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LEVERAGING HIGH-ALTITUDE BALLOONS AND MOBILE ROBOTICS FOR REAL-TIME WILDFIRE DETECTION AND MONITORING SYSTEMS

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Due to climate change, wildfires are becoming more frequent and severe in various regions worldwide, stressing the importance of enhancing wildfire research technologies and improving wildfire management infrastructures. In that sense, enhanced fire intelligence plays a pivotal role through the emergence of advanced technologies for early detection and real-time monitoring purposes, to allow a deeper understanding of these phenomena and enable better situational awareness for operational teams.

The evolution of remote sensing technologies have led to the development of monitoring systems using satellite-based information to forecast fire hazards and allow risk assessment. Nevertheless, while providing global coverage, the latency and spatiotemporal resolution of current satellite solutions are still a roadblock for an application as time-sensitive and safety-critical as wildfire detection and monitoring.

To address this issue, this work proposes an integrated system based on satellite and sensor networks data to assist in early detection and monitoring of fire events. The system combines static sensors on the ground and dynamic sensors onboard mobile aerial platforms e.g. drones and high-altitude balloons (HABs), that can be deployed to monitor areas of high risk. The decentralized, multimodal and dynamic nature of the proposed system enables its deployment in target regions in specific time-windows where there are forecasts of increased fire risk.

The proposed system combines static and dynamic sensors, providing multiple layers of perception of the environment. Ground sensors provide local data from identified fire risk regions, whereas robots empowered with advanced perception systems can deliver extensive area coverage through its high mobility. Aerial platforms e.g. drones and HABs leverage the ability of combining both remote sensing and *in situ* measurement capabilities, providing a versatile solution for Earth observation and scientific sampling.

The proposed approach aims to contribute to the development of the next generation of resilient environmental monitoring infrastructures. Bringing novel observation capabilities to address wildfire events in research and operational applications, which can help to minimize the impacts of these phenomena.