

SURVEY PAPER ON DRONS CHARACTERISTICS

Jidnyasa A. Bonde

Student of MSC.IT,
Dept. Of Information Technology,
The S.I.A. college of Higher Education,
Dombivli (East),India

Archana Vilas Kshirsagar

Assistant Professor,
Dept. Of Information Technology,
The S.I.A. college of Higher Education,
Dombivli (East), India

ABSTRACT

This article presents the drones and their possibilities for use. The construction was first discussed drones, which are the most important elements are the frame, propellers, motor, electronic control system and Communications system. A drone is powered by batteries, which is the major disadvantage because it is exhausted afterward 15 minutes of flight, causing the drone to drop to the ground. Lithium-polymer batteries are used for power supply drone. Military drones are different from civil and leadership dimensions. They are larger and powered by internal combustion engines. Civil drones are driven by electric motors. The possibilities of using the drone were shown in this paper. These can be used by public services (such as the police, fire fighters, border guards), by the army, from the industry, to take pictures and film, for the delivery of shipments.

The article shows the danger of connecting with the use of the drone. The main danger of using the drone is the fall of drones from a high altitude, which can be battery discharge, damage caused by weather conditions (low air temperature, precipitation), hitting an obstacle (tree, building, high voltage line).A the very important risks associated with the extensive use of the civilian drone are related to the privacy and the rights of citizens. This paper provide research about quad drone, hexadrone, octadrone with their real time application and technologies used

Keywords: Drons, Bicopter, Hexacopter, Octacopter, Quadcopter, thrust, Rotor, Motor, arms

INTRODUCTION

Drones or unmanned aerial systems (UAVs) Vehicle or UAS - Unmanned Aerial Systems (ATS) means airplanes which able to fly without pilot and passengers on board. Drone can be control remotely by radio waves or autonomously (a predefined route). There is no specific size or type of drone. They are often equipped with monitoring accessories and monitoring in the form of optoelectronic heads. The optoelectronic head meant to work for thermal to visible mode for detection using various sensors for the purpose of detection, recognition, identification and observation. It can work in various conditions both during day and night. Most An important feature of drones is that they do not need any additional accessories infrastructure for rapid registration and monitoring of designated areas, or object. A notable advantage is the extremely short reaction time when the unit is put into operation and ready for flight. The predecessors of the UAVs are aircraft primarily used in uniforms services - army and police. The first countries to start research on UAVs are the United States, the United Kingdom, Russia, Germany and Israel. First unmanned aircraft it was used by the Austrians in August 1849. They were back then used balloons (full of explosives) known to exist for almost 150 years and were used as bombs. One of the first drone was created by Charles Kettering, who a Created in 1915 by Elmer Sperry, Orville Wright and Robert Milikanem, the aircraft called the "Kettering Bug". It was a primitive automatic plane, which determined its height based on the sensors (using a barometer), distance travelled (based on engine speed); and situation. In contrast, the first civilian aircraft was only manufactured in 2006 Japan in the 1980s at the request of the Minister Directorate - General for Agriculture, Forestry and Fisheries. Public drones are different military size and drive. They're smaller and driven with electric motor (military is driven by internal combustion) engine). Used primarily for photography and film making.

LITERATURE SURVEY

In 1907 the world first quadcopter was created by inventor brothers Jacques and Louis Bréguet, the invention of first drone was quite excited but it has vertain limitations like steadiness and lifting from ground Wright Brothers launched radio controlled pilotless winged aircraft which acted as flying bomb which treated as opening door for combat drones. In 1943

The drone was created for World War II nicknamed as "FRITZ X". It was remote controlled drone was put into operational use for combat which is ancestor of modern precision – guided weapons. In 1960 when transistor technology come into use for drone, where indoor fly model is also available for consumers which are meant can be use for various purpose. In 2001 the first drone CIA came in February 2002, which killed the Osama bin laden. CIA drone also known as Predator drone. It turned out to an innocent man named Daraz khan who was collecting scrap mental. In 2006 Used to recognizing the potential of non-military, non-consumer drone application. The first commercial drone permit issued by the FAA. These permits lifted some limitations placed on consumer drones flown for recreational purpose. Then it opened new possibilities for companies and

