

FUTURE LEARNING IN VOCATIONAL EDUCATION
USING INNOVATIVE DRONE TECHNOLOGY
2023-2-TR01-KA220-VET-000179391

FLIGHT



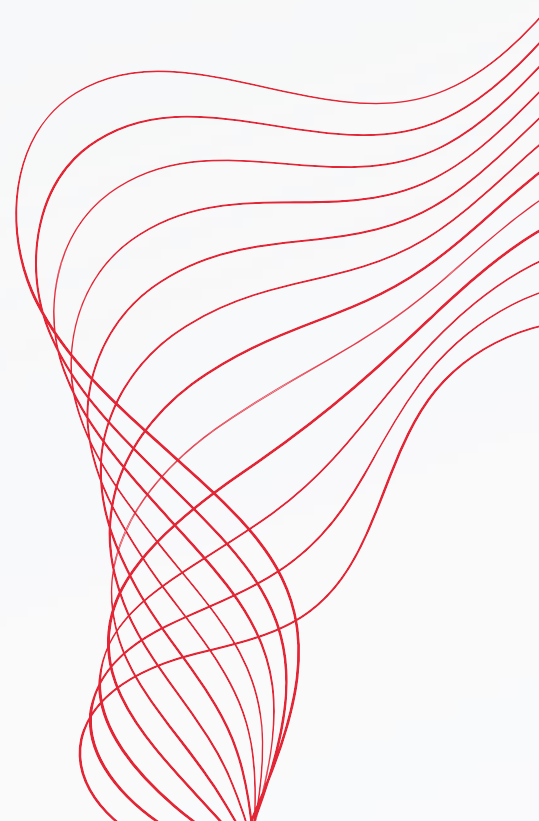
Custom Drone



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TÜRKİYE ULUSAL AJANSI
TURKISH NATIONAL AGENCY



CONTENT

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- 02** HISTORY OF UAV SYSTEMS
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DRONE

Description

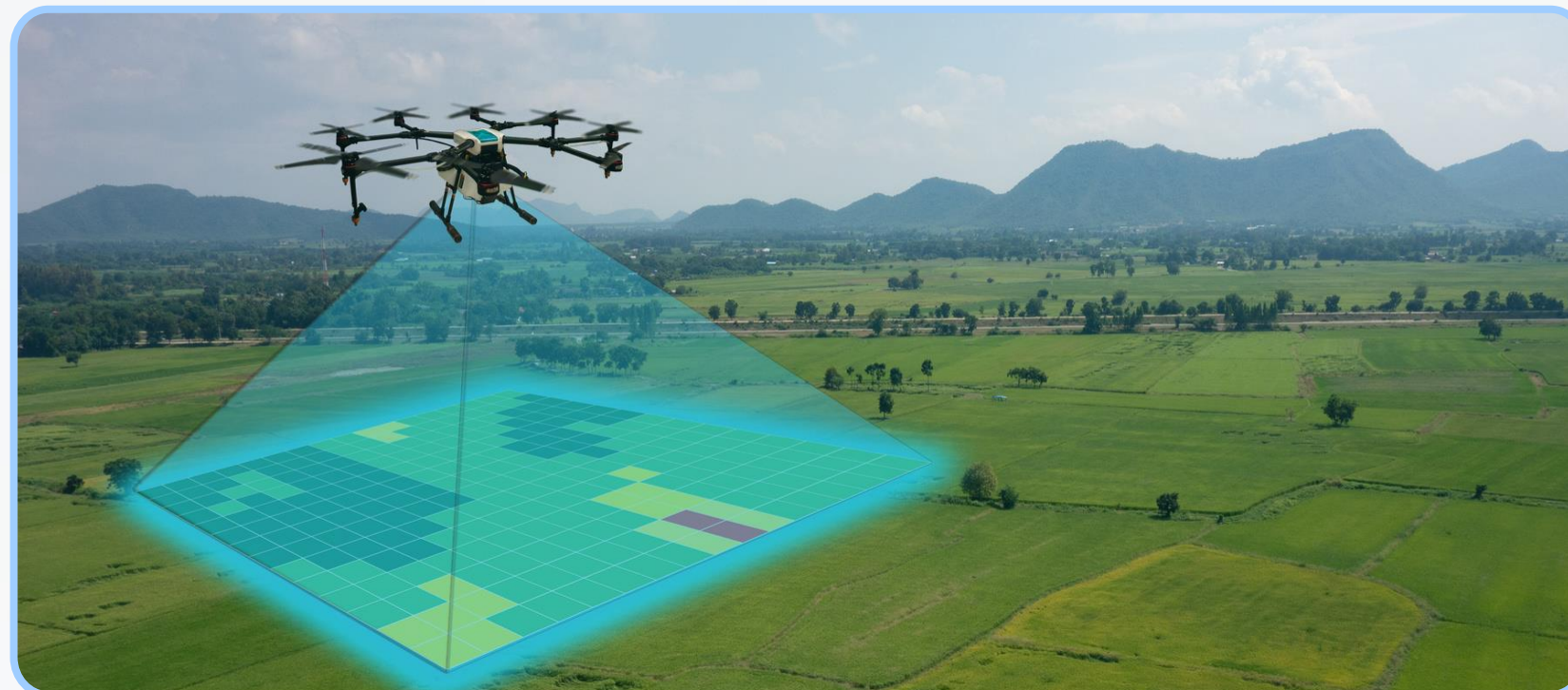
Unmanned Aerial Vehicle (UAV): Air vehicles that are controlled by remote control or autopilot systems and do not carry a human crew.

Features

Generally lightweight, highly manoeuvrable and equipped with various sensors.

History

The origins of UAVs date back to World War II; the first examples were used for reconnaissance purposes. With technological advances, a great increase in civil and commercial use has been observed in the 21st century.



