

ENGINEERING

MACHINE DESIGN CONTEST

Bob's Builders Team Journal

Jane B, Sophia W, Ary B



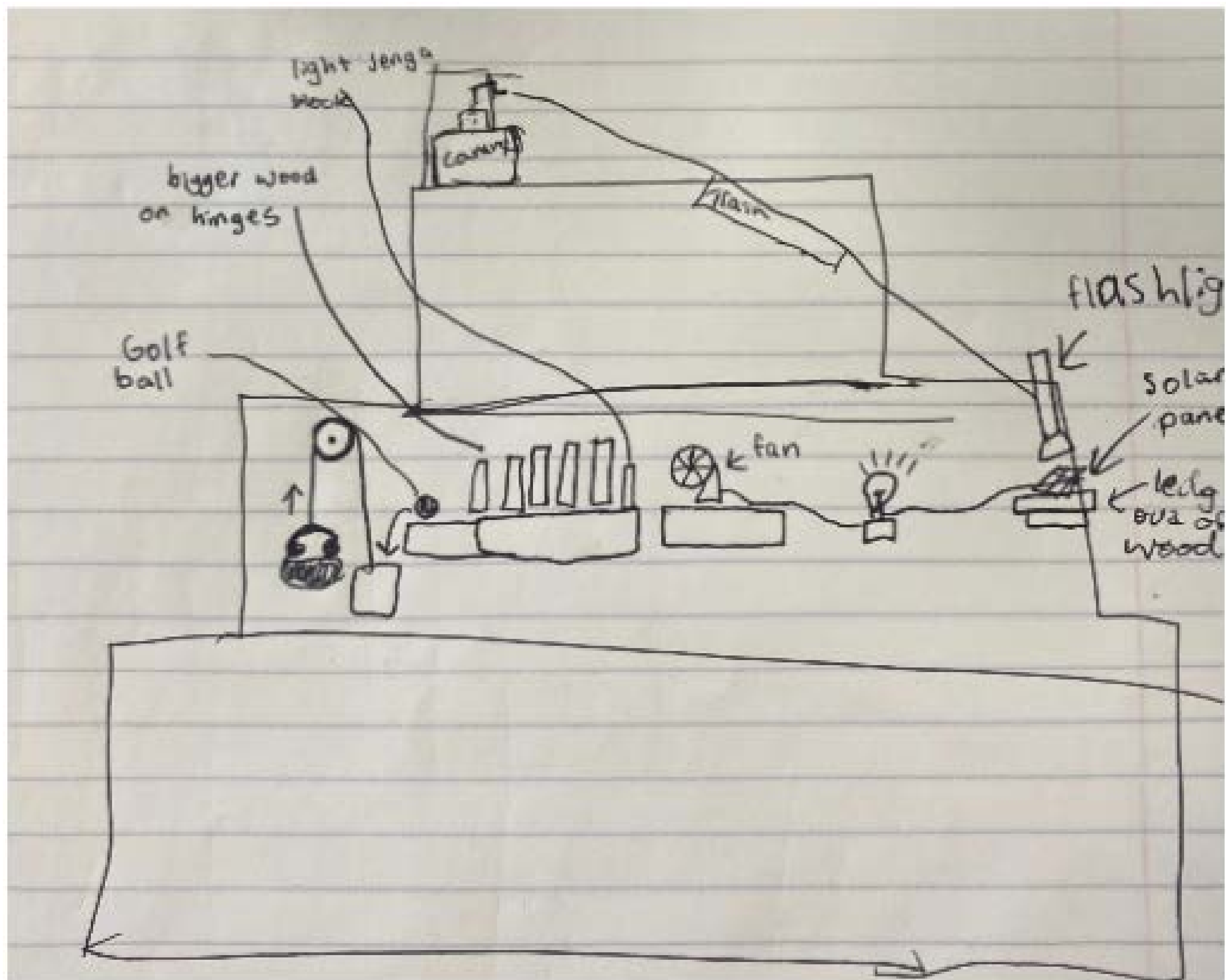
Wildlands Highschool
Coaches : Alexa Hurd and
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Table of contents

