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Automatic CO_2 Extinguisher Fire Fighting Drone

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Abstract: **Unmanned Aerial vehicles commonly known as Quad copters are aerial vehicles operated through a remote control system to fly independently. They are called rotorcrafts because it work's with a set of revolving twisted chord aerofoil's. Quad copter is getting more excessively used due to many reasons such as Easy to build and assemble, complexity is less. Generally in most of the cases drones are used in Transporting objects, military, spying, educational use, rescue etc. The main target of this paper is to explain the usage of drone for fire fighting and rescue. This paper focuses on the components that can be used for a fire fighting drone to reduce the overall weight, working principle of automatic sensor detection of fire and reacting corresponding to it.**

Keywords:-- Fire Fighting Drone (FFD),Fire Fighting Robot(FFR),Fire Fighting Equipment(FFE),Quad Copter(QC)

I. EXISTING SYSTEM

The existing system to reduce the impact of fire is the water sprinklers, fire fighting robots and extinguishers. Generally this is done by using some typical optical detectors that can detect the senses the fire place and pass on the information and by using thermo switch, thermo couple and tubular type. Automatic fire fighting area unit is used to prevent the fire place but the extinguisher does not seem to reach the required potential. The thermostat sensors present in the FFR senses the fire place but it have to be ready to build a correct vary for sensing a fireplace

II. PROPOSED SYSTEM

In this system, a FFE is equipped in the drone that consists of a Flame sensor SKU: DFR0076, buzzer, intumescent paint and a CO2 ball extinguisher or compressed gas. Whenever the sensor detects the fire and automatically opens the nozzle containing pressurized liquid carbon dioxide

III. INTRODUCTION

Generally fire fighting is done by humans and fire equipments which are operated manually. This system will not work to find the victims are there in that situation and practically It is not easy for a human to enter into the hazard place and find the victims so FFD is the best solution to find out the victims and also to control the fire. This paper explains the components that are to be used to build a drone, designing the drone using AutoCAD, assembling, operation, forces acting on a quad copter and firefighting equipment. This is designed to use in very extreme temperature conditions and all this will be controlled at the ground station manually. At present the firefighters crawl into the buildings and look for survivors using the FLIR (Thermal imaging infrared cameras) and finding out the victims manually by putting their lives at risk. The drone is used to find out the victims in the hazard and find out the hotspots. This helps to reduce the loss of lives of firefighters. This can be enabled by operating the drone who can navigate through the building quickly without any fear of crashing it to anything.

IV. COMPONENTS SPECIFICATIONS

Frame:

The frame used in the QC, is made of four aluminum drilled rods with square cross-section in order to fit the motors on it and two center wooden plates. The frame has it' s weight about 180g, the weight mostly depends upon the type of metal that is selected to build a frame. The spacing between the centers of two mounted motors is 60cm and from the centre of gravity is 30cm.The microprocessors and flight controllers can be mounted on a plate that fits over middle section of the frame.

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Fig 1.quad frame

Propellers specification:
The propellers to design this FFD are in the rotates in either clockwise or anti clock wise in direction

Fig 2.propeller preffered

Motors:
The selected motor is A2212/10T. The specification of the selected motor is
• 1400KV UAV brushless motor
•Ideal to work with 30A ESC(Electronic speed control)
•Efficiency current (maximum): 6-12A (>75%)
•Current (no load): 0.7A
The selection of the motor depends on the weight that has to be carried by it. The QD weight would easily produce an unstable flight and therefore the control algorithm has to be accurate. The amount of rpm per volt depends upon the QD weight and size.

Fig 3.Motor mounted

ESC (Electronic Speed Control):
The required ESC needed to run the motor is 30A.The modes of electronic speed control depends on the aerial platform used and a throttle range that can be programmed and compatible with all transmitters available in the market. It weight's about 25g has lot of uses such as superior current endurance, protection features.

Fig 4.ESC picked

Transceiver:
There are two types of transmitters which are used to transmit signals that can be either analog or digital.
1. Analog transmitter.
2. Digital transmitter.

With no lag between your drone and the transmitter, you can fully push your quad copter to its limits. A receiver is the opposite of transmitter. Transmitter transmits the signal by receiving it from source wirelessly. Whereas the receiver receives this wireless signal and passes it to the device. R16SCAN is used as a receiver here.

