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Title - Experimental Study of Propeller Blade Rotation CC & CCL & its Role in Control.

Objective - To know the propeller blade's role during the drone flight control in terms of CC & CCL rotation.

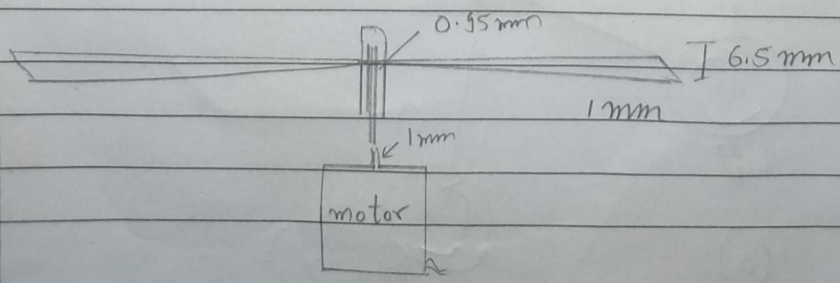
Introduction -

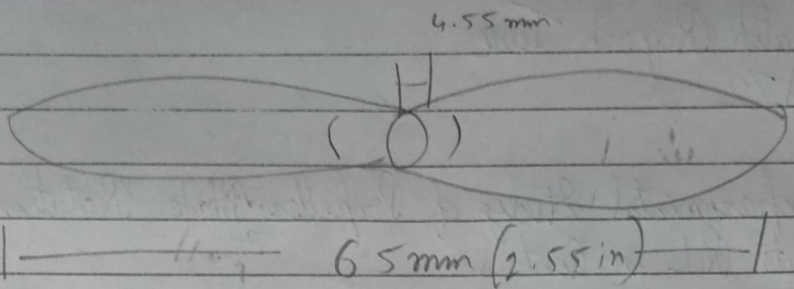
Propellers for drones & UAV's Propellers are devices that transform rotary motion into linear thrust. Drone propellers provide lift for the aircraft by spinning & creating an airflow, which results in a pressure difference between the top & bottom surfaces of the propeller.

How do propellers work.

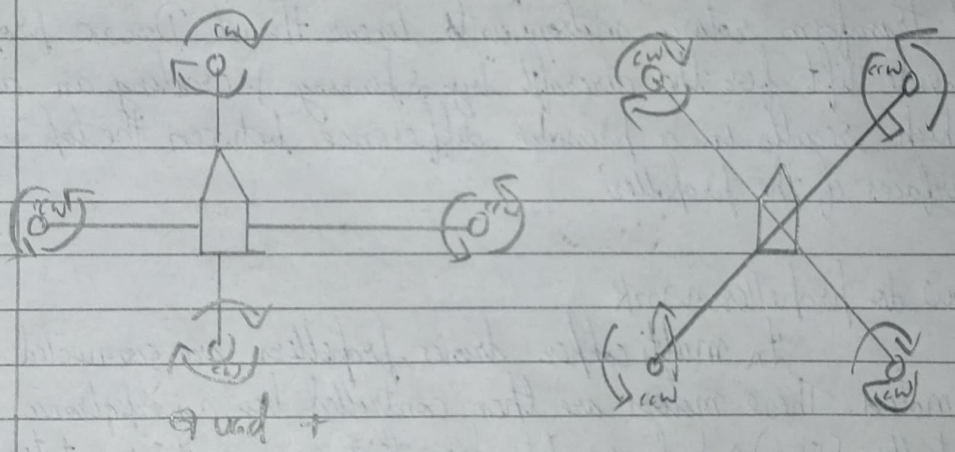
In multi copter drones, propellers are connected individually to motors. These motors are then controlled by an electronic speed Controller (ESC) which regulates how fast each motor rotates. By varying the speed of rotation of individual motors, the ESC is able to help drones manoeuvre in several possible ways.

When propellers rotate, they cut through the air & direct in downwards. If the drone is perfectly horizontal, this motion of the propeller creates lift by pushing against the wind. The lifting force generated, as well as the energy it takes to cut through the air, depends on the shape & size of the propeller. Atmospheric conditions, most notably air density, also plays a significant role.



