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A Novel Approach to a Shoe Washing Machine for Daily Using

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Abstract: *Normal automatic shoe washing machines are drum-type, which means it is possible to wet out the inside of the shoes, and it takes long time to dry out. This may be a problem. To solve it, this new-type shoe washing machine is invented. After closing the door and receiving the signal from the photoelectric sensor, the dry hairbrush will roll over the shoes in order to clean the shoes. At the same time, a spray nozzle will produce spray mixed with perfume to wet out the outside of the shoes without wetting the inside. Therefore, after the process, both dust and bad smell will be eliminated.*

Keywords: *automatic shoe washing, electronic design, structure design photoelectric sensor, automatic deodorization*

1. Introduction

1.1 The need for an improvement in normal shoe washing machines

Shoes show the appearance of a human, so it is necessary to keep them clean. However, normal shoe washing machines will mostly wet out the inside of the shoes because each of them use a large roller brush [1-3] and plenty of time is needed to dry them out. This method is not convenient. Considering this problem, a few improvements are made. Instead of a large roller brush several small roller brush are used. Moreover, spray-type water replaces the liquid-type [4-5] water. This will only take only a few minutes to dry out the shoes after washing [6].

1.2 Varity functions to maintain shoes

People who are suffering dermatophytosis always need to disinfect their shoes in order to prevent dermatophytosis from further aggravation. This new-type shoe washing machines have ability to satisfy this demand. Disinfectant fluid water can be added to the spray, and the spray will spread it to the whole shoes. Moreover, after a whole of exercise, shoes will be totally smelly. In order to solve this problem, perfume is added to the spray. Hence, shoes will be not only clean but also balmy.

2. System Hardware Design

When the shoes are put in, the photoelectric sensor will receive the signal, and then the whole machine will start to run. First, the atomizer will generate water mist to wet, and this process will last for one and a half minutes. Then, the roller brush will first move to the initial position, and then start to rotate and gradually move backward to polish shoes. When the brush moves to the end, a photoelectric sensor will receive the signal, and then the brush will return to the original way, and then stop at the initial position.

2.1 Mechanical Structure

2.1.1 Frame

The shell is made of acrylic plate, fixed with hot melt adhesive, then connected with metal material, and then reinforced with metal frame. A linear guide rail is installed in the center of the bottom, and then a frame for installing the motor is made of metal material and installed on the guide rail. The brush and the motor are connected together to form two door-shape brushing systems. The two roller brushes are not completely fixed, and the spring is used to ensure its mobility to satisfied different types of shoes. The reason for using metal materials is to improve the stability of the frame. The design process is shown

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in Figure 1.

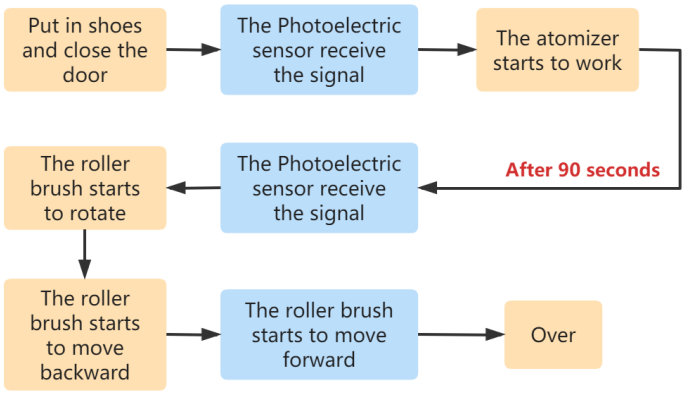

Figure 1: System flow design

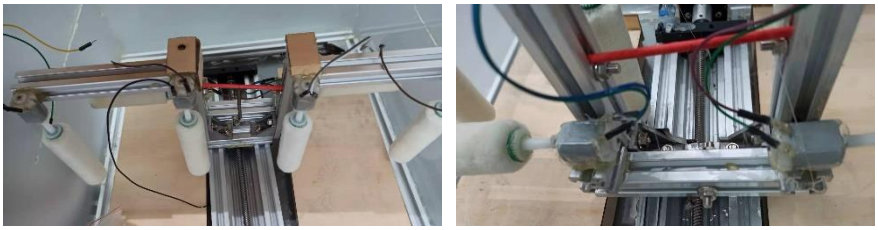

Figure 2: Physical drawing of mechanical device structure

2.1.2 Transmission Structure

The linear sliding rail is used because it can almost complete fixed. In this way, when the machine is working, the roller brush can brush the shoes without shaking. Therefore, efficiency of the shoe brushing can be improved. A coupling is used to connect the stepping motor and the linear guide rail. In this way, when the stepping motor is rotating, the linear guide rail is also working. Figure 3 showed the transimission structure of shoe washing.

