RC Quadcopter

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Abstract

The objective of this group project is to design and manufacture a remote-controlled quadcopter which is not only user friendly but can also be used as a base for various purposes and designs. The building process includes examining older designs, designing and testing different components, configuring a blackboard flight controller chip, and finishing the final product. The team was dedicated to innovate and create this project with the most advanced features thus bringing forward a revolutionary design. After the selection of initial design there were various steps to make it a reality. First, we had to figure out how to program and control the blackboard flight controller chip using a desktop interface. Next, we designed and printed the different 3-D parts using Solidworks. Next, the assembly process was started in which various dimensional and other errors were fixed. Following the assembly, the testing process was started during which numerous test flights were made, some of which resulted in various parts failing and being redesigned. Thus, the whole process was repeatedly followed which assured the betterment of the design in each cycle. The final product is an ideal drone designed for freight purposes and can be modified for various other uses.

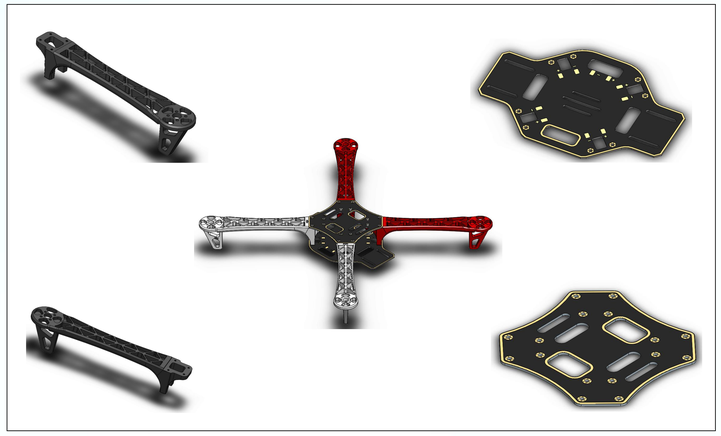
Problem Statement

In this project, our main goal is to design a drone for shipping and freight services. The design is supposed to have a budget of $250 and should fly 20ft above the ground from point A to point B. Even after an abundance of drones and quadcopters out there, basically none have actually proven to be both user friendly and affordable, thus, our main goal is for this project to be a design of future which is both user-friendly and affordable and most of all can act like a base model to which different devices can be added for different uses. Another big part of our goals is to keep the device highly safe and efficient just to ensure user and public safety.

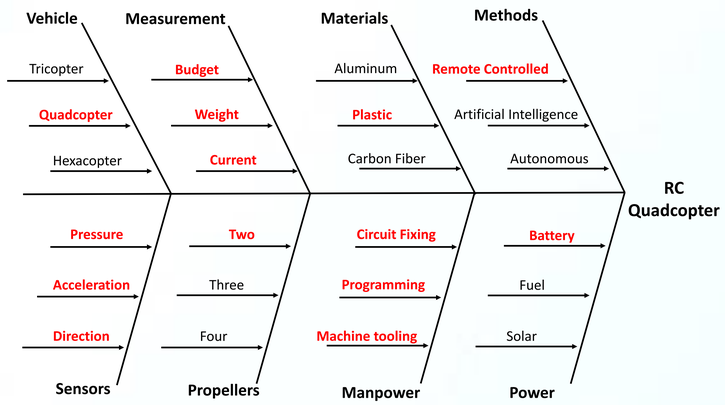
Design

The mechanical structure of the quadcopter is the supporting frame of the electrical system. It consists of an "X"-shape frame, with four sets of motor and propeller mounted at each end respectively and the control unit mounted at the center, four sets of landing legs mounted in each arm.

