



# Module 1

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## Basic Aerodynamics of Quadrotor UAVs



# Unmanned Aerial Vehicles (UAVs)

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- A UAV, or simply a drone, is a flying apparatus without a pilot on board.
- The UAV you will be working with is a small, lightweight quadcopter (a helicopter propelled by four rotors). These rotors allow vertical takeoff and landing.



# Features

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- UAV has its own power supply. The UAV you will be working with is equipped with a removable, rechargeable battery.
- Also, it is equipped with a forward-facing camera, which provides live video feed.



# Flexible Movement

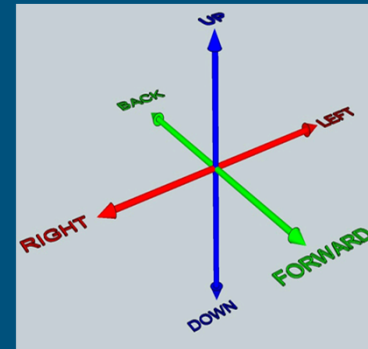
- Drones can move in various directions.
- Vertical movement : Up, Down
- Lateral movement : Forward, Back, Left, Right
- Rotational movement : Yaw, Roll, Pitch



# Types of Motion

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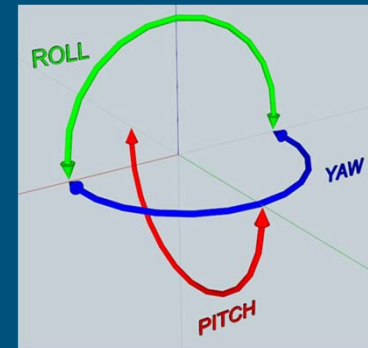
- Up, Down, Forward, Back, Left, Right : straight-line motion without any rotation.
- The drone can move a combination of these directions as well, i.e., in diagonal directions.



# Types of Motion

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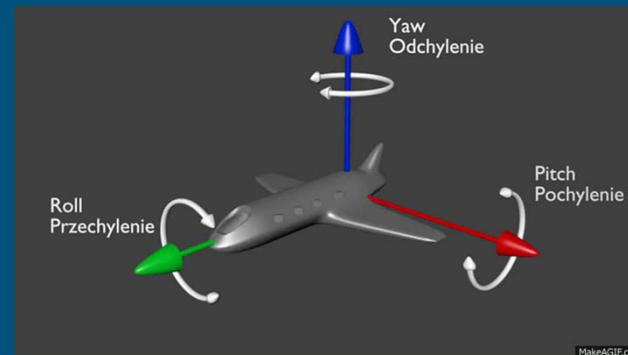
- Yaw, Roll, Pitch  
: rotations around different axes.



# Pitch

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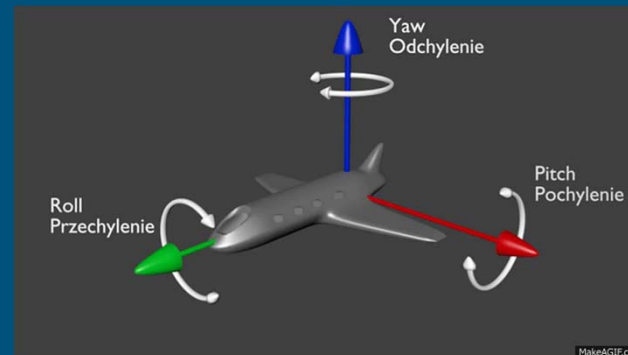
- **Pitch** is rotation around the *left-right* axis, so left and right direction remain the same.
- This motion is how you would rotate on a rocking chair.



# Roll

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- **Roll** indicates rotation around the *forward-back* axis, so forward direction remains the same even after rolling.
- This motion can describe how a dog would “roll” over the ground.

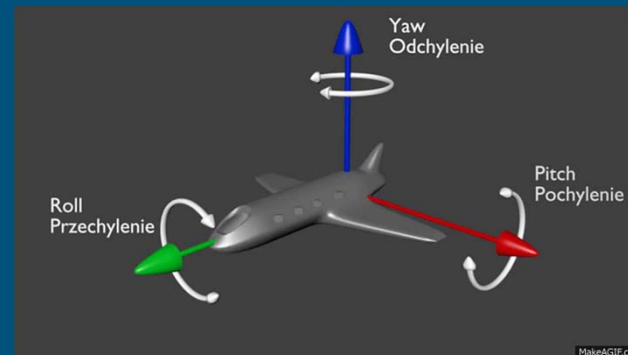




# Yaw

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- Yaw is rotation around the *up-down* axis, so up stays the same.
- This motion is how your car makes turns.



# Heading and Altitude

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- **Heading** is the direction that you are facing. It is simply where you are headed.
- **Altitude** is how high you are above the ground.



# Congratulations !



End of Module 1