

Los Pollos Hermanos

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All But this space is 3D printed

Represents top maximum thickness

Wall to stop overflow

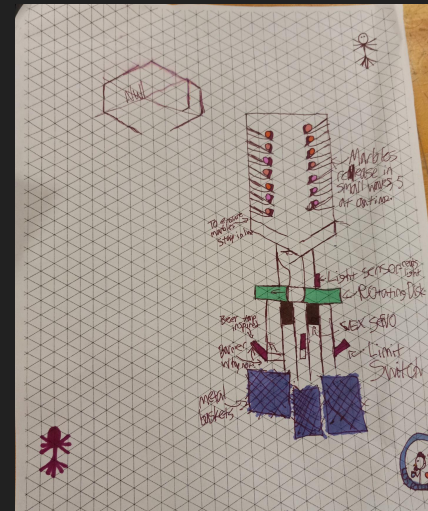
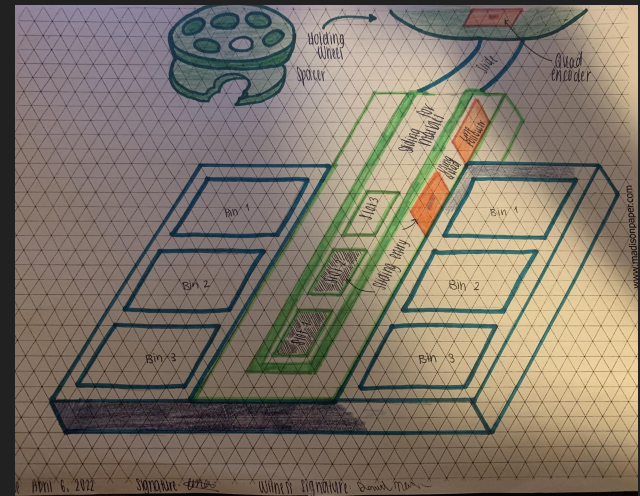
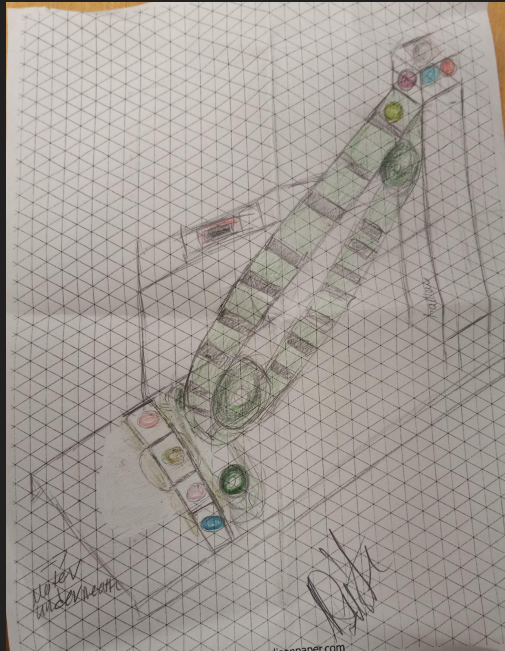
Nozzle

Extruder

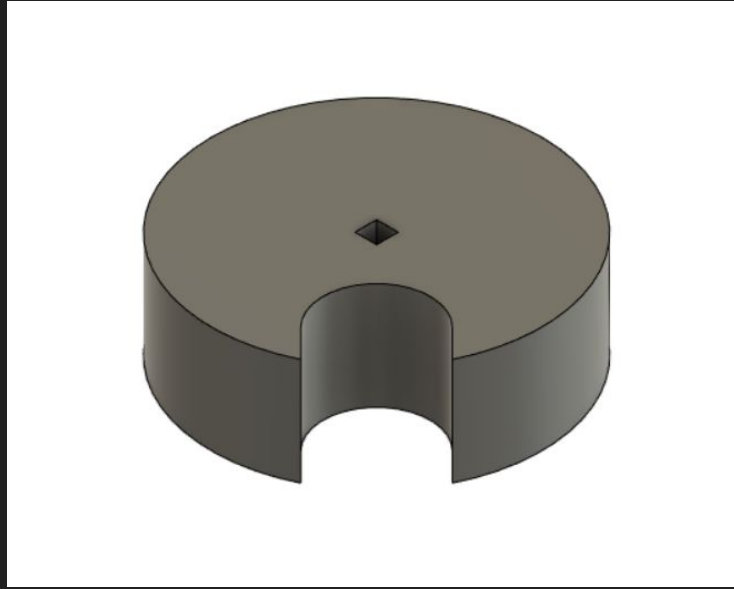
Holder that moves back and forth

Wall to support material from maximum desired spacing

Container



3D Model



*“One-Marble Stopper” on Fusion 360
Dimensions: 0.65 inches in height and 2
inches in diameter*



