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Liquid Transmission Spray Technology

Introduction

Embedded systems researchers are involved in integrating useful tools into automated systems. A liquid transmission spray technology is one example in which a spray bottle creating a stream of liquid in a cross-section is controlled by a micro controller and other electronic hardware units. Although a commercial spray bottle is common in residential use, the amount of liquid sprayed cannot be controlled precisely and automatically. In order to control the speed and duration of each spraying operation, an automated spray technology becomes a more ideal option. Depending on the complexity of the controller and purpose of the sprayer, different spray systems are built to achieve automation. This paper will review two current designs of liquid transmission spray technology from different perspectives.

Commercial Electronic Spray with switch control

A Canadian research team building a molecular communication network designed an embedded sprayer from a commercial electronic sprayer and a switch control board connected by a microcontroller [1]. The sprayer is used as a molecule transmitter which modulates chemical signals representing binary sequences according to the International Telegraph Alphabet No. 2 (ITA2) standard [2], so the amount of liquid sprayed in one action is crucial in the design.

The commercial electronic spray, DuroBlast electronic spray [3], has a battery operated electrical pump that can spray a wide variety of liquid chemicals stored inside its container. With the custom electrical switch board, the spray can be controlled by an Arduino microcontroller [4]. In this way, depending on the binary bit the system needs to transmit, the microcontroller sends command to the spray to control its spraying speed and duration. This design involves three major building blocks: the commercial electronic spray being the major spraying hardware, the microcontroller and its loaded software being the control algorithm and the custom switch board being the bridge between hardware and software control. The total estimated cost of this design is 80 dollars per unit.

Servo Auto Spray

The Servo Auto Spray is created to reduce environment temperature by automatically spraying water in all directions [5]. The purpose of this spray technology is to automate the process of water spray, therefore the speed and duration of a single spray operation is constant. This design includes a mechanical spray bottle with a handle, a TowerPro MG995 servo, a servo base and an Arduino microcontroller [6].

Instead of directly using an electronic spray mentioned in the previous section, the Servo Auto Spray uses metal wires attached to the spray handle on one end and a moving servo on the other end to trigger the mechanical spray. The servo is then connected to the Arduino microcontroller which sends out digital signals to control the angular position of the servo. This sprayer has four major components which are the microcontroller and its loaded software, the servo platform, the metal wire connecting servo to the bottle handle, and the mechanical spray bottle. The total estimated cost of this design is 35 dollars per unit.

Comparison and Summary

First, in terms of budget, the cost of the first design is twice as much as that of the second design because the spray bottle has an embedded electronic component. And since the second design uses an ordinary spray bottle, the materials needed to build the transmitter platform are more accessible and universal. Second, considering the complexity of the designs, the electronic spray bottle in the first design requires less customization because it is tailored to spray duration control. Adding to the complexity of the second project, a pulse width modulation motor control is needed to interface the servo, in order to control the speed and duration of a single operation [7]. However, since the second design involves only primitive hardware or software units, it is easier to maintain and troubleshoot problems. In conclusion, the first design is easier to achieve and control, but the second design is more cost effective and easier to maintain.

Citations

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