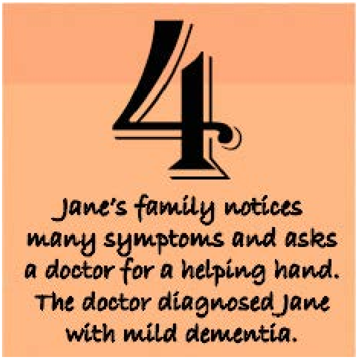
<td>
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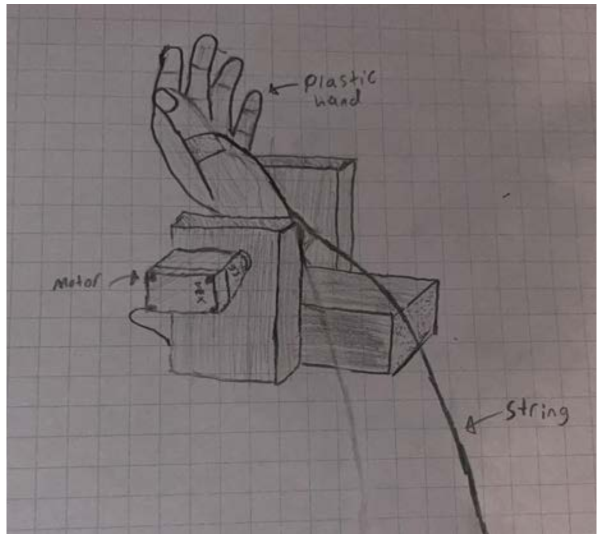
<td>
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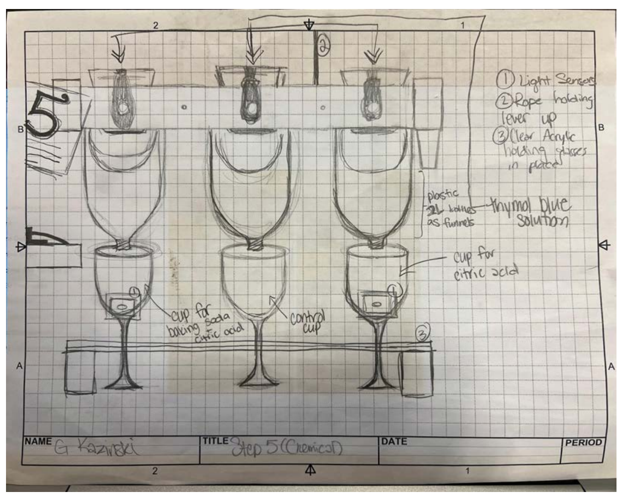
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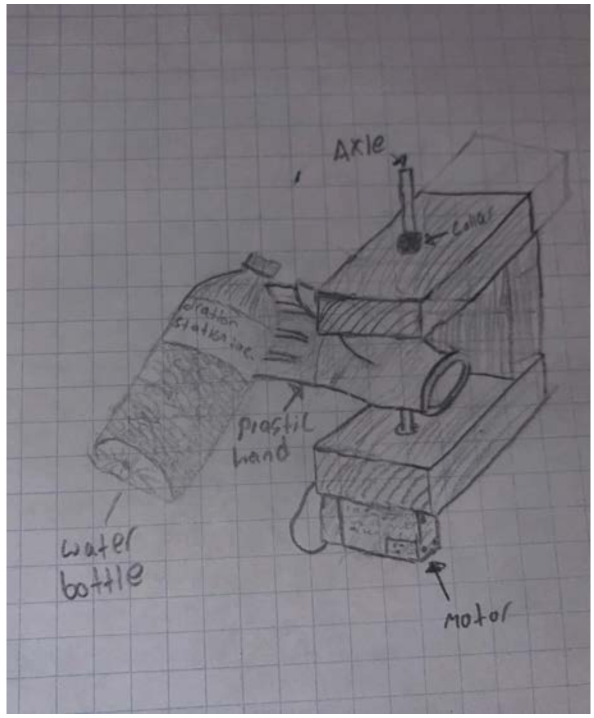
The family asks for another doctor to provide a helping hand.</td>
<td>
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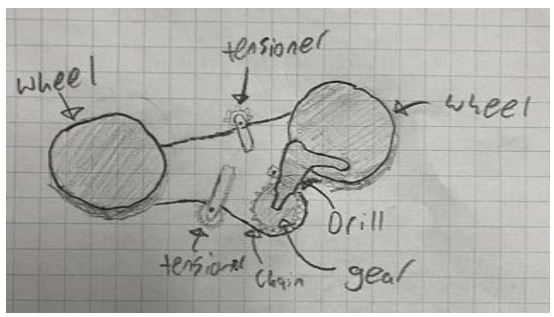
Jane's medical state is taking a quick turn.</td>
<td>
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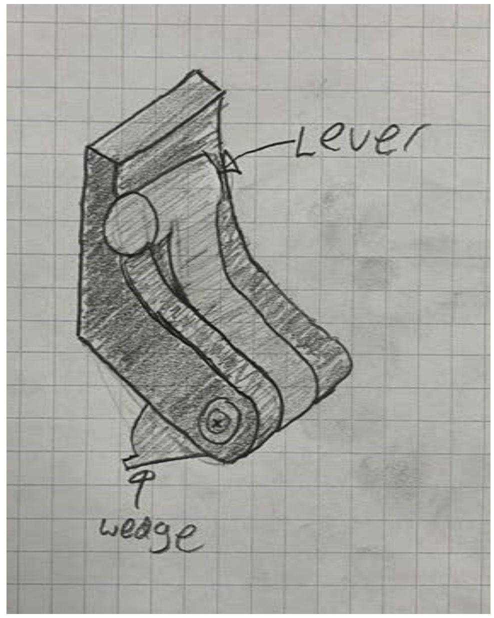

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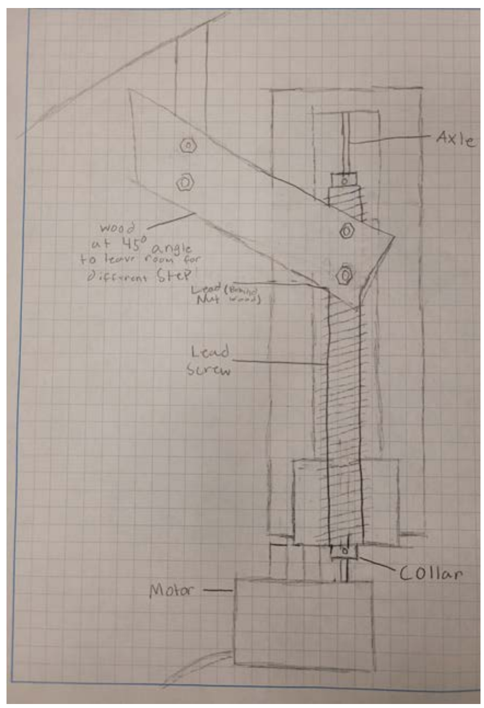

