1. Bonus

A. Wiring

Video: T-Motor Pacer F7 Flight Controller & Mini F45A 20mm Stack - Setup & Overview
Summary: This video talked about a dji F7 controller Mini F45A 20mm Stack. In the video, he went over their features and how to set them up using both digital and analog systems. The flight controller features an f7 processor and usb type-c connector. The flight controller was using 30.5 by 3.5 mm m3 mounting holes that weights 8 grams. The dji air unit can be powered directly with up to 4s batteries. The receiver is wired to the pads on the back of the flight controller. We can power it using 3.3 or 5 volts. Overall, this video explained the features and pin setup for thw flight controller and Mini F45A stack. The downside of the ministack was that it is a little pricey. This video gave an in depth explanation that allowed for a better understanding of the usage of a mini flight controller and mini stack.

B. Remote controller

Video: How to SETUP FlySky FS-iA6B with flight controller FC. Protocol IBUS y PPM. Telemetry. TX RX UART

Summary: This video talked about what a FlySky FS -iA6B is. FlySky FS -iA6B is a receiver that has three types of communication protocols which are the classic PWM, and the two serial protocols: PPM and ibus. Something learned from this video is that when this receiver is connected to a flight control one of the serial connections (PPM or ibus) is always used. Flight controllers have UART serial ports. One of the serial port lines receives information from the radio while the other sends information from the controller to the radio. The two serial port lines are called RX and TX line. Overall information is sent through the RX line by the PPM and information is received through the TX line by ibus. From this video, I learned that the radio sends information of the channel to the controller and radio receives information from sensors of the controller.

C. PID Tunning

Video: Betaflight PID tuning. The easy way to a great PID tune. EVEN WITHOUT BLACKBOX!

Summary: This video explained the theory of Betaflight PID tuning. Betaflight's PID- F controller consists of four main parts which are P (proportional term), I (integral term), D (derivative term), and feedforward. Somethings learned is that the bigger the error the harder the P term pushes toward the setpoint, the D term wants the PID error to stay the same, I term adds up the error over time and feedforward pushes in the direction the setpoint us changing. Another interesting thing learned in this video is how to find you max D gains. Having the right D gain is important for PID tuning. The more D gain the hotter your motors will get. High I term gains keeps the quad stable at speed.

D. Motor

Video: How to Set Up Motors (ESCs) in BetaFlight - ESC Protocol, Motor Order, Spin Direction, Reverse Props

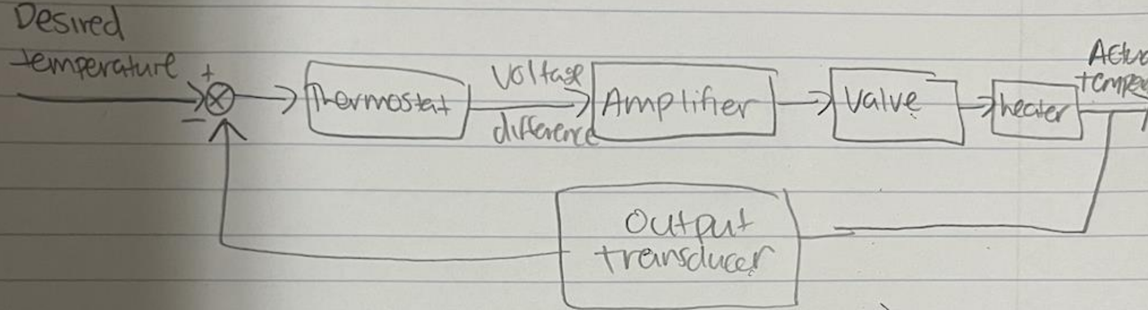
Summary: This video talked about how to setup your quadcopter motors in Betaflight. We learned that setting up your motor is important, so the motor's order and direction is correct. The first step in this process is to figure out the components you have. In this video, he used a ESC (Electronic Speed Controller) and FPV drone. The video showed us how to set the ESC protocol on Betaflight. The flight controller was connected to Betaflight. To find the protocol you need to go to the t-motors manufacturers website or manual. Something else that was learned was that you need to unplug your video transmitter and to remove your propellers while the battery is connected, or it could overheat.

E. Troubleshoot
Article: Quadcopter Doesn't Arm? Let's Fix it!
Summary: This article talks about how to troubleshoot and fix a quadcopter that does not arm. Somethings to look for when troubleshooting is to see if the radio receiver is working correct in Betaflight, check if a switch on radio is assigned to ARM mode, or remove USB connection and then reconnect it. If you completed all these tasks and the quad still does not arm go to Betaflight and check if there is any warnings that could prevent it from Arming. Overall, this article discussed how there is several ways to test why the quad did not arm. This tutorial explained reasons behind the quad not arming and ways to find out reason behind it such as the arming prevention flag lookup tables.

2. Quiz Correction

Controls Quiz 1 Correction

Problem 2.)



Problem 3.)

$$\frac{C(s)}{R(s)} = \frac{5}{(s+5)(s+6)}$$

$$C(s) = \frac{1}{s} \cdot \frac{5}{(s+5)(s+6)} = \frac{K_1}{s} + \frac{K_2}{s+5} + \frac{K_3}{s+6}$$

$$C(s) = \frac{(s+5)(s+6)K_1}{s(s+5)(s+6)} + \frac{s(s+6)K_2}{s(s+5)(s+6)} + \frac{s(s+5)K_3}{s(s+5)(s+6)}$$

$$C(s) = \frac{(K_1+K_2+K_3)s^2 + (11K_1+6K_2+5K_3)s + 30K_1}{s(s+5)(s+6)} = \frac{5}{s(s+5)(s+6)}$$

$K_1 = \frac{5}{30} = \frac{1}{6}$ $\quad K_1+K_2+K_3=0 \Rightarrow K_2 = -\frac{1}{6} - K_3$

$11K_1+6K_2+5_3=0 = \frac{11}{6} + 6(-\frac{1}{6} - K_3 + 5K_3) = 0$

$\frac{11}{6} - 1 - 6K_3 + 5K_3 = 0$

$\frac{5}{6} - K_3 = 0$ so $K_3 = \frac{5}{6} = 0.833$ $\quad K_2 = -\frac{1}{6} - \frac{5}{6} = -1$

So $\boxed{C(t) = \frac{1}{6} - e^{-5t} + 0.833e^{-6t}}$