FASTER NEWSLETTER
#5

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FASTER TRIAL ACTIVITIES

"FASTER has entered the final phase of its lifecycle where the tools and achievements will be validated."

The project foresees three trials and three final demonstrations, hosted by end users in complex training environments, following realistic and challenging scenarios. The demonstrations are designed to test whether the tools can achieve the goal of increasing first responder safety and efficiency. Letting first responders use the tools and encouraging critical and constructive feedback, allowed technical partners to fine-tune their development according to end user needs and wishes, and this way to increase the likelihood that end users will adopt the tools after the project ends.

Despite the COVID-19 pandemic restrictions, the first round of pilots has been completed in March 2021 and 7 additional piloting events were planned to overcome the travel limitation and let all end-user test the tools.

During the last six months 5 of the above extra pilots have been carried on in Portugal, Japan, Spain, Greece and France and the next will be in Japan (February 2022) and Poland (March 2022).

The final demonstrations will be carried out according to the next plan:

- Italy: January 2022
- Finland: March 2022
- Spain: April 2022

In January 2022 in Italy will be carried on one of the final demostrations of the FASTER project

In March 2022 in Finland will be carried on one of the final demostrations of the FASTER project

In Apri 2022 in Spain will be carried on one of the final demostrations of the FASTER project

2ND GREEK EXTRA PILOT

Image from the Greek pilot, october 2021

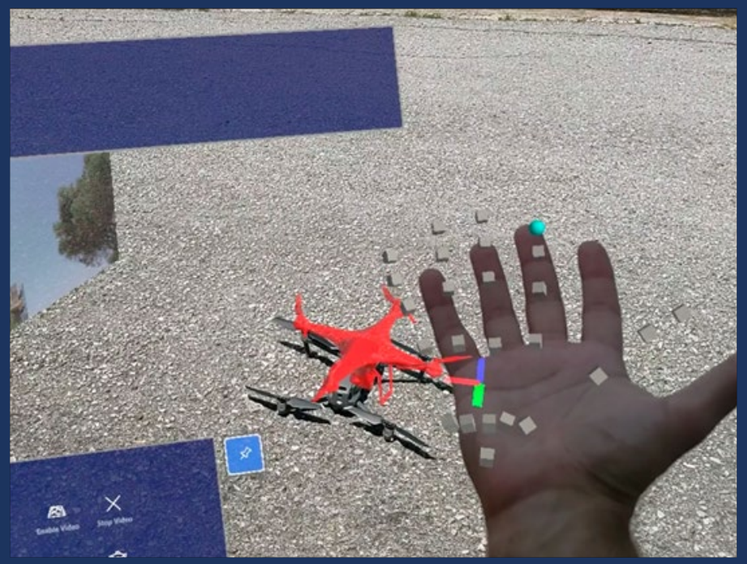


Image 1.1: UAV Gesture Control and Extended Vision

On October 21-22, 2021, the second phase of the Greek mini pilot took place at the Afidnes Training Center (ATC) of HRTA in Athens, Greece. The purpose of this field activity was to demonstrate the project's technologies demonstrations and conduct field tests in realistic operational conditions during Urban Search and Rescue (USAR) deployments of First Responder (FR) teams.

The agenda and overall planning were based on on tool-specific use cases and also on multi-use cases scenarios. All use cases, as well as their grouping into scenarios, were considered primarily based on a few critical factors and constraints, e.g., if there is Internet access or not, if the activity is to take place indoors or outdoors, etc. In some cases, combination of several toolkit components is mandatory, for example interaction of FR via the FASTER "Portable Control Centre (PCC) developed by ENG with various other components.

Tools

UAV Gesture Control and Extended Vision (developed by CERTH)

UAV Gesture Control and Extended Vision is a complete, innovative solution for intuitive, easy piloting and enhanced situational awareness. It is deployed on the HoloLens 2 augmented reality headset. Utilizing the HoloLens's hand-tracking capabilities, a drone pilot can control the drone using simple gestures. Right-hand gestures are used for navigation, while left-hand gestures can be used to control the camera. Gestures are designed to be easy to learn and intuitive, with the drone following the rotation, pitch, tilt, and lateral motions of the user's hand.

