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## Quadcopter Video Surveillance for Cleaning Agent

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**ABSTRACT:** The aim of this research paper is to design a quadcopter which can be used as a cleaning agent, attach with a video surveillance camera for live streaming and to maintain the stability of quadcopter by giving mathematical calculation regarding quadcopter. Quadcopter is a unique design, which provide cost efficiency including aerodynamic stability. This research paper focused on designing a quadcopter which is indigenously developed for specific requirement. We have been selected the feature of component based on relationship between design and performance

**KEYWORDS:** flight controller, RF trans-receiver, ultrasonic sensors, Quadcopter, Surveillance camera.

### I. INTRODUCTION

A quadcopter is an unmanned aerial vehicle or a multi-rotor helicopter which consist of a spinning rotor to push air down word creating a thrust result in lift of quadcopter. Helicopter are fixed wing aircraft in which lift is provided by main rotor blade, while tail rotor blade satisfy the aerodynamic torque. We can control the movement of quadcopter by changing the relative speed and thrust.

Quadcopter are nowadays very much in use for aerial photography and video surveillance. UAVs are radio controlled helicopter which are used for searching remote area. They can also be used in rescue operation when human life is in danger. As quadcopter has four rotating blade that collectively provide thrust to lift the quadcopter vertically upward (vertical take-off), landing and hovering at desired location. The rotor are attached at end of frame structure. Rotation of motor takes place in pair, two rotate in clockwise direction and two in anticlockwise direction hence resultant torque acting on frame structure is zero. All four rotor must be continuously controlled in term of speed so that system should remain stable in air. It is not case that setting speed of each rotor at same speed because imbalance in weight will result in drift toward side. Quadcopter should have the stable flight, capable of providing the live streaming of high definition videos or images and also detect the dust particle on the ground pickup and place these dust particles in the desired location.

#### Smart city Problems-

The notation of the “smart city” has been gaining attention around the world. Also called the “wired” “networked” or “ubiquitous” city, the “smart city” is the latest in long time of catch phrases referring to the development of technology based urban system for driving efficient city management and economic growth. Any feature which use information and communication technologies to make a city more efficient or more accessible, is said to come under the umbrella of the smart city. The objective of smart city mission is to promote cities that provide core infrastructure and given a decent quality of life to its citizen, a clean and sustainable environment and application of smart solution. The core infrastructure element in a smart city would include: Sanitation, including solid waste management. The use of drone is limitless and the accuracy of the information is assured, allowing enforcement unit to react quickly either to nap litterbugs, clear clogged drain, remove obstacle that obstruct the traffic flow. The drone can also be used to monitor contractors give Landscaping jobs or garbage collection. The drone use state-of-the-art upgradable technologies such as high-definition cameras, GPS sensors. “This limit risk and reduce cost, enable a quick response and is very accurate, making it easier to make informed decision. As per technology advancement the requirements of human

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beings are shifted from the basic needs and this leads to growth of applications of quadcopter .In this we are going to build a Quadcopter video surveillance for cleaning agent. . Quadcopter is used with a robotic arm attached with hooks or grip which can be deployed in a certain area or a region to pick plastic bags and dump at a dumping or collection site. This mechanism can be used to save time as well as human effort and achieve neat result.

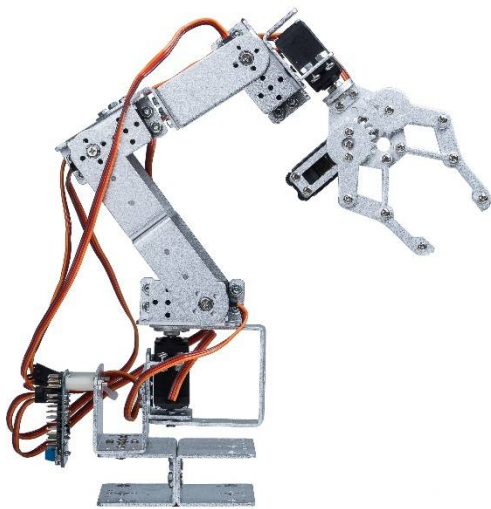


Fig a.1 Robotic arm



Fig a.2 Quadcopter with video surveillance camera

**Ease of use:** Quadcopter have been around for many years, and they are used for different purpose in different areas there is no end when it comes to their possibilities. Quadcopter are widely used because of its smaller size i.e. depending on application we can vary size of quadcopter. The main feature that we should keep in mind applications of quadcopter depend on thrust provided by it. A general rule is that you should provide at least twice as much thrust as the total weight of the quadcopter. And thrust can be selected by choosing perfect motors as per the c weight of Quadcopter with its mechanism. Here are some different application where Quadcopter are used such as for Disaster monitoring, industrial inspection, surveying and measuring, aerial photography, journalism, delivery system, sports and many more.