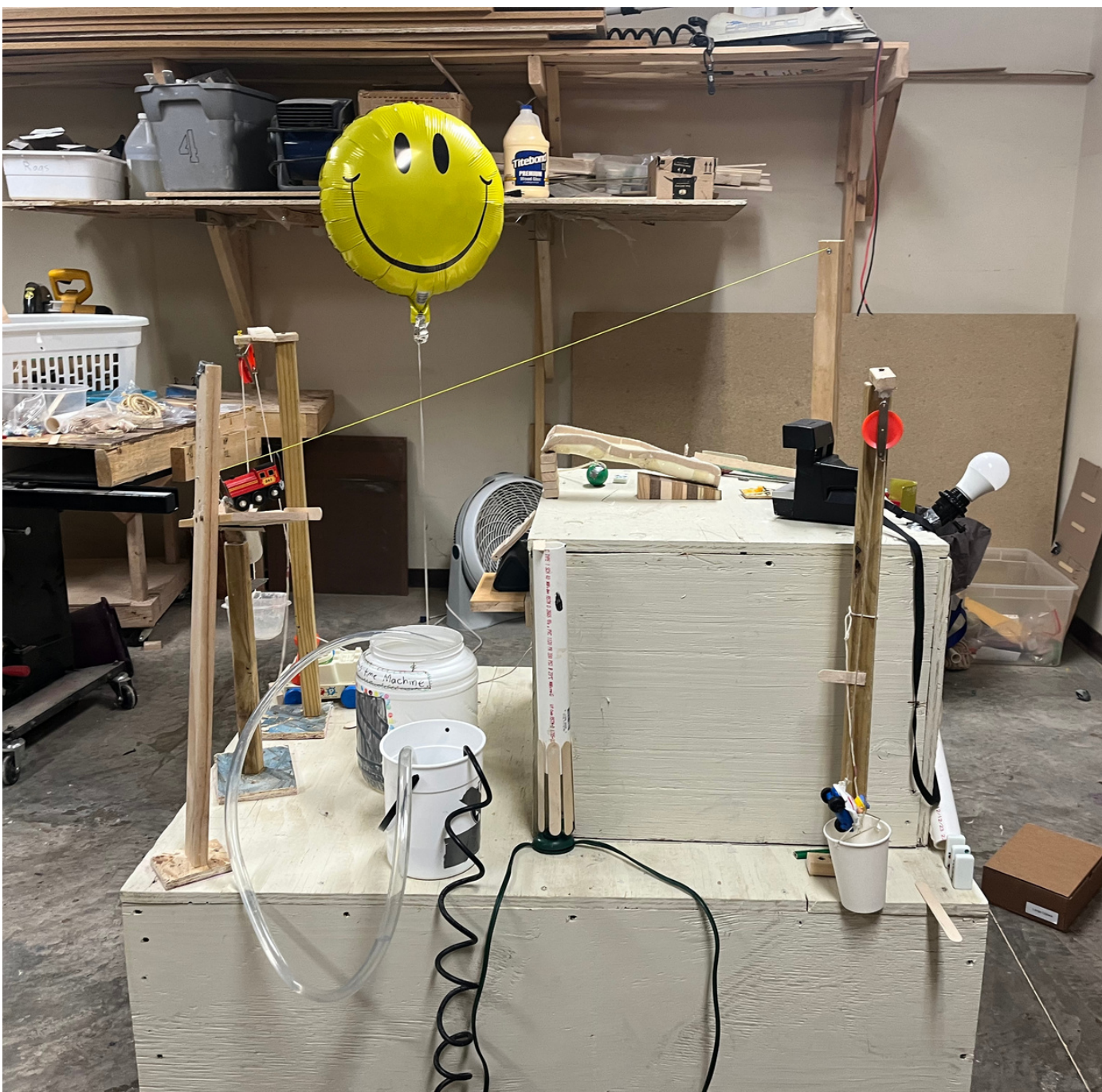
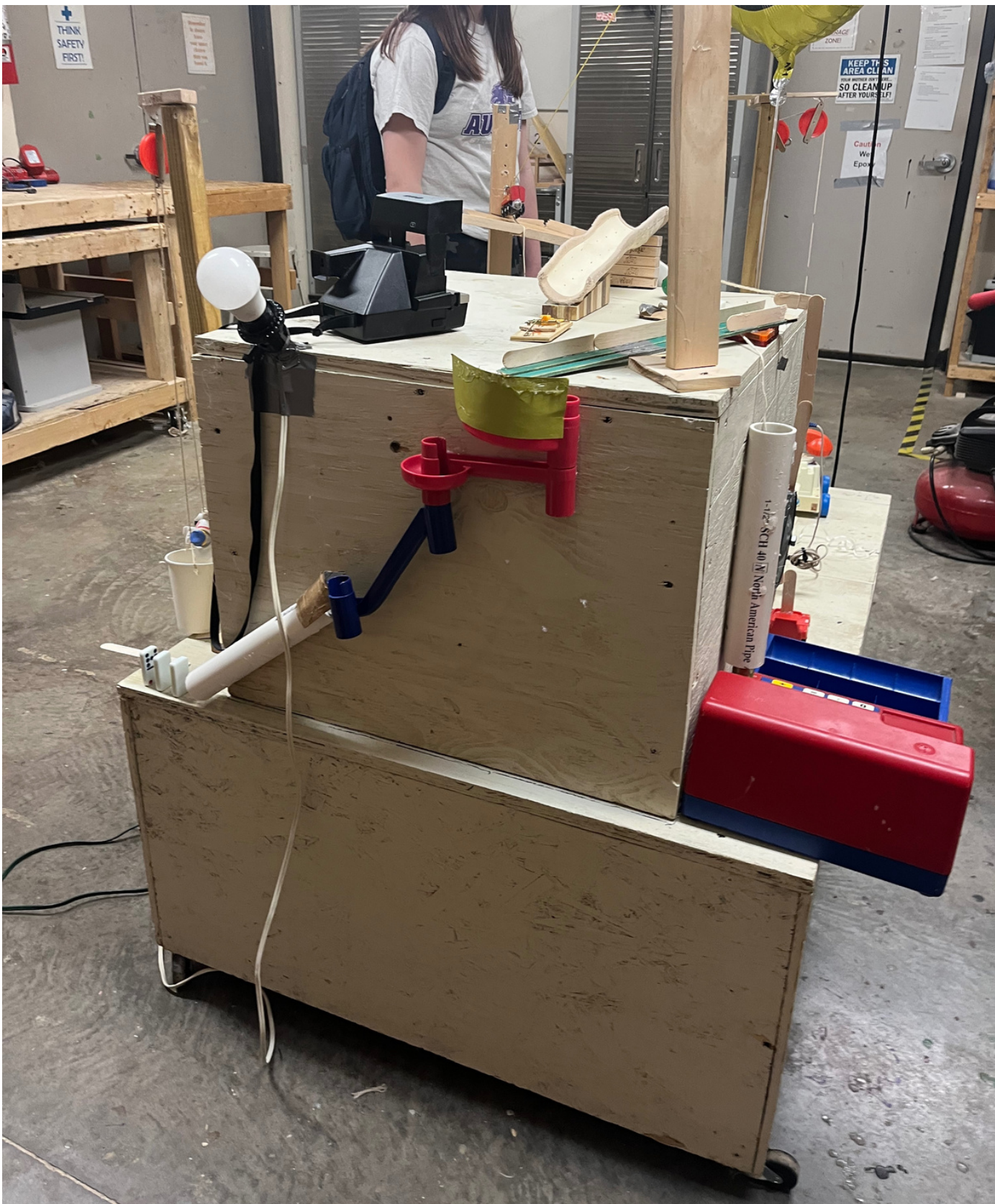
- 1. Planned machine design sketch and description**
- 2. Near final machine design**
- 3. Machine Steps**
- 4. Materials**
- 5. Stem Process: Mechanical Component**
- 6. Stem Process: Electrical Component**
- 7. Stem Process: Fluid Component**
- 8. Stem Process: Chemical Reaction Component**
- 9. Personal Reflections**
- 10. Bibliography**
- 11. Daily Journal**
- 12. Photos**

