

Quadcopter Design as an Interdisciplinary Course: A Project Based Teaching Methodology

Mohd. Zubair^{*1}, Yogesh Rohilla², Bhargav P. Pathri³, Tanmoy K. Deb

Department of Mechanical Engineering, Department of Electrical Engineering, Department of Mechanical Engineering,
Department of Civil Engineering, JK Lakshmipat University
Jaipur, India

^{*1}mohd.zubair@jklu.edu.in; ²yogeshrohilla@jklu.edu.in; ³bhargav.pathri@jklu.edu.in; ⁴tanmoy.deb@jklu.edu.in

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ABSTRACT

Current paper explores an innovative approach to teach apprentice students with an objective to develop a quadcopter in the course. The course was delivered by improvising the conventional teaching style and enabling students to learn the concepts while applying them directly into the projects. Firstly, the practical and theoretical knowledge in the area of mechanical and electrical engineering were presented to the students. Subsequently, computer-aided design (CAD) and analysis techniques were introduced. The CAD assembly developed shows various electronics and electrical hardware positioning, wire routing and other mechanical parts. A mechanical CAD model is developed along the centre of gravity under no flight condition. Later, 3D printing technology was utilized to develop the structure of the copter and electrical and electronics components were positioned in the appropriate locations. A software algorithm was then developed to manoeuvre and control the copter from a remote computer. Overall, an active environment has been provided to the students to learn and implement the concepts by carrying out small activities and realize the objective through project-based learning mode.

Quadcopter is an aerial vehicle that come in general family of multi-copter, as shown in Fig. 1. The first working model of quadcopter was developed in 1920 [1, 2]. It is designed based on payload, speed and height of flight [3]. In addition, the knowledge of control theory becomes vital in order to operate the rotors for controlling saw, surge, heave, roll, pitch and yaw motions.

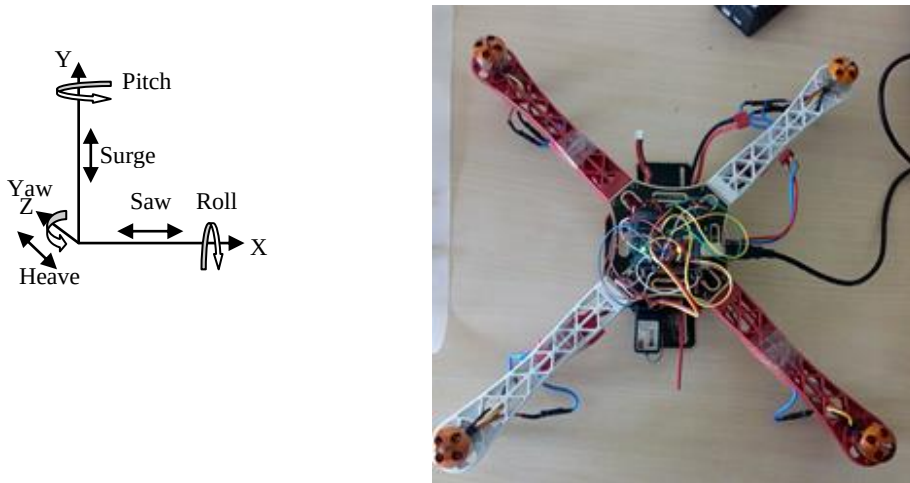


Fig. 1 Coordinate frame used to manoeuvre the inhouse developed quadcopter

The CAD drawings of the quadcopter, fabrication of mechanical parts through 3-D printing and CNC laser cutting process were carried out in Mechanical Engineering Laboratories. Setting up of the electrical connections on the microcontroller, placement of batteries, motors and other parts as well as testing the algorithm and uploading the software programs and setting up communication between transmitter and receiver were accomplished in the Electrical and Electronics Engineering Laboratories. And the outdoor space was used for testing the performance of the quadcopter during flight. In the outdoor space, the experiments on the performance parameters of the quadcopter (i.e. speed of motors, upward lift, suitable height of flight, battery performance, total fly time, forward and backward motion during the flights) were evaluated to manoeuvre it in any specific commanded trajectory.

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