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Development of Mini Unmanned Aerial Vehicle

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Abstract: *This paper presents the research and development activities for the development of Mini Unmanned Aerial vehicle. It also includes implementation activities for the unmanned aerial vehicle. Here we used the sensors and small camera and zig bee and micro controller we developed a proto type of Unmanned aerial vehicle. Where this is very much useful in military and disaster and rescue operations, and survey and monitoring the weather conditions and also we evaluated the parameter like lift, drag, centrifugal force, endurance, altitude.*
Key words:*disaster, rescue, weather monitoring, Survey.*

I. Introduction

The main objective of this paper is to describe the importance and need of UN manned aerial vehicle instead of manned aerial vehicle.For this we developed proto type mini unmanned aerial vehicle.

Unmanned aerial vehicles are the vehicles which wereoperated without human.These can be operated from the ground where there is no need of man for operating inside the vehicle.

In particular rotary-winged vehicles are expected to carry out tasks such as monitoring from fixed points that is not expected of a non-rotary winged vehicle. Their ability to hover and carry payload is what makes rotary winged mini UAVs better as well challenging to control. The vertical landing and take-off is also a feature that only rotary winged mini UAVs can provide.

Unmanned helicopters are generally better than manned helicopters in terms of safety and cost of production. Mini unmanned aerial vehicles are suitable for indoor navigation which cannot be derived from any other aerial vehicle.

In general, the possible fields of use that mini unmanned helicopters can be put to use are search and rescue in collapsed structures, exploration in mines and cave structures, defense and surveillance of airports, train stations yet to be constructed, etc.

II. Description Of Unmanned Aerial Vehicle

UAV is defined as a "powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload". Therefore, cruise missiles are not considered UAVs because, like many other guided missiles, the vehicle itself is a weapon that is not reused, even though it is also unmanned and in some cases remotely guided.

There are many different names for these aircraft. They are UAV (unpiloted aerial vehicle), RPAS (remote piloted aircraft systems) and model aircraft. It has also become popular to refer to them as drones. Their flight is controlled either autonomously by onboard computers or by the remote control of a pilot on the ground or in another vehicle.

Unmanned aerial vehicles(UAV) are the logical successors to modern aircraft and advancements in automated technology.

The current generation of UAVs is focused on wartime capabilities and reconnaissance, leaving an existing market untapped by UAV technology. There are hundreds of applications for UAV technology in the civilian market, from emergency response applications and media outlets to communication technicians and horticulturalists.

Here we developed the mini unmanned aerial vehicle.Here with the help of li-ion battery we have given the power supply to the motors and electronics components. And after balancing the forces we successfully operated the unmanned aerial vehicle. Then we placed a spy camera.Whenever we operated the aerial vehicle the camera is start working.Whenever it working the data will sends to the ground station after we will detect the things and humans. By using this we can supply the thing from one place to another place without human.

After we placed temperature sensor and co_2 and humidity sensor we measured the temperature and humidity and co_2.by using this we can know the conditions of weather and we can easily detect the forest fire accidents.

Here we used one zig bee and micro controller for data transferring from atmosphere to ground station.

III. Resultand Analysis

3.1. EVALUATION OF PERAMETERS

3.1.1 FORCE CALCULATIONS

The initial force that acts on the rotor blades is its own weight downwards at its center of gravity. The secondary force is the lift/thrust force that acts on the blades on account of the cutting of air stream by the curvature of the blades. Thirdly, as the blades rotate, they cut the airstream and therefore, the air stream also exerts a force on the blades due to the air resistance. This is the drag force that acts on the blades of the rotor. And finally, on account of the rotation of the rotor blades, there acts a centrifugal force on the blades.
The next step is to consider the forces separately and find out their values for the rotor blades individually.

