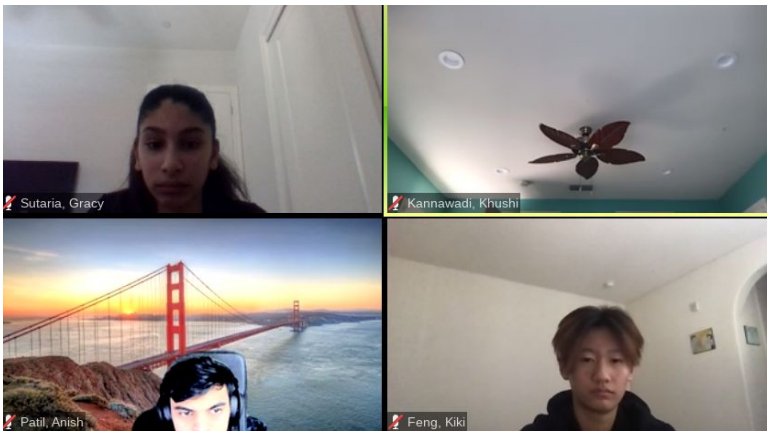
Title Page



The Santa Catcher

Designers:

Kiki Feng
Anish Patil
Gracy Sutaria
Khushi Kannawadi

Class:

Schick 3

Date:

November 11, 2020 - December 4, 2020

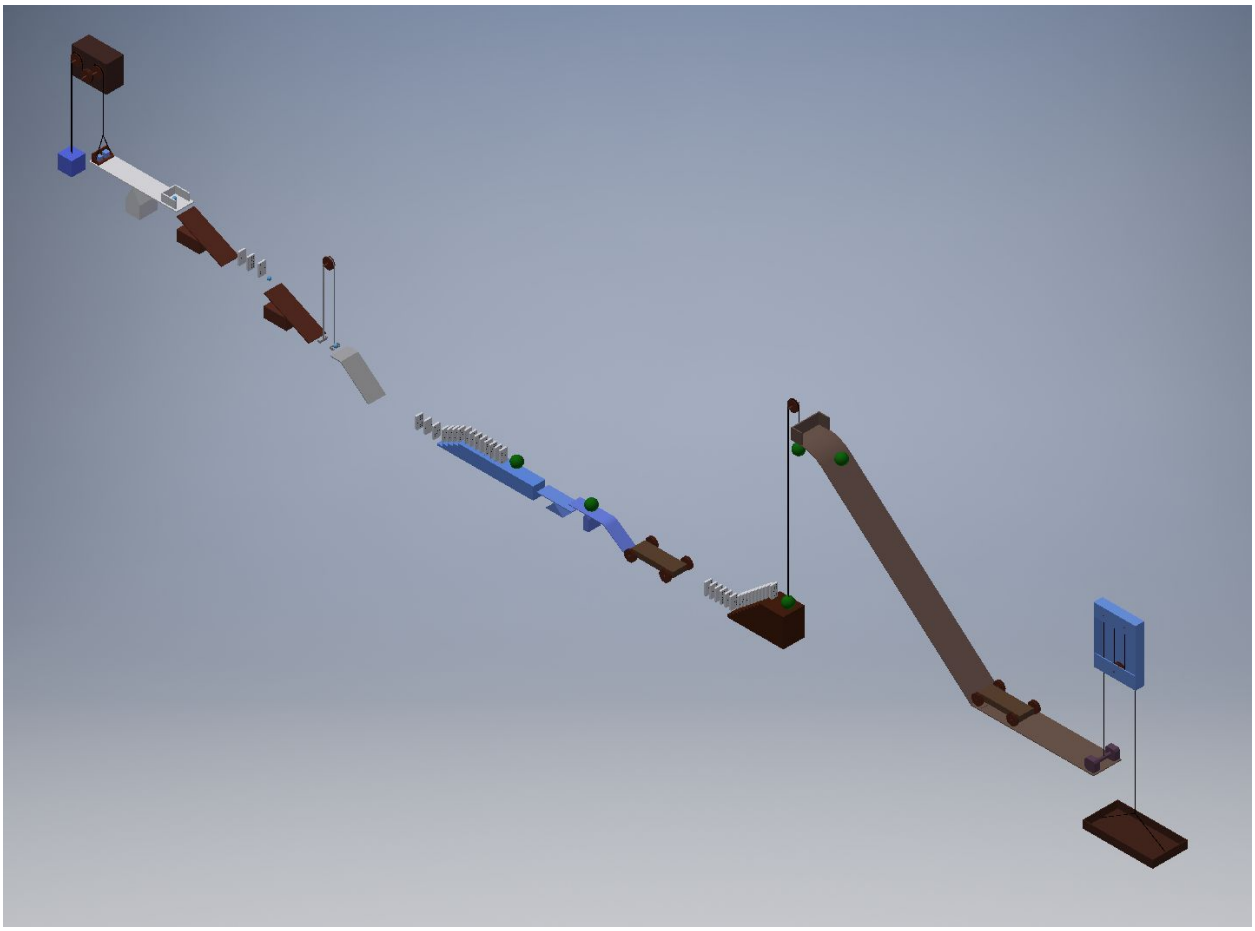


Table of Contents

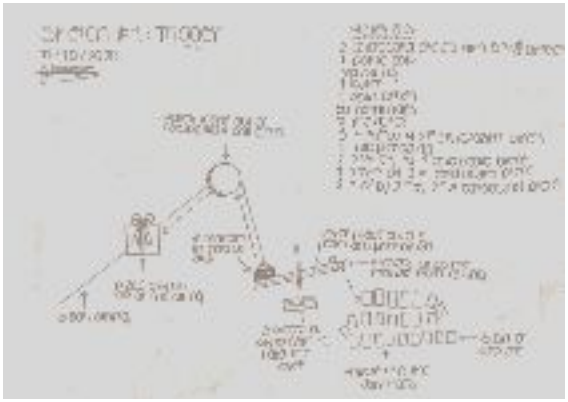
Design Brief

Overview:

Client	Joseph Herscher, a youtuber
Designer	Kiki Feng, Khushi Kannawadi, Anish Patil, Gracy Sutaria
Problem Statement	Joseph Herscher is a youtuber who creates content using complicated machines to complete a simple task. Recently he has been running out of ideas for his channel. To help Joseph we have been tasked to design and build a machine that can humanely catch Santa.
Design Statement	Brainstorm, design, test, and develop a humane way to catch Santa Clause using a Rube Goldberg machine. This machine will consist of levers, pulleys, and other mechanisms made out of common home items.
Constraints	- Each person must create three unique parts for their section of the design - The machine should function with only one human input - The design should be made out of household items - The parts used in the design should be everyday objects - Design should be completed by December 2 - Solution has to lift 250 pounds 2 feet into the air - Trigger (5 mins), Capture (2 mins) - Santa will leave through the chimney - Distance between tree and cookies is about 10 feet - Forces are calculated and accurate - Making a 3D model of the complete design
Team Deliverables	Vid of working prototype Edit video Doc describing process/evaluation of design Brainstorm jamboard Team gantt chart/responsibilities 3D model of complet design
Individual Deliverables	Sketches Ima calc Proj log Build individual portion

Brainstormed Ideas:

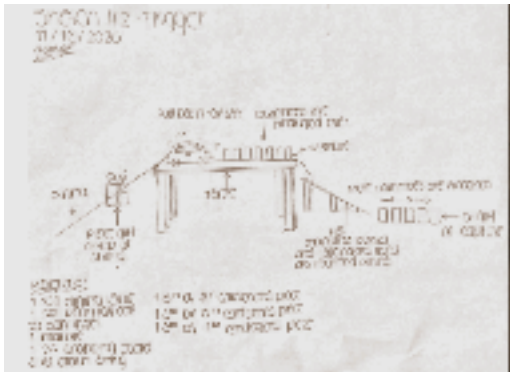
Trigger (Gracy Sutaria, 11/13/20)



Idea 1

1. A gift is placed on top of a string connected to a pulley.
2. The pulley then pulls the cardboard cart with marbles off of the ruler.
3. The ruler is used as a first class lever and once the cart is lifted the marble falls down.
4. The marble falls and hits dominoes which then leads to the capture.

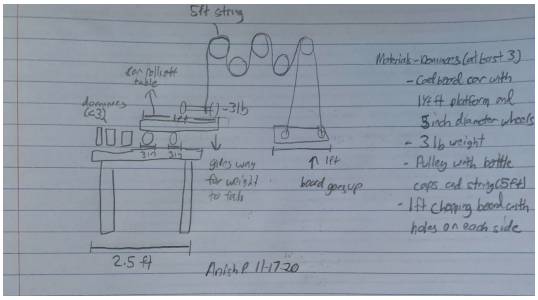
Idea 2



1. A gift is placed on top of a string connected to a pull back car on a table.
2. The pull back car moves back far enough that it can go forward.
3. The car hits the dominoes which ends up hitting a marble which rolls down the inclined plane.
4. The marble then hits more dominoes which leads to the capture.

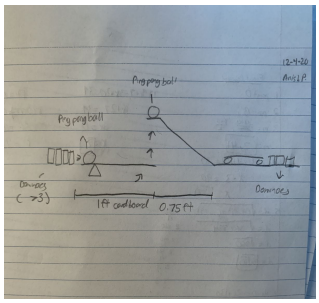
Capture (Anish Patil, 11/17/20)

Idea 1



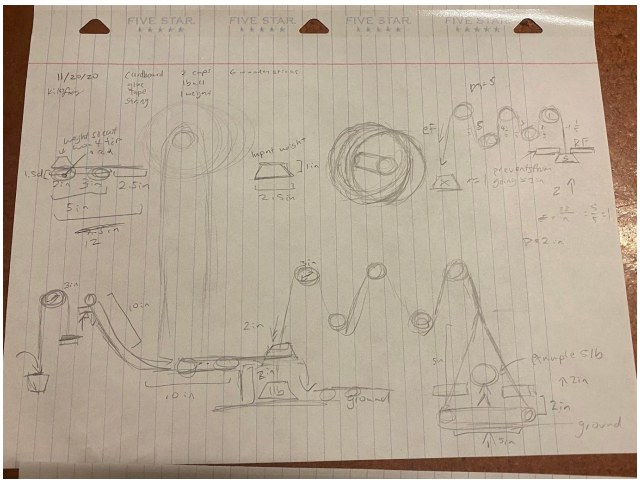
1. At least 3 dominoes are placed consecutive to each other and knocked down
2. Dominoes push a cart made out of cardboard, this cart is holding up a weight connected to the string
3. As the cart moves forward the weight loses its support and falls down
4. The falling weight pulls the string that is tied around it and moves the pulley system that lifts a chopping board to complete the capture

