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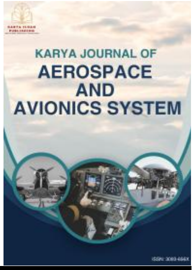

Fabricating Solar Power Drone Wing using Wing Helper Software

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ABSTRACT

This study presents an optimized approach for fabricating a solar-powered drone wing using Wing Helper software. Traditional wing fabrication processes require extensive technical expertise and specialized equipment, posing challenges for students, hobbyists, and small research groups. This research aims to simplify UAV wing fabrication by leveraging user-friendly computational tools, thereby enhancing accessibility to aerodynamic design. The study documents the complete wing development process, from conceptual design to final fabrication, with a focus on structural integrity, aerodynamics, and efficiency. The final wing configuration demonstrates the software's capability in producing precise and reliable UAV wings for solar-powered applications.

1. Introduction

The fabrication of UAV wings is a critical aspect of aircraft design, influencing aerodynamic performance, stability, and lift generation [1]. However, conventional wing construction methods require advanced technical knowledge and specialized equipment, limiting participation to highly skilled individuals. The high costs and complexity of wing fabrication often hinder small research teams and hobbyists from engaging in UAV development.

This study introduces an alternative approach using Wing Helper software, which streamlines the wing design and fabrication process. The software enables users with minimal technical background to create functional UAV wings efficiently. By integrating automation into the design workflow, Wing Helper enhances precision, reduces fabrication errors, and minimizes material waste. This research focuses on designing and fabricating a fixed-wing UAV, emphasizing optimal structural configuration and ease of assembly.

Fabricating an aircraft wing involves complex calculations in aerodynamics, material science, and structural engineering. For beginners and non-specialists, interpreting technical schematics and selecting appropriate materials can be challenging. The lack of accessibility to sophisticated tools often restricts innovation in UAV fabrication [2]. To address these challenges, this research employs

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Wing Helper software to simplify the design and fabrication process. The study aims to design and fabricate a UAV wing using an intuitive computational tool while evaluating the effectiveness of Wing Helper software in making wing fabrication more accessible. Additionally, the research seeks to optimize the aerodynamic properties and structural strength of the UAV wing, ensuring a balance between efficiency, durability, and ease of manufacturing.

2. Methodology

2.1 Flowchart

A flowchart is presented in nFigure 1 to illustrate the methodology for fabricating a wing using Wing Helper software. It outlines the sequential steps in the process, from design to fabrication.

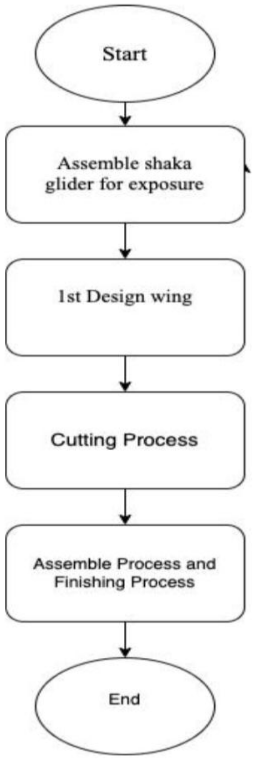

Fig. 1. Flowchart of wing fabrication

2.2 Shaka Glider

In this project, the Shaka Glider is used as an introductory tool for students with limited knowledge. Assembling the glider is straightforward due to the availability of an instruction manual, which provides guidance throughout the process [3]. Figure 2 presents the out-of-box components when purchasing the Shaka Glider.

Fig. 2. Shaka glider components

2.3 Wing Design

After gaining exposure from assembling the Shaka Glider, the wing is designed using Wing Helper software. Initially, four ribs are used to build foundational knowledge before proceeding with the final design. The materials and equipment used in this design include plywood, aluminum, plastic laminate, and a laser cutter. Plywood is used for the ribs, spar, and comb, while aluminum rods serve as the spar and leading edge. The plywood components are precisely cut using a laser cutter.

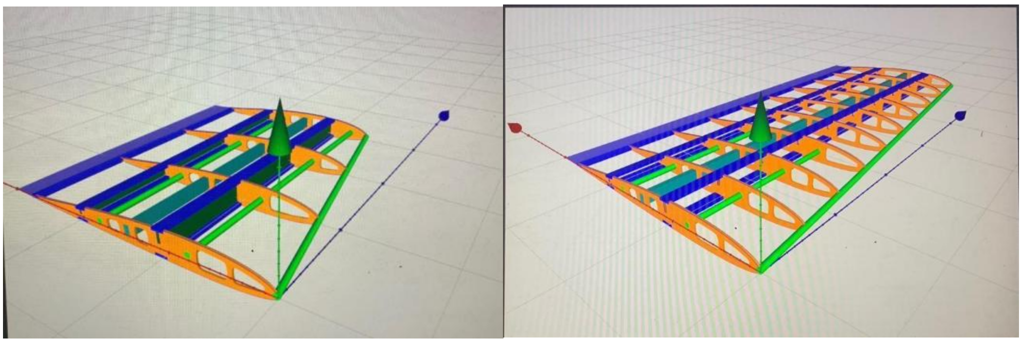

Fig. 3. (a) Initial Wing design (b) Final wing design

3. Results

3.1 Final Product

The final wing design was completed using Wing Helper software, which facilitated the entire process, from selecting the airfoil to generating the internal structure. In this final design, ten ribs were used. The chosen airfoil for this design is MH45.

Table 1
Final wing design specification

1	Wing length	310mm/one sided
2	Root chord	300mm
3	Tip chord	240mm
4	Sweep	60mm

3.2 Wing Lamination

Before laminating the wing, it is essential to sand the surface to achieve a smooth finish and remove any excess glue. Once sanding is complete, all debris must be removed to allow the laminate to adhere properly. Figure 4 presents the final product after the lamination process. The procedure involves placing the laminate over the wing, gently pressing with an iron, moving the iron along the ribs and edges to secure the laminate, and continuing the process to tighten the lamination. Care must be taken not to overheat the plastic, as excessive heat may cause melting [4].

Fig. 4. Product after lamination

4. Conclusions

The results emphasize the key features of the final wing design, including its aerodynamic properties, structural layout, and material composition. The study achieves its objective of simplifying the fabrication process for users with limited technical knowledge. Additionally, the discussion evaluates the potential applications of the design and the effectiveness of the software in achieving the intended outcomes [6].

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