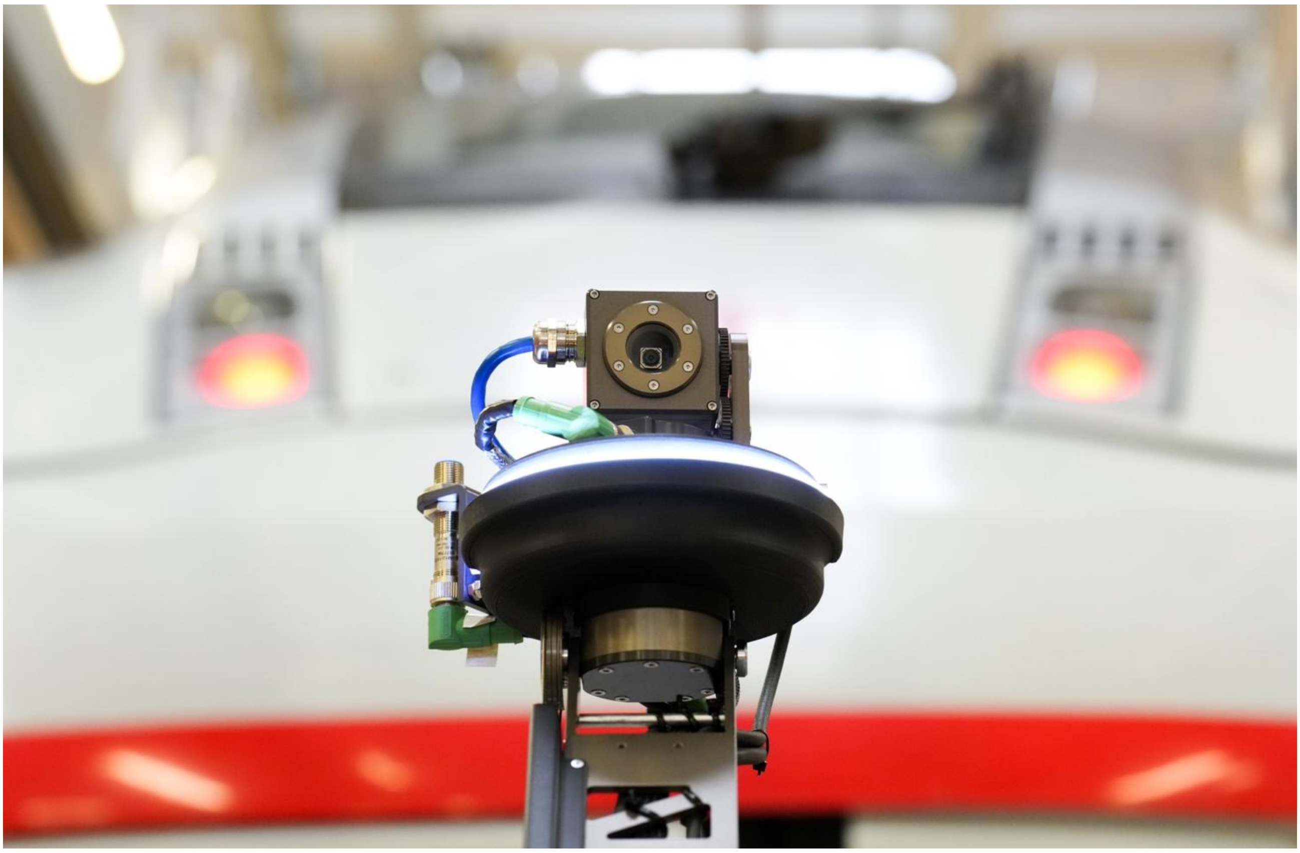
Safety in the use of mobile robotics in the track area.
Work Package 18

The integration of mobile robot systems in the railway environment opens new possibilities for automation and increased efficiency, but also brings with it specific safety risks and challenges. To facilitate risk analysis, the Work Package 18 (WP18) partners have produced a generic list of risks associated with the use of robots in maintenance applications. This list will enable a common understanding of the hazards, make it easier to identify and assess them and optimise the implementation of effective mitigation measures.



Camera on the robot arm of the mobile underfloor robot (c Lang, Deutsche Bahn).

The project is supported by the Europe's Rail Joint Undertaking and its members.

The railway environment involves multiple hazards: **mechanical** (moving vehicles, crushing risks, musculoskeletal issues), **electrical** (shock from docking or wet conditions), **chemical/biological** (allergic reactions from plant juices or detergents), **physical** (fatigue from weather or equipment), **psychological** (stress from shifts or responsibility) and **electromagnetic** (European Train Control System exposure risks due to interferences with detection assets).

However, rather than classifying risks by cause, a classification by nature and then by consequence was adopted. Four types were identified.

Machine safety is inherent in the fact that robots, which are machines, present risks by their very nature, even when they are stationary (they may have sharp edges, hot surfaces, leaks of hazardous fluids, etc.).

The second category corresponds to risks related to **movement**. When these machines are no longer stationary but dynamic, new risks can arise: collision, derailment, presence of the machine in undesirable areas, etc.

Then there are the risks associated with **inspections**. When used for this type of task, robots can provide inaccurate information. Based on this inaccurate information, maintenance personnel may be led to make decisions that impact the safety of the railway system.

Finally, the last category covers risks related to **interventions**. This category is quite similar to the previous one. A robot may be required to perform actions on the network, such as repairing or replacing a part, or positioning components. Again, poor execution of the action could have subsequent consequences for railway operations. A poorly positioned beacon could affect train location and therefore traffic safety.

The consequences are detailed on three hierarchical levels. This is not part of the generic list as such, but when the list is applied to a specific use, it is standard practice to indicate the probability and impact and then, if necessary, the mitigations required.

After examining the various robots in the project, the partners involved in WP18 can propose a list of just over 100 items.

The next step will be to formalise this list, in a format yet to be agreed upon. This list must be dynamic, be compared with other experiences and be enriched. This is how it will be useful to the sector throughout Europe.

Conclusion:

Mobile robot systems offer enormous opportunities for automation in the railway environment. However, their use requires comprehensive, constantly reviewed safety management that takes into account technical, organisational and human factors in equal measure. This is the only way to gain the acceptance of the employees and to ensure safe, efficient rail operations.

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