Door Diagnostics just got Smarter

Non-intrusive distributed diagnostics for train door condition monitoring

The Challenge

In 2012 UK rail passengers recorded approximately 36.5 billion passenger miles, continuing record levels of rail use in the UK. Today 30% more passengers use the rail network than 45 years ago, with 27 new lines and 68 more stations added in the last 10 years alone. This means there are more trains operating today and as a result each door opens and closes much more frequently.

A recent study shows that door failures are the primary cause for late trains with door faults accounting for over 30% of train failures. The delay is due to safety reasons whereby the brake systems can not be released on a train until the doors are completely shut and locked. When a fault does occur, each train operating company incurs a fine, the amount of which is dependent on the length of the delay and the number of other services affected due to the line blockage. In and around busy cities the 'knock on' effect can create many tens of thousands of pounds in fines.

For this reason all train doors are maintained regularly whether the doors need it or not. e.g. a disabled toilet door is maintained at the same intervals, as a passenger entrance door. This maintenance is a considerable expense which could be significantly reduced by not over-maintaining the doors.

The Solution

An ideal solution would be to predict emerging door faults within a fleet, enabling maintenance to be scheduled and doors maintained on an as-needs basis. In this Case Study we describe how the Door Diagnostic Unit (DDU) meets the needs of rail operators by providing a cost-effective, retrofittable door condition monitoring system, providing continuous door performance data.

The Door Diagnostics Unit (DDU) enables remote monitoring of train doors through the use of inductively coupled telemetry. It is a low cost solution that delivers "health indicators" on the doors that allow effective and targeted interventions to be made.

The DDU has powerful onboard processing capabilities, including an FPGA and micro-processor. These allow for complex parallel processing of data in real-time such as Digital Signal Processing while writing to an onboard uSD memory card.

The DDU also now comes with the ability to input 5 digital door related signals e.g. door initiation switch.

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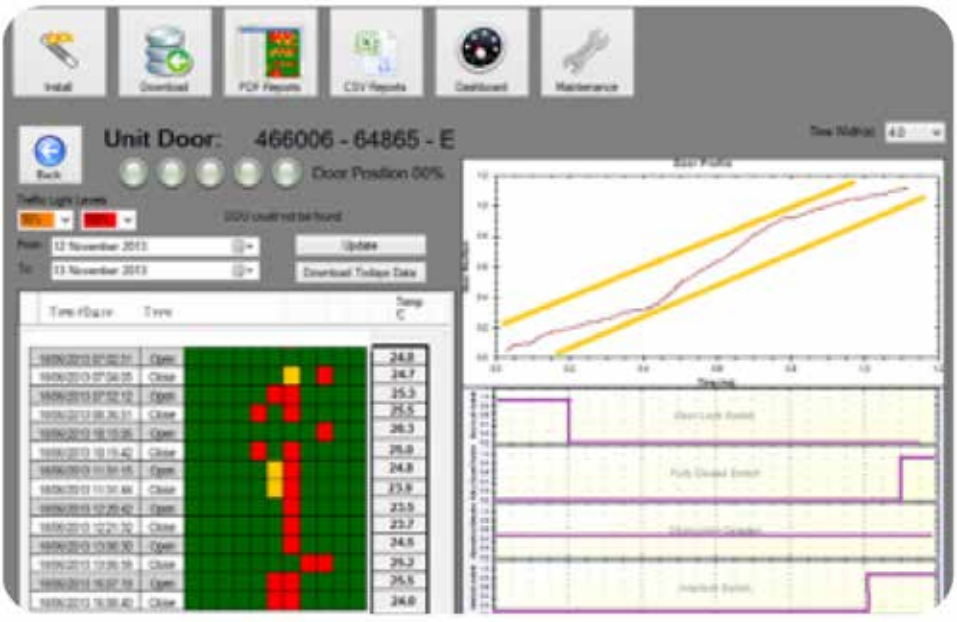
The Result

From the data collected a detailed profile of the door behaviour is obtained, including velocity curves at each stage of an open or close process. The solution offers a number of significant benefits, including:

- Real time monitoring of door performance to enable early identification of wear, which may be used for maintenance scheduling purposes.
- Cost effective installation process with a 15 minute installation time per door.
- Automated communication of all data or just simple "health" indicators to a central database.
- The sampled data can be transmitted over an existing communications network using a proprietary or standard communications protocols, such as: WiFi, Bluetooth, Zigbee, Ethernet, CAN, USB, modbus etc.
- The system is capable of monitoring other train parameters and systems, such as Heating Airconditioning and Ventilation (HVAC).

The Distributed Door Diagnostic Unit solution is capable of monitoring the performance of train doors, in a cost effective and non-intrusive way. This offers the Train Operating Companies (TOC) many benefits including maintenance cost savings.

Already in use on a number of UK fleets, the Distributed Door Diagnostics System is a unique and innovative, world-leading solution to train door monitoring. A non-intrusive, cost effective and flexible system, that has short installation times and can communicate door management data over many networks.



The DDU produces simple reports using traffic light indicators to display the health of the door. Each row in the table represents a door open/close cycle. The software also allows for graphical analysis.

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