professionals who want to use drones in assorted business ventures. In 2010 the Parrot AR drone was released by French company Parrot. It was the first ready-to-fly drone which is controlled entirely by the Wi-Fi using smartphones. Immediately drone was successful with critically and commercially. Then it receiving the award which is 2010 CES Innovation award for electric Gaming Hardware and selling upwards of half a million units. December 2013, Amazon released concept video showcasing Jeff Bezos' dream for drone-based delivery system. For drone delivers, retail giant wasn't the first company; it was which put the technology into public consciousness. In 60 min interview, Bezos described possibility of using technology to make half hour deliveries. There is a best drone maker on the market, smart computer vision and machine learning technology introduced by DJI's Phantom S. This is used to avoid obstacles, people, animals or object rather than being limited to GPS signal.

DRONE ARCHITECTURE

Physical properties

The drone is the composition of two major parts

1. Movement system
2. Control system.

Movement system consist the basic element known as a frame which need to be as light weight as possible. This frame type is mainly based on number of arms, which classify drone into following category.

1. Biocopter - two machines
2. Tricopter - three machine
3. Quadcopters - four machines
4. Hexacoverters - for the machine
5. Octocopter - eight machines

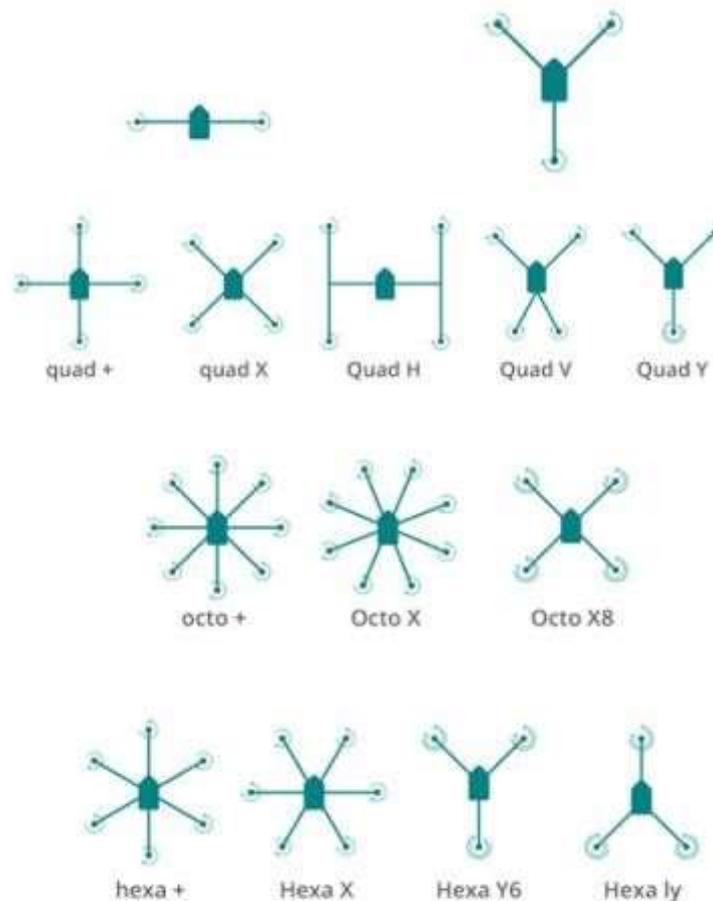


Figure 1^[1]: Possible ways for frame construction.

The figure 1 shows the various possible ways the frame can be constructed. Thus construction is based on the utilization in real time application which also relates the numbers of arms and motors which are meant to use drone control and stability.

2. The control system:

Is responsible for controlling drone movements such as fly Up, DOWN, ROTATE which ultimately gives responsiveness to force and stability required for drone movement. To achieve this drone required various sensors and algorithm which works on those sensors. Drone consists following control system.

1. Flight Controller which is meant to control machine behaviour
2. Electronic speed control is meant to control engine Rotation per Minute.
3. Supplying plates separates the power supply for motors and regulators.
4. Sim module is meant to send telemetry data to various receivers.
5. Numeric keypad is meant to enter provide Input to the system for various purpose.

Controller system is meant to provide maximum performance and failure safety.