Fig 5.Transreciever

CO2 as Fire extinguisher:
Fire extinguisher is like a aerosol can with internally having two different substances. These extinguishers are of mainly three types Water, Chemical Powder, CO_2 .Water extinguisher is most commonly used as it uses air as a propellant whereas in Chemical powder extinguisher nitrogen is used as a propellant. But CO_2 fire extinguisher is a mixture of liquid and gaseous carbon dioxide. At room temperature it works as a gas, in order made it into liquid it should be stored

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in high pressure. It attacks the fire in two ways: it smothers the oxygen and removes heat .

CO_2 extinguisher is the large, black, cone-shaped horn that allows CO_2 to expand, cool and turns it as a mixture of frozen snow and gas. Horn has to designed very carefully to avoid the major potential problems. These CO_2 extinguisher is available in low pressure and high pressure versions[1].

Fig 6.CO2 extinguisher

Battery:
The battery is LiPo battery (Lithium Polymer) i.e rechargeable batteries and has great life cycle degradation rate. The selection of the battery depends on the capacity and battery discharge rate. In order to get the best lifetime and performance the choosing of battery plays a crucial role. The battery selection also depends on the size of the drone, no of motors and the type.

Fig 7.battery

PID Micro controller:
The microcontroller selection depends upon the functionality of the drone. The parameters that are to be considered while selecting the microcontroller are expandability and full programmability. This is the ideal flight controller for your rotor aircraft. The PID microcontroller is the acronym of Proportional Integral Derivative Controller is most commonly used for quad copter stabilization & its control. It consumes less power so the flight time increases proportionally.

Flight Controller:
Flight Controller gives stabilization and controls all the multi rotors. It consists of a circuit board with build in sensors that detects orientation changes. It receives commands from the user & controls the motors in order stabilize the quad copter in air.

Fig 8.Flight Controller

SOFTWARE DESIGN IMPLEMENTATION: Software implementation of QD using CAD CAM in Solid Works Software.

Step 1: Developing the X-frame
Step 2: Adjust the top, right and front plane.
Step 3: cut the Extruders
Step 4: X frame arm
Select the frame arm material is low gloss plastic
Step 4: Design the battery.
Step 5: Design the spinner.
Step 6: Design electrical connector.
Step 7: Design the piller.
Step 8: Design the fan.
Step 9: Design the motor.
Step 10: Design the Power distribution board.
Step 11: Constructing electrical units.
Step 12: Assemble all the designed components on the base plane.

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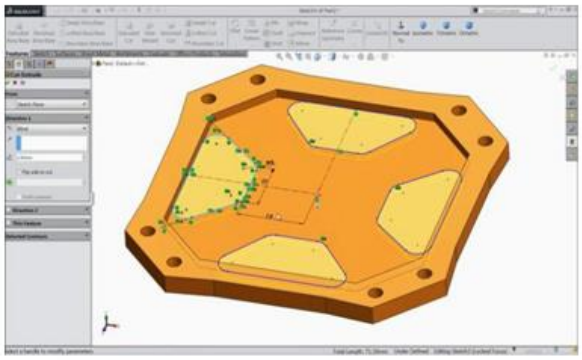
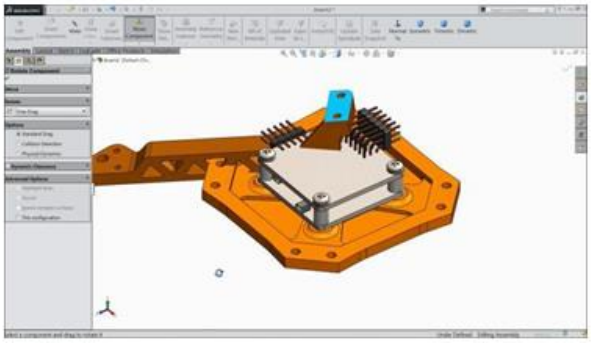
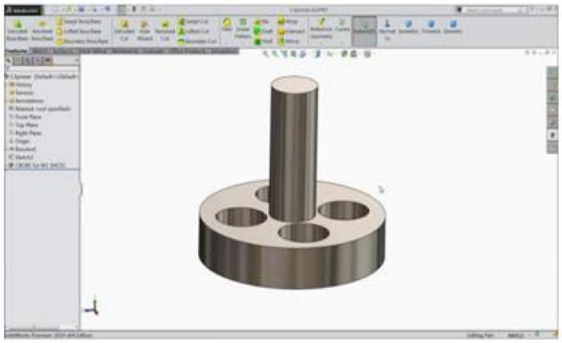
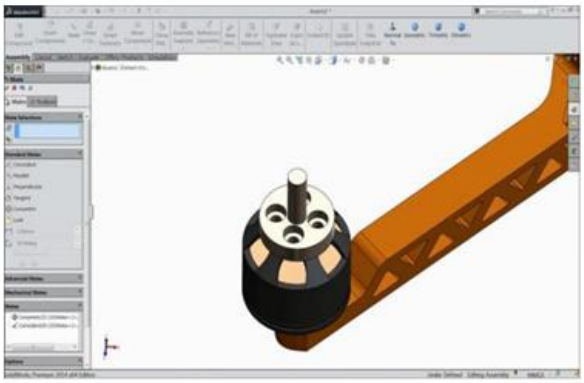
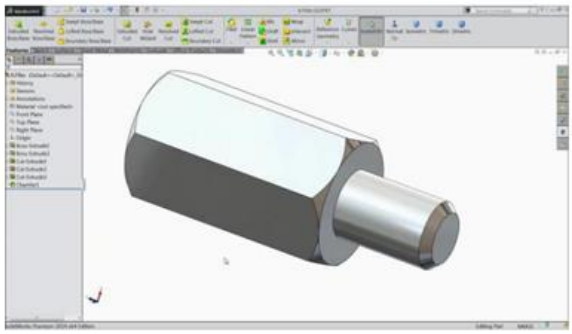


