Robotic solutions aim to improve rail bridge safety and carriage cleanliness

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Credit: Heriot-Watt University

Scientists at Heriot-Watt University, in partnership with rail industry body RSSB, are developing robotic solutions to improve rail carriage cleanliness in hard to reach places and to facilitate closer inspection of railway bridge arches.

The first project will develop robotised mobile inspection platforms able

to operate between and under the seats of a train carriage. Able to navigate and manipulate themselves in confined workspaces, the robot platforms will clean and detect hazards using an innovative algorithm.

Dr. Mustafa Suphi Erden from the School of Engineering and Physical Sciences is leading the research. He said: "Initially our work will focus on developing a robotic [mobile platform](#) that can autonomously navigate in the confined space in between and under the seats of a train carriage. We will then develop an algorithm to detect cleaning and hazardous situations using a detailed set of train carriage images.

"We will also be creating a manipulator to integrate with the mobile platform to collect predefined objects regularly dropped or discarded by rail passengers such as bottles, paper cups, newspapers, and also biologically dangerous objects such as blades, needles, and injectors left behind by the passengers."

The second project will develop autonomous drone technology to inspect railway bridge archways, particularly the inner curve where access is limited.

Drones will collect images autonomously under the arches and then automatically analyse these to detect defects in the structure. Defects such as cracks, spalling (flakes), water seepage, insufficient mortar, misalignment, and crushing will be examined and identified for remedial work.

Dr. Mustafa Suphi Erden explains how the drone would work: "A human will bring the drone to a starting edge of the arch where it will then start automatically flying along the arch surface by scanning through the arch surface and collecting images. The collected images will then be processed to detect defects and alert the maintenance experts so remedial action can be taken quickly. Our work will initially focus on

developing the drone technology that can navigate itself using proximity sensors and webcams.

"These will allow the drone to control itself from one edge of the arch to the other through a horizontal line and turn back to follow a parallel path on another horizontal line. This level of accuracy, including maintaining an accurate distance from the surface of the arch, means every inch of the arch will be inspected in detail. We will then develop a machine learning algorithm to inspect the collected images and to detect a pre-identified set of hazards in the brickwork of the bridges."

RSSB is funding two four-year Ph.D. studentships as part of the Centre for Doctoral Training in Robotics and Autonomous Systems.

Giulia Lorenzini, RSSB's Senior Partnerships and Grants Manager said: "The rail industry is only just starting to get to grips with what Robotics and Autonomous Systems (RAS) applications have to offer. It's great to be working with a leading research institution in the field so that our members in rail can see evidence of the technology's potential in a functioning, practical way."

Provided by Heriot-Watt University