index

Brainstorming

Required Specifications:

- machine must be no more than 5'x5'x5' in length, width, and height
- there must be 15-20 total steps
- ~~cast~~ As each step must be correctly labeled and correspond to a list in the journal
- the machine may not take more than 2 minutes to complete the task.
- Follow the contest theme: Into Orbit

Brainstorming

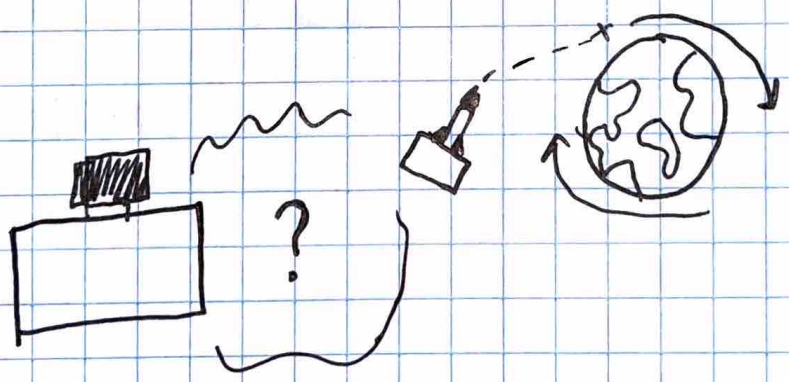
Into Orbit: Transforming Space Technology

We could set up a contraption that ends with a rocket being launched into a basket that revolves around a globe. Thus being launched into orbit.

Either a chemical reaction or a mousetrap using elastic potential energy could be used for propelling the rocket into orbit.

Possible Senerio:

View of mission control: an accident causes the launch button to be pressed and indicate the countdown to launch. During the countdown a series of chain reactions happen to ignite the rocket.



Recycling Old projects

For the frame and table we recycled from past years projects.

New Ideas

items found in mission control:

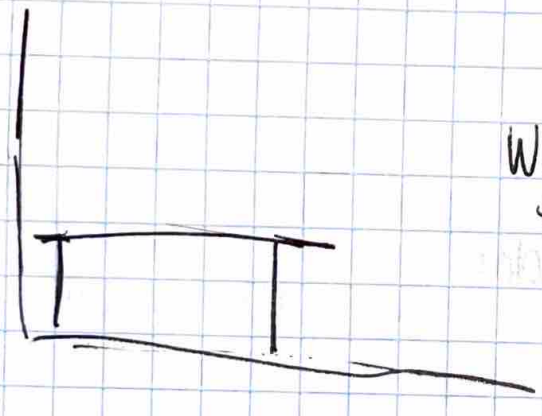
desk
chair
computer
file cabinet
trash can
clipboards
pencils and pens
calculators
paper
books
phones
clocks
coffee cup
model rocket

What could these items do:

fall
spin
hit something
ramps
pulleys
levers

Building Project

this is the start of the ramp.



We originally wanted the table to be horizontal across the background. But, it took up too much space, so we changed it so it was perpendicular

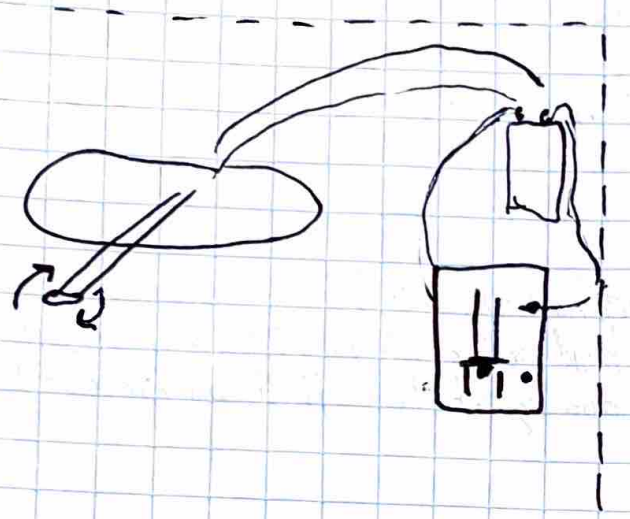
Design Process

The clock moves: causes a string to pull. The clock motor starts by a flip of a switch. The string is attached to a stopper, once the stopper is removed a ball will fall down the ramp on the computer screen.

A model globe rolls down the back side of the computer monitor landing on the computer cords. The cords are used as a ramp, leading down on to the table. The globe rolls into a mouse at the end of the table.

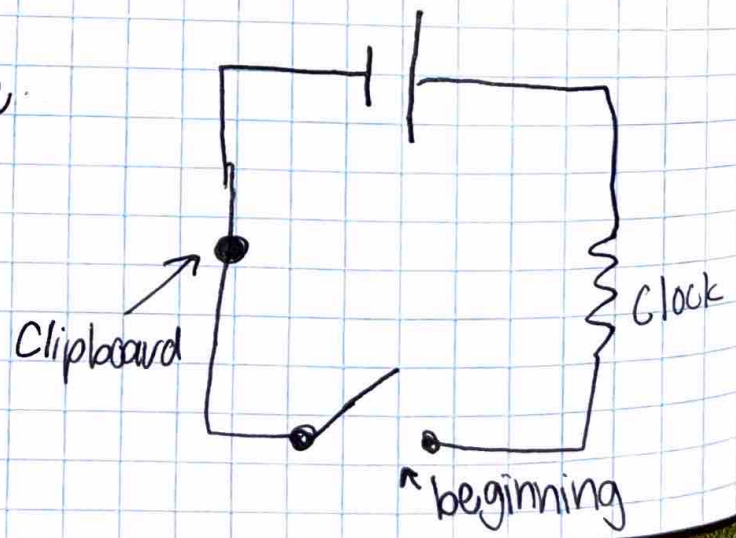
When constructing ~~our~~ the sh clock mechanism. A better solution was found. Instead of having the minute hand pull a string. The minute hand will bump into a model globe causing it to roll down the cord.

