COMMERCIAL DRONE

GROUP

42

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COMMERICIAL DRONE

ABSTRACT

Drones are used in several sectors for many important functions. In this project a new version of a drone is created; this is a commercial drone which will transport humans and cargo or luggage. These drones will solve several transportation problems, since they are well built to move very fast and to withstand all difficult weather conditions.

The most important aspect of these drones is that they are very eco-friendly, this means that they do not release any pollutants such as carbon (IV) oxide and silicon dioxide which deplete the ozone layer into the atmosphere. Hence these commercial drones are less costly, easy to drive, safe and above all eco-friendly.

INTRODUCTION

BACKGROUND

The future of modern transportation

The first passenger drone was unveiled on January 6 of 2016 at the international Consumer Electronics Show (CES) in Las Vegas. Produced by Ethang, a Chinese company based in Guangzhou, the 184 was a one passenger drone equipped with four propellers that could fly for approximately 23 minutes at a top speed of 63 mph.

Passenger drone looks like a small helicopter. The drone runs on electric battery and carries a single passenger weighing up to 100kg at a time. The drone fits the person together with a small backpack, an air condition and a reading light. It gives two commands that's the take off and land just with a single touch on a tablet. Remote security threats on commercial drone such as Man-In-The-Middle (MITM) attack have exposed the vulnerabilities in current drone system. Passenger drone can be very noisy; a single passenger drone such as Joby Aviation's all-electric vertical take-off and landing aircraft has an estimated noise pollution of 70 db.

Passenger drones can greatly reduce the time travel. As passenger drones flight paths are not restricted by conventional roads, the travel distance is shortened. It can be used for emergency services such as search and rescue missions and the delivery of life saving goods. Companies like Ethang have already begun using passenger drones as emergency vehicles as a response to the potential river bank failure during the flood season in China.

PROBLEM DEFINITION

Rapid and safe transport is needed in the health sector for transporting patients during emergencies. Rapid transport is also needed in the safety and rescue departments such as the security services and fire service to protect lives and property. Moreover, there is the general need for safe and rapid transport in commercial transport.

Due to lack of safe and rapid transport, all of the above mentioned sectors encounter a lot of difficulties when performing their duties and operations. Therefore, there is the need to find the best solution to all of these transport problems.

