# Calculations

keyur Rakholiya
Akshit Gandhi

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# Contents

# 1 Tutorial Name

**Calculations for deciding the components to be used for drone(quadcopter)**

# 2 Theory and Description

First, calculate the approx weight of whole quadcopter
1. Weight of frame = 300 gm
2. Weight of bettary = 600 gm
3. BLDC Motors = 4x85 gm
4. Propellers = 4x15 gm
5. Esc + R pi + FC(apm)= 200 gm
6. Camara + gimble = 300 gm
7. Buffer weight = 200 gm

total weight = 2000 gm

As per calculation,the total weight of drone is 2 kg about. So you need to generate 3 times of thrust of its weight for smooth lifting the quad and hovering.
So we need to generate 6 kg of thrust from four motors.
So each motor needs to generate 1.5 kg of thrust.
Now according to required thrust we have to choose specified motors and propellers First of all, calculate the power.
Equation for power is

$$Power = Prop\ Const\ * rpm^{Power\ factor} \qquad (1)$$

$$T = \frac{\pi}{4} D^2 \rho v \Delta v \qquad (2)$$

$T$=thrust [N]
$D$=propeller diameter [m]
$v$=velocity of air at the propeller [m/s]
$\Delta v$=velocity of air accelerated by propeller [m/s]
$\rho$ = density of air [1.225 kg/m³]

$$T = \frac{\pi}{8} D^2 \rho (\Delta v)^2 \qquad (3)$$

$$P = \frac{T\Delta v}{2} \Rightarrow \Delta v = \frac{2P}{T} \tag{4}$$

$$T = \left[\frac{\pi}{2} D^2 \rho P^2\right]^{1/3} \tag{5}$$

$$m = \frac{\left[\frac{\pi}{2} D^2 \rho P^2\right]^{1/3}}{g} \tag{6}$$

Where $g$=9.81$m/s^2$.

Now calculate the power according to your propellers constant and put it in equation 6. it will give u thrust. Do the propeller test and get the readings, you can also find the prop test reading from sellers.

choose your motors and propeller according to weight of your quadcoptr. follow the equations.

## 3 Experiment

we have choosen 1500 kva motors and 10x4E propellers.

