

**A Review On Inadequacies To Overcome By Commercial Unmanned
Aerial Vehicles In India**

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Abstract— This paper explains the challenges faced by the drones utilized for commercial purposes and the solutions to overcome the problems. This is an attempt to find the problems faced in India and about the drawbacks of existing commercial drones all over the world. The paper has listed down the challenges and the causes are keenly listed down across the different possibilities of logical and technical issues faced by an UAV while delivering the cargo to the peers till the comeback of drone to the hangar and the moral issues that may arise where the drone owner and operators would be facing and how the drone is expected to function in the future.

Index Terms— Drones, Commercial, Civilian, UAV, Hangar.

I. INTRODUCTION

An Unmanned Aerial Vehicle (UAV) is generally called as a drone. It is a flying machine without a human pilot on board. The flight of UAVs can be controlled by the help of computerization or by the remote control of an operator from the ground. In UAVs, when the camera is mounted, the operator can see the geographical view when it reaches heights. At times, UAVs are considered as a dangerous machinery as it caused many accidents throughout the world. It has been led to be banned in many countries. For few, UAV is just a military weapon that replaces the human soldiers and helps economically. For aeronautical students, drones are an interesting patio and fascinate them which yields them to improvise the technology. The Air force also predicts that after few years about 40 percent of its military aircraft would be drones. It's not only the military forces are aware of their potential, but also in many fields like agriculture, media, surveillance etc. Drones are being utilized for rescuing purposes as well. For example, save and rescue missions, natural preservation, and timberland fire location. At present, the amazon has introduced Amazon Prime Air as a delivery system of products through the commercial drones. The concept was revealed by 2013 and recently, the first successful delivery of Amazon Prime Air was on December 7th, 2016. The basic necessity of bringing the drones into the military field is that it fits in all small areas where human soldiers find difficult to intrude or hurdle any graveled path[2].

II. APPLICATIONS OF UNMANNED AERIAL VEHICLE IN ALL FIELDS

Though the era of Drones has started recently, they have been applied in so many fields which intentionally replaces human beings. In the means of agriculture, commercial and civilian purposes, and in military applications. In existing framework hikes, formally called Unmanned Aerial Vehicles (UAVs), have caught the consideration of adroit specialists. They keep up that drones have endless business applications, because of their sizes and capacities to fly without a human pilot. Despite, the Federal Aviation Administration has been resolute about keeping non-military UAV out of the skies. Some US nationals, officially worried about their entitlement to protection, stress that individual machines could be intrusive. Few drones are designed to be undetected by people by the military forces for the surgical strike and wars. The drones have been banned in many other countries due to some flaws.

In India, the drone's owner should overcome many rules to operate the drone. Drones are not allowed to fly over any crowded areas, public places, gray areas or in military areas. The operator should be approved with the Unique Identification Number (UIN) issued by DGCA (Director General of Civil Aviation) and should undergo the aircraft training. The drones can be allowed to fly over any private property with the owner's permission and above 200ft ground level is banned in India as per the rules issued by DGCA for the commercial drones [10]. Though there are many advantages of drones, there are few dangerous security threats as well. So, overcoming the rules and regulations for flying a drone becomes a challenge for civilians. There is a rich profusion of drones found in the areas of Agricultural, Aerial photography, Commercial, Filming, Racing between drones by Students and other Civilian, Research and Development, Scientific, Surveillance and in other military applications[9,16]. As such, organizations have utilized UAVs for video and photography, particularly for the market

purposes. However, there are numerous different utilization of UAV innovations more than what was expected to be as. From horticulture to the web get to, this machinery is a multipurpose machine that offers the possibility to rethink the absolute most basic ways of human work.

The drones can be differentiated with the usage of propellers and other payloads as such: drones with three propellers (Tri-copter), with four propellers (Quad-copter), with six propellers (Hex copter), with eight propellers (Octo-copter) and multirotor, with stabilizers, with and without the GPS, and with camera. The mechanism of the drones depends on the sizes which help to understand that whether it is a micro or mini copter. In the field of armed forces, the drones are seemed to be heavy as it carries heavy payloads such as gimbals or thermal cameras attached to it to detect the trespassers or for surveillance purposes[11]. The main drawback is as they are too expensive and has no guaranty to survive for long lifetime. So, there are too many approaches making them safer by adding protectors to the propellers, carbon fibered bodies and with safer batteries. The payload capacities depend on the weight of the drone.