## II. LITERATURE OF REVIEW

In order to do “Quadcopter video surveillance for cleaning agent” research, several theoretical and techniques are need review through previous related research paper. Below are some papers from which we got idea to assemble our project.

According to research paper [1] in this paper they designed the light weight quadcopter using raspberry pi. This small and highly manageable system would acquire data such as video/images from a camera installed in the quadcopter and send them to the base station. We got idea about camera installation for surveillance purpose.

According to reference paper [2] in this paper of Design Parameters of Indigenously Developed Quadcopter for Area Surveillance. The optimum performance of a quadcopter depends on the design features, as these will determine the weight, agility, manoeuvrability etc.

According to this reference paper [3] we learn about G.P.S and its configuration for self-navigation, we also learn interconnection of GPS with Arduino.



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## III.SYSTEM MODEL AND ASSUMPTIONS

### System overview

#### CONTROLS:

- **ROLL:** Rotation around the front-to-back axis is called **roll**.
- **PITCH:** Rotation around the side-to-side axis is called **pitch**.
- **YAW:** Rotation around the vertical axis is called **yaw**.
- **The Ailerons Control Roll**  
On the outer rear edge of each wing, the two ailerons move in opposite directions, up and down, decreasing lift on one wing while increasing it on the other. This causes the airplane to roll to the left or right. To turn the airplane, the pilot uses the ailerons to tilt the wings in the desired direction.
- **The Elevator Controls Pitch**  
On the horizontal tail surface, the elevator tilts up or down, decreasing or increasing lift on the tail. This tilts the nose of the airplane up and down.
- **The Rudder Controls yaw**  
on the vertical tail fin, the rudder swivels from side to side, pushing the tail in a left or right direction.

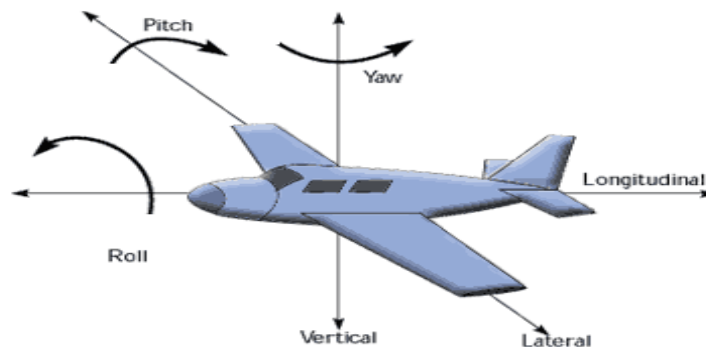


Fig 2 Flight movement

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## SYSTEM DEVELOPMENT:

### Block diagram:

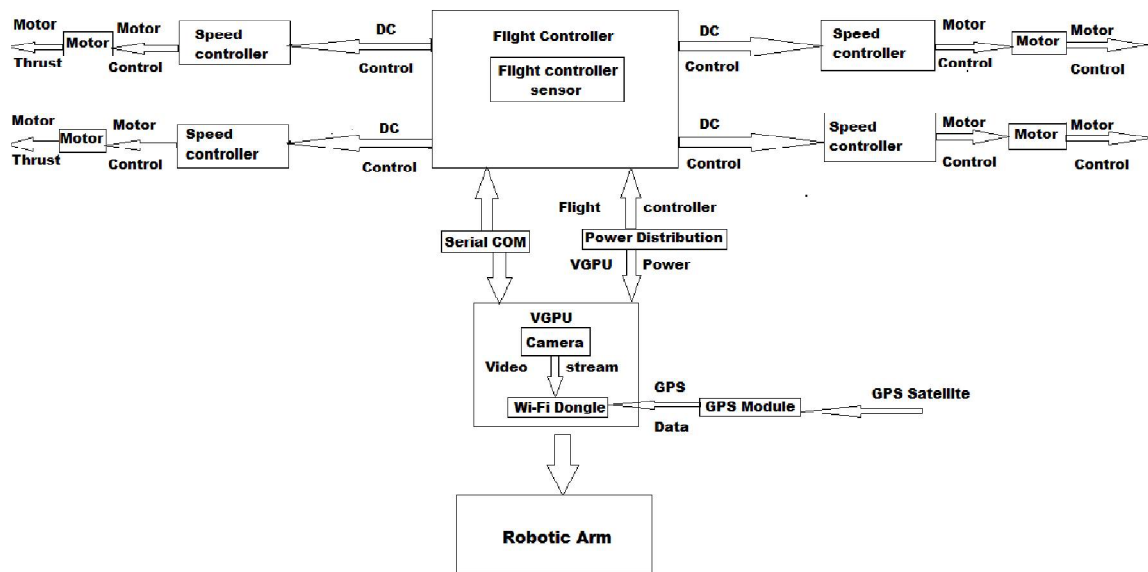


Fig 2.1 Block diagram of proposed system

Most important component which is required for construction of quadcopter is frame, propellers, electric motor. In order to get the simple control algorithm and best performance, the propellers and motor should be placed equidistance. Composite of carbon fiber have become popular due to its light weight and structural stiffness. The electrical component which are needed for construction of quadcopter are similar to the component needed for modern RC helicopter, which include electronic speed controller, controller board, and battery.

**Frame:** Every quadcopter needs a frame where we can mount everything, for selecting proper frame we need to consider its weight, size and material.

**ESC:** Electronic speed controller controls the movement of motor at any given time.

**Motor:** Rotatory mechanism which consist of stator and rotor part used to spin propeller.

**Propellers:** Propellers are typically blade which when rotated generate thrust by pushing air downwards, they are defined on the basis of its pitch and diameter.

**Camera:** Camera is used to capture high definition video, as well as photograph.

**Flight control:** Brain of quadcopter which control motor in synchronized way.

**Receiver-Transmitter:** It is used to control the movement of drone by given command signal through transmitter and receiver receive the command signal.

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**GPS antenna:** Global positioning system provide location and time information in all-weather condition, anywhere or near the earth.

**Battery:** Lithium polymer battery is used due to its light weight characteristic, but provide maximum power.

## IV.EFFICIENT COMMUNICATION

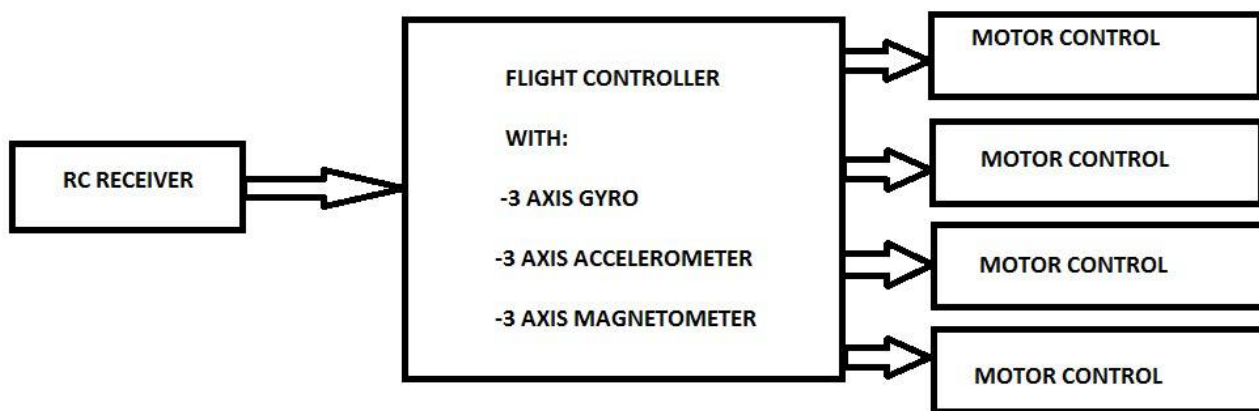


Fig 2.2 Overview for communication

There are 4 motions in quadcopter viz. throttle, elevator, aileron and rudder. These motions are controlled by the help on a radio control transmitter which result in wireless communication .wireless communication result in efficient communication.The transmitter transmits the data to the receiver which is placed over the quad.The receiver then sends the data to the flight control board.The flight controller is an inbuilt microprocessor that manipulates the signals received by it and commands the BLDC motors through the ESCs. After the command is received the motors act according to the signal transmitted by the remote.The throttle is created by rotating all 4 rotors at the same speed.An elevator is created by rotating the 2 rear rotors at greater speed compared to the front rotors whereas for backward motion the front rotors have higher speed than rear rotors.Aileron is created by rotating the left 2 rotors to rotate at a higher speed than the right rotors for the right turn and vice versa for the left turn.Rudder action is created by rotating the diagonally situated rotors moving with the same spin to rotate at a greater speed than the other.