~~Painting~~ As* Switch - Electrical step

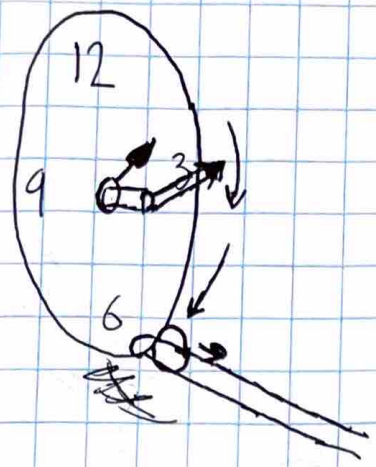


We thought it would be cool to start the entire thing "at the flip of a switch", so for our first step we have a circut that will be closed, converting our kinetic energy to electrical energy, powering the motor.

This is what the circut work looks like:

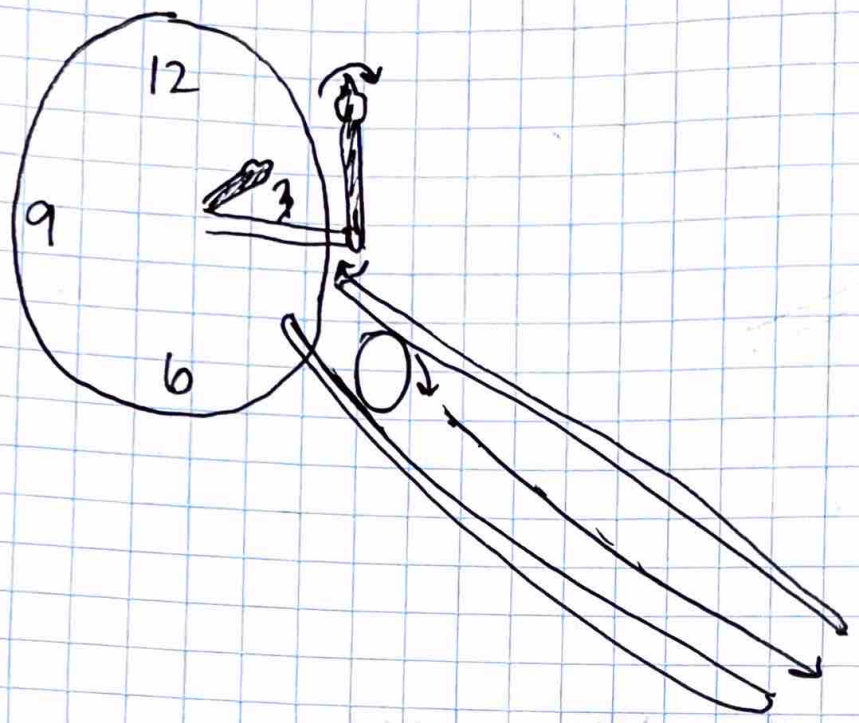


Clock - Ball Release - Mechanical step



~~One~~ As Once the motor is powered, it will turn clockwise, causing the clock to move, this converts the electrical energy into kinetic energy, turning the clock hand.

Marble fall



The minute hand will then hit a ball causing it to fall down a ramp, meaning the hand's kinetic energy will cause the marbles' ~~gravitat~~ AS gravitational potential energy to turn into kinetic energy while it falls.

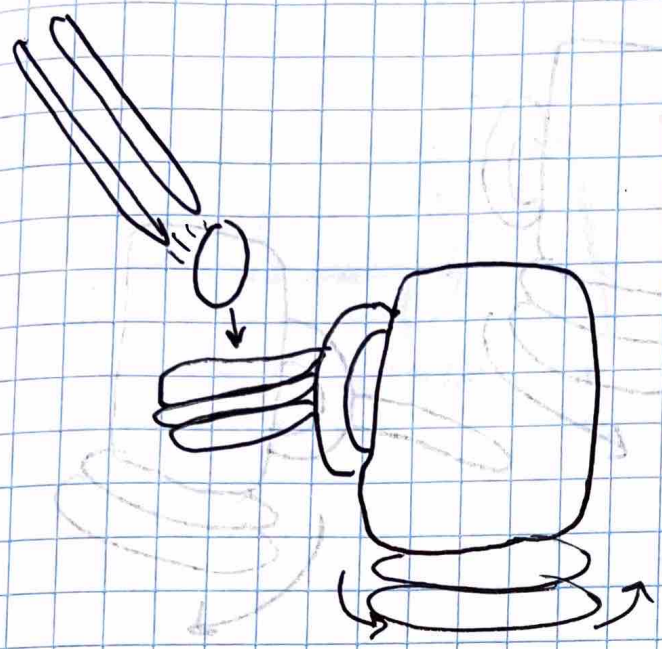
Design Process

~~If~~ AS the angle of the ramp ~~was~~ AS and placement of the ramp was a problem. So we had three options:

I: keep at 6'o clock → won't have to alter
II: move to 7 or 8 o'clock → ball won't travel as fast
III: keep in same position: extend ramp → travel closer to cups
change layout
ensure stability
more ramp = less sp

option 2 was best

Marble hits cups



- we added

to the handle to give the ball more surface area to hit

Once the ball is off the ramp, the kinetic energy from the marble will be turned into kinetic energy of the coffee mug, causing it to spin.

