HELIUM-ASSISTED HYBRID DRONE FOR FLIGHT TIME ENHANCEMENT

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Introduction:

Advances in drone technologies have enabled various types of drones (alternatively UAVs) to be used in numerous applications and missions. Unlike fixed wing UAVs, drones with a VTOL (vertical take-off and landing) feature have wide applicability since they can hover over a particular point or region and do not require runways. This type of drones (like quadcopters) can only fly in a relatively small amount of time (e.g., usually up to 20 mins). Which unfortunately limits their usability for long endurance flights. So an helium assisted drone can help us to fly for more time, which enhances the flight time of uav's to 1.5 times to twice. Higher endurance can be achieved so this can be used for many applications like wildlife monitoring, search, survival lance and rescue operations. Thus, with the clear goal of enhancing the flight time. This study aims to develop a hybrid drone system with several benefits.

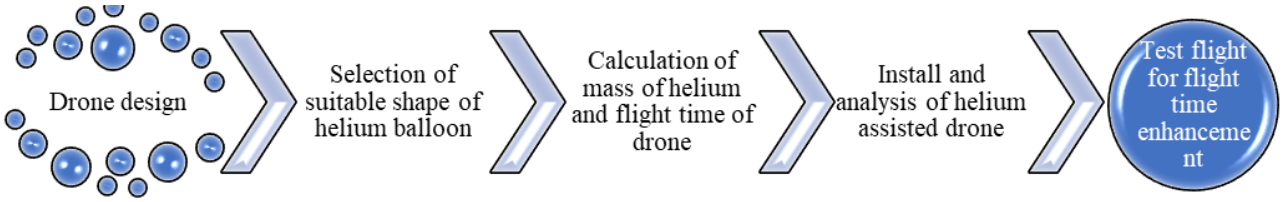
The major problem we want to tackle in this study is thus to design a hybrid drone system, which is easy to manufacture, small enough, and easy to control while maintaining a long flight time.

The main aim of our project is to build a helium assisted hybrid drone capable to fly with a minimum power consumption. The drone works by both buoyancy and propulsion of quad copter there by decreasing power, ability to vertically takeoff and landing [VTOL] and maneuverability in all direction.

Objectives:

- Design of suitable drone
- Selection of suitable shape of helium balloon
- Calculation of mass of helium.
- Fabrication of quadcopter
- Install and analysis of helium assisted drone
- calculation of flight time of drone

Methodology:



Drone Design:

Based on aim and application of our project we need to design suitable drone. Frame design and material selection, based on our requirement we need a bigger frame for our application. The material used is aluminum.

- This phase we determine the general design and layout of frame, helium hull and support platform.
- The first step is identification of design goals.
- This design combines two lifting forces the helium's aerostatic lift and lift from quadcopter motors.
- The design consists of mainly 3 components
    1. Support platform
    2. Helium Hull
    3. Quadcopter

Selection of suitable shape of balloon: Here we study about helium balloon properties, Selection of Helium Balloon Shape Among various shapes of the helium balloon such as cuboid or sphere. By considering volume, lifting force, height and easy operation shape of balloon is selected for weight balance and thrust generating.

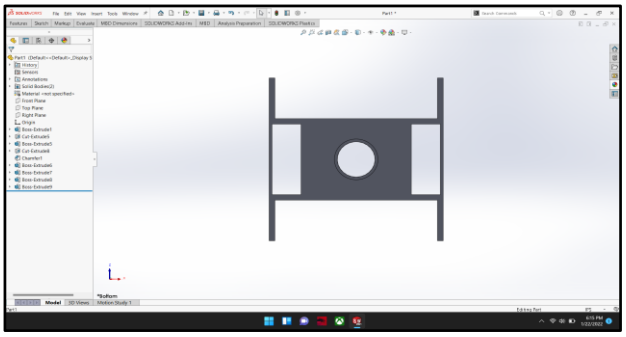
Calculation of helium mass: Here we follow three steps for calculation
Step1: determine the volume (litters) occupied by 1 mole of helium
Step2: to determine how much moles corresponds 1 litters of helium
Step3: using the molar mass of helium which in expressed grams per mole and then get weight in grams

