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Project Title	Waste Sorting Machine		

Introduction with Functional Block Diagram

Our project involves building an automated machine for sorting wastes. Objects are placed on a conveyor belt which is monitored using a camera. Computer Vision is used to localize the objects on the belt which then signals the motor driver to activate the mechanical arm via arduino. Based on the signal from the computer vision model, the mechanical arm either pushes the object of interest out of conveyor into a box or allows the waste to pass through it.

*Link to the working demonstration video of our project:*
https://drive.google.com/open?id=1kQ90Kxeq3UQOTvJIWo4PP2tgaTHYInQE
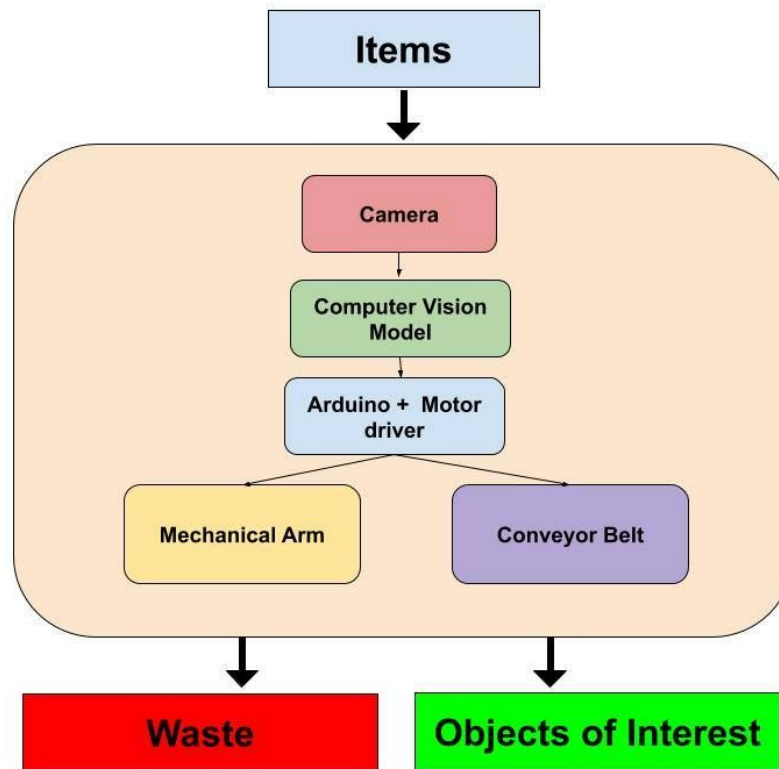
Functional Block Diagram