Planned machine design sketch and description



Here is our original design! This design ended up being pretty unreliable, so we had to take some steps off and get rid of one of our layers. We were going to have a polaroid picture would come out of the camera, that would move a piece of cardboard. The cardboard would let a train go down a string and hit a flashlight, that would power a solar panel and give power to a light bulb and a fan. The fan would blow over jenga blocks, then hit a ball that would roll into a pulley system. After a bit of research, we figured out that a flashlight could not power a solar panel. We only planned a few steps to begin with because we only had about 3 weeks to make the whole machine.

Near Final Machine design



Here is our final machine! I decided to show you photos instead of drawing it because the odd shape would make it hard to understand.

Machine Steps

Step 1 - Camera's button gets clicked releasing the train down the zipline

Step 2 - Train hits marble, making it go down PVC pipe.

Step 3 - Marble falls in bucket attached to pulley

Step 4 - Phone on other end of pulley lifts- releasing the balloon

Step 5 - Balloon floats up - triggering the piece of wood on a hinge to fall

Step 6 - Piece of wood on a hinge falls and hits the cord into the speaker, causing music to play. The ball on top of the piece of wood falls.

Step 7 - The string attached to the ball releases another ball, causing it to roll down a ramp

Step 8 - The ball hits a mouse trap

Step 9 - The mouse trap releases a string attached to a metal pipe

Step 10 - The metal pipe hits the OPEN button on a toy cash register

Step 11- The drawer of the cash register hits a toy car

Step 12 - The toy car hits a popsicle stick on a wheel - making it spin

Step 13 - A long popsicle stick on the other end of the wheel hits a marble

Step 14 - The marble rolls down a track and through the marble ramp, also through a PVC pipe, it hits a domino

Step 15 - The dominos fall and one domino falls in a cup attached to a pulley, making it go down

Step 16 - A toy plane on the other end of the pulley hits a string attached to a popsicle stick

Step 17 - The popsicle gets pulled, dropping the heavy marble that was ballanced on it

Step 18 - The marble hits a button on the extension cord. That turns on the lightbulb and the water pump

Step 19 - The water pump brings up hot water from the bucket like a syphon.

Materials

<u>Item</u>	<u>Cost</u>
plywood	recycled
electrical wire	recycled
toy train	recycled
cardboard	recycled
pvc pipes	recycled
pulleys	\$0.50
buckets	recycled
toy phone	recycled
balloon	\$1.25
jenga blocks	recycled
marbles	recycled
CD player	already owned
speaker	already owned
paint	already owned
screws	already owned
ramps	recycled
hot glue	\$4
plastic egg	recycled
yarn	\$2

mouse trap	\$1
metal tubes	recycled
toy cash register	recycled
toy car	recycled
popsicle sticks	recycled
marbles	recycled
dominos	recycled
plastic cup	recycled
extension cords	already owned
lightbulb/socket	already owned
toy plane	recycled
water pump	already owned
duck tape	already owned
dry ice	\$5

Total Cost: \$13.75

% of recycled materials: 84%

Stem Process : Mechanical Component



For one of the mechanical components, we added a pulley system to our machine, for that component we had a ball roll into the bucket making the bucket go down, pulling the phone up. Instead of adding just one pulley to lift the phone we added two to distribute the weight and spread the phone and bucket farther apart. The mechanical component was the easiest component to incorporate it into the machine. We also had more mechanicals components like inclined planes for marbles to roll down.

Stem Process : Electrical Component



For the Electrical component we added a light bulb to our machine. When a heavy marble gets released it will hit a green button that is on a extension cord, making a light bulb turn on. The light bulb turns on by the metal used to make the filament glow When it becomes hot. Thus we have light. Because the filament is so thin, it heats up really fast. We had trouble getting this to work because we didn't own the right materials and the light bulbs that we did own were not bright enough. Eventually, Jane found exactly what we needed in her basement!

Stem Process : Fluid Component



For the fluid component we have a fluid pump that pumps warm water thorough a tube and will release the water on dry ice that will make the dry ice produce white fog. The fluid pump works by displaces air, decreasing the pressure and creating a partial vacuum, so that the water can be sucked through the tube. the photo above is a picture of the water pump.