Extended Vision also includes tracking the drone in real-time and displaying its position in AR, a useful feature when the operator loses line of sight with the drone, or when the drone is hard to discern due to distance.

All the while, the user's hands remain free, as there is no need for a handheld remote controller [photo 1.1].

• UAV Mapping (developed by CERTH)

Although FRs deployed in an area have access to digital maps constructed by satellite imagery, these do not reflect very recent changes, such as damaged infrastructure, road blockages, stationary vehicles and possible victims. Moreover, satellite images have, due to distance, much lower resolution than a drone flying at low or medium altitude. UAV Mapping is a helpful tool developed in the FASTER project to provide an accurate, high-resolution, up-to-date map of an area of interest.

Mapping is fully integrated into the PCC: an authorized PCC user can request a mapping mission by drawing a rectangular area on the digital map.

When the mission is complete, the drones return to land at their starting location and the collected photos are automatically collected and combined into a detailed map, which is superimposed on the existing offline maps in the PCC. Different mapping options can provide fast 2D mapping, slower 3D reconstructions, and infrared 2D maps, when drones with thermal cameras are available.

The image below shows 2D and thermal mapping on the PCC during the exercise.

Augmented reality for operational support (developed by CS Group)

Enhanced situational awareness is a vital requirement in First Responder operations, as it can increase both their safety, by making them more aware of hazards and exit routes, and their efficiency, by helping them reach a mission objective or rescue a victim. All the above constitute Points of Interest (POI).

The Augmented reality for operational support tool is a HoloLens 2 - based application that assists with navigation and integrates POIs into First Responders' vision, also providing them with an easy means of creating new ones, using gestures or voice commands.

The application tracks the user's location using QR codes and the HoloLens's onboard spatial mapping capabilities. Navigation assistance is provided in the form of a mini map showing the user's location and the surrounding area.

• MORSE (developed by UNIWA)

MORSE (Movement Recognition for first responders) is a system that uses wearables (i.e., smart watches) to capture specific gestures, translate them into predefined messages, and transmit them to both a colleague's wearable device, which vibrates in a pattern unique to each message and deeper in the FASTER cloud to be processed for further situation analysis. A small set of hand gestures (i.e., 5 now), selected to be unlikely to trigger involuntarily, can thus be corresponded to a set of emergency messages to request aid or send a warning, especially in situation where verbal communication is difficult to efficiently perform [photo 1.2].

• ResCuE (developed by UNIWA)

ResCuE boxes (Resilient Communication Equipment) are low-cost, resilient communication relay devices independent from

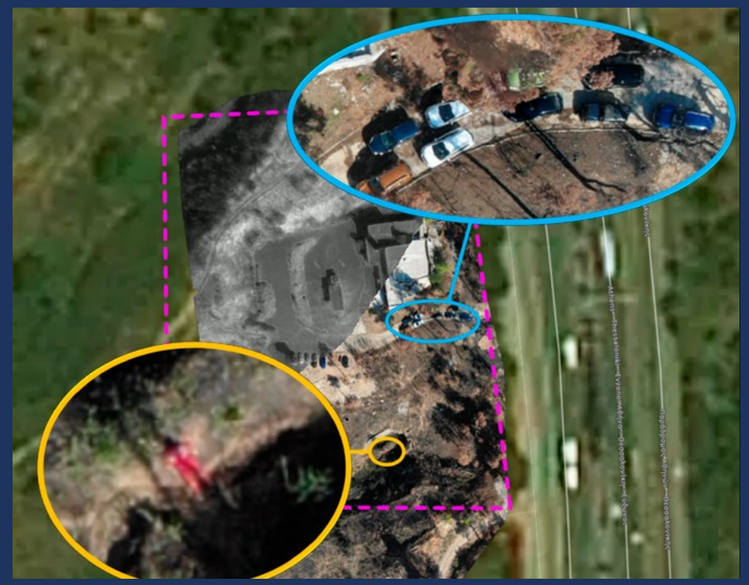


Image 1.2: UAV Mapping

any infrastructure. Each node can communicate with nearby nodes as well as an Android application. A relaying mesh of ResCuE nodes can be used to facilitate communication with team members or victims/ civilians, when conventional telecommunications are unavailable, due to damage or no signal penetration inside buildings or underground.

