



Project Case Study

Queensland Rail SEQ SMARTS Project

Background

The Queensland Rail (QR) SMARTS Project is a proof of concept project the encompasses the design, procurement, installation, testing, commissioning, trialling and maintenance of several concept technology solutions designed to monitor and protect QR rail assets including Rail and Temperature Monitoring (RATS), Level Crossing CCTV System, Bridge Impact Detection System (BIDS) and Pantograph Monitoring System (PGMS).

Rail & Ambient Temperature System (RATS)

Problem

Climatic temperature variations produce rail distortions which occasionally exceed safe limits for normal train operations. QR SEQ sought a system of rail and air temperature monitors which would permit real-time temperature monitoring at selected sites across the passenger rail network and provide remote alarming to mobile clients, improving localisation of speed restrictions thereby reducing delays to normal passenger services.

Solution

ARCS had already deployed RATS at several locations across the Public Transport Authority of WA network. The design was reviewed and modified to include a web application and automated delivery of alarms to mobile devices via the Telstra 3G network. In addition to the wireless comms and mobile platform support, ARCS eliminated the previous dependence on 240VAC supply availability by selecting components with reduced power requirements and replacing the LV supply with a solar ELV supply.

Outcomes

QR SEQ Managers and maintainers are currently evaluating RATS data and alarms reporting from twelve sites around the SEQ network. Additional sites are proposed once the evaluation period is complete.

Level Crossing (Lx CCTV)

Problem

QR SEQ identified a need for CCTV monitoring at level crossings to capture video images of traffic movements and collisions involving trains at level crossings.

Video images needed to be of sufficient evidentiary quality to enable positive and accurate road vehicle identification.

Number plate recognition was not required at the time but the design was to countenance this as a potential future inclusion.

CCTV images of the level crossing will be recorded 24 hours per day and under all environmental conditions expected to be experienced at the site. . The system was to overwrite images on a “first in, first out” basis and retained for 30 days minimum.

In addition to the functional requirements, QR SEQ also sought a system independent of existing QR SEQ infrastructure and at lower installed and whole-of-life cost than existing systems.

Solution

ARCS designed a solution around a proven dual camera arrangement with integrated IR illuminator to eliminate dependence upon ambient light for vehicle identification. CCTV images are recorded continuously to a proprietary Digital Video Recorder (DVR) and accessed from remote clients via a wireless broadband service and a server application. The DVR meets legal ‘chain of custody’ requirements through digital watermarking of images and simultaneously records two separate streams from each camera, a low res/low frame rate stream for initial review and a high res/high frame rate stream for uploading to the server. The server application maintains a log of client image requests to avoid duplicated downloads minimising wireless broadband costs and reducing image access delays for subsequent viewings.

Bridge Impact Detection System (BIDS)

Problem

Bridge strikes by overheight motor vehicles attempting to pass under low rail bridges present a significant and frequent risk to rail operations. Before investigating a reported bridge strike, QR SEQ’s standard practice is to impose a rail speed restriction or stoppage as soon as an incident is reported. Delays in attending the site to assess the risk result in delays to rail traffic.

Solution

ARCS designed a system that seeks to reduce the incidence of bridge strikes and provide instant alarming and remote damage assessment when one does occur.

The system comprises the following:

- Laser detection of overheight vehicles on a bridge approach road
- CCTV images of the bridge recorded continuously and remotely accessible
- Impact detection through sensors attached to the bridge
- Remote alarms and bridge strike force indications
- Visual warning to drivers through high visibility LED signs and lamps on the bridge

The BIDS uses a camera and recording arrangement identical to the Level Crossing CCTV system and permits remote access in the same way.

Pantograph Monitoring System (PGMS)

Problem

Worn and damaged pantograph equipment can result in a range of problems for electric rail networks from in-service breakdowns and overhead equipment damage to large scale dewirements which present a significant safety risk, can take days to repair and result in significant service disruptions and loss of revenue. QR SEQ engaged ARCS to provide solutions options for this problem and to design a system meeting QR's operational requirements.

Solution

ARCS considered a range of solutions including before concluding that the most cost-effective solution that addresses both damaged pantographs and damaged overhead wiring equipment was a combination of fixed and mobile video analytics solutions. Pantographs would be automatically inspected for damage at a series of fixed locations selected such that all vehicles were inspected regularly and frequently. It was proposed that QR use the PanCam system already proven to deliver automated inspection of coal train pantographs. Overhead 25kV equipment is continuously inspected by two roof-mounted cameras, with real-time analytics, GPS and wireless comms. Images are also recorded to a DVR for subsequent analysis and review. The required network coverage and frequency determines the number of PGMS equipped railcars. The real-time analytics detects and alarms abnormalities such as unusual pantograph or overhead equipment excursions and the DVR permits the images and GPS location data to be retrieved remotely for review within minutes of an alarm being generated. This solution greatly reduces the risk potential of any detected abnormality.

The PGMS is currently being evaluated by QR SEQ for future installation.