DESIGN AND FABRICATION OF MULTI-MODE BI-COPTER

NEW HORIZON COLLEGE OF ENGINEERING

MECHANICAL ENGINEERING

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Keywords – Drone, Bi-copter, VTOL, 3-D printing

Introduction –

A drone is a unmanned aircraft, that uses aerodynamics to provide lift that can be remotely controlled or can fly autonomously using software-controlled flight plans in its embedded systems. They work in conjunction with onboard sensors and a global positioning system (GPS). Drones were mainly developed for defense purposes such as surveillance on both domestic and international threats. But now drones are being used in many domains such as agriculture, health care, delivery, and various other private sectors. In this project, we are designing, analyzing, and fabricating a multi-mode bi-copter. We will be using various platforms such as Solidworks, Autodesk CFD, Ansys, xFoil, and Matlab for designing and analyzing the bi-copter. To print the structure of the bi-copter we used 3D printing.

Objective –

In this project, our objectives are

To design and develop a VTOL (Vertical Take Off and Landing), Hybrid wing drone that uses only 2 rotors to produce the thrust.

To design and develop a bi-copter that is cost-efficient.

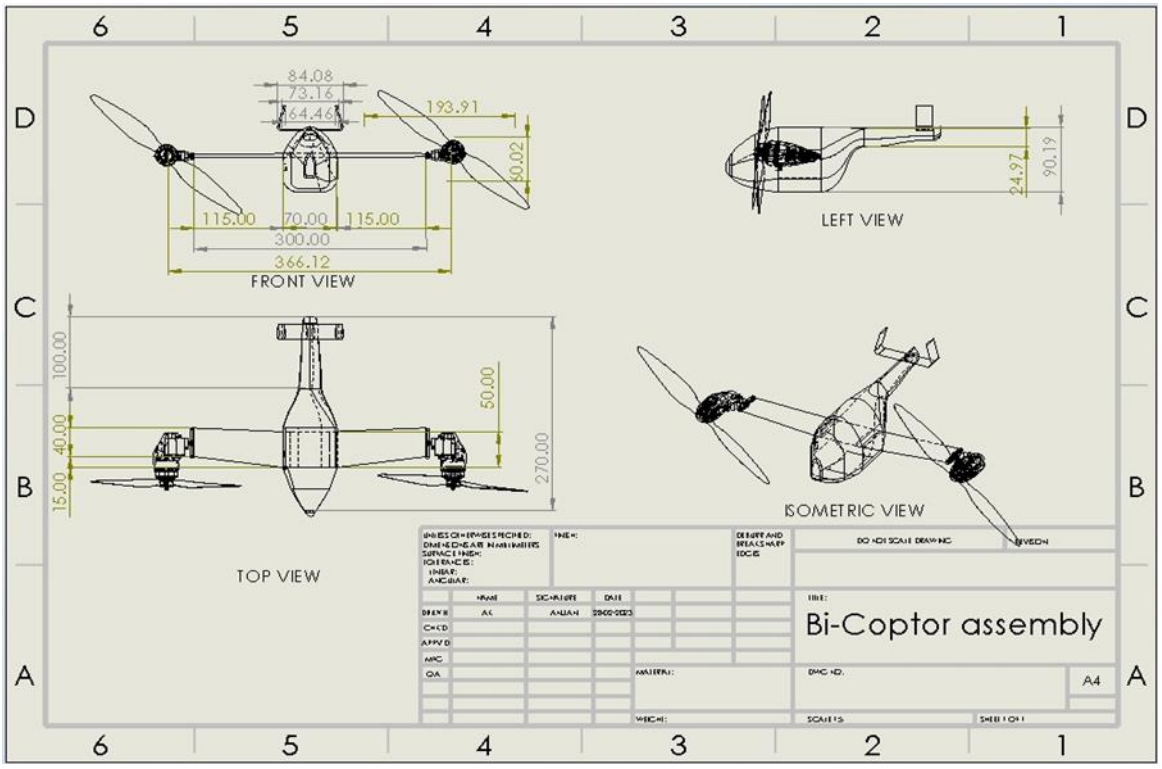
To design and develop a bi-copter that is weight effective.

To design and develop a multi-mode bi-copter.

