

Development of Disaster Reconnaissance Operating Platform for Earthquake Emergency Response

Wei-Choung Cheng, Chun-Yi Lin, Chieh-Min Ho, and Chiun-Lin Wu

National Center for Research on Earthquake Engineering, Taiwan

The on-site disaster reconnaissance is a critical component of the post-earthquake response operations conducted by National Center for Research on Earthquake Engineering (NCREE). When a disaster reconnaissance task is activated, the disaster reconnaissance action team assists in making decisions and organizes a dedicated reconnaissance team. This team prepares comprehensively for subsequent on-site disaster reconnaissance. For the purpose of effectively collecting early on-site earthquake disaster information during emergency disaster reconnaissance, so that it can be used for subsequent disaster research and judgment and further response decisions, NCREE's earthquake emergency response organization has continuously focused on establishing and rehearsing the disaster reconnaissance data collection and management mechanism to enhance reconnaissance operations over the years.

To leverage the widespread adoption of smart devices and mobile communication, and to ensure that information discovered by disaster reconnaissance teams in the field is rapidly reflected in emergency response meeting, NCREE has planned and developed a network-based disaster reconnaissance operating platform. Beyond providing an adequate visualized interface for subsequent decision-making, the platform aims to offer automated and standardized support for disaster reconnaissance operations. It facilitates rapid collection of disaster information, including common investigation forms, photos and video clips during the emergency response operation. The design of the platform also considers the practical operational context of disaster reconnaissance, providing flexibility in processes, including communication capabilities and variable media sources.

This platform comprises three main components. The first part consists of the disaster investigation tools, including both web-based applications and mobile device apps (available for both iOS and Android). Investigators of reconnaissance teams carry mobile devices to the field and use these tools to collect the disaster information. According to the investigator's group, the investigation tool provides specific forms for investigators to fill out, along with coordinates, photos, and videos to compose each reconnaissance form. Under conditions of internet connectivity, the data is transmitted back to the reconnaissance database at NCREE when available. The second part is the disaster investigation support management system. Support teams utilize this system to manage the reconnaissance task, dispatch team authentication information and review data collected by the reconnaissance teams promptly to ensure accuracy. Lastly, the disaster investigation WebGIS allows reviewed data to be published and visualized on the maps, providing essential information for earthquake emergency response and decision-making. The system architecture of this platform is depicted in Figure 1.

The initial development and testing of the platform was completed in 2023. The earthquake occurred in Hualien on April 3, 2024 was the first event this operating platform is used for NCREE earthquake emergency response. NCREE reconnaissance and support teams utilized this platform as planned. The disaster information resulting from this earthquake was collected and presented, as shown in Figure 2. At this stage, the initial development of the disaster reconnaissance operation platform focuses on the automation requirements of the emergency disaster reconnaissance operation. NCREE plans to continually review and enhance the functions of each subsystem through reconnaissance drills. Anticipated developments in the next stage include: First, providing the reviewed disaster information and assessments via a public website to meet the public's demand for disaster information. Second, integrating with 3D GIS or other advanced visualization technologies to offer a set of application programming interfaces (APIs) for various disaster management applications. Third, expanding the capabilities of the disaster investigation tools to address the needs of subsequent earthquake engineering research, including detailed collection and compilation of information on various types of disaster damage.