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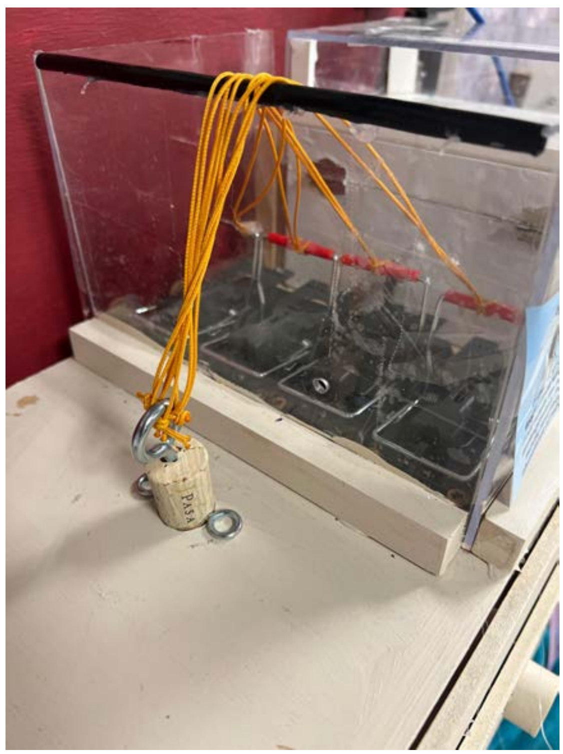
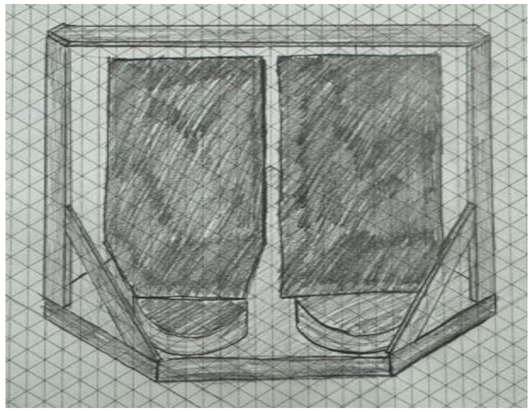
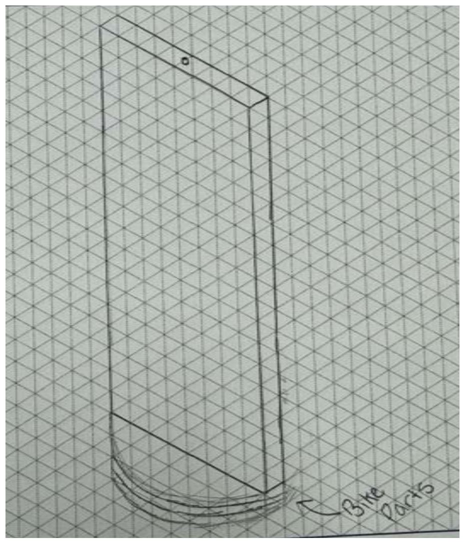
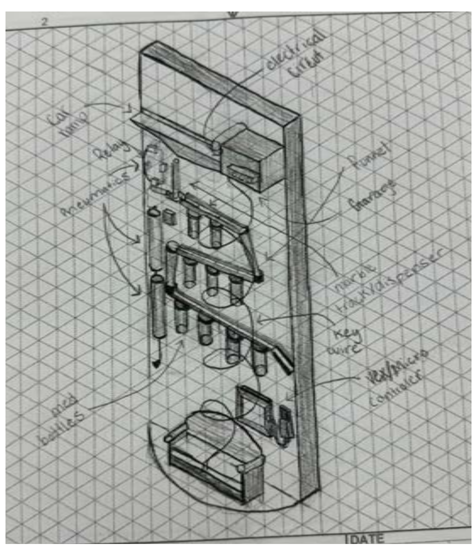
10 Mrs. Doe's memories are distant. Reminders often come through song and treasures.	
11 Mrs. Doe now needs full assistance with daily living and needs an assisted living arrangement. As the family moves Jane they find an abundance of mouse traps.	

12 The family moves Jane's nightstand to the assisted living arrangement.	
13 A young professional receives Mrs. Doe and assists Mrs. Doe in daily tasks.	

14 Mrs. Doe loses the memories of family and is no longer able to communicate.	
15 Jane Doe's memory, physical mobility, and ability to eat falls. Jane Doe's light bulb turns off.	

Base	
Wall (Base)	
Wall #1	

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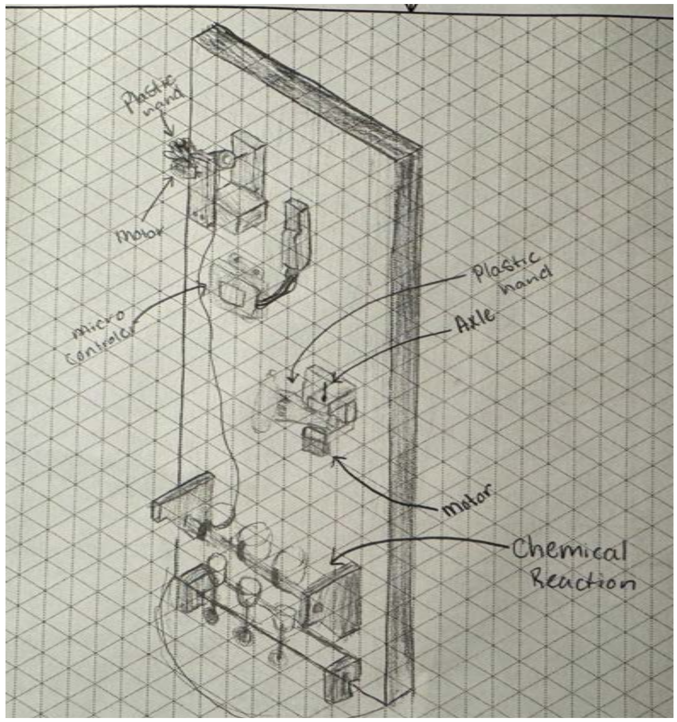
<tr><td>Wall #2</td><td>
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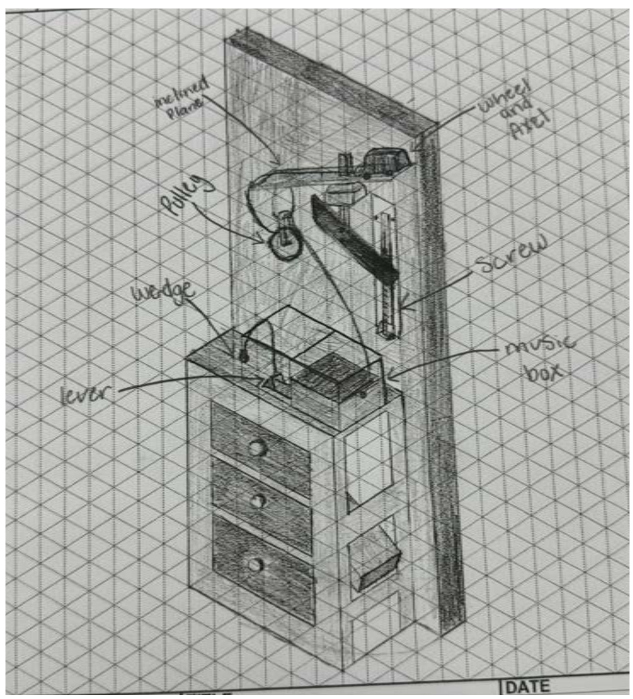
<tr><td>Wall #3</td><td>
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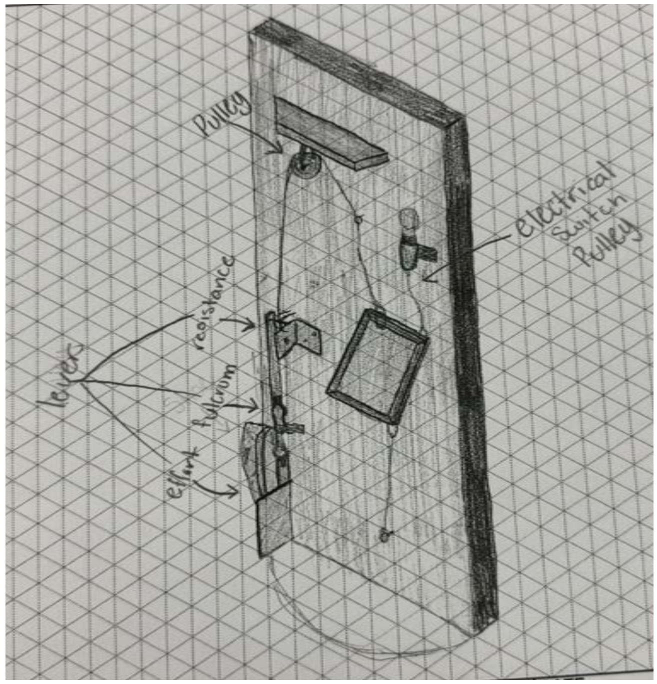
<td>
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List of Machine Steps

