EMESRT
Earth Moving Equipment Safety Round Table

Project Charter

EMESRT VEHICLE INTERACTION PROTOCOL DEVELOPMENT

Background

From 2004-2009, 35% of fatalities at mine sites were due to vehicle interaction incidents and 53% of these involved pedestrians. In response, a global trend to put appropriate legislation in place has arisen. South Africa published as of 27 Feb 2015 legislation (https://www.greengazette.co.za/notices/mine-health-and-safety-act-29-1996-regulations-relating-to-machinery-andequipment_20150227-GGR-38493-00125) requiring employers to take reasonable and practicable measures ensuring pedestrians are prevented from injury from collisions with trackless mobile machines. The legislation defines the minimum requirements to include automatic detection of pedestrians on trackless mobile machines, with automatic speed reduction and application of brakes to be undertaken if the operator does not take action to prevent potential collisions.

In response, EMESRT initiated a project focused on developing an open-architecture industry communications standard for proximity detection and vehicle interaction. In December 2015 EMESRT held Workshop 1 on Vehicle Interaction in Brisbane Australia for the purpose bringing together original equipment manufacturers (OEMs), proximity detection suppliers (PDSs), and end users (mining companies) to reach agreement on, and establish a common protocol for communications between PDS and OEM devices in the mining industry. The working group resolved that, due to its familiarity and broad industry acceptance, the preferred basis for the protocol should be the J1939 standards as established by the Society of Automotive Engineers (SAE).

EMESRT Workshop 1 also defined a set of fundamental signals or messages between the PDS and OEM systems (inputs and outputs) that would be required for compliance with the proposed industry standard. Further analysis by EMESRT and their experts revealed a need to refine the input and output definitions as well as specifying the data parameters (SPNs), messages (PGNs), related conventions and PGN transmission rates to an SAE level. EMESRT held Workshop 2 in March 2016 in Brisbane (with the same work group and their software engineers), for this purpose. The outcome of Workshop 2 is a DRAFT protocol document.

Some key issues remain to be addressed as part of the implementation process, such as the need for an agreed hardwired interface for communication with non-computerised vehicles. Of particular note in this category is the question of the extensibility of the proposed protocol, and the need for an ongoing roadmap to carefully manage the implementation process.

Goal

- A standard, open architecture protocol with wide acceptance and uptake by the entire industry

Objectives

- An approved (EMESRT, ICMM, SAE, and ISO) and expandable detailed VI open architecture protocol between a single PDS and vehicle on an J1939 CANbus system
- Bench tested and debugged VI protocol (collaboration between OEM and PDS)

- Field tested and debugged VI protocol (collaboration between OEM/PDS/End User in a surface diesel and in an underground diesel application)

Scope

The scope for the working group includes:

1. Attending workshops for the purpose of developing an expandable VI protocol between a single PDS and vehicle on an existing CANbus with PGNs and SPNS defined to an SAE level and using J1939 as the basis.
2. Working collaboratively with an approved and documented bench test with an OEM as a partner (PDS and OEM (or multiple partnerships) to be defined by the working group).
3. Working collaboratively within the working group to debug and update the VI protocol.
4. Working collaboratively within the working group to field test (surface and u/g diesel application).

The scope for EMESRT includes:

1. Facilitating, participating, and guiding collaborative workshops including end users, primary OEMs, and primary PDSs to achieve the goal.
2. Establish the protocol bench and field evaluation scope.
3. Communicate with ISO, SAE, ICMM, other Associations and Standards organisations and facilitate the path to a successful open architecture protocol.
4. Compile and disseminate all materials related to the above.

Out of Scope

Working with the regulatory agencies and Standards groups is out of scope for the working group (OEMs and PDSs) but in scope for the EMESRT Advisory Group.

Key Stakeholders

End Users	All mining companies
OEMs	All mining original equipment manufactures
PDSs	All proximity detection system suppliers
Regulators and various Standards and Associations/Organisations	ISO, SAE, ICMM, GMSG, AMIRA, CSIRO, etc.
Sponsor	EMESRT
Project manager	Susan Grandone
Project team members	BDechant, BLucke, CDoran, CHargrave, ICurran, KUsher, MDunn, MVowles, MWundenberg, RWilson, TEgan, TGray, TGreyvensteyn, SGrandone

Project Milestones

DEC 2015: Workshop 1, Identify the common and open communications platform to be used, identify key inputs/outputs - define each as well as define data frequency rates, etc.

Jan 2016: Compile current architecture and interfaces used by OEMs and PDSs into a single document.

Feb 2016: Obtain input from OEMs and PDSs on defining the PNGs and SPNs in preparation of Workshop 2.

Mar 2016: Workshop 2, refine definitions for inputs/outputs/PNGs/SPNs.
Apr 2016: Define the protocol bench and field evaluation scope.
May 2016: Conduct bench tests and quantify results
Jun 2016: Workshop 3, update/debug protocol; generate semi-final protocol and refine field evaluation.
Jul/Aug 2016: Field evaluation protocol in surface diesel application and also in u/g diesel application.
Sep 2016: Compile results for surface and u/g evaluation; generate report and identify modification requirements.
Oct 2016: Update the protocol to the Final Draft Version
Nov 2016: Joint OEM/PDS session to review the finalized protocol
Dec 2016: Close out report.

Project Budget

Non-applicable (so far)

Constraints, Assumptions, Risks and Dependencies

Constraints	1. The selected CANbus approach will not work for older equipment without control systems or CANbus.
Assumptions	1. Sufficient expressions of interest and collaboration between OEMs and PDSs for bench and field evaluations will occur in a timely manner. 2. Bench and field evaluations will be done under a consistent and approved methodology with full disclosure of results. 3. The bench and field evaluation methodologies will be developed by EMESRT. 4. The proposed protocol will comply with SAE standards (no rework).
Risks and Dependencies	1. The proposed request/reply messaging protocol may not fit the J1939 definition and if this is the case, there may be a significant amount of rework required to be consistent with the Architecture Standards 2. The proposed protocol facilitates transferring critical data items between OEM and PDS – there are limitations regarding implementing the "rules" layer (or decision system) to reside within the PDS system. Because implementation can occur by either OEM or PDS or some other 3rd party, messages should be defined between each of these system components. 3. Data logging requirements for a system do not belong in the communication protocol; this should be addressed as part of the system requirements 4. J1939 provides a short-term solution and is relatively easy to implement but may not be a good option for off-vehicle communications (v2v, back to base), multiple systems on-vehicle, and for sites with a mixed fleet (either different vehicles or different PDS)