

# Quadcopter Design and Build Log

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# 1 Introduction

The purpose of this document is to record and explain the design process of the quadcopter and why each decision was made. Since I have little experience with the design process, all steps performed for this project were made up as I went along and may or may not be representative of the real-world design process. Most or all decisions are made using a weighted decision matrix using information found online. This document was created to better organize my thoughts and each decision I made for future collaborators to get up to speed and to learn what is going on. All information that is obtained from outside sources is cited with footnotes, however only the url or website is noted and no proper citation format is used. All information is presented in a way that someone with little to no technical experience can understand (hopefully).

A quadcopter is a four rotor manned or unmanned vehicle used mostly for aerial photography. Many sensors such as gyroscopes and accelerometers, which are located on the flight controller, are used to provide the aircraft with feedback on altitude, acceleration, orientation, etc. This data is then sent to the motors and the quadcopter's position is compensated if it does not match the user input from the transmitter. More info can be found [here](#).

## 2 Objectives

The main goal of this project are for the quadcopter to be/have:

- a minimum 8 minutes flight time
- easily replaceable parts in the event of a failure or crash
- space and bracket(s) for mounting of a GoPro camera in the future for aerial photography
- small enough to carry in a backpack
- room for future expansion such as GPS\*

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\*may be omitted if a Version 2 is made later on

All decisions that must be made for which materials to use, physical design, etc. will follow these rules strictly.

Two main design sections will be considered, the frame and the electronics. The frame will consist of the structural components of the quadcopter where all the electronic components will be mounted. The electronic components will include the flight controller, motor, battery and receiver.

The main restriction imposed on this project is cost. Most, if not all, decisions are made with cost as one of the heaviest factors. Time and difficulty are not as important as this project does not have a deadline and new skills can be learned along the way.

### 3 Frame Design

The frame of the quadcopter must meet the following requirements:

- strong enough to survive a crash several times
- easily replaceable
- easily manufacturable or purchased online
- as lightweight as possible
- mounting locations for GoPro, motors, battery, flight controller, receiver, ESCs\* and future peripherals
- modular system
- affordable

Two alternatives exist for frame design: purchasing a prebuilt frame from sites such as eBay or Aliexpress, or 3D printing a frame. To determine which alternative is better, a decision matrix will be considered.

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\*Electronic Speed Controller; converts battery voltage to three-phase AC signal for motors

		Purchased Frame		3D Printed Frame	
Criteria	Wgt	Rating	Score	Rating	Score
<i>Price</i>	-0.5	2	-1	4	-2
<i>Replaceability</i>	0.4	4	1.6	5	2
<i>Customizable</i>	0.5	0	0	5	2.5
<i>Modular</i>	0.3	2	0.6	4	1.2
		Total	1.2	Total	3.7

Table 1: WDM for Frame

## 4 Electronics