MOUSETRAP FINAL REPORT

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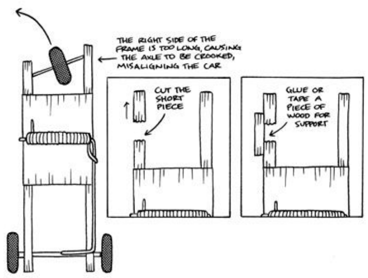
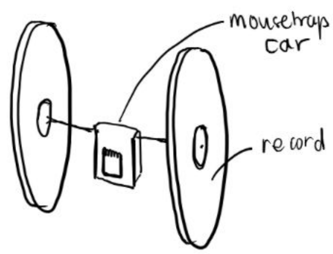
A. Explanation of other designs that you have considered but did not adopt

(including drawings, where necessary)





<u>Figure. 1 (left) Figure 2 (right)</u>

We first considered implementing this slanted front steering wheel design (Figure. 1) as our prototype. It has decent turning stability and sufficient contact with the track. However, we did not choose this design because it would've been too difficult to determine how much the steering wheel should be rotated in order for the car to turn with the correct radius; and if our first build was incorrect and the car didn't turn with the correct radius, then the whole body would've needed to be rebuilt because this design uses holes at the front of the chassis to fix the steering wheel to a specific direction.

We also considered the two-record-wheeled mousetrap car design (Figure. 2) . By making one of the wheels smaller than the other, we could achieve a smooth, curved motion. However, we chose our current design over this design after concluding that four wheels would provide our car with more stability. The use of records as wheels would've also significantly expanded the overall size and bulk of our car, making them not an ideal choice as wheels for this project since there are specific parameters to limit the width, length, and height of our car.

B. Description of Vehicle and Operation

Our mousetrap car is composed of a few main parts.

The first of these parts is the chassis. The chassis is constructed by laser cutting multiple parts based on a central design. The parts fit together like puzzle pieces and provides solid support on both top and bottom half of the chassis. Based upon need, the chassis could be cut using any materials. It's easily manufacturable nature adds to the versatility of our design.

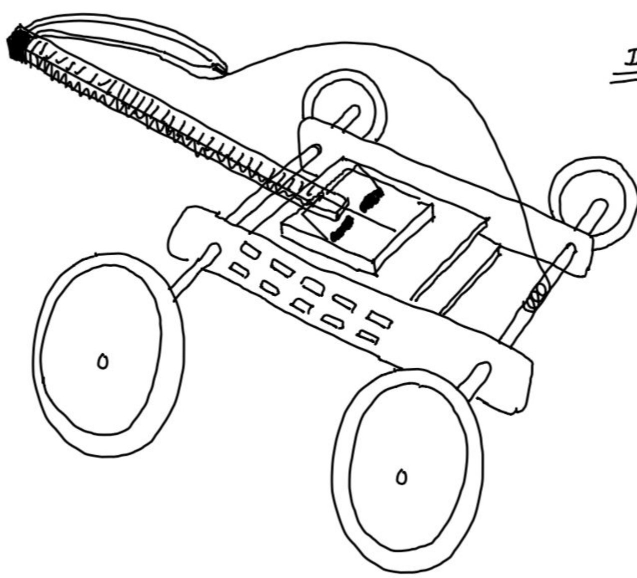
The next part of our chassis are the axles. For the axles, we chose aluminum. We realized that threaded steel rods added too much weight to our car; thus, we switched to light aluminum rods. The rods are strong, not easily malleable, and has smooth exteriors. These rods provide low friction spinning and guarantee fast and consistent speeds.

The next part of our design are the wheels. By offsetting the radius of the wheels, we have generated a consistent turning mechanism for our car. Originally planned to be a cone, the design was simplified into variable radius wheels. Although less stable, this design takes a lot of weight off of the car, giving the car more potential to generate force through the mousetraps' mechanism. Additionally, the wheels are coated with tape to generate friction for efficient rolling motion. To generate an accurate angle of turn, we performed multiple trials with different sized wheels until we were able to turn with the correct radius path. Theoretically, we could have solved the angle of turning using mathematical formulas. However, the friction of the wheels are not consistent, which means our estimations would have large inaccuracies.