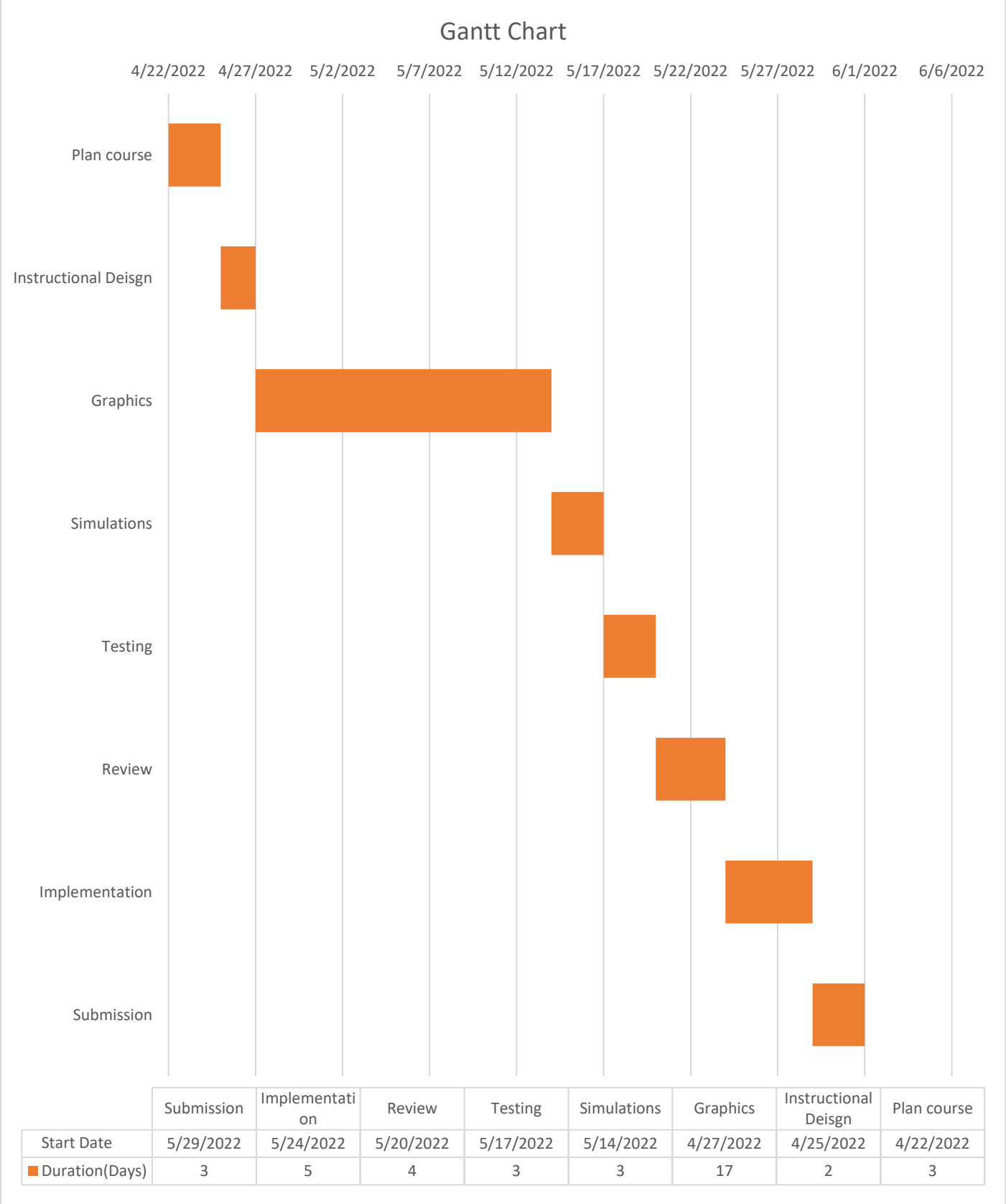
REQUIREMENTS

There is the need to construct an ultramodern mode of transportation which will be very fast, less costly, safe, and convenient to be used in the health, public, security, commercial and rescue sectors.

This mode of transport should be able help to curb the problem of bad roads, loss of human lives due to delay in transporting patients and also help to quickly solve issues relating to fire outbreaks and floods.

FUNCTIONAL REQUIREMENTS	DESIGN REQUIREMENTS
Drone should hold as least a minimum of two individuals and maximum of four (three passengers and the pilot for a manually controlled system)	Must have four propellers and a streamlined shape to enhance effective flight so as to withstand air pressure
Drone must be able to fly at high altitudes and withstand air resistance in severe weather conditions of rainstorms	Transparent glass for easy vision and two exit doors

PLANNING



	Submission	Implementation	Review	Testing	Simulations	Graphics	Instructional Deisgn	Plan course
Start Date	5/29/2022	5/24/2022	5/20/2022	5/17/2022	5/14/2022	4/27/2022	4/25/2022	4/22/2022
Duration(Days)	3	5	4	3	3	17	2	3

EVALUATION CRITERIA

Without any doubt, passenger drones have set to change the way humans transport themselves forever. Seriously, this is one welcome idea, considering the number of cars that ply our roads every day. The human population continues to explode and the roads really wouldn't be able to handle it for long. They are already super-choked. Analysis of such conditions has led to the creation of a passenger drone. The questions stand? Is it safe and how effectively efficient will this drone be? Will it serve its purpose and are there challenges or unexpected outcomes? This evaluation criteria seeks to address all pressing issues ranging from sustainability through to the analysis of the final design.

• Sustainability

There are several benefits that drones have brought to the field of sustainability. First, UAVs with video camera are a very useful tool when flying over large tracts of land to obtain images quickly: areas of agricultural crops, forest areas, fire control... This way, we achieve the reduction of pollutant emissions derived from a ground or air control and can go faster to a critical point before the incident escalates.

The Passenger Drone can be controlled in three ways: autonomously by the drone itself, remotely by an operator via secure LTE (4G) network, or manually by you (in case, you can't trust the machine, the control is returned to you).