Storyline description	Technical details
	• A toy car is pushed down a declined plane, colliding with a set of keys. • Advanced component - Mechanical (Wheel and Axle, & Decline Plane)
	• The keys fall off the ledge. Previously, the metal keys completed an electrical circuit. Now that the electrical circuit is open the digital signal 0 is sent to a microcontroller. The microcontroller uses this information to start the next step. • Advanced component - Electrical
	• A microcontroller sends signals through a relay to activate a pneumatic solenoid. The solenoid releases a small amount of air. When the air is released a piston from a cylinder pushes a marble down an inclined plane. The inclined plane has ten trap doors. When a marble meets the trap door the marble falls into a medicine bottle and the trap door closes. Ten marbles will meet the trap doors. Three more marbles will roll off the inclined plane. • Advanced component - Fluid Power (Pneumatics) • Advanced component - Mechanical (Declined Plane, & Lever)

4 Jane's family notices many symptoms and asks a doctor for a helping hand. The doctor diagnosed Jane with mild dementia.	• A marble from the medicine dispenser fell into a funnel that has a distance sensor inside the funnel. The change in distance activates a conditional statement on a microcontroller. The microcontroller sends a signal to a motor turning a hand. • Advanced component - Electrical • Advanced component - Mechanical (Lever)
5 At a dinner party, the family sees the change in 'colors.' Jane has a noticeable change in personality and poor judgment.	• The hand rotates due to the activation of the motor. The hand is attached to 3 cups of diluted thymol blue, an indicator, by a tightly held string. As the hand is rotated, the tension is released and the cups fall, dropping the solution into three wine glasses with baking soda and a mix of citric acid and baking soda, which detects a change in acidity. Due to the citric acid, the thymol blue turns red because of the high acid content which activates a light sensor that looks at the difference in shade. • Advanced component - Chemical
6 The family asks for another doctor to provide a helping hand.	• The hand on the right is attached to a motor. When this motor is activated, the hand spins towards the right, hitting a limit switch, and then rotating back to the original position. • Advanced component - Electrical • Advanced component - Mechanical (Lever)
7 Jane's medical state is taking a quick turn.	• The limit switch activates a drill that is attached to a bike chain and bike gear. When this drill spins, the bike gears spin as well due to the connection through the bike chain. These bike gears are attached to the base of our walls, thus spinning our walls rapidly. • Advanced component - Electrical • Advanced component - Mechanical (Wheel and Axle)

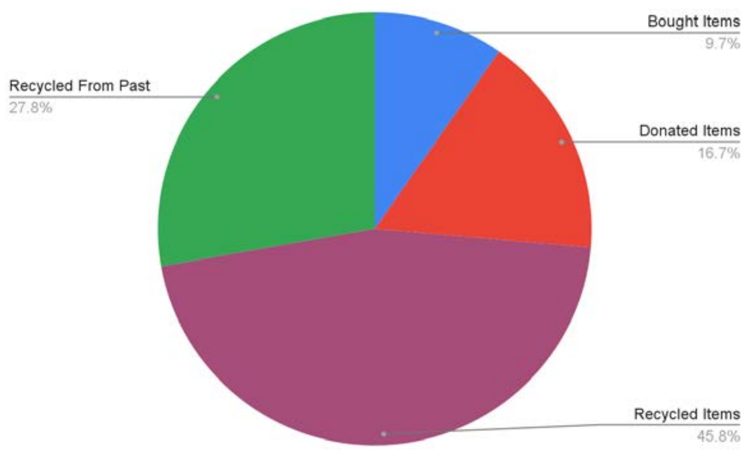
8 The family meets the abrupt stop and finds themselves on the way to the hospital.	• The walls stop spinning, revealing the ambulance (wheel and axle) • Advanced component - Electrical • Advanced component - Mechanical (Lever, & Wedge)
9 An ambulance drives Mrs. Doe to the hospital. She is diagnosed with Moderate Dementia.	• A screw connected to a barrier begins to rotate, thus moving the barrier down. This barrier holds the toy ambulance in place, and as the screw rotates down, the ambulance is slowly released down a declining plane. • Advanced component - Electrical • Advanced component - Mechanical (Screw, Wheel, Axle, & Decline Plane)
10 Mrs. Doe's memories are distant. Reminders often come through song and treasures.	• After the toy ambulance falls off of the edge of the inclined plane, it causes a pulley to lift open a music box. The top of the music box is covered in coins, and as the box is opened, the coins fall off the top. • Advanced component - Mechanical (Pulley, & Lever)
11 Mrs. Doe now needs full assistance with daily living and needs an assisted living arrangement. As the family moves Jane they find an abundance of mouse traps.	• The coins that fell from the top of the music box landed on four mouse traps. Said mouse traps act as a lever when they are set off. Once the traps are set off, they release a drawer by removing a cork from the dresser. • Advanced component - Mechanical (Lever, & Wedge)

12 The family moves Jane's nightstand to the assisted living arrangement.	• The drawer is released from its hold and slides down a decline plane, thus colliding with a shoe that is attached to a lever. • Advanced component - Mechanical (Decline Plane, & Lever)
13 A young professional receives Mrs. Doe and assists Mrs. Doe in daily tasks.	• The shoe, acting as a lever, is hit, thus activating a pulley as it falls. • Advanced component - Mechanical (Pulley)
14 Mrs. Doe loses the memories of family and is no longer able to communicate.	• The pulley rapidly drops a picture frame from its position on the wall. • Advanced component - Mechanical (Pulley)
15 Jane Doe's memory, physical mobility, and ability to eat falls. Jane Doe's light bulb turns off.	• The picture frame is attached to a light pull switch, and as the picture frame falls, this pull switch is activated, thus turning off the light. • Advanced component - Electrical

Cost of Machine and Percent of Recycled Materials Used

Our team prioritized reusing and recycling parts for our machine. When we lacked the necessary components, we sought donations from companies. Notably, the Milwaukee Bicycle Collective generously donated three bikes, and local companies provided a monetary donation for a pneumatics system, fulfilling our desire to learn more about how fluid power is used in industry. Additionally, the school theater department offered leftover wood. We even embraced the challenge of incorporating unique items like prescription bottles, picture frames, and wine glasses into our design. While calculating a specific percentage is complex due to varying item costs, we visually represent our efforts through a pie chart based on the number of recycled and reused components.