DRONE

Categories

Fixed Wing UAV
Rotary Wing UAV
VTOL UAV

Advantages

Cost Effectiveness
Accessibility
Versatility

Disadvantages

Limited Flight Duration
Security and Privacy
Concerns
Regulations

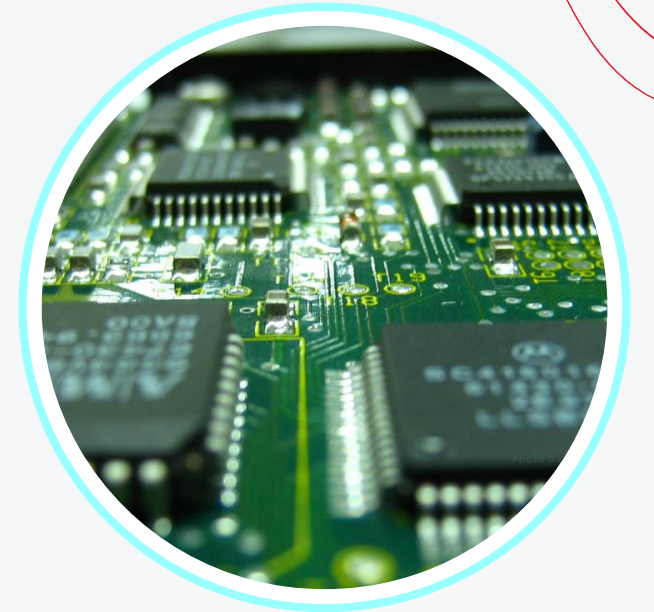


DRONE SYSTEM COMPONENTS

Components of the Drone System

Hardware
Body and Structure
Propulsion Systems
Control Units
Sensors and Cameras

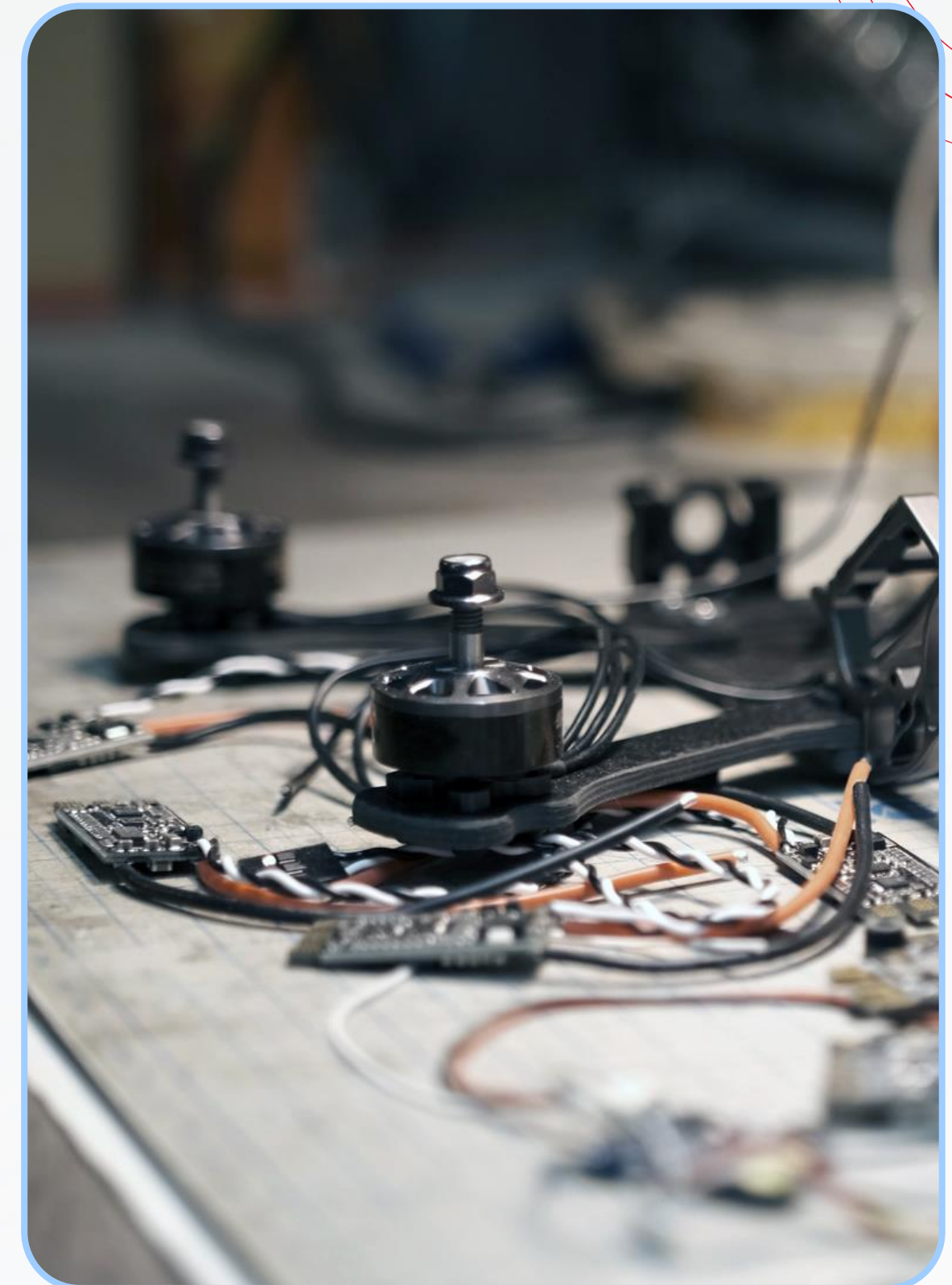
Software
Flight Control Software
Data Processing
Software
Autonomous Flight
Systems



