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Hybrid Heavy Load Multi-Rotor

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The Hybrid Heavy load Multi-Rotor is based on an aluminum frame. It has a maximum lift load of 25-30kg.The Multi-Rotor uses four electric brushless motor. Each of the electric brushless motors generate thrust load of 8kg.The Multi-Rotor also has a Internal Combustion Engine which generates thrust equivalent to 10kgs.The engine uses methanol as fuel. The engine is attached in the aluminum under frame of the multi-Rotor; this enhances the push and pull of load theory. The T/W Ratio of the Multi-Rotor is much high.

The Multi –Rotor has an aerodynamic design to maintain stability at higher altitudes. The structure is made out of Aluminum.

The Internal Combustion Engine is fixed in the bottom of the Multi-Rotor frame; this helps in maintaining a balanced thrust while carrying heavy load.

The IC Engine 61 A generates thrust to push the Multi-Rotor where as the Electric Brushless Motors generates thrust to pull the Multi-Rotor to get Airborne. The Push Pull thrust generated helps to carry heavier load and makes it even easier to lift the load and maneuver it.

The Multi-Rotor has a water tank mounted in it, The water tank is of 20 liters. The water tank is connected to a spray pump, The spray pump will pump the water and flush it to a distance of about 10ft.

The Multi-Rotor will be used for extinguishing fire in high-rise buildings and other equivalent high-rise infra structure.

The Hybrid Multi-Rotor uses four 340 KV Brushless motors which generates a maximum thrust of 8 Kg each (Eight Kilo Grams Each), Which sums up to a total 32Kg including all four. The Motors are connected to a 60A Electronic Speed Controller. The Multi-Rotor uses an 8000 MAH 6 Cell Battery to power the brushless motors.

Total thrust generated in the Multi-Rotor is 40Kg, which includes thrust generated from the IC Engine and the electric brushless motors.

The Engine is fixed to the Multi-Rotor frame on two aluminum tune mounts using screw and bolts. The engine is faced upwards 90 degrees and is placed at the center of the frame at the bottom.

Above the engine the load compartment is designed. The entire structure is built using 19" Inches Aluminum tune, which is connected to each other using bolts and screws. The Multi-Rotor Structure is designed to lift loads up to 20Kg (20kilograms).

The Multi rotor frame is designed in a load push pull technique. The Load in the Multi-Rotor is pushed by the IC Engine and at the same time pulled by the four electric brushless motors. In this method the load lifting capabilities is tremendous and faster. It also improves flying efficiency as well as improvises the flying time to its maximum limit.

The motor Mounts were deigned separately and mounted on the main frame.

The Hybrid Multi Rotor has four brushless motors and an IC Engine. The brushless motors use the LIpo battery. Methanol is used as Fuel for the Internal Combustion Engine (IC Engine). The four brushless motors are connected to a flight controller board for Multi-Rotor Flight. The IC Engine is connected to Channel number 3 for throttle. Channel 3 is modified for two connections I) Flight Controller Board for the Multi-Rotor. ii) IC Engine

Weight of the Multi-Rotor:

The Multi-Rotor frame is Made of Aluminum and the entire frame with all four Brushless Motors and the Engine weights 7kg (6.975Kg on Meter). The weight is excluding Payload, Fuel (methanol) for the Engine and Battery for the Brushless Motor, etc. The Gross and the final weight will be higher.

Brushless Motors:

The brushless motors used are of 340KV and has a maximum thrust of 8kg.The E.S.C (Electronic Speed Controller) used is a 60 amp-UBEC.

IC Engine:

ASP 61 Engine is used which generate a maximum thrust of 10kg

IC Engine weights 850 Grams

Controller:

NAZA V2

Engine Throttle Control:

Engine throttle Servo is connected to channel 3 of Rx (Receiver). Channel 3 is used for both Multi-Rotor and the Engine. This is done to balance and equalize the thrust of both the Engine and Electric Motors.

Structure/Design

The Multi-Rotor frame is made from Aluminum Tube. The Aluminum tube has a thickness of 17 Millimeter (mm). The Multi-Rotor Frame has an aerodynamic design and is divided and joined together in four parts.

I) Lower (Engine)
II) Middle (Load)
III) Upper (Controller)
IV) Frame (Motors)

The lower part of the Multi-rotor frame houses the IC Engine. It has a area of 20" * 17"It has a height of 10". The Engine is mounted centrally over two aluminum tube using plywood. Using plywood reduces the engine vibration.

The Aerodynamic Multi-Rotor frame has a height of 37.5 Inches and width of 18.5Inches. The Length of the Frame is 30 Inches.

Distance between Rotors

Distance between M2 and M4 = 28 Inches

Distance Between M1 and M3 = 28Inches

Distance Between M1 and M2 = 37 Inches

Distance Between M3 and M4 = 37 Inches

Distance Between Multi-Rotor Motors (M1, M2, M3, M4) and E1 = 22 Inches

Note: - Here E1 Stands for IC Engine, E1 is Mounted below the Multi-Rotor Motors.

Load Area

Height = 19.5 Inches

Width = 11.5 Inches

Width = 8 Inches

Load Capacity = 20kgs

Controller

The controller board with compass is mounted exactly at the CG point. The GPS Module is aligned a little further.

Battery

Battery Weight = 1.090Kg

Battery Power = 8000 mAh

No of Cell = 6Cell

Current = 22.2 Volts 25C

WING

The Multi-Rotor prototype is Aerodynamic Multi-Rotor System; Prototype has wings attached to it for Aerodynamic efficiency. The wings keep the Prototype stable at higher altitudes. The wing is a retractable wing. When the Multi-Rotor takes off, the leading Edge and the angle of attack point upwards, If this is not done then wing will create drag and the climb rate will reduce. To increase the rate of climbing the wings are faced upwards while climbing.

The Wing also stops the rotating momentum produced from the IC engine and keeps it stable. During descend the wings retract to its normal position.

The Wings are turned 90 degree using metal-geared Heavy-duty servo motors.

The wings are extended from the Prototype frame to prevent interference with the Motors thrust.

The addition of wings keeps the prototype stable with heavy loads during takeoff and while gaining altitude.

The Wings are mounted centrally on the frame at the Midpoint between the Engine and the Electric Motors, In the push pull technique its very essential.

Robotic Arm

The robotic arm will be fixed to the Multi-Rotor frame. It will help is moving obstructions during a fire Emergency at higher altitude. EX : opening a Window or breaking to extinguish the fire.

Uses/Purpose

The prototype is developed to help in fire fighting in places where a conventional fire fighting services is not able to reach the source of the fire. In Countries like India, There are several places which have habitat but are inaccessible for fire fighting. Such as narrow lanes, Roads, etc.. It takes several minutes for fire fighters to reach the exact source of the fire. Some narrow roads which length up to 1km and more are only accessible by walking.

The prototype developed will solve this problem. It will be a quick response for fire fighting. It can easily access high skyscrapers and even a narrow lane to extinguish the fire. More than one prototype will be involved in extinguishing the fire.