48V LEAD ACID BATTERY CHARGING MONITORING SYSTEM ON ELECTRIC WHEELBARROW

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ABSTRACT

This study aims to design an offline monitoring system for the 48V Lead-Acid battery charging process of an electric wheelbarrow, providing real-time visualization of charging current, voltage, and power (Watts) without an internet connection. The system utilizes a multi-microcontroller architecture, combining an ESP32 NodeMCU (Master Node)—which reads data from a PZEM-017 DC sensor via an RS485-to-TTL converter—with an Arduino Uno R3 (Slave Node) that displays graphs on a 2.4-inch TFT LCD screen via UART serial communication. Instrument performance testing was conducted offline over a three-hour period with 15-minute sampling intervals. The results demonstrate excellent accuracy, with an average voltage reading error of 0.09% compared to a digital multimeter and a current reading error of 8.79% compared to a standard clamp meter. The system successfully captured the initial "Bulk Charge" phase, recording a maximum power intake of 91.53 Watts. Upon reaching 100% capacity, the voltage stabilized at a float voltage of 54.53V, and the current automatically dropped to 0.03A. This offline instrument proved to be more precise than conventional IoT-based systems (which exhibit a voltage error of 0.47%) and demonstrated *reliable local data transmission stability without the risk of packet loss.*

Keywords*: Electric Wheelbarrow, Offline Monitoring, Charging Power, PZEM-017 Sensor, Bulk Charge.*