Open software platform for industrial vehicles

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Introduction

Industrial vehicle OEMs face a market, where end-users ask for better operator support and usability in vehicle control. CrossControl proposes an open software tool chain approach for Graphical User Interfaces (GUI). With touchscreens that provide intuitive ways of interaction and sharp GUIs, Smartphones represent a reference for nowadays product usability. And now operators of industrial vehicles start asking for the same user experience in industrial vehicles.

Observing first meetings between end-users and vehicles at e.g. Bauma 2010 and Conexpo 2011 confirmed that operators are open to, or even expect, modern HMI solutions; after getting seated in the cabin and some fiddling with joysticks their next move is to seek interaction with the machine by pressing the in-cab display with their finger.

Another observation in our business is that very little attention is given to the graphical design in user interfaces. With consumers expecting a brand to be all-encompassing, a well-designed user interface should address not only the usability of the vehicle but also the given brand's visual appearance. This represents a major untapped potential for differentiation in the industrial vehicle market.

We constantly hear witness from vehicle man-ufacturers of how their machines are used only at a fraction of the full potential. It is often the case that we design the HMI systems based on our own, often engineering-based, background. Successful design of HMI systems puts more focus on the operator reality and translates 'low-level' technical features in the

> " By using state-of-the-art, open frameworks it is possible to realize the premium user experience that will differentiate successful industrial vehicle brands. "

vehicle system into value functions that the operator can understand and utilize. This may often include automating certain operations, pre-defining operation modes and implementing easy-to-understand settings. The need of this approach is made even more evident when moving into new markets where operator skill levels are different from traditional markets.

For the industry to respond to these challenges you need many things but the software strategy is fundamental. Small- and medium-sized OEMs in many cases rely on hardware suppliers that control the software functionality in displays and other devices. This may work fine in day-to-day business but with more of the value in terms of user experience being realized in software, there is an eminent risk that the vehicle OEM is not in control of the value added. Large OEMs have in most cases this control but often spend resources on low-level software and the application frameworks, resources that instead could be spent on value-adding applications.

With the well-established standards and open, powerful and hardware in- ▷

dependent frameworks and tools available, industrial vehicle OEMs have the opportunity to source electronics and software frameworks and focus their system engineering on software application development.

Integrated and open platform

CrossControl has in its software platform for displays carefully avoided creating a proprietary solution, but instead set up an architecture that combines and

HMI computer
Software platform architecture
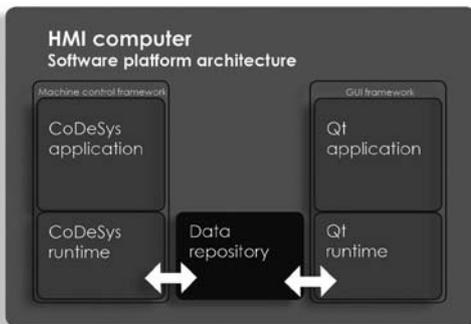
integrates the most powerful, yet easy-to-use, commercially available frameworks for GUI and machine control.

The machine control framework handles the CAN communication with other parts of the system and runs a controller inside the display. This controller computes the algorithms and value functions that help the operator utilize the potential of the vehicle. In the standard packaging of the platform we chose to adopt the IEC 61131-3 compliant Codesys framework by 3S Smart Software Solutions for this task. It is hardware independent, widely adopted in

the industry and provides an easy-to-use programming environment for typical controller functionality.

The GUI framework handles the visualization of graphics and user interaction on the display. In the standard packaging of the platform we chose to adopt Qt for this task, being an open, mature, and hardware independent framework. Qt supports really advanced GUI functions and mimics, and has a drag-and-drop type of programming environment that requires only basic programming skills.

To integrate these two frameworks, we have developed a data repository that handles instant data exchange between them, meaning that GUI execution runs independently of the real-time cycles of the machine control system. To that we have added style sheets, day-and-night modes and ready-made components for gauges, alarm lists, warning lamps etc. with a number of parameters that allows easy adaptation of behavior and graphical appearance.

The result is an integrated software platform with a seamless tool chain that enables efficient engineering of advanced HMI functions. The platform is already being adopted by a number of leading OEMs, which deploy it for realization of their next generation HMI solutions. ◄

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