Development of a Trash Can That Can Peel PET Bottle Labels

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1. Motivation/purpose

The purpose of this research is to develop a system for peeling off labels from PET bottles in order to make them recyclable. It takes time and effort to peel off and throw away the labels by hand, and many people throw them away with the labels still attached, which increases the effort and cost of collecting them. We thought that we could solve this problem by installing a system in the trash can that peels off the labels on plastic bottles.

2. Research content

The trash can system consists of two mechanisms: a cutter that cuts the labels, and a roller that winds up the cut labels.

(1)Cutter

The cutter uses the expansion and contraction of a spring to cut the label to fit the shape of the plastic bottle. A spring is installed behind the cutter, and when a plastic bottle is inserted, the cutter moves back and forth depending on the shape of the bottle, cutting the label. We decided to use a round cutter instead of a regular cutter so that the cutter could cut smoothly while moving back and forth. (Photo 1)

Production costs can also be reduced because no electronic equipment is used.

(2)Roller

The roller is a robot using python that winds up the label by rotating two motors side by side inward. We decided to use rubber as the material for the tires used for the rollers, which is soft and has a large contact area and can generate strong friction. (Photo 2)

3. Cutter

Problems with the cutter part

・When the cutter blade moves back and forth, it does not fit vertically, and the label cannot be cut straight.

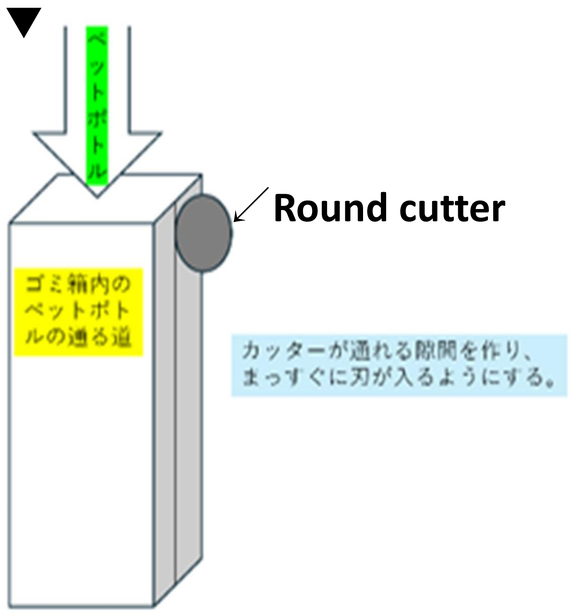
・We thought that we might be able to cut better by fixing the cutter and using a sponge on the other side, so we conducted an experiment. The following results were obtained by comparing the cases in which the round and pointed cutters were moved back and forth, and the cases in which the cutters were fixed and a sponge was installed.

	If the cutter moves back and forth	When fixing the cutter
round cutter	▲	X
sharp cutter	△	X

◀(Photo 1) Device where the cutter moves back and forth using a round cutter

The plastic bottle passes through the narrow entrance of the garbage can, then a gap is opened in the passageway that is wide enough for only the plastic bottle to pass through, and the cutter is passed straight through.

(Image diagram) ▼



・When we moved the round cutter back and forth, the blade was unstable and did not go in straight vertically, making it difficult to cut the label properly.

・Even when the cutter was fixed, the label could hardly be cut.

・We Narrowed the path that the plastic bottle passes through inside the trash can, making it wide enough for only the bottle to pass through, and creating a gap through which the cutter can pass straight through.

4. Roller

Roller experiment

Assuming that the label had broken, we conducted an experiment in which we used a roller to peel off the label from a plastic bottle. The labels to be peeled off were made in the following three patterns.

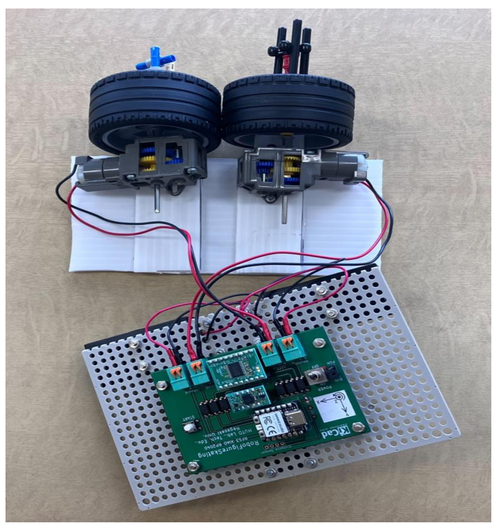
1. When the label is torn on the opposite side of the glued part (peel off line)
2. When the cutter passes directly above the glued part of the label
3. Midway point between 1 and 2

Result

・We were able to easily remove the labels from items 1 and 3.

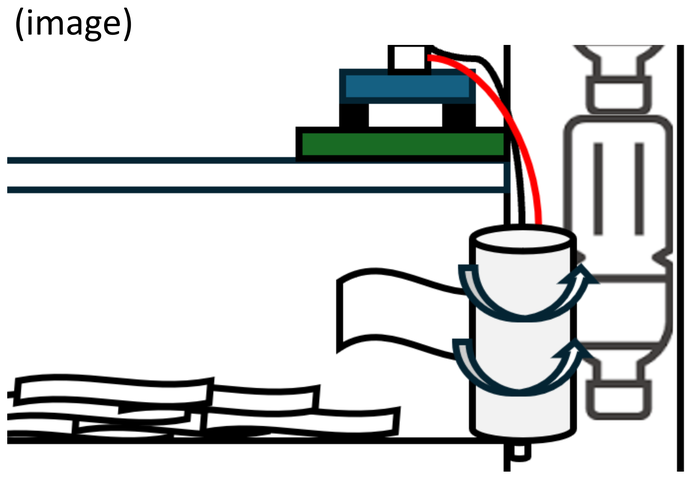
・For 2, the label did not peel off properly when we cut just above the top. It cannot be removed even if you increase the rotational force of the roller.

It is thought that this problem could be solved by using an ultrasonic distance sensor to avoid cutting the glued part.



◀Photo (2) A machine that winds up labels with a roller.

▼ A trash can collects labels with a roller (image)



5. Challenges and future prospects

◀ ultrasonic sensor detects the distance and presence of an object based on the time it takes for the sound wave to oscillate and return.

- **Cutter and roller interlocking**
- **Cap collection function**

◀ (Photo 3) A trash can that allows you to put plastic bottles in from the bottom.

quotation ：
https://www.google.com/url?sa=i&url=https%3A%2F%2Fxtrend.nikkei.com%2Fatcl%2Fcontents%2F18%2F00484%2F00013%2F&psig=AOvVaw1J31BZzGx9f-Sx4O-L8ndf&ust=1729172698929000&source=images&cd=vfe&opi=89978449&ved=0CBcQjhxqFwoTCKCplbuEk4kDFQAAAAAdAAAAABAE

The design of the entrance to the trash can was originally planned to be just a hole, like the trash cans next to vending machines, but there was a cutter inside, so young children could get their hands in there and get hurt. We are thinking of creating a structure where plastic bottles can be inserted from the bottom to prevent injuries. (Photo 3)