FIELD EVALUATION CRITERIA

Length	Excellent
Width	Very good
Surface	Well-maintained air strip (should work in any condition related to climate change)
Slope	Slope is hardly noticeable (land based on wind and direction of control)
Ground obstacles	Any obstacles should be obvious and easy to avoid
Approach obstacles	Any obstacles should be obvious and easy to avoid
Accessibility	Tow-out and relatively easy
Landing directions	Possible landing directions are specified. 360 means that the passenger drone should be easy to land from any direction.

MODELS TAKEN INTO ACCOUNT

- ✓ Passenger drone with conventional rotor blades ->**Model A**

- ✓ Passenger drone with Fenestron rotor blades -> **Model B**

• Safety and risks assessment

The safety and risk evaluation assessment below is done based on the analysis of the two models A and B. The purpose is to make a vivid analysis so as to select a suitable model of the passenger drone that serves its purpose efficiently and effectively.

RANKINGS (Based on how effectively each model withstands each risk item):

1- Poor 2- Good 3- Excellent

ID	CATEGORY	RISK ITEM	EFFECT	CAUSE	MODEL A (WEIGHT)	MODEL B (WEIGHT)	ACTION REQUIRED
1	Technical	Flight malfunction	Drone falls and breaks	Motor malfunction or flight controller error	2	3	Inspect drone before and after each flight
2	Technical	Incorrect programming	Corrupts data collection of images	Program bugs not found	2	3	Review programming and correct all bugs
3	Technical	Over-consumption of power	Low flight time	Too much drawn by onboard devices	3	3	Calculate the power consumption rate

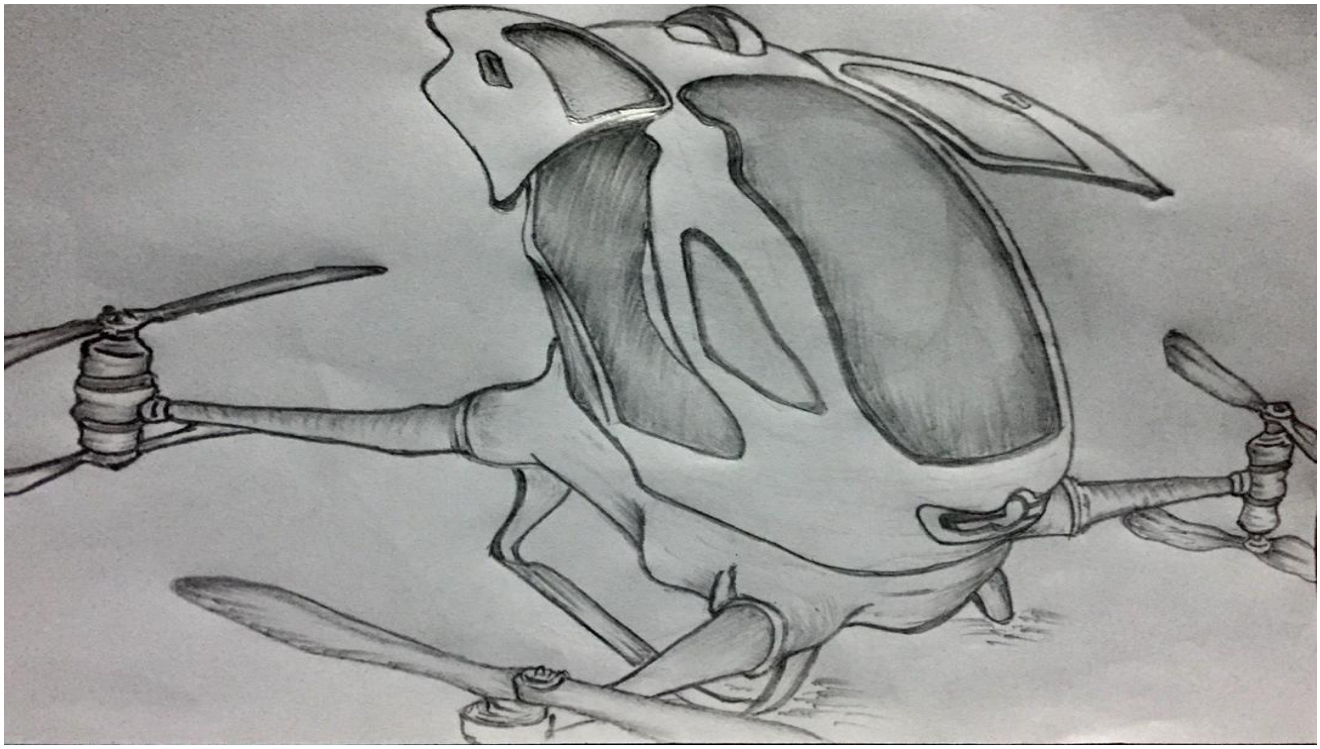
4	Technical	Inability to record thermal video	Lack of thermal video	Inability to use proprietary software on board the drone	3	3	Thoroughly research the capabilities of onboard storage devices
5	Safety	Injury from blades	Severe cuts to team member or spectator	Improper safety or knowledge when in close contact to a running drone	1	3	Be sure there is always maintained clearance from running drone
6	Safety	Injury from falling drone	Impact injuries to head and body	Poor piloting or clearance from a flying drone	1	3	Be sure there is always maintained clearance from running drone

