**DIY DELIVERY DRONE**

After doing some research, I decided to come up with a hardware list for making a DIY delivery drone. I know that there are many different configurations and ways to make one so I considered an approach that would be cost effective for a student or a beginner. Of course bigger would be better at handling a heavier load but I looked at some options that would be similar to a DJI PHANTOM drone but without the $1000 cost. So my hardware list is for a quadcopter that could potentially carry a small load between 1-2kg (2-4 lbs). I also showed a hexacopter frame just to show a variation that can be used. The hexacopter would definitely affect the load carrying ability but you would have to be willing to spend a little bit more to carry those extra pounds.

**HARDWARE COMPONENTS**

Frame: *YoungRC F450 Drone Frame Kit 4-Axis Airframe 450mm Quadcopter Frame Kit with Landing Skid Gear -- $18.99*

So for the frame I decided that the best cost effective option would be to go with an F450 frame kit from YoungRC that sells for $18.99 on Amazon. There are other 450 frame kits that are a little more expensive but they are very similar and in my opinion are not worth the extra money. So this frame is 450 mm across. These frames are made from quality glass fiber and polyamide nylon. I also liked this frame because the kit includes the landing skid gear. It is also a nice choice for the price because it has integrated PCB connections on the frame so it easy to solder parts directly to the frame and keeps your project “cleaner” as it requires less lengthy wires. It also has predrilled holes throughout the frame to mount the motors and to attach other gear like a small camera if you so choose.

Link: YOUNGRC F450 FRAME <https://www.amazon.com/dp/B0776WLHX7/ref=nav_timeline_asin?_encoding=UTF8&psc=1>

Alternate frame: *USAQ F550 550mm Hexacopter Drone Frame w/ Integrated Power Distribution Board -- $29.95*

This is an alternate frame from a brand called USAQ that would be better for lifting a heavier load than the quadcopter frame mentioned above. Biggest difference being that it has two more motors and is a bit bigger in width (550 mm) but you would need to buy the landing gear separately. You would also need to purchase a set of 6 motors instead of a set of 4 and 6 ESCs which would cost you extra as well. Other than that, it has similar features like the integrated PCB connections to solder directly onto the frame.

Link: USAQ F550 HEXACOPTER <https://www.amazon.com/dp/B07DZRCKPQ/ref=sspa_dk_detail_7?psc=1&pd_rd_i=B07DZRCKPQ&pd_rd_w=OCpOk&pf_rd_p=45a72588-80f7-4414-9851-786f6c16d42b&pd_rd_wg=fNCyq&pf_rd_r=H3N4F90YYXJMC1BTJM8S&pd_rd_r=88a7dcc1-2fd2-4e09-ba48-f41ba6a5afa5&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEzRkZXS0hQNTIyODBLJmVuY3J5cHRlZElkPUEwMTg4NTU0Mzg5Q0RDOTdGQUxMRyZlbmNyeXB0ZWRBZElkPUEwODM5NDI1MjFXOUtIS1A1SDJRUCZ3aWRnZXROYW1lPXNwX2RldGFpbCZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0NsaWNrPXRydWU=>



Power Distribution Board: $0

None required because frame has an integrated power distribution board built right onto the frame.

Motors:

*(Better performance) EMAX MT2213-935KV 2212 – $49.99*

*(Economical choice) WOAFLY 2212 920KV -- $31.99*

The recommended motors for the quadcopter frame above is brushless motors with a rating between 800 KV and 1100 KV. There were two options here that I considered and after reading reviews it mainly comes down to the quality of the motors made by the different brands. The more economical choice would be a set of 2212 920KV brushless motors from a brand named WOAFLY. These sell on Amazon for $31 but have mediocre reviews with some people having no issues to some people having failures out of the box. The better option here seems to be a set of motors from a brand called EMAX. The model number for these are the MT2213-935KV 2212s and they have really good reviews. Both options come with a set of 4 motors, two are clockwise motors and the other two are counter clockwise.