Idea 2



1. At least 3 dominoes are knocked down
2. Dominoes push a ping pong ball across a first class lever, which tips upward and hits a second ball down an inclined plane
3. The ball smacks into a cart which knock more dominoes over

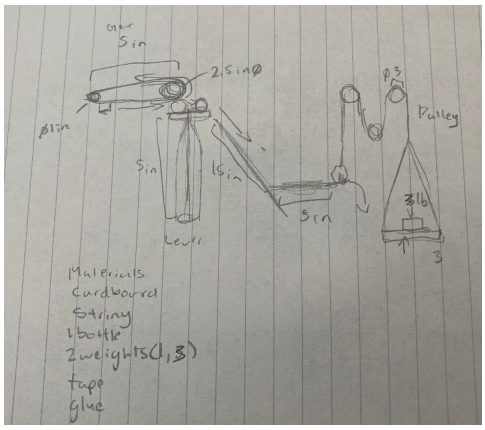
Capture pt2 (Kiki Feng, 11/20/20)



Idea 1:

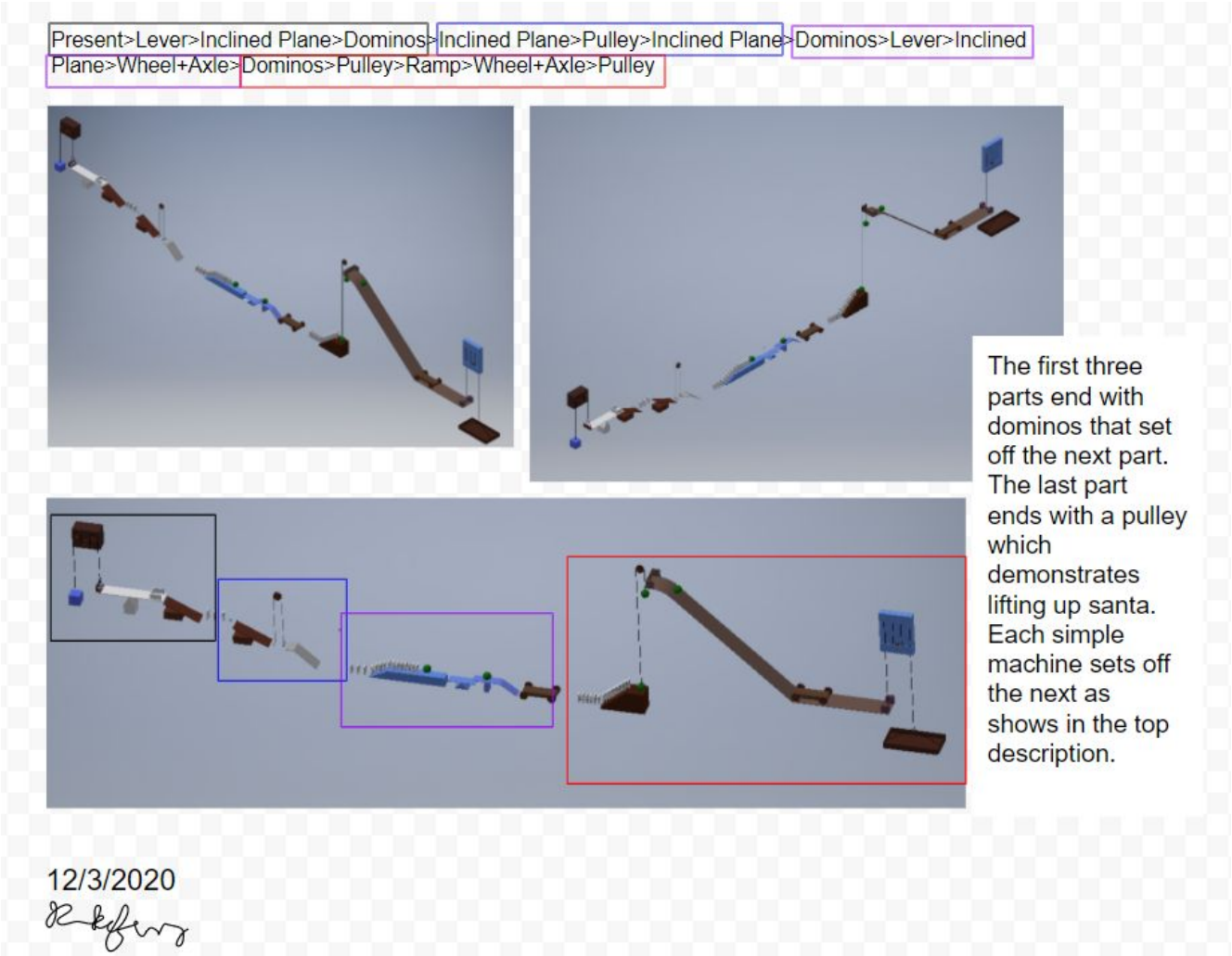
1. dominos from the previous part continue
2. The dominoes fall into a cup attached to a pulley. The other end of the pulley hits a lever which allows the ball to drop down the ramp/inclined plane.
3. The ball hits a car made of a body along with wheels and axles.
4. The car hits a weight attached to a group of pulleys which lift up the platform and “Santa”