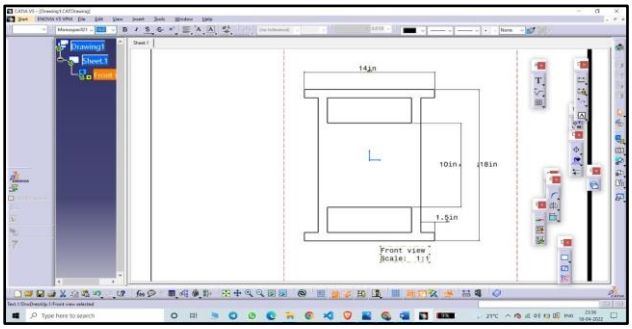
Install and analysis of helium assisted drone: Here we need to design support frame for the helium balloon. Assemble the helium balloon and drone. Analyse the stability and performance of drone.

Test flight: The final flight test will be conducted and flight time enhancement is noted

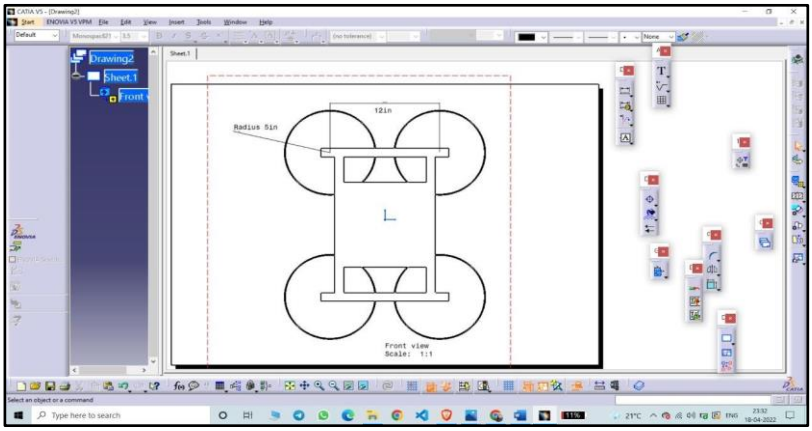
Frame Design:

- Based on our requirement we need a bigger frame for our application. The shape of frame is designed.
- The material used is aluminum
- The dimensions of the frame are given below





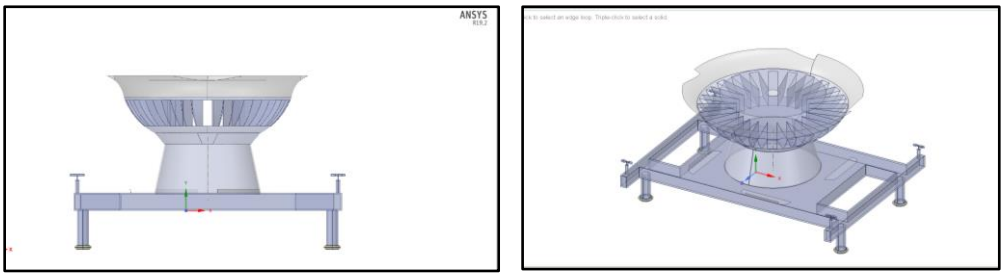
Frame Dimensions



Frame and Blade Dimensions

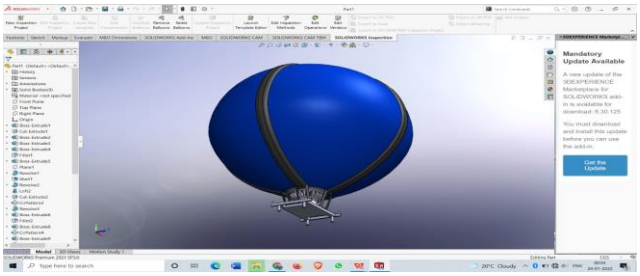
Support platform

- The suitable support joint is to be selected.
- A basic support platform is designed to attach the helium hull and quadcopter with the help of strips.
- The support system is designed.



