



UNMANNED AERIAL VEHICLE (UAV)

AMMAR AHMED MAHDI DOKHAN 1612863





INTRODUCTION

- Unmanned aerial vehicles (UAVs) are aircraft with no on-board crew or passengers. They can be automated 'drones' or remotely piloted vehicles (RPVs).
- The first pilotless vehicles were developed in Britain and the USA during the First World War.
- It was invented initially for military purposes mainly for surveillance and targeted attacks
- Nowadays, drone have many application such as monitoring climate, filming and delivering goods



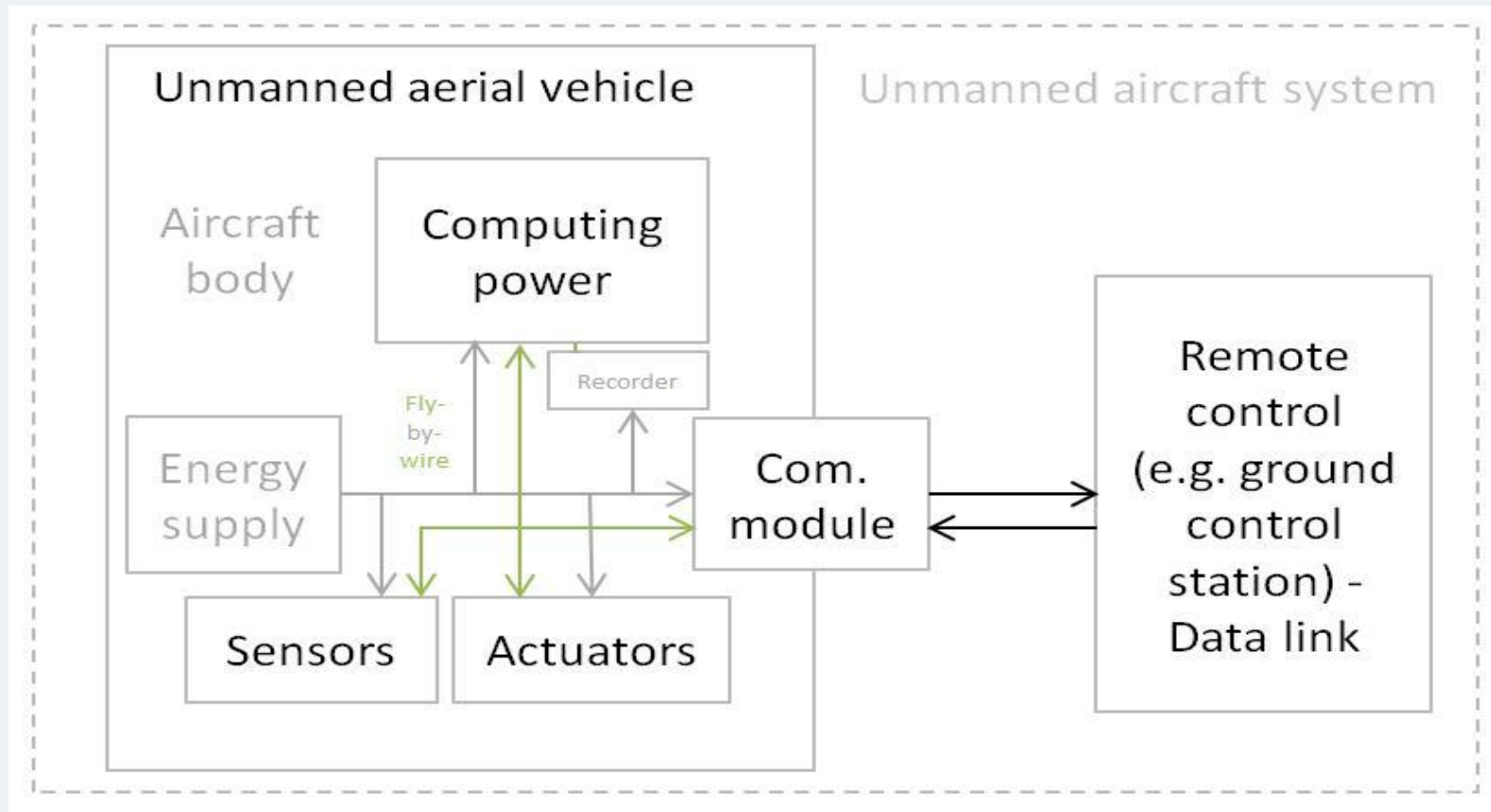
DESIGN OF UAV

- The major difference for planes is the absence of the cockpit area and its windows. Tailless quadcopters are a common form factor for rotary wing UAVs while tailed mono- and bi-copters are common for crewed platforms.
- One of the possible categorization of UAVs is into three groups: rotary wings, fixed wings and lighter than air. This categorization looks upon launching capabilities,
- Each of these groups have their own advantages and disadvantages, but they all have enormous potential in the future for all different applications UAVs can be used for.

Types	Advantages	Disadvantages	Example
Fixed wing	Long range Endurance	Horizontal take-off, requiring substantial space or support Inferior maneuverability compared to VTOL (Vertical Take-Off and Landing)•	
Tilt wing	Combination of fixed wing and VTOL advantages	Expensive Technology complex	
Unmanned Helicopter	VTOL Maneuverability High payloads possible	Expensive Comparably high maintenance requirements	
Multicopter	Inexpensive, Low weight Easy to launch	Limited payloads Susceptible to wind due to low weight	