Discussions on Design with Illustrations; Circuit Connections

The waste sorting machine aims to segregate various types of wastes with the least human involvement. It does so by reducing dependency on a human operator in deciding which waste objects to eliminate and also in physically removing the selected waste object.
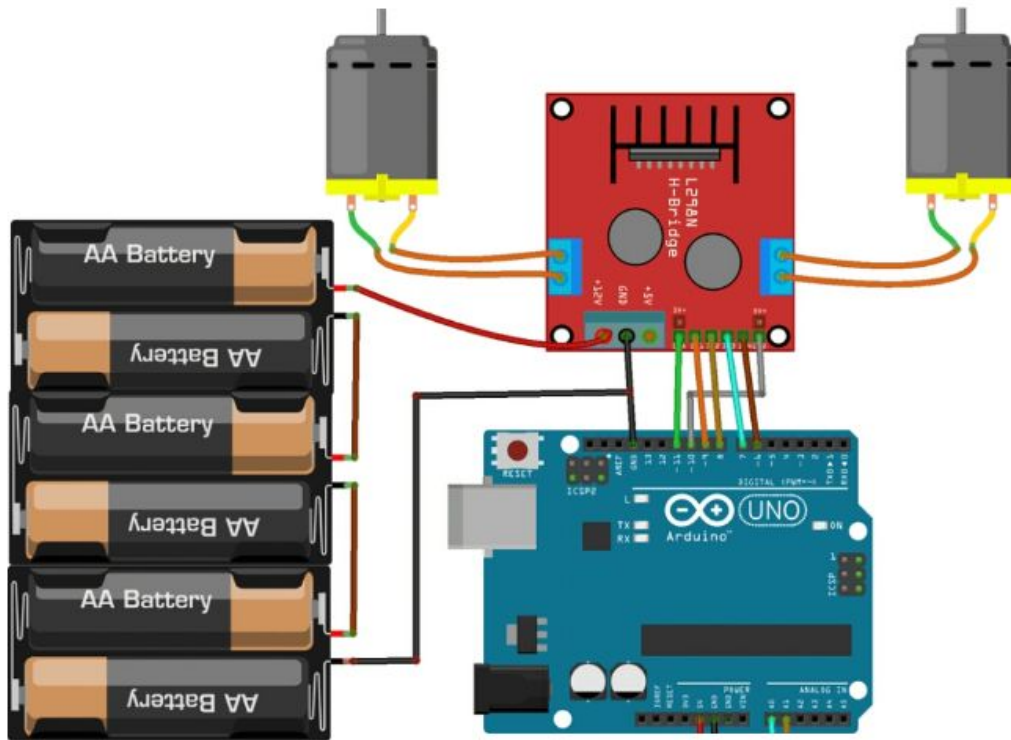
Circuit Connection for LM298N Motor Driver

A conveyor belt and mechanical arm mechanism was constructed using 30 RPM and 60 RPM motors respectively, LM298N motor driver, and other objects including PVC rollers, rubber belt etc.

The conveyor belt moves forward continuously while newly acquired waste objects are put on it. As the waste material moves forward along the belt, a camera is used to monitor the waste objects along it. Computer vision algorithms were used to segment all the objects on the belt as well as check if they are plastic bottles. If the algorithm finds that the segmented object is a plastic bottle, it waits for the bottle to reach the area of the mechanical arm and activates the arm as soon as it reaches the specified area.

Conveyor Belt and Mechanical Arm

When the plastic bottle reaches the area in front of the arm, the conveyor belt is stopped and the mechanical arm protrudes forward to push the plastic bottle off the conveyor belt in to another container placed below it .

The conveyor continues its motion after the arm has been retracted back to its starting position.

Mechanical arm pushing segregated object

Experiments and Results; Performance Analysis

The setup was run for several objects and the whole mechanism was tested. The conveyor was able to support and move light objects forward along the belt. The arm was able to push the segregated objects off the conveyor belt quickly. The arm takes 1s to push the object and come back to its place. Repeated operations also didn't result in any deterioration of the speed or stability of the mechanism.

There were some hindrances in moving the belt in a complete rotation as the thickness and abruptness of the joint in the belt (where the two ends for the belt were joined to make it circular) poised a difficulty for the belt while passing over the PVC rollers. With a little support to the conveyor belt in the middle part, it was able to support objects without toppling over. Finally, the conveyor belt and the mechanical arm worked as expected for the project.

Summary and Future Work

We made a waste sorting machine that separates particular type of objects from the rest of the waste. Our next step would be to increase the classification accuracy and localization results to the computer vision algorithm. To be of practical use in an industry setting, our project can be scaled up by using multiple arms belt to segregate the waste at a higher speed and with better accuracy. We can also use wider and stronger conveyor belt to enable the machine to process heavier and larger sized waste.

List of Components				
#	Item Name	Qty.	Provided by (Dept/Self/Guide)	Price (Rs.)
1	Camera	1	Guide	-----
2	Arduino	1	Self	450
3	Motor driver	1	Self	300
4	Motor (30 rpm)	1	Self	350
5	Motor (60 rpm)	1	Self	280
6	L clamp	4	Self	120
7	Gear	2	Self	90
8	Geared Rack	1	Self	110
9	Wire	1	Self	25
10	Roller	2	Self	100
11	Shaft	2	Self	60
12	Jumper wires	10	Self	80