DRONE SYSTEM AND USAGE AREAS

Agriculture

- Aerial Imaging
- Spraying and Spraying
- Data Analyses



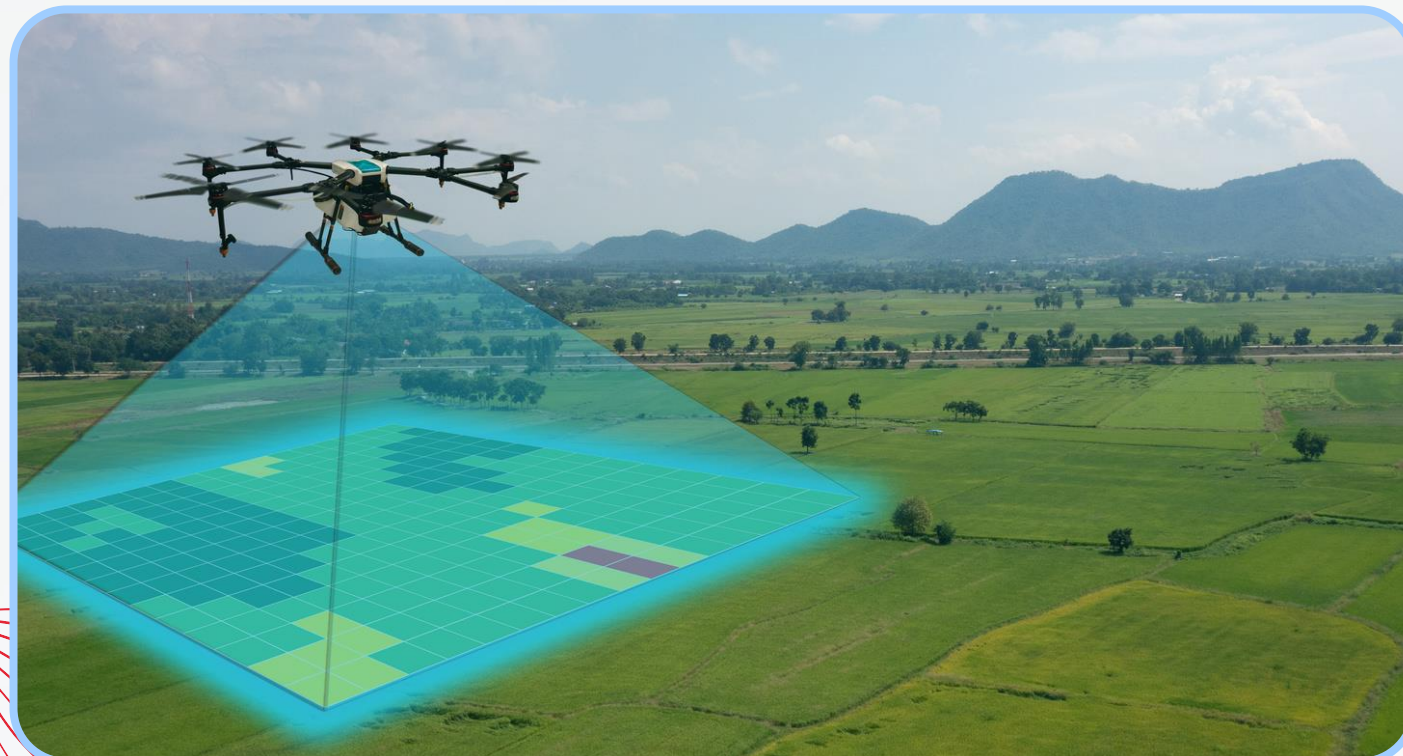
Defence Industry

- Reconnaissance and Surveillance
- Weapon Systems
- Logistics and Supply

DRONE SYSTEM AND USAGE AREAS

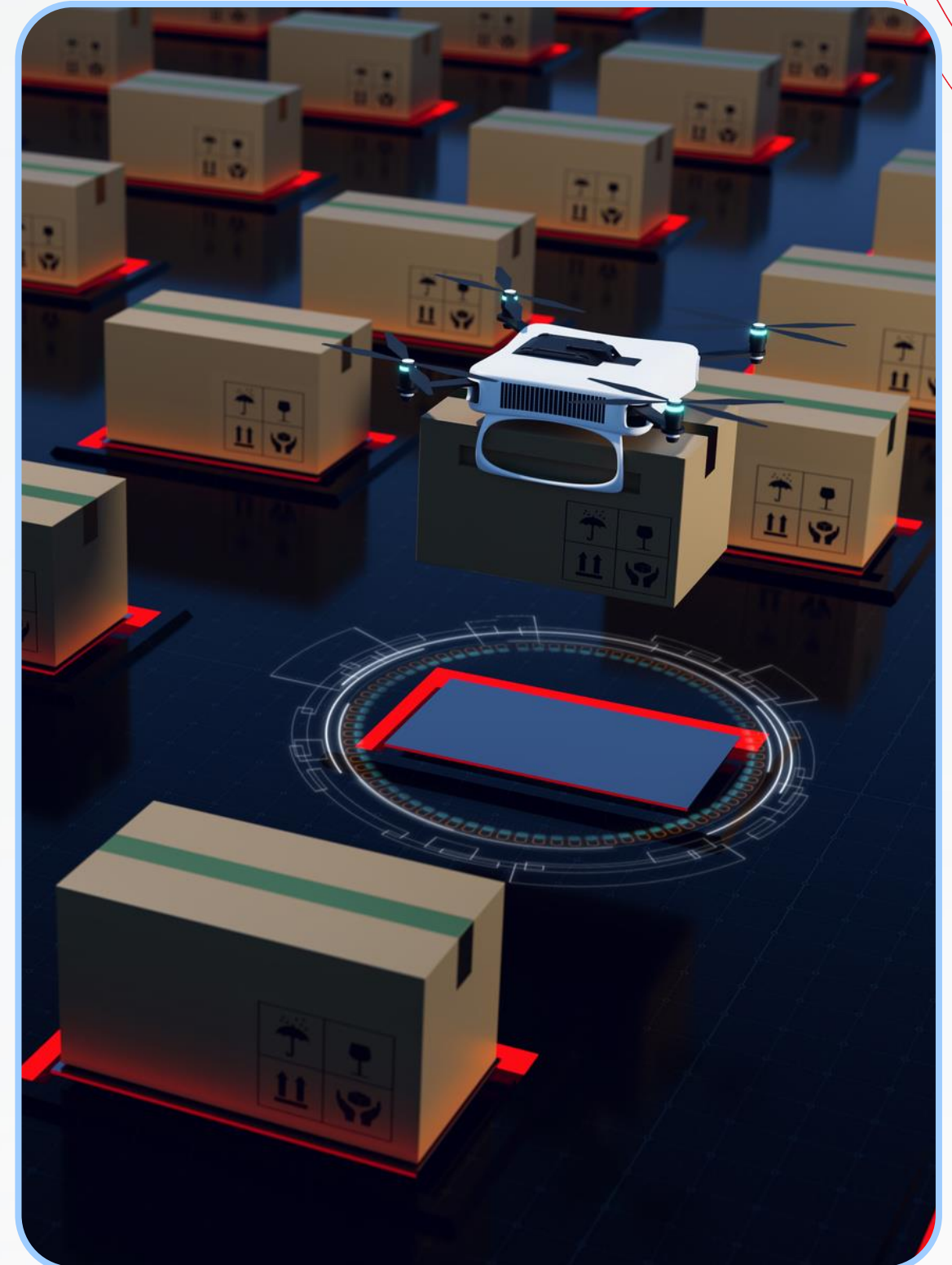
Transport

- Cargo Transport
- Emergency Response
- Last Mile Delivery



Emergency Management

- Search and Rescue
- Fire Surveillance