Source: adapted from Heutger, 2014 and Kelek, 2015

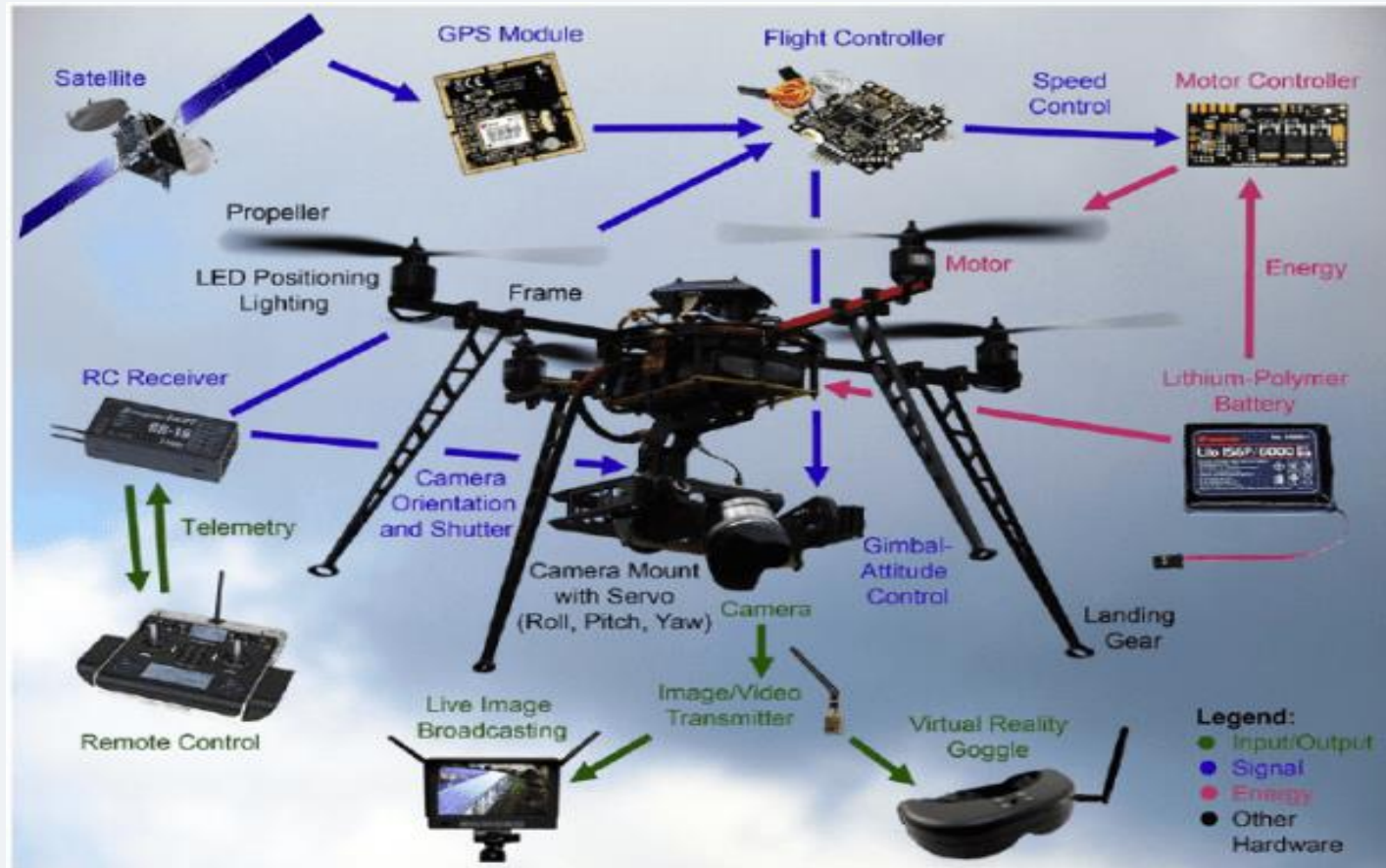
