EcoSense-CH4: Using Mobile Technology to Monitor Methane Emission for Sustainable Environmental Management

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Worldwide, food waste is a major contributor to methane emissions, a potent greenhouse gas, creating an urgent need for sustainable, decentralized energy technologies. EcoSense-CH4 is a small-scale, IoT-enabled biodigester designed with a Biodigester Monitor App that continuously collects and analyzes real-time data on methane concentration, internal pressure, and temperature. Two substrate configurations were evaluated: cow manure alone and a mixture of cow manure with food waste. Methane production was quantified using inflatable gas collection containers, complemented by continuous sensor telemetry across two digestion cycles. Results demonstrated that co-digestion with food waste increased methane yield, maintained stable temperatures, and ensured safe operating pressures. Real-time IoT monitoring confirmed consistent anaerobic conditions, validating system reliability, safety, and operational efficiency. These findings support the hypothesis that integrating food waste with cow manure enhances microbial activity, optimizes biogas output, and enables precise process control. EcoSense-CH4 exemplifies how combining anaerobic digestion with IoT and sensor technologies provides a scalable, technology-driven solution for renewable energy generation and organic waste valorization. Future work will explore automated feeding, extended sensor arrays to further enhance efficiency. Overall, EcoSense-CH4 demonstrates the potential of technology-enhanced small-scale biodigesters to convert household organic waste into renewable energy, reduce landfill accumulation, and deliver data-driven, resilient energy solutions for communities worldwide.

Awards Won: