ABSTRACT

In the midst of the growing trend of electric vehicles this year, one of the current focuses of the BRIN is to develop an autonomous three-wheeled electric vehicle. One of the key components of an autonomous electric vehicle is the DC motor, which serves as the propulsion for forward and reverse movement. The main challenge lies in the unstable control process of the Brushless DC Motor (BLDC) for the vehicle's forward and reverse operations. Additionally, there is an issue with the lack of battery capacity readings in the currently used batteries. To address and perfect these issues, an easily operable solution is required.

The primary solution to the main issue involves designing a stable BLDC speed control for the autonomous electric vehicle, both in forward and reverse operations, without load. This system has three modes: slow mode, normal mode, and fast mode. Furthermore, the system can display real-time battery capacity readings on the interface. The designed interface system can control the BLDC motor with various speed options, and it can also display RPM data and the remaining battery capacity.

During the testing of the PID anti-windup BLDC speed control method, it was found that when operated in slow mode forward at *setpoint*s 500 and 2500, normal mode at *setpoint*s 500, 3000, 3500, and 4000, and fast mode at *setpoint*s 500, 2500, 3000, 3500, and 4000, there was an *Overshoot* more than 8%. In slow mode forward, it could only reach a *setpoint* of less than 4000, and in normal mode, it could only reach a *setpoint* of less than 4200. Similarly, when the BLDC motor operated in reverse in slow mode, normal mode, and fast mode, there was also an *Overshoot* of more than 8% at *setpoint* 500. In reverse conditions for slow mode, normal mode, and fast mode, it could not reach a *setpoint* of 2000. Testing the battery percentage readings revealed an accuracy level of 98.26%. The testing of the specifications of the autonomous electric vehicle control system, operable by the user through the interface, showed effective monitoring of BLDC speed, voltage, current, and battery percentage during operation. Therefore, based on these tests, it can be concluded that several specifications of this system are successful and meet the existing needs. However, there are still some shortcomings, such as the *Maximum Overshoot* from some *setpoint*s that is not yet optimal and the unstable readings of current and voltage sensors.

Keywords: BRIN, BLDC, realtime, PID anti-windup, stable, interface