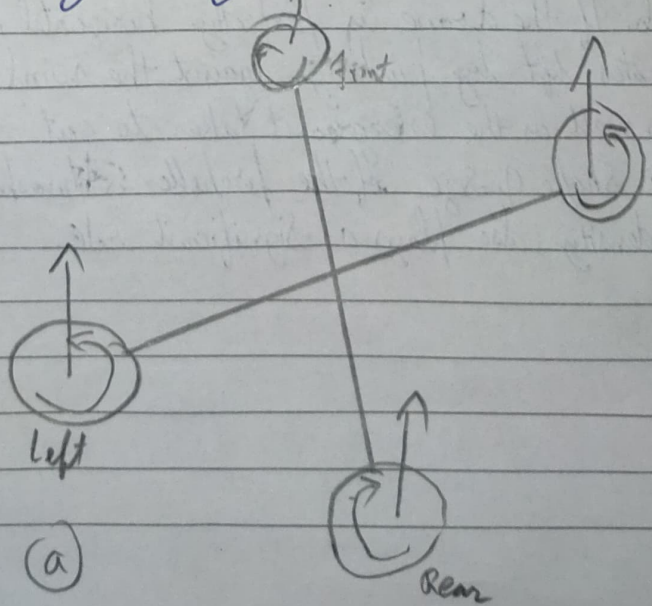


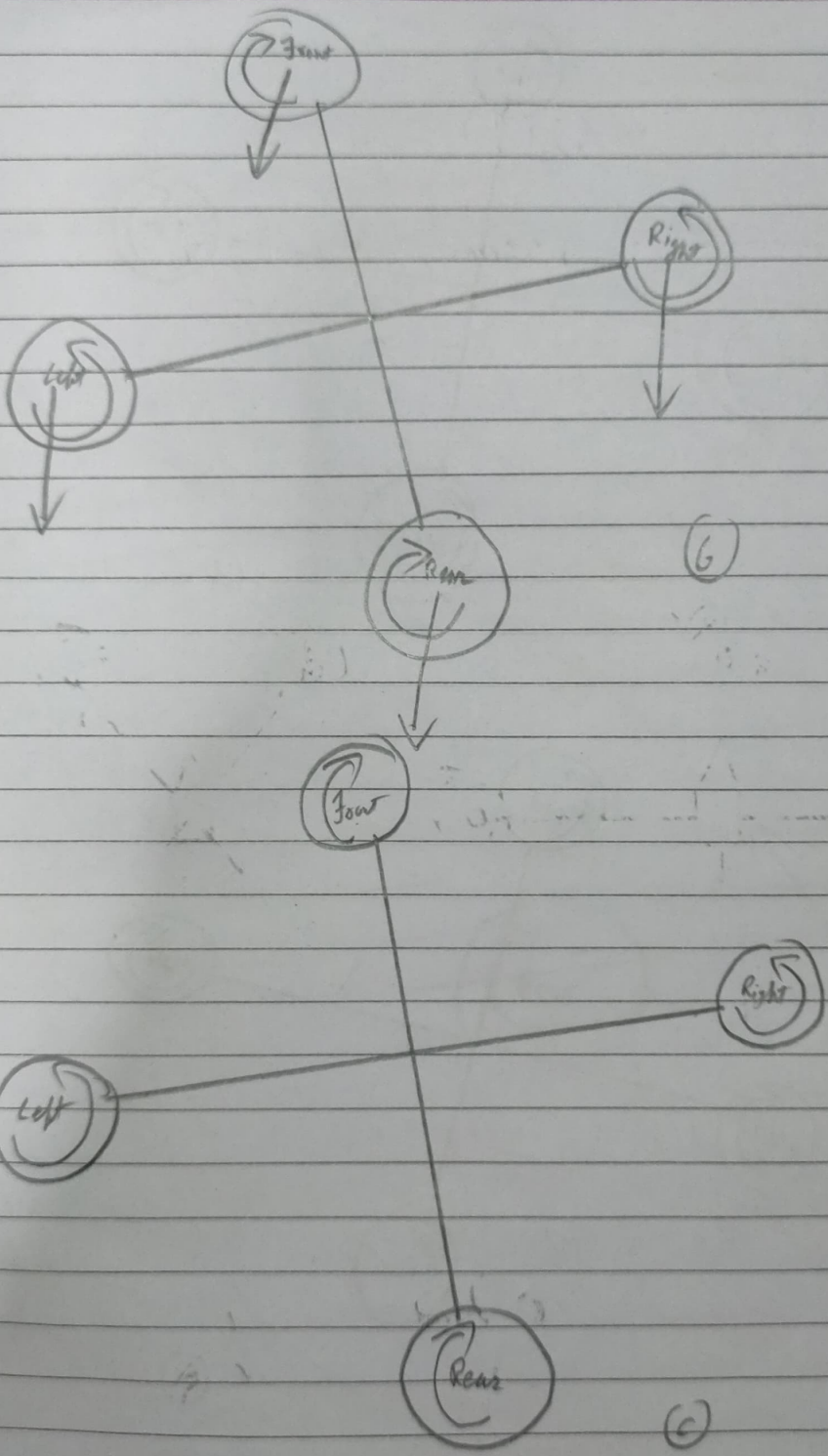
3 Effect of rotation (clockwise & counter clockwise) & its role in drone flight control:



CW ⇒ Clockwise Rotation Using Pushing propeller

CCW ⇒ Counter-clockwise Rotation Using Normal propeller

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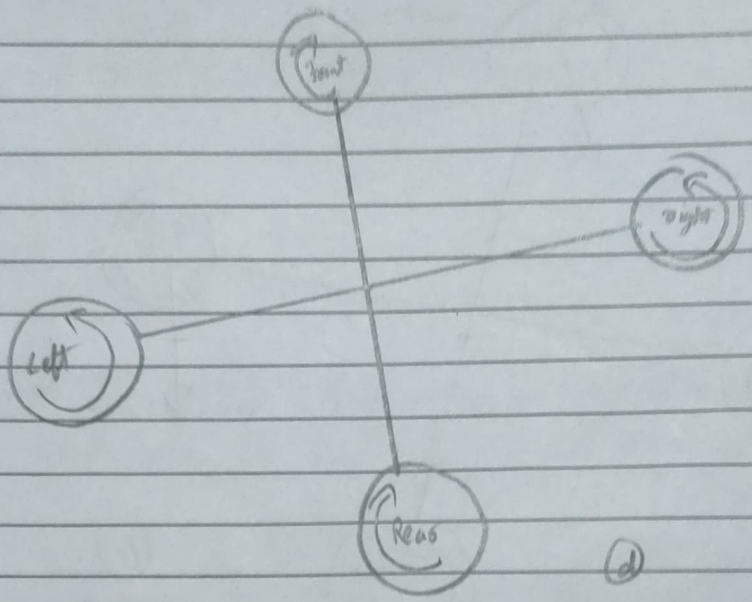

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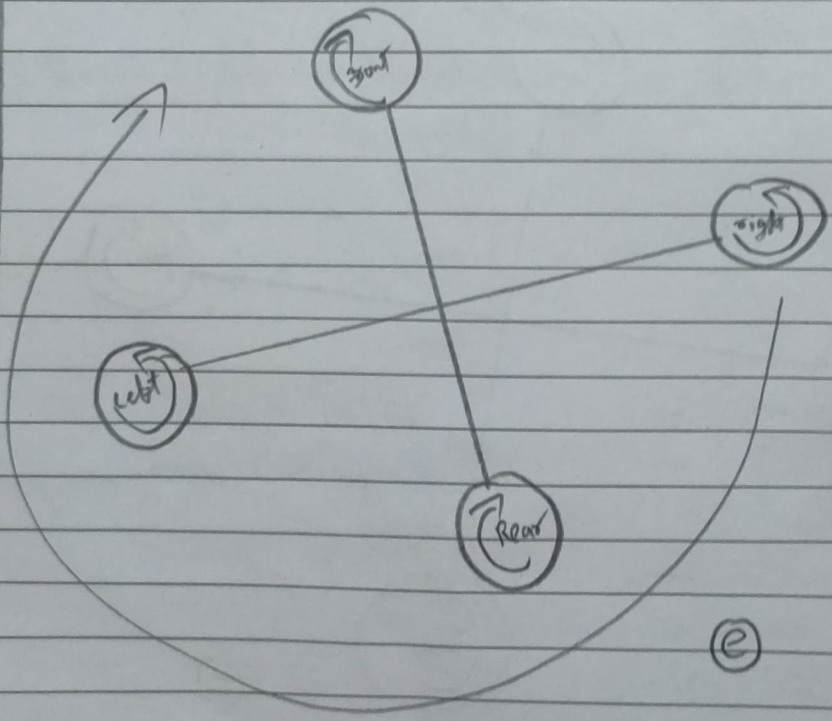

