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gsm-r
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ELECTRONIC SYSTEMS

GSM-R Applications

Ciro De Col
10/09/2013

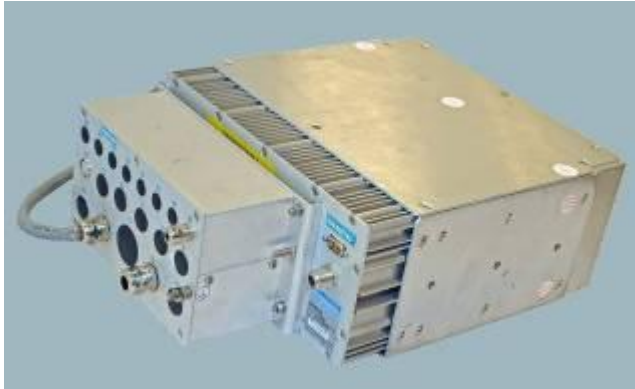
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GSM-R on board – Cab Radio

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- Most of the time the GSM-R Cab Radio is not utilized.
- The driver Control Panel is normally just displaying the Network information and registration number.

What if:

- We could use the computing capacity of the Cab radio
- We could use the driver Control Panel to display other useful information's
- Send receive Data information's

All without jeopardizing the GSM-R Voice application

- Applications

Driver advisory system

Concept

- Expand existing on board Cab Radio
- Single train dynamic advice to driver
- Providing real time guidance to train drivers about optimum route speed and driving approach
- Utilising timetable data, speed limits, train characteristics and positioning information Routes are profiled, simulated and then provided as a real time advisory to the driver



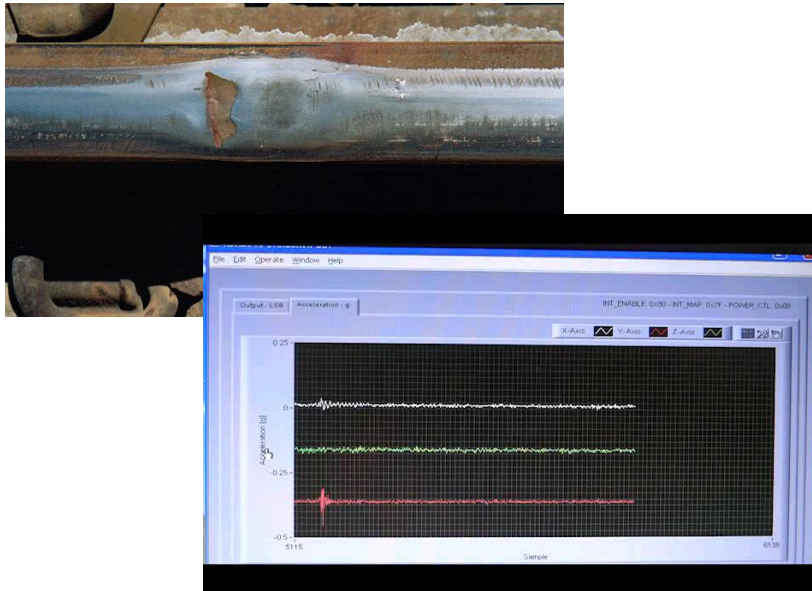
Further information

- Timetable data is stored in the cab radio CPU
- When a train run is initiated SiDAS collects all relevant data (timetable, speed limits and train characteristics).
- Based on current position the optimum speed profile is continuously calculated and the recommended speed and action presented to the driver using the Cab Radio Display.
- When terminating the run performance can be displayed to the driver.
- The system also:
- Builds an understanding of the human factors implications (effects on the driver) of taking driving advice
- Facilitates the development of 'real time' timetables and modeling the commercial implications for all stakeholders (eg performance regime adjustment should overall network performance decisions cause trains to be delayed for the greater good).
- Builds a bridge towards a connected DAS system (i.e. port software to ETCS system).

Remote condition monitoring

Concept

- Expand existing on board Cab Radio
- On train sensors to detect the Track/Points etc. condition.
- Process sensors data on board and transmit results to ground over a GSM-R radio link.



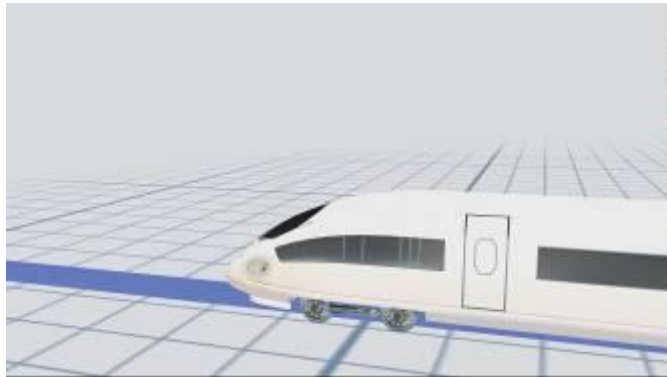
Further information

- A sensor card in the cab radio is able to detect the condition of track / points etc
- It is looking for rail defects and a vibration / shock profile of track is built up and each run is compared on the same line with historical data collated over many runs.
- Profile variations are detected / recorded and then reported.
- Signatures pre-processed & analysed on board
- “Unusual” signatures sent to Ground Terminal
- The ground terminal records events (incident & time log).
- A history of signatures is developed enabling comparison of train / track relationships over time
- The ground terminal assesses event and:
 - Either: ground terminal stores event in database (and)
 - Or: ground terminal sends automated message alert to maintenance system / displays on screen
- It is recommended to use the rear cab radio to avoid usage of the leading cab “operational” radio, or alternatively to use priority schemes to ensure that the leading radio is always available to the driver when required.