In the field of Agriculture, Agriculturists can profit by Unmanned Aerial Vehicle through monitoring the crop fields and replaces the work of farmers, such as surveying the fields, observing the movement of animals, helps in analyzing the crops and grounds, irrigating the channels after the growth of the crops and prepared to spray pesticides, manures or water on harvests. In France, the drones have helped the farmers to crop the yields in ten percent and it was the first country in the world to invest on drones[17]. The latest implementation of drones in this field is, helping them in shooting the pods with seeds and providing the nutrients to help them in sustaining their lives. To avoid collision with the crops, the altitude is measured with the help of Li-DAR (Light Detection and Ranging) for the range which varies with typography and geography. This results in proving that the spraying aerially by the drones is five times faster than the customary mechanisms.

In the field of filming, the video can be shot by a vertical view or oblique view. Vertical shot is the perpendicular angle to the ground surface and the oblique shot is the slanting angle, which is tilted in a high or low angle. The high oblique is a portion of surface, horizon and the sky in view. The low oblique is the view of only the surface. It helps in reducing the human labor, the copter's expenses and the time efficient as well as a well-balancing factor. This helps the crew to take the video at ease, without any disturbances, utilized to screen the moments and rapidly accumulate and track necessary information about the cosmos[14]. The aerial photography is also mainly used in weddings and the events.

In the field of Commercial, the civilians also use drones, without any knowledge of aerodynamics or air-crafts. Then after few incidents which threatened the affected people, the government banned the use of drones by regulating few rules. The aerodynamics and aeronautical scholars are using the drones to study the airborne, airworthiness and the dynamics of the aircraft.

To help the defense division, the places near to natural borders like rivers, dense forest and tough mountain terrains where humans could hardly reach or reaching there could be extremely dangerous. If an aerial view of the surrounding is known, then the exact location for an attack could be planned even from a longer distance. It can also help in surveillance of those areas and intruders could be identified more efficiently than human soldiers[21]. This kind of aerial view helps the vision of the army men at the times of battle. The drones could help reducing the risks of life losses in war and can be more efficient than a normal soldier. The operator controls the drone from a distant location and performs needed task efficiently with the help of these intelligent drones. Also, during natural calamities when help is needed in places where the human cannot reach these drones can be sent for rescue missions and distributing resources to the stranded people in affected areas[4].

In Military applications, there are more complex and advanced drones are being used. Usually, the military drones are tested in aerodromes, and then to the terrain where it is supposed to recce about the meteorological, geographical and hydrographical traits of place under inspection. In Military, it is mainly used for security purposes which include, Security and Control, Airborne Reconnaissance, Airborne Traffic and Security Observation, Frontline Management, Synthetic, Biological, Radiological and Nuclear Conditions, Broadcast communication traffics, Restricting control center [12]. In the means of search and rescue by the disposition of life rafts in disasters, checkpoint marking for the rescue. It also helps in monitoring in the waterways and shipping and recce all over the marine which is basically used in navy forces, and used for analyzing the pollution in the air. Drones used in the military are heavier than the normal drones as it should help in munitions such as air to air missiles, air to ground missiles, wide area munition roll outs and payloads heavy missiles for war. In this field, United states, Israel, China, Iran, Russia are the leading countries to use the drones more frequently in their forces.

III. SYSTEM ARCHITECTURE OF COMMERCIAL UNMANNED AERIAL VEHICLES

The drones are different from normal air-crafts by its cockpit and windows and environmental control system, whereas in other manned air-crafts the frontier is used. Basically, there is no need of any cockpit or frontier as there is no presence of the human.

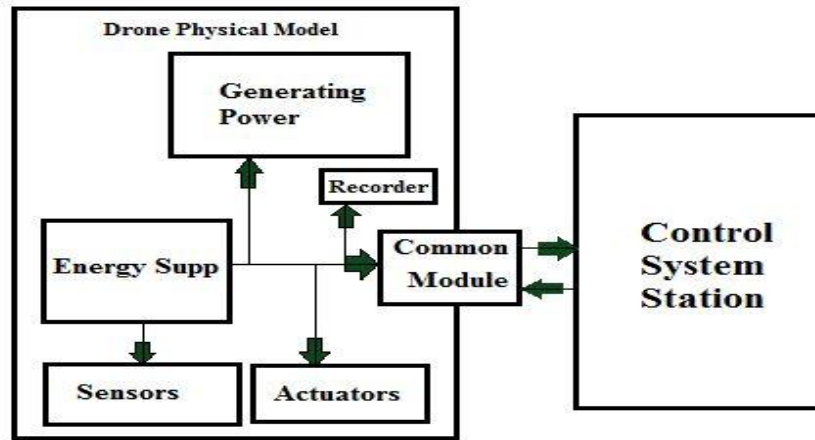


Figure 1. Structure of an UAV

In addition, the surveillance drones and the military drones use payloads like cameras and missiles which are attached to the architecture of a drone[19]. In a basic commercial drone, the components consisting the motors, propellers, the hub (the body of the drone) consisting flight controller, receiver, programming board and batteries. The additional assisting components such as GPS the compass for positioning and to make the flight more stable, Sensors and actuators help in positioning and movement and landing gear helps to dampen the vibration and land the drones safely. They are commonly used for the accuracy of the flight.

Propellers are always fixed in such a way that it doesn't collide with any other part of the drone. More the farther away from other parts, the lesser the air turbulence is. There are different kinds of Propeller have been used. The motors are chosen after it is classified with the KV rating. This rating counts the rotation by rpm (rotate per minute), when 1V of voltage is provided to motor. When a high-speed motor is being used, the size of the propellers must be smaller. Basically, AC brushless motors are used over DC motors as they are precise, more durable and waterproof comparatively[20].

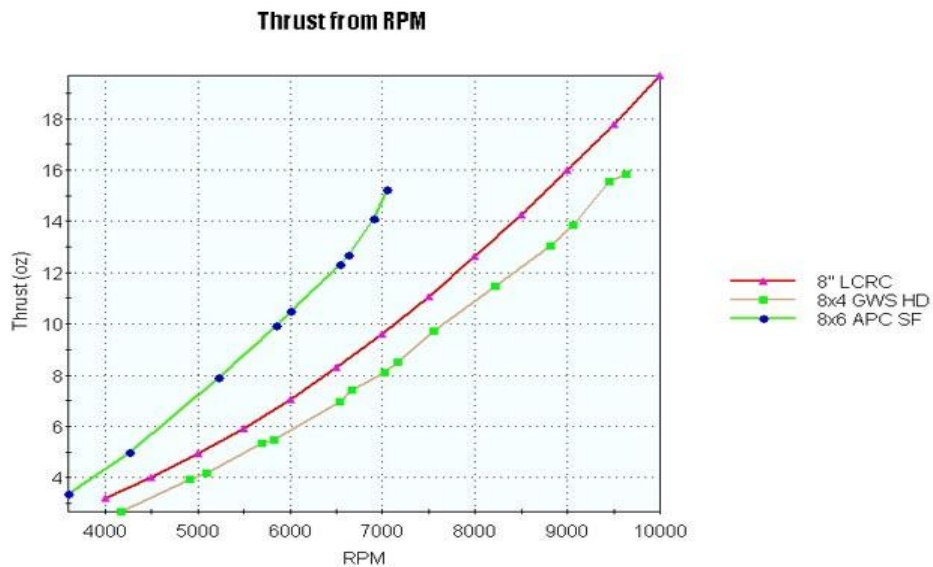


Figure 2. Thrust vs Torque in rpm

The sensors help to identify the objects or to direct the drones avoiding the collision whereas the actuators are connected to the propellers, the engines and the motors which help in the movement of the drones.

IV. SENSORS AND SYSTEMS USED FOR SYSTEMATIC UNMANNED AERIAL VEHICLES

A. Auto Pilot System

The drone provided with autopilot system which includes the flight controller and Global Positioning System to keep the drone stable while flying. There are many components used to make the drones more efficient. The flight controller controls the whole aerodynamics of the aircraft. The 8bit processors are less productive compared to 32bit processors which are widely used for drones [7]. The widely-used sensors are Accelerometer and gyroscope. The accelerometer measures the force of accelerations and gyro measures the force of rotations, combining these forces it calculates on which angle does the drone flies at. The flight controller is the important integrant of the autopilot system. It reads the data, processes the data, calculates it by the processors and sends it to the drones as commands. The signals are transmitted through transmitters, receives through the receiver and it increases the velocity of the motors when the function starts and it gets stabilized by making necessary corrections.