Itemized Material Percentage



Breakdown of Materials

Bought:	Cost:	Comments:	Recycled:	Recycled from past competitions:
Wood	$50.00	Will be used in future competitions	Wood	Vex Brain
Light Bulb	$2.50		Cardboard	V5 Motor
Speed Controller	$29.99	Will be used in future competitions	Corks	Distance Sensor
AAA Battery	$12.88		Wine Glasses	Light Sensor
Thymol Blue	$9.00		Rope / String	Limit Switch
Master links	$6.99		Prescription bottles	Vex hardware
String	$4.99		Bike Chain	Screws
Total:	**$116.35**		Music box	Washers

			Shoe	Marbles
Donated:	**Cost:**	**Comments:**	Toy cars	Eye hooks
Wood	$30.00	Will be used in future competitions	Bike Wheels	Drill
Coins	$0.12		Foam	Pulleys
Wallpaper	$15.00		Measuring cups	Relay Circuit
Tile	$15.00		Paint	Bolt
Pneumatics System	$600.00	Will be used in future competitions	Newspaper clipping	Nuts
Tape	$3.59		Plastic Hands	Acrylic
Lemon Powder	$14.98		Magnets	LEDs
Baking Soda	$7.99		Picture frame	Power cord
Wires	$10.00		Carpet	Mouse Traps
3d printing filament	$35.00		Water Bottle	Electrical Outlet
Cable management	$8.49		Bike Metal	
Hot glue	$7.59		Felt	
Total:	**$747.76**		Popsicle stick	
			2 Liter Bottles	
			Keys	
			Metal wire	
			Paper	
			Foam core	
			Band Aid	
			Bike crank system	
			Bike wheels	
			Bike spokes	
			Cardboard angle	

Totals	
Bought Items	7
Donated Items	12
Recycled Items	33
Recycled From Past Competitions Items	20

Applied STEM Processes

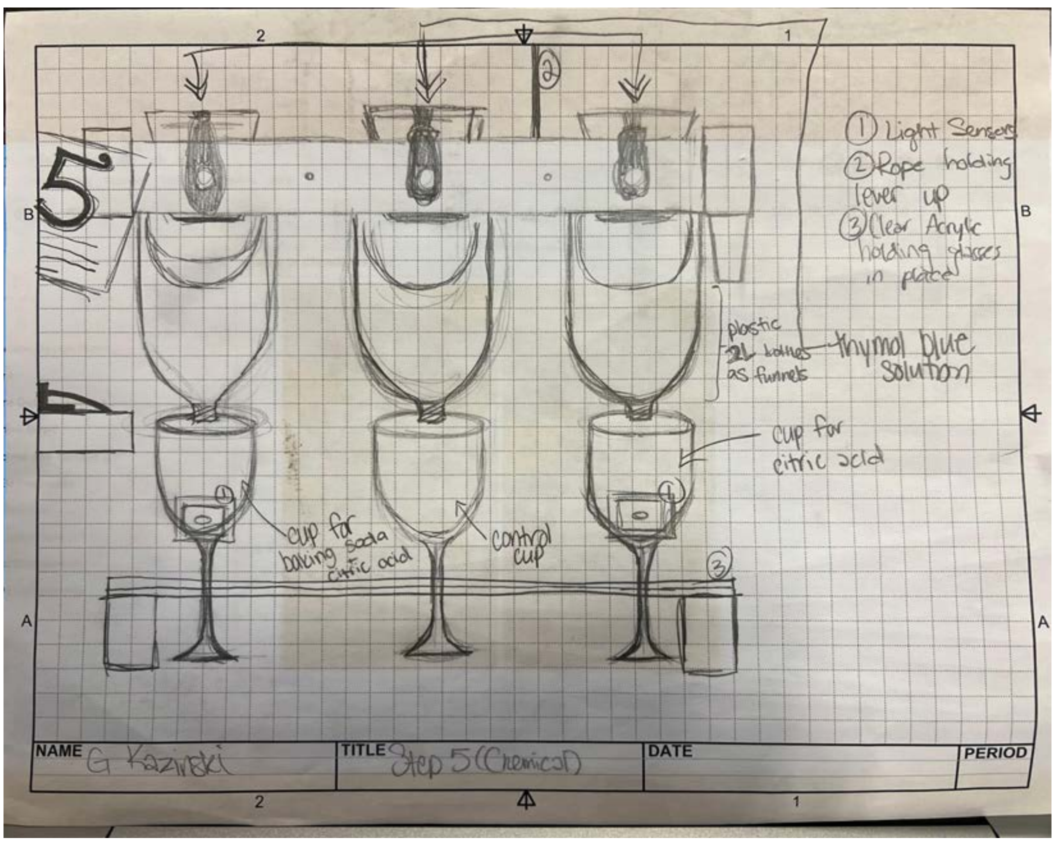
Chemical Reaction

Our chemical step involves an indicator of an aqueous solution with a concentration of 0.04% called thymol blue. This indicator can detect changes in basic or acidic solutions of <2.0 or >8.0 and turn blue and red respectively. The experiment we chose is a simple color change.

Thymol blue is a pH indicator that changes color in response to acidity or alkalinity. A chemical reaction occurs when mixed with our acid, citric acid, and baking soda. The citric acid reacts with the baking soda and produces CO_2 gas, water, and sodium citrate. This causes a pH shift which causes the thymol blue to change color. In an alkaline environment, the mixture will appear blue and in an acidic environment, it will turn yellow from its swampy green. This dynamic experiment shows the care and precision we've put into our machine due to the recalibration of the light sensors.

Images of Chemical Steps
 


family sees the change in
'colors.' Jane has a noticeable
change in personality and
poor judgment.


① Light Sensors
② Rope holding lever up
③ Clear Acrylic holding glasses in place
plastic 2L bottles as funnels
thymol blue solution
cup for citric acid
cup for baking soda citric acid
control cup
5
NAME G. Kazinski
TITLE Step 5 (Chemical)
DATE
PERIOD

Electrical Component

Throughout the machine, we integrated electrical components. Some components are electrical circuits whereas others are programmed using a microcontroller. One of the steps uses a relay to start an electric drill. A relay works by using a smaller electrical signal to control a larger one, allowing it to switch on and off a circuit remotely. A relay is an electrical switch that is controlled by an electromagnet. It is used to turn on and off a circuit remotely by using a smaller electrical signal to control a larger one.

A relay consists of three parts: a coil, a switch, and a contact. The coil is made of copper wire wrapped around an iron core. When an electrical current flows through the coil, it creates a magnetic field that pulls the switch toward it.

The switch is normally open, which means that it is not making a connection. When the magnetic field from the coil pulls the switch toward it, it closes the contact and completes the circuit. This allows the current to flow through the circuit and power a device or perform a specific function.