A drone can do following things in the vertical plane from ground:

1. Hover Still: it is the net thrust or a power which can create using motor by allowing air flow using arms meant to push drone up by creating exactly equal force as gravitational force pulling drone down

2. Climb Ascend: by increasing the thrust using rotating arms to pull the drone up in such way that the upward force is greater than the weigh and pull gravity.

3. Vertical Descent: it is opposite to Hover still where thrust need to decrease for fly down.

In this research paper we will discuss some types of drones with their real time applications.

1. The Bicopter drone:



Figure 2: The Bicopter drone

Figure 2 shows how bicopter can be served with specific application. The shown bicopter has two motors, it is cheapest sort of multicopter. Following are some components of bicopter^[4].

1. Duct

It is enclosed with motor and propeller meant to have greater air flow. It uses lighter duct material such as aluminium. The diameter of duct is generally 260 mm diameter and 25mm of height. Due to duct like construction bicopter proves safe presence near human.

2. Connecting plate

It meant to connect two duct of bipolar. The central hole is provided for wire passage, with considered batteries, microcontroller and other electronics devices.

3. Motor housing Plate

This plate is made according to the size of rotational duct, where inner diameter of duct is matching with connecting plates. Bicopter generally has 3 motor housing plate which is sufficient to distribute the weight of motor.

4. Bicopter assembly

It consist two duct, four motor housing plates, two ribs to join two duct and a connecting plate. This overall assembly gives strength and stability to bicopter. Also allows goof air flow for fly UP and DOWN.

Advantages of Bicopter

- All components easily available
- Symmetrical thrust
- Compact design

- Free airflow
- Cheap
- Lightweight

Disadvantages of Bicopter

- Both propellers next to each other require more space
- Arms are located in the airflow, thereby reducing efficiency
- Additional mechanics compared to "V configuration"
- Cannot handle heavy carriage.

2. The Quadcopter drone



Figure 3: Quadcopter drone

Figure 2 represents Quadcopter which has 4 motors on symmetric frame. Each arm is 90 degree apart from each other. This copter has two motor rotated CW (clockwise) and remaining two rotate CCW (Count clockwise) to create opposite stay to balance. Quadcopter is the most popular drone with simplest mechanical structure. It is widely used for drone racing in the form of "mini quad". There are 2 main configurations: X or +. The X configuration is more popular because you can keep the propeller away from camera view (for FPV and aerial film making). Some people use the plus (+) configuration because it is more intuitive, and flies like an airplane. It's easier to find out orientation. Quadcopter are famous for lightweight design, can fly indoor and outdoor due to its compact blade size. Quadcopter are famous for lightweight design.

Advantages of Quadcopter

- Symmetrical thrust
- All components are easily available
- Cheap
- Lightweight
- Less risky for close interaction
- Indoor friendly.

Disadvantages of Quadcopter

- Arms are located in the airflow, thereby reducing efficiency.
- Propellers next to each other require more space
- Additional mechanics compared to "V-configuration"
- Cannot handle heavy carriage
- More number of blades creates negative impact on momentum.

3. The hexadrone:



Figure 4: The Hexacopter drone

Figure 3 shows hexa drones got categorize into hexa +, hexa Y, hexa Y6 and hexa ly. [2] Based on its type hexa drone have different arrangement regarding to its engine and propellers, which helps for lifting and balancing the drone which defines durability this also helps in directing the flight direction.

It has 6 motors which are symmetrically mounted and each with 60° apart from each other. These all motors move in symmetrical way with the propellers. It just works same as quadcopters but the lifting capacity is more as it has more numbers of motors which also helps in lifting heavier carriage. Even if one motors fails drone can keep on lifting itself with extra motors. The problem with physical architecture is they are heavy in weight and large in sizes. The architectural problem of hexa drones can be solves by type hex Y6 copter. Which has 3 arms and looks like a tricopter but has 6 motors running within without jaw like angle for propellers, this gives more compactness and same lifting capability. Where apart from 6 motors architecture the hub motors model is efficient one. It has central hub for payload attachment and 6 propellers which are placed to separate aluminum road at the end which are attached with central hub with an angle of 60 degree angle apart from each other. This central hub model provides good stability with low amount of vibration also the twisting of propellers creates twisting force which help directing the drones, when propellants are distinguish according to their rotation direction. Propellants can follow different direction, in hexacopter three propellants are spinning clockwise where as other as rotating anti clockwise. It follows four basic movements **Throttle**, **Roll**, **Pitch** and **Yaw** as shown in figure

The central hub also provides home for various devices to attach with battery. In reference with figure 4 to achieve Roll movement ailerons i.e. wings of drone get used. Yaw movement is achieve by Rudder i.e. the tail arms for rare arm/ blade of the drone and Pitch movement is achieve using front arms/ blades of drone. Depending upon the application the selection of ailerons, rare and front wing can be decided.

