Robotics and autonomous mechanical systems

Problem statement

How can safety be improved with robotics and autonomous systems in challenging environments such as urban areas, debris removal, enclosed spaces, tree lines and forests?

Key obstacles include the limitations of existing systems in navigating complex terrains, detecting mines accurately, and ensuring cost-effectiveness for widespread use, while also addressing challenges related to productivity and user-friendliness.

Key factors/requirements

- Productivity: enhance navigation, geo-tagging, and mine detection while minimizing false positives/negatives.
- Safety: ensure reliability in hostile environments with robust navigation and collision avoidance.
- Usability: prioritize affordability, ease of operation, repairability, and involve field operators in the design process.
- Data management: ensure access to labelled data for AI training and efficient data-sharing mechanisms.
- Standardization: establish protocols for evaluation, certification, and interoperability of uncrewed systems.

Proposed response

Further work is needed to define the specific use cases and requirements for the development of robotic systems tailored to mine action. Advanced machine learning, sensor fusion, and navigation technologies are already available and can be integrated into existing mechanical systems, from small, unmanned ground vehicles such as four-legged robots, explosive ordnance disposal robots, to light and heavy machinery rubble removal, ground preparation or mechanical demining machines. Cost-effectiveness remains a substantial challenge in mine action operations.

Road map for implementation

- Phase 1 – Partnerships: secure collaboration with AI/robotics developers, mine action operators, and stakeholders.
- Phase 2 – Requirements: define functional needs and access to high-quality datasets.
- Phase 3 – Design and prototype: develop robotic systems tailored to mine action, focusing on terrain adaptability and explosive ordnance detection.
- Phase 4 – Testing: carry out pilot in diverse environments to refine performance and address challenges.
- Phase 5 – Standards: develop standards for testing, evaluation, and certification.
- Phase 6 – Iteration: refine systems based on feedback and field performance, preparing for scaling.