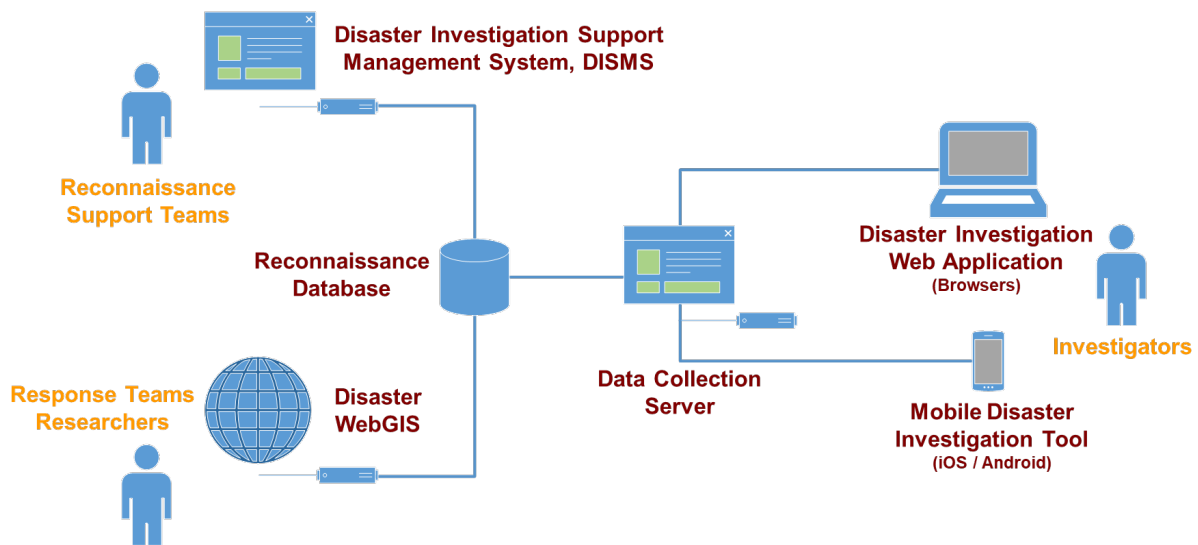


Figure 1. System architecture of the disaster reconnaissance operating platform.

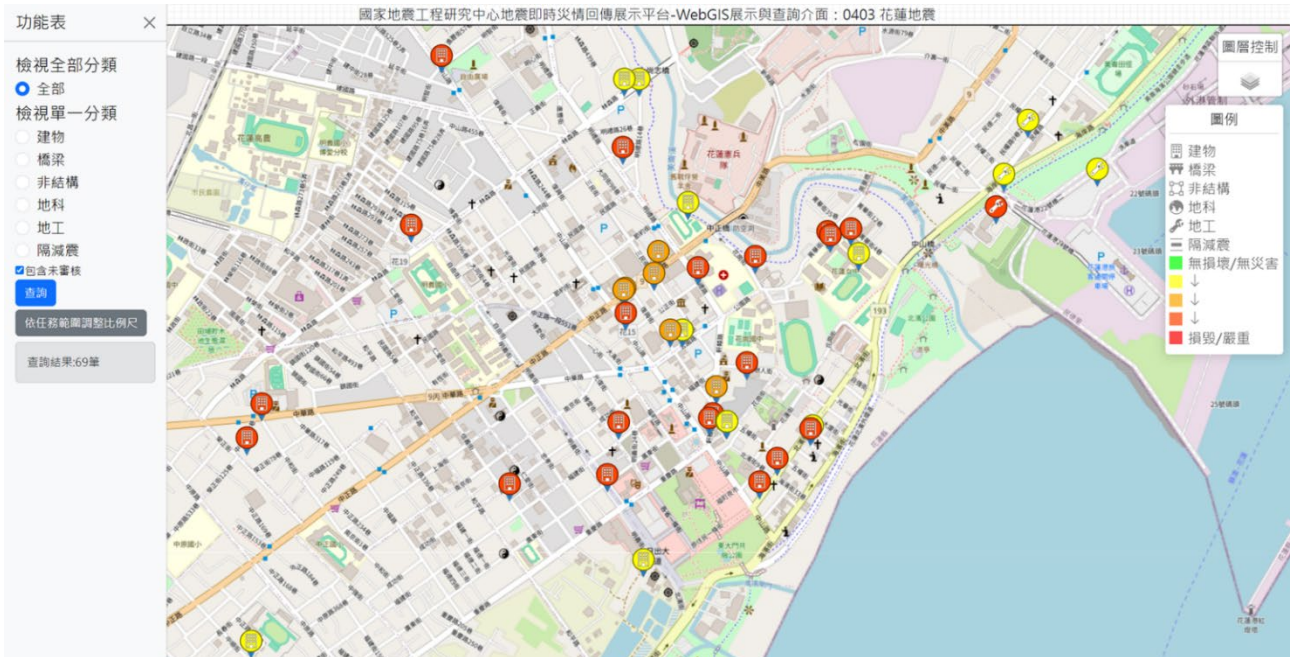


Figure 2. Map with information collected during reconnaissance of 2024 Hualien earthquake.

REFERENCES

- Lin, C. H., Lin, C. M., Chou, C. C., & Wu, C. L. (2024, June 30th – July 5th). *NCREE Post-Earthquake Response Program and Lessons Learned from Past Earthquakes in Taiwan*. 18th World Conference on Earthquake Engineering, Milan, Italy.