Stem Process : Chemical Reaction Component



For the Chemical Reaction we have hot water pouring on to dry ice. The hot water from the fluid component, pours over the dry ice to make it start to fog. Hot water makes the dry ice turn in to a gas more rapidly. The air around the dry ice condensate into a thick fog.

Personal Reflections

Sophia

I really like working on this project. I was gone for a little over a week before the competition so I didn't really get to work on it a lot. The thing that I struggle on the most was probably staying on task and not working on the machine as much as I should have been. I think that the team could have done better with is probably trying to start the project earlier and to work more on the machine more in the beginning of the project. The thing that I would do better next time would be not procrastinating. The thing I enjoyed most is coming up with fun creative steps to put in our machine. I liked it because there was no limit you could be as creative as you wanted. Over all I loved this project I would definitely want to do it again.

Jane

I had a very good time doing this project. I'm glad that we all communicated good. One thing I would change would definitely be when we started. It was super stressful trying to get everything done on time because we only had about 3 weeks to do it. I wish that the team could have got together more. My favorite part was coming up with all of the step ideas. It was the best feeling ever when I got a difficult step to work. I would definitely do this project again

Ary

I liked this project a lot, I was my first year being able to do this project. We started it a little late and that made it a challenge to get it done one time. I wish that we all could have worked on it together more, but with the time line we had we just had to do what we had to do. And bring it to Janes house witch made it hard for us all to work on the project. Are team worked rreally well together I would say, we listened to each others ideas . I enjoyed doing research and looking at ideas that we could use and putting the steps together. I would definitely do this project again.

Bibliography

<https://www.youtube.com/watch?v=nGR9zo1oZlw>

We watched this video because we wanted to make this our chemical component. After more research we realized that this reaction is unsafe to have indoors around a lot of people.

Jake Fields

Our teacher Mr. Fields helped us brainstorm ideas and he also helped us find materials around the school. He helped us with different chemical components that we could use.

<https://www.youtube.com/watch?v=JpV-aEIMA2o>

We used this for step ideas. We found a few things that we could use.

<https://www.scienceworld.ca/resource/lemon->

This video showed us some chemical reaction ideas.

Barb Black

Barb (Jane's mom) helped us brainstorm lots of steps. We are glad that she was able to help us! She helped us with our specker step idea.

Erick Schimnowski

Erick (Jane's brother-in-law) Helped with steps a lot. He is an engineer so his suggestions were super helpful. But mainly helped us with the plane hitting the marble.

<https://www.youtube.com/watch?v=VpLDfkLBJ0Q>

We used this video for step ideas.

Daily Journals

February 8th

This was our first official meeting! We talked about what steps we wanted to incorporate that fit well with our idea. We wrote down a big list of things that were a part of the evolution of technology. Jane found what year each of them was invented and then she organized them by date. We each decided to make sketches for each step.

February 12th

Today we showed each other what step ideas we came up with. We decided to get rid of a few steps because they were not important to the evolution of technology.

February 14th

We discussed what we wanted the base of our machine to look like. Jane made a sketch of what it would be and then she wrote measurements for all the wood we needed. We decided on a 3 - tier base because we wanted to do something unique.

February 20th

Jane built the top half of the machine. Ary built the base and middle tier. They worked on them at their houses.

February 22nd

Today Jane and Ary painted their base parts white. We both painted a primer and a regular coat.

March 8th

Today we met at Ary's house and we talked about the plans for the machine again. We also looked at the base. We brainstormed a bunch of different steps

March 11th

We all unloaded the machine from Ary's truck to our school shop. After a bit of brainstorming we decided to not use the top tier because our machine would be too tall. We built the zipline step. It took a lot of trial and error but we figured it out. Jane figured out how to make the camera step work. That also took a lot of trial and error.

March 18th

Today we put the wheels on the bottom of machine. We also made a phone and finished the phone lift step. Jane took it home to work on it because

March 20th (Jane at home)

Today we worked on it at school brainstorming steps and finding materials. Then I (Jane) took it home because we are running short on time. When I got it home I re-adjusted the steps we had on because they moved around in transit. I tried a few different chemical reactions but none of them were what we wanted. My dad told me that vinegar and baking soda would give the fizzing effect we wanted. It worked great.

