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CONCEPTUAL DESIGN OF HELIUM DRONE

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ABSTRACT

The purpose of research paper shows the possibility and usage of the drone with the help of latest technology. Firstly, there was discussion related to usage and limitation in current drone technology. Later on, we discuss about the most important element of this paper is design and construction of the drone, in which the most important elements are lifting force, frame design, propellers, DC motor, electronic system. This paper shows the helium drones and possibilities of their using. The main purpose of design for the hybrid drone has several advantages, including manufacturability and a small size when compared to other types of hybrid drones, which allows for end user portability. When compared to other types of hybrid drones, it is quite modest. For the design of the hybrid drone system, various evaluations are performed, including balloon shape and size, buoyant force, flying time, and connector design.

Keywords: UAV Design, Drone Analysis, CAD Design, Tricopter, Conceptual Drone Design.

I. INTRODUCTION

Unmanned aerial vehicles (UAVs) or unmanned aircraft systems are other names for drones. A drone is a flying robot that may be remotely controlled or flow autonomously using software-driven flight plans in embedded systems that work in conjunction with onboard sensors and a global positioning system (GPS) [1].

UAVs have traditionally been used by the military. They was initially used for anti-aircraft training, intelligence collection, and, more controversially, as weapons platforms. Drones are now being employed in a variety of civil purposes, including search and rescue, surveillance, traffic management, weather forecasting, firefighting, personal use, drone-based photographers, and videographers, agricultural, delivery services, and so on.

They are often equipped with optoelectronic heads, which are used for surveillance and monitoring. The drones' most crucial feature is that they don't require additional infrastructure to quickly register and monitor a particular area or object. When it comes to commissioning and preparing the unit for a flight, the extremely fast reaction time is a huge benefit.

The present drone operating configuration was first discussed in this study, followed by their use as well as limitations. Next, we proposed a novel helium drone design based on a tricopter design in this paper. A drone with such a three-motor architecture can fly via rotating propellers. Because we used a tricopter design featuring three propellers, the drone's power consumption is lower than typical drones, cutting the cost and making it more accessible to consumers (such as quadcopter, hexacopter).

The lifting force required to lift the drone is generated by helium balloons, because of this reason low performance parts can be used to build the drone (such as, dc motor, propeller, battery, etc.), due to all this reasons the cost of the drone reduced while the flight time increased. All the parts required to build the drone can be purchase from online or offline market which makes it easy to manufacture.

1.1 Tricopter working Principle

The most common shape of these rotary wing aircrafts is a "Y" with a rotor at each end. Because the additional thrust source, they have enhanced their stability. When there is a lot of wind, the tricopter is a better option [2].

The disadvantage of this layout is that it makes significantly more use of tail rotor than that of the two front ones. Tricopter can't usually tilt their rotors. In order to perform manoeuvres in all axes differential thrust is performed. The tail rotor must generate greater lift and pitch the vehicle downwards in order to fly forward. The single tail rotor is handling the majority of the work, which can make maintenance and tracking the hardware's degradation difficult.

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As shown in fig.1, one propeller rotates opposite direction from other two propellers, by this configuration tricopter fly stably without rotating its own centre axis. To move drone at x-y axis, speed of the one motor can be increased or decreased accordingly. While to change the altitude speed of all motors can changed accordingly.