7	Environment or Social	Battery safety	Polluting the environment with battery waste	Polluting the environment from improper disposal of batteries	3	3	Read on how to properly dispose used batteries
8	Environmental or Social	Campus rules	Inability to fly on campus in undesignated areas	Not reviewing campus rules for test flight	3	3	Read campus rules
9	Financial	Running over budget	Inability to purchase the necessary components or materials	Improper assessment of necessary project components	2	3	Taking time to thoroughly research on the parts or materials

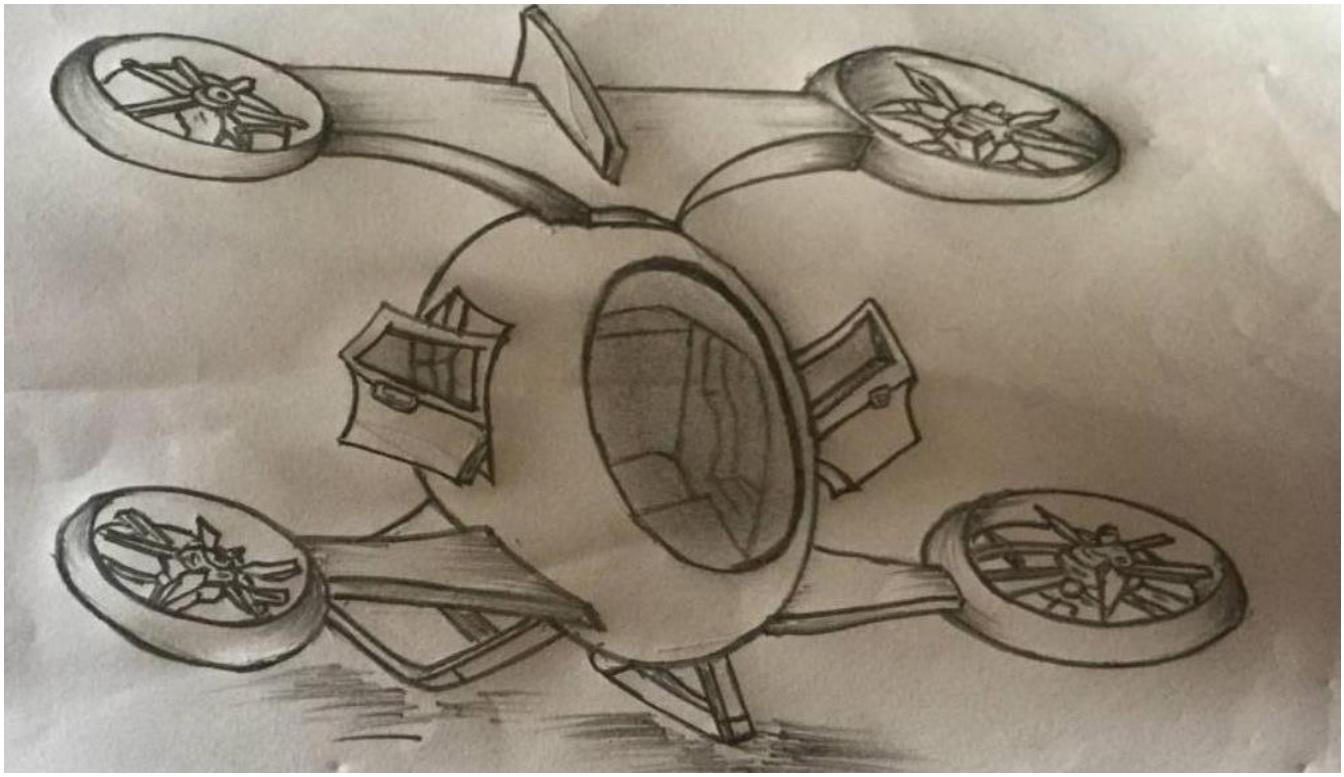
10	Resource	Flight location	Inability to test drone in specific locations	Poor planning of flight locations	3	3	Plan out flight locations

