Connecting vehicles to the "clouds"

The possibility to monitor vehicles remotely by analyzing data gathered on the CAN networks opens new opportunities for every player along the value chain.

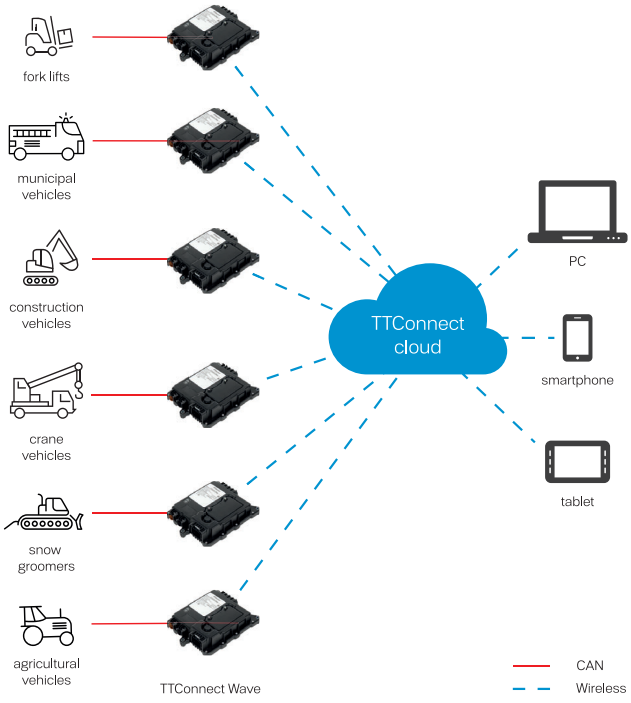

Figure 1: Customized dashboards and widgets for monitoring (Source: TTControl)

The Internet of Things (IoT) and the related mobile machinery telematics systems allow OEMs (original equipment manufacturer) and fleet owners as well as vehicle rental companies to utilize their machinery and equipment more efficiently. They gain a better understanding of how their vehicles are used by the operator and benefit from continuous system monitoring and diagnostics. Today, the availability of new technologies and the increase of requirements for safety, control, and efficiency demands for a new way of approaching the off-highway market.

Joint-venture company

TTControl is a joint-venture company of TTTech and Hydac International offering control systems and operator interfaces for mobile machinery and off-highway vehicles such as fork lifts, cranes, municipal vehicles, snow groomers, as well as construction and agricultural equipment. As a provider for functional safety, the company unites two partners for the mobile machinery market. Its software and hardware platforms enable equipment manufacturers to develop reliable electronic control systems in a quick and economical manner.

OEMs as producers of vehicles need an efficient environment for local troubleshooting, diagnostics, and testing. By accessing the machinery remotely, they can reduce downtime and costs for local support engineers during the warranty period. Additionally, by using the machine´s CAN networks to access information contained within the device´s ECUs, OEMs can study usage patterns to anticipate operator needs that can be considered when developing new product generations.

For fleet owners it is key to reduce the total cost of ownership and improve their fleets. They also require efficient asset management through predictive maintenance, integration of recurring billing and subscription management for the end user management. The localization of vehicles is crucial in terms of security and anti-theft protection. Alarms, monitored through a web portal or sent automatically via email or SMS, ensure fast reaction to any kind of machinery issue.

At the forefront of this trend, TTControl developed a comprehensive IoT platform including a cloud solution and a gateway to address the needs of OEMs and fleet owners.

The TTConnect Cloud Service can be integrated seamlessly into existing electronic architectures of machinery, enabling remote access to all data available on the vehicle's CAN networks. This includes traditional engine data such as engine rotation per minute, load or fuel consumption, but also additional diagnostic information gathered from electronic control units (ECU), hydraulic systems, and sensors. To achieve this, TTConnect Wave, a ruggedized IoT gateway suitable for harsh environments typical for off-highway vehicles, is installed on the machinery and connected to the CAN networks. The gateway collects data and redirects them to the "cloud". This web portal is accessible anywhere, anytime, and from any web-enabled device, allowing the user to visualize and analyze all collected data. ▷

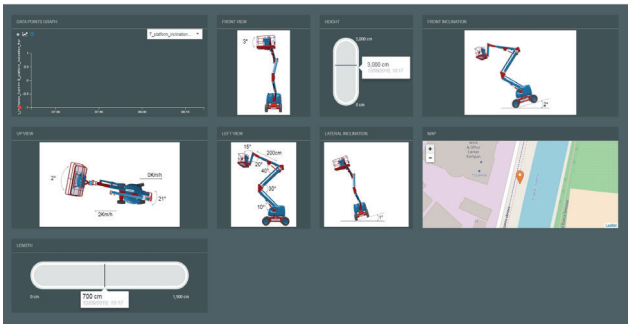

Figure 2: Processing machinery data from vehicle to cloud (Source: TTControl)

DIN 4630: Open network for body builders

The CAN-based open network specified in DIN 4630 (still under development) brings body applications such as truck-mounted cranes, refrigerators, etc. into the "clouds". There are two options for the application layer provided: CANopen and J1939. The standard will define body application units (BAU), telematics unit (TMU), in-vehicle gateway unit (IGU), and fleet management unit (FMU). This German standard will be published in English language and is intended to be submitted for international standardization.

The "cloud" platform

The platform stores a database of the CAN data the user of the IoT solution wants to monitor. The configuration is transmitted to the IoT gateway device installed on the machine so only the selected parameters will be monitored. The "cloud" offers intuitive dashboards and widgets that can be customized, allowing for a fast understanding of any live parameters of the vehicle. User accounts with custom dedicated access rights can be created through the web portal in order to tailor the available data to the requirements of certain end user groups, e.g. for configuration engineers, service technicians or operators monitoring alarms.

The IoT gateway acts independently from the ECUs installed on the vehicle and therefore can be retrofitted easily. It reads data via multiple CAN networks and transmits it via its cellular interface when it is connected to a mobile network. When the vehicle is not connected, it stores the data until the vehicle re-enters an area with network coverage. The set of CAN data to read and transmit to the platform is defined by the CAN data database previously defined in the "cloud" configuration section.

The "cloud" offers customers an end-to-end solution allowing for a deep insight into vehicle data. The solution enables users to use CAN-based data efficiently for predictive and preventive maintenance analyses, machine performance history, remote/local testing, diagnostics, and system calibration. The security core concepts of TTControl products are part of the solution allowing for custom access to data and warnings of any undesired events before they happen.

Figure 3: Ruggedized IoT gateway (Source: TTControl)

If desired, the "cloud" services can be customized with a dedicated web portal using branding colors and logos of the OEM or fleet owner. For each IoT gateway several dashboards can be created and widgets chosen from a wide selection in order to monitor only what is really needed in a clearly laid out graphical user interface. A map localization widget shows the position of the currently selected machine.

The solution is scalable and ready for deployment on hundreds or thousands of machineries with different properties thanks to the air gateway and ECU software upgrades that are configurable in the web portal by grouping devices with multiple criteria (i.e. machine type, machine model, geographical area, etc.) for scheduled machine upgrades.

The IoT gateway provides GSM/UMTS/HSPA+ connectivity, is currently licensed for 35 European countries and North America (USA and Canada), and can be installed on all off-highway vehicles with a CAN interface. The "cloud" service is accessible via internet browsers as available on PC, tablet, or smartphone featuring a secure multi-user login. No software programming skills are required to set up the system as it can be configured easily via graphical setup screens. ◀

Authors

Janosch Fauster, Andrea D'Achille
TTControl
office@ttcontrol.com
www.ttcontrol.com