ME 410 - Week 6 Summary

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Summary

This week's objectives were to implement a proportional yaw controller and achieve a stable hover in ground effect.

In order to implement yaw control, the error was calculated as desired yaw rate (from joystick) minus yaw rate (from gyro data) and scaled by a proportional gain. The scaled error was then added to the speeds of motors 2 and 3, while being subtracted from motors 1 and 4. The motors are numbered based on the image below.

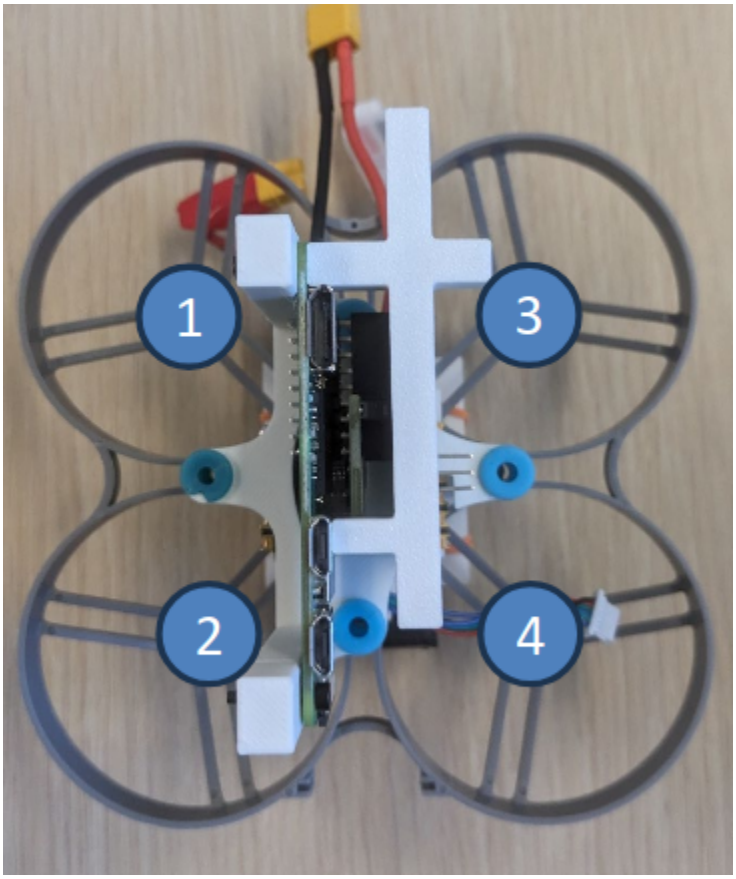

Figure 1: Motor Labels

After verifying the correct yaw control direction, the following plot was generated to show the effect of yaw control (Note - we did not disable PID control on the pitch and roll angles while

gathering the data for the plot). I do not remember the exact gain we used for the plot below, but we eventually landed on a gain of 5.5.

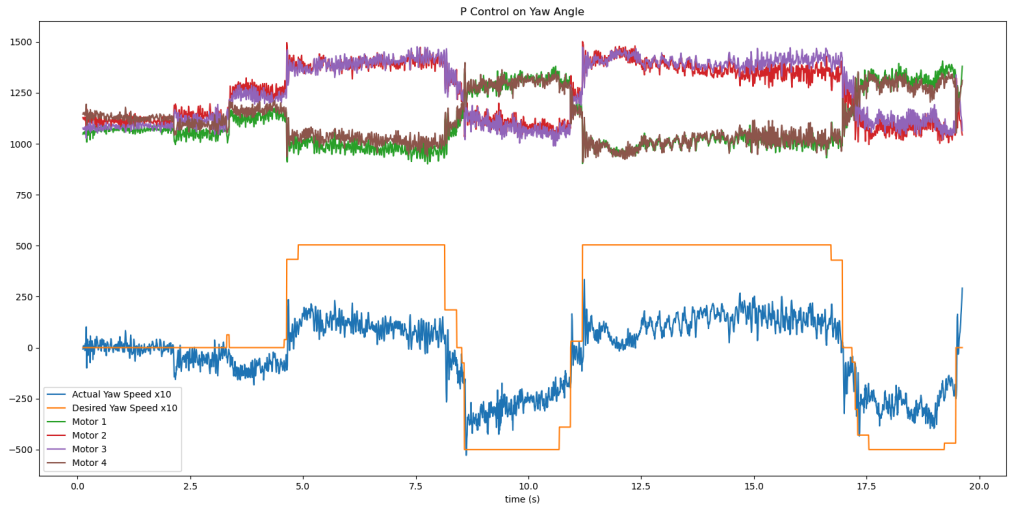

Figure 2: Yaw Control Plot

As shown in the plot, our drone has a much easier time turning in one direction compared to the other, but with some later adjustments we made, the turning has improved.

With yaw control implemented, we shifted our focus on achieving a stable hover in ground effect. We made sure all of our controller gains were turned on and adjusted our thrust neutral and amplitude values to ensure we had enough thrust to hover. With minor adjustments to the thrust and desired yaw speed joystick variables, we were able to achieve a stable hover in ground effect.

Next, we shifted our focus to achieving a controlled hover to a waypoint. We made some adjustments to our gains and joystick bounds to make our drone easier to control, but we still have not achieved the controlled hover to a waypoint even though we have had some close attempts. One issue that has been occurring is that our drone pitches up when we hover and do not touch the roll and pitch joystick. I suspect it is due to some integral windup, but we have not confirmed this.

Assessment - What Went Well

Implementing yaw control and achieving a stable hover in ground effect both went pretty quickly this week. Once we got yaw control working, all we really needed to do was turn on our pitch and roll gains and increase our thrust and then we were able to hover in ground effect.

Assessment - What Did Not Go Well

Our main issue this week was our drone drifting towards motor 2 in figure 1 above when we are hovering and not touching the pitch and roll joystick. While we are still able to have a controlled flight, this movement makes control much more difficult and we have not been able to fly to a waypoint in a controlled manner.

Assessment - Adjustments for Next Class

Overall, I think we mainly just need to spend more time tuning our controller. The movement when applying no pitch or roll input is concerning and we definitely need better control for when we are actually flying.

Team Member Effort

Me - 52% (Worked on .cpp file on my laptop; helped Ben with editing our plotting file)
Ben - 48% (We worked on his laptop to edit our plotting file; helped with .cpp file)