Drones

Name:

Drones (or unmanned aerial vehicles, UAVs) are vehicles without human pilots onboard.

Drones were used initially in military applications, but have rapidly become part of popular culture.

While many people enjoy using drones for aerial photography, drones are also used for commercial, scientific, agricultural, and recreational purposes. Drones have also found their way into many other applications such as surveillance, delivery, infrastructure inspections, and drone racing.

How do drones fly?

Let's start with aeroplanes...

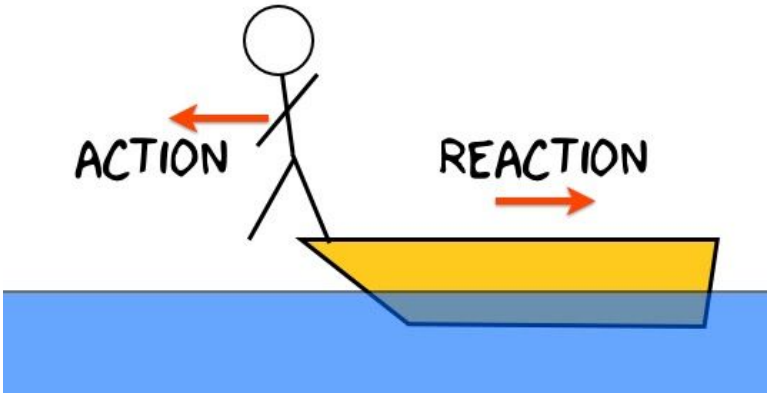
https://www.youtube.com/watch?v=GgOTXNXGz-w

How does wing design make more air molecules hit this underside of the wing? Draw a diagram below to explain.

In what ways could the rotors of a drone be described as "mini-wings"?

Newton's third law

For every action, there is an equal and opposite reaction



Can you draw two other examples of where you see Newton's 3rd Law:

Helicopters have two rotors.

If there was only one rotor on the top of the helicopter, the fuselage part will also start rotating.

That is due to the torque generated by the rotor.

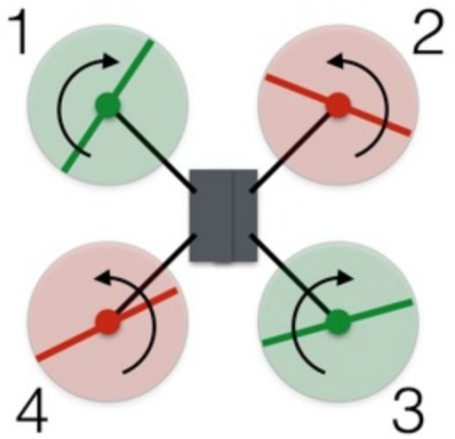
To prevent this, helicopters need something that acts against this torque

This role is performed by the tail rotor of the helicopter

The same happens with quadcopters

When you have all the motors rotating in the same direction (e.g. clockwise) the drone body will start rotating in an anticlockwise direction too.

To remove that torque activity, we need some opposite force.

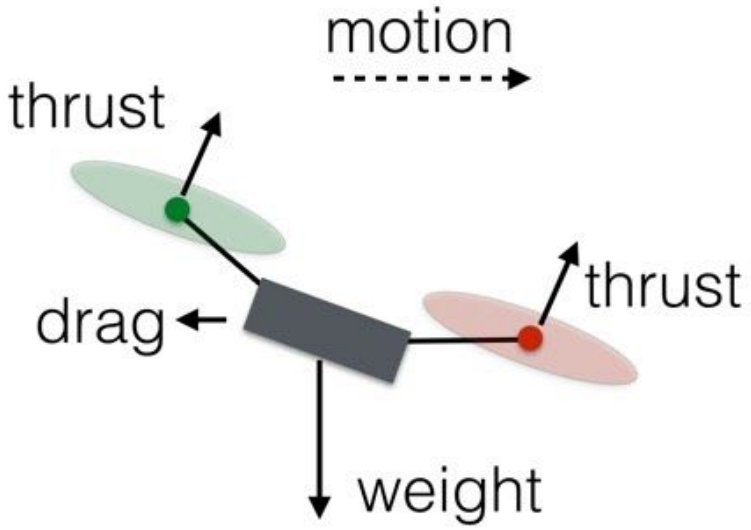


Motion

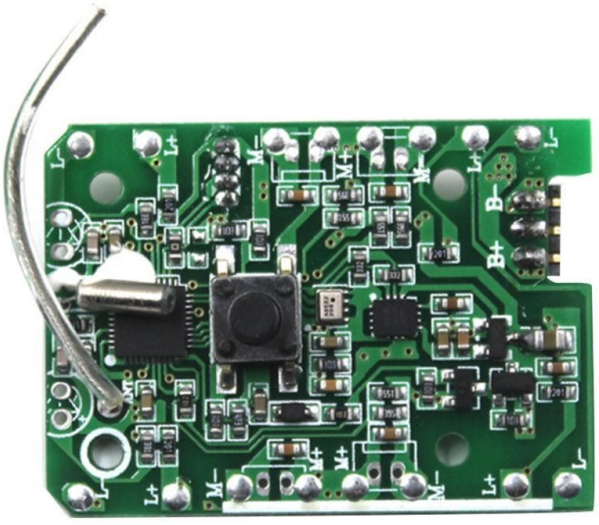
Drones use rotors for propulsion and control. You can think of a rotor as a fan, because they work pretty much the same. Spinning blades push air down. Of course, all forces come in pairs, which means that as the rotor pushes down on the air, the air pushes up on the rotor. This is the basic idea behind lift, which comes down to controlling the upward and downward force. The faster the rotors spin, the greater the lift, and vice-versa.

To climb:

The rotors need an up force greater than the down force greater than the weight of the drone, and gravity.



Using a Computer



Every movement of a drone is accomplished by changing the spin rate of one or more rotors. Doing that requires a controller that can increase or decrease the voltage to each motor.

If you have some type of computer control system, you can simply push a joystick with your thumb and let a computer handle which motors need to change to achieve the desired outcome. An accelerometer and gyroscope in the drone can further increase the ease and stability of flight by making minute adjustments in the power to each rotor. Add a GPS system and you can pretty much get rid of the human entirely.

https://www.wired.com/2017/05/the-physics-of-drones/

How does a drone work?

https://www.youtube.com/watch?v=6Bc2nu0urjM

The rotors push down on the air. What pushes back up against the rotors?

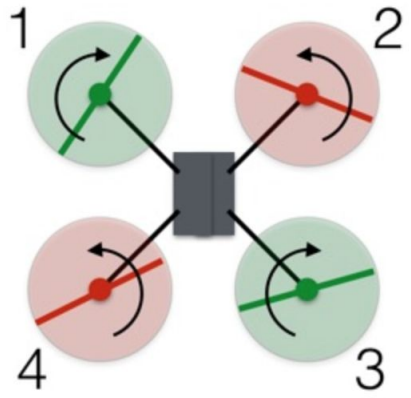
When the rotors turn fast, which way will the drone fly?

When the rotors turn slow, which way will the drone fly?

What causes the drone to turn?

Which motors would have to speed up on this drone (below) to make it turn to the right?

Front



Which motors would have to speed up on this drone to make it go forward?

Front