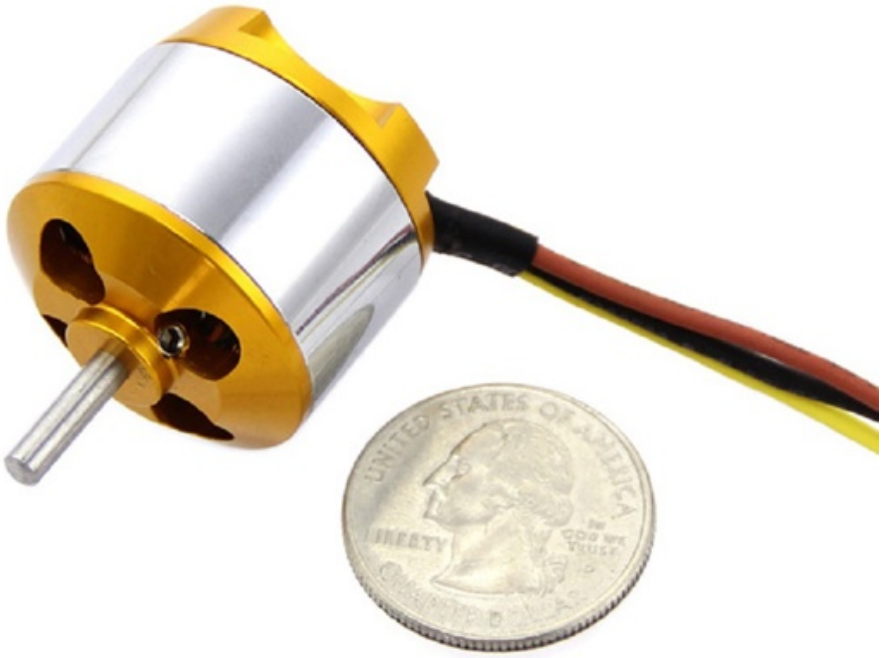


Figure 1: Brush less DC MOTOR 1500KVA

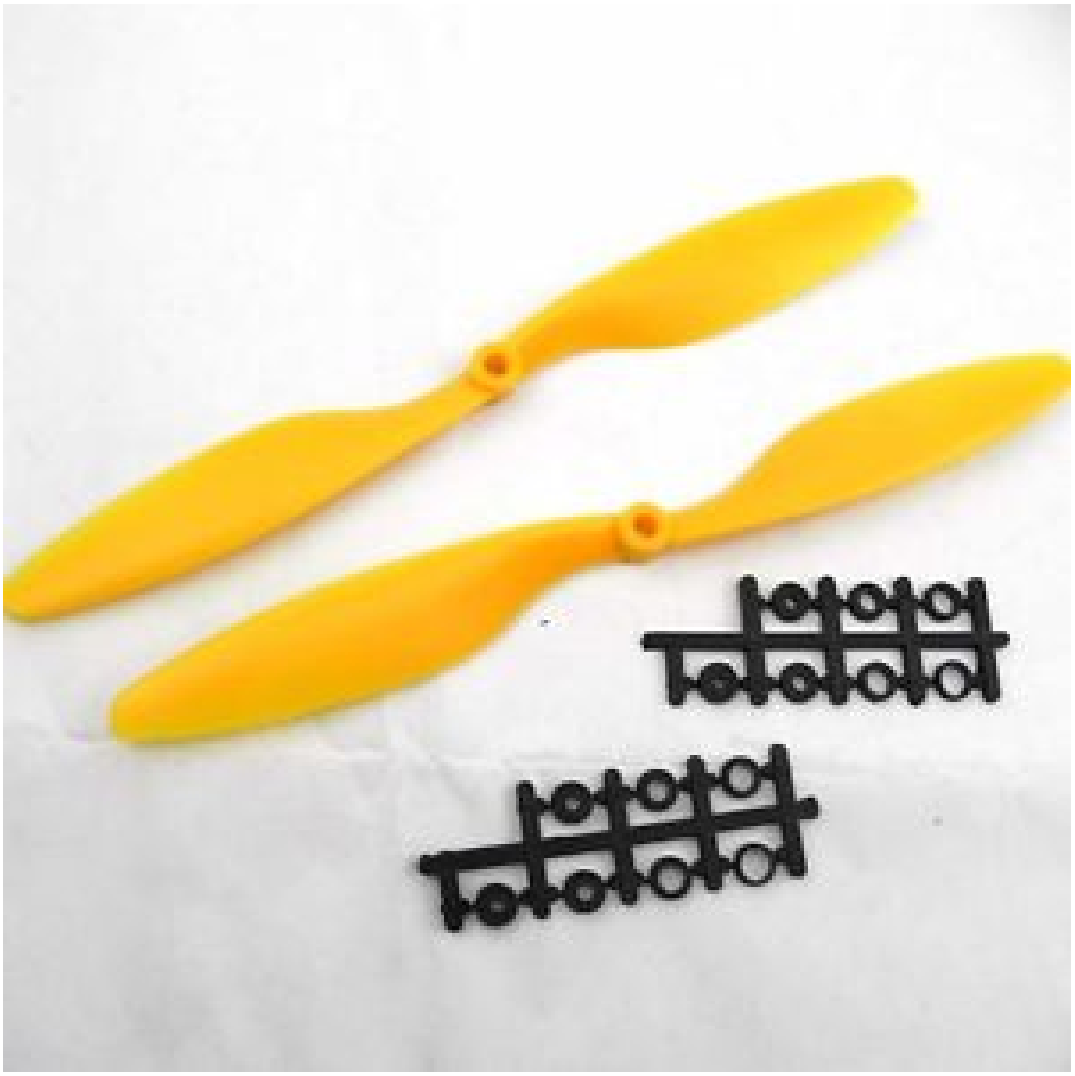

Figure 2: 10x4E PROPELLER

## 4 References

https://quadcopterproject.wordpress.com/static-thrust-calculation/