Engineering Design Competition Journal

Anoka High School Team Sparkle Darts



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Planned Machine Design Sketch and Description Page 3:

When we first started with what theme we had wanted to do, we had many ideas ranging from Star Wars to the Jetsons. Over time we had landed on the idea of what a space mission might look like in the future. We originally started by designing the box. This was the foundation to the further development of the machine as a whole.







#3 Each of our team members contributed ideas to the creation of our machine; some of these ideas included a "space elevator" (reaction chamber facing upward), and a planetary landing in water. Ultimately, our



design was to utilize a Sodium Chloride and Magnesium to resemble the idea of a space elevator. This would transition to a ship launching from orbit above the planet (machine base). It would progress by having the ship fly through an asteroid field which would have parts fall off and trigger different reactions. At the end, the ship would release a ball (capsule) that would orbit a foreign planet. Then it would work its way back to Earth where it would land in water.

Unfortunately, this design wasn't meant to be due to logistical errors and lack of foresight, we had to swap our tactics. The new design was to utilize a much shorter chamber and use a Alka seltzer and water reaction. While more simplistic, this allowed a more practical and creative resolution to the constraints of our construction process.



Final Machine Design and Sketch Page 5:



The machine starts here with a balloon filling up with gas, this gas is created by combining alka seltzer and water. This is the first step of our machine.



The marble will fall and activate a switch, which in turn will turn on the conveyor belt moving another marble. Which will knock over the hanging bering that is sitting on a "U" bracket. That bering will run to a wooden plank that will also knock into the toy car.



The toy car will be pushed forward and push a marble into a paper bowl. Due to the weight of the marble the board will tip. This tipping will cause a weight to fall and land on the blue pressure plate and cause water to be pushed through the clear tube. The pressure will build and cause the syringe plunger to move outwards and trigger a marble to roll down the ramp and hit the spinning dowel. Which in turn will allow another marble to roll down and hit a button triggering LED's to go off.



The LEDs will cause a light sensor to spin a motor, this will spin our planet. After that a ship will crash into one space capsule which will cause it to fall onto the ground.

Machine Steps Page6:

*Step 1: Chemical Reaction: Alka Seltzer & Water reaction fills a balloon and lifts a ramp **Step 2:** 2 Marbles fall from the ramp and onto a lever *Step 3: Electrical Step: Lever pushes up on a button to spin a DC Motor **Step 4:** A chain spins around & hits a pendulum **Step 5:** Pendulum hits blocker for Hot Wheels car **Step 6:** Hot Wheels car hits marble *Step 7: Mechanical Action Step: Marble falls into a cup, which pushes a weight down the inclined plane ***Step 8:** Fluid Power Step: Weight falls onto the plunger of a syringe Step 9: Other plunger of the syringes pushes out, pushing a marble down a ramp Step 10: Marble hits a spinning pole, causing it to spin **Step 11:** Top part of the spinning pole hits a bearing, causing it to go down a track Step 12: Bearing hits button, lighting up an LED **Step 13**: The LED triggers the light sensor of a micro bit, causing a servo motor to spin Step 14: The servo spins our planet **Step 15**: One of the ships hits the capsule and lands in the ocean

* Denotes Advanced Component

List of materials

Purchased

| Items: | Cost: |
|--------------|--------|
| Styrofoam | \$4 |
| Syringes | \$8 |
| Marbles | \$1.29 |
| Cups | \$1.99 |
| Balloons | \$1.25 |
| Alka Seltzer | \$8 |

The project in total cost \$24.53

35.7% recycled

Recycled

| Quantity: | Material description: |
|-----------|-----------------------|
| | Cardboard |
| | DC motor |
| 3 | wires |
| | Plastic pipe |
| 3 | Vinyl sheets |
| 3 | Lipton bottles |
| | P.L.A filiment |
| 1 | "U" bracket |
| 3 | "L" brackets |
| 7 | Small plywood pieces |
| 3 | Wheel barrings |
| | Masking tape |
| 6 | Straws |
| | 200 gram weight |
| | servo motor |
| 12 | cardboard circles |
| | Light sensor |
| 1 | LED's |

| Material description: |
|-------------------------|
| Toy car |
| Black paint |
| PVC cement |
| popsicle sticks |
| Hot glue gun |
| Hot glue sticks |
| Paper bowl |
| Dowels |
| marbles |
| Roll of electrical tape |
| Button |
| funnel |
| microbits |
| 2x4 |
| plywood "4'4" |
| Spraypaint |
| |

Applied STEM Processes

Page 9:

Chemical reaction:

Pictures



The bottle is gonna get filled with water about ²/₃ of the way and fill the balloon with crushed alka seltzer. The goal is to have the balloon grow by having all the gas that is created by the combination of water and alka seltzer. By doing this the balloon will cause the wood plank to tip starting the events.

Electrical step:



This step involves a series of steps, a marble will fall into the funnel which will land on a plank and push the green button. This in turn will cause the conveyor belt to move.



Mechanical action:



The goal of this is to have the car get pushed and move a marble, the marble will then go on to land into the cup. The cup will then angle down slightly, allowing a weight to land onto the pressure plate



Fluid power:



This step is powered by the weight, the weight will push down on the syringe transferring the water to the other syringe. The pressure will push the end of the other syringe pushing another marble down the angled slope.



Reflection Page 13:

Through working on this project we have all learned better teamwork skills. We've all become better communicators, and we've all become better group members that can work together to make our project come to fruition. We struggled at first with everyone's schedules, because of that planning became more difficult, but we did make it work. We persevered and made schedules that worked for everyone involved. This project was stressful, but we made it work, and ultimately, we did have fun. We all had different strengths and weaknesses and learning to adapt to them was an interesting learning curve, but we made it work. We found things for everyone's unique skill sets to contribute to, and we worked together pretty well. It may have taken a while to find our footing, but we did and once we did we sprinted to completion. All in all, we've had our hiccups in our plans, but we still managed to push through it all and finish the project in a timely manner.

(word count: 168)

What has changed?

We have included a small bump instead of the tape on the pendulum, this should resolve the issue of having the pendulum be stuck in place. This should allow for more consistent runs. Also a dowel has been added to the



underside of the track, which should make the track more stable. Now the look of the project is also being worked on, the top of the planet is going to be attached to some fishing line. Also the water portion of the project will have a painting, and will no longer be painted bubble wrap. Also a new capsule is being 3D printed, and should look much better than the one we had before.





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