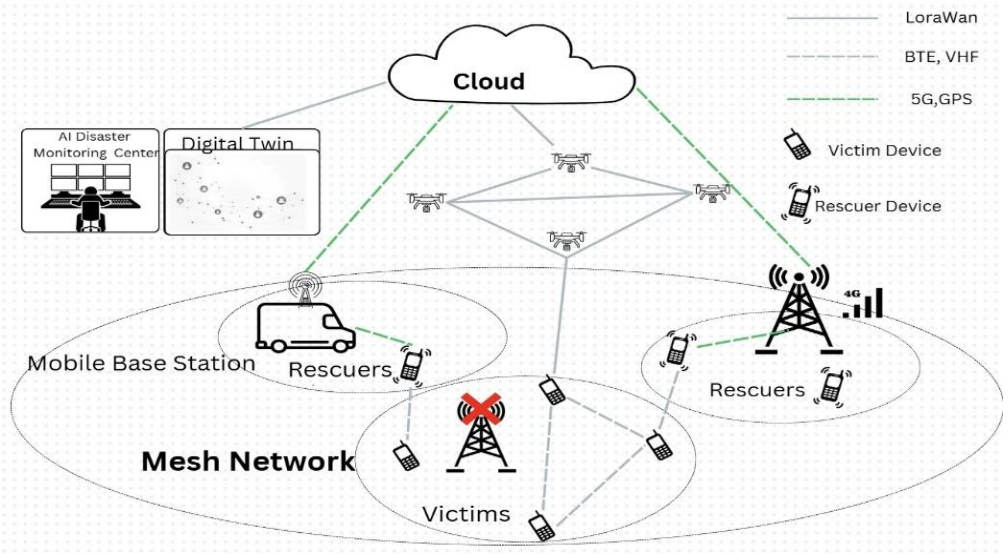
TwinSR-AI: An AI-powered Search and Rescue Platform for Disaster Victims Leveraging Opportunistic Mesh Networks and Digital Twins

ASEAN IVO 2026

Natural disasters such as landslides and floods frequently disrupt communications infrastructure and alter terrain of affected areas. Rescue and relief operations become an urgent demand, while conventional positioning and communication solutions are largely ineffective. Rapidly locating and accurately identifying victims within the critical window of opportunity remains a major challenge, requiring advanced technological solutions to increase survival chances and minimize double risks.

This project proposes a next-generation search and rescue framework integrating multi-mode IoT devices, opportunistic mesh networks, AI-based analysis, and a real-time Digital Twin. Victim IoT devices transmit multi-mode signals and form together with rescue devices, drones, and mobile base stations an opportunistic mesh network to relay rescue signals to reachable communication points. AI-enabled edge nodes analyze the received signals to predict victim locations and survival status, while the Digital Twin provides a dynamic virtual representation of the disaster area to support optimal rescue decisions. The expected outcome is a comprehensive prototype combining IoT, AI, and Digital Twin to significantly shorten search and localization time. The proposed platform provides a foundation for future research in disaster response and cyber–physical systems as well as enhances public safety by improving search and rescue effectiveness in disaster-prone communities.



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