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WHY ZERO GRAVITY DRONE?

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ABSTRACT

A drone is a pilotless vehicle which can be guided by remote control, or can be navigated automatically based on preprogrammed software. They are used in many scientific and civilian projects. Can be find in numerous shapes and sizes. The few past years drones are becoming more and more popular. The use of the drones has grown quickly in the recent years because they can stay aloft for many hours and they are much cheaper than a lot other aircrafts. Also there is no flight crew in it that can be brought to danger. Drones work precisely in situations that are considered risky or difficult and can provide high quality monitoring. They are becoming more and more necessary in each scientific research. Their usage is huge in the outer space in the military and medical action. They are easy to control. Our goal is to create an indoor drone with sophisticated design and engine with system that can be wireless -controlled or with a help of specialized chips.

Introduction

The whole concept of constructing and using a drone is new on the technology market and for sure, very intriguing for the master organizations such as NASA. By choosing to work on this project I knew that I am bringing myself in front of huge responsibility and pressure, but felt ready to express my creativity and use my knowledge in the field of Physics, Programming and Simulation to create the closest image of a drone that is closest to my idea. The main reasons I chose to work on this challenge were: First of all it was very interesting field for researching. Drones are not expensive to construct. In my calculation, for my drone I am going to need approximately 4.500 $.

- 0.50 kg carbon fiber =10 $ (10 $ per 1 pound , 1 pound = 0.453592 kg)
- 6 li–on batteries =600 $ (100 $ per battery -100$ x 6=600 $)
- 3 Electric Motors With propellers = 66.2$ (16.20 +16 + 16 + 2x 10 +8 =66.2 $)
- 10 pairs of parking sensors=125$(8 pieces = 50$)
- Kerosene=3539.95$
- KEROSENE–365 cent (3.65$) per GALLON

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- 6kg drone x 500 kg kerosene=3000 kg kerosene
- 3000 kg=3671.297 liters=969.85gallons
- 969.85gallons x3.65$=3539.95$

If there are no other costs the total cost is 4341.15 $

Project Challenges

Project theme: Designing and simulating a drone to be used anywhere, to assist with moving items (5lb/~2kg) around. Weightlessness and zero gravity will be a major design change compared to terrestrial applications.

Our challenge is to construct a drone that will:

1. Fly autonomously from point A to point B onboard a human – inhabited.
2. Spacecraft.
3. Be able to carry a 5 lb/ 2 kg payload for a suitable length of distance.
4. Find a safe, quick and efficient way of delivery.

Informations about the Materials (Technology) Used

Parking Sensors

Parking sensors are used in cars and they are very specific because they use beeping to determine if an object is near or far away. The more the object is near the more it beeps louder and more frequently. They were re-invented in 1992, they emit electromagnetic signals, and if you move slower they are more effective…

Electric Motors

An electrical motor is a motor is an electrical machine that converts electrical energy into mechanical energy into electrical energy and is done by an electric generator. In the normal mode, most electrical operate through the interaction between an electric motors magnetic field and winding currents to generate force within the motor.

Lithium-Ion battery

A lithium-ion battery (sometimes Li-ion battery or LIB) is a member of a family of rechargeable battery types in which lithium ions move from the negative electrode

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to the positive electrode during discharge and back when charging. Li-ion batteries use an intercalated lithium compound as one electrode material, compared to the metallic lithium used in a non-rechargeable lithium battery.

Synthetic Setae

Synthetic setae emulate the setae found on the toes of a gecko and scientific research in this area is driven towards the development of dry adhesives. Geckos have no difficulty mastering vertical walls and are apparently capable of adhering themselves to just about any surface. The 5-toed feet of a gecko are covered with elastic hairs called setae and the end of these hairs is split into Nanoscale structures called spatula (because of their resemblance to actual spatulas). The sheer abundance and proximity to the surface of these spatulas make it sufficient for van der Waals forces alone to provide the required adhesive strength. Following the discovery of the gecko's adhesion mechanism in 2002, which is based on van der Waals forces, biomimetic adhesives have become the topic of a major research effort. These developments are poised to yield families of novel adhesive materials with superior properties which are likely to find uses in industries ranging from defense and nanotechnology to healthcare and sport.