3.1.2 WEIGHT

Due to the mass of the blades, there acts a weight force downwards at the center of gravity of the blades. An individual blade is considered and the force value is found for it. Now, we know that:

$$\mathbf{W = M_b g}$$

The mass of an individual blade is measured is found to be 0.29 g.

$$\text{Hence, } W = 0.29\times10^{-3}\times9.8$$

$$W = .002842 \text{ N.}$$

And, weight of the helicopter body of mass 20.2g is

$$W = = .0202\times9.8 = 0.19796 \text{ N.}$$

3.1.3 LIFT FORCE

When the blade cuts across an air stream, there is a flow of air both above and below the blade. The blade profile is such that the air that passes above the blade has to travel more distance in the same time as compared to the air that passes below the blade. Hence, the air that passes above the blade has a higher velocity than the air that passes below it. Now, according to Bernoulli's principle, the fluid having higher velocity is at a lower pressure. Hence, the air above the blade, due to its higher velocity, is at a lower pressure. That means there is a pressure difference between the air above and below the blade.

Thus there arises a force from the high pressure region to the low pressure region. This is the lift force that acts essentially in the upward direction due to the blade profile.

The lift force on a blade is given approximately by:

$$F_L = 0.5\times C_L\times\rho\times v^2\times A$$

Now, the area A is the area of the total rotor disk. So, area A is given by:

$$A = L\times B$$

Here, L = 16cm. and width=2.5cm so, area of the rotor disk is:

$$A = 0.16\times (0.025)\ 4$$

$$A = 0.016 \text{ m}^2$$

Here C_L is assumed to be 1.6, a typical lift coefficient value.
Density of air is taken as 1.29 kg/m^3. So, ρ = 1.29 kg/m^3.
The angular velocity of the blades N_b is already found out it is to be 473.6 rpm.
The rotational speed Ω of the blades is: $\Omega = 473.6/60 = 7.894$ rev/s
So, the linear velocity of blades in m/s is:

$$v_b = 7.894\times2\times\pi\times0.06 = 2.974 \text{ m/s}$$

Hence the lift force comes out to be:

$$F_L = 0.5\times C_L\times\rho\times v_b^2\times A$$

$$F_L = 0.5\times1.6\times1.29\times2.974^2\times0.016 \text{ N.}$$

$$F_L = 0.1469 \text{ N}$$

Now, combining the lift force for the 2 rotor disks, we get the total lift force acting on the helicopter fuselage.
Hence**,** $F_L = 2\times0.1469 = 0.2926358$ N.

3.1.4 DRAG FORCE

The drag force acts on the rotor blades as they cut through the airstream. As they do so, they exert a force on the airstream, which itself exerts a force opposite to the direction of movement of the rotor blades. This force is called the drag force.
Drag force is given by**:** $F_d = 0.5\times C_d\times\rho\times v_b^2\times A$
Coefficient of drag C_d is assumed to be 0.5 which is a typical value for helicopters.
Hence, drag force comes out to be:

$$F_d = 0.5\times0.5\times1.29\times2.974^{\wedge}2\times0.016$$

$$F_d = 0.045 \text{ N.}$$

3.1.5 CENTRIFUGAL FORCE

As the blade rotates at a very high speed of 473.6 rpm, there is force acting towards the center of the hub along the plane of the blade. This force is the centrifugal force which is an inherent force for any rotating body.
The centrifugal force is given by:

$F_c = Mb\Omega^2R$
$F_c = 0.29\times10^{-3}\times (473.6/60)^2\times0.06$

$$F_c = 0.001084 \text{ N.}$$

3.1.6 SPEED OF THE ROTOR IN HOVER CONDITION

At hover condition, the lift force and the weight of the helicopter balance each other out. Hence.
Lift force on 2 rotor disks = Weight of helicopter body.

$$2\times0.5\times C_L\times\rho\times v_b^2\times A = W_b$$
$$1.6\times1.29\times v_b^2\times0.011304= 0.19796$$
$$v_b= 3.912 \text{ m/s} = 7.93 \text{ rev/s}$$
$$\Omega_h = 463.82 \text{ rpm.}$$

This is the speed of the rotor at which the helicopter hovers and this is the speed at which the helicopter takes off because at this speed, the lift generated just equals the weight of the helicopter and as the speed increases from this value, the lift force keeps increasing and the weight remains the same.