Link: EMAX MOTORS <https://www.amazon.com/MT2213-935KV-Brushless-Motor-Quadcopter-Multirotor/dp/B00N3I9GM4/ref=pd_bxgy_21_img_3/135-3410312-1040318?_encoding=UTF8&pd_rd_i=B00N3I9GM4&pd_rd_r=4728752e-d483-4baa-a72b-0d093b33b428&pd_rd_w=B4bXu&pd_rd_wg=V5WUu&pf_rd_p=3edd75bb-e36e-488e-b666-80dd1a52c658&pf_rd_r=34BX5HBNVH0HRZKHDQEN&psc=1&refRID=34BX5HBNVH0HRZKHDQEN#customerReviews>

Link: WOAFLY MOTORS <https://www.amazon.com/dp/B01HM8EXJG/ref=sspa_dk_detail_4?psc=1&pd_rd_i=B01HM8EXJG&pd_rd_w=xGJlb&pf_rd_p=45a72588-80f7-4414-9851-786f6c16d42b&pd_rd_wg=T06tF&pf_rd_r=GWARKBBJWRDGR3NKFCS8&pd_rd_r=98dfb67e-4d2c-4ad2-99bc-8197d96ae5ce&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEyVlJMM1RXTVVZS1lUJmVuY3J5cHRlZElkPUEwODkzNzEzMVg5WE44TVBDM0ZPWiZlbmNyeXB0ZWRBZElkPUEwMTY2ODQ1MzRJQzVBNlZGSklFTCZ3aWRnZXROYW1lPXNwX2RldGFpbCZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0NsaWNrPXRydWU=>



Propellers: *RAYCorp 1045 10X4.5 Propellers. 8 Pieces(4 CW,4 CCW) Black and Red 10-inch Props -- $9.99*

For the propellers the best option is a set from RAYCorp. They have different options like sets of 8, 10, 16 as well as different color schemes but for a beginner I would choose a set of the black and red propellers. The reason for the two colors is to distinguish the clockwise propellers from the counterclockwise propellers. In your quadcopter build you would only need 4 and this set is a good deal because you will have extras left over if you need to replace one. RAYCorp also has different sizes of propellers but these 10-inch propellers are the ones that are recommended for a F450 frame and they fit the motors mentioned above.

Link: Propellers <https://www.amazon.com/RAYCorp%C2%AE-Propellers-Quality-Quadcopter-Multirotors/dp/B01CJMJ886/ref=pd_bxgy_21_img_2/135-3410312-1040318?_encoding=UTF8&pd_rd_i=B01CJMJ886&pd_rd_r=82fffd6d-a8f0-4135-9197-437eaf9b4fed&pd_rd_w=MwKVo&pd_rd_wg=TwgcU&pf_rd_p=3edd75bb-e36e-488e-b666-80dd1a52c658&pf_rd_r=BVPJ8VAZGBJW15W67VCD&psc=1&refRID=BVPJ8VAZGBJW15W67VCD>



ESCs (Electronic speed controllers): *Hobbypower Simonk 30A ESC Brushless Speed Controller (Pack of 4) -- $24.97*

For the motors that I chose in this build the recommended ESCs should be between 15 and 30 A. This pack of 4 meets our needs and it has moderate reviews.

Link: ESCs <https://www.amazon.com/Hobbypower-SimonK-Brushless-Controller-Quadcopter/dp/B00QRR7N32/ref=pd_day0_hl_21_3/135-3410312-1040318?_encoding=UTF8&pd_rd_i=B00QRR7N32&pd_rd_r=9dd6f025-e1cb-4da8-9720-138d7fb3a275&pd_rd_w=qbs59&pd_rd_wg=nXTfe&pf_rd_p=ad07871c-e646-4161-82c7-5ed0d4c85b07&pf_rd_r=JFYDA7E5AQ0THYZ4V2W4&psc=1&refRID=JFYDA7E5AQ0THYZ4V2W4#customerReviews>



Battery: *Floureon 3S 25C 11.1 V Li-Polymer battery pack (3000 mAh) --$25.99*

For the motors with the 1045 propellers it is recommended to use either a 3S or 4S LIPO battery. On Amazon and Ebay there are many different brands of batteries. This choice just really comes down to preference of brand and preference of power rating of each battery. There are 2200 mAh, 3000 mAh, 5000 mAh, and many other batteries and they all have good reviews. I picked something in the middle so I went with a 3000 mAh battery from a brand called Floureon. According to people that I have seen use these batteries with similar setups it gives us an average flight time between 8-15 minutes but that also depends on your builds individual power consumption based on gear that you are running.

