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# Real-Time Monitoring of Gas Station underground Fuel Tanks Using IoT Technology

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The management of underground fuel storage in gas stations presents significant challenges, including imprecise level measurements, the absence of real-time monitoring capabilities, and potential safety hazards. Contemporary solutions predominantly rely on manual or rudimentary automated systems, lacking comprehensive data integration. This paper introduces an innovative Internet of Things (IoT) based Real-Time Monitoring of Gas Station Underground Fuel tanks designed to address these critical issues. The proposed system integrates advanced sensing technologies: the HRXL MaxSonar WRIST ultrasonic sensor for fuel level detection, BMP280 for pressure monitoring, and DS18B20 for temperature measurement orchestrated by an ESP32 Devkit V1 microcontroller. This configuration enables high-precision, real-time monitoring of tank conditions. The primary innovation lies in the seamless integration of these components with a cloud-based data management system, utilising Wi-Fi technology for real-time data transmission to a Firebase database. To mitigate connectivity challenges in diverse operational environments, a dual-storage approach has been implemented: cloud-based storage for immediate data access and local SD card storage as a failsafe mechanism. This design ensures continuous data collection and integrity in areas characterised by unreliable network coverage. The methodologies involved gathering insights through interviews with professionals and management in the fuel station industry to ensure practical relevance and system efficacy. The system encompasses custom firmware development, the creation of an intuitive web-based interface, and rigorous testing in simulated environments. This study contributes significantly to the digitization and modernization of fuel station operations, enhancing safety protocols, mitigating environmental risks, and optimising inventory management processes.

**Keywords**: *Internet of Things, gas station, monitoring system, underground fuel tank*