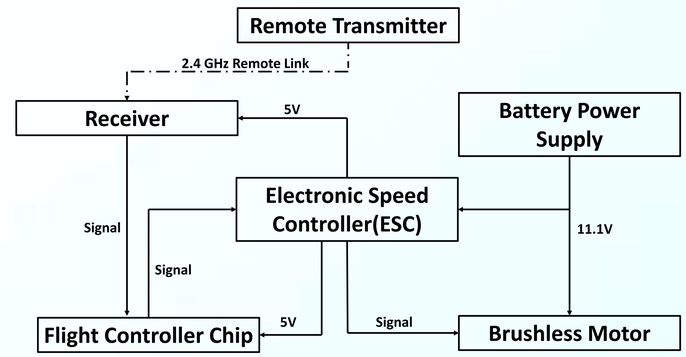
Design Sketches



Fish Bone Diagram



Block Diagram



Financial Analysis

Prototype Cost = $500 | Estimated Cost Per Unit = $238 | Estimated Demand = $5K | Estimated Fixed Cost = $40K | Estimated Capital = $200K

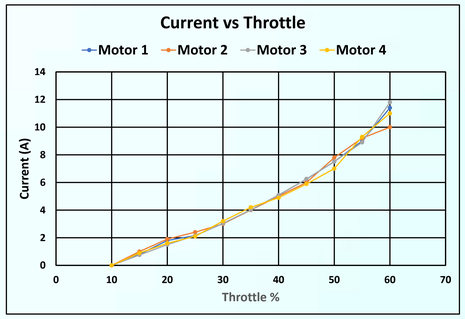
	Year 1	Year 2	Year 3	Year 4	Year 5
Prototype	$500	$0	$0	$0	$0
Capital	$0	$0	$0	$0	$0
MKT & Field Support	$2,000	$5,000	$5,000	$5,000	$5,000
Amortization	$40,000	$40,000	$40,000	$40,000	$40,000
Fixed cost	$40,000	$44,000	$48,400	$53,240	$58,564
Variable cost	-	-	-	-	-
Volume @ +10% Qty.	250	5000	5500	6050	6655
Unit Cost -10%	$238	$214	$193	$20	$20
Sales Volume Qty.	250	5000	6050	6655	7321
Unit Price	$357	$411	$472	$543	$624
	Year 1	Year 2	Year 3	Year 4	Year 5
Period Cash flow	($50,750)	$897,750	$1,707,712	$3,399,108	$4,339,533
PV, at 10%	($50,750)	$741,942	$1,283,029	$2,321,637	$2,694,509
Payback		$691,192	$1,974,221		
Net Present Value	$6,990,367				

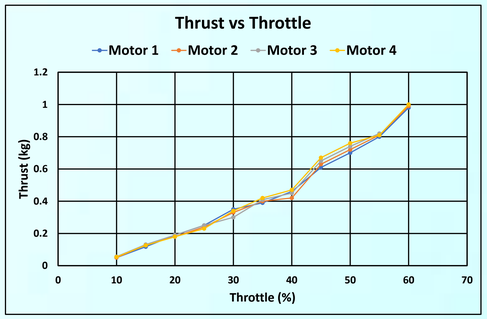
Shipment Companies	Delivery Time	Shipping Cost
Google	1 – 2 Days	$4.99
Amazon	1 Day	$8.99
UPS	2 Days	$5.25
FedEx	2 Days	$8.32
Drone Type Delivery*	30 Minutes	$1.00

*Drone Delivery Cost is taken by Amazon's Drone Type Delivery

Results

The ESC has a continuous current rating at 40A so that 12A of current is safe for the ESC to handle. The quadcopter has an approximate weight of 2 kg, so that 1 kg thrust at 60% throttle per motor is capable of lifting up the quadcopter. The efficiency of power flowing in and power consumed is approximately 90% when throttle is at 60%. With these verifications, ESC, motor and battery are able to provide enough thrust and the quadcopter can hover for 15 minutes only with battery power supply.





Conclusion

The design made by this team is not only simple and affordable but proves to be a base for various uses, different add-ons could be added and used by a simple installation onto this device. The team's findings show that an invention like quadcopters don't necessarily have to be a complex and expensive endeavor that is beyond commercial and professional use. Moreover, this design proves that drones are a device of great use and could soon be playing huge part in various human operations including freight, surveillance etc.

Acknowledgements

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