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"LIVESTAQSENS": AI-Calibrated Network of CH_4 and NH_3 Sensors for Monitoring Air Quality in Livestock Farming

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Intensive livestock farming, with high animal density, is widely used to meet the growing demand for meat but negatively impacts air, water, soil, climate, and biodiversity. Ammonia (NH_3) and methane (CH_4) are the main air pollutants, and farmers are adopting strategies to reduce their emissions. This requires continuous, widespread monitoring using reliable, low-cost devices. However, conventional systems are often expensive and require specialized maintenance, discouraging regular use.

This work, along with the LivestAQsens project (Emilia-Romagna PR-FESR 2021-2027 project –Website: www.livestaqsens.it), aims to create a monitoring network using MOX chemical sensors for CH_4 and NH_3, supported by self-calibrating algorithms. MOX sensors are fabricated using screen-printing technology and chemical wet synthesis, ensuring compact size, low cost, and ease of use. The network's core consists of an array of five thick-film gas sensors, optimized for livestock environments, housed in a small unit with dedicated electronics and a main control unit for data transfer via Wi-Fi. Data, including temperature and humidity, are sent to a remote server in real-time. Calibration algorithms based on machine learning ensure accurate, reliable monitoring, adjusting sensor calibration dynamically based on environmental conditions. This solution supports effective strategies to reduce the environmental and climate impacts of livestock farming.

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