Changing the Paradigm of Mapping

UAV/ DRONE with AI/ ML Innovations

Edited by **MOHAN DAS VISWAM**

Drone enables topographic surveys of the same quality as highly accurate measurements collected by traditional methods, but in a fraction of time. This substantially reduces the cost of a site survey and efforts. Today drones coupled with Artificial Intelligence (AI) and Machine Learning (ML) can use large data sets (such as aerial images) for processing in a semi-automatic manner. This has become possible due to an immense and rapid increase in processing power, reducing costs of storage and availability of digital data in the recent years.

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Drones can be termed as flying robots but currently majority of them are controlled by human pilots. Drones have various benefits in the multiple industries from mapping to real estate, from defense to package delivery and so on. Drone enables highly accurate topographical maps within fraction of time with lesser cost as compared to conventional techniques. They can fly at low altitude and capture remote data, surveillance videos and also analyze it for various objectives. To reduce the human intervention in data, there are intelligent drones that can read, calculate, analyze and predict data themselves to provide useful information. Without humans, drones can rely on the in-built machine learning algorithms to function.

Technology behind

A drone, in technological terms, is an unmanned aircraft. Drones are more formally known as Unmanned Aerial Vehicles (UAVs) or Unmanned Aircraft Systems (UASs). Essentially, a drone is a flying robot that can be remotely controlled or fly autonomously through software-controlled flight plans in their embedded systems, working in conjunction with onboard sensors and GPS.

In the recent past, UAVs were most often associated with the military, where they were used initially for anti-aircraft target practice, intelligence gathering and then, more controversially, as weapons platforms. Drones are now also used in a wide range of civilian roles ranging from search and rescue, surveillance, traffic monitoring, weather monitoring and firefighting, to personal drones and business drone-based photography, as well as videography, agriculture and even delivery services.

Components of Drone

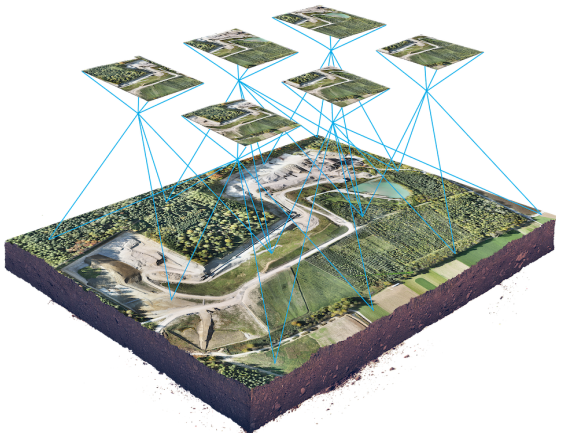
- Electronic Speed Controllers (ESC)
- Flight controller
- GPS module
- Battery
- Antenna
- Receiver
- Cameras
- Sensors, including ultrasonic sensors and collision avoidance sensors
- Accelerometer, which measures speed
- Altimeter, which measures altitude

How it works!

A typical unmanned aircraft is made of light composite materials to reduce weight and increase manoeuvrability. This composite material strength allows military drones to cruise at extremely high altitudes.

Drones are equipped with different state of the art technology such as infrared cameras, GPS and laser (consumer, commercial and military UAV). Drones are controlled by remote Ground Control Systems (GSC) and also referred to as a ground cockpit.

An unmanned aerial vehicle system has two parts, the drone itself and the control system.



Drone Photogrammetry generates 3D map

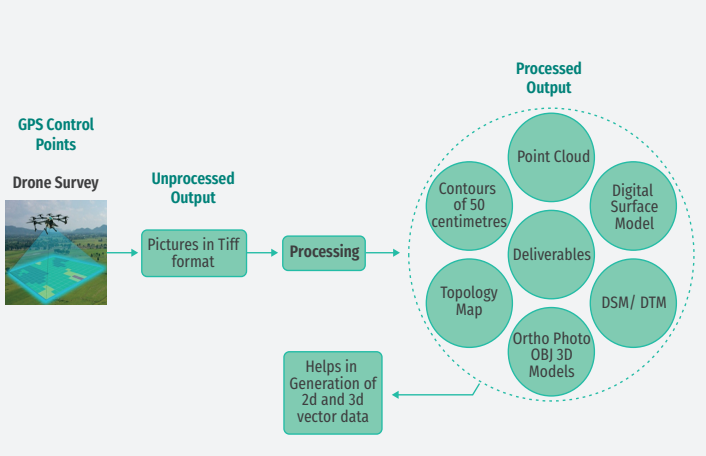
The nose of the unmanned aerial vehicle is where all the sensors and navigational systems are present. The rest of the body is full of drone technology systems since there is no space required to accommodate humans.

The engineering materials used to build the drone are highly complex composites designed to absorb vibration, which decrease the sound produced. These materials are very light weight.