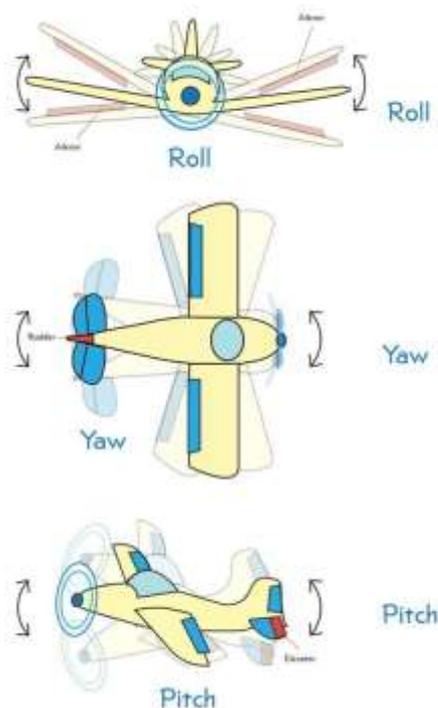


Figure 5. [3] Hexacopter drone basic movement

Advantages

- More capacity to lift than the tricopter and Quadcopter.
- It is more flexible and stable.
- If one propeller blade fails, the other five can still keep it flying.
- It offers flexibility and robustness.
- Various fly control mechanism can be applied over the different wings.

Disadvantages

- It is more expensive.
- Rotors are more complicated and larger than Quadcopter.
- Larger in size

Application of Drones**1. Agriculture**

- The country like Japan is using UAV drone for seeding and spraying rice fields.
- To identify the moisture level in the air and on fields as well
- The precision agriculture like weed identification
- For surveillance of fields.

2. Civil Engineering

- Aerial mapping
- Capturing videos for construction sites
- Infrastructure inspection
- Monitoring forest roads

3. Energy and Utilities

- To get real time access information about energy generation reading and energy consumption reading
- Inspecting transmission and distribution of lines
- To inspect wear and tear within infrastructure

4. Mining

- Survey for field for blast designing
- Rapid pre and post blast data
- Identify mine damage and wall damage
- Inspecting underground scenario for mining.

5. Oil and Gas:

- To detect gas leaks, oil spill
- Scout for whales
- Inspecting sea area for danger alert
- To identify the weather for sailing ships and gas and oil transportation

6. Aerial photography and video capturing**7. Shipping and deliveries of small packages to save manpower and to skip road traffic****8. Geographic mapping to capture mountains, Islands and coastlines where human reachability is difficult.****9. Disaster Management:**

- Provide quick anticipation to gather disaster information
- Navigate debris
- To find out victims for disaster

- In case of fire or earthquake drone can help to identify risky locations, victims where risk for human does exist.

- Search and rescue

10. Wildlife monitoring

11. Law enforcement:

- Surveillance of large crowd and ensure public safety
- Monitoring criminal and illegal activities
- Border patrolling

12. Military applications:

- Patrolling
- Bomb droppers
- Surveillance in risky or out of scope area.

13. Film making, journalism and sports

14. Scientific research such as supervising into very high temperature, near volcanos, capturing the changes in risk environment such as chemical experiments.

Scope of research:

The paper discusses the various aspects of drone characteristics. Where research is focusing on the physical characteristics, how this physical characteristics are impacting the drone application. Paper also discuss about how motors, propeller, sensors and arms are acting as core hardware which impact overall framework of research.

CONCLUSION

The research is focusing on bicopter drone, Quadcopter drone and hexacopter drone. Each drone has its specific physical and control system characteristics, which is also depend upon the application of drone or the environment in which drone is meant to work. These behaviour characteristics of drone also provide some positive and negative impact which helps for further research and development.

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