- Here we conclude that Speed of the rotor is obtained as 473.6 rpm and at that speed of the rotor, the lift generated is found to be 0.2926 N. This lift force is found to be greater than the weight of the helicopter, which is found to be 0.19796 N. Thus, the lift force generated is calculated to be greater than the weight of the helicopter, which is the necessary condition for take-off.

- Speed of the rotor in hover condition is found out be 463.82 rpm. This is the speed at take-off state of the helicopter. Thus, it is concluded that the speed of the rotor must lie between the limit values of 463.82 rpm and 473.6 rpm for the helicopter to be in flight. Any speed less than 463.82 rpm will result in the lift force to be less than the weight for which the helicopter will not take off or if in flight, will fall down.

3.1.7 ENDURANCE:

It is the maximum time of the vehicle in the air. This is found as 50 minutes.

3.1.8 ALTITUDE:

It is the distance covered by vehicle from ground to atmospthere.it is found to 50 feet from ground.

3.1.9 TEMPERATUREAND HUMIDITY CO_2: By using zigbee and micro controller and also with the help of flash magic software we got the temperature, co_2 and humidity readings.

The readings are as follows

Day: 1
Temperature 28ºC
Humidity 0.66 and co_2 32 (analog value)
Day-2
Temperature 38ºC
Humidity0.55 and co_2 34 (analog value)

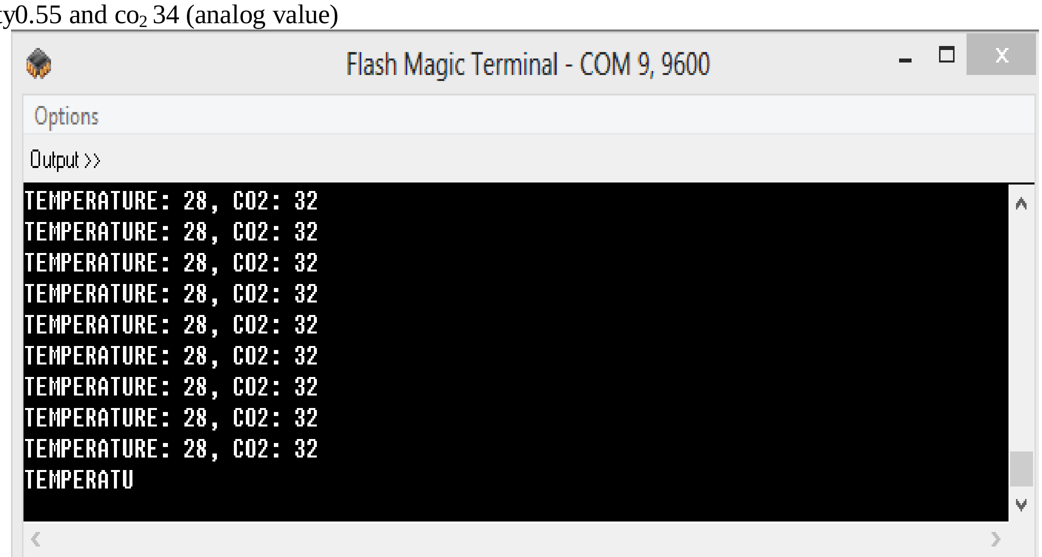

Fig: Temperature and co_2 values were obtained in the computer

IV. Applications

- Used in capturing 3D images
- Used in survey lines
- Used in disasters
- Used in aerial survey
- Used in carrying ligase
- Used in military
- Used in forest for find outing

Fire accidents and animal hunters

V. Conclusion

Unmanned aerial vehicles offer advantages for many applications when comparing with their manned counter parts. They preserve human pilots of flying in dangerous conditions that can be encountered not only in military applications but also in other scenarios involving operation in bad weather conditions, or near to buildings, trees, civil infrastructures and other obstacles.

VI. Future Scope

- Future UAVs may be capable of reaching heights that are over double or triple what we can reach and stay in the air for months at a time. These UAVs would resemble gliders with solar panels to maintain power and sensor arrays.
- In addition to new technical capabilities, the future of UAVs is trending towards automated systems. Rather than having several personnel monitoring a UAV, in the future it is expected that one person can monitor many different UAVs at once.
- In future this unmanned aerial vehicle may carry the passengers from place to another place.

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