Idea 2:

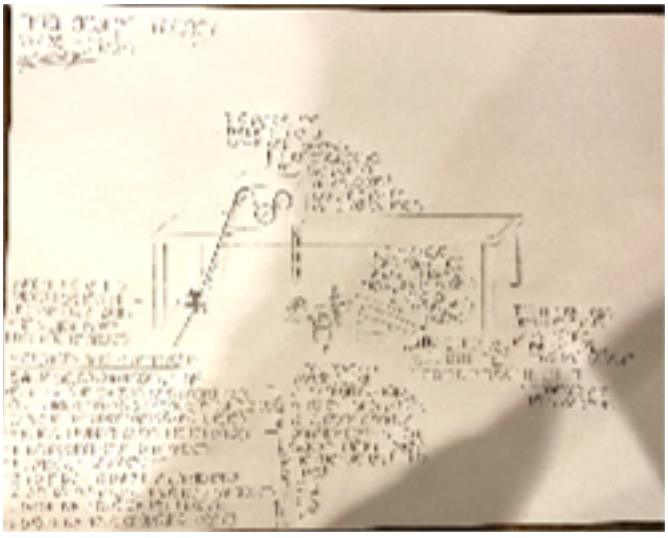


1. The mechanism starts with a domino landing inside a cup. This cup is attached to a string which, when unwinded, starts up the gear and chain machine(made of cardboard)
2. The next part, a small box attached to the chain hits a ball, offsetting the lever’s balance allowing the ball on the other side to fall.
3. The ball rolls down an inclined plane and hits a weight.
4. The weight is attached to a group of three pulleys and a platform used to lift Santa up.

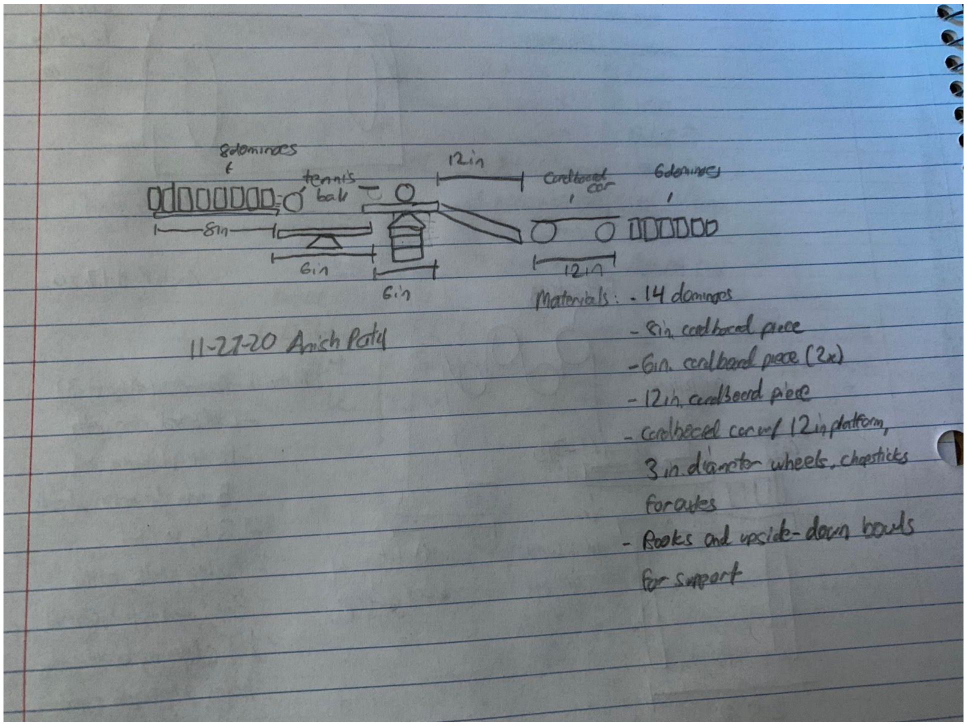
Design Proposal:



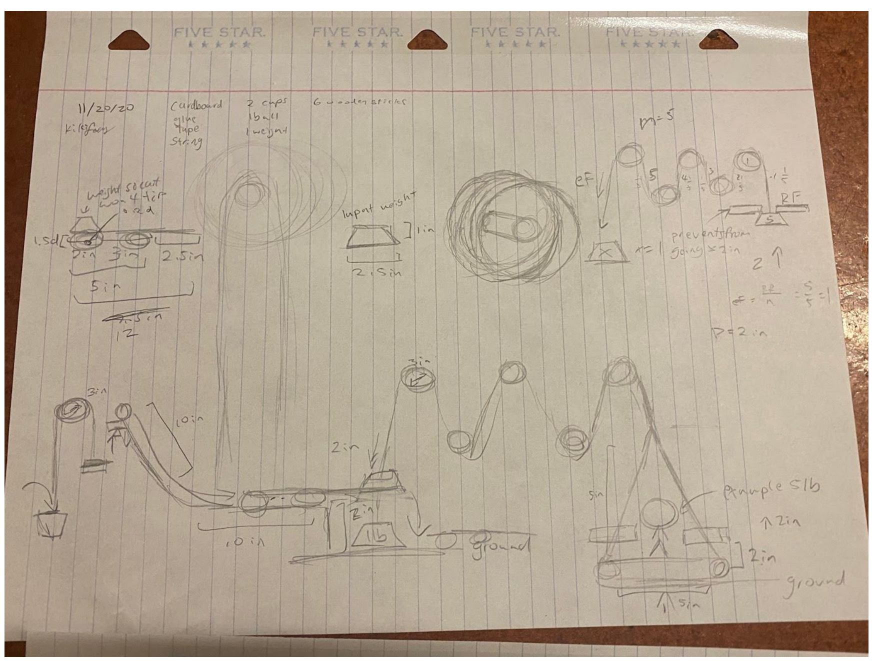
Trigger pt 1:



Capture pt 1:

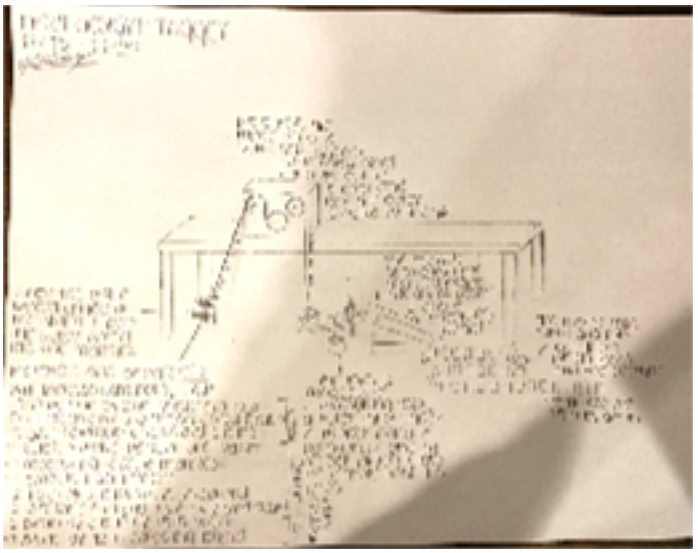

8dominoes
tennis ball
12in
cardboard car
6dominoes
8in
6in
6in
12in
Materials: - 14 dominoes
- 8in cardboard piece
- 6in cardboard piece (2x)
- 12in cardboard piece
- cardboard car w/ 12in platform, 3in diameter wheels, chopsticks for axles
- Books and upside-down bowls for support
11-22-20 Anish Patel

Capture pt 2:


FIVE STAR.
11/20/20
input weight
ground
ground

Modifications:

Trigger (Gracy Sutaria)

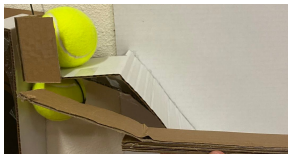


1. I added two more pulleys connected to the first pulley and placed them in a box. (11/25/20)
2. I changed the materials I used for the first class lever.
    a. Instead of a paintbrush attached to foam, I used toilet paper for height added on to the measuring tape used as a fulcrum. (11/27/20)
3. I decided to add an inclined plane.
    a. I made the inclined plane out of two books and a chopping board which helped the marble roll down easily. (11/28/20)
4. All these modifications can be seen in this new sketch.

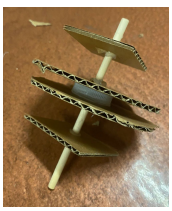
Capture: part 1 (Anish Patil, 11/29/20)

1. Increased the number of dominoes used at the start of the mechanism
2. Replaced ping pong balls with tennis balls, which are heavier and apply more force to the levers
3. Replaced pulley system and weight with a lever, which hits a ball that goes down an inclined plane and hits the cart
4. Used books and bowls to support levers, and are used as fulcrums, as well as 6 dominoes