To propel the car, we started with the sole use of two mousetraps. The two mouse traps were paired with a long lever arm to provide sustaining force to carry the car far enough from the starting line. However, the force was not enough to even get the car to start moving. To solve this problem, we decided to implement a rubber band into our design, using it as a key propelling factor. We wrapped the rubber band around the mousetrap's clamps so that when the mousetraps’ springs were compressed from the clamps being “opened,” the rubber band would also stretch, and store more elastic potential energy for the car to use for movement. The rubber band worked in providing a huge burst of force in a short duration, carrying the car a far enough distance forward into the end goal box. Using the natural friction of the car, the car then “brakes” in the box of the given mousetrap car track. Our design allows not for speed, but consistency in reaching the end goal. Although not mechanically complex, it is precise in its operation.

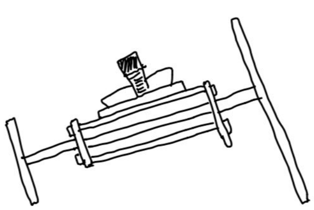
C. Drawing of Final Vehicle

(Isometric, Front, Side, Top)

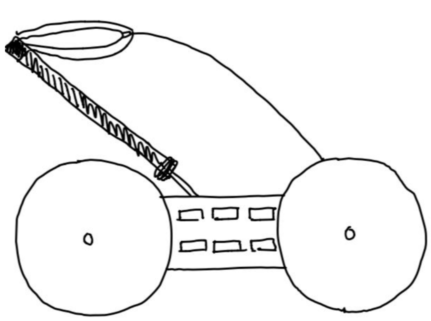


ISOMETRIC

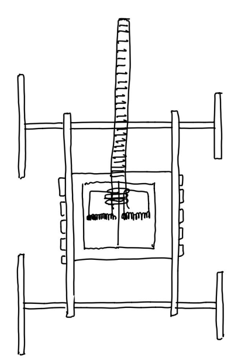
FRONT



SIDE



TOP



D. Description of good/not so good traits of Vehicle

In our current design, we kept concepts from previous designs. The advantage of our current car is that the car is capable of turning consistently. The base of our car is also easily manufactured since we laser printed the body with joints that can be assembled without any tapes or screws. Overall, the car is very accurate from our observed trial runs. Our wheels are designed to have variable radii on the two sides, making the turning radius easy to control. All we would have to do is print wheels of different radii to change the curve of the path that the car travels in. The car is also powered by a rubber band, strong wooden lever arm, and two mouse traps together, giving the car a consist torque throughout the run. The disadvantage of our current car is the speed. However, our priority was never the speed of the car. We aimed for the accuracy.

From our old car, we changed the material for the chassis, tires, and strings connecting to the mousetrap. We originally printed the chassis from acrylic. However, while providing aesthetics, we found acrylic to be far heavier than wood. To guarantee performance, we printed our final chassis with wood.. Secondly, we changed the surface of the wheel from electric tape to a rougher duct tape design. In our previous design, the electric tape did not provide enough traction for the car's wooden disc-shaped wheels. During the test runs, the wheels would slip on the group and the car would suddenly drift and turn around, showing that the electric tape wheels made the car neither stable nor consistent. After using the rougher duct tape, we never had the problem of the wheels slipping on the ground. However, then our problem became the fact that the turning radius of the car was too small : the car would just turn in a small circle and not even pass the first half-way gate. As a result, we changed one side of the wheel diameter from 2.5 inches to 4.5 inches to make the car turn in a bigger radius. Finally, we also made changes to the string connecting the axle and the mousetraps' clamps. Initially, we used only a fishing line for the connection. Later on, we realized that our car did not go far enough to finish the track so we added a rubber band in series with the fishing line to provide more power to the car when it was first being propelled. Finally, we were able to get the car to reach the end-box fo the mousetrap car track. sang.

E. Chart of Quantification of Vehicle's Performance

Trail #	velocity(ft/s)	distance(ft)	time(s)
1	1.54	9.56	6.21
2	1.32	8.95	6.78
3	1.30	9.32	7.15
4	1.34	9.84	7.32
5	1.46	9.78	6.68