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Abstract

A system that combines the advantage of the long-range (LoRa) communication method and the structural characteristics of a mesh network for an LoRa mesh network-based wireless electrical load tracking system is proposed. The system demonstrates considerable potential in reducing data loss due to environmental factors in far-field wireless energy monitoring. The proposed system can automatically control the function of each node by confirming the data source and eventually adjust the system structure according to real-time monitoring data without manual intervention. To further improve the sustainability of the system in outdoor environments, a standby equipment is designed to automatically ensure the normal operation of the system when the hardware of the base station fails. Our system is based on the Arduino board, which lowers the production cost and provides a simple manufacturing process. After conducting a long-term monitoring of a near-field smart manufacturing process in South Korea and the far-field energy consumption of rural households in Tanzania, we have proven that the system can be implemented in most regions, neither confined to a specific geographic location nor limited by the development of local infrastructure. This system comprises a smart framework that improves the quality of energy monitoring. Finally, the proposed big-data-technology-based power supply policy offers a new approach for prolonging the power supply time of off-grid power plants, thereby providing a guideline for more rural areas with limited power sources to utilize uninterrupted electricity.