UAV SYSTEM ARCHITECTURE



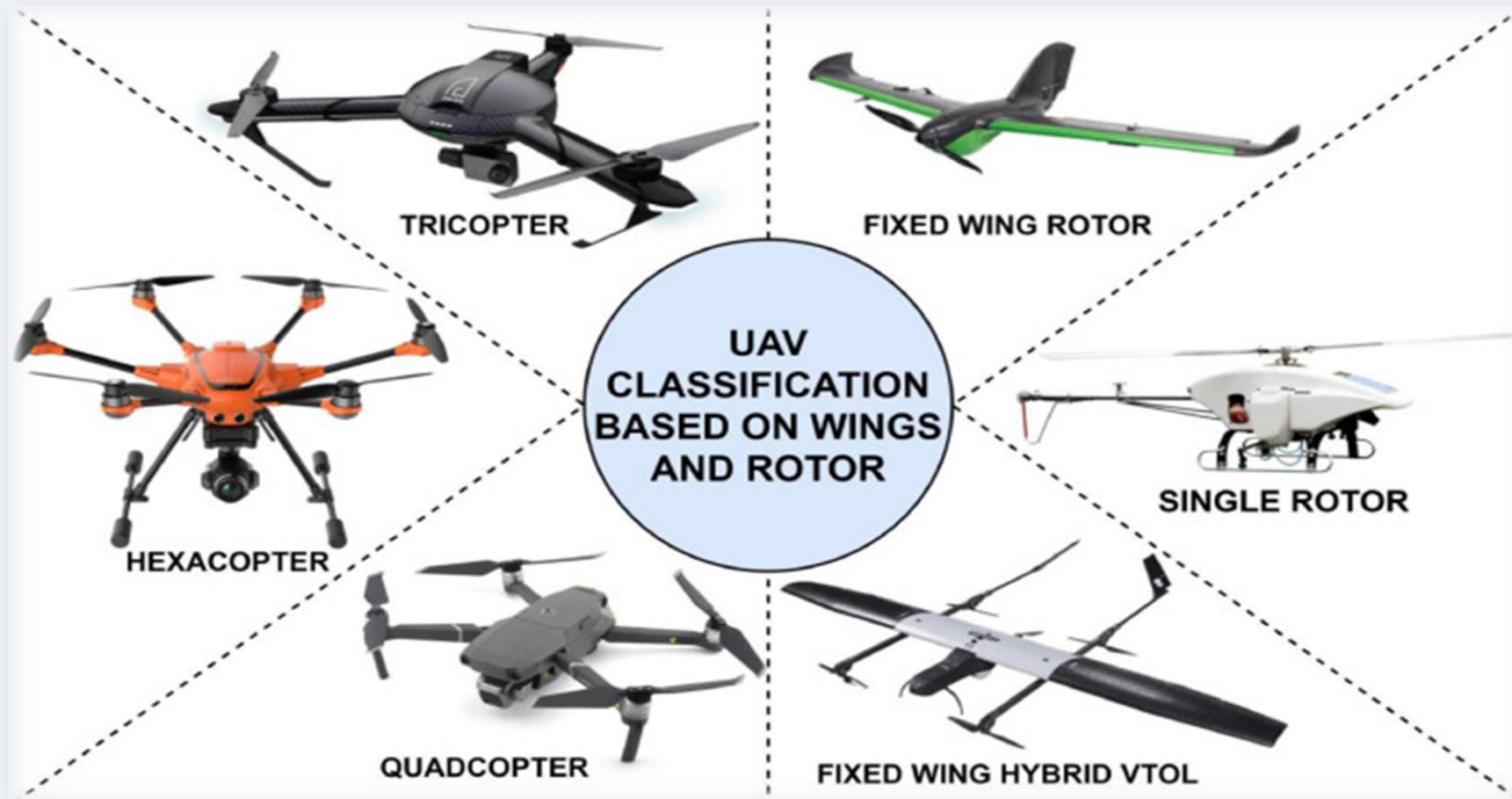
General physical structure of UAV.