Carbon Fiber Reinforced polymer

Carbon fiber–reinforced polymer, carbon fiber–reinforced plastic or carbon fiber–reinforced thermoplastic (CFRP, CRP, CFRTP or often simply carbon fiber, or even carbon), is an extremely strong and light fiber-reinforced polymer which contains carbon fibers. CFRPs can be expensive to produce but are commonly used wherever high strength-to-weight ratio and rigidity are required, such as aerospace, automotive and civil engineering, sports goods and an increasing number of other consumer and technical applications. The binding polymer is often a thermo set resin such as epoxy, but other thermo set or thermoplastic polymers, such as polyester, vinyl ester or nylon, are sometimes used. The composite may contain other fibers, such as aramid e.g. Kevlar, Tawron, Aluminium, Ultra-high-molecular-weight polyethylene (UHMWPE) or Glass fibers, as well as Carbon fiber. The properties of the final CFRP product can also be affected by the type of additives introduced to the binding matrix (the resin).

The most frequent additive is silica, but other additives such as rubber and carbon Nano tubes can be used. The material is also referred to as graphite-reinforced polymer or graphite fiber-reinforced polymer (GFRP is less common, as it clashes with glass-(fiber)-reinforced polymer). In product advertisements, it is sometimes referred to simply as graphite fiber for short.

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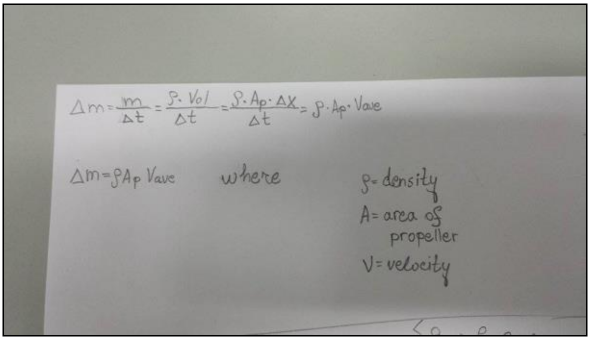
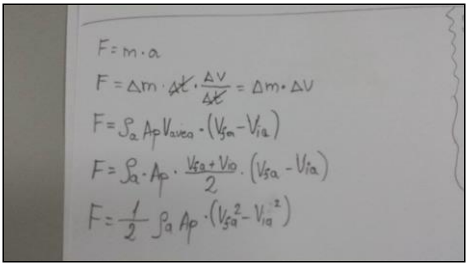
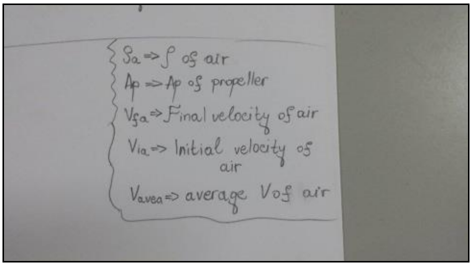
The Drone Flight

The drone flight is based on Bernaulli's principle. The fluid environment (air) avails the usage of propellers. The logic behind the movement availability is pushing the drone forwards by exerting pressure onto the air. The air basically flows through the propellers. The flow of mass of air crossing through the propellers is represented by the following equations:



We can use the previous equations to calculate the force exerted by the propellers:





In the very first moment, the initial velocity of air is zero, since there are no external disturbances such as wind. At the same time the drone starts moving, the initial velocity of air increases by the same change in velocity of the drone. By the laws of relativity we can assume that the drone is stationary and the air is coming towards the drone with the exactly same speed of the drone. At some point the velocity of the drone would reach the final velocity of the air which is pushed behind the propellers. At this point the force would equal to zero and the drone would be unable to change velocity and with that it would not be able to change direction / stop moving, which is why we must avoid reaching this particular velocity. We are looking for the optimal final velocity of the drone which depends upon the environment, and that is proven in

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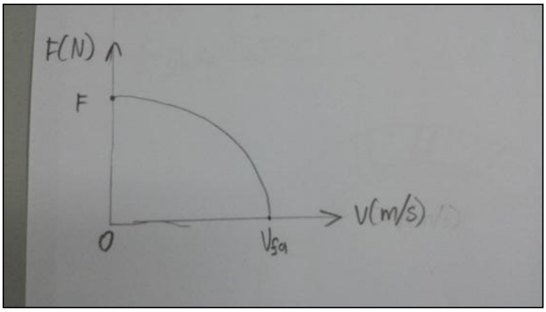
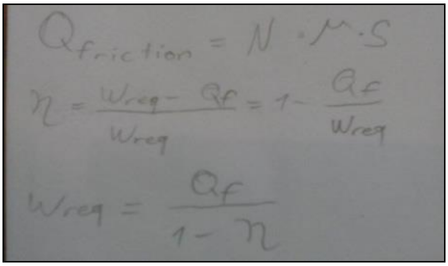
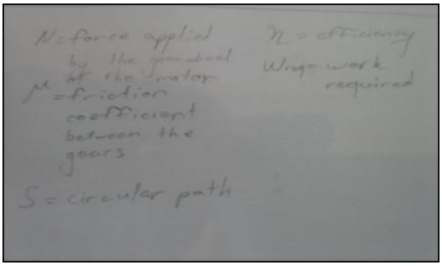
the previous equations. We have 2 propellers on the sides which are responsible for rotation of the drone (by exerting torque in same direction) and moving the drone forward or backward (by exerting equal torques in opposite directions). Some of the work done by the motors we expect to be wasted released as heat energy in the environment, which is why our motors would have to do additional work equal to the energy wasted.







The Drone's Payload

The package that is supposed to be lifted off the ground will be carried by a specially designed metal grabbing "tentacles". There are four "tentacles" that are going to be called grabbers from now on in this head. They are going to be made of carbon fiber and because of this relatively low weight of the payload area of the Drone, the package will be lifted with less energy, which means that less electricity from the batteries will be spent on the lifting of the package. The lowest part of the grabbers are going to be made from polished steal with really thin ends and because of the polished area, the friction is really low. Because of this, any object with irrelevant form can be lifted and hold inside the payload. From the polished metal ends upwards, the area will be covered with Synthetic setae. Synthetic seta is a model of material that has the same characteristics like a gecko's skin. This S.S.-layered area has high friction and having

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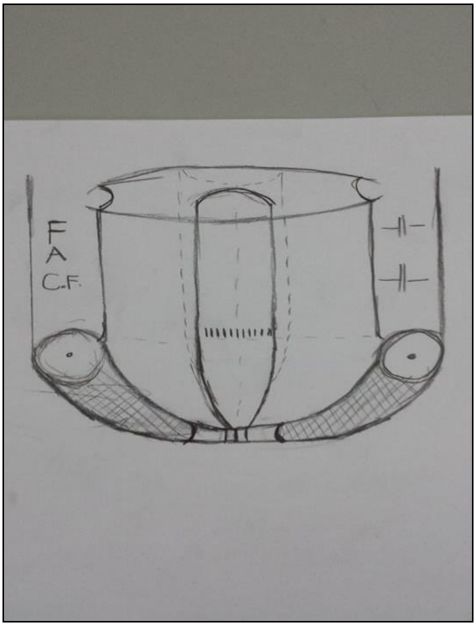
this as a factor, the object inside is stable and it doesn't move a lot around. High friction as a factor enables the stability of the body inside the payload.



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