Relays are commonly used in many electronic devices such as cars, refrigerators, and air conditioners. They are also used in industrial settings for controlling motors and other heavy equipment.

The term “LED” is an acronym for Light- Emitting Diode. A LED works by allowing electrons to pass through a semi conductible material. Photons are created as a result of electrons moving. LEDs are designed to put a great number of photons outwards. This creates a higher-efficiency light source that puts out more lumens than the average lightbulb. Originally, LEDs were a more efficient but expensive replacement to lightbulbs. In 2000, the cost of LEDs dropped drastically and became a safer and better alternative to classic light bulbs which ran off gasses.

Another electrical step is the key is an electrical component that functions as a switch. It is two pieces of metal that are connected by a key resting on them, which keeps the circuit closed (1). When the key is knocked off, the circuit opens (0) and allows energy to flow through the wires and trigger the pneumatics, the next step.

We have several microcontrollers on our machine. A microcontroller is a small computer on a single circuit containing a processor core, memory, and programmable input/output. It's designed to execute a specific task within systems, such as controlling electronic devices, sensors, or actuators. Microcontrollers come in various different applications and are programmed using specialized software, often in languages like C or assembly. They're commonly used in appliances, automotive systems, industrial automation, and more, due to their low cost, low power consumption, and compact size.

We have included multiple microcontrollers in our machine to help us control and make all the separate parts of the machine work. The microcontrollers are a large part of how we were able to make our machine work together and have all the steps connected as we have included multiple very complex steps that require a controller so we can have them work properly.

Images of Electrical Steps

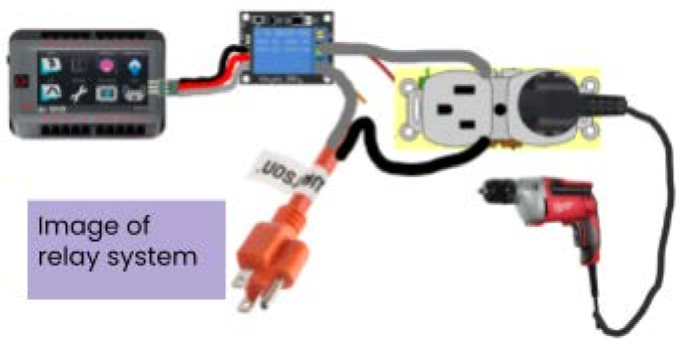


Image of relay system

Image of relay

```
Wall_Spin = 0
message1 = Event()

def when_started1():
    global Wall_Spin, message1
    while not limit_switch_b.pressing():
        wait(5, MSEC)
    wait(3.5, SECONDS)
    digital_out_a.set(True)
    wait(4, SECONDS)
    digital_out_a.set(False)
    wait(2, SECONDS)
    motor_2.set_position(0, DEGREES)
    motor_10.set_position(0, DEGREES)
    wait(2, SECONDS)
    motor_2.spin(REVERSE)
    motor_10.spin(REVERSE)
    while not motor_2.position(DEGREES) == 90:
        wait(5, MSEC)
    while not motor_10.position(DEGREES) == 90:
        wait(5, MSEC)
    motor_2.set_stopping(HOLD)
    motor_10.set_stopping(HOLD)
    motor_10.stop()
    motor_2.stop()
    wait(6, SECONDS)
    # stop project not currentl

when_started1()
```

Picture of Code for relay

Image of Microcontroller

Image of System controlled by Microcontroller

Image of Key Step

Image of LED Light

Image of Internal Components of LED

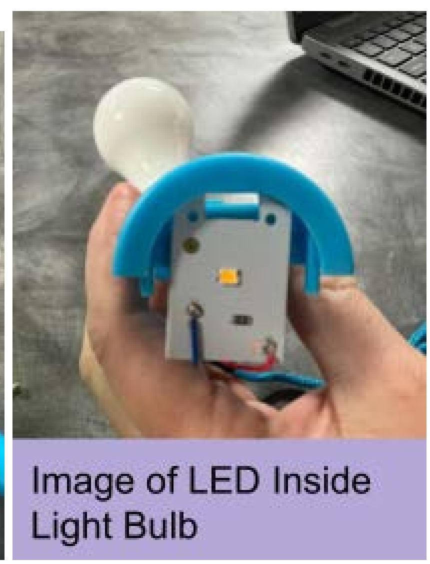


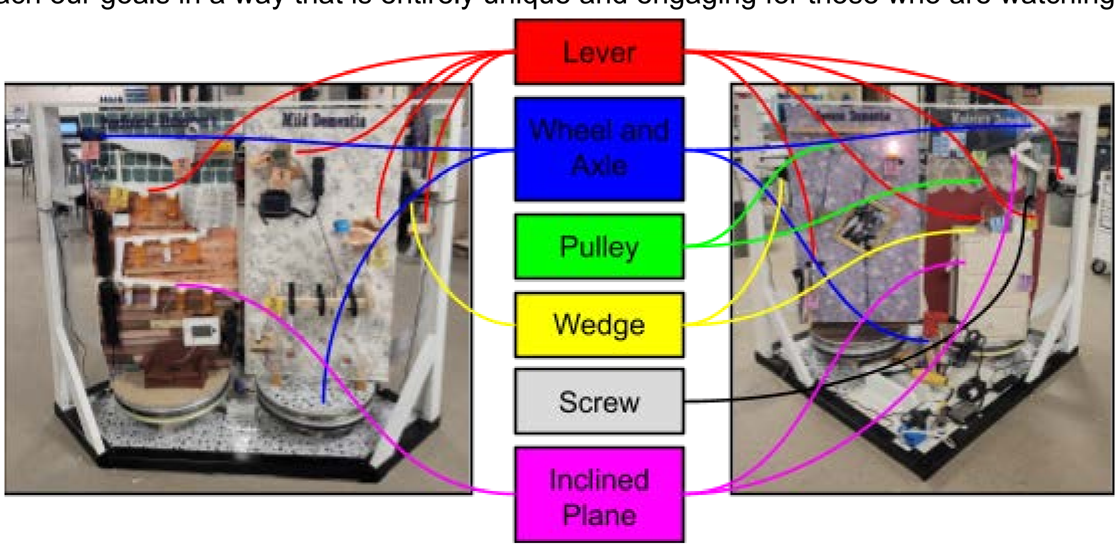
Image of LED Inside Light Bulb

Mechanical Components

Simple machines are a component of everyday life, whether it is realized or not. Nearly every single mechanism incorporates these simple machines to achieve complex results. In our machine, we strived to use every single simple machine to show the power and importance of these mechanical components in our everyday lives. These simple machines are not limited to a single purpose, machines like an inclined plane and a lever can be used to achieve a variety of different results, as seen in our machine. Overall, simple machines are masterfully incorporated into our machine to show the versatility of mechanical components.