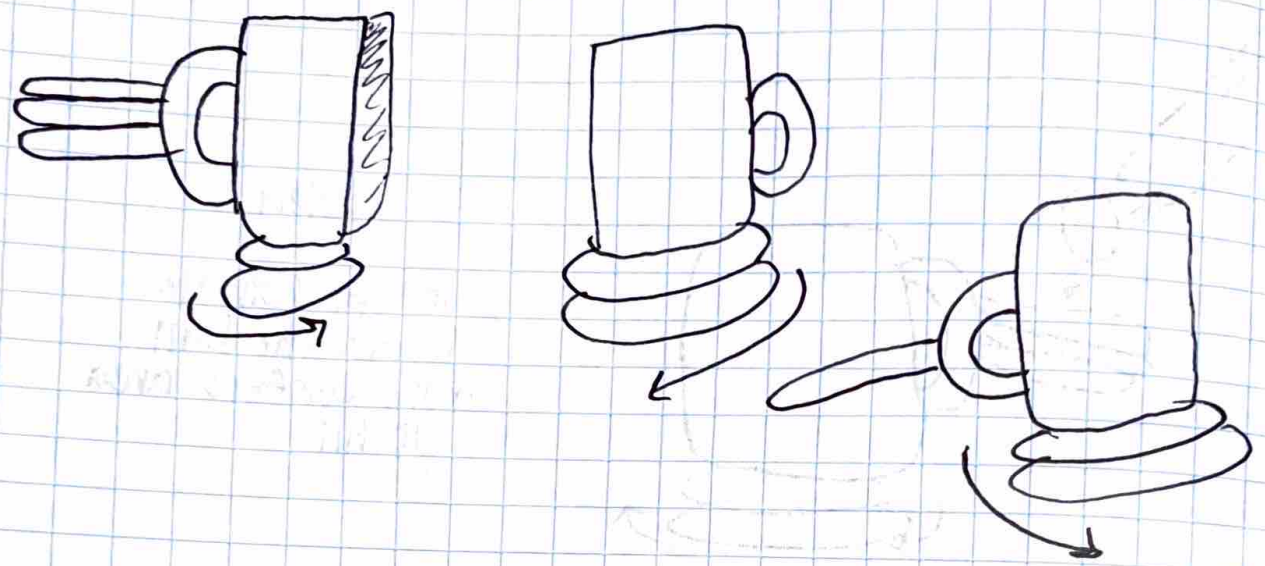
We didn't want to break the mug, so we had options for reinforcement.

Design Process

	pro	con
I: Duct Tape	→ easy to apply,	may not work great
II: cardboard	→ protect handle,	ruins realness
III: arm	→ less force on cup,	increases space

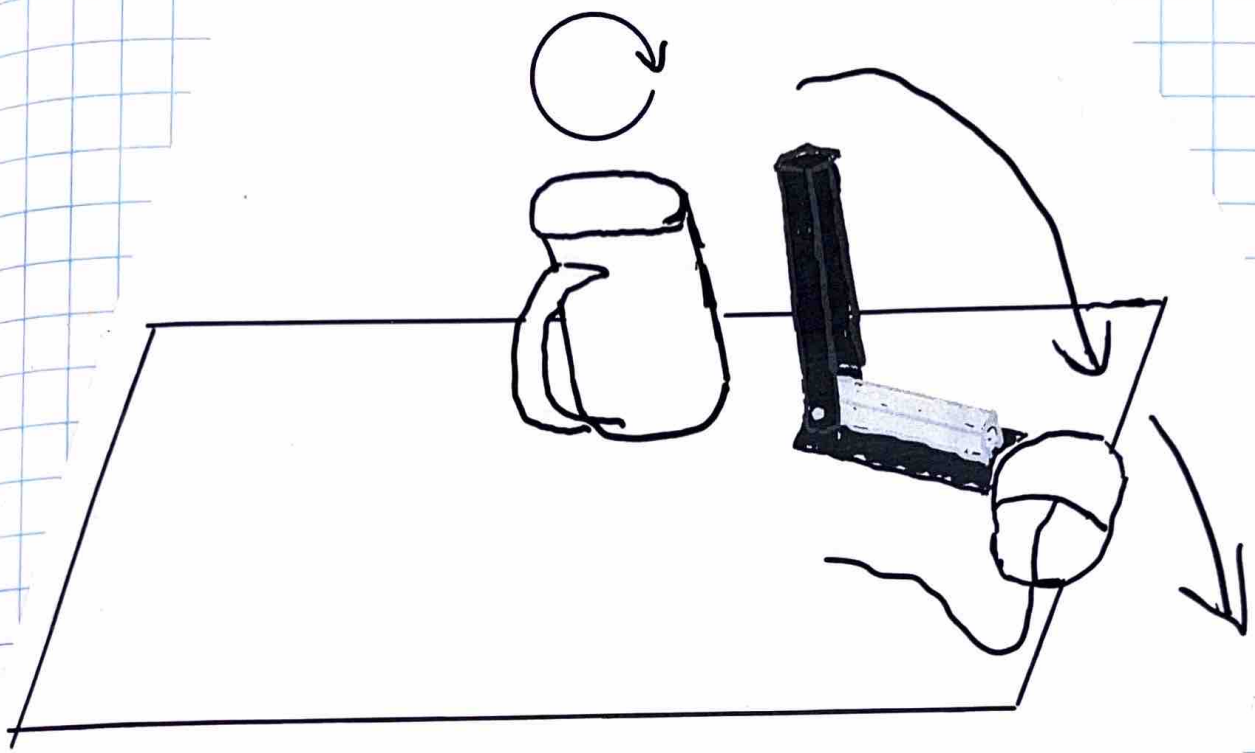
the cardboard was the best option, for both protection, & good surface area for the marble to hit.