B. Magnetometer

The compass attached or the magnetometer helps to measure the magnetic forces where these devices are widely used in multi-rotors aircraft as the usage of only accelerometer and gyroscope cannot control the directions of the drone. As the multi-rotor can fly in any directions, it cannot be only guided with accelerometer and gyroscope, the drone still needs a magnetometer or the compass for the guidance. It is mounted on GPS and far away from other equipment as it is very sensitive to the magnetic fields.

C. Barometer

To measure the altitude of the drone, the barometer is being used. All the sensors are very sensitive to some certain actions. The barometer is very sensitive to the air pressure when it starts to move. When it comes to fixed wing drones, Pitot tube senses the airspeed that the aircraft is passing through. It compares the static and dynamic pressures in the air. Airspeed is mainly calculated for the fixed wing drones, in order to help them from crashing because of air flows faced by the wings.

D. Infrared Sensor

The infrared sensor is extensively used for the purpose of autonomous obstacle avoidance. The IR rays are released from the sensor and keep traveling until it encounters an obstacle. Depending on the time of return, the onboard system calculates the obstacle's distance and performs necessary maneuvers to avoid a collision.

E. Thermal Sensors

This is mainly used for surveillance in the cold area or in the dark to identify if there are any living organism trespasses on the path [8,13]. FLIR camera being one of the most prominent thermal cameras reads the heat signature of an organism irrespective of a poor visibility. They are highly put in use in armed forces [5].

F. Temperature Sensor

The temperature sensor has the ability to provide an almost accurate temperature value of its surroundings. This sensor is used to obtain the temperature of autopilot system and other sensors. Depending on its output, the user can terminate the flying preventing a situation of grave danger which could occur by overheating of flying components.

G. Weather monitoring system

Drones are used as weather monitoring systems over the conventional weather balloons mainly due to it being reusable unlike the latter. When fit with relevant sensors, it can provide values of major atmospheric parameters such as air pressure, humidity, gasses concentration and lot more. Due to its precise 6dof motion in the air, it is able to provide accurate values at every required altitude and distance[18].

H. Dampner

A drone experiences a great amount of twisting and rotational forces, especially while landing. The presence of a dampener reduces the impact experienced by the drone while harsh landings, increasing the drone life to a huge extent. They are usually made of the material with a high damping coefficient.

I. Aerodynamics

The dynamics used to perform the operation, control the operation and to maintain the stability are known as Aerodynamics. The three basic operations are Roll, Pitch and Yaw. Roll and flips are the left and right rotations which allow the drones to roll literally, while the pitch is front and back axis movements where the drone is tilted and yaw is the movement of vertical axis rotations where it helps to change the direction when it is necessary.

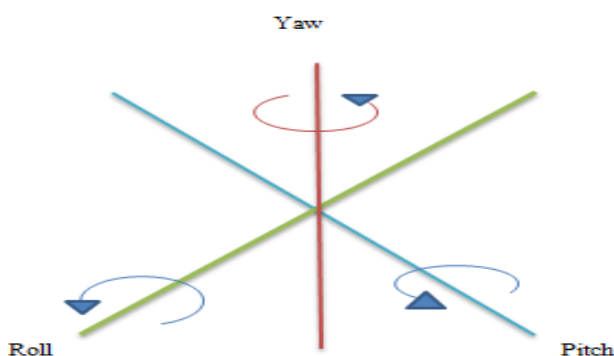


Figure 3. Operations and controls of Aerodynamics

The operation of the pitch is when the speed is increased in the front motors and the speed is decreased in the back motors and vice-versa. The operation of the roll is when the speed of the left and right motors are increased and decreased. The operation of yaw is performed when the motors are run in the same direction. When it comes to fixed wing drones, the roll is controlled by ailerons, the pitch is controlled by elevator and the yaw is controlled by the rudder. The throttle deals with the height and the altitude of the drones and it helps in hovering by allowing the drone to stay in the same position when it is airborne.

The different types of technologies are being added in drones, facial recognition by CBI or Military squad to identify the criminals or intruders, Object recognition is used by the commercial or civilians related to the surveillance, and for the Research and Development team [15]. Tracking technologies are by the higher authorities who wanted to track any crime zone area by the geo-location or tracing or tracking followed by some commodity. Computer vision is used in advanced drones which it can recognize, process, analyze and take the decision by itself which is not depended on the operator. It is completely independent.