A **pulley** consists of wheels and a rope. This rope is wrapped around the wheels, and when one end of the rope is pulled down, the other is pushed up. This mechanism provides mechanical advantages and is able to change the direction of applied force. A **screw** uses threading, an inclined plane wrapped around the screw, to change rotational movement to linear movement. A **wheel and axle** consists of two primary components, an outer ring or cylinder, the wheel, and an inner ring or cylinder, the axle. These two parts are connected and rotate in the same direction when either component is rotated. A **lever** consists of a rigid beam and a fulcrum. The fulcrum, depending on its position in the lever, can provide a mechanical advantage, thus allowing less effort to be used to lift large amounts of weight. An **inclined plane** consists of a sloped surface that provides a mechanical advantage by allowing the load to be raised at a more gradual pace. A **wedge** consists of two inclined planes attached to one another, thus creating a thin side and a thick side. This allows force to be applied on the thick side of the wedge while also applying force down both sloping edges. Incorporating these simple machines into the overall design improves the machine's functionality, enabling smoother operation and enhanced performance. This efficiency allows the machine to encounter fewer issues and be more consistent throughout all uses of the machine.

Not only were simple machines used, but complex machines were used to achieve even more varied results. A complex machine is a combination of two or more simple machines, and by combining simple machines, we are able to both gain more mechanical advantage and create much more complex and interesting machines. The use of complex machines allows us to reach our goals in a way that is entirely unique and engaging for those who are watching.



The next few pages explain the mechanical components of each of step that uses simple machines.

<table>
<tr>
<td rowspan="2">Step 1:
Mechanical Step Description:
The machine starts with a wheel and axle going down a declining plane.
Mechanical Advantage Explained:
In a car's wheel and axle system, the output force is the force the wheels exert on the ground, and the input force is the force the engine applies to the axle.
When the car goes down an inclined plane, gravity is the primary force causing it to move, not the engine. The wheels are simply rolling freely, and the engine isn't actively applying any force to overcome resistance.
While the wheel and axle system in the car still exists, it's not functioning as a force-amplifying mechanism in this specific situation. The car is moving due to the combined effect of gravity and the incline, not because the wheels are multiplying the engine's force.</td>
<td>Picture:

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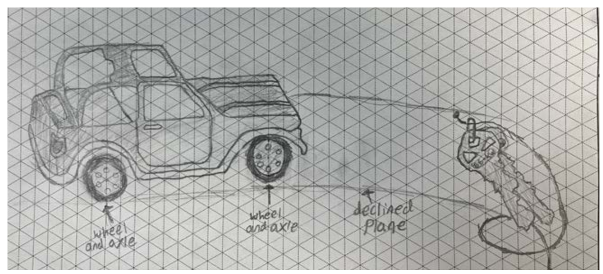
<tr>
<td>Annotated Sketch:

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</table>

Step 3:
Mechanical Step Description:

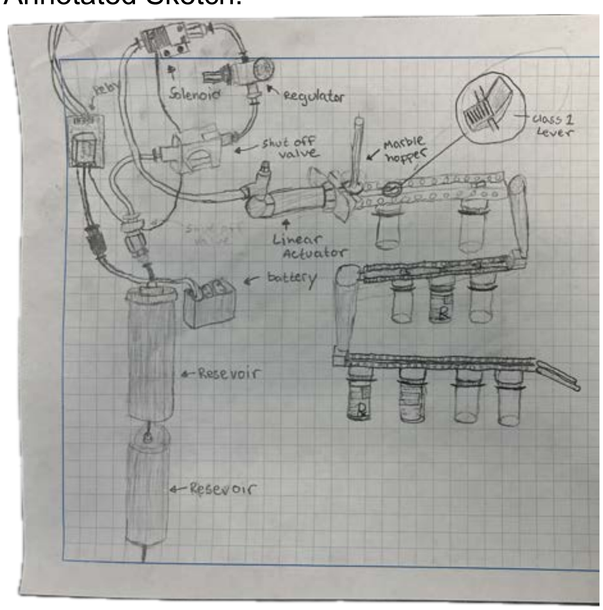
- Three inclined planes with hidden levers to allow for a repeating step.
- There is a green lever trap above each pill bottle. The lever flips down and allows the next marble to roll past into the next bottle.

Mechanical Advantage Explained:

- The incline makes it easier to move the marble to a higher position. Instead of lifting it vertically against gravity, you're moving it over a longer distance but with less force required at any moment.
- A green lever sits above each pill bottle. The marble applies a force to one end of the lever, while the fulcrum is the pin supporting its rotation

Picture:

Annotated Sketch:



Step 4:
Mechanical Step Description:

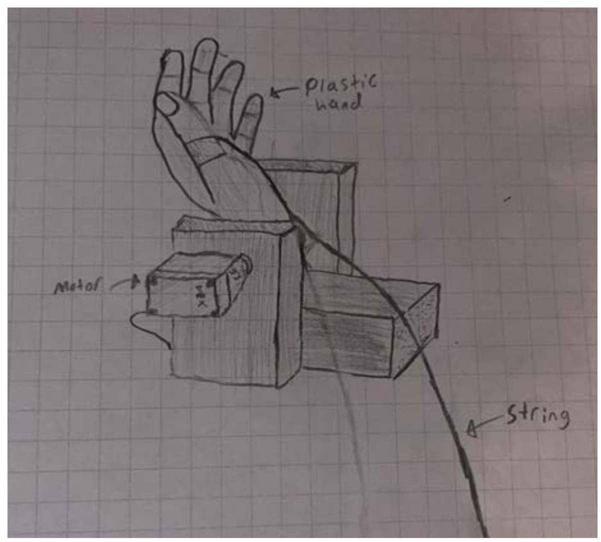
- The hand, acting as a lever, is flipped by a motor, acting as the fulcrum and the effort.

Mechanical Advantage Explained:

- The hand flipping is a lot like a wrench. Here is the explanation of how a wrench is a 2-class lever.
    - The lever: The body of the wrench itself acts as the lever. This is typically the long, solid metal bar.
    - The fulcrum: The fulcrum is the point around which the lever pivots. On a wrench, the fulcrum isn't always a single fixed point, but rather the point where the wrench contacts the nut or bolt. This point can move slightly as you turn the wrench.
    - The effort: The effort force is the force you apply with your hand on the wrench handle.
    - The resistance: The resistance force is the force needed to turn the nut or bolt (often caused by tightness or friction).

Picture:

Annotated Sketch:



Step 6:

Mechanical Step Description:

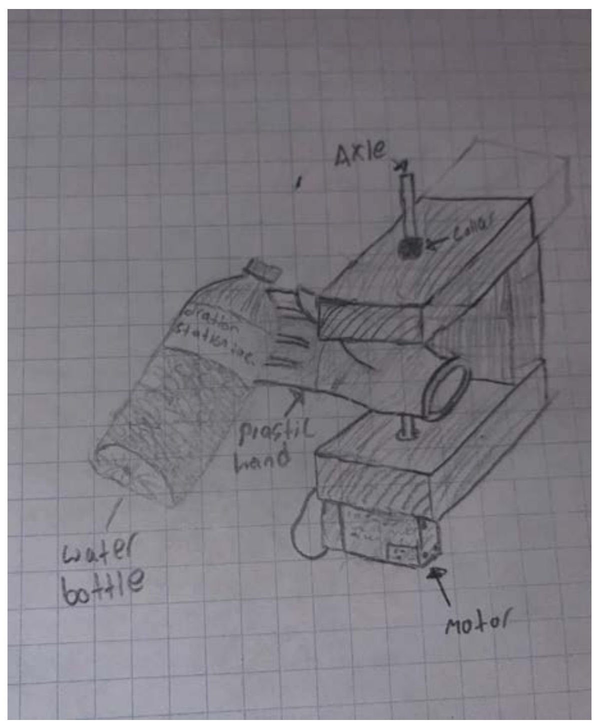
- Step six also has a flipping hand. Look at step five for the explanation.
- The hand flips and hits a limit switch, acting as a lever, to activate the next step.