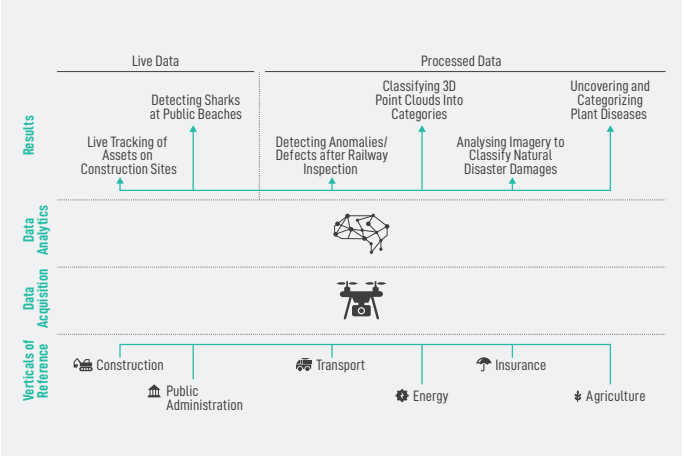
Capturing high resolution images on a stabilized drone is very important. Free or Propriety photogrammetry software can be used to process the images into real maps and models.

Drones in Mapping

A drone survey refers to the use of a drone, or Unmanned Aerial Vehicle (UAV), to capture aerial data with downward-facing sensors, such as RGB or



▲ Mapping Process Workflow



▲ Drones & AI in action

multispectral cameras, and LIDAR payloads. During a drone survey with a high resolution RGB camera, the ground is photographed several times from different angles, and each image is tagged with coordinates. Continuously Operated Reference Stations (CORS) can be established for Real Time Kinematic Positioning for drones.

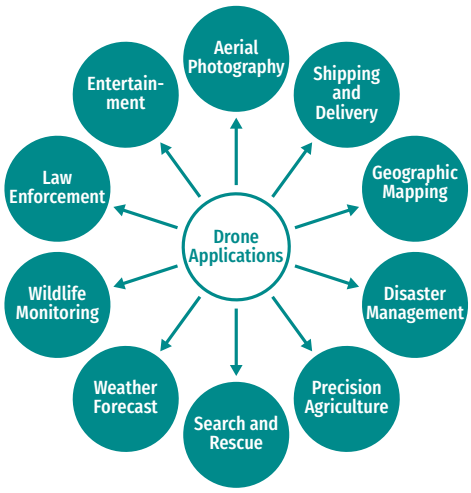
From this data photogrammetry software can create geo-referenced orthomosaics, elevation models or 3D models, volumetric measurements, of the project area. Unlike manned aircraft or satellite imagery, drones can fly at a much lower altitude, making the generation of high-resolution, high-accuracy data, much faster, less expensive and independent of atmospheric conditions such as cloud cover.

Benefits

Some of important benefits are:

Versatility

Due to their size, and unlike a manned aircraft - drone use means being able to fly into areas that were not possible before. They can fly from only a few centimetres off the ground to over 300 hundred feet in the air. All the while in one long continuous shot, panning and framing a chosen "subject" - for example a building. Drone can give the operator total control, whether it is wanting to move from left to right, or rotate on the same spot - all to get the perfect shot.



▲ Application areas *(Figure: 4)*

Time

The drone team is small, usually only involves the pilot, and a camera operator. So, this means that once arriving on site, it can be up and running in about 5 minutes. Even if the weather goes against it can land for the next window of opportunity. No matter if it is a small window, the drone can be launched and the shot can be obtained. These are simply things which a manned aircraft can never do. It also facilitates video of projects on landscape using 360-degree Rotation, Time-Lapse Cameras and Drone Aerial Views.

Full-HD Quality

Technological innovations mean drones are able to shoot in full HD and capture amazing aerial footage, with 4K resolution or higher, without sacrificing any quality.

Application

Drone usage has multiple applications; often people see drones being use for film production and news broadcasting. Other industries like construction, corporate, sports, and farming also use it for their applications. Contractors use them to aid in the assessment of a new projects and generate 3D maps. The maps preparation is fivefold faster than traditional land survey.

Minimal Interference

Have very less noise. Using drones for aerial photography is more peaceful, meaning they can be used at sensitive areas as well as on specific site operations.

Application Areas

Utility Mapping and associated Smart City Applications of large-scale mapping for rural and urban India can easily be carried out using drones. Apart from military use, drones are now being used by individual entrepreneurs, SMEs, and large companies to accomplish various other tasks. India has seen innumerable startups in Drone technologies and have set up a Drone Federation of India (DFI) which is a non-government, not-for-profit, industry-led body that promotes and strives towards building a safer and scalable unmanned aviation industry in India. The regulatory framework for drones has been issued by the Directorate General of Civil Aviation (DGCA) on August 27, 2018, by way of Civil Aviation Requirements (CAR), Section 3 – Air Transport Series X, Part I, Issue I (Drone Regulations) for legalizing and regulating the operation of drones for civil use in India. Some of the applications areas of drone are given in figure 4.

Use cases

Large Scale Mapping for Greater Noida Industrial Development Authority using Drone

Greater Noida is being developed as Metro Centre providing for quality urban environment, to attract economic activities and population to decongest Delhi. NIC is developing a Geo Portal for integration of its MIS/ SAP HANA data with large scale base map (1:1000) using Drone and CORS.

Scrap volume assessment at Tughlaqabad Railway Yard, New Delhi

Scrap is collected and sold by Indian Railways. A POC for calculation of volume of scrap was carried at Tughlaqabad Railway Yard.

Future Road map

The drones of the future will be controlled by artificial intelligence. AI allows drones and other machines to make decisions and operate on their own on your behalf. Machine Learning algorithms shall be used to classify and thereafter predict in various applications.

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