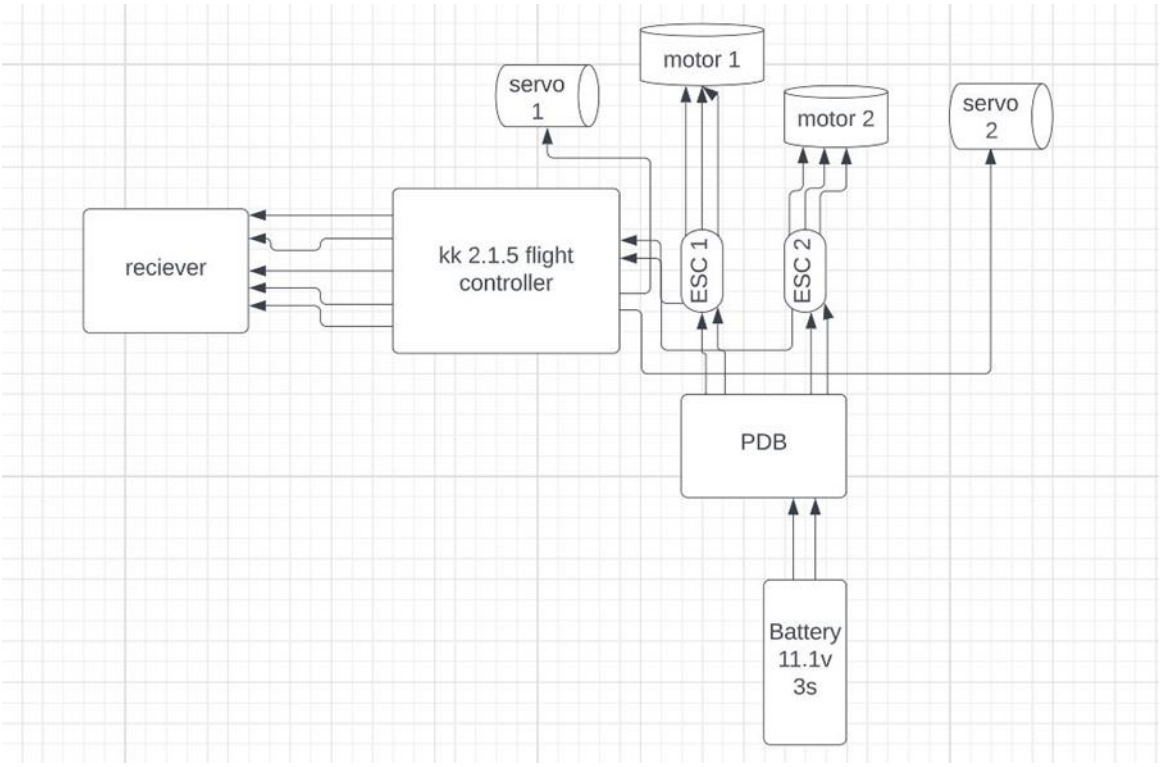
Methodology –

At the beginning of the project, we started by making a list of electronic items required for the drone. Later using the measurements of the items the structural design of the bi-copter began. Once the design was completed it was subjected to analysis. The next step was to procure the electronic gadgets. The electronics were assembled and checked their working

