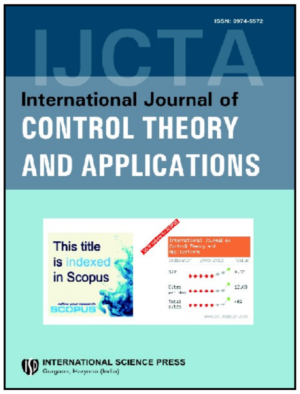

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Current Trends in Electrical Drones in the Alive Technology

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Abstract: Unmanned Ariel Vehicle (UAV) is defined as an aerial vehicle, uses aerodynamic forces to lift the vehicle, can fly automatically or be operated remotely, that does not carry a human operator. That can be expandable or recoverable, and can carry a lethal or nonlethal pay load. It can be operated by remote control of a pilot on the ground or autonomously by on-board computers. Currently, its usage is limited due to its cost and satellite communication. A Drone has been built that can send live audio-visual feedback and operated by radio frequency controller. In early days, Drones are also using in military applications such as spying on both domestic and international threats. The areas that the developed drone can be used for are policing, agriculture, monitoring flood affected areas firefighting, recording video footage from impassable to reach areas and both military and non-military security operation work. Android mobile device incorporation with GPS has been used for real time audio-visual feedback from drone and for live position tracking of drone.

Keywords: drones, quadcopter, unmanned aerial vehicle and application, current trends in drone technology.

1. INTRODUCTION

A flying machine without pilots inside it to operate is a Drone. It can be handled like a specified toy helicopter and operated on remote system. The only difference is it can be used to solve serious issues like calamities, sting operations in which human beings remain unharmed though the entire operation is done by humans.

Now a day's the microelectronic industry is increasing day by day and more micro electro mechanical sensors (MEMS) available in market which makes the drones work like robot. In the last decade the unmanned aerial vehicles (UAV) were used widely for military purpose, agriculture purpose as well as for the wide range of commercial applications.

A conventional helicopter consists of rotors which can able to change the pitch of their blades dynamically as they move around the rotor hub are differ from Quadcopter. In the early days of flight, quadcopters were seen as possible solutions to some of the persistent problems in vertical flight torque-induced control issues can be reduced by anti clock wise rotation and the relatively small blades construction is easier [1]. Due to their mechanical simplicity, Small size drones are more durable and cheaper than conventional helicopters. They had the ability to cause less damage, because their smaller blades possess less kinetic energy. For small-scale drones, this makes the vehicles safer for close interaction. At the same time, by increasing the blade size the efficiency can be improved as it takes less energy to generate thrust by moving a large mass of air at a slow speed than by moving a small mass of air at high speed. Therefore, the cost of control comes by increasing the efficiency. Helicopters don't encounter this issue as increasing the size of the rotor disk does not significantly affect the ability to control blade pitch.

2. DRONE MODEL AND FLIGHT DYNAMICS

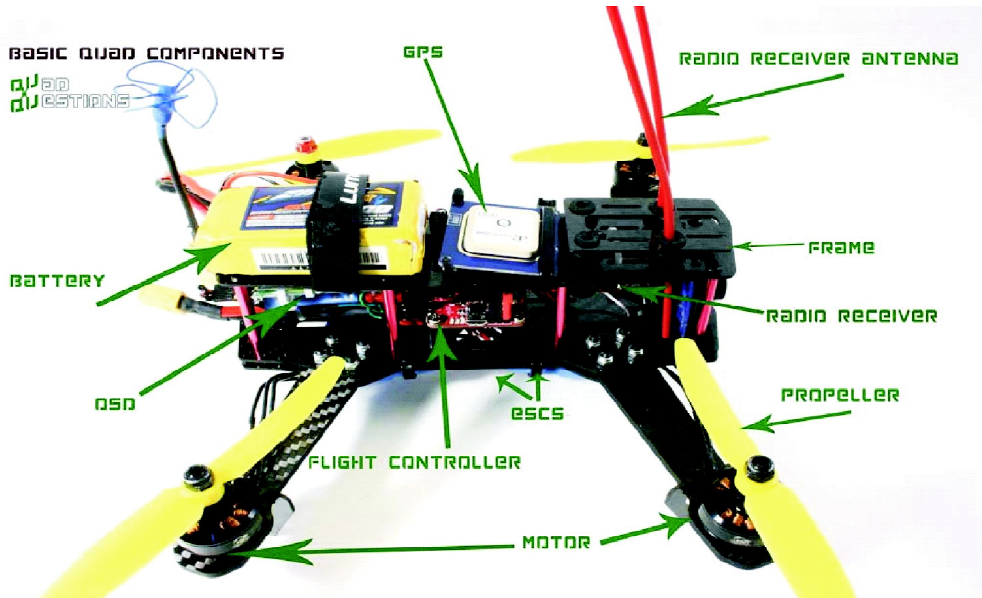

Figure 1: Quadcopter

There are two sets of identical fixed pitched propellers in the quadcopter; two are in clockwise (CW) or in one direction and two in anti-clockwise (CCW) or in opposite direction. The total weight is shared by each motor to produce upward thrust. So, for cost efficient less powerful motors are used. To achieve control these use independent variation of the speed of every rotor to achieve control. It is possible to specifically generate a desired total thrust by changing the speed of each rotor to create a desired total torque or turning force and to locate for Centre of thrust both longitudinally laterally.

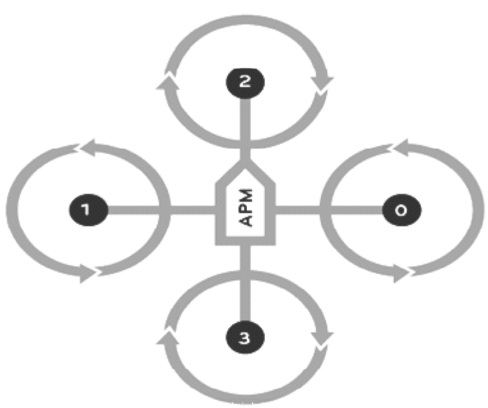

Figure 2: Quadcopter model

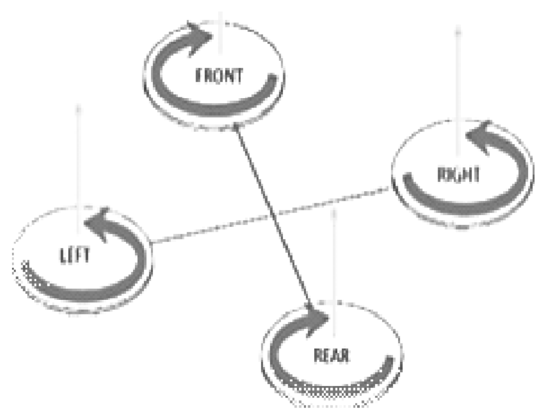

Figure 3: Take off motion

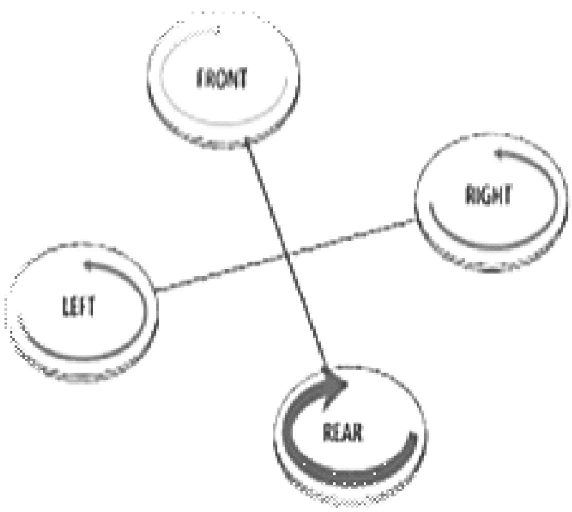

Figure 4: Forward motion

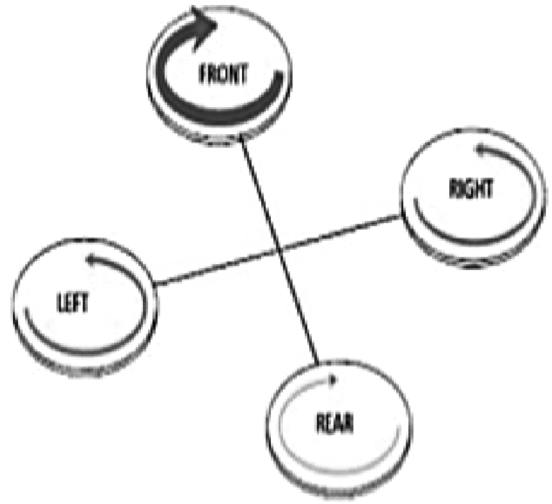

Figure 5: Backward motion

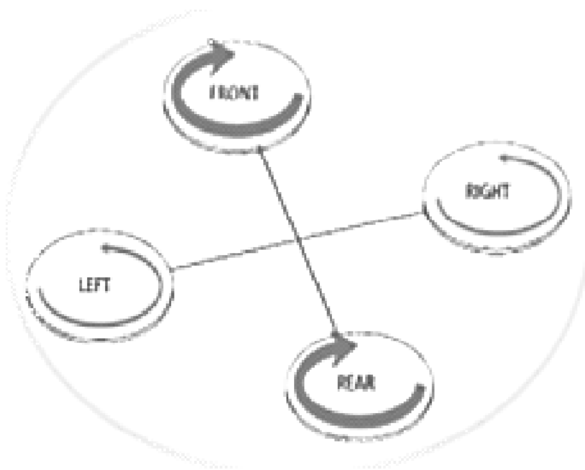

Figure 5: Right motion

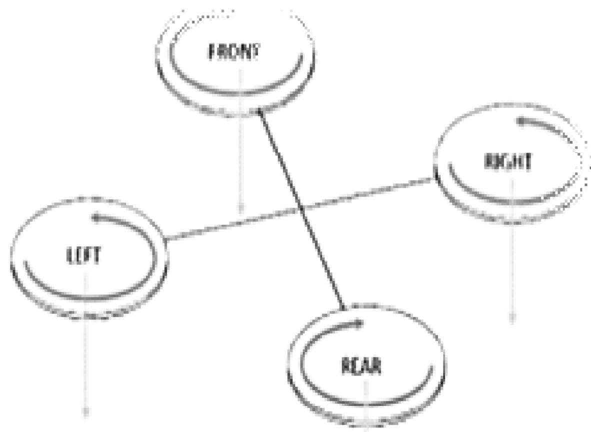

Figure 6: Landing motion

3. STATIC THRUST CALCULATION

To select the proper propellers and motors Static thrust calculations are needed [2]. It is defined as the total thrust produced by the propeller which is at standstill condition. Quadrotor helicopters are more likely to perform at low speeds relative to the earth and so this calculation is more important for this project. The calculation of static thrust is necessary to apply a wide range of flight conditions depending upon this low speed performance. Also, it is important to note that the final calculations of static thrust are not actual values they are estimates. The power transmitted by the motors to the propellers is

$$\text{power} = \text{prop const} * rpm^{\text{power factor}} \tag{1}$$

The thrust produced by a propeller is as follows

$$T = \frac{\pi}{4} D^2 \rho \upsilon \Delta \upsilon \tag{2}$$

T = thrust [N]
D = propeller diameter [m]
V = velocity of air at the propeller [m/s]
Δv = velocity of air accelerated by propeller [m/s]
ρ = density of air [1.225kg/m^3]

A generally used rule is that velocity of the air at the propeller is V=1/2ÄV is a total change in air velocity. Hence, equation 3 is derived.

$$T = \frac{\pi}{8} D^2 \rho (\Delta v^2) \quad (3)$$

The power absorbed by the motor propeller is calculated by equation 4. Equations 5 is obtained by solving equation 4 for Δv and substitute it into equation 3. In doing so, torque can be calculated by eliminating Δv.

$$P = \frac{T \Delta v}{2} \Rightarrow \Delta v = \frac{2P}{T} \quad (4)$$

$$T = \left[\frac{\pi}{z} D^2 \rho P^2 \right] \quad (5)$$

To express the results in terms of mass equation 5 is useful. Equation 6 is used to obtain Newton's Law, F=ma.

$$m = \frac{\left[\frac{\pi}{2} D^2 \rho p^2 \right]^{\frac{1}{3}}}{g} \quad (6)$$

Where g = 9.81m/s^2

It is necessary to calculate the mass of the quadcopter since it is directly effects hovering thrust. In practical hovering thrust must be equal to the mass of aircraft.

4. CURRENT TRENDS IN DRONE TECHNOLOGY

(A) Drones for Deliveries

Unmanned quadcopters can also be used for delivering parcels to our door steps. In this modern world these type of drones are very helpful for human beings in delivering packages. It saves time and does not require human labor. In financial point of view it is very cheaper than the present courier system.

Figure 7: Drones for delivery

The number of drop offs you can make on a delivery route is Route density. The number of parcels per stop is Drop-size.

B) Monitoring Agricultural and Environmental Conditions

Drones take high resolution pictures by flying over the field. The gathered information is directly sent to the cloud/software and made available to the customer. The user gets the information from the images and makes different prescription maps depending on the operation the farmer wants to perform on the field. The maps can then be uploaded on the farm equipment which will adjust the amount of inputs (seeds, fertilizers, pesticides) that would need to be applied in the field accordingly.

In agricultural applications [3], such as for spraying chemicals on crops UAVs are responsible. The feedback from the wireless sensors network deployed at ground level on the crop field controls the process of chemical apply.

Figure 8: Drones for agriculture

C) Drones for Defense

Drones occupy a prominent role in the development of the nation. These are the best solution for counterterrorism and counterinsurgency. This act as a soldier in the battle field and save valuable lives of the soldiers[6]. As they are of low cost they can be expendable and can be used in highly dangerous areas and these have capability to carry warheads also.

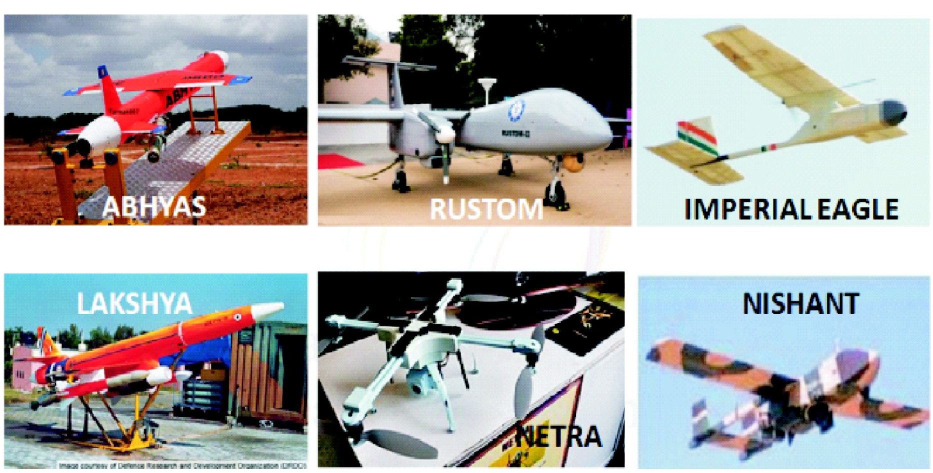

Figure 9: Drones in Indian for Defense

D) Drones for Civilian Application

(i) Police work

Police departments to improve their ability to enforce the law and protect lives, they can deploy drones to save valuable resources like police officer time and money [5]. Because the ability of UAVs to fly near to the ground, under the bridges, structures and even fly inside of the buildings and takes valuable information and it sends to the ground station.

Figure 10: Drones for police work

(ii) Firefighting

Drones technology has the capability of capturing unbelievable view of scenes of fire [7]. Otherwise-unachievable vantage places and it can be gives a unique incident intelligence which will assist firefighting efforts while firefighters are working.

Figure 11: Drones for fire

Drones can also work even in thick smoke conditions which keeps manned helicopters from gathering fire information with its infrared capability. They can keep people out of risky situations. They could provide accurate and real-time information to firefighters on the ground and alert officials when conditions change or the fire jumps the line.

(iii) Search and rescue

UAVs will give visual data at the time of earthquakes and tsunamis. The response of these devices is very quick and it provides real time information which will more helpful in disaster situations [4]. In rescue conditions these covers large area within a short time.

Figure 12: Drones for rescue

(iv) Ambulance

The prototype drone is designed to work when emergency services are required. Drones could arrive at the scene faster than an ambulance, unconstrained by traffic.

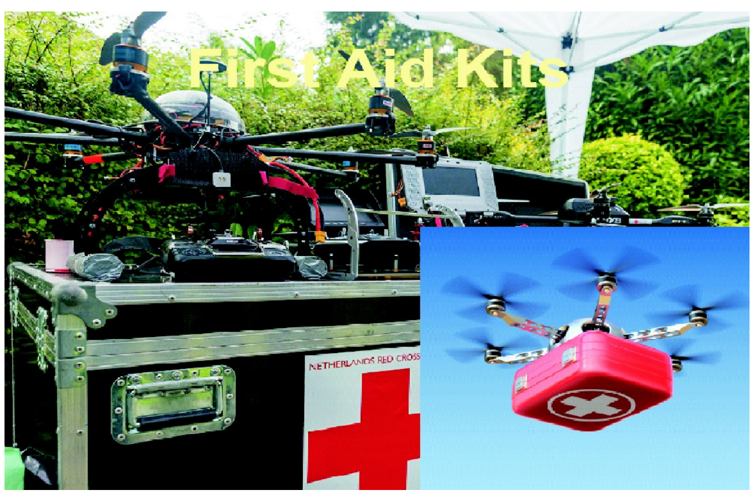

Figure 13: Ambulance drones

These drones are equipped with live stream audio and video connection [8]. So that the medical practitioners can deliver instructions to the patient or the people at sight through the webcam.

(v) Drones for photography and filming

Drones with on-board camera can be used to record high-definition videos and take pictures. To produce stabilized, wide-angle shots the front-facing fish-eye lens camera has been specifically designed. Images are sent to piloting device and saved on to the flash memory drive and then can easily be transferred onto computer, tablet or phone.

Figure 14: Drones for photography and filming

(vi) Nature and wild life protection

Animal monitoring approaches such as both direct animal counts and indirect counting of animal signs, nests, dung, and calls [9]. It can be Achieved impossible Conventional time-consuming and costly, ground surveys on foot in remote areas. Already for terrain mapping and classification of forest types currently Drones are employed for conservation.

Figure 15: Drones for wild protection

5. CONCLUSION

This paper explains the work of quad copter, flight dynamics information of UAV and appropriate mathematical modeling equations. It also explains the most relevant trends in drone technology.

REFERENSES

[1] Domenica Costantino, Maria Giuseppa Angelini, Gabriele Vozza," The Engineering And Assembly Of A Low Cost Uav" 2015 IEEE.

[2] Kourosh Rahnamai,"Quadrotor Drones Thrust Measurement Apparatus", 2016 IEEE.

[3] Theerapat Pobkrut ,Tanthip Eamsa-ard , Teerakiat Kerdcharoen," Sensor Drone For Aerial Odor Mapping For Agriculture And Security Services" 2016 IEEE.

[4] Sebastian Schlauderer, Sven Overhage, Julian Weidinger," New Vistas for Firefighter Information Systems? Towards a Systematic Evaluation of Emerging Technologies from a Task-Technology Fit Perspective" 49th Hawaii International Conference on System Sciences 2016.

[5] Nils Miro Rodday, Ricardo de O. Schmidt and Aiko Pras," Exploring Security Vulnerabilities of Unmanned Aerial Vehicles" Network Operations and Management Symposium (NOMS 2016)Demonstration Session Paper 2016 IEEE/IFIP.

[6] Glyn Owen, CGH Technologies, Inc., Washington, DC," Addressing The Drone Data Collection Process For The Required Data Quality" 2016 IEEE.

[7] Vyacheslav Kharchenko, Anatoliy Sachenko, Volodymyr Kochan, Herman Fesenko," Reliability and Survivability Models of Integrated Drone-Based Systems for Post Emergency Monitoring of NPPs", The International Conference on Information and Digital Technologies 2016.

[8] Radu-Cãlin Pahonie , Rãzvan-Viorel Mihai , Cristian Barbu, "Biomechanics of flexible wing drones usable for emergency medical transport operations" The 5th IEEE International Conference on E-Health and Bioengineering - EHB 2015.

[9] Noseong Park, Edoardo Serra, Tom Snitch, and V. S. Subrahmanian," A Data-Driven, Behavioral Model-Based Anti-Poaching Engine", ieee transactions on computational social systems, vol. 2, no. 2, june 2015

[10] Meysam Basiri, Felix Schill, Pedro Lima, and Dario Floreano," On-Board Relative Bearing Estimation for Teams of Drones Using Sound", ieee robotics and automation letters, vol. 1, no. 2, july 2016.