Mechanical Advantage Explained:

- Function: Limit switches are primarily sensors. They use a lever mechanism to detect the position or presence of an object, but not to amplify force.
- Lever for actuation: The lever in a limit switch is triggered by the movement of a machine part or object. This movement overcomes a small spring force or other resistance within the switch, causing it to change its electrical state (opening or closing a contact).

Picture:

Annotated Sketch:



Step 7:
Mechanical Step Description:

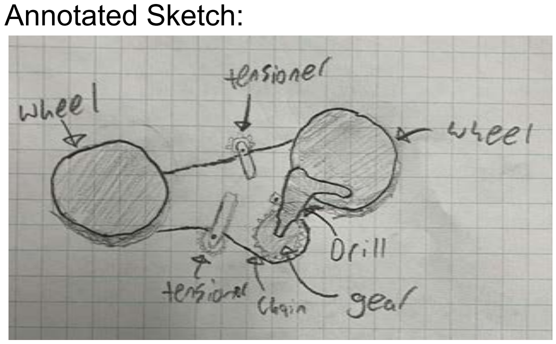
- One of our favorite steps, The drill turns on and turns two bike wheels.

Mechanical Advantage Explained:

- Drill Wheel and Axle: The crank handle acts like a wheel, and the shaft holding the drill bit acts like an axle. By turning the larger wheel (crank handle), you create more torque (turning force) on the smaller axle (drill bit).
- Bike Wheel and Axle: The drill is attached to a chain drive. The chain drive turns the bike wheel.

Picture:

Annotated Sketch:



Step 8:
Mechanical Step Description:

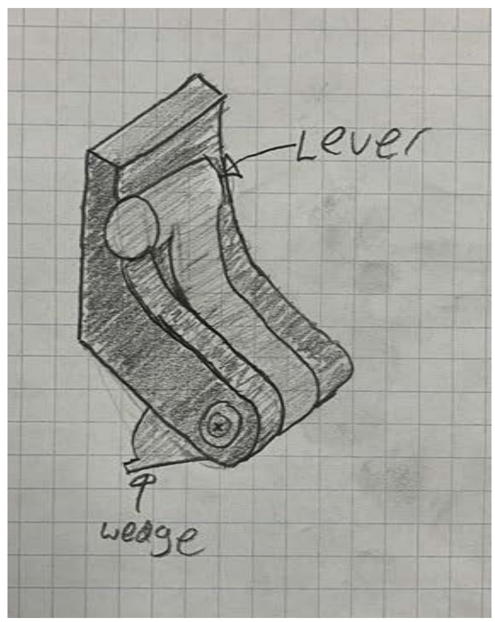
- The bike wheel coasts into a stopper gate. This step works because of the gate latch.

Mechanical Advantage Explained:

- Lever: The latch itself acts as a lever. One end (the handle) is where you apply force to lift the latch. The other end (the hook or catch) holds the gate closed by engaging with a notch or plate on the gate post. The point where the latch pivots on the gate (usually a screw or nail) acts as the fulcrum.
- Wedge: The design of the latch, also incorporates a wedge. Some latches have a slanted edge on the hooked end that acts like a wedge. When you push down on the handle, the wedge pushes sideways against the gate post, creating a stronger hold and preventing the latch from bouncing back up.

Picture:

Annotated Sketch:

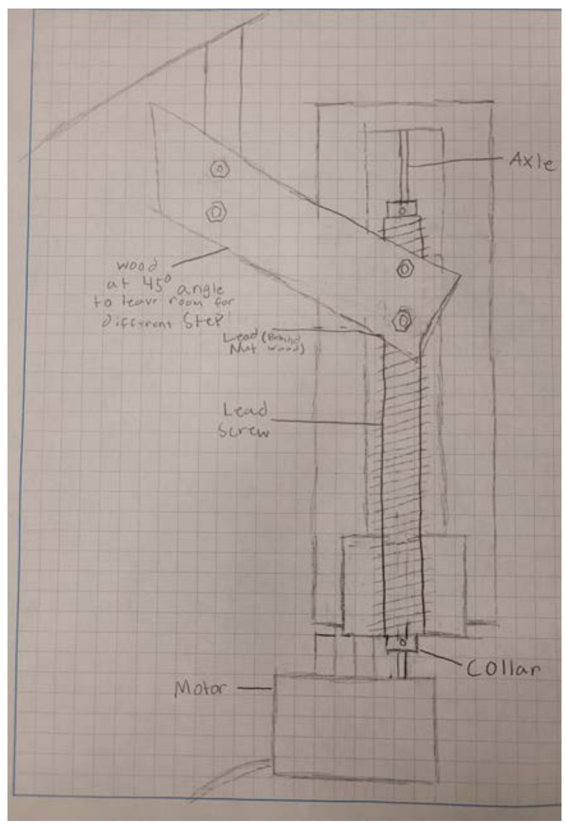


Step 9:
Mechanical Step Description:
- The sensor starts a lead screw system. The lead screw lowers a blocker and resets itself. Without the lead screw, it could not reset itself.

Mechanical Advantage Explained:
- A lead screw, like an inclined plane, is a simple machine that translates rotational motion into linear motion by spreading a force over a longer distance.

Picture:

Annotated Sketch:



<table>
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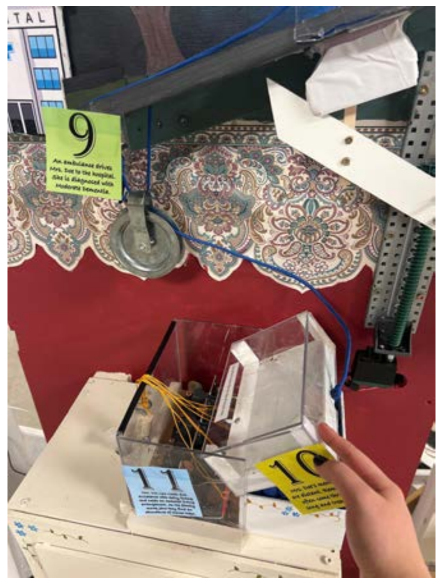
<td>
Step 10:
Mechanical Step Description:

The step is a toy ambulance rolling down a decline plane. Look at step one for the mechanical advantage of a rolling car.
The car falls off the declined plane and changes directions because of the pulley.
This step also has a music box that acts as a 2nd class lever. Moving the force of the coins to the next step

Mechanical Advantage Explained:

A second-class lever, like a wheelbarrow, provides a mechanical advantage by allowing you to apply force further away from the fulcrum, requiring less overall force to move a heavy load.
The pulley allows us to change direction and allows a falling action to be a pulling action.

</td>
<td>
Picture:

</td>
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</table>

Step 11:	Picture:
Mechanical Step Description: ● Music box, lever, drops a bunch of coins on mousetraps. ● Mousetraps have a bunch of levers. ● The mousetraps pull a cork. A cork is a wedge. Mechanical Advantage Explained: ● Lever action: When a mouse steps on the trigger (effort applied), it forces the bar down at the far end from the hinge (opposite the fulcrum). This pivots the lever and snaps the metal bar towards the base of the trap, trapping the mouse. ● Wedge: The is working like a doorstop. The cork is holding back the drawer.	 