- Earthquake and Disaster Assessment



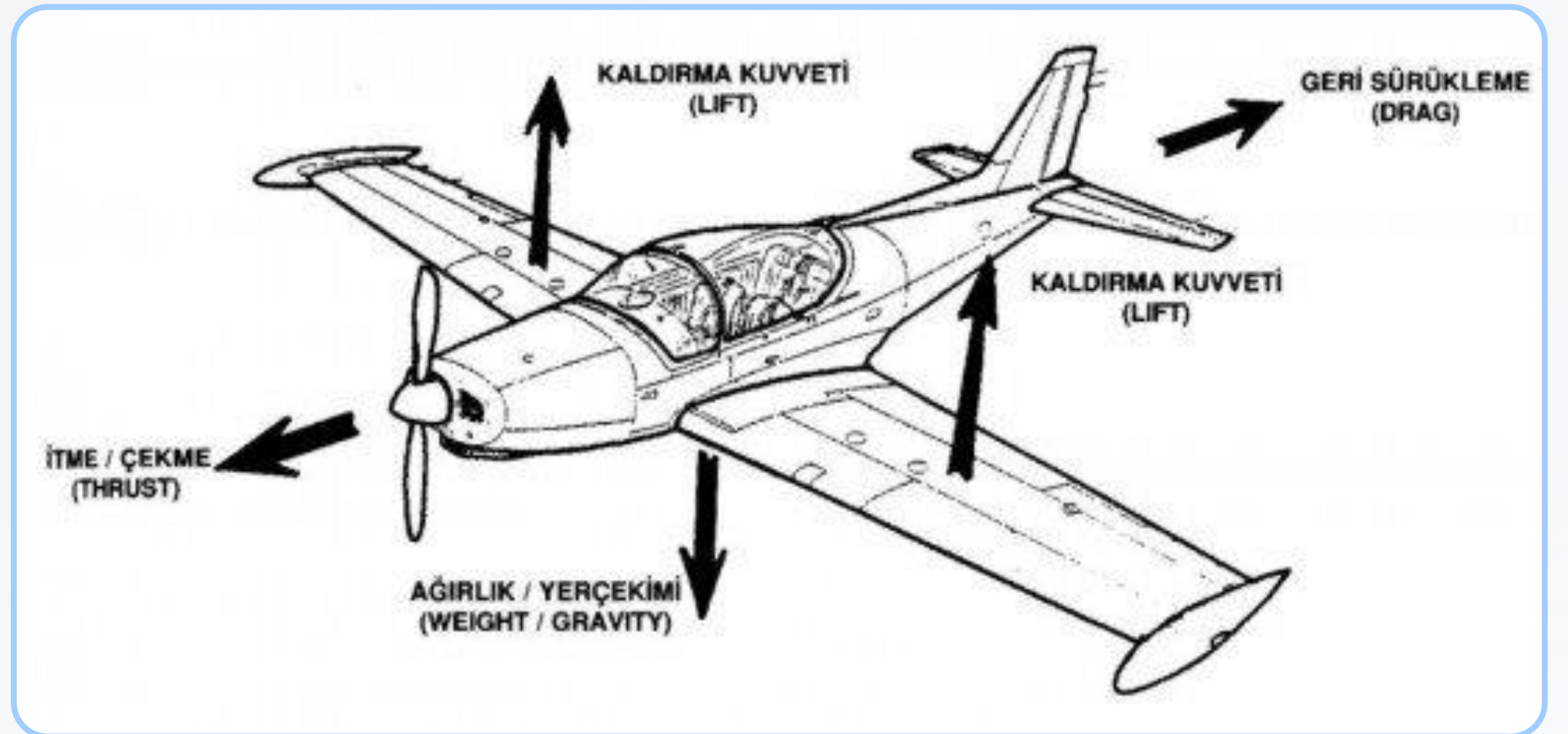
PHYSICS AND DRONE

Physics of Flight

- Lifting Force
- Resistance
- Weight and Balance
- First Law (Law of Inertia)
- Second Law ($F = m \cdot a$)
- Third Law (Law of Action-Response)

Control and Stability

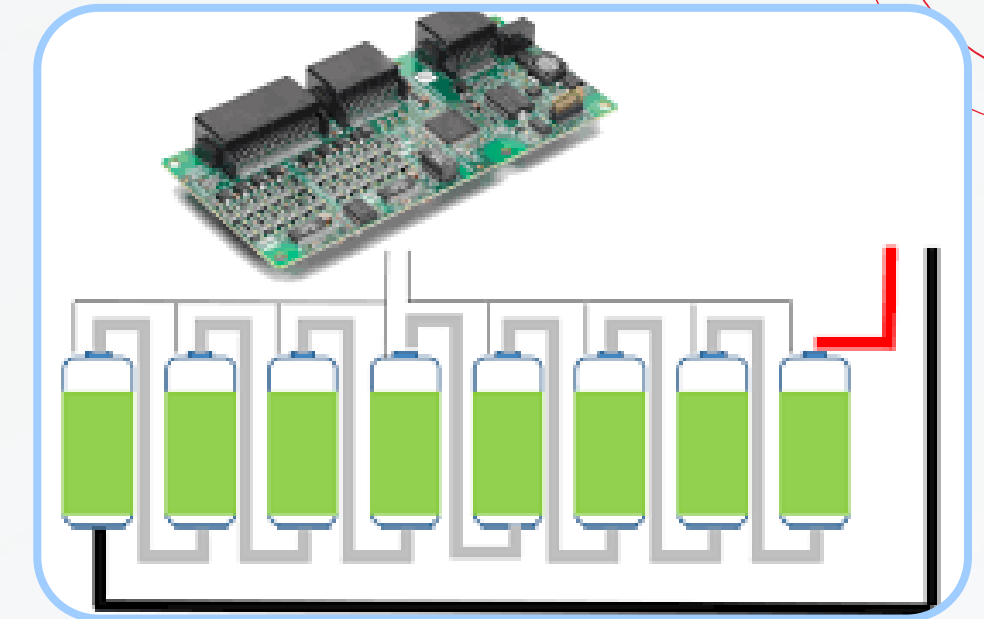
- IMU (Inertial Measurement Unit)
- PID Controllers
- GPS and Navigation Systems
- Autonomous Blocking



