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# DEVELOPMENT OF A VEHICLE-LEVEL CAN-BASED LOGGING FRAMEWORK FOR A LOW-VOLTAGE ELECTRIC UNMANNED GROUND VEHICLE

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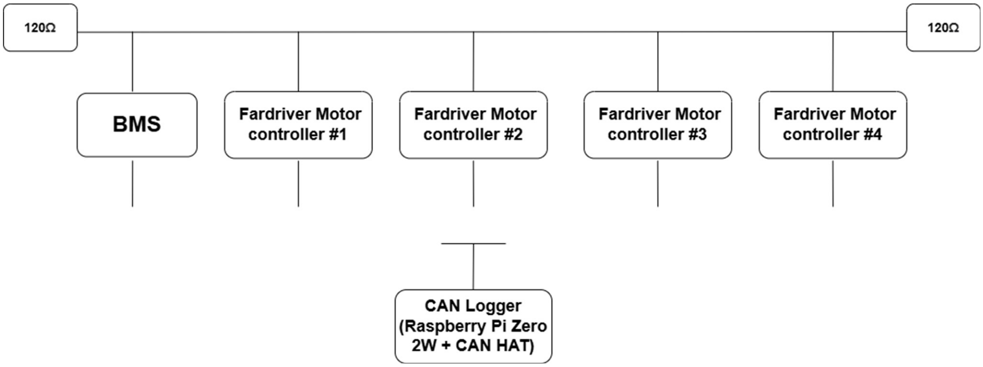
***Abstract*** – Electric unmanned ground vehicles (UGVs) increasingly consist of multiple distributed electronic subsystems responsible for traction control, battery management, and diagnostics. These subsystems typically communicate via the Controller Area Network (CAN), which enables reliable data exchange but also introduces challenges related to data volume, interpretability, and auxiliary energy consumption. Existing CAN-based logging solutions often focus on individual subsystems, most notably the battery management system (BMS), and therefore provide limited insight into vehicle-level operating conditions. This work presents the design and system-level integration of a vehicle-oriented CAN-based logging framework for a low-voltage electric UGV. The target platform is a four-wheel-drive vehicle equipped with hub motors, individual motor controllers, and a low-voltage traction battery, where all subsystems communicate over a shared CAN network with termination at both physical ends. All control subsystems are connected directly to the main bus, while a low-power embedded CAN logger is attached via a short stub and operates as a passive monitoring node. Instead of employing a dedicated vehicle control unit, vehicle operating states are inferred in software using CAN messages originating from the BMS and motor controllers. High-level operating states, including OFF, IDLE, DRIVE, CHARGING, and FAULT, are defined to provide contextual information for the interpretation of energy usage and diagnostic events. The proposed framework introduces a state-aware logging concept in which CAN message selection, decoding, and storage behaviour are adapted according to the inferred vehicle state. The logging architecture distinguishes between raw CAN frame capture, decoded signal storage, and event-based snapshots, enabling selective data acquisition without modifications to the underlying communication network. The framework has been implemented and evaluated in a laboratory environment using real hardware components, including a low-power embedded logging unit and CAN-connected subsystems, allowing verification of data flows, state inference logic, and logging behaviour under representative operating conditions. The results indicate that integrating battery telemetry, traction-related data, and vehicle-level operating context enables a structured and scalable approach to CAN-based diagnostics in low-voltage electric UGV platforms. The proposed framework reduces system-level complexity and provides a solid foundation for extended experimental validation, energy efficiency analysis, fault diagnostics, and data-driven control strategy development.

***Keywords – Embedded monitoring systems; energy usage analysis; state-aware data acquisition; subsystem telemetry***




Physical CAN bus topology of the UGV logging system

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