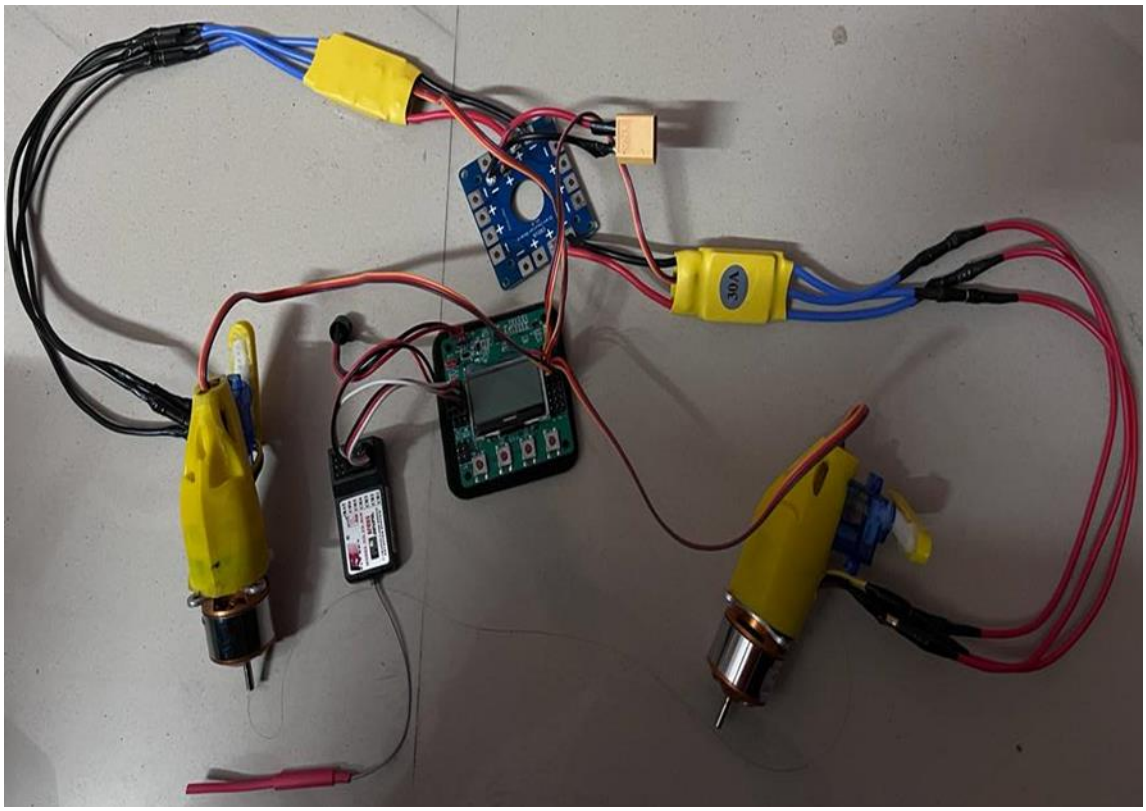
conditions. The structure of the bi-copter was fabricated using 3D printer. PLA material was used to print the structure. After printing the electronic assembly was fixed to it's structure, and testing was done.



Design of the bi-copter



Electronic assembly



3D printed structure

Results and Conclusions –

The main goal is to develop a bi-copter that can be used for surveillance operations. To achieve this, we have used various components such as radio frequency transmitter and receiver, ESC, BLDC motors, servo motors, and flight controllers to control the drone. In order to design the bi-copter, we used SolidWorks, which is a popular software tool for creating 3D models of parts and assemblies. This allowed us to create a detailed design of the bi-copter that could be analyzed and optimized before fabrication. To test the aerodynamics of the wings, you have used xFoil, which is a software tool that is commonly

used for designing and analyzing airfoils. By using xFoil, we were able to simulate the airflow around the wings of the bi-copter and optimize the design for maximum lift and efficiency. Additionally, we used Ansys Fluent for computational fluid dynamics (CFD) simulations. CFD is a powerful tool for simulating the flow of fluids and gases around objects and can be used to optimize the design of the bi-copter for different flight conditions. Once the design and analysis were completed, we moved on to the fabrication phase. It seems that you have used a 3D printer to fabricate the parts that you designed using SolidWorks. This is a common approach for rapid prototyping and can save a lot of time and money compared to traditional manufacturing methods.

Innovations –

A bi-copter is considered to be a less stable drone when compared to quadcopters or hexacopters. We designed a bi-copter that can show significant stability.

We implemented a bi-copter that has VTOL (Vertical Take Off and Landing) operability with hybrid wings.

This bi-copter comes under the small-size drone category as its weight is less than 500 grams. Which makes it suitable for surveillance and combat during SpecOps.

Future Scope –

In the future, advancements in technology may allow for the development of nano-sized drones through the design of smaller battery packs. By reducing the size and weight of the battery, significant weight reductions can be achieved, enabling these drones to carry more

payload. The smaller battery packs could utilize cutting-edge miniaturization techniques, leveraging nanoscale components and materials to achieve higher energy density while maintaining a compact form factor. This would lead to a substantial reduction in the overall weight and size of the drone. With reduced weight, nano-sized drones could achieve enhanced maneuverability, agility, and speed, making them ideal for tasks that require precise and intricate movements in confined spaces. These drones may also benefit from extended flight times. This would increase their operational range and endurance, allowing them to stay in the air for longer periods, gathering valuable data or completing missions efficiently. The increased payload capacity would open up new possibilities for nano-sized drones. They could carry miniature sensors for environmental monitoring, enabling them to collect data in areas that were previously inaccessible. These drones could also be equipped with tiny cameras for surveillance purposes or miniature delivery systems for transporting small items. These drones could find applications in various fields, including search and rescue operations, precision agriculture, infrastructure inspection, and even medical interventions. Their diminutive size would allow them to navigate tight spaces, reach remote locations, and perform tasks that larger drones cannot accomplish.