

Flying Squirrel

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Sub System Prototype 1



Figure 1: Partial Lifting Assembly

- Motor and lead screw supplied by Dr. Razavian
- 3D printed fixture combines the components; prevents nut from rotating freely

Question(s) this prototype answered:

- Is the screw lifting system feasible for our design?

Sub-System Prototype 2



Figure 2: Completed Lifting Motor Circuit

- Components provided by Dr. Razavian
- Features a 24V DC power supply, a stepper motor and stepper driver
- Controlled by Arduino

Question(s) this simulation answered:

- How do we incorporate a motor driver into the code?
- How do we create a circuit using the necessary components to successfully power and control the motors?

Virtual Prototype

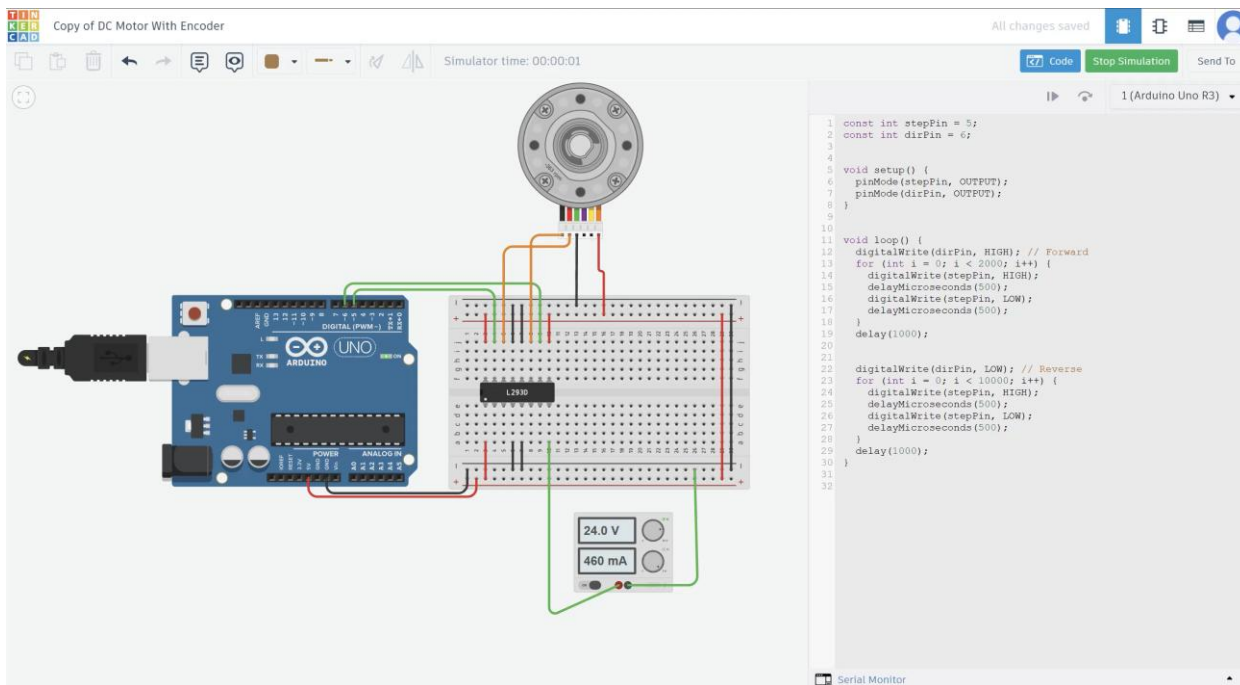


Figure 3: Motor Circuit Simulation

- Simulation uses an H-bridge connector in place of motor controller
- Circuit created by breeno3
- Motor controller used for real prototype has malfunctioning B-coil output resulting in no movement

Question(s) this simulation answered:

- Does the code used for direction of motor work as intended?