PHYSICS AND DRONE

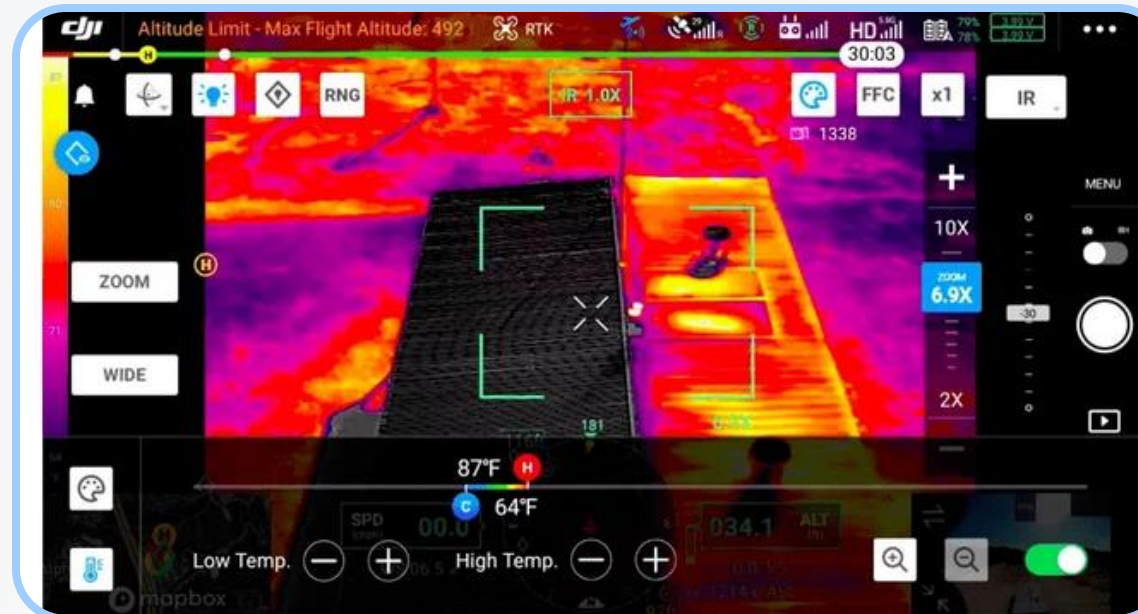
Energy and Performance

- Lithium Polymer (Li-Po) Batteries
- Battery Management Systems (BMS)
- Motor Efficiency
- Light Ingredients



Sensors and Data Processing

- Camera Types
- Data Collection
- LIDAR
- Radar and Ultrasonic Sensors
- Autonomous Navigation



MULTICOPTERS

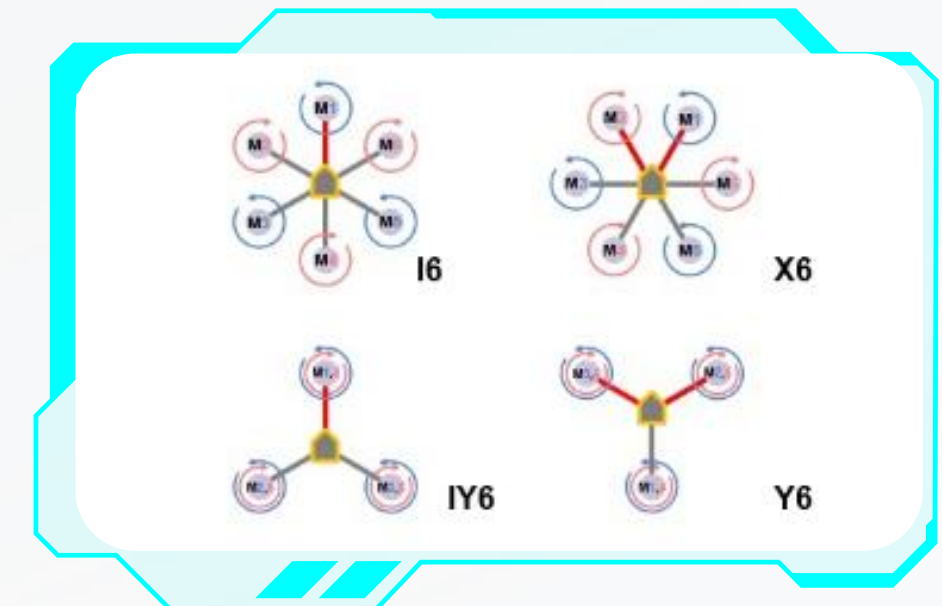
Description

- Aircraft with more than one engine and propeller, capable of vertical take-off and landing.



Features

- Classified according to the number of motors (e.g. quadcopter: 4 motors, hexacopter: 6 motors).
- Provides high maneuverability and stability.



WHAT DOES AN INCREASE IN THE NUMBER OF ENGINES DO?

- Lifting Power
- Stability
- Backup
- Performance



FPV (FIRST PERSON VIEW)

A system in which the pilot controls the flight with a real-time image from the drone's camera.



Racing drones, reconnaissance missions, aerial filming.

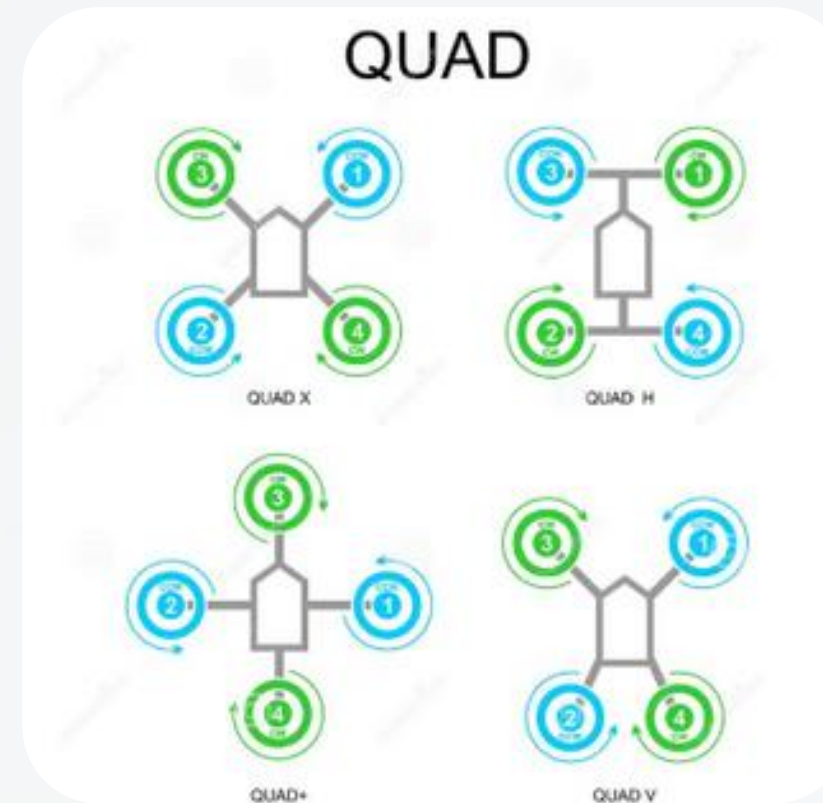
QUADCOPTERS

Description

- With 4 motors and propellers, the most widely used type of multicopter.

Features

- Lightweight construction, high manoeuvrability.
- Capable of vertical take-off and landing.
- Wide areas of use: Agriculture, military, media.