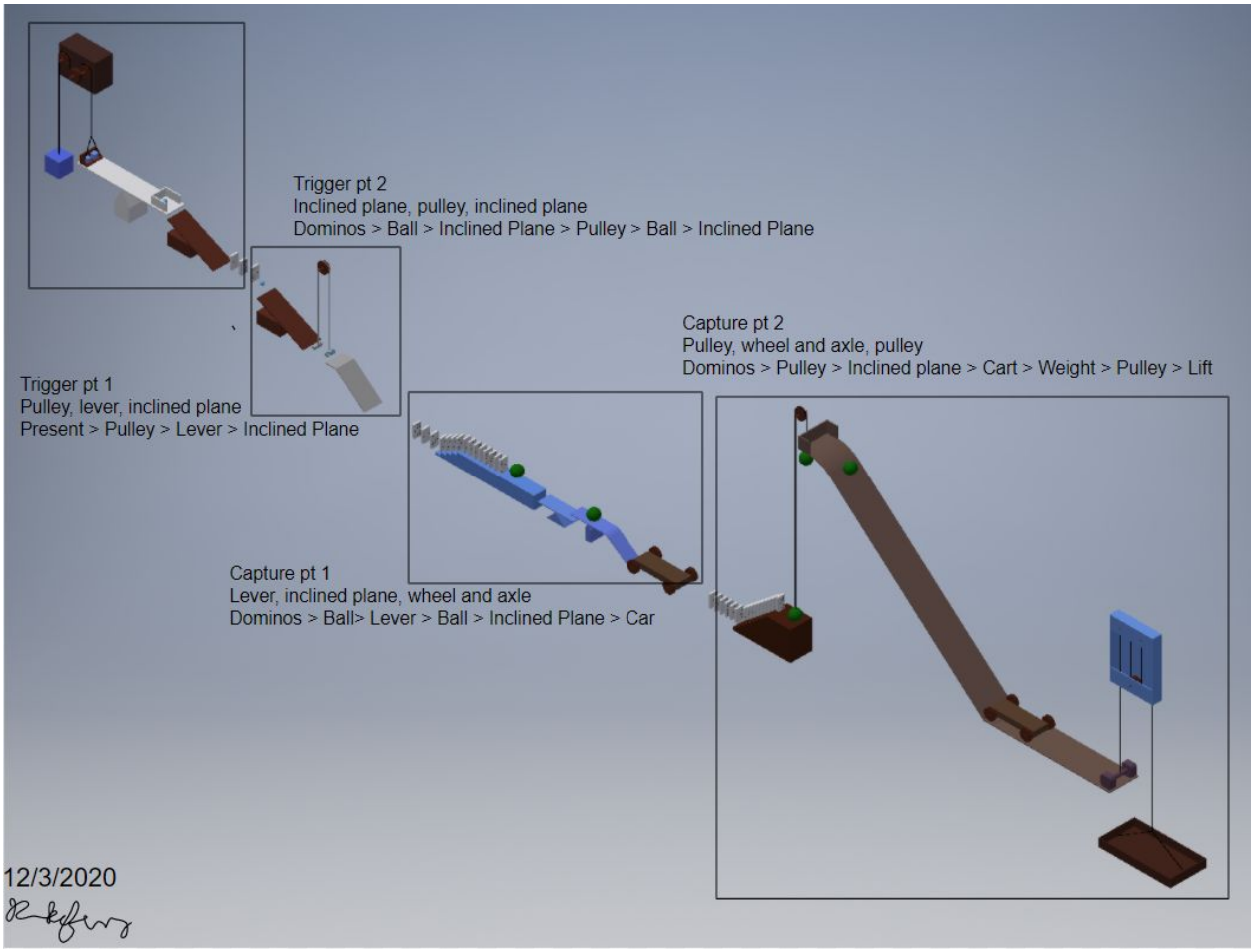
Capture: pt2 (Kiki Feng, 11/26/20 for all)



1) connected the flap to the ramp (originally two separate pieces)
    a) the edge of the flap is now connected to the edge of the ramp allowing more stability and makes the parts move better
2) attached the pulleys to a cereal box rather than them being separate
    a) keeps all the pulleys together and makes it so the frame is stable, previous idea didn't work either
3) Attached a bottle of milk to the cart, changes it so the car knocks over the weight
    a) The cart was too light to push the weight, adding the milk increased the weight allowing it to work
    b)



Final Design Description:
Our final design starts with the trigger which is set off when Santa places a 1lb gift on top of a string which is connected to the pulley made out of cardboard and a bottle cap. When this happens a cart full of marbles are lifted from the first class lever. The lever consists of a ruler, a measuring tape as the fulcrum, and toilet paper to give it some height. After it is lifted, a marble attached to the opposite side rolls down the inclined plane which is made out of a chopping board on top of two books. Once it rolls down it hits several dominoes which leads to the start of the capture. The capture is set off by dominos hitting a tennis ball. The tennis ball rolls onto a lever with the fulcrum close to the left of the platform, which tips upward, and hits another platform with a tennis ball. This ball rolls down and hits a car. The car initiates the second part of the capture. Once again, it hits a row of dominos, this time going up a set of cardboard stairs. The final domino pushes three wheels down triggering a pulley where the right side hits a lever. This lever knocks a ball down a ramp, hitting a car. That car rolls and hits a weight attached to a pulley. This pulley demonstrates lifting up santa.



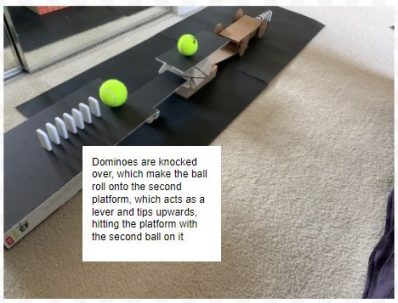
Trigger

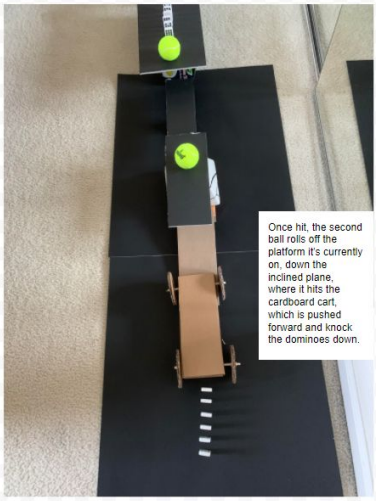
When a 1lb gift is placed on the string that is attached to the pulley, it pulls a cart with marbles in it off of the lever which causes the marble on the opposite side to drop.

