



The University of Georgia

ELEE 4220: Feedback Control Systems

Milestone 5

Group 5

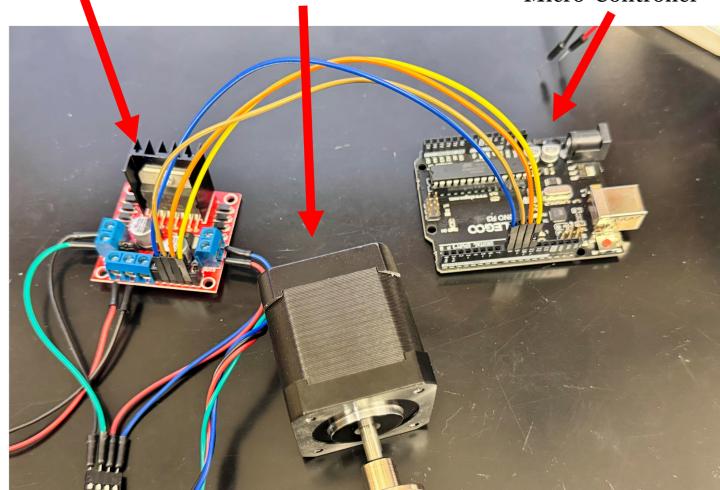
04/06/2025

Part 1 Motor Drive Circuit Design and Component Specifications

The first part of the project involved implementing basic control of a stepper motor using a microcontroller and an L298N dual H-bridge driver. The motor was driven through four control pins (IN1–IN4), each connected to the microcontroller. The motor's rotation speed could be controlled by adjusting the stepping frequency (i.e., the delay between steps).

<u>H-Bridge</u>	<u>Step Motor</u>
Out 1	Pin 1 (A+)
Out 2	Pin 2 (A-)
Out 3	Pin 3 (B+)
Out 4	Pin 4 (B-)

<u>H-Bridge</u>	<u>Micro-Controller</u>
In 1	D 8
In 2	D 9
In 3	D 10
In 4	D 11



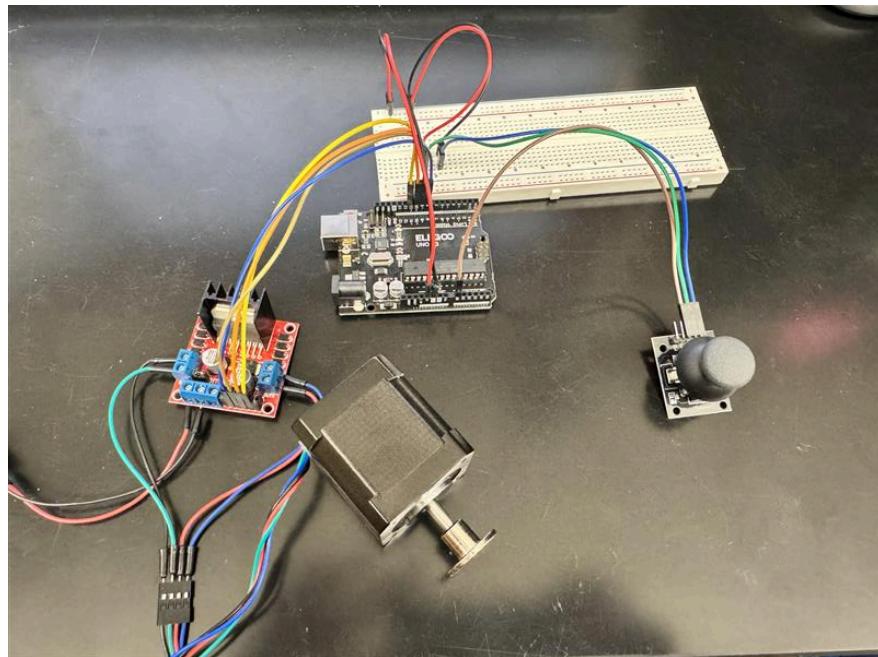
The code implementations for Part 2's motor control and Part 3's P-control at the following:
[FeedBackGroup5](#)

Part 2: Bidirectional and Variable Speed Motor Control Demonstration

We use a joystick to provide interactive control of the stepper motor's rotation. The joystick's analog X axis (connected to analog pin A0) adjusts the rotation speed and direction.

The video demonstrating the motor running at different speeds and directions is available below at the link: [Video Demonstration](#)

<u>JoyStick</u>	<u>Micro-Controller</u>
VRx	A0



Part 3: Implementation and Testing of Rudimentary Proportional Control

To implement the P-controller, we use the MPU6050, which offers both accelerometer and gyroscope data via I2C communication. The tilt angle of the rod is calculated based on the formula:

$$\theta = \arctan\left(\frac{a_x}{\sqrt{a_y^2 + a_z^2}}\right)$$

Because of sensor noise and vibrations during movement, the raw data from the sensor can get pretty messy. If we just use that data to calculate the tilt angle, the results can be way off — sometimes the angle drifts over time or even flips sign incorrectly. To fix this, we use a Kalman filter to smooth out the noise. And instead of relying only on the accelerometer, we also bring in gyroscope data using a complementary filter to get a more stable and accurate angle reading.

The video demonstrating the implemented P-controller is available below at the link:

[Video Demonstration](#)

JoyStick	Micro-Controller
Switch	A0

Acc and Gyro Sensor	Micro-Controller
SDA	A4
SCL	A5