Coffee mugs



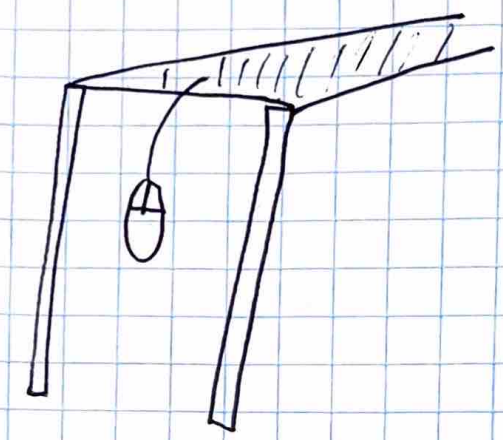
Once the mug has been hit it will spin. The kinetic energy of the first mug will turn into kinetic energy of the second mug, then the third. each cup spinning, then hitting the other.

Mug to stapler March 14, 2023



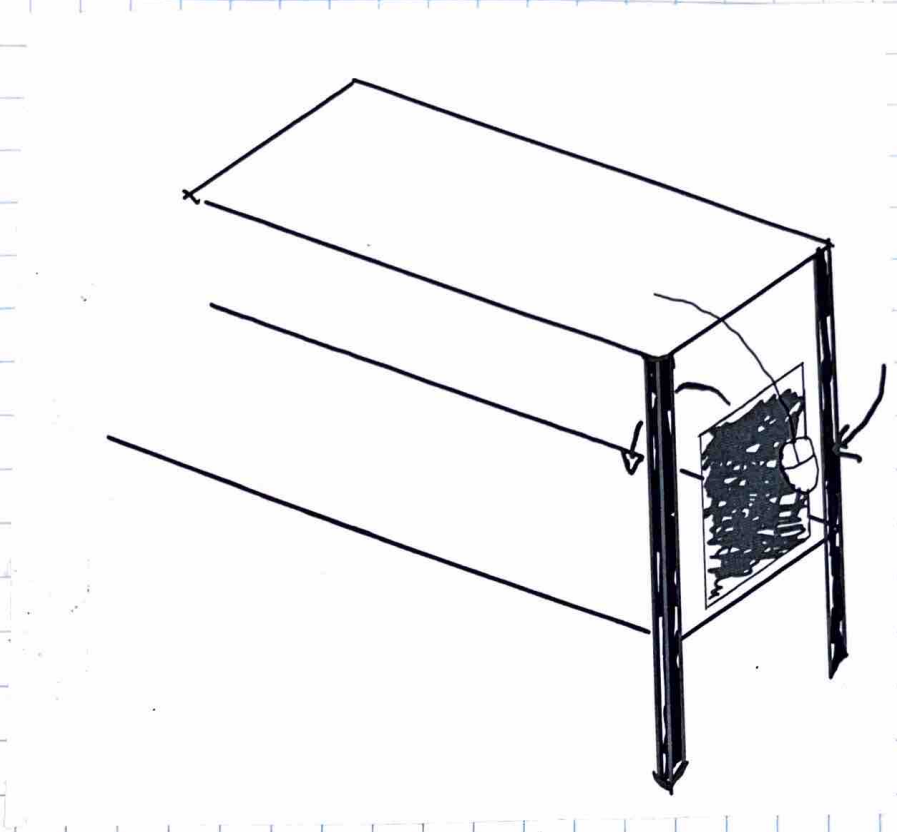
The second mug will hit a stapler causing it to shut. the force of it shutting will cause a mouse to fall off the table.

