Development of Automatic Umbrella Rolling System

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Abstract

In this paper, we discuss the automatic umbrella rolling system. This system can roll an umbrella and fasten it automatically. This system holds strap of umbrella with clip and then turns umbrella. After turning the umbrella, Velcro tapes on both end of the strap are fastened. The clip is opened by a motor, and the motor is connected by wire with clip. This system uses light sensors to determine three things. The first is whether the clip is opened or not. The second is whether the motor rotated enough to open the clip and the third is whether there is an object between the claws of the clip. Arduino controls all motion of the system.

The umbrella's body is usually wet after use. When we touch an umbrella, our hands get wet. With this system, we do not need to touch the body of an umbrella. Therefore our hands will not get wet.

Keywords: light sensor, servo motor, Arduino, umbrella, Velcro tapes.

1. Introduction

Everyone uses umbrella when it rains, and after using it, we may roll the umbrella. When we roll the umbrella, we hold the body of the umbrella. Then, our hands get wet because umbrella's body is wet after use.

However, some people do not roll umbrellas. If they do not roll their umbrellas, there are so many problems.

First, if people put umbrellas in the umbrella stand without rolling, they look so messy. They do not look organized. Each umbrella takes too much space and there is less space for other umbrellas to put in. When we take the public transportations such as train or bus, umbrellas often make other people wet. That is because if an umbrella is not

winded, it can contact other people easily. Particularly when an umbrella is not rolled, it can touch other people easily. Especially, during rush hour, there are so many people on the train or bus and people on them are close to each other. As a result, umbrellas can cause people's clothes and possessions to become wet. This often annoys people and makes them irritate.

Second, when people put their umbrellas in an umbrella stand, they could thrust their umbrellas into another umbrella by mistake if the umbrella is not rolled. Then, rainwater flows from one umbrella to another and as a result, the ribs of umbrella may rust.

Third, when people pick up their umbrella, it can be caught by another umbrella, if these umbrellas are not rolled. This can tear cloth of the umbrella, make a hole in the cloth, break the ribs or cause the ribs to come off.

People tend to have troubles of these kinds on rainy days. Rolling an umbrella should be recognized as a manner in general.

Although it takes less than thirty seconds to roll an umbrella, some people find troublesome to roll it up. Why is it? The major reason is that "It's too hassle to wind the umbrella." Other reasons are "They hate to get wet with rainwater." and "They may not have habit of winding umbrella." The environment they were brought up made them not to do so.

On the other hand, it is not good for umbrella to roll right after it is used. If people do not roll an umbrella before it dries, it can get damaged. Because its ribs are made of metal, they may rust.

Some people can't roll umbrella easily, because of the situation they are facing. When their hands are not available, they had no choice but leave it unrolled. For example, they have other things in their both hands, it is not easy for them

(a) Top view

(b) Side view

Fig. 1. Overview of the system

Fig. 2. Block diagram of the system

to roll an umbrella.

For the reasons above, some people do not roll umbrellas, but our system can roll an umbrella automatically.

2. Construction of the System

2.1 Appearance of the System

Overview of this system is shown in fig 1. The body is composed of a servo motor (1060390 by TAMIYA), a clip, two light sensors (photo reflector PRP-220) and Arduino (Genuino Uno). The block diagram is shown in Fig.

Fig. 3. How to open the clip

Fig. 4. strap inside a clip

2. Arduino controls all sensors and motor. The clip is held to aluminum wall and motor is also held to aluminum plate. The clip is connected servo motor. One light sensor is installed right next to the clip. The other is installed above the motor. The start and finish buttons are in the circuit of Arduino.

2.2 How to wind umbrella

This system is roughly divided into two unit; moving unit and sensor unit.

The moving unit consists of a motor and a metal clip. This unit opens the metal clip. The clip is opened by the motor. As shown in Fig.1, one side of the clip is fixed to the aluminum wall and the other side is connected to the motor. When the motor rotates clockwise, the clip opens. How to open clip is shown in Fig.3. When start button is pressed, the motor starts rotating and the clip opens. Then, a strap of an umbrella is put between the claws of the clip as shown in

Fig. 5. Fixed umbrella's strap

Fig. 6. How to turn umbrella

Fig. 7. How to detect obstruction

Fig.4. As of now, this procedure is done manually. Then, the sensor right next to the clip detects the object between the blades of the clip and motor starts rotating counterclockwise to close the clip. When clip is closed, the umbrella strap is fixed to this system as shown in Fig.5 and the umbrella is turned. As of now, this procedure is done manually. After turning the umbrella, stick Velcro tapes each other. Figure 6 shows how to turn an umbrella. It is turning clockwise. It can be turned both clockwise and counterclockwise, and it depends on the position of velcro tapes. Finally, we press the finish button to take the

Fig. 8. Held umbrella

Fig. 9. Fix Velcro tapes

umbrella off from the system. When we push this button, motor starts rotating to open the clip. If there is nothing between the claws of the clip, the clip starts closing.

The sensor unit consists of two light sensors and Arduino. One sensor next to the clip is shown in Fig.1 (b) and in Fig.4. This sensor determines two things. One is whether the clip is opened or not and other is whether there is something between the blades of the clip. When clip is closed, the photo reflector's value is around thirty and when clip is opened, the value is almost zero. When the system keeps the clip open and there is an umbrella strap, the value becomes around ten.

If value is over ten, the motor starts holding umbrella strap. Other sensor determines whether motor winds long enough to open the clip. There is a small piece of paper which makes the value of the sensor more than thirty when it comes right in front of the sensor as shown Fig. 7. If the obstruction is in front of the sensor, the value is more than thirty. Sensor how to detect the obstruction is shown in Fig.7. If there is nothing in front of the sensor, the value is less than thirty. When the value is less than thirty, the motor continues to rotate clockwise, and when the value exceeds thirty, the motor stops rotating. When the motor stops

(a) binder

(b) Metal

Fig. 10. Pictures of the clips

rotating, that means the clip opens enough.

3. Experiment

We tested whether we can roll the umbrella without holding umbrella's body. We succeeded in opening the clip, holding umbrella strap and sticking Velcro tapes. Fig. 7. shows holding umbrella strap and Fig. 8. shows sticking Velcro.

We tested two types of clip; binder clip and metal clip. The pictures of the clips are shown in Fig.10.

First, we tested binder clip. The binder clip is easy to open, but it was too weak to hold umbrella's strap. When the motor rotates too much, the black part of clip deforms, and it never regains its original form. In other words, it was broken.

Second, we tested metal clip. This clip is much stronger than binder clip. It endured the pulling force of the motor. It was not broken. Thus, we decided to use metal clip.

Because umbrella strap is very thin, it was easy to slip through the clip. Thus, it was hard to hold the strap. To hold the strap, more power is required, and the power should be concentrate on the tips of the clip claws. Therefore, we attached non-slip material to the tips of the clip. As a result, the strap becomes hard to slip. In this way, we succeeded in holding umbrella strap.

4. Conclusions

With the help of our system, we can wind the umbrella automatically and our hands will not get wet. However, we still have problems to overcome. We need to turn the umbrella manually after the system hold umbrella's strap. We also need to stick the Velcro tapes manually. We are going to keep improving the system in these respects.

References

- (1) <https://info-tribe.com/archives/2092>
- (2) <https://matome.naver.jp/odai/2137924230037337401>
- (3) <https://youpouch.com/2016/06/01/355731/>