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Compact Unmanned Aerial Vehicle with Carbon Fibre Frame and Propellor for Underground Application : An Approach

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ABSTRACT

A drone is a device useful for surveillance, security and improve safety aspects. Drone has many applications contributing in societal developments which is the motivation for the present project work. Drone is being emerged by various military organization, commercial capacity and its applications is increasing day-by-day. Unmanned aerial vehicles are designed as a self-operating device based on receiving feedback from signals and sensors. Brushless DC motor, frames, transmitter, receiver, propellor, flight control board, LiPo battery, electronic speed controllers were used to perform the experimental set-up. An attempt has been made to design light weight drone compared to the conventional drones available. The drone is fabricated in such a manner that initially it performs downward motion into the well followed by the upward motion. All the components of a proposed drone have been fixed and checked for its working. The drone operates in a stable manner with four propellors and contributed its excellence for the underground application.

Keywords : Drone, Frames, Propeller, Light weight, Secure.

I. INTRODUCTION

Drones are capable to carry over various tasks without much human interruption. It can also perform well even in greater heights and temperature to complete the desired work. A drone is called by other means as quad copter or unmanned aerial vehicle. A drone has four ended frame which as four motors over it. The motors fixed over the frame is used to lift the drone set-up to some altitude. Out of 4 motors, two motors will operate in clockwise direction and other two motors will operate in anticlockwise direction in order to facilitate the drone set-up to lift vertically. While taking the flight with the help of camera we can have live streaming and prisoner images.

There are two styles to align or geo reference data direct and circular styles. Direct geo - referencing is often achieved using the camera position information of a global navigation satellite system (GNSS), recorded by the onboard receiver during UAV flight. There's time synchronization between the camera and GPS of a UAV system. The primary approximation of the camera position is calculated using the GNSS onboard UAV. The SIFT algorithm is additionally used for large number of features that can be used as tie / pass points inside the lapped areas between conterminous images to upgrade the geo- reference result.

Although this technique is briskly and more provident, it provides low result quality and is not recommended for high perfection operations, similar as attestation of literal structures or artificial operations. The circular geo - representing system are often applied using the equals of certain targets as ground match points (GCPs). These targets must be easily visible and distinguishable within the images for homemade selection of their centers during the data processing way. It is also possible to use any being artificial features in a terrain that are fixed, similar as corners, manhole covers, or road markings. Preparing and measuring the positions of GCPs requires time and trouble, but this technique is preferred if a advanced perfection product is needed. In the present work, an attempt has been carried out to construct aerial vehicle with carbon fibre as a material for frame and propellor.

A. Project Background

Drone now a days has become the longer term of many businesses and took a huge place to be employed by individuals and the government. It still needs plenty of permissions to be used and there's limitation in Saudi Arabia to use it specially inside the city. The challenges start when a corporation or an individual think of using a drone or test it without official permit which will make him to be stopped immediately. Another challenge is when eager to program the Arduino by the individual himself, he will need a high skill in programming plus a WIFI Arduino which might be unavailable in Saudi Arabia. All the boards and therefore the digitals equipment's that are related to the drones are not available in Saudi Arabia. All equipment's should be bought from amazon or another internet site which will take more time to provide all the needed equipment.

Batteries aren't allowed to be shipped in normal ways; it should be shipped by airplane which will add some extra cost for shipping. Another challenge has all our connection done in the right way so we don't connect the incorrect voltage in the wrong port which can damage the board. This is the main body which is formed of two main parts upper and lower. It was scaled up during a way that fits the 3D printer to be printed as one piece.

II. DESIGN AND MODEL

A. Modeling of Quadcopter Dynamics

This section presents the essential Quadcopter dynamics. The essential idea of the movement of the Quadcopter is shown within the following figure. It is often seen from the figure that the Quadcopter is straight forward in mechanical design compared to helicopters. Movement in horizontal frame is achieved by tilting the platform whereas vertical movement is achieved by changing the total thrust of the motors. But Quadcopter arise certain difficulties with the control design.

B. Design Assumptions

The following assumptions is considered during design

- The structure is rigid.
- The Centre of Gravity and the body frame are assumed to be coincide.
- Thrust & drag are proportional to the square of the propeller's speed.
- The structure is axis symmetrical.

III. EXPERIMENTAL SET-UP

A. Materials Used

Table 1: Technical specifications

COMPONENT	STANDARDS	DETAILS
Lithium Polymer Battery	3.7 V, 300 mAh	Power supply to drone
KK2.1.5 Flight Controller Board and Transmitter	2.4 GHZ	To control and monitor drone wirelessly
Propellers	5.5 CM	To generate the thrust power
F4450 Frame	22*17*5.5 CM	To hold the parts of drone
BLDC Motor	150 KV	Motors to rotate propeller and lift the drone

Figure 1. Fabricated Propellor

Figure 2. Fabricated F4550 FRAME

B. Experimental Works

In this project; a battery, propellor, frame, BLDC motor and controller whose specifications are mentioned above is used for construct the set-up. The following shows the components and the assembled set-up. The specifications of the components were finalized based on the underground applications where the maximum smaller size of the underground well is taken as consideration. The Arduino program to make the drone to move down first and then to lift up is loaded into the control system to make the set-up auto controlled. Four frames are used in such a manner four motors have been used to driven the four propellors.