Decision Matrix

	Difficulty to Build	Difficulty to Program	Amount of Material Required	Efficiency	Total
Gumball-Inspired	4	3	4	2	13
Rotating Cups	2	2	2	3	9

Rated from 1-5, 1 being easiest or the lowest value and 5 being the most difficult or highest value. Lowest total value was used to build the sorter, as it provided for the easiest building process within the time being given.



Final design solution: Advancements in recycling technology

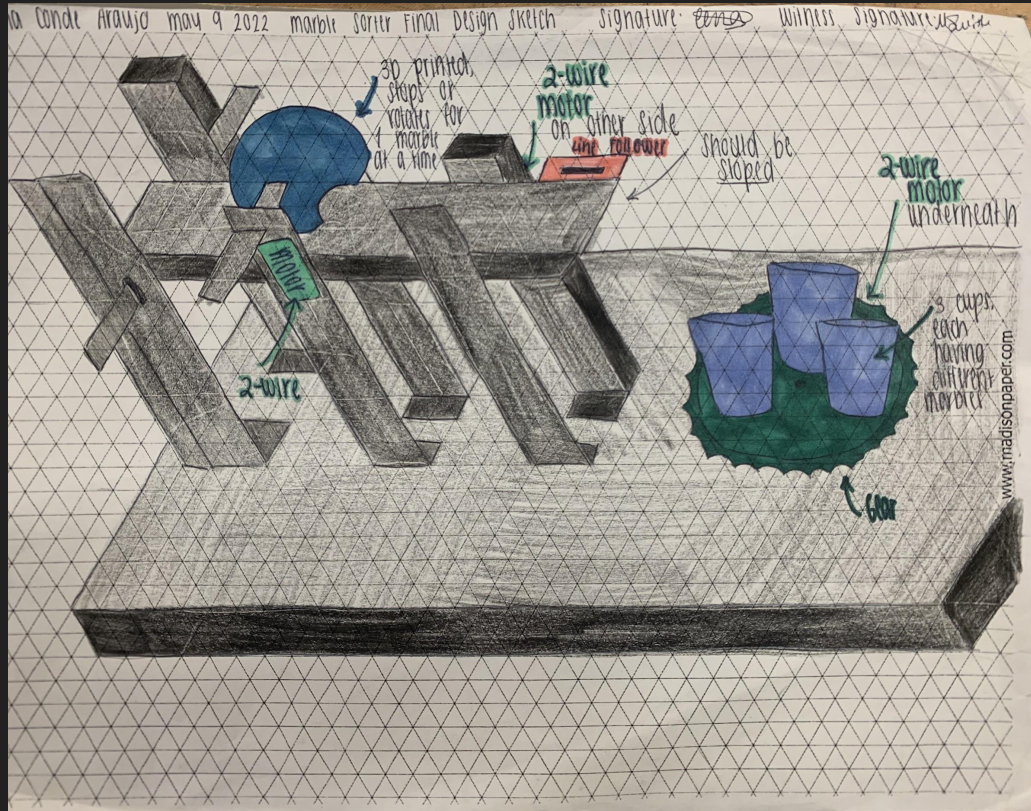
Through the years, the amount of waste has increased, demanding for a change in the waste system. In 1960, Americans generated an average of 2.98 pounds of garbage per day and has increased to as much as 4.51 pounds by 2017. Additionally, only 66% of that recycled paper, 27% of glass, and 8% of plastics are recycled. Therefore, it's demanded for a rapid development in recycling-related technology. It's estimated that said recycling technology will take 19 to 30 years to achieve wide use, and because of this estimated time period entrepreneurs are rushing to roll out such systems. An example of these systems is Rubicon Global, using visual recognition and machine learning to conduct screenings of its client's waste systems. The company has been able to receive as much as 269.1 million dollars in funding and continues to make headlines as the first unicorn of waste management.

Design Modifications

Design modifications include how marbles are dropped, using the “One-Marble Sorter” with a 2-wire motor, opposed to the gumball inspired design and the change in the sorting system to the gear rotating with a 2-wire motor to 3 different cups, each storing different types of marbles. Additionally, we added to quad encoders to rely on accurate sensor values instead of timing.



