

Name: Panneerselvam N

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Unmanned Aerial Vehicle(UAV)

Unmanned aerial vehicle(UAV) is an aircraft with carries no human pilot or passengers. Commonly UAV are known as Drones.

Basic Components used UAV:

- Body
- Power supply - (Lithium polymer and Lithium-ion)
- Sensors - (Accelerometer , speed and distance sensor , GPS, LiDAR)
- Controller - (Flight controller , System on chip , Autopilot)
- Communication medium– (Radio signal , Data link)
- Software
 - Firmware : ArduCopter-v1 , PX4
 - Middleware : PX4 , ArduPilot
 - Operating system : ROS , Nuttx , Linux distributions

Types of UAV:

1.Multi-rotor type: (Tricopter , Quadcopter , Hexacopter , Octocopter)

In multi-rotor type there are three or more rotors are used to fly a Drone.

Pros:

- Cost effective
- Compact design
- Controlling is simple
- Increasing payload capacity

Cons:

- Less flying range
- Take more power

2. Fixed wing type :

These type drone are used fixed wing and rotor to fly in air.

Pros:

- Flying long time
- use less power

Cons:

- Take off and landing area is required
- High cost

3.Single rotor type:

These types of drones are like Helicopters having One big rotor on top and one small rotor in tail.

Pros:

- Flying long time
- Good payload capability
- Strong and durable

Cons:

- Dangerous of heavy blade
- Higher complexity
- High cost

Applications of UAV:

- Aerial Inspection
- Aerial Photography
- Mapping & surveying
- Agriculture
- Product delivery
- Crop spraying and monitoring
- Traffic Monitoring
- Defence
- Drone racing

Advantages of UAV:

1. Drones can Survey dangerous places
2. Drones can enforce security and surveillance
3. Used in various industries
4. Get high quality and clear Photography
5. Good at Shooting a Wide Range
6. 3D Models Can be Done Easily

Limitations of UAV:

1. Low operation speed - (UAV has less operation speed with compared to Manned Aerial Vehicle)
2. Battery Life : (Battery Life limits the operating time of UAV)
3. Weather Changes: (Sometimes temperature , snow and wind affects the Drones)
4. Vulnerable to hackers: (There is possibility of hackers misuse Drones)
5. Operating skill : (Little bit operating skill is required to control drones)
6. Software Issues: (If software is crashed during drone flying, there will possibility to damage any people or others)

Current Advancement in Drones:

Drone and AI :

AI enables Drones to avoid collisions , locate and track target by analysing Real time data.

Applications of AI enabled Drone:

- Agriculture : (Crop Disease detection and monitoring)
- Aerial Inspection : (Automatically detect defects)
- Defence : (Aerial Surveillance and Destroy targets)
- E-commerce : (Autonomous Drone Delivery)

Drone and Virtual Reality(VR) :

Drone and VR enables human to view Bird view of environment.

Applications of VR enabled Drones:

- Inspections : (VR enables humans to inspect anything from sitting position)
- Real Estate : (View 360 degree of real estate properties in one place)

Battery Optimization:

Now a days Lithium Metal batteries are gives 70% more power storage with compared to Lithium-ion batteries.

Aerial Inspection

Drone is used to inspect and identify defeats or faults of an industry by capturing and analysing drone data is called Aerial Inspection.

List of industries used Aerial Inspection:

Agriculture:

In agriculture one big benefit of drone inspection is improving crop yield.

Inspections:

- Corps health
- Irrigation conditions
- Land conditions
- Soil health

Chemical Industry:

This is one of dangerous industry to inspect manually , So Drones simplifies inspection tasks.

Inspections:

- Pipe cracks
- Chemical storage monitoring
- Pressure vessels
- Cables
- Heat exchangers

Construction:

In this industry drone data are used to Pre-Planning , Surveying and Monitoring.

Inspections:

Site conditions
Measurements
Soil conditions
Construction progress

Solar Pannel:

Solar panels are constructed with large amount of area . Manual inspection for this large area is very difficult . So, drones are use to Inspection.

Inspections:

- Pannel cracks
- Plant Installation planning
- Pannel cells health

Oil and Gas

The Oil & Gas industry stores natural gas and gasoline, among other substances, in pressure vessels and storage tanks, which means they must conduct regular inspections of these containers.

Inspections:

- Chimneys and smokestacks
- Storage tanks
- Refineries
- Jetties

Advantages of Aerial Inspection:

- 1.Accuracy : (Good inspection accuracy)
- 2.Speed : (Inspection speed is very high compared to manual process)
- 3.Safety : (Drone gives safe inspection)
- 4.Access any object : (Inspect even very small and big objects)
- 5.Cost effective : (Drone gives cost effective way of Inspection)

Disadvantages of Aerial Inspection:

- 1.Skills requires : (Some drone operating and domain knowledge is required)
 - 2.Privacy : (Possible to hackers to hack drone and misuse that data)
 - 3.Manual correction :(only inspection is done by drone ,but correction is done by manually)
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Software's Used in Aerial Inspections

Pix4D:

Pix4D is drone mapping and photogrammetry software company.Pix4D has various product.

Products:

Pix4Dmapper
 Pix4Dbim
 Pix4Dfields
 Pix4Dmodel
 Pix4Dcapture

Pros:

- Attractive UI
- Gives analysing tools for various industries (Agriculture , Power ,Real estate)
- Orthoscopic :(Create high resolution orthoscopic image)
- Thermography : (Gives thermal analysing tools)
- Supports video and 360 ° images processing

Cons:

- The user has limited impact on processing. There is no way to work around and adjust intermediate results. That's why you will probably not get a satisfactory result from flawed data or complex scenes
- The option of editing the results manually is quite limited

Agisoft PhotoScan:

PhotoScan is a very flexible tool. It is easy to learn

Main features: flexibility, nonlinearity, Python script support, distributed processing.

Pros:

- Simple interface, very easy to learn the basics. Good manuals for beginners

- Image masks can be created
- 4D modelling, that is to reconstruct a model dynamically
- Automation of processing. An internal scheduler lets you create scenarios of varying complexity. In addition, the program supports external Python scripts, allowing you to create your own extensions. Work through the console is possible.

Cons:

- No pre-existing scenarios. The user will have to create them on their own
- It is difficult to master “advanced” functionality

Bentley ContextCapture:

Main features: cool 3D models, speed, integration with other Bentley products.

Pros:

- Supports video processing
- Convenient scheduler with widgets
- Generates 3d models of very high quality
- Evaluates system resources and splits the scene into subtasks. It allows for rather big scenes to be processed
- Imports and processes LiDAR point clouds

Cons:

- The scheduler’s interface is unnecessarily overloaded
- The viewer is only capable of displaying the 3D model (and only displaying). For other processes, the user will have to export it into another software
- Working with tie points and GCPs is complicated.

Scopito :

Scopito is an efficient, intuitive visual data management solution designed to process large amounts of aerial inspection imagery captured by drones.

Pros:

- AI based analysis of image data
- Cloud based environment
- Clear view of even small object
- Easy import and export data

Cons:

- No integration of GIS map
- Give dynamic polygon instead of rectangle for annotations