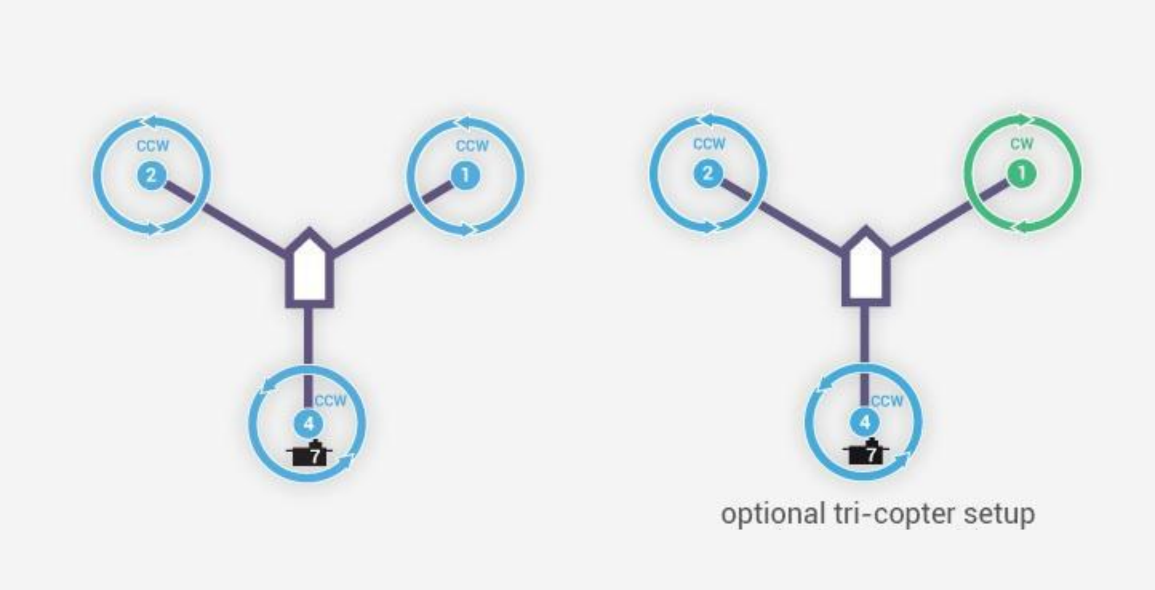

Figure 1: Tricopter Working Diagram

1.2 Use of current drone technology

Drones are already breaking down obstacles in the way businesses operate. Drone delivery is being tested by major corporations such as Amazon and Google. Drones are being used by Facebook for give Internet access in rural areas. There's even a start-up that delivers tacos to your door using drone planes [3]. The following are some examples of current drone technology applications:

Agriculture: Drone technology is already being used by the Environmental Agency to manage animals and monitor crops. Farmers and ranchers may be able to use unmanned aircraft to monitor and spray their crops in the future.

Conservation: Unmanned planes are being used all over the world to track endangered species and map variants in different ecosystems. As drone technology progresses, so will the use and relevance of unmanned drones in conservation projects.

Delivery/fulfilment: Drones can deliver anything a postman can carry. Food, medicines, and that last-minute birthday gift for your father—the way things arrive at our doors is about to change dramatically.

Disaster mitigation and relief: Drones can go locations that humans cannot, making them ideal for risky search and rescue operations as well as delivering emergency supplies to remote locations and disaster zones.

Logistics: For inventory management and carrying items between facilities, heavy-duty drones can take the place of trucks. This will most likely reduce the number of semis on the road.

Film-making and photography: Drones are already being used by low-budget filmmakers to take aerial views, and Hollywood will soon be hiring whole drone crews. Photojournalists who wish to capture breaking news from above are increasingly using unmanned aircraft.

1.3 Limitation of current drone technology

Drones are fantastic tools for any project, but they're not without their drawbacks. Drones have some limits and can cause issues in any job [4]. Using a drone technology business might assist your in overcoming some of these obstacles. Drones have a finite amount of flight time. Drones can only fly for a certain amount of time due to their batteries. If a project needs to be completed quickly but covers a big area, multiple drones may be needed to ensure complete coverage, or a project manager may want to investigate alternate, possibly more suited, technology. Drone technology is constantly evolving, and as battery power increases, the use of drone in

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construction becomes more feasible. Drones will suffice for the majority of aerial mapping studies. Regular maintenance scans are a valuable application of drone in construction, yet they are typically not time sensitive.

Drones Don't Fly Well in High Wind Conditions:

Drones are agile and dependable, but they struggle in heavy winds. Drones are small and light, and high winds can blow them off course, making it impossible for them to take accurate measurements. Fortunately, it's unusual that a job is so critical that an inspection or survey can't wait until the wind has died down. However, there are some sites where severe winds are expected on a regular basis, and drones would not be suitable. Airplanes are frequently employed for aerial scanning in high winds because they can easily fly over the landscape. Another feasible alternative is helicopters, which can safely fly closer to the ground than planes.

Drones May Require a Specialized Data Pipeline:

Drone data, as advanced technology, frequently requires analysis thru a specific data flow. While this does limit the use of drone technology to companies with access to advanced analytics services, there are a multitude of reasons why construction managers should be embracing complex data analysis like Building Information Modelling.

