High-Speed Photography Assistant

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Problem

The motion of droplets is a common subject in high-speed photography, and gains popularity among amateur photographers. To capture the images of rapidly moving objects, one need some special equipment. However, a high-speed camera is too expensive, while some existing assistant devices on the market are single-functioned and very complex to operate.

Fig. 1 Image of the collision of two water droplets [1]

Needs

To solve the problems of current high-speed photography technology, several needs should be satisfied.

- Affordable substitute to replace the function of high-speed camera.
- Multiple functions of photo taking.
- Easy-operating programming system that can precisely trigger the camera and flash light.

Solution

A high-speed photography assistant is designed that can help users shoot high-speed photographs of droplets. The idea is to automatically control the camera and the flash light using the Arduino, and trigger them at the moment we want. Solenoid valves will be used to drip the droplets, which will also be controlled by the Arduino. The device consists of two parts: the mechanical structure and the control system.

The control system will first drip droplets from the solenoid valves. The height of the solenoid valve from the table is fixed, and the time delay of the control system is also fixed. Therefore, the time needed for the objects moving to a particular position can be determined after some experiments. So when droplets are about to move to the desired position, the Arduino board will send signals to both the camera and the flash light, and pictures will be shot.

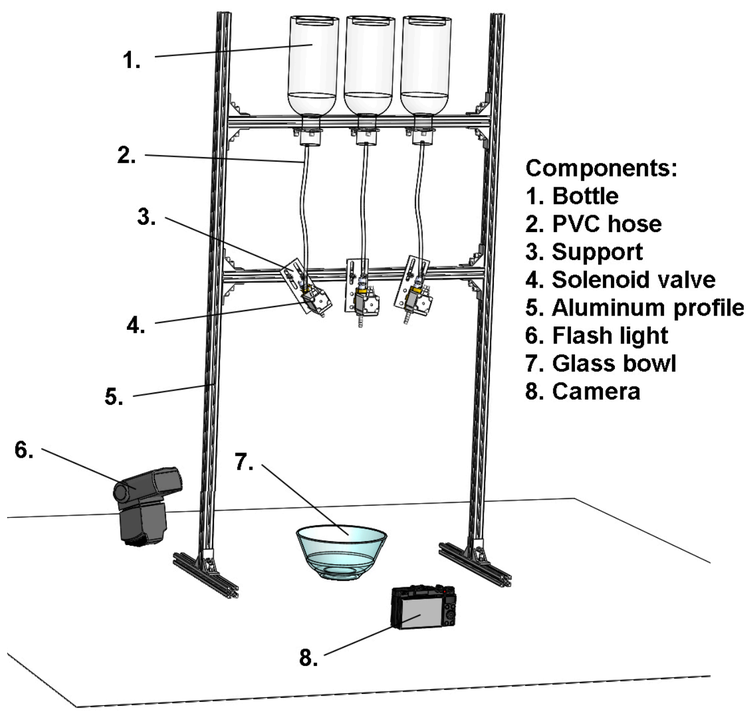

Fig. 2 Design diagram

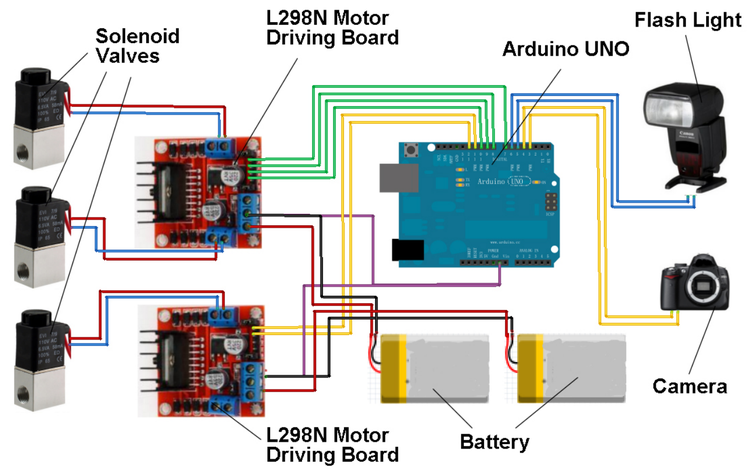

Fig. 3 Circuit diagram

Objectives

- Precisely control the droplet, including the time to drip it and its size.
- Capture the image at the very time.
- Realize high-speed photography of multiple droplets by making collisions and changing the colors of droplets.

Tasks

First, we use the Arduino to control the solenoid valves. By controlling the duration of opening the valve, the size of the droplet can be controlled according to our needs. Once the valve is closed, no liquids can be flowed through. Then, the camera and flash light are connected with the Arduino. Both of them can be triggered simply through short circuit. Next, more solenoid valves are used and they may drip more droplets successively to make collisions. Different solenoid valves can contain different colors of liquids. Having finished all the above tasks, we are able to shoot our own fantastic high-speed photographs.

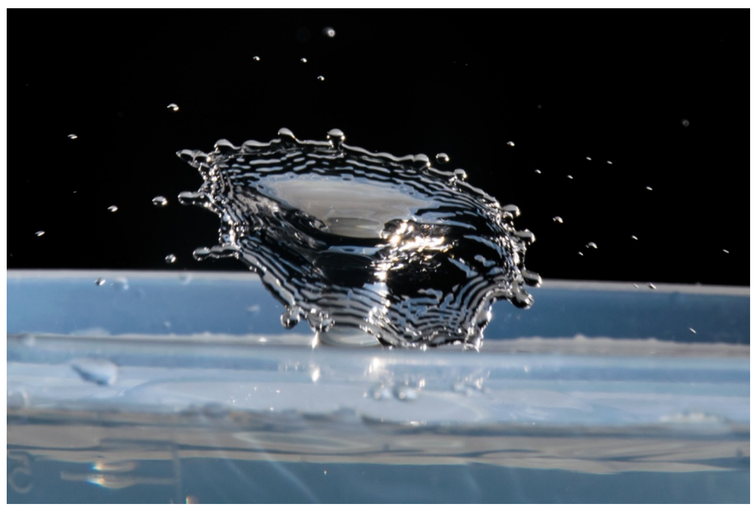

Fig. 4 The high-speed photograph taken by our project.

Conclusion

Our high-speed photography assistant is accurate, easy-operating, affordable, and multiple-functioned. It can help the users capture the images of rapidly moving droplets.

Acknowledgements

Prof. Roberto Dugnani, and Prof. Thomas Bowden from UM-SJTU Joint Institute

Zeqing Jin, Zihan Li, Zixin Huang and Xinyi Liu from UM-SJTU Joint Institute

Reference

[1] http://www.dailymail.co.uk/news/article- 2072572/A-little-drop-magic-One-woman-turns-dropswater-mushrooms-aliens--Spider-Man.html