Event Notification

Concept

- Utilise existing GSM-R cab radio to enable “live” updates from TCMS / TMS
- Utilise position information from train based system e.g. GPS



Further information

- An interface between multiple systems and the GSM-R cab radio is provided.
- Pre-processing is completed on board.
- Relevant information is sent from the train to a ground based system.
- SMS is used for small amounts of data that are needed to be sent periodically, this can be done without affecting on going voice communications using a different radio channel, and can be sent concurrently.
- Alternatively Circuit Switched Data calls are available on the GSM-R Radio and Network which allows a data rate of nominally 9600bps which is sufficient for a lot of on train applications which need data sent to the ground.
- In the case of CSD the rear cab radio would be used to send / receive data so that it does not have any effect on the leading cab radio which is being used by the driver.
- This system provides a real-time data communications link from train to ground, providing pre-emptive maintenance opportunities and advance train data at maintenance depots./

E-Learning

Concept

- Interactive training application software package
- Supplied to users on memory stick
- Designed to enable the drivers to run the training package from a portable device



Further information

- The Training application replicates the DCP layout and GSM-R radio functionality.
- Customizable pre-defined training scenarios are provided.
- Training may be repeated time after time to increase familiarisation.
- Assessment of the participant is provided at the end of the training.
- Results may be uploaded and analysed from a centralised database

Customer benefits:

- Reduced training cost as no class-room is required
- Ease of migration i.e.. Analogue to GSM-R
- Ease of introduction of new EIRENE features

- Application Enablers

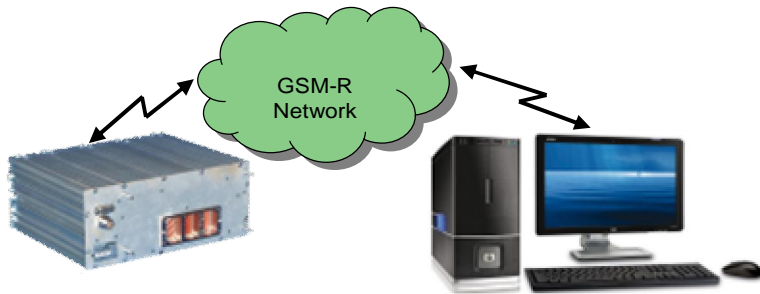
Cab Radio Management Terminal

Concept

- Enable direct communication with the cab radio from anywhere within GSM-R coverage through a circuit switched data call
- Provide operator with an intuitive user interface with menu based options
- Provide facility for cab radio application software and data to be remotely managed from a ground system.

Further information

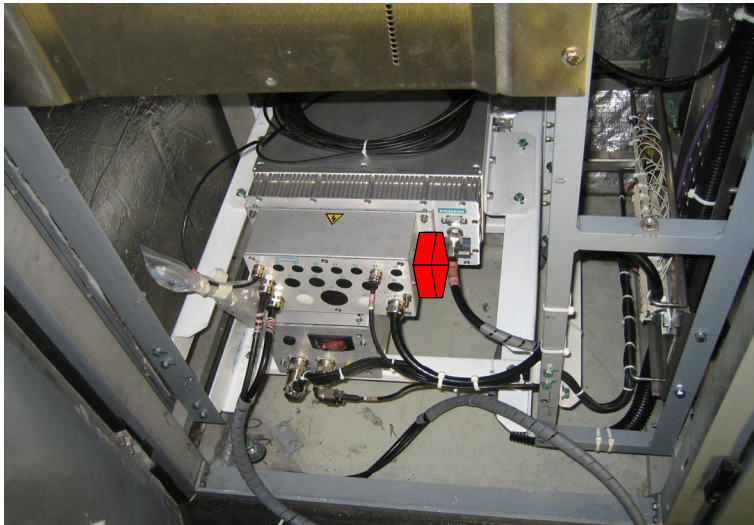
- Windows based PC
- Connects to single/multiple cab radios using CSD calls.
- A scheduler enable operations to be performed on a fleet of trains during a defined period.
- It allows software updates and phonebooks to be uploaded to the cab radio
- Inventory information and fault logs can be downloaded and then viewed.
- Perform updates to the Driver Advisory System database.
- Download and record the Condition monitoring results.
- Customer Benefits:
 - Maintaining a database record of all cab radios in the network, recording the stock number, cab radio serial number, software release current and awaiting switchover, phonebook version and time stamp
 - Reduced cost of SW upgrades



Location Systems

Concept

- Provide different location systems to enable train location identification
- Select location system based on available on-board technology and preferred customer solution.



Further information

- GPS
External unit providing location data to cab radio and/or other devices.
- May use a shared GSM-R/GPS antenna.
- GSM-R Location
Utilises timing data obtained from the cab radio transceiver to determine track position.
- Provides location data to the cab radio and/or other devices.

Customer benefits:

- Re-use existing on board technology
- Re-use positioning information for other train applications.
- Minimise the number of antennas on the train

Summary

- Maximize the use of the on-board asset.
- Produce savings with better fuel economy.
- Produce savings by using all trains to detect track deterioration.
- Produce savings by reducing Drivers class days.
- The presented applications could now be added to the already comprehensive list identified by ERIG and published in the document no. ERIG 3339 titled:

Additional Applications outside EIRENE using GSM-R

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Thank you