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Design And Improvisation Of Uav Fire Drone

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Abstract

Our project; "The fire fighting cum rescue f-450" drone focuses on fire fighting operation through fire ball mechanism and rescue operation through thermal imaging camera. Even though technology has evolved so much, but the use of drones hasn't made the full use of it. We aim at providing an interface for fire fighting and rescue at the same time. The purpose of fire fighting cum rescue f-450 drone in rescue is to help fire fighters to evacuate people from generally high rise building and this will also alleviate rescue and fire fighting team during distinct operations. The expected outcome would be a fully fledged drone designed for human safety.

Keywords:- *Propeller, Landing Gear, Servo Motor, Fire Capsule, Electronic Speed Controller ,Multi Rotor Control Board, Refrasil Material, Transmitter & Receiver.*

I. Introduction

Fire fighting cum rescue f-450 drone is designed for firefighting operations and to alleviate rescue stress. It is a drone which shall be used only by a skilled and designated firefighter, managing and operating the fire operation. These drones can also be used to reach in critical areas where water cannot reach during fire fighting.

At present firefighters needs to bend or kneel down to look inside the building for victims which becomes very difficult and risky in dark areas, smoky areas. It also becomes very difficult to rescue victims stuck inside debris during earthquakes. So the drone has thermal imaging infrared camera which will detect the hotspots of living bodies and so how it will reduce the risk of firefighters and victims at the time of emergency and will make the operation faster and easier.

II. Literature Review

The beginning of the development of remote controlled devices started with the invention of the radio, back in the 1880's, when Nikola Tesla invented the induction coil, a necessary device to send and receive radio waves. At first, these radio signals were intended for communications purposes, but during World War I the Germans started using remote control stations for manipulating tanks loaded with explosives. Between 1914 and 1918, the development of various radio controlled unmanned aircraft were intended to be used for military purposes; however none of the prototypes was fully functional to be used during the war. This also marked the beginning of the use of radio waves for commanding machines and computers, such as power plants and satellites. After the increasing development in computer technologies in the 1940's, the use of UAVs had opened new frontiers, mostly military purposes for reconnaissance missions and also pilot trainings, but their civilian applications were moving slowly along with research. One clear example is the incorporation of GPS technologies. Since World War II, the preliminary research into general relativity led to the base for our actual GPS technologies, this was called ground-based radio-navigation systems. Although, it was not until the 1990's that the US began incorporating this technology into the UAVs of that period.

It was until in the 1920's when Oehmichen experimented for the drones . The rovercraft included six designs, his earlier designs included with 4 rotors and 8 propellers which all were operated by a single engine. The structural integrity of the subject was designed with a steel tube frame, It included 2 bladed rotors which were installed at the end of the arms of drones. His mechanism for propellers stated that the angle was to be varied in propellers, five of propellers were to varied in horizontal plane for lateral stabilization. The propulsion of other three propellers were rotated for the forward direction. The exhibition of these experiments led

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to considerable number of tests to achieve required degree of stability and time control for the flight. On April 14 1924, the UAV achieved the record distance of FAI for the helicopter which was 360m. The operation of the controlled flight performed completion of a circular course. Later for the test it completed 0.62 miles in a closed circuit of the rovercraft.

On the other hand Dr George De Bothezat in late 1922 designed a X-shaped structure for the rovercraft which had 6 blades installed at the end. The mechanism for the drone was based on variable pitch. The thrust for the UAV was designed to gain it by two small propellers operating on variable pitch. Taking off it's first flight in October 1922 the rovercraft completed over a 100 flight tests in a span of 12 months. Built by the North America it achieved the highest distance of 16fts. However, for attempt for lateral motion it was little complex as pilot workload was too high to heavy material for their construction. The designed lacked mechanical stability, was underpowered and lacked reliability.

III. Methodology

F450 Kit

F450 frame kit is built from high quality of fiber and ultra durable poly amide nylon. The colored arms of the drones helps keeping flight in right direction.

Figure 1 : F450 Kit

Motor (1000 kV brushless motor)

The motors which are being used are of 1000kv, these motors are pulsating DC brushless motors, and have inductors inside them which produces magnetic field which generates movement.

Figure 2 : Motor

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Battery

A battery is a container which consists of one or more cells and converts chemical energy into electricity and is used as a source of power. The most common batteries used to power quad copter drones are lithium batteries due to their high energy densities and high discharge. Especially in drone batteries C rating plays an very important role which should be minimum 20C to fly a quad copter drone properly.

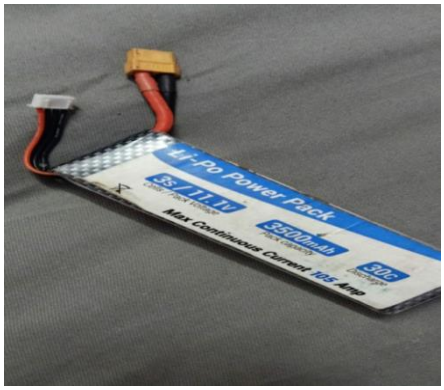

Figure 3 : Battery

Receiver

A receiver is a device which receives signals from transmitter and it is an interface between multi rotor control board and transmitter FS-IA6B.