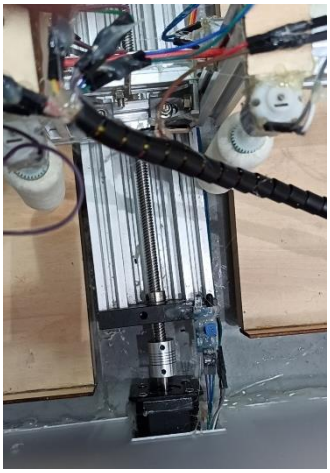

Figure 3: Physical drawing of transmission structure

2.2 Electronic Circuit Design

In the whole circuit design, there are many sub-components that need to be considered, such as drive, controller, sensor, etc., and the physical circuit built is shown in Figure 4.

Control core 2560

It is used to control other parts of electronic components and send and receive messages to and from the computer. Because it is small and simple in structure, it is easy to control and repair. It also has a code base, which means functions are easy to call and use.

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Stepping motor

Stepping motor is used for driving the linear guide rail because it is easy to control the speed of rotating in order to achieve accurate control of the movement of the linear guide rail.

Motor driver (L298N)

It is used to control DC motor to work. In this way, different DC motors can operate different work at the same time.

Motor driver (TB6600)

It is used to control Stepper motor to work. In this way, different Stepper motors can operate different work at the same time.

Electric relay

In the output circuit of electrical appliances, an electrical appliance that makes the controlled variable change in a predetermined step. It uses little current to control large current in the circuit. And it mainly acts as a switch.

Photoelectric sensor

It can detect the light and send signal to main control panel if there is no light. It is used because it is easy to control, and no other electronic components are needed to let it work

Power

It can provide energy to run the machine. Using socket power because high level of voltage is needed to run the machine. At the same time, there is no need to worry about charging and its stability.

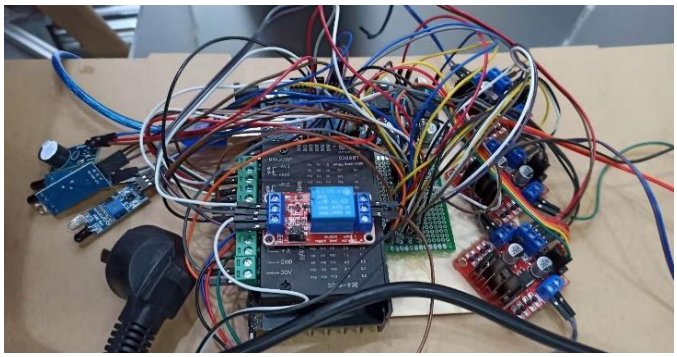

Figure 4: Physical drawing of embedded circuit wiring diagram

3. Process

Photoelectric sensor1 is placed on the wall of the box to check whether the door is closed or open. Photoelectric sensor2 is on the initial position of the linear sliding rail, and photoelectric sensor2 is on the final position of the linear sliding rail. Figure 5 is the working flow chart of the automatic shoe washing machine. Figure 5 showed the follow chart of automatic shoe washing.

4. Conclusion

The shoe washing machine has been designed and tested. It can generally clean the dust on the shoes, and remove the bad smell. However, the roller brush can not touch all of shoes, so the shoes can not be cleaned completely. Moreover, the efficiency of the spray nozzle is not enough. As a result, the time taken to finish the whole operation is longer than expect. All in all, this machine is barely achieving the desired effect. Hardware in the machine can still be improved. In the future, with precise measure and high tech this kind of machine can be made with lower production cost and the size of it can be just a little bit bigger than a shoes box. In this way, it can widely enter the ranks of household appliances.

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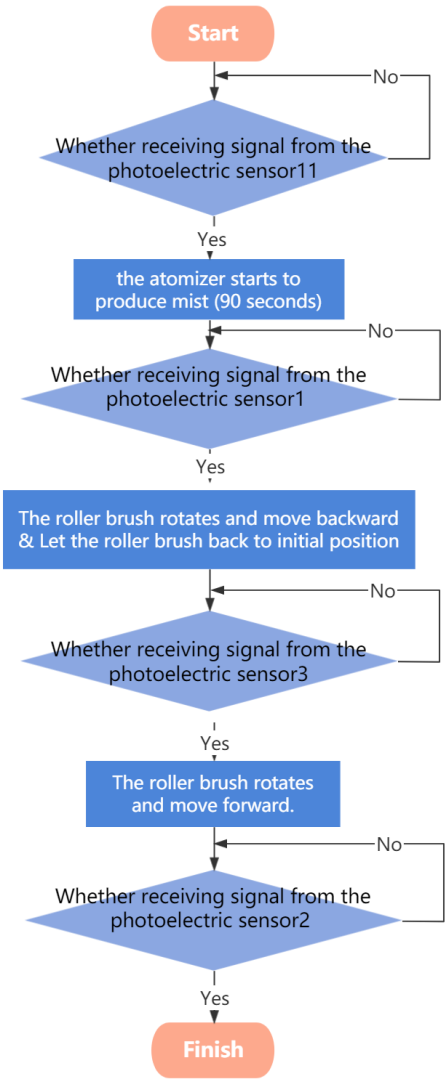

Figure 5: Working flow chart of automatic shoe washing machine

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