Partnering with a company that manages and analyses data in-house can eliminate the requirement for a sophisticated data pipeline. An in-house data processing service will be able to give surveying data in a format that the client company can understand and use, such as 3D maps or charts.

Optimal Use of a Drone Requires the Services of a Trained Professional:

Drone scanning should not be performed by anyone. The drones can yield erroneous, partial, or unpredictable information if the scan isn't done by a skilled specialist. A drone that is not properly managed can even cause damage to property. Drones require additional skill and experience to fly successfully, while aerial survey and scanning systems require much more.

II. CONCEPTUAL DRONE DESIGN

The aerostatic lift provided by the balloon, mixed with the fan lift of the propeller, allows the vehicle to achieve easy take-off, lifting, floating, and landing with lower power consumption.

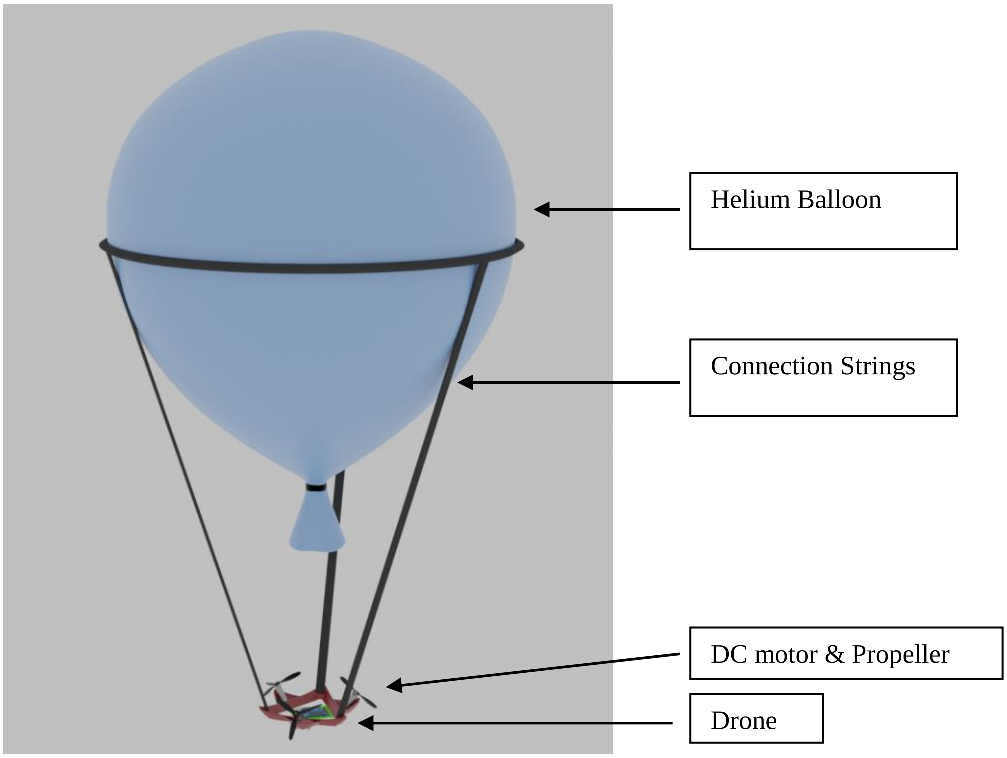

Figure 2: Conceptual Helium Drone Design

As shown in fig.2, the drone is connected with the helium or hydrogen balloon, by which the lifting force is generated to lift the drone. the drone is connected by balloon with the help of connecting threads. The drone gets its moving force by propeller which driven by dc motor, which powered by battery and controlled by

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microcontroller. Drone can be controlled over the internet with the help of Arduino iot microcontroller. By connecting the drone with the internet, we can explore many possibilities of iot system [5]. Because the drone can work over the internet, we can transfer high amount of data between drone and ground control. In this conceptual design of drone camera module is connected at the bottom of the drone since drone can fly at high altitude. And the drone can be controlled by microcontroller (such as Arduino nano IoT) over the internet. By connecting drone with IoT system we can explore many possibilities of IoT system.

