International Journal of Research in Advent Technology, Special Issue, March 2019
E-ISSN: 2321-9637
Available online at www.ijrat.org

Comparative Study of Drones: Types and Payloads

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Abstract— Unmanned aerial vehicle can be ordered as far as the sort (fixed wing, multi-rotor and so on.), the size and weight and administration extend. These determinations are imperative from application perspective. Beside the automaton itself different kinds of payloads can be recognized (precedent bundle, prescription, fire douser and so on.) and different types of sensors (cameras, Infrared, ultrasonic etc.).In request to work an automaton requires remote correspondence with a pilot on ground. Likewise there is additionally a requirement for correspondence with a payload like a camera or a sensor. To enable this correspondence to happen a recurrence range is required. Automaton innovation is probably going to end up progressively self-sufficient later on and payload will assume a vital job in automaton employability.

1. INTRODUCTION

UAV stands for Unmanned Aerial Vehicles but can also be referred to as drones. They can be hardware or software controlled and can fly wirelessly with the help of a controller to accomplish various tasks. They are used where the use of airplanes or helicopters would be too expensive or risky. The aim of this paper is to provide an overview of the different types of drones currently used, their technical specifications, potential payloads and applications and the current and near-future technological development in drone technology. The capabilities and roles of Unmanned Aerial Vehicles (UAVs) are evolving and so are their applications. Drone itself is divided into two parts which is the basic platform and the equipment attached to it which is the payload. The drone, which is the flying platform can be made suitable for different goals. These goals can be achieved in combination with specific payload suitable for that load.

2. TYPES OF DRONES

The main drone types are fixed wing systems and multi-rotor systems. Majority of existing drone can be classified into these types.

1. Multi Rotor Drones

Multi Rotor drones are the most well-known sorts of automatons which are utilized by experts and specialists alike. They are utilized for most basic applications like aeronautical photography, ethereal video observation and so on. Multi-rotor automatons can be additionally arranged dependent on the quantity of rotors on the stage. They are Tri-copter (3 rotors), Quad-copter (4 rotors), Hexa-coper (6 rotors) and Octo-copter (8 rotors). Out of these, Quad-copters are the most prominent and generally utilized variation. The
Conspicuous ones being its constrained flying time, restricted continuance and speed. They are not appropriate for vast scale ventures like long separation flying mapping or reconnaissance.

2. Fixed Wing Drones

Fixed Wing drones altogether extraordinary in structure and work to multi-rotor type drones. They utilize a 'wing' like the typical planes out there. Most fixed wing drones have a normal flying time of several hours. Gas motor fueled automatons can fly as long as 16 hours or higher. They can't be utilized for aerial photography where the automaton should be kept still reporting in real time for a timeframe. Alternate drawbacks of fixed-wing rambles are greater expenses and ability preparing required in flying. It is difficult to put a fixed wing ramble noticeable all around.

3. Single Rotor Drone

A single rotor model has just one big sized rotor plus a small sized one on the tail of the drone to control its heading. Single rotor drones are much efficient than multi rotor versions. They have higher flying times and can even be powered by gas engines. However, these machines comes with much higher complexity and operational risks. Their costs are also on the higher side. The large sized rotor blades often pose a risk (fatal injuries have been recorded from RC copter accidents) if the drone is mishandled or involves in an accident.

3. TYPE OF PAYLOADS

This section will discuss the types of payloads that can be attached to drones. Virtually all kinds of payloads can be

attached to drones, the only restrictions are usually the weight and size of payloads. Most drones are equipped with cameras by its manufacturer. Other payloads can be ordered at drone manufacturers, but drone users also can attach payloads to their drone themselves. In this section, we will distinguish between sensors and other types of payloads. We will describe some applications for these payloads as well.

1) Sensors

The weight, model, and energy source of a drone are major factors influencing its maximum altitude, flight duration, flight range, and maximum payload. An important category of payloads are sensors. Most drones are nowadays equipped with cameras. Cameras and microphones are the most often used payloads for drones and often come standard when buying a drone. Cameras can be regular cameras but also infrared. Such cameras may enable night vision and heat sensing. Other sensors include biological sensors that can trace microorganisms, chemical sensors ('sniffers') that can measure chemical compositions and traces of particular chemical substances including radioactive particles and meteorological sensors that can measure wind, temperature, humidity, etc.

Cameras can be useful payloads for the prevention, criminal investigation, criminal prosecution, and sentencing of criminal behavior. Most applications assume drones to be flying camera surveillance. The preventive function of camera surveillance shows mixed results.

For instance, **heat sensors** are very useful for detecting hemp that people are growing in their attics. Chemical sensors may be useful for detecting traces of illegal drugs. Drones equipped with Wi-Fi hotspots may provide clues about someone's position and can be used for tapping phone and Internet use.

Drones may also help monitoring illegal waste dump and transport of toxic waste. When particular animals are provided with **RFID tags**, drones can track migrations, biodiversity, poaching, and habitats. Images created by drones may also be useful for estimating animal populations and tracking their behavior.35 Drones with sensors are currently used in agriculture, for instance, for monitoring crop growth, estimating biomass, checking for weeds and plant diseases, and evaluating the quality and level of water.