• Smart Textiles Framework (developed by UNIWA)

The Smart Textiles Framework comprises of a vest with integrated sensors that monitor a First Responder's bio signals (such as heart rate) and an environmental module (integrated with sensors to measure temperature, CO and humidity) that collect and transmit data to the First Responder's smartphone, which will raise an alarm in case of abnormal or dangerous readings. These alerts will, also be delivered in the FASTER cloud and will be processed to raise the situational awareness of the area.

Moreover, an OAI/OPEN5GS implementation, based on the 4G RAN network (developed by OTE and Synelixis), was adopted to ensure the coverage of the area. Both OAI and OPEN5GS are open-source network emulators that are offering, apart from meeting the network requirements, flexibility in design and upgrade and portability. At the same time the network design targeted the creation of a network bubble, exclusively used by first responders [photo 1.3].

Image 1.3: OAI/OPEN5GS implementation

Operation

• Wide area search

Phase 1:

Upon arrival the team leader gathered information from locals, while PCC was set up at the worksite C&C hub. Power grid and the local mobile network were unavailable or highly volatile, due to damages and saturation. Equipment including FASTER tools was prepared for operational tasks. A few minutes later PCC was fully operational and received information given by the field operation leader. First information reported two missing people in the surrounding area, one female and one child (small body shape), as well as others inside the damaged building after the earthquake. The operational leader requested a drone mapping the area of interest, including 2D and thermal components. After a few minutes, the detailed map was available on the PCC, showing the current layout of the area and aiding in the planning of the subsequent ASR2 actions. Of particular interest was the detection of two victims laying on the ground and a line of abandoned cars blocking an exit route.

Phase 2:

Two teams of four FRs (wearing STF) each were assigned to operate in the specific areas with the corresponding equipment, using FASTER tools. During the operation one FR fall in the gorge and asked for help using the MORSE. Assistance was provided to the FR by team members and as there was no major injury the mission continued. One RESCUE device was set up in the location near the gorge in order to provide texts regarding the danger of falling down the gorge slopes (loose ground and gaps after the earthquake). The FR team located the victim, performed preliminary medical assessment and assisted the person moving out of the gorge. For fast and safe extrication, the victim was secured and moved uphill and out of the gorge using rope lines that were set up for this purpose by the FR team. The second team wearing STF was directed uphill where the drone had spotted the second victim, in order to assess the health condition of the person and offer first aid if needed. The team reported that the victim suffered from tibial fractures in both legs and needed immobilization. A stretcher was used for the victim to be transported back to the FR medical tent for further treatment and psychological aid.

• Search around the building and on the ground floor

Phase 1:

The operations continued around and inside the building area. The drone pilot employed UAV Gesture Control and Extended Vision to search the area around the building. The drone was piloted to different locations and put in periscope mode, allowing the pilot to scan in 360 degrees easily and safely. Both FPV and contextualized visualization were employed, to focus on detail or location, respectively. The search located two more victims, one on the 1st floor's porch (rooftop) and the other under the ground floor's eastern porch.

In addition, 3 ResCuE relay nodes were deployed in the area: one inside the ground floor and two on the first floor. ResCuE's mobile application was installed in two smartphones carried by two HRTA members that will participate in the scenarios below.

A First Responder performed ASR2, equipped with ResCuE's mobile application and the HoloLens 2, to see and create AR POI annotations. Pre-known POIs (entrances, exits) were already marked from the PCC, and she continued to create additional ones as she encountered risks (e.g., vertical shafts), stairs, and other objects of interest. The PCC team monitored her location and created annotations. When the victim was located a message was generated through the ResCuE mobile application to the closest ResCuE node, which would initiate the relaying of the message to all the three ResCuE nodes in the area. Eventually the message would reach the mobile phone of the second FR, with the role of operation leader, who in response ordered a rescue unit to retrieve the victim. The victim extraction was successful.