UAV COMPONENTS

- Most UAV main components are the same as shown below.

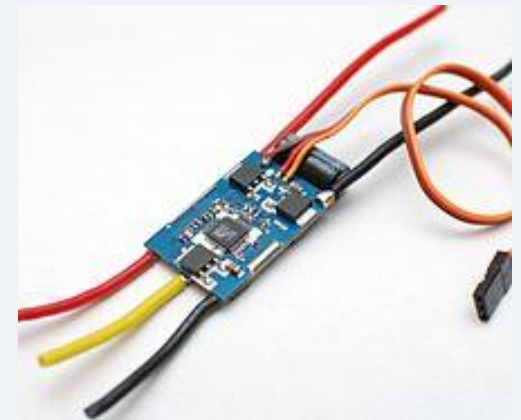


LOCOMOTION SYSTEM & ACTUATORS



LOCOMOTION SYSTEM & ACTUATORS

- There are different number of actuators used depending on the type of UAV.
- In most cases, the actuators used to control the vehicle motion are propellers driven by motor and servomotors which is mainly for planes and helicopter.
- These actuators are connected to digital electronic speed controller in order to control the speed of the vehicle.



SENSORS & CONTROL

- There are various types of sensor used in drones such as

Accelerometers: Used to determine position and orientation of the drone in flight.

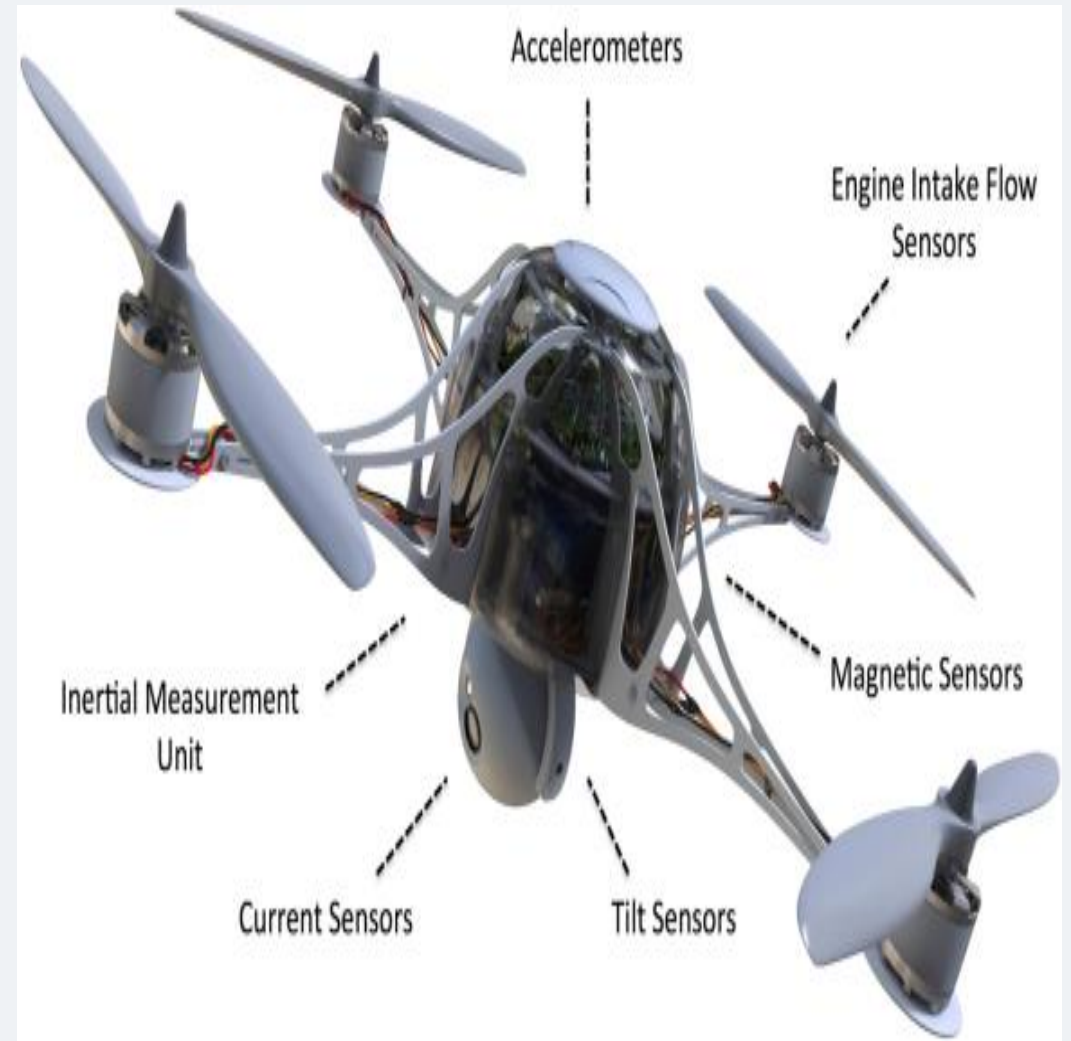
Inertial Measurement Units: Combined with GPS are critical for maintaining direction and flight paths.