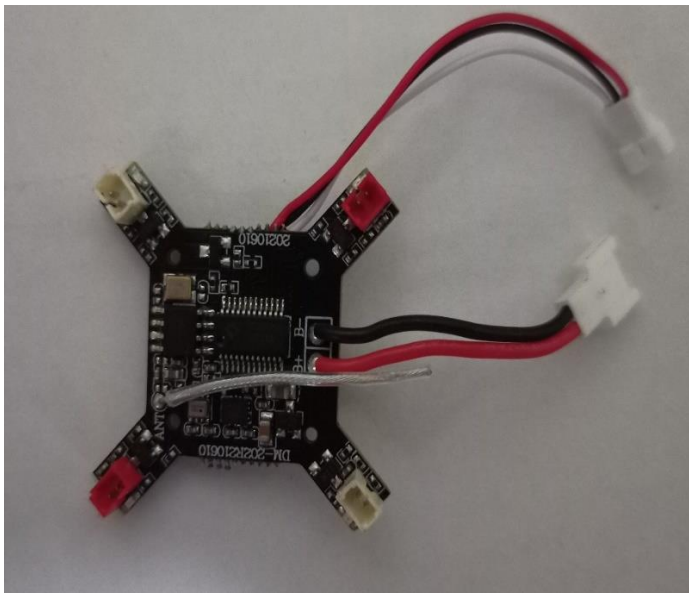

Figure 3. Flight controller

Figure 4. LIPO battery

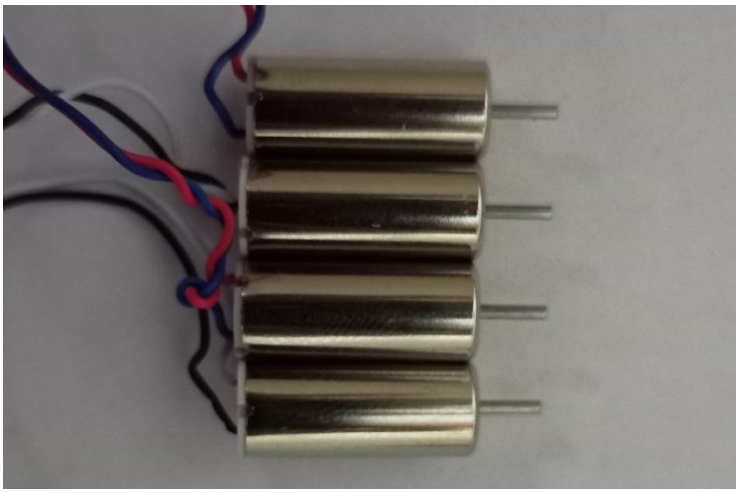

Figure 5. BLDC Motors

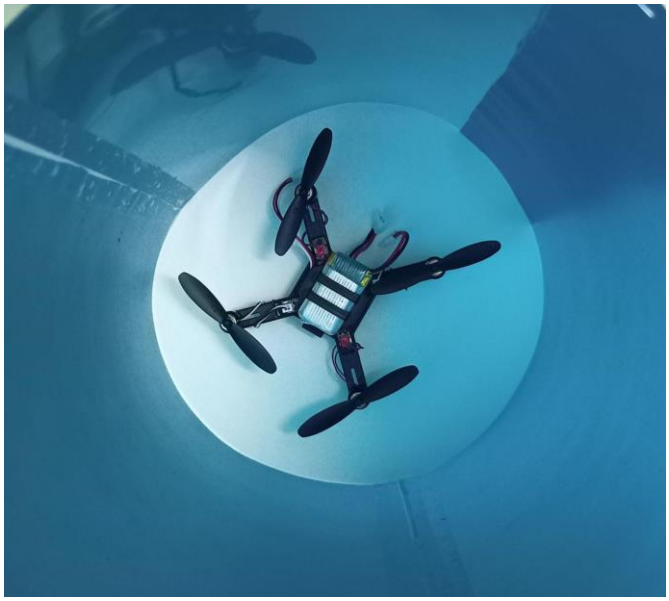

Figure 6. Carbon fibred Mini Quadcopter inside the pipe

IV. CONCLUSION

- The basic fundamentals, knowledge, operating parameters required to carry over the project is analyzed with the help of previous research articles.
- The components needed to construct mini quadcopter is designed and fabricated by considering the required specifications to perform underground applications.

- The fabricated components were assembled to form a stable and rigid structure of mini quadcopter.
- The set-up was tested for its running condition by supplying electricity through LIPO battery.
- The main intention of the project is to familiarize with the complete design process and engineering requirement needed to bring carbon fibred mini quadcopter for the societal benefits.

V. FUTURE SCOPE

- The same fabricated set-up will be also made through 3D printers and composites.
- The same set-up has been modified to operate with advanced wifi camera accepting cost consideration.
- The battery used in the drone will be charged through renewable energy sources like solar before connecting to the drone.

Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

Statement about Contents

It is confirmed that all of the figures, images, and tables that appear in this article are original and author-created.

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