Phase 2:

Moving on the 1st floor, a victim was located unconscious and tagged with the respective AR annotation. Guided by the annotations, an FR team could easily and safely navigate to that Point of Interest while avoiding the marked hazards. Reaching the victim, they set up all necessary equipment, including a stretcher for victim evacuation, while the EMT of the team checked and prepared the victim. The victim was safely carried out of the building by the FR team transferred to the medical tent.

• Search in the basement

Phase 1:

Operations continued with an FR team descending into the northern basement, which was dark and field with smoke. Equipped with the HoloLens but unable to pilot the drone in the confined space, they ingeniously opted to carry it in their hand and project its infrared video feed to the HoloLens in FPV mode, providing them with vision in total darkness. This allowed them to locate an unconscious victim and extract him safely.

Further down the basement, thick reinforced concrete walls and floors prevented all medium/ long-range communications via R/F or WLAN. The FR sent alert signals via MORSE to stop all activities (silence) because there were sounds from possible victims, e.g., from hitting a rock or asking for help. The FR team (wearing STF to monitor the vitals and the environmental conditions) approached the victim and was informed that there was another person trapped and possibly hurt somewhere inside the same area. Thus, two FRs went and by using the thermal camera searched the northern basement. As they were moving, the field operation leader sent an emergency signal by MORSE for immediate evacuation from the building due to an aftershock. Internet access was only partially available around the worksite, so PCC received the information and the emergency message "STOP ALL ACTIVITIES – EVACUATE IMMEDIATELY" was relayed via all possible means of communication (R/F, WLAN, MORSE, RESCUE) to ensure no missed FR reception due to obstacles. All FRs evacuated the building area and rallied to the designated area outside.

Phase 2:

After the clearance to continue activities, the FR team (wearing STF) is re-deployed inside the building to continue the SAR operations. They located the second victim as they searched the southern basement, injured and incapacitated. The victim was trapped under the stairs with debris in front of it. Due to the injury mechanism (possible neck/head/ spine injury) and limited access routes for the stretcher, a message was propagated through ResCuE to initiate the evacuation process. The victim was secured and evacuated horizontally via

one of the windows at the south side of the building, moving it to the FR medical tent for further treatment and psychological aid.

At this point, a total of six victims had been located and safely evacuated to the rally point (FR medical tent) and all indicated actions regarding ASR2-ASR3 levels were completed. Thus, HRTA passed the Command of this worksite to the next designated FR team(s), in order to continue with ASR4/ASR5, while HRTA re-deployed swiftly to the next tasked worksite.

Conclusion

The second phase of the Greek mini-pilot saw the deployment of much more robust, integrated, and close-to-final versions of FASTER tools compared to the 2020 first phase. Several of the participating tools were integrated with the PCC, including UAV mapping, STF, Augmented reality for operational support and Smart Textiles Framework. Advanced communication modes, including the OpenAir Interface and Kafka mirroring, were tested.

Moreover, this second phase included the enactment of a full operational search-and-rescue scenario, which included both FASTER tools and standard First Responder procedures and equipment. It provided valuable understanding of real-scenario limitations, robustness requirements and safety concerns, and how FASTER tools can adapt or improve to come closer to operational readiness.

Both local (HRTA) and visiting (MG, ENSOSP) First Responders had the chance to test FASTER tools hands-on and see how they can fit into a rescue operation.

Image from the Greek pilot, october 2021

DEVELOPMENT OF THE FASTER EXTRA PILOT IN MADRID ON OCTOBER 18

On October 18, the extra-pilot of the FASTER project was developed in the old Villaviciosa de Odón Oncology Hospital. On this occasion, and thanks to the elimination of some of the restrictions on traveling in Europe, it was possible to count on the participation on site of some members of the consortium, such as KPeople Research Foundation, LINKS Foundation, Municipality of Grandola, INOV, Drone Hopper and Robotnik.

Other partners such as Engineering, CERTH, University of West Attica and Crisis Plan assisted online the team of first responders.

The Spanish teams of first responders consisted of: Madrid Police, ERICAM, within health workers from SUMMA 112, that is the medical team of ERICAM, the Firefighters of the Community of Madrid, and the Spanish School of Rescue and Detection ESDP with dogs.

The main objective of this exercise was to test on field some of the technologies developed in the framework of the FASTER project such as: the Portable Control Centre (PCOP), the Chatbot (providing the position of in field operators), the social network analysis tool, the 2D mapping module, the scheduling for autonomous flight of the hexacopter drones, the Robot Summit with gas detection sensors (LEL, O2, CO and H2S) and the device developed for rescue dogs.

SWARM OF DRONES

During an innovative demonstration, the drones carried out coordinated flight missions with a certain degree of automation, and the responsible flight operator (MADRID POLICE) could control the drones operating on a single ground station, while the rest of the pilots supervised the smooth running of the mission from their command posts.

Before the exercise, the drone pilots were trained by technical partners.

All the data collected by drones were transmitted to PCOP using UAV relay services allowing the Portable Control Centre a real-time visualization of the disaster area and monitoring of the FR tools used in this operation. The participants pointed out that drones are becoming an essential tool for surveillance, inspection and review of structures, damages, or even crowds, during crisis situations. Thus, research projects like FASTER provide insights for the increasing need of further development and research in the field.

The mobile application for social media analysis was tested by ERICAM and provided useful information derived from the affected and surrounding areas.
A meteorological station was installed in the affected area by the First Responders for monitoring the weather conditions as weather might affect the development of the occurring event or the response missions.

LOCATING VICTIMS WITH ROBOTS AND K9 RESCUE DOGS

During the rescue phase, the medical team established by SUMMA 112 and firefighters used the SUMMITXL Robot (developed by ROBOTNIK) equipped with thermal camera, smoke sensor and microphone, to inspect the outer terrestrial zone and the inner collapsed structure in order to locate living victims in areas of restricted access. Using the robotic platform, a 3D terrestrial mapping was created, and search dogs were activated to locate the rest of the living victims inside the building. The canine guides of the ERICAM USAR Team(Urban Search and Rescue) of the ESDP and of the MADRID POLICE used the K9 harness (developed by UNIWA)

According to the First Responders the usability experience of the tools was notably improved compared to the first Spanish pilot.

The Chatbot tool was easy to use, since it was enough to have Telegram installed on the mobile device, register with one of the users created by LINKS and share reports, photos and videos.
In the same way, when posting Twitter or Facebook posts , it was only necessary to consider the hashtags created for the event.

CONCLUSION

The entire team of participants provided positive feedback about the overall pilot experience and highlighted that it was a useful hands-on practice in order to get familiar with the tools that will be demonstrated in the final pilot in Madrid in April 2022.

A detail of one of the drones used during the Madrid exercise

Chatbot tool in use

The SummitXL Robot in action on the pilot site

1ST JAPANESE TRIAL PILOT

Outdoor operations on the Japanese pilot site of Miki, July 2021

On July 26th, 2021, the first Japanese pilot took place at Hyogo Prefectural Disaster Management and Training Center in Miki City, Hyogo Prefecture, Japan. FASTER's Japanese partner, Kwansei Gakuin University / Intelligent Blockchain+ Innovation Research Center (KGU/IBIRC), organized this pilot as a part of FASTER's COVID-19 mitigation plan, reflecting the restriction for international travel. Still, as KGU/IBIRC was going to test AIngle, a distributed network with trust, KGU/IBIRC decided to hold this pilot in Japan. This pilot also aimed to contribute to EU-Japan knowledge exchange about advanced technology for first responders.

Four FASTER technical partners, the University of West Attica (UNiWA), The Centre for Research & Technology, Hellas (CERTH), CS GROUP (CS), and Engineering Ingegneria Informatica (ENG), participated remotely from the FASTER side. UNiWA provided MORSE. CERTH provided UxV gesture control, 2D mapping, and AI Scene Analysis. CS provided an AR application. ENG provided G-COP.

