MASTER'S THESIS

Interactive Real-Time Mapping System for Forest Fire Monitoring and UAV Control

ABSTRACT BOOKLET

Abstract

Interactive Real-Time Mapping System for Forest Fire Monitoring and UAV Control
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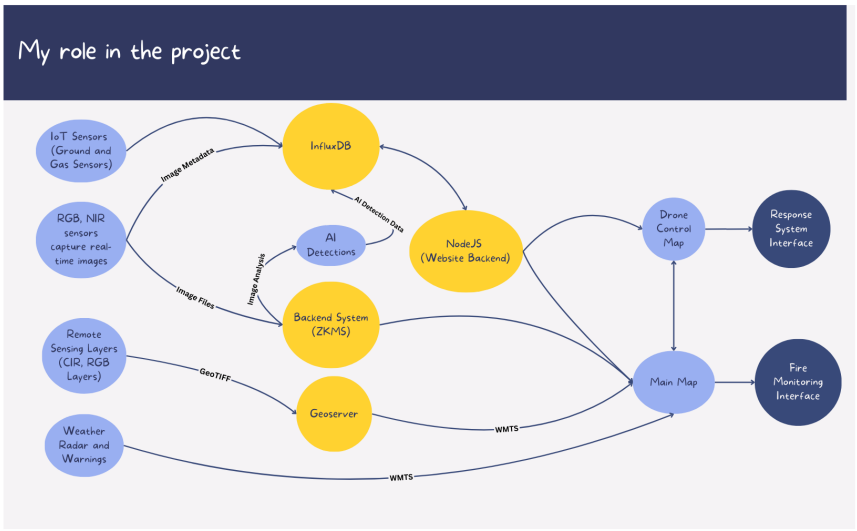
For my master's thesis, I focused on developing an Interactive Real-Time Mapping System for Forest Fire Monitoring and UAV Control. This comprehensive system integrates advanced technologies for real-time monitoring and management of forest fire disasters, building on research by Kanand et al. (2020) regarding wildfire detection and sensor fusion technologies. Utilizing remote sensing, Internet of Things (IoT) sensors, and geospatial mapping, the project aims to mitigate the devastating effects of forest fires.
Data gathered from RGB and near-infrared (NIR) sensors, ground-based IoT devices, AI-based fire detections, and weather radars are processed through a backend system (ZKMS) and Geoserver. My role focuses on integrating these diverse datasets into the Leaflet maps using JavaScript. This involves dynamically overlaying CIR and RGB imagery, thermal detection gradients, and real-time sensor data to create highly interactive and informative geospatial visualizations. By implementing custom JavaScript code, I ensure the map layers effectively convey actionable information, such as areas of high fire or smoke detection intensity, real-time weather patterns, and UAV flight paths (Allen et al., 2016).

KEYWORDS: Forest Fire Monitoring, Real-Time Response System, Remote Sensing, IoT Sensors (Internet of Things), leaflet maps, UAV (Unmanned Aerial Vehicles), ROI(Region of Interest), Geoserver.



These dynamic visualizations empower operators with tools for rapid decision-making and response. For example, interactive map features allow users to explore data from three monitoring stations—Brand, Rietschen, and Podrosche—that capture 360-degree real-time images. My work ensures these images are precisely positioned on the map, updating dynamically based on the current heading of interest. The thermal overlay, achieved through gradient-based visualization, highlights fire and smoke intensities, transitioning from green to red to indicate severity (DLR, 2019).
Additionally, I contribute to integrating drone control interfaces into the map, enabling seamless UAV deployment for reconnaissance and response. Operators can issue commands such as "fly to," "circle," or "ROI" (Region of Interest) through the map interface, which I develop using JavaScript with WebSocket to synchronize real-time data with drone navigation. By bridging geospatial mapping with real-time monitoring and response, the system delivers a transformative solution for proactive forest fire management, safeguarding ecosystems and communities from wildfire threats (König, 2020; Remote Sensing Solutions).

References

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