

AIDERS: An Integrated Multi-UAV Platform for Disaster Management

Demonstration Track

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ABSTRACT

Effective disaster response relies on the timely integration and analysis of dynamic data, as early insights improve decision-making and resource allocation. Unmanned aerial vehicles (UAVs) enhance situational awareness by providing real-time aerial surveillance to first responders. This work presents the AIDERS platform, a multi-UAV system designed to support both real-world and simulated UAV operations for disaster management. The platform enables collaborative autonomous UAV missions, allowing multiple UAVs to navigate and survey affected areas while streaming live video for real-time detection of people, objects, and disaster-related damage. In addition, AIDERS facilitates seamless connectivity with mobile and IoT devices to support coordinated response efforts.

KEYWORDS

UAVs; Multi-agent Systems; Micro-services; Disaster Management

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1 INTRODUCTION

The ability to make rapid and accurate decisions is critical in disaster response to save lives and reduce damage. Traditional disaster management systems primarily depend on ground-based emergency response for situational assessment. However, post-disaster conditions often restrict ground access, significantly hindering the effectiveness of first responders [3]. On the other hand, UAVs play a

crucial role in disaster response by enabling rapid situational awareness and survivor detection equipped with advanced imaging and sensing capabilities [1]. Their ability to operate in environments with limited ground access allows rescue teams to coordinate response efficiently. Hence, multi-UAV platforms help first responder units overcome the limitations of manual UAV operation by enabling coordinated, simultaneous tasks. Accordingly, the primary contribution of this work is to develop a multi-UAV platform aimed at supporting emergency response teams across all phases of the disaster management lifecycle. The platform provides functionalities including real-time monitoring through onboard sensors, live video streaming with real-time analytics from multiple UAVs, and mission planning supported by advanced multi-agent algorithms.

2 THE AIDERS PLATFORM

2.1 Design and Development

The AIDERS platform [4] is a web-based system designed to support multi-UAV deployments in disaster management scenarios, by leveraging the technologies summarized in Table 1. Communication between UAVs and the platform is managed through the AIDERS Android mobile application, which provides seamless connectivity and control for DJI UAVs. In addition, the platform supports any UAV compatible with the MAVLink communication protocol. An NGINX server handles user requests and WebSocket connections, ensuring real-time telemetry exchange and keeping the system synchronized across all devices. Persistent data storage is maintained via a MySQL relational database, while a dedicated offline map server supports spatial visualization for mission planning and analysis.

The platform leverages Docker-based containerization to achieve scalability and simplified deployment, ensuring reliable performance through a modular architecture. The proposed system’s code is included at <https://code> with a demo video link <https://aiders>.

2.2 Web and Mobile Applications

The execution of the platform is managed by a centralized system launcher, which serves as the primary control mechanism to start



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Table 1: Technology stack of the development environment of the platform

Tier	Technology Stack
Front-end	HTML, CSS, JavaScript
Back-end	Python-based Django, Go
Database	MySQL
Mobile Application	Android and DJI Mobile SDK
Computer Vision	Python-based models

and stop the platform’s various services. Once initialized, the front-end provides an map-based interface for real-time UAV monitoring and control as illustrated in Figure 1. This dashboard centralizes the display of real-time telemetry, mission planning, and live-stream capture. Also, UAV camera footprints are calculated and visualized based on the position, altitude, heading and the gimbal angle to facilitate field of view (FoV). The AIDERS Android mobile app secures the authorization through the DJI Mobile SDK [2] to establish a direct connection with the UAV. Following a successful link, the mobile app initializes a WebSocket connection with the platform using a unique UAV identifier, and an RTMP live stream which is captured for real-time object detection, crowd localization and disaster classification.

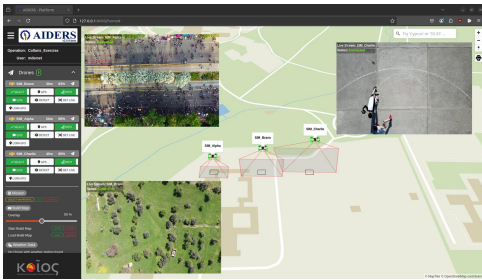


Figure 1: AIDERS platform dashboard showing UAV telemetry, and live video feed

2.3 Flight Planning

The platform supports both point-to-point and multi-agent grid missions tailored for search and rescue operations, based on configurable mission parameters and algorithms. Figure 2 illustrates how the platform enhances search and rescue operations by executing grid missions. In addition to UAV integration, the platform enables connectivity with mobile and IoT devices, allowing telemetry data and images from these sources to be visualized within the system.

2.4 Integrated Algorithms

The computer vision detection module incorporates Artificial Intelligence (AI) models specifically designed for disaster response applications. It supports crowd localization and object detection using an HRNet segmentation model [7], disaster classification through EfficientNetB0 [6], and high-precision object identification via the WALDO model [5]. As illustrated in Figure 3, the computer

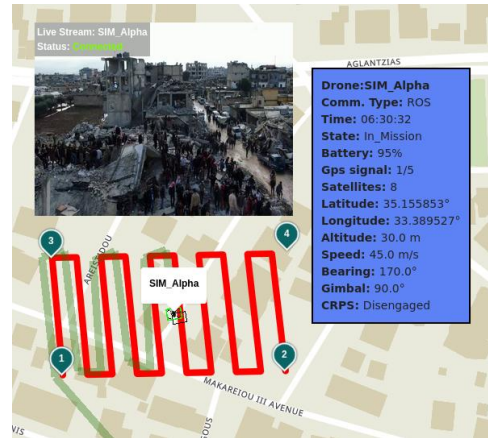


Figure 2: Grid mission planning in the AIDERS platform for search and rescue operation

vision detection pipeline enables simultaneous crowd localization and disaster classification, allowing search and rescue teams to identify high-density areas and assess disaster types in real time. The platform also integrates predictive algorithms for fire spread modeling. Furthermore, the AIDERS platform supports real-time mosaic mapping, and offline orthophoto and 3D model generation.



Figure 3: Computer vision-based detection in the AIDERS platform.

3 CONCLUSION

This work presented AIDERS, a multi-UAV platform designed for disaster management that supports real-time monitoring, situational awareness, and post-disaster mapping. The platform enables resource management, collaborative mission planning, live video streaming, and computer vision-based object detection. Its robust simulation capabilities allow extensive testing and validation in virtual environments before real-world deployment.

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