As local partners in Japan, Kobe City Fire Bureau's Tarumi Fire Station, Japan Rescue Association (civil canine group), and Hyogo Sanda Chapter of Regional Revitalization & Disaster Prevention Useful Drone Promoters Association (a civil drone operators' group) participated as first responders. Also, to provide a cyber-enhanced canine suit as a "made in Japan" technology, a laboratory at Tohoku University participated in this pilot.

Scenario

The main scenario was an earthquake with fire. The scenario consisted of three components.

Two canines, wearing the cyber-enhanced canine suits, investigated for victims. The first one was an outdoor dog rescue operation in a debris field. The second one was an outdoor victim search operation in a debris field conducted by firefighters wearing AR glasses with CS's AR application installed and smartwatches with UNiWA's MORSE application. The third one was an indoor victim search in a mock maze conducted by firefighters equipped with the same tools used in the second case.

Integration

One of the main aims of this pilot was to test AIngle, the distributed network of trust created by KGU/IBIRC. The KGU/IBIRC integrated technologies provided by FASTER partners and Tohoku University to AIngle. This integration was quite successful and demonstrated fast and secure data correspondence.

Evaluation

Five firefighters responded to our questionnaire after the pilot. On the one hand, they mentioned issues in operation and hardware persistency due to the extreme weather conditions.

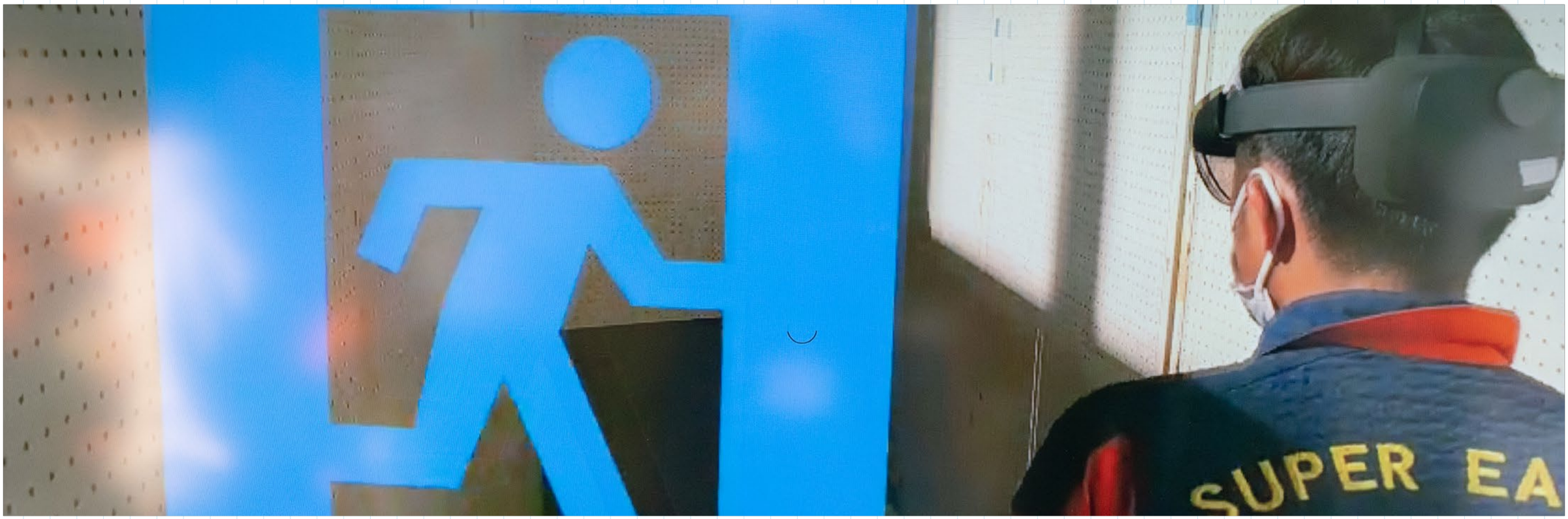
On the other hand, they evaluated the potential highly.

Media presence

A local newspaper company and a local television station reported the pilot in their coverage.

Next steps

KGU/IBIRC plans to hold the second pilot and international workshop on advanced technologies for natural disasters in February 2022.



Images from within the Japanese pilot site in Miki, July 2021

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