Code

```
const int stepPin = 5;
const int dirPin = 6;

void setup() {
  pinMode(stepPin, OUTPUT);
  pinMode(dirPin, OUTPUT);
}

void loop() {
  digitalWrite(dirPin, HIGH); // Clockwise
  for (int i = 0; i < 2000; i++) {
    digitalWrite(stepPin, HIGH);
    delayMicroseconds(500);
    digitalWrite(stepPin, LOW);
    delayMicroseconds(500);
  }
  delay(1000);
  digitalWrite(dirPin, LOW); // Counter Clockwise
  for (int i = 0; i < 2000; i++) {
    digitalWrite(stepPin, HIGH);
    delayMicroseconds(500);
    digitalWrite(stepPin, LOW);
    delayMicroseconds(500);
  }
  delay(1000);
}
```

Figure 4: Motor
Control Code

Potential Errors

The Issue

The motor driver given to us by Dr. Razavian had a faulty output port for the motor's second coil. The circuit was set up correctly, and it would have operated as intended under normal circumstances.

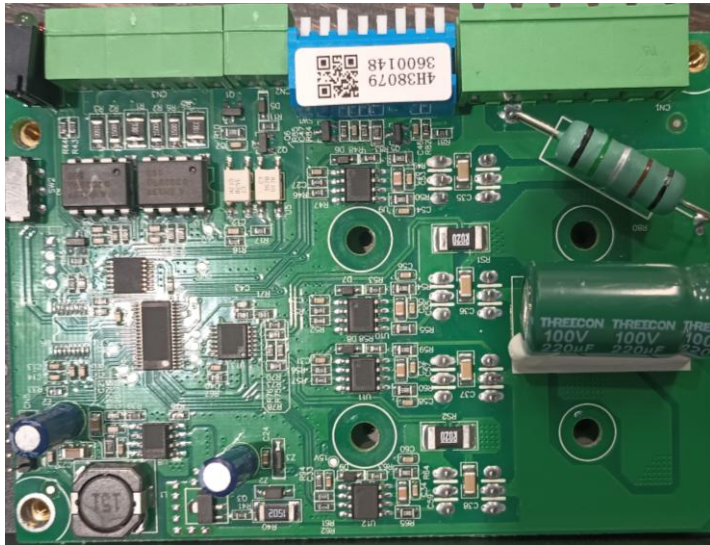


Figure 5: Faulty Motor Driver Internals

Possible Causes

These issues could have possibly been damaged during its last use, whether by pushing too much current through it, extended duration of use, or a faulty motor was used.

Another possible issue is that it may have been disassembled previously and handled incorrectly, which could have damaged the board.

Resulting output voltage from motor driver

- Channel A +20V
- Channel B -15mV

Conclusion

Results

- The screw design should work for our purposes
- We now have the most basic circuit design to control our motors
- Our code to control the motors works (Both directions) and can control speed

Design Adaptation

- Research common issues in motor drivers and test all physical components
- Use fundamental circuit design in our robot (With different components)

A close-up photograph of a squirrel with brown and white fur, holding a nut in its paws. The squirrel is looking towards the camera. The background is dark and out of focus. The text 'Thank You!' is overlaid in a large, bold, yellow font. The image is framed by a blue and yellow curved border on the left and right sides.

Thank You!

The Northern Arizona University logo, consisting of the letters 'NAU' in a large, stylized, blocky font. The letters are white with a blue outline. The text 'NORTHERN ARIZONA UNIVERSITY' is written in a smaller, white, sans-serif font across the middle of the 'NAU' letters.

NORTHERN ARIZONA UNIVERSITY

Resources

[1] Tinkercad, <https://www.tinkercad.com/> (accessed Apr. 28, 2025).

[2] "Circuit design DC motor with encoder," Tinkercad, <https://www.tinkercad.com/things/5XmfSjHGloF-dc-motor-with-encoder> (accessed Apr. 28, 2025).



A squirrel with a large, bushy tail is shown in profile, facing left. It is standing on a light-colored, possibly concrete, surface. The squirrel's fur is a mix of brown and grey, with a lighter patch on its chest. Its tail is raised and spread out, showing the underside of the fur. The background is a plain, light blue-grey color. The image is framed by a blue and yellow curved border on the left and right sides.

Question?

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