March 21 (at school)

today we worked on the layout of the journal. We decided to work on canva because google docs is harder to work on.

March 21st (Jane at home)

After I got home from school I started getting more steps on. I found a kids phone toy to use for our phone step. I also tried to find a way to get the train to go down the zipline. I was unsuccessful today but I have some more Ideas.

March 22nd (at school)

Today we worked on the journal. We added the steps that we have to the step list.

March 22nd (Jane at home)

When I got home from school I began to think of more steps with my mom. She had some good ideas that I kept in mind. I kept trying to get the train to go down the zipline but was stumped again. I built a lever for the balloon to hit out of plywood and cardboard.

March 23rd (Jane at home)

Today got a balloon for the balloon step. I'm glad I finally got it because now I can keep going with other steps. I Attached the balloon to the machine and also attached a jenga block to the phone to hold the balloon down. I thought that the lever thing I built would work but it was being really difficult.

March 24th (Jane at home)

Today I kept working with the balloon and lever. Eventually I had to take off the lever part because the balloon wasn't hitting it up with a marble on it. I tried for about an hour to build a step to get the CD player to play but nothing I tried worked. I finally found that using only 1 train and hanging it from the zip line with paperclips worked great every time. I was so relieved.

March 25th (Jane at home)

Today was a snow day so I got lots done. The ramp before the PVC pipe got bumped and the sides I attached to it got knocked out of place. I tried to fix it but I ended up just taking it off and building a new, more reliable one out of plywood.

March 26th (Jane and Ary at home)

Today Ary came over to work on the machine. Jane's brother Sam also worked with us. we got the ramp on the top of the machine. we also got a plastic egg to drop and release a golf ball. We tried to get the ball to hit a water bottle into a wheel system but we figured out that it wouldn't work. Sam and Ary found a cash register that shot open when a button was hit. They created a cool step with that.

March 27th (Jane at home)

Today I decided to replace part of the mechanism that Sam and Ary built for a mouse trap. It was more reliable and worked great. I moved the wheel thing to the side of the machine and made that into a step. I tried to work with baking soda and vinegar to push a ramp up but I couldn't get it to be reliable. I was disappointed about that.

March 28th (at school)

Jane and Ary worked on the journal. We assigned tasks for everyone.

March 28 (Jane at home)

Today I tried to get the wheel thing to trigger dominos. I decided to get rid of that idea because it was too unreliable. I made a ramp and got the sticks on the wheel to hit a marble down it.

March 29th (Jane at home)

Today I added some marble ramps to the back of the machine. I was mostly working on perfecting the earlier steps.

March 30th (Jane at home)

Today I made another pulley system on the side of the machine. My brother-in-law helped me because he is an engineer. we added a tube from the marble ramp and then put 3 dominos after it. We made it so the last domino fell in a cup on the pulley.

March 31st (Jane at home)

Today I was working under a lot of pressure. It is Easter Sunday and that means company is over! My sisters and brother-in-laws gave me more advice that was helpful. I added a plane to the other side of the pulley. I tried to have a ramp that it would hit but that didn't work. I figured that part out with some help. Then I finally added the lightbulb step. That was fun to see go off. Next I found a water pump in my basement. My dad showed me how it worked. I was so happy because it was exactly what we needed. That made the water powered step. Since it is a day before I have to bring it into school, I am just trusting that the dry ice step works for our final steps!

April 1st (Jane at home)

Today me and my brother brought the machine to school because tomorrow is the competition! I bought the dry ice, finalized the journal, and made the presentation!

April 5th (at school) today we worked on getting the machine running. We had to reglue on all of the steps on our machine.

April 8th (At school) we spent more time on getting the machine ready for the competition. We needed to get the steps to the machine and make sure it runs smoothly

April 9th (at school) we worked on getting the machine ready putting it all together. We then ran through half of our machine making sure it works. we also updated our journal and made changes to it.

Photos of our Process

