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Creating a Low Cost Flying Drone Using The Concepts Of Radio Frequencies

[1]Kavya, [1]Sanjana S., [1]Sangireddy Harika, [1]Teju Raju Gaddadaguli, [2]Dr. Pavithra G., [3]Dr. T.C.Manjunath*

[1]First Year (Second Sem) ECE Students, Dept. of Electronics & Communication Engg., Dayananda Sagar College of Engineering, Bangalore, Karnataka
[2]Associate Professor, Dept. of Electronics & Communication Engg., Dayananda Sagar College of Engineering, Bangalore, Karnataka
[3] Professor & Head, Dept. of Electronics & Communication Engg., Dayananda Sagar College of Engineering, Bangalore, Karnataka

Abstract
In this paper, creation of a low cost flying drone using the concepts of radio frequencies is presented. A UAV, or Unmanned Aerial Vehicle, is an aircraft that lacks a human operator, generates lift using aerodynamic forces, can operate autonomously or under remote pilot control, is capable of expandable or recoverable missions, and can carry payloads, which can be either lethal or nonlethal. UAVs can be operated by on-board computers or controlled remotely by a ground-based pilot. Their current use is constrained by issues like satellite communication and cost. A new drone has been constructed for operation via radio frequency controllers and real-time audio-visual feedback transmission. The control system for this drone has been effectively simulated in MATLAB/Simulink, demonstrating stable and precise control of the developed UAV. The work carried out is the second semester mini-project by the students of Electronics & Communication Engineering under the guidance of the faculties.

Introduction

A drone, or Unmanned Aerial Vehicle (UAV), is an electronic device used for controlled, stable vertical flight. Drones excel in performing tasks that are challenging or unsafe for humans, such as high-temperature and high-altitude surveillance across various industries and rescue missions [1]. These devices typically feature four propellers with individual motors to provide the necessary thrust for lift. Quadcopters, a type of drone, employ a straightforward flying mechanism with four propellers, two of which rotate counterclockwise (CCW) and the other two clockwise (CW) [2]. To maintain stability, quadcopters rely on flight controllers that transmit instructions to the motors through electronic speed control (ESC) for precise control of their movements [3]. The figure no. 1 gives the photographic view of the drone developed with 4 fans.

Fig. 1 : Photographic view of a developed drone with 4 fans

Drones, also known as Unmanned Aerial Vehicles (UAVs), have become versatile tools with numerous applications. They are used for tasks that may be challenging, hazardous, or impossible for humans to perform, such as:

Surveillance: Drones are widely used for aerial surveillance in various industries, including

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agriculture, construction, and security. They provide a bird's-eye view for monitoring and data collection.
Rescue Missions: Drones play a crucial role in search and rescue operations. They can quickly access remote or dangerous areas, providing real-time information to aid in locating missing persons or assessing disaster-stricken regions.
Environmental Monitoring: Drones are utilized in environmental research to collect data on wildlife, ecosystems, and weather patterns. They help scientists study and conserve natural resources.
Mapping and Surveying: Drones equipped with cameras and sensors are employed for creating maps and conducting land surveys. They offer a cost-effective and efficient means of gathering geographic data.
Infrastructure Inspection: Drones are used to inspect infrastructure such as bridges, power lines, and pipelines. They can identify structural issues without the need for manual inspections, reducing costs and risks.
Delivery Services: Some companies are exploring drone delivery services for small packages and medical supplies, especially in remote areas or during emergencies.
Entertainment: Drones are also used for recreational purposes, capturing aerial photographs and videos, as well as participating in drone racing.
Agriculture: Drones equipped with specialized sensors assist in precision agriculture by monitoring crop health, optimizing irrigation, and assessing field conditions.
Law Enforcement: Police and law enforcement agencies use drones for surveillance, crowd monitoring, and accident reconstruction.
Scientific Research: Drones are deployed in scientific research, including atmospheric studies, archaeology, and marine biology.
Film and Photography: Drones provide unique perspectives for filmmaking and aerial photography, capturing stunning visuals and landscapes.
Military and Defense: UAVs have a significant role in military operations, including reconnaissance, surveillance, and target acquisition.
Overall, drones have revolutionized various industries and continue to expand their applications as technology and regulations evolve.

Proposed Methodology & Block Diagram

A quadcopter relies on the angle of inclination and the strategic arrangement of four propellers positioned at its frame's corners. These propellers operate with independent control over their speed and direction of rotation, ensuring stability and maneuverability. In a traditional quadrotor configuration, all four rotors are evenly spaced from each other. To maintain equilibrium, one set of rotors rotates clockwise, while the other rotates counterclockwise. Elevating the quadcopter (hovering) necessitates all rotors to run at a high speed. Variations in rotor speed enable the drone to move forward, backward, and side-to-side. Generating adequate upward thrust, typically achieved through the propellers, is essential for lifting the vehicle against gravitational forces [6]. The Fig. 2 gives the block-diagram of the proposed drone system that is developed.

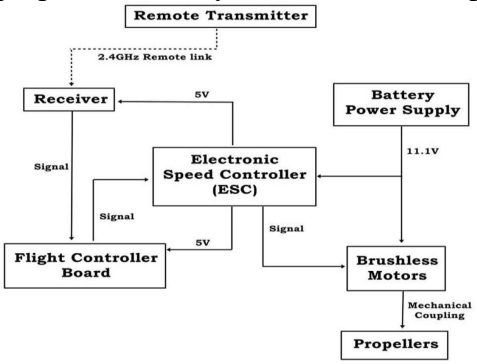

Fig. 2 : Block-diagram of the proposed drone system that is developed

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Conclusions

The primary objective of this project was to construct a drone entirely from scratch. The control system for the drone involves a 2.4 GHz radio frequency transmitter, receiver, microcontroller, electronic speed controller, brushless DC motor, and servo motor. The successful operation of the drone is demonstrated, highlighting its functionality. There exist numerous scenarios where human surveillance can be perilous due to extreme conditions like harsh temperatures and high-altitude tasks. Unfortunately, lives are often at risk in such situations. The proposed solution to this issue involves the use of a remote-controlled aerial vehicle for surveillance. This project's primary application lies in military and defense, particularly in border security, where it can significantly reduce the risk to human lives by providing vital information to soldiers about potential threats.

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