Other Payloads

Apart from the sensors described in the previous subsection, all kinds of other payloads can be attached to drones. Most payloads that are not sensors involves cargo that needs to be delivered, i.e., mail like letters and parcels, medicines, meals, supplies, and fire extinguishers. Cargo can also be illegal, such as narcotics and firearms. In some cases, the cargo is not intended for delivery; examples of such payloads are ads and WiFi hotspots.

Another commercial application of drones is that of flying advertisements. Objects, banners, ticker tapes, and speakers can be attached to drones to disseminate marketing messages. Examples may be to attach a large beer can or a large shoe with a logo to a drone and fly it around. However, such applications are still in development.

4. DRONES INCLUDED FOR STUDY

1) Pluto X

Pluto X is a Nano drone developed by Dona Aviation Private Ltd. which is a start-up company having roots at IIT Bombay. Pluto is powered by a 400mAh battery which gives it a flight time of about six to seven minutes. It is a highly modular drone capable of interfacing many sensors on board due to the presence of 16 general purpose Input/output pins although is limited by the payload capacity which not more than 15 grams. Pluto X is programmable via the 'Cygnus IDE' SDK which can be downloaded online. The IDE is based on C++.This drone provides a relatively stable flight.

2) DJI Tello

This is a drone developed by DJI Company. This drone Perform flying stunts, shoot quick videos with EZ Shots, and learn about drones with coding education. Tello is powered by a 4000mh battery which gives a flight time about thirteen to fifteen minutes. This drone is capable of interfacing of different type of payload but it also have a payload capacity which is double than Pluto-X. The payload capacity is up to 30g. It also has a range limit of 50m.

3) Parrot AR

Parrot AR. Drone is a discontinued remote controlled flying quad copter helicopter built by the French company Parrot. The drone is designed to be controlled by mobile or tablet operating systems such as the supported iOS or Android within their respective apps or the unofficial software available. The airframe of the AR. Drone, constructed from nylon and carbon fiber parts, measures 57 cm (22 in) across. Two interchangeable hulls were supplied with the airframe, one is designed for indoor and one for outdoor flight. The indoor hull is made from EPP foam, and encases the circumference of the blades for protection. The outdoor-use hull is made from lightweight plastic and allows for increased manoeuvrability. In total, the AR. Drone has six degrees of freedom, with a miniaturized inertial measurement unit tracking the pitch, roll and yaw for use in stabilisation. Inside the airframe, a range of sensors assist flight, enabling the interface used by pilots to be simpler, and making advanced flight easier. The on board computer runs a Linux operating system, and communicates with the pilot through a self-generated Wi-Fi hotspot. The on board sensors include an ultrasonic altimeter, which is used to provide vertical stabilization up to 6 m (19 ft 8 in). The rotors are powered by 15 watt, brushless motors powered by an 11.1

Volt lithium polymer battery. This provides approximately 12 minutes of flight time at a speed of 5 m/s (11 mph).

4) DJI Mavic

The Mavic is a series of tele-operated compact quad copter drones for personal and commercial aerial photography and videography use, released by the Chinese technology company DJI. The Mavic Air, which was released in early 2018 was the first "pocket-sized" portable drone being able to capture 4k video at 30 FPS. The Air has a 3-axis gimbal and 25mm lens. The Air also has a 'SmartCapture' feature, a three-directional environment sensing system and a max flight time of 20 minutes. The Mavic controller is more compact than those for other DJI drones. It includes fold-out grips for smartphones and small tablets and has a built-in flight information display for flight without a smartphone or tablet.

5) DJI Spark

This drone was released in May 2017, the Spark was designed to be an affordable consumer drone that is nevertheless capable of producing high-quality images and video. This drone is DJI's cheapest to date and features a 12-megapixel camera capable of shooting 1080p video at 30fps. The camera is stabilised mechanically by a 2-axis gimbal. The Spark also carries an advanced infrared 3D camera that helps the drone to detect obstacles in front of it, as well as facilitating hand-gesture control—a feature that was, until the release of the Mavic Air in January 2018, unique to the Spark. In addition to a smartphone app with virtual controller, a physical controller can also be bought, extending the drone's range up to 1.2 miles (2 km). The aircraft has a flight duration of up to 16 minutes, but its exhausted battery can easily be swapped out for a charged battery to extend flight time. There have been multiple complaints that the drone could switch off and fall while flying. DJI responded to this by releasing a mandatory battery firmware update.

5. OBSERVATIONS

Parameters	Pluto X	DJI Tello	Parrot AR	DJI Mavic	DJI Spark
Multi-rotor	Yes	Yes	Yes	Yes	Yes
Weight	75g	360g	420g	430g	360g
Payload capacity	15g	30g	50g	50g	40g-50g
Durability	15mins	13mins	20mins	20mins	16mins
Range	60m	50m	50m	40m	100m
Type of motor	Brushed	Brushed	Brushed	Brushed	Brushed
Controller	App	RF	App	RF	RF

6. CONCLUSION

In this paper we have provided an overview of various drones (UAVs) easily available in the market for hobbyists and drone enthusiasts. The study describes and explains various types of payloads which are attached to a drone mainframe for accomplishing various tasks. The payload capacity of the drones mentioned is not more than 500 grams as the drones compared are of 'mini' category. As the miniaturization of technology improves with time smaller drones with higher lift power will be possible.

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