Multipurpose UAV Drone

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Abstract— The Unmanned Aerial Vehicles are sometimes referred to as Drones, Quad rotors or Quad copters. We are living in a 21st century and Drones have their plethora of advantages and that is the reason why Drones are getting more popularity among the people. Drones can be used for various purposes. Drones are the device full of features and functions that efficiently manage the time to complete hours of work in few minutes and with the same or even more effectiveness [1]. Quad copter is an assistive device which has a high demand in the industrial & surveillance sector. As the technology has matured and become more main stream, a number of practical and very interesting uses of Quad copter technology have emerged. This system will use a GPS system and camera for identification of path being travelled by it. This system will be controlled by a remote system or a transmitter by sitting inside our home, office, or any place within its transmitter range. This concept will thus facilitate the surveillance activities. The quad copter is useful for in many situations. From the scope of the quad copter, it's used for security and rescue, aerial photography, industrial inspection and much more [2]. The result of this project will help people in natural calamities by reaching the dense areas where humans cannot reach immediately.

Key words: Quad-Copter, Servo Mechanism, Mission Planner Software, APM 2.8

I. INTRODUCTION

The main motive of this project to build, modify and to make improvements in quad-copter design such as adding servo mechanism. The objective of this paper can be grouped as follows-

- To provide lifebuoy rings to the drowning people at beach as well as during flood within a few seconds so that victim life can be rescued..
- For condition monitoring and inspection of extra high voltage lines, since drone has thermal cameras which are able to detect lines or elements heated during operation.
- For agricultural operations such as pesticides spray, seeding, health assessment for plants, soil variation and field analysis, farming area management etc.
- For 3D designing and regular monitoring of construction sites especially for huge constructions which take time less than human for inspection.
- Drone delivery is very useful in urban areas.
- For security purpose especially in military areas.
- Filming and Panorama picturing in film industry.

A. Problem Formation:

1) According to WHO Every year about 3,60,000 people died due to drowning only due to not getting proper rescue at the right time [2].
2) In EHV/UHV power line many parts are heated due to heavy current flowing through it which causes accidents.

B. Work Methodology:

Drone is a device of intense mixture of Electrical, Electronics, and Mechanical and mainly on the principle of aviation. The Drone has 4 motors whose speed of rotation and the direction of rotation changes according to the users desire to move the device in a particular direction (i.e. Takeoff motion, Landing motion, forward motion, backward motion, Left motion, Right motion.) The rotation of motion changes as per the transmitted signal received from transmitter. Each rotor produces both thrust and torque about its center of rotation, as well as drag force opposite to the vehicle's direction of flight. The goal of this project is to build, modify, and improve an existing drone kit to obtain stable flight, gather and store and GPS data, and perform auto commands, such as auto-landing.

II. PROPOSED METHODOLOGY

Quad copter system works on the principle of air lifting phenomena with high pressure. The propellers force the air in downward with high pressure due to which an uplift force is created and as a result action reaction law is applied on the whole system. When this uplift force dominates the earth's gravitational force, the whole system start flying in the air. But there is a problem with the rotation of propellers. If we rotate the propellers in clock wise direction then due to this rotation, a torque will be applied over the whole system in one direction. And similarly if we rotate the propellers in anti-clock wise direction then also a torque will be produced over the whole system and the whole system will start rotating anticlockwise. To overcome this problem we rotate two propellers in clockwise direction and remaining two propellers in anticlockwise direction [3]. This phenomenon produces torque in opposite direction and they get balanced and the system remains stable while flying. Two basic phenomena are used for movement of quad copter, thrust and torque. Quad-copter uses its four propellers attached to motors which create thrust and help quad copter to elevate high. Motion of quad copter are defined based on the input values (x, y, z, θ, ϕ, ψ) given to it. Out of four motor attached with propellers, two motors rotate in clockwise (CW) direction while other two in counter clockwise (CCW) direction. Motion of quad copter is thus controlled mainly by three movements.