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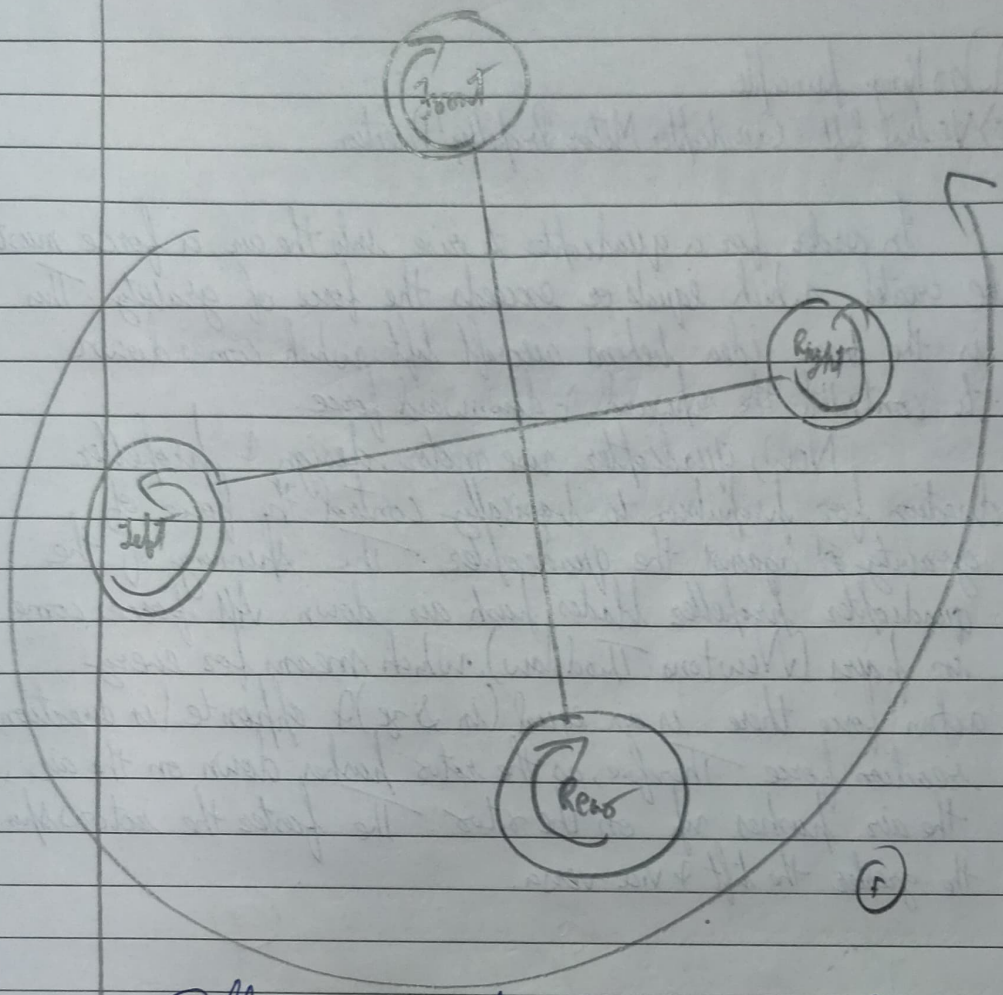


Different motion representation ⓐ Take off motion ⓑ landing motion ⓒ Forward motion ⓓ Backward motion ⓔ Right motion ⓕ Left motion

Drone propeller construction -

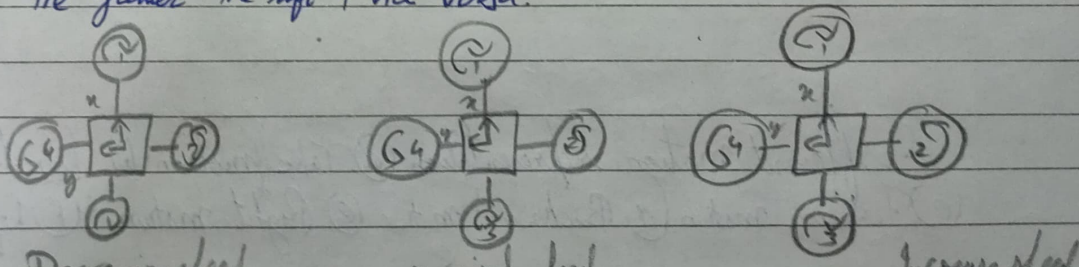
Drone propellers can be contructed with two, three or four blades. Propellers with more blades provide greater lift due to more surface area moving through the air per rotation, but are more inefficient due to increased drag. Smaller drones with limited battery life are best suited to propellers with fewer blades. Drone propeller blades are most commonly contructed from plastic or carbon fibre. The increased stiffness of carbon fibre propellers, although providing less durability, decrease vibration & improved the performance of the drones & it quieter.

Working principle

a) Vertical Lift - Quadcopter Motor Propeller Direction

In order for a quadcopter to rise into the air, a force must be created, which equals or exceeds the force of gravity. This is the basic idea behind aircraft lift, which comes down to controlled the upward & downward force.

Now, quadcopter use motor design & propeller direction for propulsion to basically control the force of gravity against the quadcopter. The spinning of the quadcopter propeller blades push air down. All forces come in pairs (Newtons Third law), which means for every action force there is an equal (in size) & opposite (in direction) reaction force. Therefore, as the rotor pushes down on the air, the air pushes up on the rotor. The faster the rotors spin, the greater the lift & vice-versa.



Hover still

To hover, the net thrust of the four rotors push the drone up & must be exactly equal to the gravitation force pulling it down.

Climb Ascend

By increasing the thrust (speed) of the quadcopter rotors so that upward force is greater than the weight & pull of gravity.

Vertical Descend.

Dropping back down requires doing the exact opposite of the climb. Decrease the rotor thrust (speed) so the net force is downward.

Summary -

In this experiment, the rotational effect of propeller blades on drone flight has been caried out Clockwise & counter clockwise effect due the propeller blade has been caried out. Also, the role of propeller blades in motion control has been studied.