1.4 Working Principle of conceptual helium drone

As shown in fig. 3, the three propellers connected to dc motor, rotates to move drone around. By rotating 1st and 2nd propeller clockwise and 3rd propeller anticlockwise at constant speed we can change the altitude of drone. by this configuration the central axial point is been at centre of drone. and by rotating one propeller at opposite direction to the others, we prevent drone from rotating at its own axis point. To change the direction or x-y axis, the speed of the dc motors can be changed with the help of the microcontroller.

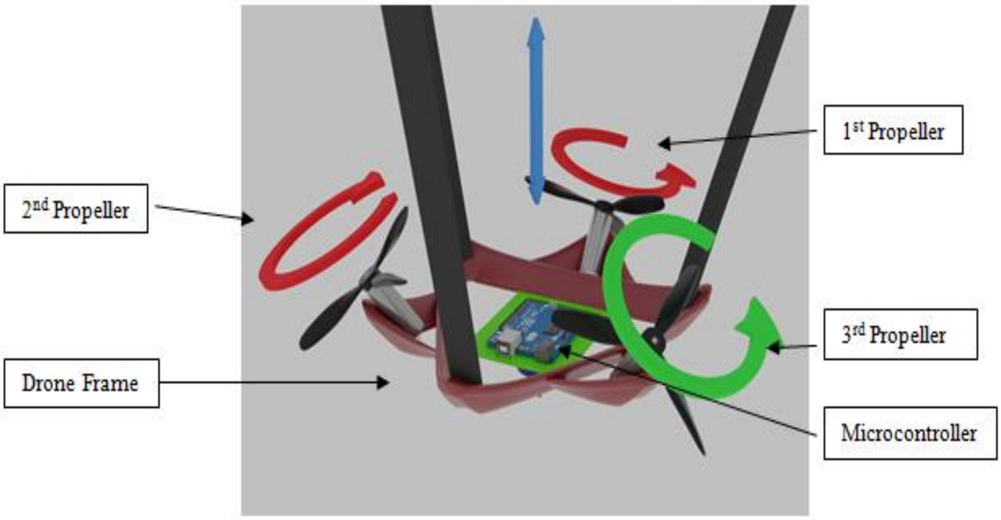

Figure 2: Working Principle of Proposed Drone Design

The majority lifting force required to lift the drone itself and other components, are provided by helium balloons. Numbers of balloons required to generate enough lifting force for lifting of drone. Since the helium balloon is placed just above the drone's body Propeller of the drone are placed at 40-degree angle to get maximum thrust. The power supply is placed below drone along with camera module.

III. RESULTS

The test field and air currents are critical in evaluating the lifting qualities of the inflation gas used in our drone. Only the temperature variations of air and the inflation gas are studied in this research. Because relative humidity has such a small impact on lifting properties, it is ignored. The air speed has been set to zero (hovering condition). Because there is no fuel consumption, no change in payload mass was considered.

Most of the parts required to build this drone system can be bought from online or offline shops. The size of helium balloons and its size are depended upon the final weight of the drone, number of balloons can be increased accordingly, to generate enough lifting force. As per the above research we concluded that, this conceptual design is practical and more affordable for customer, whose required long fight time.

IV. CONCLUSION

This paper described the key phases of the conceptual design of a low-cost, electrically powered hybrid UAV. We evaluated the drone's long flight endurance capability by examining every facet of a hypothetical helium drone. We propose a method for trying to extend endurance by using a helium balloon, resulting in improved endurance/weight ratio than typical electric motor/battery driven UAS, where improving endurance necessitates heavier battery packs, resulting in a weight increase. We developed the new drone configuration after reviewing past research on the subject. The lifting force analysis was combined with the shape of the balloon, weight, battery backup, and size of the drone in this hybrid drone system.

This drone method does have certain drawbacks. Because helium or hydrogen provides the lifting power, a balloon's volume expands. It is difficult to use in an outside area. Traditional drones have less flexibility. However, there are certain advantages, such as extended flying times than conventional drones, smooth and stable motions, lower cost than others, best for interior use, and so on.

Many aspects can be improved in future research on this topic, such as the weight and power consumption by designing a bespoke board that can work as an Electronic Speed Controller (esc) and motor driver. Phones having reverse charging capabilities may now power low-power drones without the need for an external power source.

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