Support Platform Design

Helium Hull

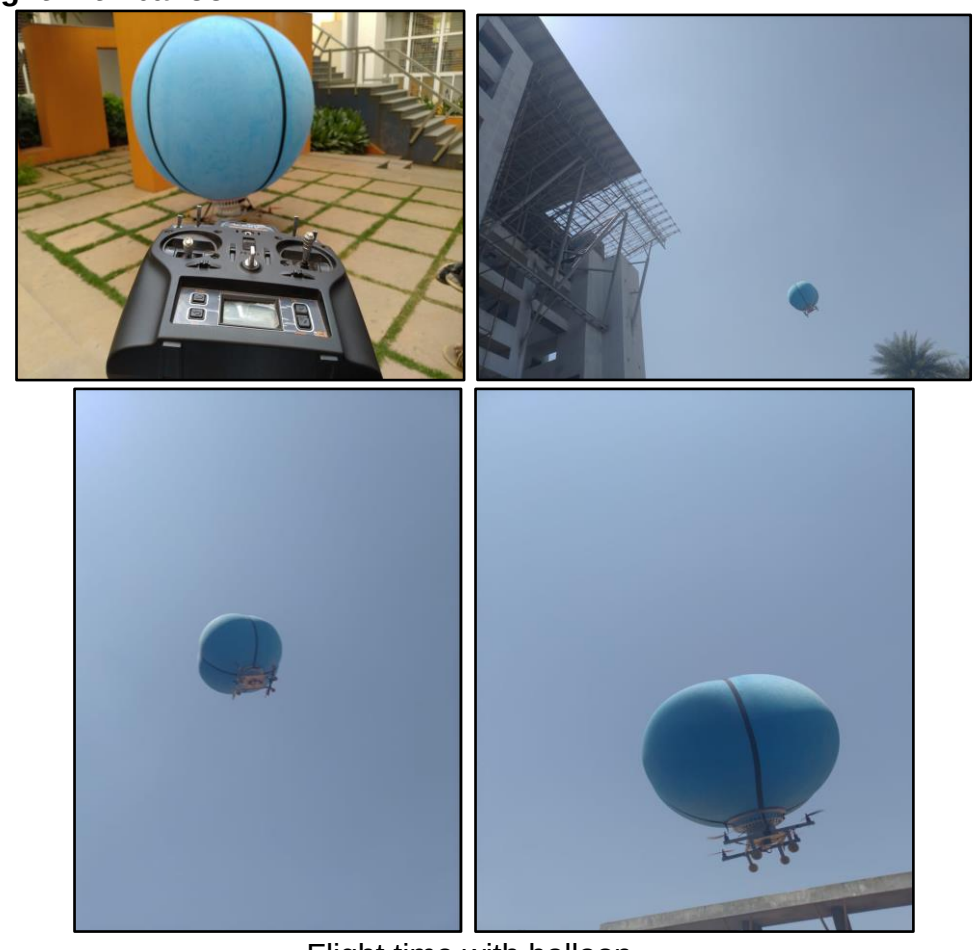


Cad Prototype Model with Helium Hull

Test Flight :

Drone Flight Time Test

Test flight with balloon:



Flight time with balloon

Result:

- **Test flight without balloon**
  - Several test flights are conducted to know the average flight time
  - The average flight time of the drone is about 8 to 9 mins

- **Test flight with balloon**
  - The Final Test Flight Conducted with the helium balloon to know the average flight time.
  - The average flight time of the drone with helium balloon is about 14 to 15 mins

CONCLUSION

- Various analyses are conducted for the design of the hybrid drone system including the balloon shape and size, buoyant force, flight time, and connector design.
- The hybrid drone design is stable as well as robust. To validate the effectiveness of the proposed design and flight time enhancement, experiments have been conducted and experimental results provided using the manufactured hybrid drone system.
- Through the experiment, it is proved that the hybrid drone can increase the flight time more than 2 times while guaranteeing stable motions.

Scope for future work:

With further developments, the application of the “helium-assisted drone” can be improved like:

- Has high efficiency low power consumption with increase in scale can be used for large amount of cargos transportation with low cost.
- Geographical pictures by installing high resolution cameras.
- Under water detection.
- Can land and take-off from solid, water, ice surfaces.
- Providing food, life jackets and medical helps during floods, earth quakes.
- Used for reconnaissance by military.

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