Tilt Sensors: Provide input to the flight-control system in order to maintain level flight.

Current Sensors: Used to monitor and optimize power drain, safe charging of internal batteries, and detect fault conditions with motors or other areas of the system.

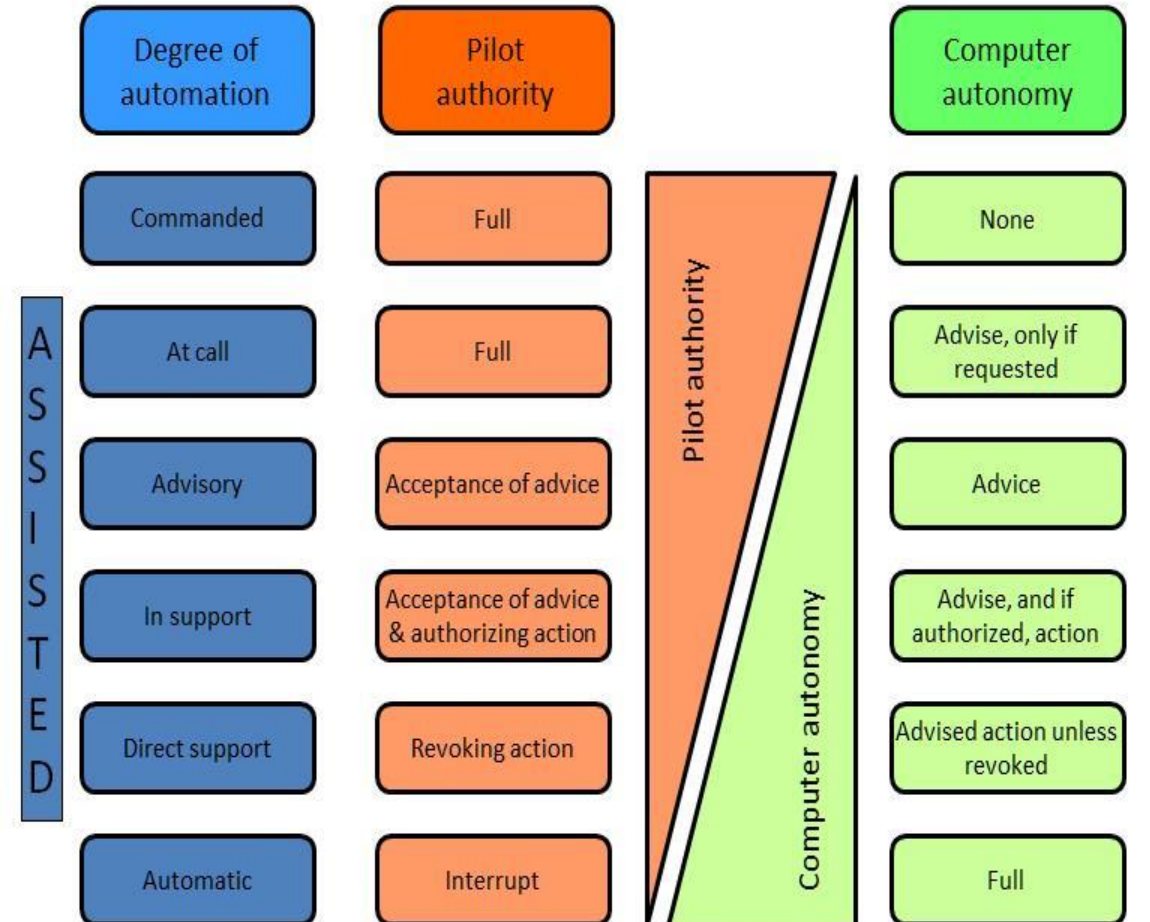
Magnetic sensors: It provide critical directional information to inertial navigation and guidance systems.

