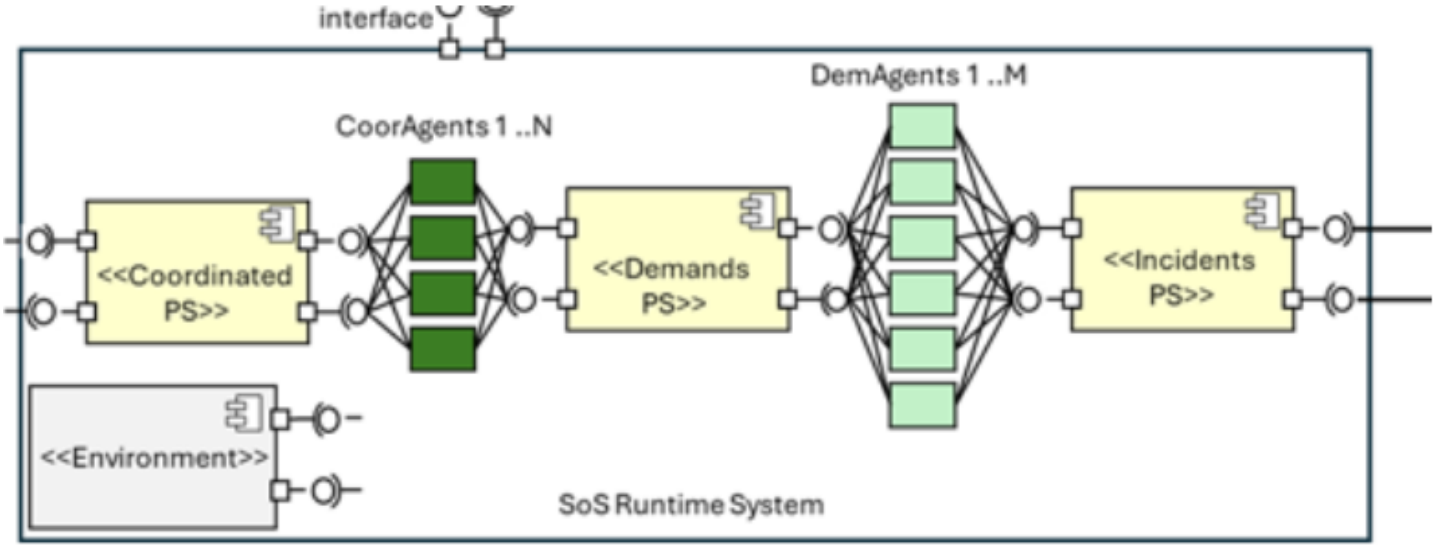
Digitalizing Disaster Management System Through Digital Twins

Traditional response operation of Disaster Management activities often face critical delays. In many current frameworks, the transition from an incident occurring to a physical response being executed can take days due to hierarchical reporting and registration. Recent insights from **Prof. Dr. Ir. Mehmet Aksit** and **Seher Turan** highlight that digitalization is no longer optional — it is a necessity. By implementing a **Systems-of-Systems** architecture, we can shift from slow, human-centric reporting to an agile, automated pipeline that saves lives when every second counts. The core of these technological lies in **Digital Twin (DT)** technology.

These digital replicas allow for a three-tiered approach to safety: **Descriptive twins** monitor current real-time bottlenecks; **Predictive Digital Twins** simulate various disaster scenarios to anticipate failures; and **Prescriptive Digital twins** recommend the best resource allocation. Research indicates that integrating these smart infrastructures can reduce queue waiting times by over **70%**, drastically increasing the speed and efficiency of life-saving interventions in urban environments. To further refine accuracy, the introduction of **Cooperative Agents**—DemAgents and CoorAgents—automates the conversion of raw incident reports into precise resource demands. Using several combination of **fuzzy logic** and **machine learning**, these agents reconcile conflicting data from multiple sources to ensure ground teams receive reliable instructions. As we modernize the relevant disaster management system infrastructure, this digital shift offers a scalable, resilient and data driven foundation for managing the increasing complexities of modern-day disasters.



The CoorAgents and DemAgents component

Contact us at: 22001492@siswa.um.edu.my, 23063593@siswa.um.edu.my, rjry@um.edu.my

Digital Disaster Management Workshop

Muhammad Syukri Othman,
Dept. SE FCSIT, UM
Khairul Anam Amat Sidiq,
Dept. SE FCSIT, UM
Raja Jamilah Raja Yusof,
Dept. SE FCSIT, UM,
WADDEM, WIE Malaysia

Discussion of Digital Disaster Management

A workshop discussing the importance of digitization of disaster management was held on the 27 April 2026 at the Faculty of Computer Science and Information Technology (FCSIT). It involved speakers in Malaysia and Turkiye addressing the critical problems. The organization from Turkiye was represented by the the Department of Disaster Management Technologies Working Group, Disaster and Emergency Management Authority (AFAD) Agency, Türkiye. Organization from Malaysia involved was the Universiti Malaya, FCSIT and the Department of Civil Engineering. The first emphasized on the software engineering approach while the latter presented the flood situation in Malaysia, the Civil Engineering approach of solving flood.

Another organization is the Southeast Asia Disaster Prevention Research Initiative (SEADPRI), Institute for Environment and Development of the Universiti Kebangsaan Malaysia. SEADPRI presented the Multi-hazard Platform for Early Warning System for All. Additionally, input was taken from the practioner's point of view, Chief Strategy Officer, Malaysia Emergency Action Force. The event was also a part of World Alliance of Digitalization of Disaster and Emergency Management (WADDEM's) and sponsored by IEEE Women in Engineering (WIE) Malaysia as part of the activity of IEEE Humanitarian Technology initiative.

Distinguished speakers Prof. Dr. Ir. Mehmet Aksit and Seher Turan alongside participants following the insightful session on Digitalization in Disaster Management