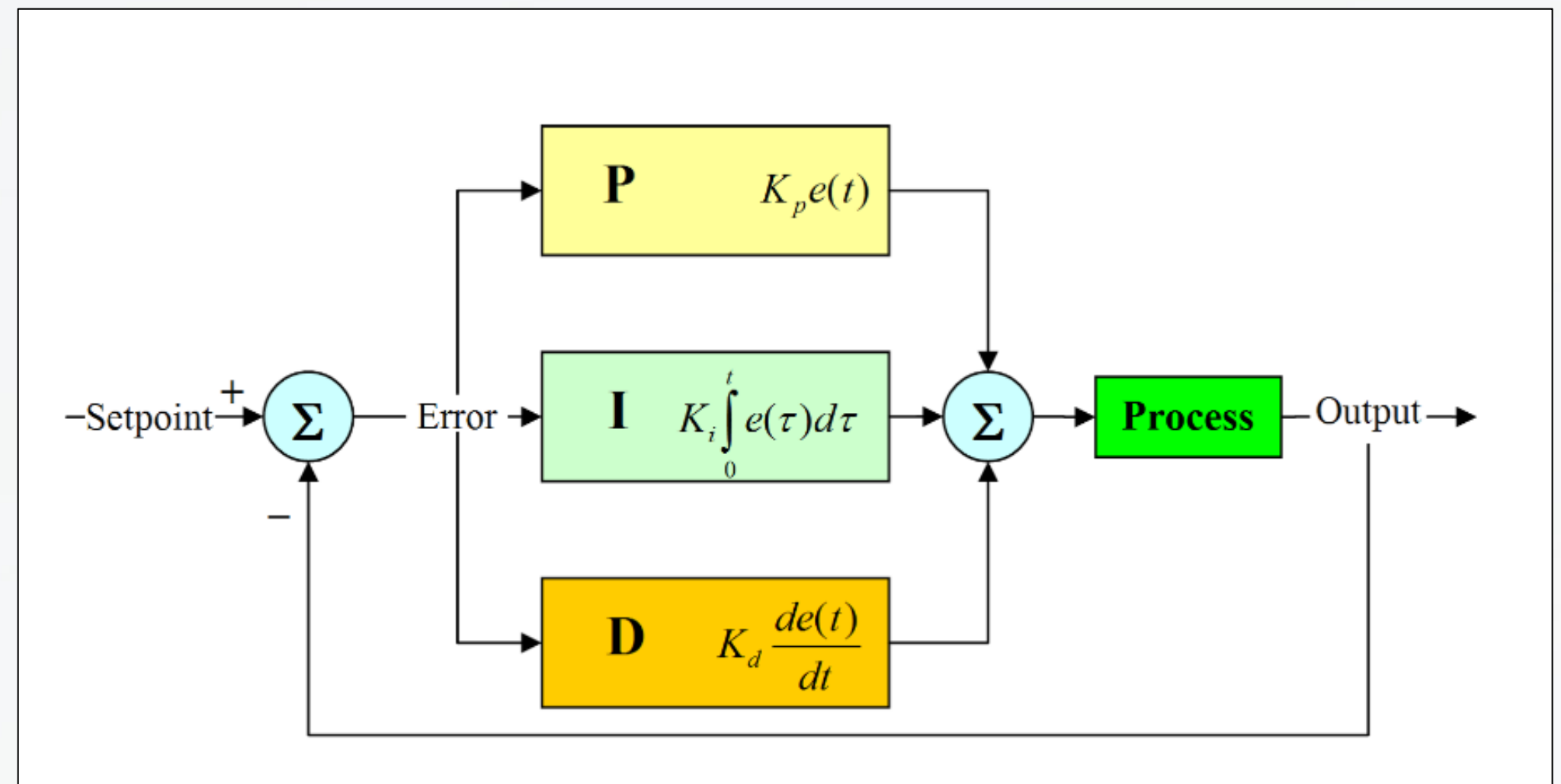


DRONE CONTROL AND PID

Description

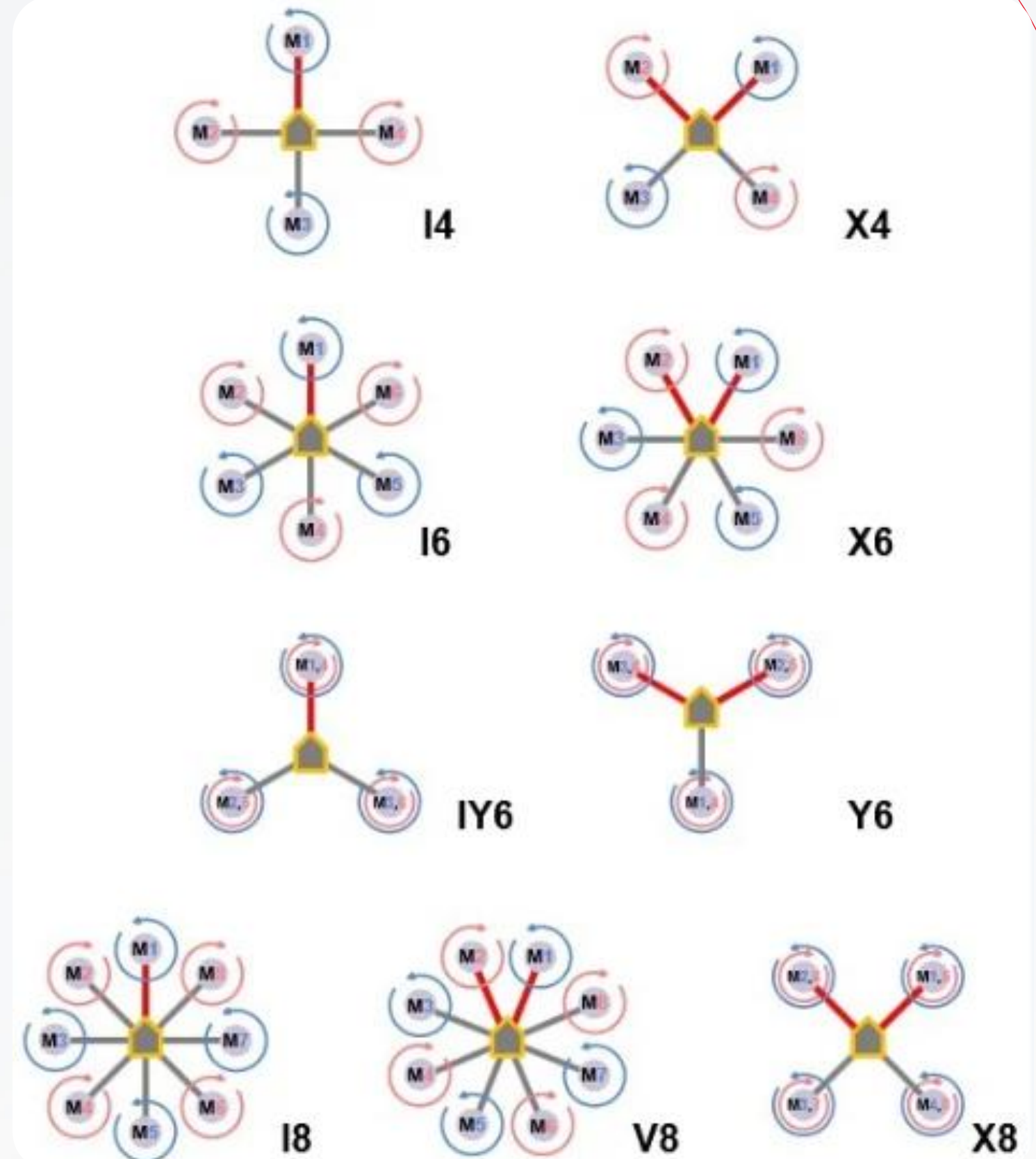
- The PID (Proportional-Integral-Derivative) control algorithm ensures the stability and motion accuracy of the drone.
- Significance: It ensures that the drone flies stably and remains balanced against wind and external factors.

- Proportional (P): Reacts quickly to errors.
- Integral (I): Corrects errors accumulated over time.
- Derivative (D): Regulates the response to sudden changes.



DRONE CONTROL AND PID

- Quadcopter (4 engines):
 - High stability and manoeuvrability.
 - Ideal for light loads.
- Hexacopter (6 Motors):
 - More powerful lifting force.
 - Suitable for medium loads.
- Octocopter (8 Engines):
 - Capable of carrying heavy loads.
 - Offers more redundancy and stability.
- Tandem Rotor (Double Rotor):
 - High speed and lifting capacity.
 - Vertical and horizontal flight advantage.
- Tiltrotor:
 - Combines fixed wing and multicopter features.
 - Can perform vertical landing and long-distance horizontal flight.



DRONE SYSTEMS

DIFFERENCES FROM FIXED WINGS

- Take-off and Landing:
 - Fixed Wings: Requires runway or catapult.
 - Multicopters: Can take off and land vertically (VTOL).
- Scenery and Movement:
 - Fixed Wings: Suitable for high-speed, wide-area scanning.
 - Multicopters: Highly manoeuvrable in narrow areas.
- Energy Efficiency:
 - Fixed Wings: Longer flight times.
 - Multicopters: Shorter flight times, high energy consumption.
- Areas of Use:
 - Fixed Wings: Mapping, long-term surveillance.
 - Multicopters: Target-orientated missions, short distance flights.



DRONE ELECTRONICS

Equipment to be Used Compulsorily for Drone Construction

- Body (Frame)
- Flight Card
- Controller and Receiver
- Engine and Propellers
- ESC (Electronic Speed Controller)
- Li-Po Battery



Non-Mandatory Equipment for Drone Construction

- Telemetry Module
- Video Transmitter
- OSD Unit (Own Screen Display)
- Camera & Gimbal
- Additional Development Cards: Raspberry Pi, Nvidia Jetson, Xavier.

FRAME

- **Plastic Body:** Lightweight and economical, suitable for hobby drones.



- **Carbon Fibre Body:** Lightweight, durable, preferred for professional applications.



FLIGHT CONTROL CARD

- Autonomous Flight Cards: Pixhawk Cube+, APM 2.8, Navio 2.



- Manual Fly015f Cards: Omnibus F4, Mini F4, XRotor Nano F4.



- Autonomous boards support autonomous flight, while manual boards require hand control.**

ENGINE AND PROPELLERS

- Motor Brushless DC motors are more efficient and durable.
- Propellers: Made of plastic or carbon fibre material.



ESC (ELECTRONIC SPEED CONTROLLER)

Description: Controls the speed of the motor and the energy transfer of the battery.

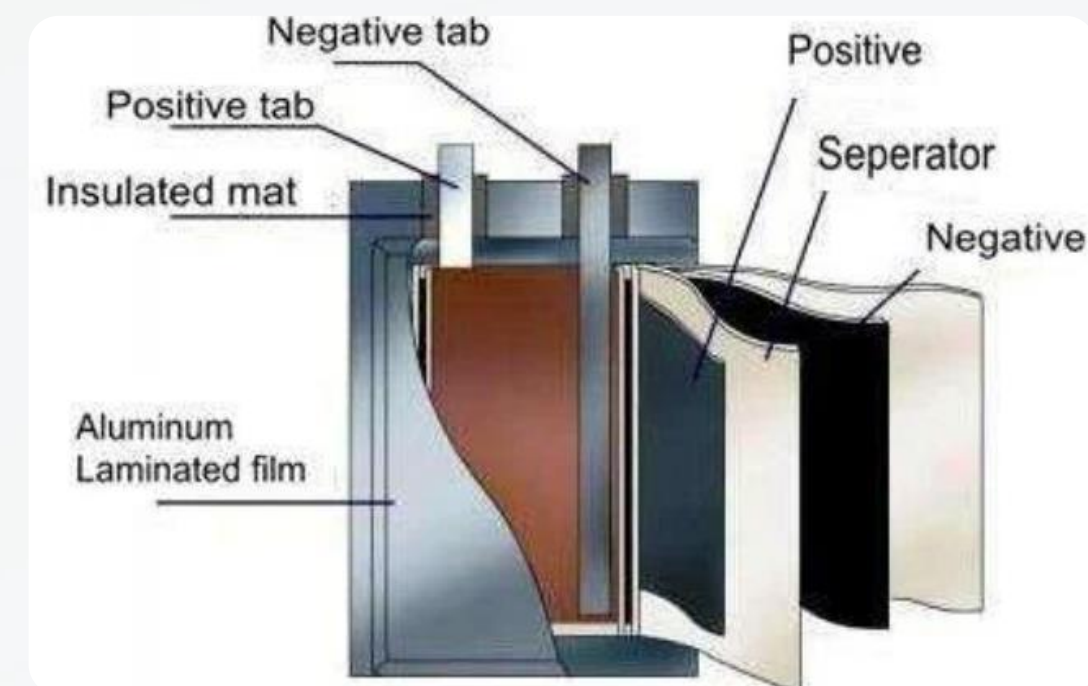
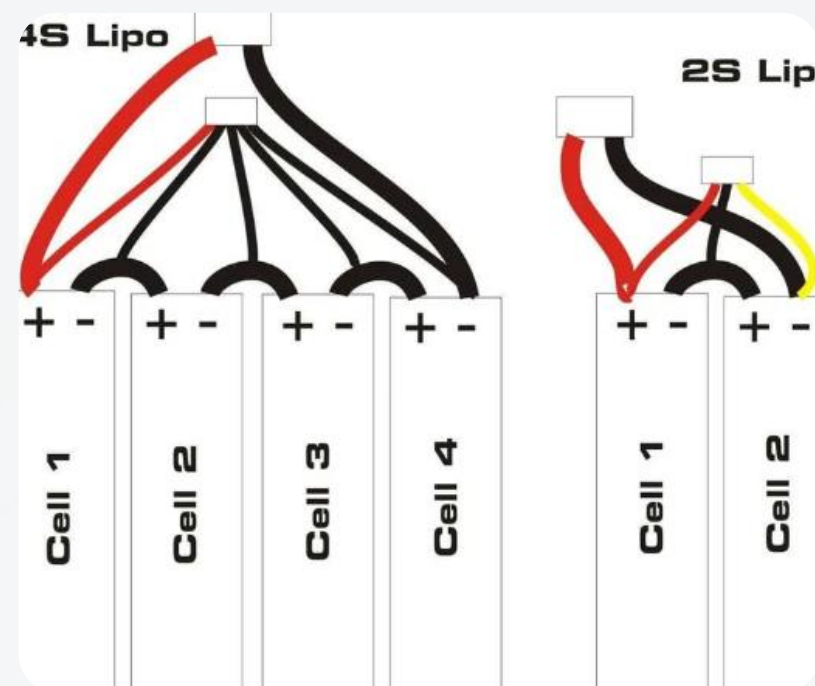
Provides the stability of the drone.