ALTERNATIVE SOLUTIONS

MODELS OF COMMERCIAL DRONE



MODEL A (CONVENTIONAL ROTARY)



MODEL B (FENESTRON ROTARY

DETAILED FUNCTION OF BOTH MODELS

Model A

This commercial drone consists of four **conventional** rotary wings(open wing system). Each rotary wing consists of a rotary motor and two rotary blade system each. The drone runs on electrical energy; which makes it rechargeable .

This drone flies automatically, the destination only has to be input it's GPS system. It has a flight time of 23 minutes and a recharge time of 2 to 3 hours. Due to the conventional wing system, this drone has a maximum capacity to carry more load (about four to five average weight individuals). but at a relatively slow rate.

Model B

This commercial drone consists of four F**enestron** rotary wings(closed wing system). Each rotary wing consists of a rotary motor and two rotary blade system each. This drone has a hybrid energy system, it recharges automatically by absorbing solar energy due to it's dark surface and embedded system of rechargeable solar cells beneath it surface; and it can also be electrically charged for 2 to 3 hours.

This drone flies automatically, and can also be flown manually. The destination of a passenger can be input into its GPS system. It has an extended period of 30mins after its initial 23 minutes has elapsed. The extended flying time depends on the weather conditions, since the second phase is solar powered. Model B travels relatively faster but carries an average number of load, maximum load is about three average weight individuals.

DECISION (EVALUATION) MATRIX

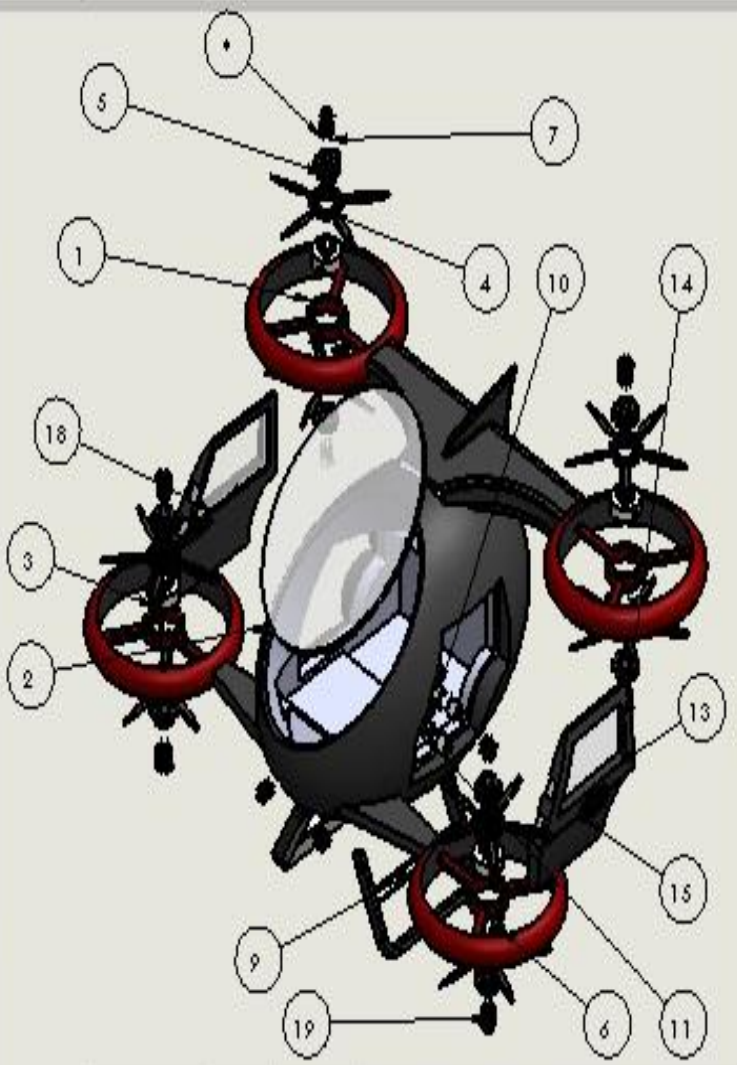
CRITERIA	WEIGHT	MODEL A (Passenger drone with conventional rotor blades)		MODEL B (Passenger drone with fenestron rotor blades)	
		r	**$w_o(r_o-3)$**	**r**	**$w_o(r_o-3)$**
Safety	20% (0.2)	2	-0.2	4	0.2
Ease of installation	10% (0.1)	3	0	4	0.1
Ease of operation	10% (0.1)	4	0.1	4	0.1
Size	5% (0.05)	3	0	5	0.1
Sustainability	15% (0.15)	3	0	4	0.15
Weight allowance	10% (0.1)	2	-0.1	3	0
Speed	10% (0.1)	3	0	4	0.1
Mobility	10% (0.1)	4	0.1	4	0.1
Efficient power source	10% (0.1)	4	0.1	4	0.1
TOTAL SCORE(Total score, $Cw_o = \sum w_o(r_o-3)$	100% (1.0)	**Cw**A = 0		**Cw**B = 0.95	