Final Design

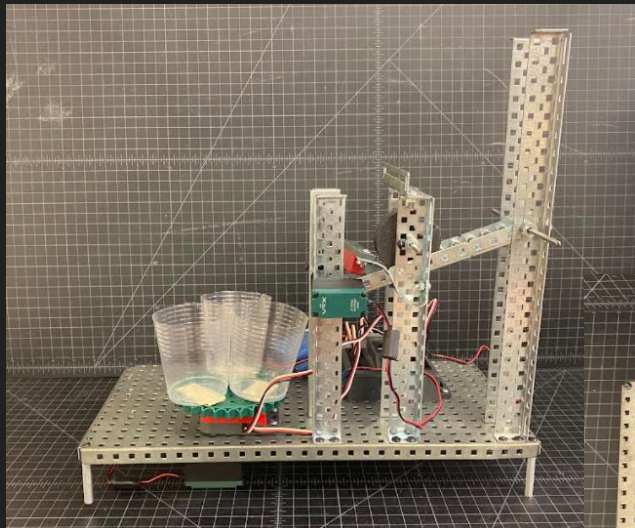


This is the final design sketch, the system uses a total of 3 2-wire motors and a line follower. It takes the marbles through a system where one is stopped at a time to be detected and then dropped onto 1 of 3 cups.

