How to Make an Inexpensive Motion Triggered Water Sprayer

These instructions will teach you how to construct a simple Arduino project and will bring you one step closer to having all the knowledge you need to use an Arduino to invent anything. The Arduino will use the motion sensor to sense if someone is within close proximity and immediately switch on power to the motor using a transistor. These instructions require some basic knowledge of electricity and how to use an Arduino. There isn't a significant risk of electrical shock since you will be working with such low voltage.

Parts Required:
- Spray bottle with battery powered sprayer
- Arduino
- PIR Motion Sensor
- Diode
- NPN Transistor
- Roughly 3 feet of wire
- Small breadboard
- 9-volt Battery

Major Steps:
1. Modifying the Sprayer (10 mins)
2. Building the Circuit (10 mins)
3. Writing the Code (10 mins)

Time Required:
30 minutes depending on experience

Modifying the Sprayer

Start by taking apart the sprayer and confirm that there is a small motor (as seen in Figure 1) powered by two wires inside. If not then the sprayer is either too complex or just won't work for this project.

Figure 1: Internals of a battery-powered sprayer

1. Once apart, cut the two wires powering the motor and use more wire to extend them to about another foot or two long.
   - These wires will later be connected to the breadboard and the Arduino, which should not be near the wet spray bottle.
2. Either keep the existing straw on the sprayer or use small tubing to have the sprayer draw liquid from a larger reservoir.
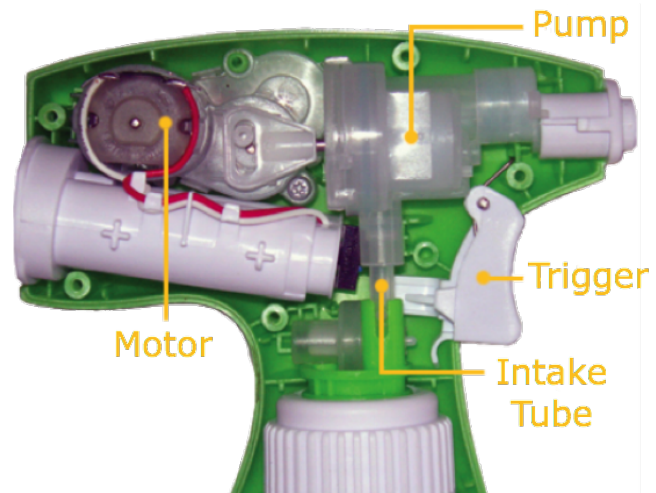
Now your sprayer is ready to be controlled by the Arduino. You can reassemble the body of the sprayer if you wish but be sure to leave the two wires outside the casing so you can connect them in the next steps.

Building the Circuit

In these steps you will assemble the circuit shown in Figure 2.

1. Starting with the PIR Motion Sensor, connect the ground pin on the Arduino to the ground pin labeled on the sensor. Then match up the pin labeled +5V on the sensor to pin 13 next to the ground pin on the Arduino. Finally, connect the signal pin on the sensor to pin 12 on the Arduino.

2. Install the transistor to the breadboard with the round side facing away from the Arduino in the same orentation as indicated in Figure 2.
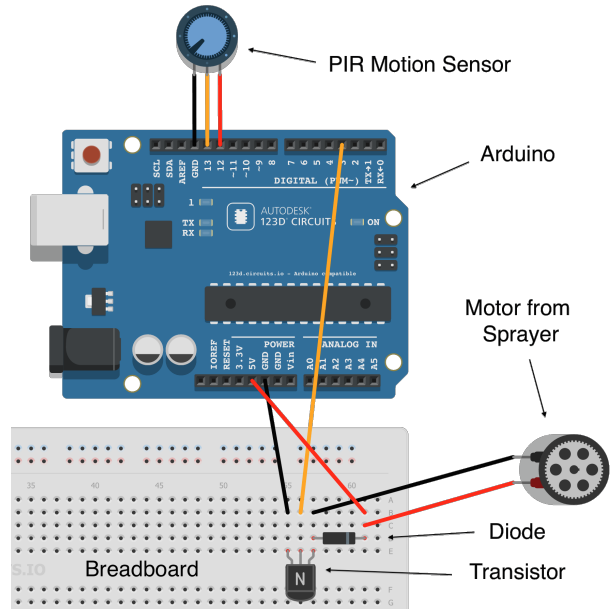

Figure 2: The completed circuit

3. Connect one of the ground power pins of the Arduino to the left most pin of the transistor using the breadboard.

4. Connect pin 3 of the Arduino to the middle pin of the transistor using the breadboard.
5. Install the diode to the breadboard with the left pin connected to the right most pin of the transistor. Install the other end of the diode a few rows down the breadboard.

   - Warning: It is important that the direction of the current flowing through the diode is correct. Be sure that your diode is orientated the same way it is shown in Figure 2. Your circuit will not function if the diode isn't oriented correctly.

6. Connect the ground wire of the sprayer motor to the right most pin of the transistor as well as the left end of the diode.

7. Connect the 5V power pin of the Arduino to the right end of the diode using the breadboard.

8. Connect the positive wire of the sprayer motor to the right end of the diode using the breadboard.

Writing the Code

At this point the entire circuit should be completed. The final step is to write and upload the code to the Arduino so that the sprayer only sprays for a finite amount of time and is triggered by the motion sensor.

1. Start by opening up the Arduino software and create a new sketch.

2. Assign variables to each pin used on the Arduino. Use 'pirPower' to indicate the pin that will be providing power to the PIR motion sensor. Use 'pirIn' to indicate the pin that will receive a signal from the sensor. The 'motor' variable will be used to turn the motor on or off.

```
const int pirPower = 13;
const int pirIn = 12;
int motor = 3;
```

3. Configure the pins functionality by using the pinMode and digitalWrite commands. Set 'pirPower' and 'motor' as outputs. Set 'pirIn' as an input. Use the digitalWrite command to set 'motor' to be off and 'pirPower' to be on.

```
void setup(){
pinMode(pirPower, OUTPUT);
pinMode(pirIn, INPUT);
pinMode(motor, OUTPUT);
digitalWrite(motor, LOW);
digitalWrite(pirPower, HIGH);
}
```

4. Create a loop that will wait for a signal from the motion sensor and when it reads this signal it will output a signal to turn on the motor. Use the delay function to have the sprayer run for a half a second or 500 milliseconds. You can change this number to whatever your specific use for the project requires.

```
void loop(){
   int value= digitalRead(pirIn);
    if (value == HIGH){
       digitalWrite(motor, HIGH);
       delay(500);
       digitalWrite(motor, LOW);
     }
}
```

5. Plug in the Arduino to an available USB port and click upload. Unplug once it has finished uploading.
6. The only step left is to provide power to the Arduino to run the code and circuit. Connect the positive terminal of the 9-volt battery to the V_{in} power pin on the Arduino. Connect the negative terminal of the battery to the ground power pin on the Arduino. You should see lights on the Arduino light up as it initializes.

Conclusion

You should finally have a completed Arduino powered project that sprays water when it detects motion. If you don't then go back and compare your code to what is listed above and compare your circuit to what is illustrated in Figure 2. With this project you can keep your cat off the counter, keep your roommates out of your beer fridge, or surprise your friends.

Citations

Rako, Paul. "The Scrubbing Bubbles Power Sprayer." *EDN*. UBM Tech, 17 Nov. 2011. Web. 13 Nov. 2014.
    <http://www.edn.com/design/analog/4368687/The-Scrubbing-Bubbles-power-sprayer>.

All pictures other than Figure 1 were screenshots of my own work on different pieces of software.