<table>
<tr>
<td>

Step 12:
Mechanical Step Description:

The drawer is a load being released down a decline plane.
The drawer hits a shoe attached to a lever. The lever allows us to change direction and pull a pin.

Mechanical Advantage Explained:

A first-class lever, with the fulcrum between effort and load, allows you to change the force direction or gain a mechanical advantage by trading off force and distance.

</td>
<td>
Picture:

</td>
</tr>
</table>

Step 13: Mechanical Step Description: • The shoe acts as a first-class lever, allowing a pin to be released.	Picture:  

Step 14:	Picture:
● The pulley allows the string to change direction. This drops a heavy object, in our case a picture frame, and triggers another	

Fluid Power Components

Our fluid power part uses pneumatics. Our pneumatics design uses a reservoir, regulator, three-way shut-off valve, solenoid, and a linear actuator. The reservoir stores the potential energy as compressed air, the shut-off valve isolates the stored compressed air, the regulator maintains the pressure, the solenoid electronically controls the airflow and the actuator converts the compressed air to mechanical energy. This is different from the syringe fluid power because it uses a gas (air) instead of water or fluid. We use this step to start the slow transition to the next step by having the actuators push pills, or marbles, into the medicine bottles.

When doing this step we had some difficulties with enough potential energy to get all the way through the step. We decided to quadruple the reservoir capacity. This way we only needed to charge the reservoir 1 time for two machine runs. Eliminating the need to put compressed air into the system during the two-minute reset time.

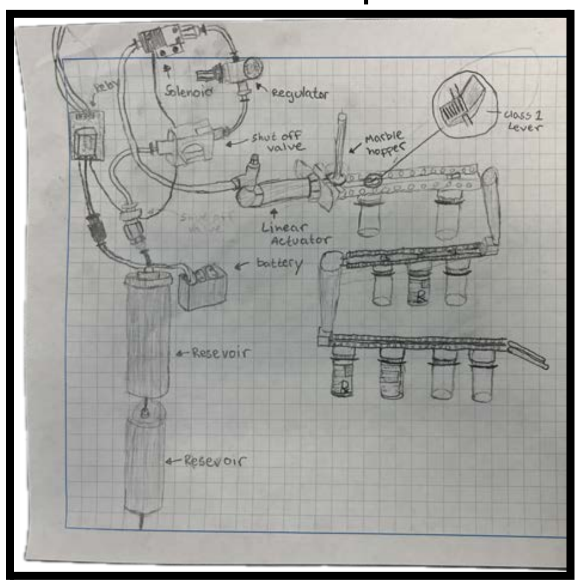
The linear actuator we selected has a spring inside the actuator. This helps so we only need to put air into the actuator when we want it to go out. When there is no air in the system the spring brings it back to the original state.

Images of Fluid Power Step

Original pneumatic system. The capacity of the reservoir was not enough.

Final pneumatic system.

Sketch of Fluid Power Step



Reflection

Throughout the machine we've all learned lots of information including how things function, some tricks to make our steps work better, and how to work as a team. There have been many ups and downs during this journey, but we've been able to overcome these issues through teamwork and perseverance. These are experiences that the team can carry with them and use in the future of their careers and overall lives. There are a few major successes and/or challenges that the team has been through.

One challenge that the team faced was the chemical components of our complex machine. When the chemical steps were being developed, there was the issue of figuring out the chemistry and functionality of each reaction that was supposed to happen to ensure the step worked correctly. Once the team had the materials needed to allow the reactions to happen, the experimenting started. The reaction was run over and over to see if it would work. At first, this step didn't work at all. It took a few weeks to get this to function properly, as the amounts of reactants needed to be almost exact to get the reaction to change how we wanted it to.

Furthermore, the team had a great success that was substantial to the teamwork of everyone being able to work efficiently together. During the first couple of weeks, the team was in the planning and research process. The decision to have four sections was made, and the team then wanted to split the tasks among each wall, and then assign each wall to a group of team members. By doing this, people were able to rely on each other to get each step done and be able to work together with people who they were comfortable with. Moreover, people didn't have to work on top of each other while assembling the machine. This then allowed us to reset the machine faster when practicing running the machine for the competition.

Another challenge was getting the spinning walls to function properly. We ran into multiple issues to get the walls to work such as how were we going to get the wall to spin. At first, we didn't have any good ideas for how the wall was going to spin, but eventually, we landed on the idea of using a drill. Another obstacle we faced was how the drill was going to spin the walls. To get around that issue, we used a bike sprocket and a large bike chain to get the drill to spin both walls at the same time. However, we struggled greatly to get the chain connected to the bike wheels under the wall. It took five people and three frustrating hours but eventually, we were able to get the walls and drill connected. The team of five people was struggling and our ideas were clashing a lot. Eventually, we took a short break and when we came back we worked together and all agreed on one idea and it worked to get the wall spinning properly.

Ultimately, the team learned a lot about how things work and grew their teamwork skills. As a whole, we all enjoyed working together and growing as a team from the beginning of this journey all the way through. The Saturday meetings and lunch sessions were tough at times, yet we persevered through it and then finished what we started back in October. This engineering team has been a great experience for everyone who worked on the machine throughout the year.

Logo Permissions

Milwaukee Bicycle Collective

2930 W. Clybourn Street,
Milwaukee, WI 53208

(414)-431-0825

www.bikecollective.org

February 28, 2024

Dear Eisenhower Engineering Team,

We're thrilled about your participation in the Engineering Machine Design Contest! You're welcome to use the **Milwaukee Bicycle Collective logo** creatively in your project, maintaining its original design and colors whenever possible. This letter grants permission for the Milwaukee Bicycle Collective logo.

Sincerely,

Dana McLaren

2/28/2024

Dana McLaren

President of Milwaukee Bicycle Collective

SysLogic, Inc. Permission

On Fri, Dec 8, 2023 at 1:38 PM Charlene Wietzel <cWietzel@syslogicinc.com> wrote:

Hi Gabby,

Tina asked me to send you the attached SysLogic logo. Please let me know if this does not work for you for any reason.

Thanks,

Charlene

Charlene Wietzel | Executive Administrator

SysLogic, Inc.

(o) 262.780.0380

From: Gabriella GK12277 <gk12277@stu.nbexcellence.org>
Sent: Friday, December 8, 2023 11:03 AM
To: Tina Chang <tchang@syslogicinc.com>
Subject: Re: Engineering Machine Design Contest Inquiry

Hi Ms. Chang,

Thank you so much for donating! There are two options for sending the money: an online form or a check. The link for that would be https://form-renderer-app.donorperfect.io/give/efnb_ikerube. You can also write a check to the New Berlin Eisenhower Engineering Team. That check would be mailed to 4333 S Sunnyslope, New Berlin, WI 53151.

Also, is there a chance I could get a transparent vector file of the SysLogic logo? It just makes it a little easier to get visuals with an image directly from the company to ensure high image quality rather than a blurry JPEG from online.

Again, thank you so much for your generosity!

Gabby Kazinski

Co-Captain of Eisenhower Engineering Team

Class of 2024

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