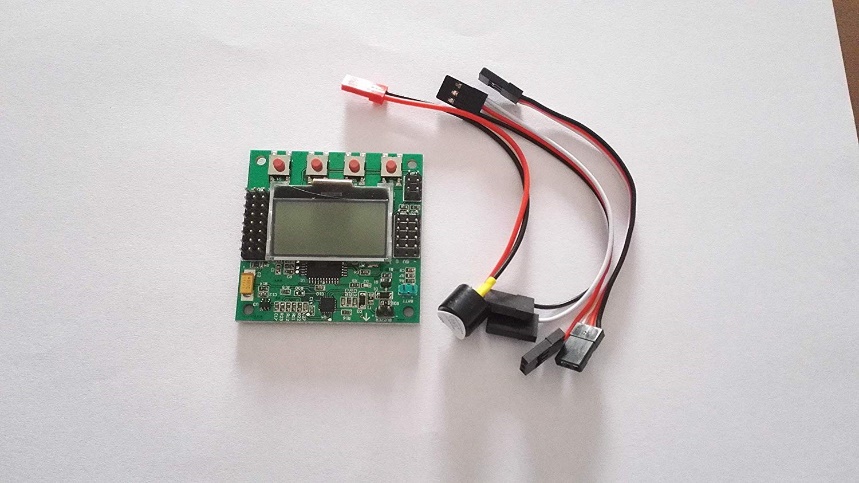
Link: battery <https://www.amazon.com/FLOUREON-3000mAh-Battery-Airplane-Helicopter/dp/B06Y1ZBZ7K/ref=sr_1_14_sspa?crid=24ZPTKQOORWQG&keywords=3s+lipo+battery&qid=1570383017&s=toys-and-games&sprefix=3s+%2Ctoys-and-games%2C187&sr=1-14-spons&psc=1&smid=A3VS8XRDRZZJGS&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUExS0lTRDVCVjJCUlRPJmVuY3J5cHRlZElkPUEwNTA3Mjk2Mk1RNVcxRDFIT09ZMyZlbmNyeXB0ZWRBZElkPUEwOTIyMzI5M0JXRlJISEtQOTdWOCZ3aWRnZXROYW1lPXNwX210ZiZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0NsaWNrPXRydWU=>



Flight Controller: *KK2.1.5 LCD Multirotor KK Flight Controller Board KK 2.1.5 Newest V1.17S1-- $16.99*

I’ve seen many videos online of DIY builds and a lot of people seem to be using this board. It has a built in LCD screen with different options to help you calibrate the motors. It allows you to work with up to 8 motors. There are different brands of these boards as well with the basic one starting at $16.99 going all the way up to $49.99 by a brand called HobbyKing.

Link: <https://www.amazon.com/Multirotor-KK-Controller-Quadcopter-Multicopter/dp/B07PDFWNQJ/ref=sr_1_4?crid=2MKOO536SIFIN&keywords=kk+2.1.5+flight+controller&qid=1570388264&s=toys-and-games&sprefix=kk+2.1%2Ctoys-and-games%2C174&sr=1-4>



Payload release kit: *E-flite Servoless Payload Release, EFLA405 -- $26.99*

This little device is a perfect option for attaching a payload to a drone. It is basically a device that can operate with your transmitter and receiver. After connecting it properly all you need to do is hit your switch on your controller that is dedicated to it and this device will release any load that is attached to it. It is basically a pin that is holding your load in place and when you ‘release’ it the pin retracts and the load is free to fall from the device.

Link: payload release device <https://www.amazon.com/E-flite-EFLA405-Servoless-Payload-Release/dp/B00CPNA52I/ref=sr_1_7?keywords=drone+release&qid=1570390394&s=toys-and-games&sr=1-7>