## V. SECURITY

UAVs are infrastructural in managing the critical facts of security & safety at major events, from event security infrastructure, through to spectator and crowd control and safety to overall health and safety planning. This includes the completion of initial security risk assessments to developing bespoke security infrastructure solutions. Areas covered include general security, such as vehicular access, landscapes, fire evacuation procedure and adaptation of the original building design. In addition to monitoring and rapid reaction, UAVs can provide detailed visual documentation of sites, enabling effective analysis, risk management and security planning. Abu Dhabi's security company, uses UAVs to supplement its security system, especially around ports .UAVs are also used for monitoring and assessing the scale of accidents.UAVs provide a rapid response and fast "eyes on" to the target area with live updates control stations while active waypoint tracking can be maintained based on the target parameters, like thermal signature



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## VI. RESULT AND DISCUSSION

In this section we will be verifying each hardware component and software component (K.k.2.1) board .All problem will be described in detail and the solution we make to solve these problem. In order to cross check the stability, efficiency of quadcopter we have done performance analysis.

Serial number	List of weights	Weight in g/kg
1	Weight of quadcopter: Assumed all-up weight	2 kg
2	Weight of frame platform	1200g
3	Weight of camera	400g
4	Weight of payload	40g
5	Weight of arm	250g
6	Thrust (grams) per motor	Allupweightx2/4 $2 \times 2000 / 4 = 1000$ (grams) per motor
7	Motor specification	1400 kv
8	Thrust	1200g Thrust
9	weight	59g
10	Current of motor	16.5Amp current
11	Configuration use in motor	10x4.7
12	Considering 20 percent safety margin, ESC with capacity is used.	25A
13	3-cell used	3-cell, 11.1 V, 5500mAh LIPO battery is useds
14	Battery Rating	5500 mAh
15	Current draw for each motor for hovering	7.8A
16	For 4 motors	31.2 A
17	Battery rating per cell	$5500 \text{ m Ah} / 31.2 \text{ A} = 0.176 \text{ h}$
18	Stable flight	$. 0.176 * 60 = 19.23 \text{ min}$

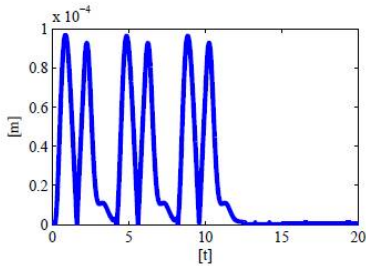


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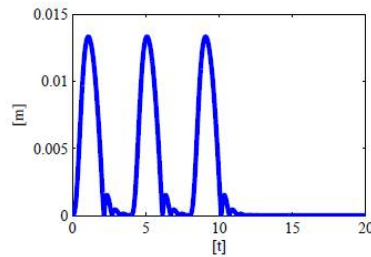
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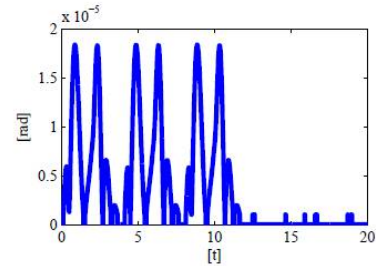
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(a) Case study A. Rigid behavior. Error norm of the manipulator end-effector position.



(b) Case study A. Rigid behavior. Error norm of the quadrotor position.



(c) Case study A. Rigid behavior. Error norm of the quadrotor orientation.

## VII. CONCLUSION

Personal Drones have been all the rage for the past few years, as toys, and primarily as new device for capturing amazing aerial photography. As the technology has matured and become more mainstream, a number of practical and very interesting uses of Drone technology have emerged. In the past few months we have seen some amazing developments in the flying drone industry. Amazon has announced a service, which will deliver your orders right to your door, and 3D Robotics, a commercial drone maker, has received 36 million in funding. The future of drones flying around everywhere is coming closer and closer to us. Robotic pick and place automation speed up the process of picking polythene bags and placing them at new location, increase cleaning rate.

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