The marble goes down the inclined plane which then hits several dominoes and leads into the capture.

Gracy Sutaria, 12/04/2020

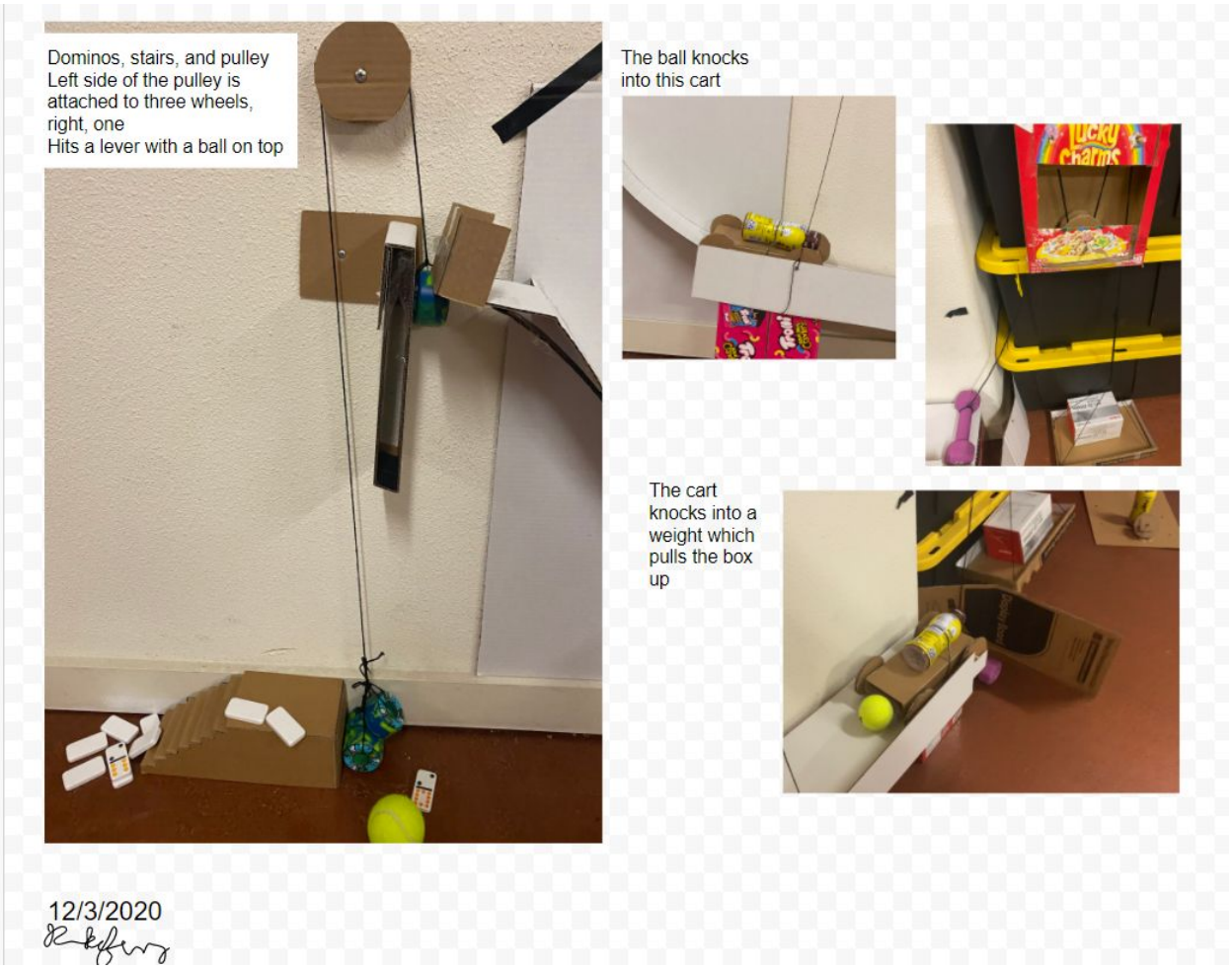
Capture pt 1



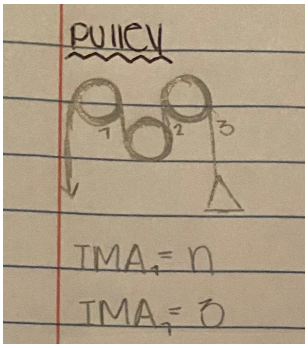


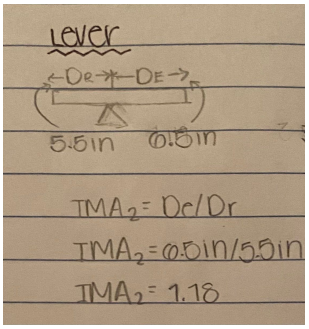
12-3-20

Capture pt 2


Dominos, stairs, and pulley
Left side of the pulley is attached to three wheels, right, one
Hits a lever with a ball on top
The ball knocks into this cart
The cart knocks into a weight which pulls the box up
12/3/2020