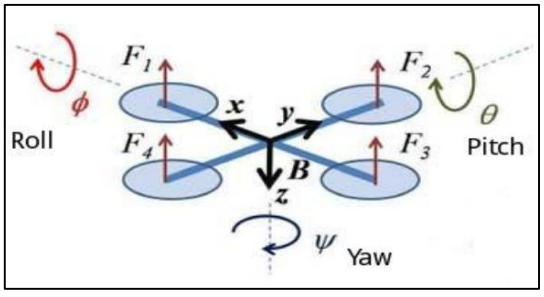

Fig. 1: Movement axes

These movements are classified as,

1) Yaw Rotation (ψ): Yaw is defined as movement of quad copter either to left or right and it is controlled by throttle stick of transmitter. Yaw decides the direction of quad copter.
2) Pitch Rotation (θ): Pitch is defined as the whole movement of quad copter either in forward direction or in backward direction. It's also controlled by throttle of receiver. Moving the throttle in forward direction moves quad copter in forward direction while moving throttle backward moves quad copter in backward direction.
3) Roll Rotation (ϕ): The movement about the longitudinal axis of quad copter is known as roll motion. Left or right motion of throttle stick is followed by quad copter, it moves in towards right when throttle move to right and moves to left when throttle stick moves in left direction. This parameter thus makes quad copter to fly in left or right direction.

III. HARDWARE MODEL

APM 2.8 Flight Controller works on 12V DC power supply which is provided by Li-Po Battery. According to the direction of rotation of motors ESC's connected to the Flight Controller. Telemetry Module and GPS Module is externally connected to Flight Controller. Output of Receiver is connected to input of Flight Controller. Servo Mechanism is connected to the Receiver. Live video streaming can be achieved through the video transmitter. Telemetry Module is able to provide data of velocity, acceleration, altitude, battery status to the mission planner software. GPS module provides exact location of quad-copter also it contain in built compass which is able to detect direction of quad-copter. APM2.8 flight controller contains in built gyroscopic sensor which is able to detect gravity and according to that it gives the signal to the controller. So the balancing of the quad-copter can be achieved.

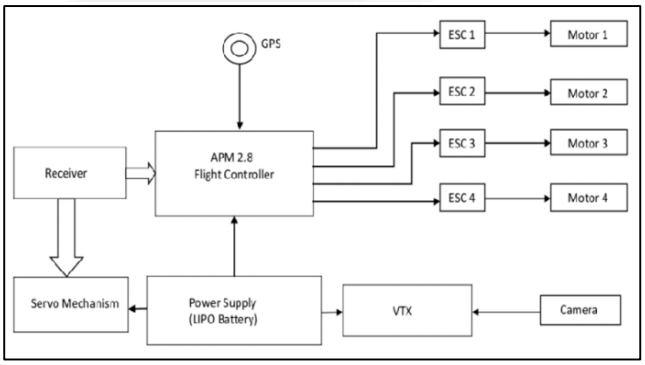

Fig. 2. Block Diagram of Quad-copter

IV. COMPONENTS

A. APM 2.8 flight controller:

This is the new APM 2.8 autopilot module. The sensors are exactly the same as with APM2.6, however this version has an onboard compass, which makes this version ideal for use with multi copter and rovers. The central flight controller also takes information from IMU, Gyroscope, GPS modules and sensors if on the quad copter. It makes computation calculations using programmed flight parameters and algorithms, and then sends this data to the electronic speed controllers [4].

B. BLDC Motors:

As the name implies, BLDC (Brushless DC) motors do not use brushes for commutation. They are electronically commutated & the advantages are Better speed vs. torque characteristics, High efficiency with Noiseless operation & very high speed range with longer life. You need an Electronic Speed Controller control the motor. As there are no brushes to wear out the life of BLDC motor is much longer. There is no sparking and much less electrical noise.

C. RF Transmitter and Receiver:

A radio control system is made up of two elements, the transmitter you hold in your hands and the receiver you put inside your drone. Dramatically simplifying things here, your drone transmitter will read your stick inputs and send them through the air to your receiver in near real time.

