Annotated Bibliography

DIY 3-Axis Brushless Gimbal: Acrylic, SimpleBGC, GoPro. "DIY 3-Axis Brushless Gimbal: Acrylic, SimpleBGC, GoPro." *YouTube,* 2024, youtu.be/lCRU35E6C3Y. Accessed 16 Jan. 2025.

Often referred to as YouTube University, this was the force resource/source that I visited when thinking about my capstone. My capstone has three parts that I am trying to package as one whole project: Creating the Gimbal, a 3D blender reel, as well as an extreme documentation of the entire process. I want to be able to bridge the gap between engineering and digvid in a way that is not only meaningful to me (I think Gimbals are insanely useful), but also showcases SLA's core values. But before all that, I wanted to know if it was really possible. Looking on YouTube, there were plenty examples of DIY gimbals (that being the search I typed in), and I landed on what Drone Gimbals looked like/how they function.

"Steady Brushless Gimbal 2 Axis BGC 3.1 MOS DIY." *YouTube,* 10 May 2014, www.youtube.com/watch?v=Hm76w-0Tp_4 . Accessed 15 Jan. 2025.

While many of the YouTube videos I scanned through did feature DIY 2 Axis gimbals, they all seemed to be small in size. With the goal of creating a Gimbal that can be used by my Canon r100 camera, I was wondering whether I needed to switch to use my phone instead of the camera. Thankfully, I landed on a video where someone created a 2 Axis Gimbal with a hefty Luminex camera, reassuring me that it was possible with my camera type. Besides reassurance, this video served as a basis for my equipment research. I looked into the model parts that were listed in the description, to further understand why they were chosen and if they would be a good fit for my project as well.

2 Axis vs 3 Axis Gimbal on a Drone [Diagrams]. 27 May 2021, droneflyingpro.com/2-axis-vs-3-axis-gimbal/ Accessed 16 Jan. 2025.

Now that I had higher confidence/reassurance that my capstone idea was indeed possible, my next steps were to understand what exactly makes a 2 Axis (2AG) gimbal different than a 3 Axis Gimbal (3AG) (Besides something as obvious as one less axis of rotation). This source was a demonstration of what 2AGs vs 3AGs on drones, which wasn't exactly what I was looking for. Even so, this source still was able to demonstrate the differences between the two, and what specific situations would call for a 3AG over a 2AG. Given that this person created both the 3AG and 2AG that were on his drone, and had video demonstrations of what he was explaining allowed me to start my execution document.

Gremsy. "TWO-AXIS MIO - SPECIFICATIONS." *Gremsy.com*, Gremsy, 22 May 2023, gremsy.com/two-axis-mio-spec. Accessed 16 Jan. 2025.

Still in the research phase of my project I started to suffer from information overload. Basically there is so much information on gimbal's as well as how they're built I started just researching and looking at things that show different types of gimbal structures. This of course is useful however wasn't helpful in the beginning of my search this is something I would do later along the line which is something I've already done but at the time I wanna access this source all it did was provide information about the specific lengths in millimeters of the cage that the camera would be sitting in.

"Hobby Tech :: IPower Gimbal Brushless Motor GBM4108-120T." *Hobbytech.com.au*, 2018, www.hobbytech.com.au/products/rc-accessories/motors/ipower-gimbal-brushless-motor-gbm4108-120t/#features. Accessed 16 Jan. 2025.

HobbyKing. "2-Axis Brushless Camera Gimbal Stabilization Control Board W/IMU."

Hobbyking, 2016, hobbyking.com/en_us/2-axis-brushless-camera-gimbal-stabilization-control-board-w-imu.html?___store=en_us. Accessed 16 Jan. 2025.

As the name suggests the website hobby king sells many different products tools and components for a variety of different hobbies. At the time of accessing this link I was actually in the design phase of my gimbal research project so I was looking not only for design structures but also materials and equipment I would need to build the actual gimbal. One of those sad pieces of equipment is an imu sensor board which hobby king sells for a price of $53. I specifically selected hobby king because they have imus dedicated for two axis gimbals and two axis motors.

https://www.facebook.com/staakercompany. "The Staaker Company." *Staaker.com*, 8 July 2021, staaker.com/2-axis-vs-3-axis-gimbal/. Accessed 16 Jan. 2025.

Early on this website provided the easiest to understand examples of what gimbals are and how they operate in space. From this website I was able to understand not only the three different dimensions of movement that an object can take through space but is also able to understand what a 2 axis gimbal does differently than a three axis gimbal. Typically 2 axis gimbals affect and control the roll and pitch dimensions of space while a three axis gimbal includes Yaw. So while three access gimbals typically stabilize better and have a higher chance of being useful in more scenarios it doesn't mean that a 2 axis is useless. Not only is it 2 axis gimbal simpler to use but it also is sometimes more than enough than what you need it for.

Maning, Jayric. "Brushed vs. Brushless Motors: What's the Difference, and What's Best?" *MUO*, 20 Aug. 2022, www.makeuseof.com/brushed-vs-brushless-motors/. Accessed 16

Jan. 2025.

If I wanted to create a 2 axis gimbal that not only worked but relatively looked nice and was efficient then I had to do more than just create a part list. I wanted to make sure I understood exactly what each component of the two axis gimbal would do and how it works and the main components of gimbals are gimbal motors. Motors could be either brushed or brushless and without going to further deep about it I learned that brushless motors are superior but also hard to use on more pliable surfaces than brushed. Now I still could use brush motors but it wouldn't be as efficient nor as successful than using brushless but of course those come at a cost with brushless motors ranging in prices to 30 to $200. The ones that I thoroughly researched through similar sources have led me to prices of 114 for each with the total of $228.

Morales, Jowi. "What's the Difference between a Two-Axis Gimbal and a Three-Axis Gimbal?" *MUO*, 24 Aug. 2021, www.makeuseof.com/two-axis-vs-three-axis-gimbals/. Accessed 16 Jan. 2025.

Another source that allowed me to see the difference between 2 axis and three axis gimbals and how they're operated. By this point I was just cross-referencing sources to make sure that I didn't find one that says A2 axis gimbal actually uses two different accesses of movement than the other one says. It'd be weird thinking that everything the gimbal would control is on 2 axes but it's on another 2. It was relatively simple to understand, and it did confirm that I was right and that 2 axis gimbals operate on the pitch and roll dimensions. It also confirmed that using 2axis gimbal could be useful for creating food promotion videos which may be something I do with the nimble once I create it maybe I could do it of a pizza place that I go to often.

SimpleFOC. “2 Axis Gimbal Stabilizer, Shaking/Precision Issue.” *SimpleFOC Community*, 20 June 2024, community.simplefoc.com/t/2-axis-gimbal-stabilizer-shaking-precision-issue/5076. Accessed 15 Jan. 2025.

Now this source was probably one of the most useful ones I actually came across when it comes to the development stage of my gimbal project. When I’m creating this gimbal, the reality is that I’m going to need to program it to work with not only the motors but the imu sensor that is not actually included in the motors it’s gonna be a separate sensor and also the camera weight. This of course isn’t easy and many people have struggled with it specifically the shakiness and precision with the gimbal motors and what that means for their code/how they fix it. Ultimately the best way to go about this is to use a sturdy backed up frame for your gimbal motors. This puts you in the best position for when things go wrong you know that what you’re working with is stable and correct therefore the gimbal won’t have to move to correct that unstableness and throw everything off. When it comes to the precision of the actual gimbal you’re gonna have to dive into the code that is thankfully provided when you purchase your gimbal specifically from stores like hobby king or hobby tech.