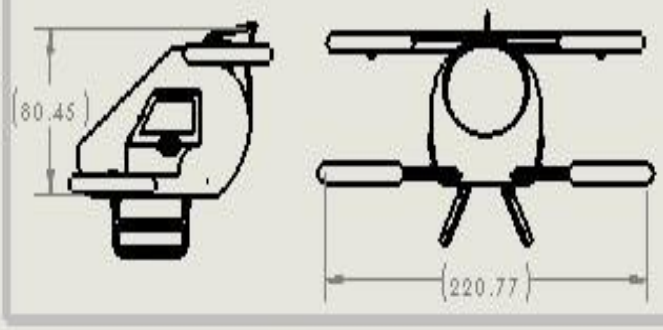
Ranking (r): 1- Poor 2- Average 3- Good 4- Very good 5- Excellent
Conclusion: If the given weights are considered, then it can be said that, **MODEL B is more favorable than MODEL A.**

ASSEMBLY OF CAD MODEL

ASSEMBLY DRAWING OF CAD MODEL

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EDP42_BD1	MAIN BODY	1
2	EDP42_WDS1	WIND SCREEN	1
3	EDP42_M1	MOTOR	4
4	EDP42_R1	ROTOR	8
5	EDP42_RC1	ROTARY COVER	8
6	HX-SHCS 2-12x2.5x2.5-N	ROTAR SCREW 1	8
7	HX-SHCS 1.125-12x5.5x3-N	ROTAR SCREW 1	30
8	HX-SHCS 1.125-12x5.75x3-N	ROTAR SCREW 1	15
9	EDP42_ST	STAND	2
10	EDP42_H1	HINGE HD	4
11	EDP42_H2	HINGE FRT	4
12	EDP42_H3	HINGE LOCK	4
13	EDP42_LD2	LEFT DOOR BOBY	1
14	EDP42_LDWS1	DOOR WIND SCREEN	2
15	EDP42_HA_1	HANDLE FRAME	2
16	EDP42_HA_2	HANDLE	2
17	EDP42_HA_3	HANDLE PIN	2
18	EDP42_RD1	RIGHT DOOR	1
19	HX-SHCS 1.125-12x5.5x3-S	ROTAR SCREW 1	5
20	HX-SHCS 1.125-12x2.75x2.75-S	ROTAR SCREW 1	5





	NAME	DATE
DRAWN	CPP_A2	31/05/2022
CHECKED		
ENG APPR		
MFG APPR		
Q.A		
COMMENTS		

UNIVERSITY OF GHANA

TITLE:

COMMERCIAL DRONE

SEE DWG. NO. REV

A DRONE ASSEMBLY

SCALE: 1:2 WEIGHT: 24945.07 SHEET 1 OF 1

ANALYSIS

The analysis of the selected and fully assembled drone – FENESTRON DRONE is based on a few chosen criteria of major interest to the general public. Frequently asked questions are: “Is the drone safe?”, “How fast can it fly?”, “Is it very expensive considering the materials from which the drone is manufactured?” and many more. This analysis is written based on test results accumulated from the evaluation of the product (drone) and it seeks to provide answers to the frequently asked questions of the public.

i. WEATHER ANALYSIS
ii. MODE OF POWER ANALYSIS
iii. METHOD AND TIME OF FLIGHT ANALYSIS.
iv.DURABILITY AND LOAD ANALYSIS

WEATHER ANALYSIS

Based on the evaluation test conducted in reference to the performance of the fenestron drone, it was noted that the mechanized system of the drone is operational and compatible to all weather conditions ranging from storms to snowing conditions, a sunny day and even rainy nights. This is possible because of the form in which it was made – that is its design of having a streamlined shaped to be able to withstand atmospheric pressure, rain and wind currents as well as air resistance.

MODE OF POWER ANALYSIS

Is there a need to worry about fuel? No. The Fenestron drone has electrically powered rotary blades which run on electric charges and only need a command so as to be activated and become fully operational. The drone has an inbuilt system that triggers auto-landing in case of trouble.

METHOD AND TIME OF FLIGHT ANALYSIS

The Fenestron drone has maximum time flight of 53 minutes on a sunny day and a minimum of 38 minutes on normal days due to it's hybrid system of solar and electrically charged. It has an efficient power supply source being LiPo batteries and other alternative sources like the hybrid power. The control mechanism for the Fenestron drone is a smooth one. It operates on an autonomous system which only demands a simple click on the Google Map to set the destination and the drone takes you to your desired location. In case of emergency situations, the Fenestron drone will be piloted by personnel sitting at the command centers who will help to land the drone safely supposing that the auto-landing system fails.

DURABILITY AND LOAD ANALYSIS

The Fenestron drone has the capability of carrying a maximum of three (3) people plus their luggage and if there is no luggage, then a maximum of four (4) people can occupy a single Fenestron drone. Weight is not much of an issue when it comes to the Fenestron drone because of its rotary blades and the materials from which it is made. Someone might be curious enough to ask about the materials from which the Fenestron drone was made. These materials are: Alloy (Aluminum 7075), Acrylic, Carbon steel and Stainless steel. The materials mentioned have good properties that enhance the effective mode of operation of the drone and make its cost very affordable.
So yes, the Fenestron drone is one hundred percent (100%) safe, efficient and effectively functional.

BILL OF MATERIALS.

PART NUMBER	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
EDP42_BD1	MAIN BODY	1	$50,000.00	$50,000.00
EDP42_WDS1	WIND SCREEN	1	$10,000.00	$10,000.00
EDP42_M1	MOTOR	4	$20,000.00	$80,000.00
EDP42_R1	ROTAR	8	$5,000.00	$40,000.00
EDP42_RC1	ROTARY COVER	8	$2,000.00	$16,000.00
EDP42_ST	STAND	2	$5,000.00	$10,000.00
EDP42_H1	HINGE HD	4	$90.00	$360.00
EDP42_H2	HINGE FRT	4	$100.00	$400.00
EDP42_H3	HINGE LOCK	4	$50.00	$200.00
EDP42_LD2	LEFT DOOR BODY	2	$9,000.00	$18,000.00
EDP42_LDWS1	DOOR WIND SCREEN	2	$5,000.00	$10,000.00
EDP42_HA_1	HANDLE FRAME	2	$50.00	$100.00
EDP42_HA_2	HANDLE	2	$70.00	$140.00
EDP42_HA_3	HANDLE PIN	2	$20.00	$40.00
EDP42_RD1	RIGHT DOOR	1	$9,000.00	$10,000.00
HX - SHCS	ROTAR SCREW	63	$10.00	$630.00
TOTAL		**110**	**$115,390.00**	**$245,870.00**

CONCLUSION

The commercial drone will help to reduce several problems related to transportation around the world, from bad roads and heavy traffic on high ways. This mode of transportation is fast, and very safe; it will also have no negative effect on our atmosphere and ecosystem at large. It runs on solar and electrical energy so it is very eco-friendly. The Fenestron commercial drone is the best and reliable way of transportation for the future.