ABSTRACT

The advancement of autonomous electric vehicles demands reliable and secure electronic systems. The Electronic Control Unit for Traction Motor (ECU-TM) is a critical component that is vulnerable to electromagnetic interference and voltage surges, which can disrupt control signals, degrade motor performance, and compromise safety. This study develops an ECU-TM module with enhanced noise reduction and improved safety through the implementation of an isolated power supply.

The methodology involves designing a hardware architecture with galvanic isolation between the low-voltage control circuit and the high-voltage motor power circuit. Additionally, the Printed Circuit Board (PCB) layout is designed using a solid ground plane to minimize loop area and return path impedance.

Test results show a significant reduction in the Coefficient of Variation (CV) and an increase in Signal-to-Noise Ratio (SNR) for key signals: RPM (CV reduced from 141% to 13%, SNR improved from -2.99 dB to 17.59 dB), J3 (CV from 3% to 1%, SNR from 30.33 dB to 44.74 dB), Vmotor (CV from 17% to 1%, SNR from 15.23 dB to 41.58 dB), and current (CV from 16% to 14%, SNR from 16.11 dB to 17.18 dB). This implementation effectively enhances signal integrity and reduces noise, supporting the development of a more reliable and secure control system for autonomous electric vehicles.

Keywords**:** *autonomous electric vehicle, traction motor, ECU-TM, isolated power supply, noise reduction*