D. Servo Mechanism:

Using just gears and the servo, gripping, grabbing and even clamping objects can be easily implemented into quad copter. An Input command is sent to the gripper from a controller. With most electric grippers, the command can be a position, a speed or a grip force. The robot can send commands to the gripper using digital I/O's. This servo is controlled by transmitter which is operated by operator. This gripper is used to Pick-Hold-Drop any object (in our case life ring). This gripper is connected to receiver and operates when signal by transmitter.

E. LIPO Battery:

Orange 3000mAh 3S 30C Lithium polymer battery Pack (LiPo) batteries are known for performance, reliability and price. It"s no surprise to us that Orange Lithium polymer packs are the go-to pack for those in the know. Orange batteries deliver the full rated capacity at a price everyone can afford. They are equipped with heavy duty discharge leads to minimize resistance and sustain high current loads. Each pack is equipped with gold plated connectors and JST-XH style balance connectors. All Orange Lithium Polymer batteries packs are assembled using IR matched cells [5].

V. SOFTWARE REQUIREMENT

Mission Planner is a ground control station for Plane, Copter and Rover. It is compatible with Windows only. Mission Planner can be used as a configuration utility or as a dynamic control supplement for your autonomous vehicle. Here are just a few things you can do with Mission Planner:

1) Load the firmware (the software) into the autopilot board (i.e. Pixhawk series) that controls your vehicle.
2) Setup, configure, and tune your vehicle for optimum performance.
3) Plan, save and load autonomous missions into you autopilot with simple point and-clickway-point entry on Google or other maps.
4) Download and analyze mission logs created by your autopilot.
5) Interface with a PC flight simulator to create a full hardware-in-the-loop UAV simulator.

6) With appropriate telemetry hardware you can:
   - Monitor your vehicle‟s status while in operation.
   - Record telemetry logs which contain much more information the the on-board autopilot logs.
   - View and analyze the telemetry logs.
   - Operate your vehicle in FPV (first person view)

Fig. 3. Mission Planner Software

VI. CALCULATIONS

For satisfatory working of Drone, total thrust generated by total systerm should be greater than the weight of system.
i.e. Weight to thrust ratio > 1:2 (Minimum Requirement)
Total weight of our system=1400gm
So for satisfactory work total minimum thrust should be 1400*2=2800gm.
But we are taking weight to thrust ratio 1:3. So that it can be use for drone delivery application also.
Now, for making ratio 1:3 total thrust of system should be 1400*3=4200gm.
This is thrust by whole system i.e.by all four motors.
Now thrust produced by each motor should be 4200/4=1020gm.
Each motor should generate 1020gm thrust.

VII. CONCLUSIONS

It is possible to bring all aspect of UAV Drone together. Which will be convenient, efficient and user friendly so that a non-technical person can also handle it for technology and mankind.
Drone can be use in different applications due to its advanteges such as

- Drone can work in risky area where human can‟t work.
- Drone Delivery in urban areas.
- Great surveillance and security.
- Less monitoring cost.

As far as future enhancements are concerned, this project has ample scope. For the detection of heated lines and elements in EHV/UHV power lines high resolution thermal camera. To work in stormy and heavy rainy season it can be make mechanically strong. Advancement in controllers which make Quad copter less costly.

REFERENCES

[1] New Era of Drones in India and its Future-Mohan Ramesh Mudaliar, Sumit Ganesh Sorate, Institute of Management and Computer Studies, Thane, Maharashtra.
[2] https://www.who.int/news-room/fact-sheet/detail/drowning
[3] Design and Development of Arduino Uno based Quad copter-Vibha Kishor, Ms. Swati Singh UG Student, Department of Electronics and Communication, Meerut Institute of Technology, Department of Electronics and Communication, Meerut Institute of Technology, Meerut.
[4] https://www.aliexpress.com
[5] https://robu.in
[6] https://www.dronezon.com/learn-about-drones-quadcopters/