Mouse Falls



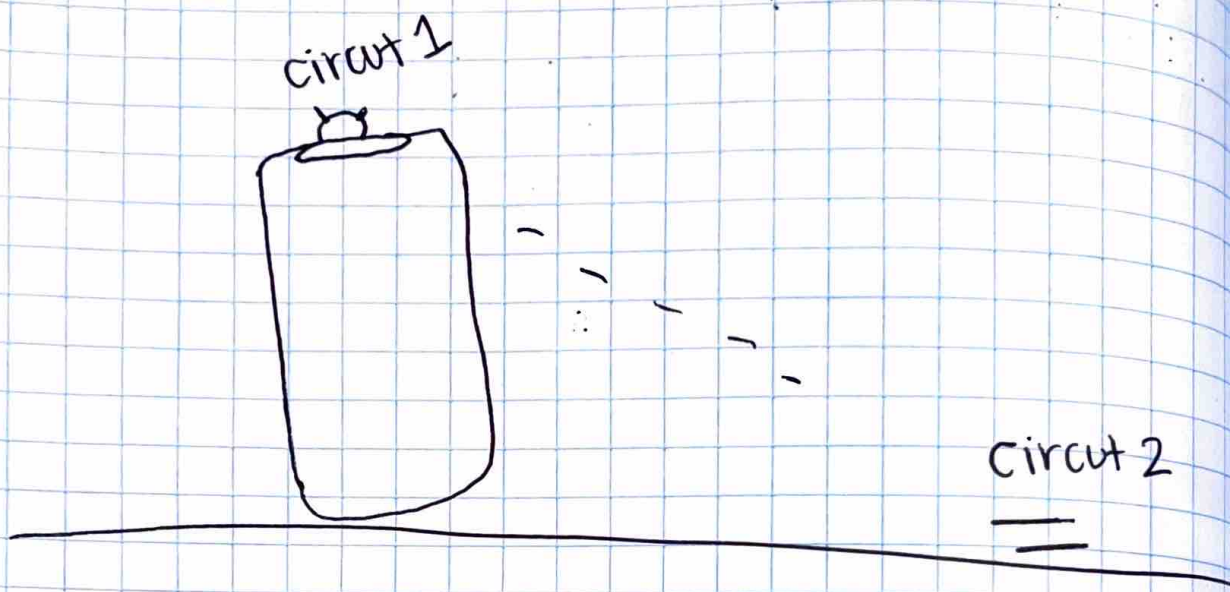
Once the mouse is hit, it will gain kinetic energy.

Mouse to Clipboard



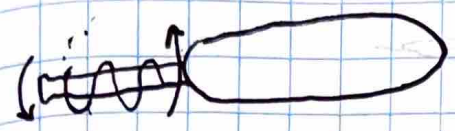
The mouse falls and will hit the clipboard causing the clipboard to gain kinetic energy and fall over.

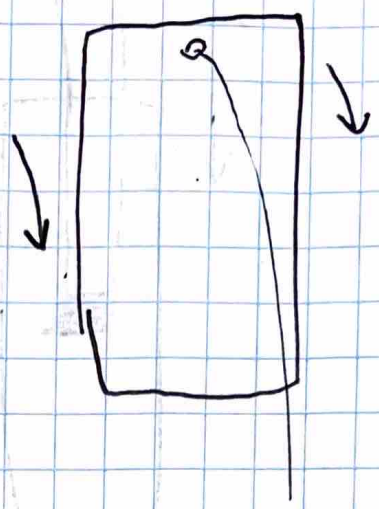
Clipboard



The clipboard is connected to two circuts. The first is when it is upright, it is connected to the clock motor. Once it falls it will disconnect causing the clock to stop moving. the second is after it falls, it will close a circut that will start another motor.

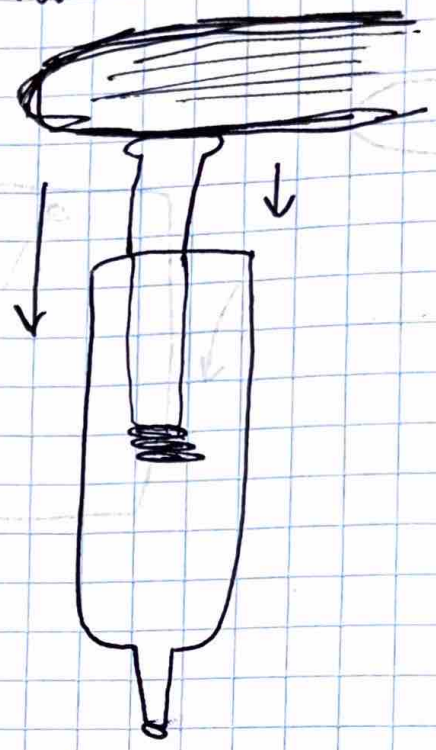
Book circut





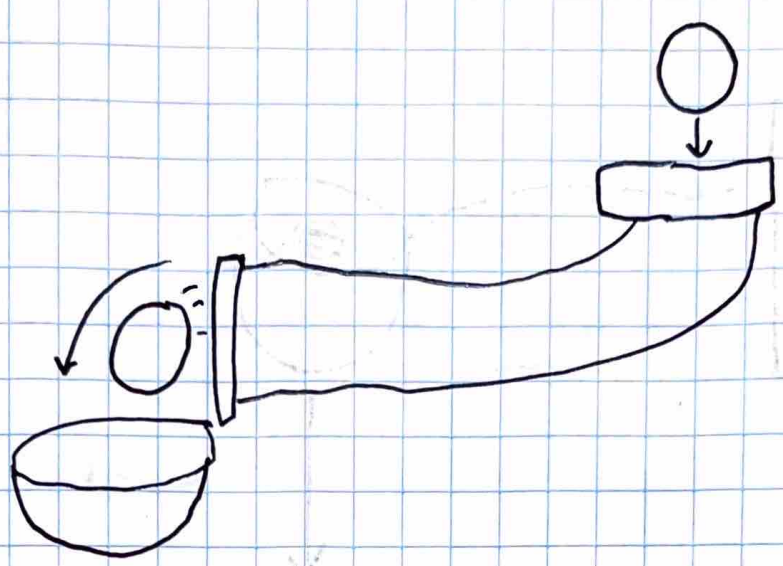
Once the second circut is closed a second motor will start. this one will coil string attached to a book and make the book fall.

