

Feasibility of Robotic Autonomous System for Train Fluid Servicing

Atherton, M.A., Hill, S.A., Harrison, D.J., Ajovalasit, M.

Passenger train maintenance includes fluid servicing tasks of refilling water, wheel sand, coolant and windscreen wash; emptying effluent; and monitoring oil levels. These fluids servicing tasks generally present a structured environment where locations and required actions are known and therefore have a good prospect for successful automation.

The feasibility of robotic autonomous system (RAS) to perform these key fluids servicing tasks was investigated. This project took a human-centred approach throughout, including Hierarchical Task Analysis, aiming to improve the quality of manual work by reducing the need for operators to carry out tasks that are 'dirty, dull or dangerous', and addressed how the operators could be best utilised when operating a RAS. Two RAS concepts emerged, a Cartesian RAS and an Articulator RAS, which were compared technically and economically. The need for fluid 'ports' of existing rolling stock to be modified for access by the RAS were also explored.

It was found that the capacity of a Cartesian RAS would be approximately 16 vehicles/ hr and an Articulator RAS would be 20 vehicles/ hr. These results show at least a doubling in throughput compared to the approximate 8 vehicles/ hr for current manual fluid servicing processes to accommodate projected increases in passenger traffic. Either RAS requires only 1 operator compared to the 2-4 required for current fluid servicing processes but the Articulator RAS is approximately double the capital cost of the Cartesian RAS for a nominal 10-car service point.

A physical proof-of-concept for modified fluid port interfaces and RAS end-effectors is the next step on the road map to developing and implementing a commercial solution to meet the increased demand. Progress with a follow-on project funded by InnovateUK starting in October 2017 will also be presented.