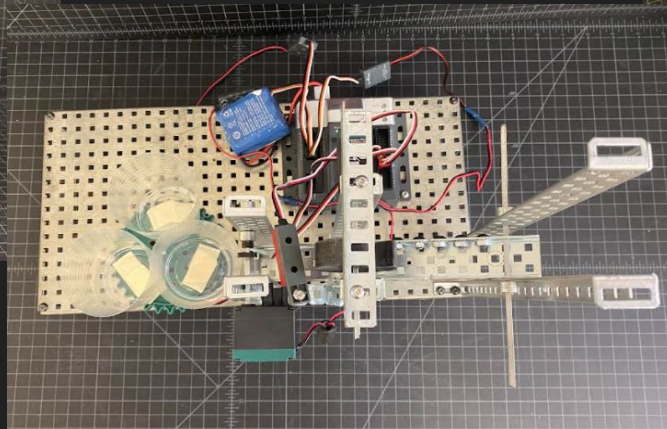


Final Design Photos

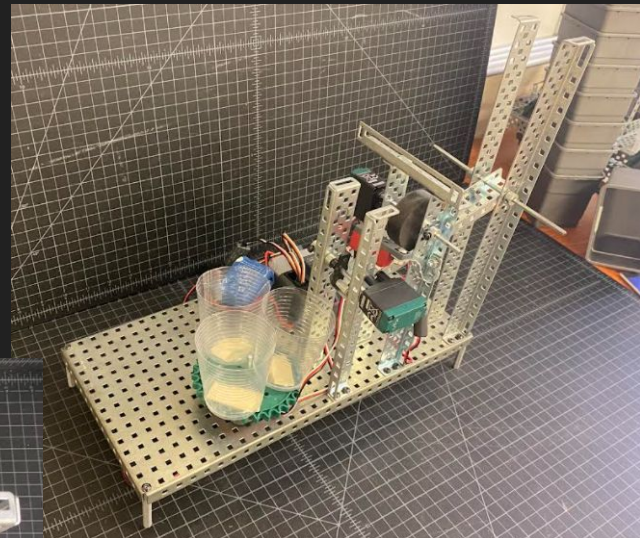
Side View



Top-Down View

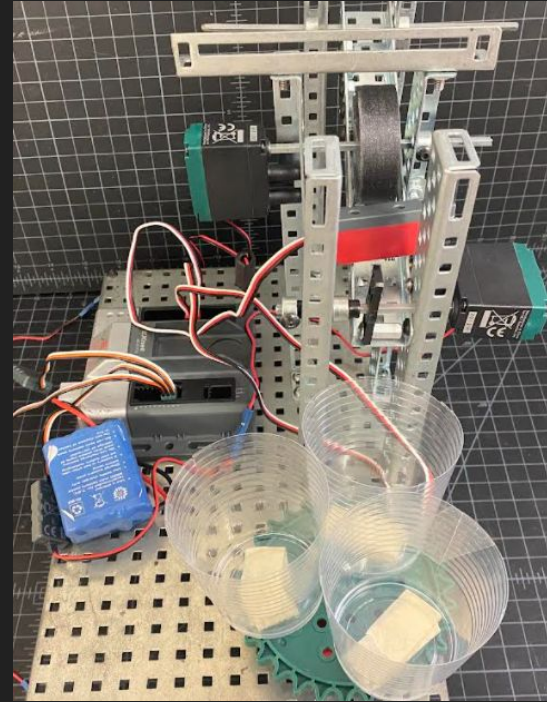
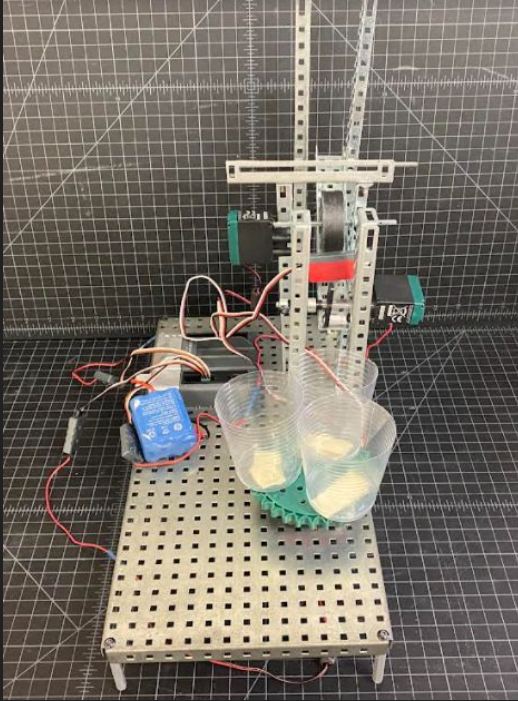


Isometric View



Final Design Photos Part 2

Front View



Final Solution Program

```
int x;
task main() {
    while(true) {
        SensorValue(quadEncoder)=0;
        startMotor(marbleSpin, -20);
        wait(2);
        stopMotor(marbleSpin);
        x = x + 1;
        while(x==1) {
            if (SensorValue[lineFollower]>2300) {
                startMotor(marbleStop, 10);
                startMotor(cupSpin, 30);
                untilEncoderCounts(0, quadEncoder);
                stopMotor(marbleStop);
            }
            if (SensorValue[lineFollower]>2600) {
                startMotor(marbleStop, 10);
                startMotor(cupSpin, 30);
                untilEncoderCounts(134, quadEncoder);
                stopMotor(marbleStop);
            }
        }
    }
}
```

```
        stopMotor(marbleStop);
    }
    if (SensorValue[lineFollower]>1800) {
        startMotor(marbleStop, 10);
        startMotor(cupSpin, 30);
        untilEncoderCounts(360, quadEncoder);
        stopMotor(marbleStop);
    }
    startMotor(marbleStop, -5);
    wait(0.3);
    stopMotor(marbleStop);
    x = x- 1;
}
}
```


Final Design Solution & Reflection

We accomplished our objectives fairly well given the time that was given to complete the machine sorter. Taking previous research on advances in recycling technology into account, we were able to create our machine sorter. Using a maintained orientation, the marbles are taken down a downward slope, to be detected by a line follower to rotate gear with 3 cups, rotating depending on which marble is detected. The system uses a total of 3 2-wire motors, one for the gear and one for the one-marble sorter. We believe the NRPA will benefit from this solution due to its low value on the Design Matrix for the amount of material being used.



Conclusion Questions

- What was the most challenging aspect of this design problem?

The most challenging aspect of this design problem is designing the marble sorting process. We went through many solutions using different sensors, deciding between a line follower and an ultrasonic sensor. Additionally, we went through three different ideas in ways to drop the marbles into the sorter, including a funnel, a standard sloped tube, and a gumball-inspired sorting system which would sort the marbles from the start instead of later on in the system. Due to the amount of time we were given, we decided on a standard sloped tube to follow the marbles into the rest of the sorting system, using a line follower, and then into the cups holding each different marble.



Conclusion Questions

- What are some creative changes that you would make to the design solution if you could start over?

Creative changes I'd made to the design solution if I could start over include using a different system outside of the gumball and rotating cups. Both design solutions didn't score a 5 on the design matrix for efficiency and admittedly don't take advantage of VEX materials to make a more professional design. Additionally, they lead to inefficient programming applications which use an unnecessary amount of sensors instead of focusing on using the least amount of material possible, putting into mind the environment. For example, a conveyor belt system using right-angle transfers instead of a slope would've performed exponentially better.



References

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