V. INADEQUACIES TO OVERCOME IN INDIA

Before a drone delivery to become a successful option in India, there are plenty other challenges which must overcome. Since the news about the amazon commercial drones has started delivering the packages to the houses, there was a question raised by the populace at the other end. Where would the drones drop the packages if the customer lives in an apartment complex? In the early stages of delivering, the drone needs a pilot to be monitored from the delivery to the destination and till it comebacks to the hangar. It's all put in a risk in the means of expenses, security and the customer's trust.

Since this drone is an electrical machine, they have limited battery and range. To avoid this, they will most likely be fueled by gas or by some other fuels. If the drones are designed to support gas as their fuel, then there would be an issue with the pollution as well as with the noise pollution, where the populace might raise the restrictions on the usage of drones. If the allowance of the drones into the field with limited range and capacity, then it would be able to carry only selective and limited items. For its kind of delivery, it should satisfy many constraints. It should be carefully monitored as the weight is one of the increasingly important factors.

Considering all these inadequacies in India, Drones should have designated places for the delivery of packages. In their lifetime, at least they will be counting more than a thousand flights is the durability which is expected. Any unexpected natural situations could happen, they will need to be aware of those conditions and should be able to tackle the problem. The investigation should be followed when a drone collides, it should be able the emergency signal to be indicated by the drones in the means of any collateral damage to the UAVs. There's a need of consistent maintenance to long last the drone for proper flights where there should be the regular replacement of propellers, cleaning of the sensor, controller board and motor alignments etc. This type of commercial drones can be hijacked or hacked easily and there's a huge possibility to lose the signal as it is connected through wireless mode.

Every commercial UAVs should be insured and licensed, and the pilots who have the responsibility to control should be licensed as well, like the aircraft pilots. Every drone should be aware of the weather conditions as well. It should be preplanned in a way that they should be able to face the challenges if in case, there comes any rain, hail or storm or the high degree of heat or extreme cold. The drone must be able to deliver the goods and return to the hangar safely. The security and privacy rules are the most important factors to be considered because it all relies on customer's risk. So, it should thoroughly be traced with cameras and sensors from packaging to delivery. Spams would be following once the drones become a part of our daily life. These drones might become noisy as it is an electric drone which may use any petrochemical fuel and it may cause the nuisance to our populace. When it's dealing with the pick-up and drop down the packages, even the customers will require the knowledge about it.

When it comes to the aerodynamics, the payload becomes an issue i.e., when the packages are attached to the bottom of the drone, it needs to be balanced and it would not be able to carry heavy loads. The drones need to detect or sense the appropriate place for landing where there are many chances it might fail to land on the right place as the buildings are closely merged up together without any compound segmentation. There's a huge possibility of a drone crashing the power lines which ends up either in the collision or in the confusion. To avoid this, the drone must be able to detect the obstacle in front and must be able to self-navigate accordingly with the help of the collision avoidance system. In future, they might cause the traffic in the air also as there would be many drones flying. So, there must be a proper communication between themselves, which would take more time to implement this idea. As a drone is not just a play toy anymore, the people must possess a right to own the drones by any authoritative officials. Docking system must be provided to avoid an open invitation to the trespassers. There's a high possibility of animal tries to attack the goods or to hijack as it might see them as an unusual thing. The cargos should be delivered to the right person, where the human detection and face recognition plays a vital role. Battery technology has not been progressed as fast as the drone. It needs to be improved so that fuels can be replaced, no air pollution or noise pollution may arise. Airbag or parachutes must be attached to the drones if in case the drones fall from the sky due to some collateral damage, the payload, the populace must be taken care and the drone itself as it would be expensive.

VI. CONCLUSION

A few amendments in the model of the architectural concept in the commercial UAVs would lead to an efficient drone. The hub consisting the arms- smaller the arms, the aerodynamics of roll, pitch and yaw would be easier and longer the arms, would allow the drone only for the upward and downward motion. It depends on the requirement basis. Landing gears are one of the analytical and condemnatory self-contained system, which dampens the vibration while takeoff or landing the drones and makes the attempt smoothly without any disturbances. The sensitivity of the sensors can be protected without any difficulties or damage. For the extending the battery life, Lithium polymer battery can be used with the calculation of capacity of the UAV, the requirement of the power and the number of cells in the battery. When the drone is sent for any search and rescue or for the commercial purposes in a foggy climate or in the smoke, usually the image gives a blurred vision, so the usage of FLIR helps to get a clear image. These are the concepts which can be overridden in order to overcome all these challenges.

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