Figure 4 : Receiver

Transmitter

It is an electronic device which produces radio waves and is used to transmit signals. F16

Figure 5 : Transmitter

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Electronic Speed Control

Electronic speed controller is an electronic circuit which controls the speed of the motors and is used to convert DC into AC. And it is also used for dynamic breaking. It is the interface between multi rotor control board and motor.

Figure 6: Electronic Speed Control

Rotor Control Board / Flight Controller

A Multi rotor control board or flight controller is used to provide stability to aircraft during flight. It is an interface between receiver and electronic speed controller. The multi rotor control board consists of gyroscope and accelerometer which converts three dimensional movements into mathematical values. It's function is to direct the RPM of each motor in response to input. A command from the pilot for the multi-rotor to move forward is fed into the flight controller, which determines how to manipulate the motors accordingly.

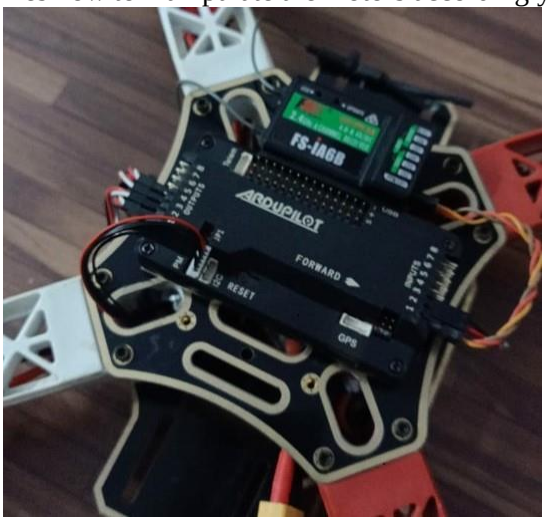

Figure 7 : Flight Controller

Servo Motors

Servo motors are low power motors available with both linear & rotator motion. A servo motor is programmable and is capable to perform motions with great precision. Motor will be equipped with a mechanism programmed to drop the fire extinguishing ball when servo motor

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is actuated.

GNSS

GNSS is Global Navigation Satellite System which gives the correct position of an object by using various algorithms. Either GPS or IRNSS can be used for the positioning of drone. The main reason of equipping navigation system is to avoid the drone from getting out of range and if in any scenario the drone gets out of the range, it is programmed to fly back to its original position.

Figure 8 : GNSS

IV. Experiment & Result

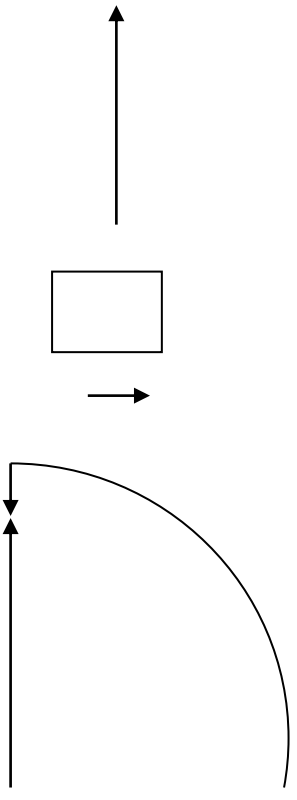
Load Distribution:

Gross weight = (kerb weight) + (weight of passenger and cargo)

- Kerb weight = 125kgs
- Weight of passenger and cargo=150kgs

Weight of passenger and cargo:
Y

1. Passenger weight =75kgs
2. Extinguisher weight = 60kgs
3. Tool box = 5kgs
   X
4. Other =10kgs Total = 150kgs



$\Delta Y = V_t + \frac{1}{2} gt^2$ (1)

$V_{X=}$ 1m/s

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$V_{Y=0}$

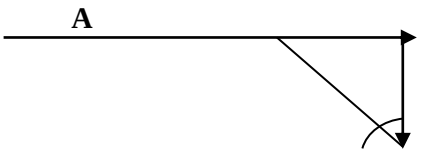
$\Delta X = V_x \times t$ (2)

$V_{fx} = \Delta X$ (3)

ΔY = 450m

$V_{fy} = V_y + gt$ (4)

$\text{Tan}\,\theta = \frac{Vfx}{Vfy}$ (5)



B **V_{fx}**

$\theta = \text{Tan}^{-1}\ \frac{Vfx}{Vfy}$ (6)

ΔX = ? **θ** **V_{fy}**

Now using equation (1) Using equation (4)

$\Delta Y = V_t + \frac{1}{2} gt^2$ $V_{fy} = V_y + gt$

$450m = 0 + \frac{1}{2} \times 9.8 \times t^2$ $V_{fy} = 0 + 9.8 \times 9.58$

$\therefore$ t = 9.58 sec $V_{fy} =$ 93.884 m/s

Using equation (2) Using equation (6) & (3)

$\Delta X = V_x \times t$ $\theta = \text{Tan}^{-1} \frac{Vfx}{Vfy}$

$\Delta X = 9.58m$ $\theta = \text{Tan}^{-1} \frac{9.58}{93.884}$

θ = 5.82°

V. Conclusion

The new concept of fire fighting cum rescue f-450 drone is to help the firefighters in rescue operations and reduces risk to the life of victims as well as of firefighters. With the use of fireball extinguisher which is been attached to drone with the help of servo motor is also capable of extinguishing minor or small fires of rooms in a building, warehouse, wildlife fire etc. through any available easy access.

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