The Recyclinator

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Abstract

Recycling is a quintessential part of our ability to reuse and repurpose discarded materials. However, it is often difficult to sort out materials, making the recycling process less efficient overall. Additionally, the conventional automated sorting process can often be cumbersome with many points of failure.

Our project's goal is to streamline this process for smaller scale commercial usage. Our sorting system will allow us to intake a recyclable item, sense the material input, and deposit the item into its corresponding recycling bin through a carriage. We hope that with our project we can allow recycling to be easier than ever.

Background

Recycling is one of the most essential activities that helps protect our environment. It has diverted over 82 million tons of material away from landfills. However, while opportunities to recycle are widely available, sorting methods are not. Due to the lack of sorting method, people avoid recycling, or recycle in a sloppy manner. This results in a significant negative impact on the environment with an increase in pollution, destruction of natural habitats, and overflowing landfills..

[1]

References

Methods and Materials

Our project is fundamentally comprised of two parts: the sensing component and the carriage mechanism. In terms of the sensing part, we are using a capacitive sensor and light sensor to differentiate between the four types of materials we plan to recycle (paper, plastic, glass and metal). The carriage mechanism will be what holds the waste material as well as what moves along the rail to sort the trash. A stepper motor will be used to move the carriage along the rail while a servo motor will operate the 'trap door' in the carriage to allow the trash to drop into their respective bins. Additionally, the sensors will be attached to the carriage to detect the material.

The carriage and its attachments are made of 3D printed resin, allowing the carriage to remain light, reducing strain on our stepper motor. We are using an adjustable-voltage battery to power our electronic components. Overall, our materials are low cost and easily sourced making our project very commercially viable.

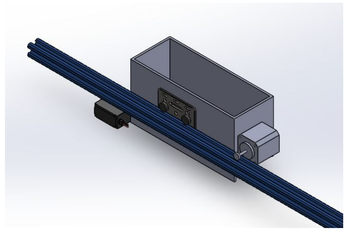


Fig 1. Isometric view of carriage system

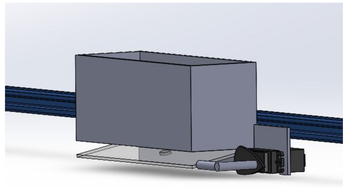


Fig 2. Side view of carriage system

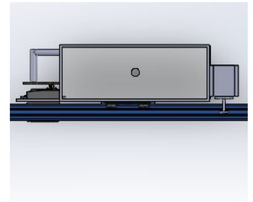


Fig 3. Top down view of carriage system

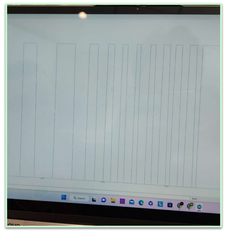
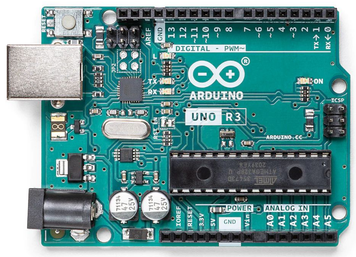


Fig 4. Output generated by capacitive sensor

Results

The physical component of the project will consist of a combination of 3D printed parts, store bought material, and electronic sensors. The design of the physical component is displayed in the CAD model. While making the CAD model we noticed that a lot of the electronic components may be difficult to attach since the carriage has to move down the rail and the box has to open up at the bottom. After a minor redesign we were able to come up with the final CAD design to ensure mobility.



The electronic component of the project is powered by an external voltages source. The stepper motor as and servo will be controlled using an Arduino board and code. The code works to control the speed and movement time of the stepper motor, as well as the direction and time that the servo moves to open the door. The sensors are connected to a display so that the output can be used to sort the material into its respective bin. Combining the physical and electronic components leads us to our final result of a machine that helps sort recyclable materials efficiently.

Future Direction

Looking forward, many significant improvements can be made to the sorting mechanism. First and foremost, the sensors are quite limited in the materials it can detect. Materials like electronic waste can be very useful if their parts are recycled, but currently it might just be sorted into the metals or miscellaneous category. We would like to develop a more robust sorting system to account for these materials that we aren't able to detect currently.

Additionally, we would improve on how many items the we would be able to sort at a time. As of right now our project can only sort one item at a time, which is useful for personal, small-scale usage, but not efficient on a larger scale. Given more time, we'd could implement a conveyor-like system that could more quickly sort and separate multiple items in quick succession.

Acknowledgements

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