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UMV (Unmanned Vehicle) for Gas Leakage Detection for Industrial Application and Underground Mining

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Abstract: *The increasing demand for safety and efficiency in industrial and underground mining operations has led to the exploration of advanced technologies for gas leakage detection. Unmanned Vehicles (UMVs), including Unmanned Aerial Vehicles (UAVs), Unmanned Ground Vehicles (UGVs), and in some cases, Autonomous Underwater Vehicles (AUVs), are emerging as effective solutions for real-time, remote gas monitoring. These vehicles are equipped with a range of gas sensors, such as infrared (IR), electrochemical, and photoionization detectors, which can detect hazardous gases like methane, hydrogen sulfide, carbon monoxide, and volatile organic compounds (VOCs) in various environments.*

In industrial applications, UAVs can rapidly survey large-scale facilities, including refineries, chemical plants, and storage tanks, identifying potential gas leaks with high efficiency and minimal human exposure to dangerous conditions. Similarly, in underground mining, UGVs are deployed to monitor gas concentrations in confined and hazardous mine tunnels, detecting harmful gases like methane and carbon monoxide, which pose significant risks of explosions and health hazards. These vehicles can enhance safety by providing real-time data to operators, enabling quick response actions to prevent disasters.

By integrating advanced sensor technologies with AI-driven data analysis, UMVs offer predictive capabilities that can foresee gas leak incidents before they escalate, optimizing maintenance and ventilation systems. Despite challenges such as limited battery life, environmental sensitivity, and regulatory constraints, the use of UMVs for gas leakage detection represents a significant advancement in enhancing workplace safety, operational efficiency, and environmental protection in both industrial and underground mining sectors. This paper explores the potential, technologies, and challenges of deploying UMVs for gas detection, outlining their applications, advantages, and future outlook..

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