LI-PO BATTERY

Definition: The energy source of the drone.

Capacity (example): 3S (11.1V) and 4S (14.8V).



TELEMETRY VE VIDEO TRANSMITTER

- **Telemetry Module:**
Transmits flight information to the ground.
- **Video Transmitter:**
Transmits images from the drone camera.



Holybro 433MHz Telemetry Module



RFD900X Telemetry Module



3DR Telemetry Module

REMOTE CONTROL AND RECEIVER

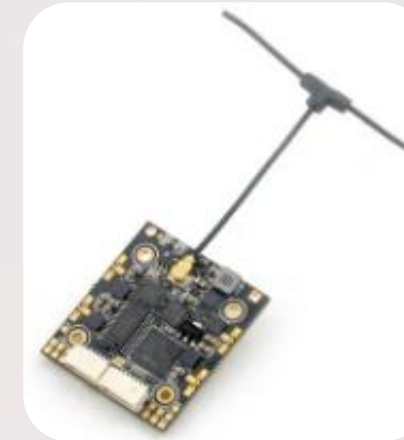
Remote Control Types:

- Stick Control: Precise control, multi-axis movement.
- Pistol Control: Simple control, usually for car models.



What is Binding?

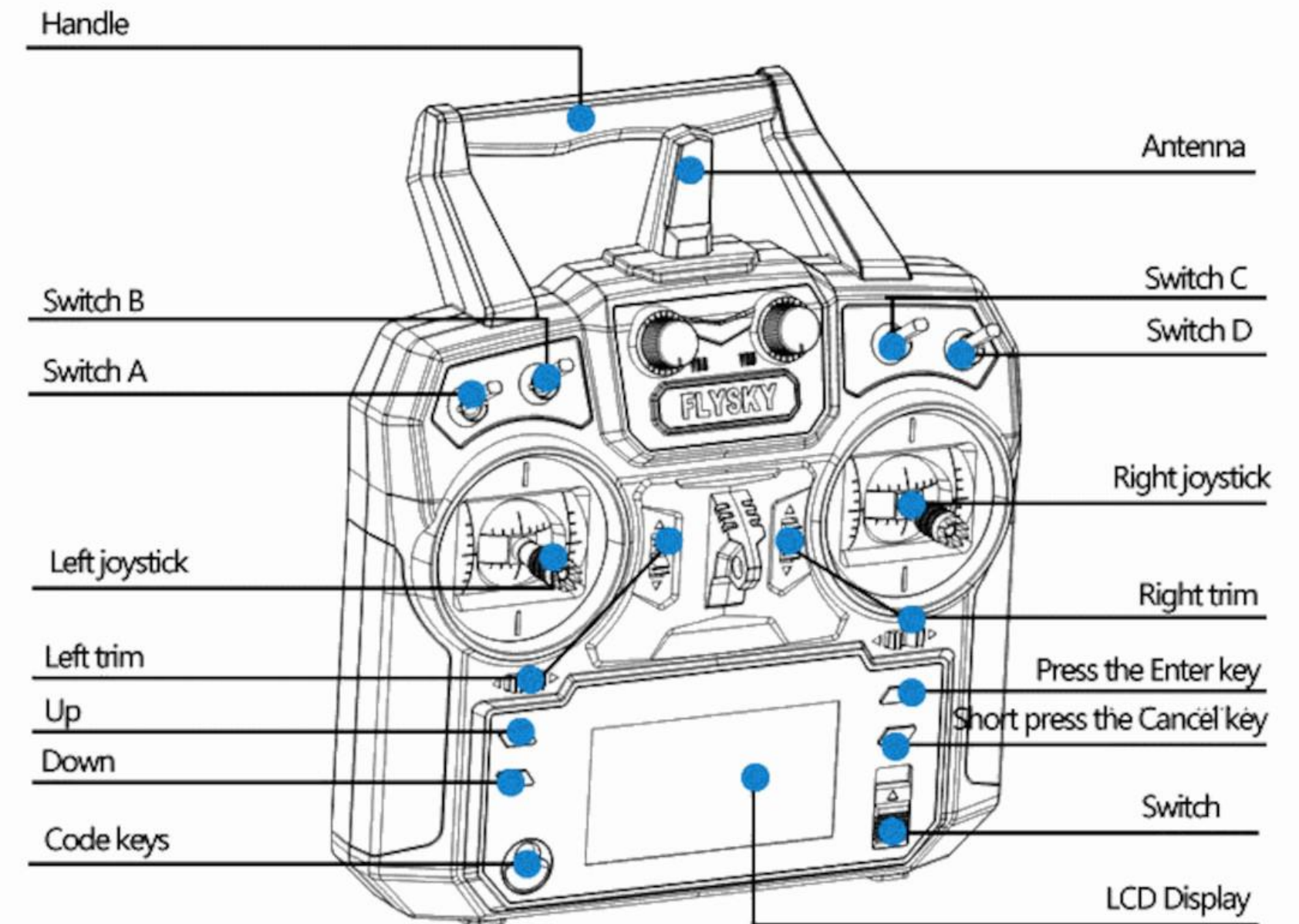
- Definition: Provides the connection between the controller and the receiver.
- Example: 2.4 GHz frequency communication.



WHAT IS A CHANNEL?

Definition: Signal paths that control the drone axes (yaw, pitch, roll, throttle) and functions.

The more channels, the more functions can be controlled.





THANK'S FOR YOUR ATTENTION



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