* Syringe - Fluid Power



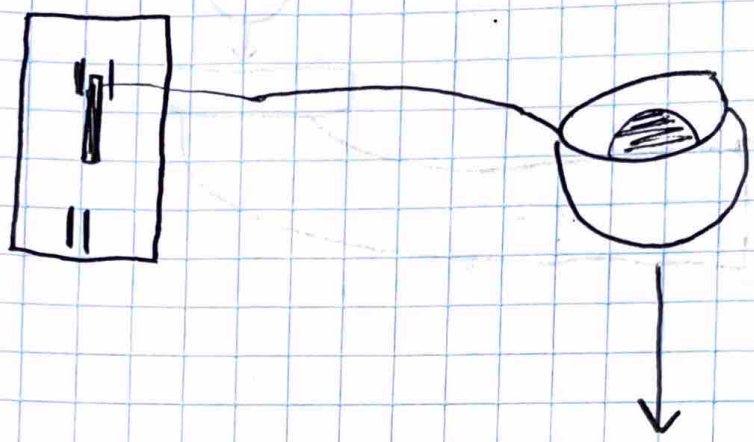
The book will fall onto a syringe and push the plunger down.

Ball to Basket



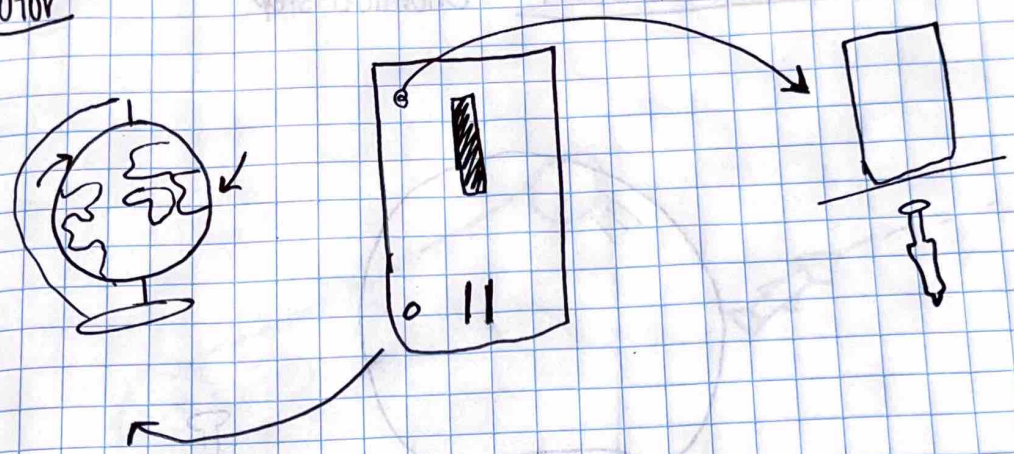
Going back, the ball is still going to be used. After the ball hits the mug, it will fall down a ramp, and fall in a basket. Transfering it's kinetic energy to the basket.

Basket and switch



Once the basket gains energy, it will fall down and pull a string along with it. This string will pull a switch connected to a motor.

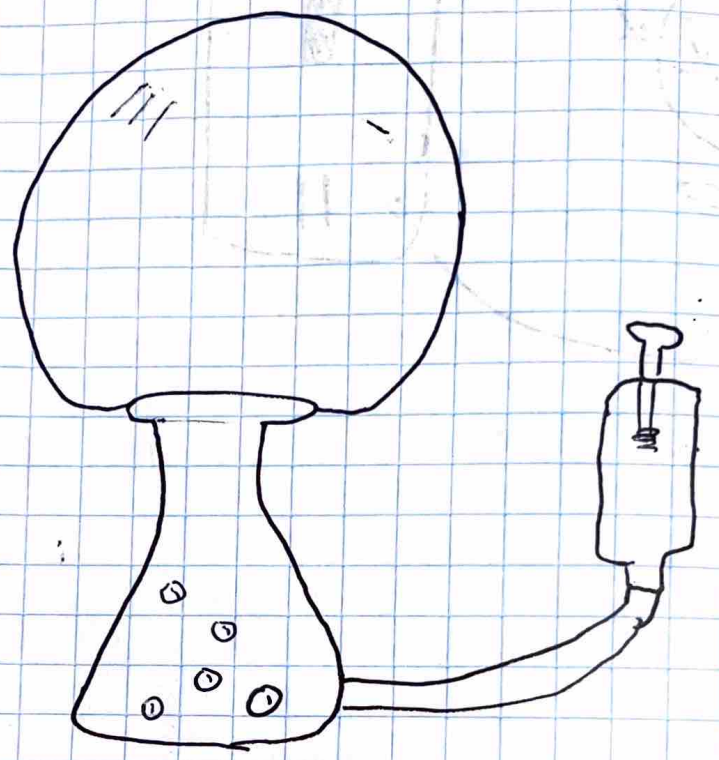
Motor



This motor and switch combo will do two things. When the switch is up, it will be connected to the motor that lowers the book. When it is pulled down, it will disconnect & connect to a new motor, this one will spin the globe.