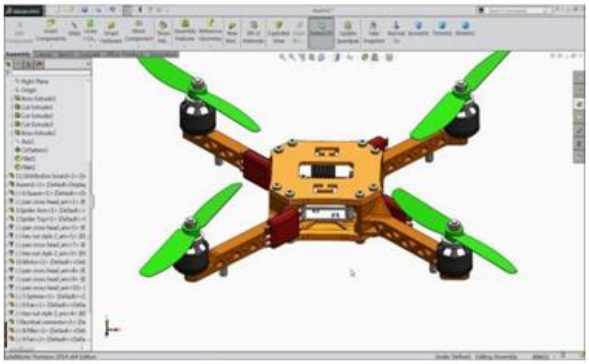


Mounting motors on the arms

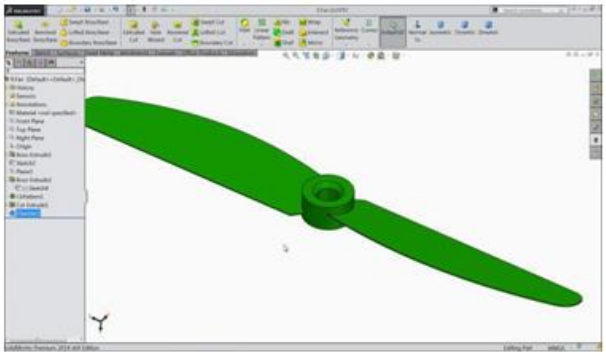




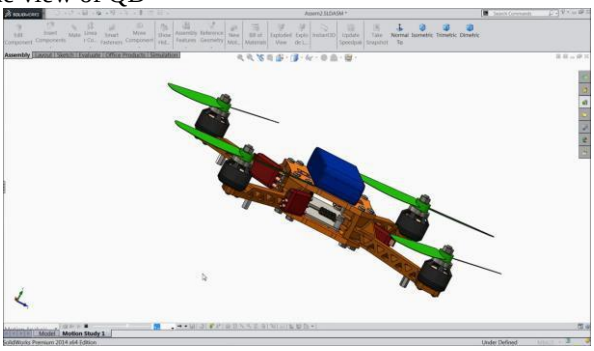




Side view of QD



Fixing the arms to the base



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Hardware Implementation:
Considering all the above specifications QD can be designed by following the below steps:

Step 1: Assembly of QD frame
Arms are screwed on the bottom plate of the frame first then flip the frame and start screwing on the top plate. Now mount the plates for the motors.

Step 2: Munting the motors & speed controllers:
Mount the motors on the mounting plates with facing inwards by using hex screws. Solder the ESC's on power distribution board.

Step 3: Mounting the electronics
Fix all the ESC's & power distribution board to the frame and connect all the ESC's to the corresponding motors.

Step 4: Flight Controller setup Mount the flight controller board on the top of the frame. Now remove the red wires from ESC's except from one ESC because flight controller needs power from only one of the ESC.

Step 5: Configuring the Brain Dump the code into the flight controller & follow the corresponding control mode to balance the QD.

V. CONCLUSION

This new concept of FFD provided to reduce the time to clear a building or find a distressed inhabitant. This is also useful to help the Firefighters as well as to save their lives. The sensors that are used to make this drone is also cost effective so that the price point of the drone can below and affordable to the many underfunded fire fighter department.

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