Assignment 2

Unmanned Aerial Vehicle (UAV)

1912343

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History Of UAV

1849	Austrian use unmanned balloons for bomb attacks
1898	Nikola Tesla demonstrates remote control of a boat
1915	1st development of UAV by US military, Kettering Bug
1944	First combat use of UAVs by the German
1960	Development of drones in US military
1980	Development of predator drone for surveillance
2000	Increased use of armed drones in military
Current time	Development of commercial drones for personal and professional use such as mapping, photography, search and rescue and delivery service.

Application of UAV

Industries	Application
Agriculture	- Crop monitoring - Crop mapping - Fertilizer spraying
Environmental Care	- Forest mapping - Wildlife monitoring and rescue

Entertainment	• Family photography • Film industries
Logistic	• Packages delivery
Public safety	• Traffic monitoring • Accident response • Search and Rescue

Main Components of UAV

1. Airframe Design
   - The body of the UAV that gives structure support and aerodynamics.

Types	Advantages	Disadvantages
Fixed-Wings -UAV designed as a plan, usually used for surveillance, mapping and military purpose	- Efficient for long-duration flight - Can cover larger areas - Can carry heavy payloads - Less affected by wind - Less power consumption	- Need a runway or a catapult launch and parachute or runway landing making them less flexible during takeoff and landing - Higher maintenance - Cannot hover at 1 place at a long time making them less useful in

		certain application
Rotary-Wings -An UAV that is designed as a helicopter	- Can take off and landing vertically making them more efficient - Have more maneuverable than fixed wing - Can hover at 1 place longer and at low speed good for surveillance rescue and monitoring	- Less efficient for long-duration flight - Can hold smaller playload - More power consumption than fixed-wing UAV - More expensive to buy and maintain than fixed-wing UAV
Hybrid -A marriage between fixed-wing and rotary-wing UAV which shares both capabilities	- Having both features of fixed-wing and rotary-wing - Combine the benefits of both	- Complex design - Potentially higher cost
Multirotor -Uses multiple rotor to lift and localize.	- Can fly in place at low speed, making useful for precise positioning - Not more expensive than all others UAV - Simple to handle and maintain	- Short flight time than other UAVs - Limited payload, cannot carry heavy sensors - Easily effected by winds

Types	Example UAVs
Fixed-wings	

Rotary-wings	
Hybrid	
Multirotor	

2. Propulsion System

Type	Advantages	Disadvantages
Electric	- Quite - Efficient - Low maintenance - Suitable for small UAVs	- Shorter time flight - Limited payload capacity - Frequent battery change
Gasoline	- High power output - Longer flight time - Good for larger UAVs	- Noisy - Higher maintenance - Fuel storage issue
Jet engine	- High speed and high-altitude capability - High performance UAVs	- Complex design - Expensive - High fuel consumption

	- Suitable for military use	
Hybrid	- Combine features of multiple propulsion types - Provides benefits of all those types	- Complex design - Higher cost than most UAVs
Solar	- Green power source - Longer flight time than battery - Good for environment	- Limited power source (sun) - Higher cost

Types	Example
Electric	
Gasoline	
Jet	

Hybrid	
Solar	

3. Navigation system

UAVs can be controlled using remote control, mobile apps as well as autonomously

Types	Description	Example
Remote Control	- Most command type of control - The handler uses remote control device to communicate and navigate the drone. - Controlled using Radio wave signal - Precise control of altitude and position - Suitable for photography and videography	

Mobile Apps	• User friendly interface • Drones can be controlled using smartphone • Easy access to automatic flight mode and camera settings	
Autonomous	• Perform task without humas intervention • Ideal for dangerous task and forest mapping • Equipped with advanced sensors such as camera, IMU, GPS reciver, Radar Altimeter to collect data and perform real-time analysis	

4. Data transmitter:

There are several sensors that are used in data collection of UAVs for variety of applications such as mapping, surveying, agriculture, and environmental monitoring.

Types of sensors	Application
RGB cameras	capture visible light and are used for aerial photography and videography.
Thermal camera	capture infrared radiation and are used for detecting heat signatures, such as in search and rescue operations or building inspections.
LiDAR Sensor	use laser beams to measure distances and create 3D maps of the environment.
Multispectral sensor	capture data across multiple wavelengths of light and are used for crop monitoring and environmental monitoring.
Gas sensor	detect the presence of gases in the environment and are used for environmental monitoring and industrial inspections.

Data receivers:

- Some UAVs are equipped with onboard storage to store data locally such as internal storage.
- UAVs are able to transmit data in real-time to a ground station or other receiver using wireless communication technologies such as Wi-Fi, Bluetooth, or cellular networks
- Ground station commonly consists of computers, software and communication link to the UAVs to receive and process the data.
- The software then analyzes the data collected and draws the map and input data to the system by using the data collected.

5. Power Source

Types	Advantages	Disadvantages
Lithium polymer (LiPo) battery	• High energy density • Lightweight • Rechargeable	• Limited flight time • Risk of fire and explosion
Gasoline	• High power Output • Long flight time • Easily obtained	• Heavy • Noisy • Emission
Jet fuel	• High power Output • Long Flight time • Widely available	• Expensive • Requires specialized handling
Solar Cell	• No fuel required • Good for long time flight	• Limited power output • Limited power source (sun light)
Hydrogen Fuel cell	• Efficient and Clean power source	• Limited technology available • Higher cost

LiPo battery drone

Gasoline drone

Solar cell drone