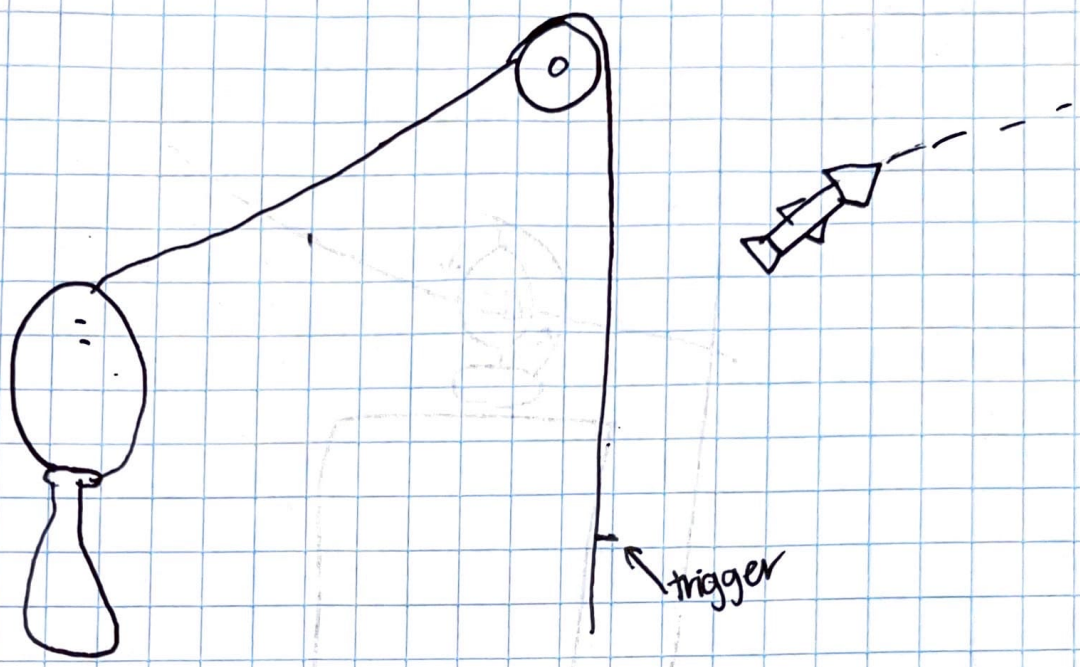
the timing of the switch would be off, meaning we would have to find a way to shut off the book motor, after the book pushed down the syringe.

✱ Chemical Reaction - Chemical Step



the syringe will eject ~~the~~ vinegar and bring it into the bottle that already has baking soda in it. The two substances will mix and realise carbon dioxide - which will inflate the balloon.

Balloon

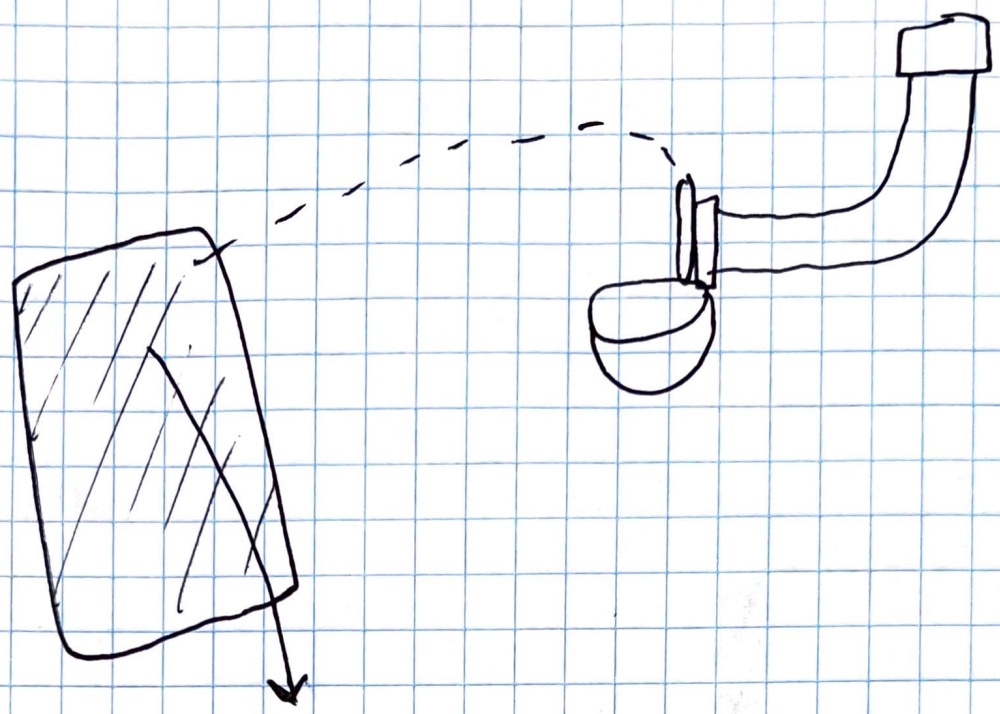


Once the balloon is inflated, it will pull on a string connected to a pulley. the pulley will lift up a trigger that will start the rocket on it's path down the zip line.