Engine Intake Flow Sensors: Used to effectively monitor air flow into small gas engines used to power some drone varieties.



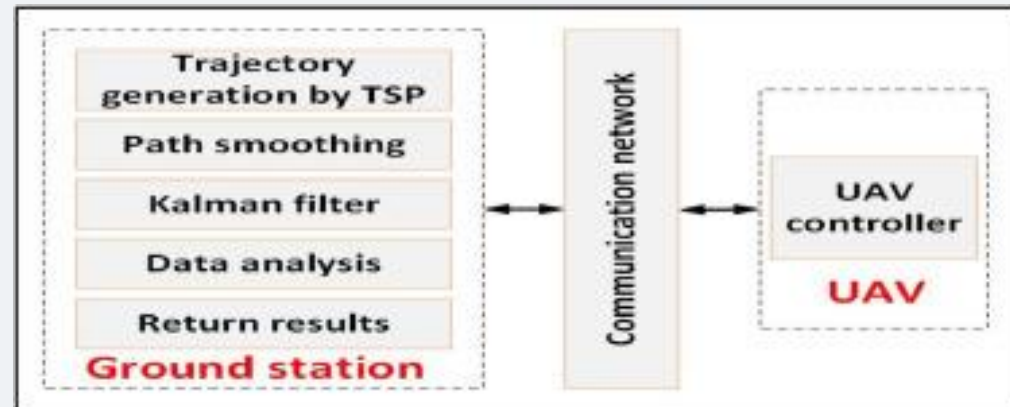
SENSORS & CONTROL

- UAV can be controlled by onboard electronic equipment's (autonomous) or via control equipment from the ground.
- When it is remotely controlled from ground it is called RPV (Remotely Piloted Vehicle) and requires reliable wireless communication for control.
- There are different degree of autonomy of UAV as shown in figure.



DATA COLLECTION

- The receiver is the unit responsible for the reception of the radio signals sent to the drone through the controller.
- The minimum number of channels that are needed to control a drone are usually 4. However, it is recommended that a provision of 5 channels be made available.
- There are very many different types of receivers in the market and all of them can be used when making a drone.



DATA TRANSMISSION

- The transmitter is the unit responsible for the transmission of the radio signals from the controller to the drone to issue commands of flight and directions. Just like the receiver, the transmitter needs to have 4 channels for a drone but 5 is usually recommended.
- The receiver and the transmitter must use a single radio signal in order to communicate to the drone during flight.
- Each radio signal has a standard code that helps in differentiating the signal from other radio signals in the air.

POWER MANAGEMENT

- Battery elimination circuitry (BEC) is used to centralize power distribution and often harbors a microcontroller unit (MCU).
- Small UAVs mostly use lithium-polymer batteries (Li-Po).
- Larger vehicles often rely on conventional airplane engines or a hydrogen fuel cell.



POWER MANAGEMENT

