ABSTRACK

Manual inspection of power transmission lines is considered inefficient and has high safety risks, while the use of Unmanned Aerial Vehicle (UAV) drones is hampered by short flight durations, which are only 20 to 30 minutes. This limitation causes significant operational downtime because it requires human intervention for battery replacement. This study aims to design and build an automatic drone battery swap station to improve UAV operational efficiency with the Pulse Width Modulation (PWM) control method on the NEMA17HS4401 stepper motor. The implementation of the tool in this journal only focuses on the mechatronics system for exchanging a mock-up of the DJI Phantom 3 Advanced drone battery. The test results show that after adjustments to the landing gear to reduce friction and vibration, the average battery swap time is 2 minutes 9.7 seconds, slightly faster than the condition without adjustments, which is 2 minutes 23.3 seconds and much faster when compared to the DJI Dock 3 technology, which is 27 minutes with the wireless charging method without the battery swap process. The system is equipped with a camera to detect the orientation of the drone's battery as part of mitigating random landing conditions on the landing pad. It also includes an RCWL-1601 ultrasonic sensor, which detects the drone's presence within a radius of less than 55 cm with an accuracy of 92.48%.

Keywords: *Automatic drone battery swap station, Unmanned Aerial Vehicle, Pulse Width Modulation, mechatronic systems.*