Ending

Once the rocket goes down the zipline, it will stop in front of the spinning globe. Making the illusion that it is orbiting the earth.

Book to ball release



After realizing the timing would be off, it was decided to have the book pull the string and ~~realis~~ release the ball into the basket

Stoichometry

$NaHCO_{3(aq)} + HC_2H_3O_{2(aq)} \longrightarrow NaC_2H_3O_{2(aq)} + H_2O_{(l)} + CO_{2(g)}$

$Na^{+1} + C_2H_3O_2^{-1}$

$H^{+1} + HCO_3^{-1} = H_2CO_3$

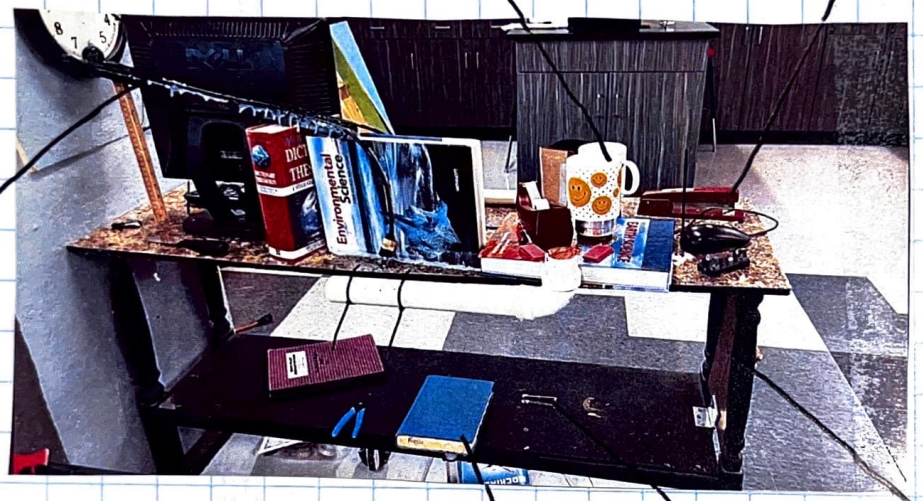
$H_2CO_3 \rightarrow H_2O + CO_2$

Cost of materials

= recycled from classroom stockpile

item used	cost
table	
clock	
switches	
ramp	
books	
coffee mugs	
computer	
ruler	
pencil	
erasers	
mouse	
stapler	
clipboard	
hinges	
syringe	
string	
PVC pipes	
globe	
rocket	
walls	
batteries	
wiring	
crates	
tape dispenser	

Final Machine



mugs hit eachother

Stapler will make mouse fall

ramp marble falls down

Clipboard

book falling on syringe

where clipboard falls to start second motor

Steps

1. Flipping a switch - KE → El. E
2. Clock handle moves - El. E → KE
3. Clock hand hits marble - KE → KE marble
4. Marble hits coffee mugs - KE marble → KE mugs
5. Mugs hit stapler - KE mugs → KE stapler
6. Stapler causes mouse to fall - KE stapler → KE mouse
7. Mouse hits clipboard - KE mouse → KE clipboard
8. Clipboard falls - GPE clipboard → KE clipboard
9. ~~KE~~ Clipboard starts motor → KE clipboard → El. E
10. Motor wraps up string - El. E → KE string
11. String causes book to fall - KE string → KE book
12. Book falls on syringe - KE book → KE syringe
13. Syringe ejects vinegar - KE syringe → Chem. E
14. Chemical Reaction blows up balloon → Chem. E → KE balloon
15. Balloon Pulls String - KE balloon → KE string
16. String Pulls Rocket - KE string → KE rocket
17. Rocket Falls

QR CODES

Testing of initial steps

The video shows the testing of steps 1-12

Reflection

Sean:

From start to finish, this project has been a struggle to overcome. Throughout the journey, many obstacles were conquered, and problems were solved. We have learned many new and important skills that will be useful for years to follow. Starting with brainstorming a design for our machine. Our initial thought was ending with a rocket launching from Earth to the moon. Over time we realized that launching the rocket was going to be harder than anticipated. Instead of physically launching the rocket, we would have the rocket on a ledge higher than the globe and have a string pull it down to the globe.

Aubrie:

This project has been something I have been looking forward to all year. But, I didn't realize how time consuming and how much mental work goes into it. All of the problems and ideas we had really made me think about how often we use scenarios- like problem solving- everyday. One problem we had was incorporating the globe in some way. We knew we wanted to have a rocket "orbit" it somehow, but didn't know how to make that actually happen. So, instead of having the rocket orbit, we decided to have the earth spin instead. Time was also a big issue, we had many conflicts and lost days, so when we were in class we were always busy working on the project. I really enjoyed learning more about engineering, as it has been something that has always interested me. Even though I don't plan on being an engineer, I still hope to use the skills I learned in my future career.

Bibliography

- Walker, James S. [redacted] Physics. Pearson, 2014. Book, pg. 205.

- Helmenstine, Anne Marie. "Equation for the Reaction Between Baking Soda and Vinegar" thought Co. Dotdash Meredith, 30 Jan. 2020. www.thoughtco.com. Accessed 10 Mar. 2023