UNIVERSITY OF BIRMINGHAM

BCRRE

Development of an Accurate Railway Positioning System Using RFID Technology

Motivation and Challenge

- Accurate information about rail vehicle position is invaluable for safety and maintenance purposes. However, obtaining it is a significant challenge.
- Whilst, currently, several positioning systems are used to locate trains on the network; these all have limited precision
- Vehicles equipped with monitoring equipment, such as the Network Rail track recording vehicles (TRVs), use linear referencing (mileposts) combined with GPS to calibrate position on the track. Unfortunately, this positioning system is not accurate enough to reference the maintenance data to the switch and crossing (S&C) being traversed, and in particular to the key elements of an individual S&C.

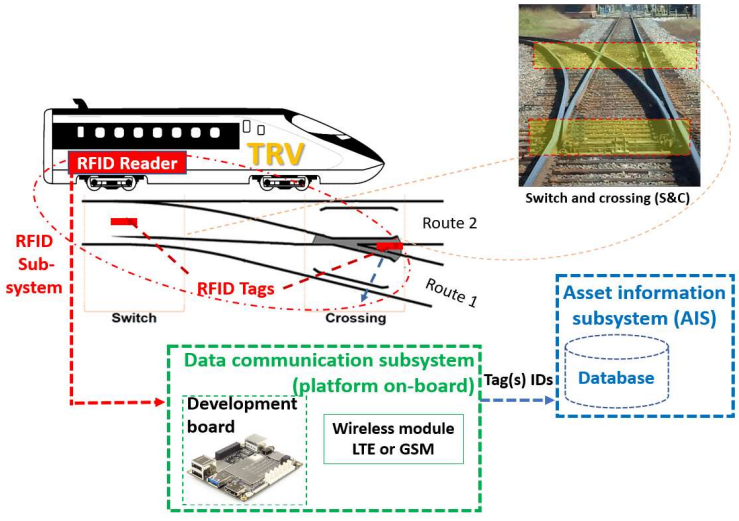
Objectives

1. Develop methods to improve the positional accuracy of the system within railway applications (*currently limited to ±5 m*)
2. Focus this to improve the TRV inspection-reporting system, especially for alignment of vehicle data and track position data for track-geometry-defect reporting.

S&C identifier node will enable synchronisation of data to pinpoint the exact location of track geometry defects; this will allow direction of maintenance staff to the exact S&C (and components within the S&C) that require maintenance.

Novel approach

- Using radio frequency identification (RFID) technology: installing two (RFID) tags, one on the switch-toe sleeper and the second on the crossing-nose sleeper, with an RFID reader that will be installed underneath the vehicle.
- Key features of the switch and crossing (S&C), the switch toe and crossing nose, will be considered as a definitive reference point for the inspection vehicle's position.



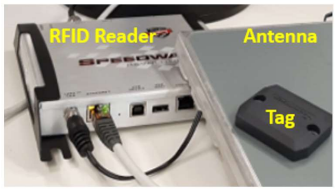
Three subsystems of the new railway positioning system

How does the positioning system work?

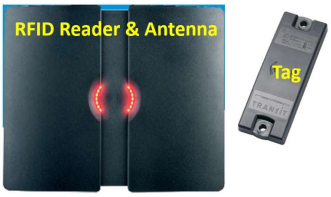
- Three subsystems of the complete positioning system: the RFID, the Data communication and the Asset information subsystems are linked together.
- As a monitoring vehicle passes over a piece of S&C, the system will provide information about this S&C's ID, which is stored inside the RFID tags. The data communication subsystem will transfer the S&C ID to the Asset Information System (AIS) where the S&C's GPS coordinates and the history maintenance information will be stored.

Experimental Results

- The scope is to design, build and test a demonstrator of the positioning system
- Two RFID technologies proposed & tested (passive and semi-passive)

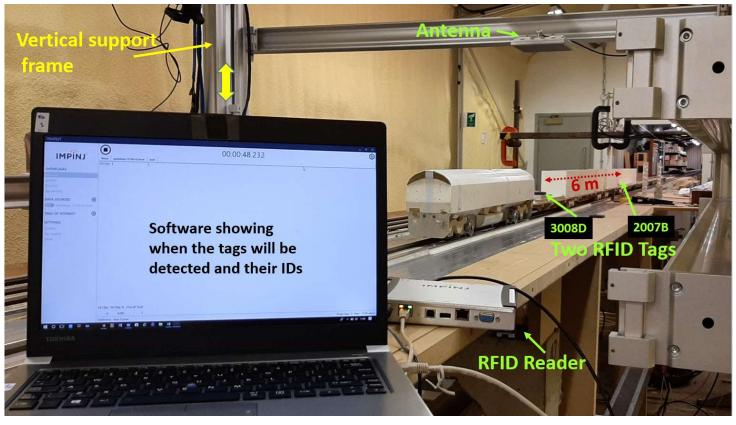


Passive RFID technology



Semi-Passive RFID technology

- More than 400 laboratory tests, of the RFID subsystems (passive and semi-passive), have been performed in a variety of conditions: including:
  - Different passage speeds,
  - Different distances between the reader and the tags,
  - Varied strength signal transmitted
- Both RFID technologies could provide and achieve a promising result (*Position accuracy better than ±1 m at speed ranges; 5 to 70mph*)
- Passive RFID technology is the most suitable solution for the positioning system developed; in terms of functionality, data communication, usability & practicability, and costs.



Installing and setting up the Passive RFID technology in the testing lab

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The authors gratefully acknowledge the support received in funding this research work under the Shift2Rail programme that is a Joint Undertaking (JU), partially funded by the European Union via the Horizon 2020 fund. The funding was received via Network Rail (NR, UK) which is a founding partner of the JU.