# New robotic system enhances safety for emergency services in hazardous environments



Researchers at the Fraunhofer Institute for Communication, Information Processing, and Ergonomics (FKIE) have unveiled a new robotic system aimed at enhancing the effectiveness and safety of emergency services during operations in hazardous environments. The project, named 3D-InAus, utilises advanced LiDAR (light detection and ranging) technology to produce precise three-dimensional models of terrains and structures, which is particularly beneficial in scenarios such as disaster sites or chemical plant incidents.

Emergency responders frequently encounter situations, like flooding or industrial accidents, where direct access to dangerous areas is restricted due to safety concerns. The 3D-InAus system addresses this critical challenge by deploying a mobile robot outfitted with a LiDAR laser. This system operates by emitting pulses of light, which are reflected off objects and returned to the robot, allowing it to measure distances and create a detailed 3D point cloud—a comprehensive array of data points that accurately represents the surrounding environment.

Operating at a remarkable speed, the LiDAR system rotates a laser module mounted on a turntable and emits an impressive 1.3 million pulses per second. The timing of the returning pulses is utilised to determine precise distances, and the resultant data is transformed into a geometrically accurate 3D representation. This model provides detailed views of buildings, rooms, open spaces, and other objects with precision down to just a few centimetres.

The remote operability of the robot is enhanced by a joystick and tablet interface, allowing users to control it from a safe distance. Additionally, the system incorporates a camera that adds colourisation to the 3D model, enriching the visual detail of the generated environment. In instances where GPS signals are disrupted—common in indoor or obstructive settings—the robot employs previously mapped terrain data to create a simulated internal virtual GPS, enabling it to navigate autonomously within structures.

One notable advantage of the 3D-InAus system is its capacity to provide rapid yet accurate overviews of hazardous areas. While a comprehensive mapping of a 400×400 metre zone typically requires around three hours, the system can produce preliminary visualisations in as little as one hour under accelerated conditions. Moreover, the project allows for the simultaneous deployment of multiple robots to further expedite data collection efforts.

The applications of this innovative mapping technology extend beyond emergency services, holding significant potential for the Bundeswehr, the German armed forces, which commissioned the initiative. The 3D models generated can incorporate additional sensor data—such as measurements of toxic gases or radiation—enhancing situational awareness in perilous environments.

Timo Röhling, a technical project manager in the Cognitive Mobile Systems department at Fraunhofer, remarked on the advancements of their system: “Compared to robot systems that use cameras to explore a danger zone, our project goes a big step farther. The laser pulses supply measurements for precision 3D cartography of an area of terrain or building. Distances and dimensions are not estimated but instead determined with accuracy down to just a few centimetres."

He elaborated on the fusion of visual data, saying, “You might think of us melding the camera images and point cloud together. This gives us a vivid, detailed and also geometrically accurate 3D environment showing buildings, open space and objects."

The development of the 3D-InAus robotic system represents a significant advancement in the integration of automation and advanced technologies in emergency response, offering a sophisticated tool for risk assessment and operational planning in dangerous environments.

Source: [Noah Wire Services](https://www.noahwire.com)

## Bibliography

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