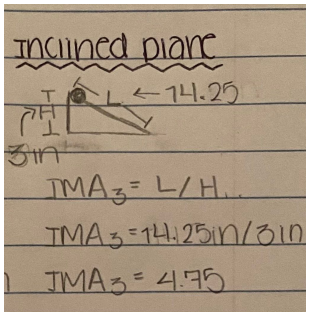
Final Design Evaluation:





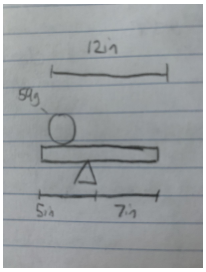
Trigger (Gracy Sutaria)

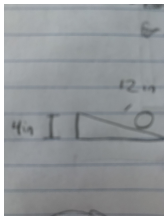
- Pulley
  - IMA_1= total # of strands
  - IMA_1 = 3
- Lever
  - IMA_2 = De/Dr
  - IMA_2 = 6.5in/5.5in
  - IMA_2 = 1.18
- Inclined Plane
  - IMA_3 = L/H
  - IMA_3 = 14.25in/3in
  - IMA_3 = 4.75
- Total
  - IMA = IMA_1 x IMA_2 x IMA_3
  - IMA = 3 x 1.18 x 4.75
  - IMA = 16.815

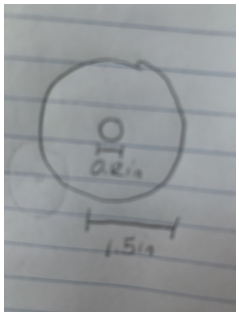


Capture part 1 (Anish Patil)

- Tennis Ball Lever:
  - IMA1 = De/Dr
  - IMA1 = 7in/5in
  - IMA1 = 1.4
- Tennis Ball Inclined Plane
  - IMA2 = De/Dr
  - IMA2 = 12in/4in
  - IMA2 = 3
- Cardboard Cart
  - IMA3 = De/Dr
  - IMA3 = 1.5in/0.12i
  - IMA3 = 12.5
- Total
  - IMA = IMA1xIMA2xIMA3
  - IMA = 1.4x3x12.5
  - IMA=52.5

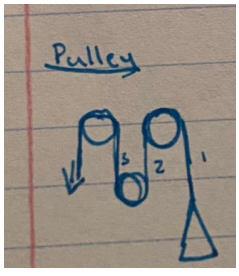




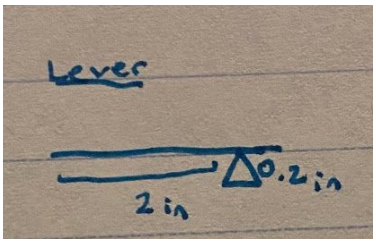


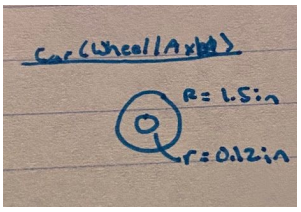
Capture part 2 (Kiki Feng)

- Pulley
  - IMA1=n



    - n=3strings
    - IMA1=3
- Lever
    - IMA2=De/Dr
    - IMA2=2in/0.2in
    - IMA2=10
- Cart
    - IMA3=De/Dr
    - IMA3=1.5in/0.12in
    - IMA3=12.5
- Total
    - IMAt=IMA1xIMA2xIMA3
    - IMAt=3x10x12.5
    - IMAt=375





Full Machine

- IMAt=IMA1xIMA2xIMA3
- IMAt=375(52.5)(18.815)
- IMAt=370,420.31

Link to Video:
https://drive.google.com/file/d/1klhL27a-A02gJPidBlinEWzGQXcHXRoU/view?usp=sharing

Paragraph:

The parts of the machine that do the trigger complete the task perfectly. However there are some inefficiencies like the marble rolling down the ramp and not hitting the dominoes or strings attached to the pulley that get stuck after multiple uses. The chopping board on the books can also fall, not completing the task or continuing the machine. Some parts like the pulley can encounter friction when pulled too hard by the gift. In general, this part of the machine wouldn't last long because the string that is part of the pulley would eventually break. Some improvement if given more time would be to thicken the string by twisting them together and use a better fulcrum for the levers so that they are more sturdy.

The capture portion of the machine is able to complete the task fairly well. There are parts that encounter friction which may slow down or cause the machine to not function properly. These parts include the dominos toppling over, pulleys not working, string getting caught on parts, or the cardboard being damaged after multiple uses. Friction can be encountered when the axle is being blocked or when the string is turning the pulleys. Overall, the machine would be able to

survive a few uses, but after that, it most likely will not function anymore. This is mainly due to the way the pulleys were made since the string tends to get caught between the bottle cap and the cardboard. Improvements can include a better seal on the pulleys, thicker cardboard, stronger and thicker string to reduce friction(can be done by braiding or tying the string together), and we could have spent more time making the levers more stable and reliable.

Sources Used:

Pulley
4:17Video How to make a pulleyYouTube · Shae HaylenOct 23, 2016