



Trends in digital systems and IT

By Heinrich Prankl, Wieselburg (Austria)

Trends in Digital Systems and IT

Digitalization is permeating all areas of our professional and private lives to an extent never seen before. This development is, of course, also evident in agriculture and especially in agricultural machinery. As a result, hardly any new machines, systems, or products appear on the market without electronics and more or less complex software. The more expensive a product is, the more important professional service and maintenance become. Accordingly, machines in the higher performance range are naturally connected to the Internet. However, the trend toward ever-increasing automation requires more and more intelligent systems, such as the use of complex sensor technology, control and regulation technology, and artificial intelligence.

Intelligent systems for increasing automation

Yet this trend is no coincidence; it is essentially due to the following factors:

The demand for quality work in the various processes involved in crop production is constantly increasing. Precision in soil cultivation, sowing technology, crop protection, fertilization, and harvesting technology requires sophisticated process control and monitoring, as well as the corresponding sensor technology and actuators.

The complexity of machines is constantly increasing. On the other hand, there is a shortage of suitably qualified operating personnel. Such intelligent and complex systems require an operating concept that is as simple as possible.

There is considerable pressure to further increase work efficiency. Resources must be conserved and working hours must be reduced. It is therefore necessary to further increase the power of machines. The machine settings must therefore be adjusted as precisely as possible to the environmental conditions. Corresponding sensor technology is also required for this.

Problems, errors, and component or system failures are extremely time-consuming and costly. Therefore, problems must be identified at an early stage, which requires the use of sensor technology that can be very complex in some cases.

Due to climate change, with periods of drought on the one hand and heavy rainfall on the other, it is becoming increasingly necessary to recognize unexpected situations and respond to them flexibly.

Time and cost pressures ultimately lead to machines and systems becoming increasingly automated and ultimately operating autonomously. The system must monitor itself, its environment, and the work process, and be embedded in a management system. However, this is only possible thanks to the rapid development of new, innovative technologies. Digitalization, and artificial intelligence in particular, are currently play a major role. Provided that the appropriate data is available, AI methods can be used to model a wide variety of processes. This allows , for example, information from image data to be obtained for process control. Models can be trained based on this. High-quality models enable forecasts to be made, thereby facilitating automated decision-making processes. This requires extensive sensor systems and machine learning methods. Thanks to affordable communication technologies, process data is often delivered directly to the manufacturer's cloud, where it can be conveniently evaluated and processed.

Many new developments are evident in this area, which are described in more detail below.

Innovative developments

Developments in the field of digital systems and IT have been divided into four different categories, some of which overlap:

Sensor technology and forecasting systems

- Computer vision
- Management systems
- Hardware and software components
- Sensor technology and forecasting systems

Sensors are used to record individual parameters and provide data. In order to correctly assess situations and base decisions on them, it is often necessary to implement models that have been pre-trained using AI methods. Vibration monitoring is a typical example. Agrosentinels Kft. offers a vibration sensor of the same name in combination with a diagnostic system that

enables real-time fault monitoring and early detection of component damage in agricultural machinery. The Italian company COMET S.p.A. presents Campus, a diagnostic system for pumps in crop protection equipment based on various sensors. EMILIANA SERBATOI S.r.L. offers Emil Level, a level sensor that is primarily designed for use in mobile tanks. Another very interesting product is Intuitu Smart Pressure Assistant from Nokian Heavy Tyres Ltd. As with a tyre pressure monitoring system, the tyre pressure sensor is built directly into the tyre and transmits pressure, temperature and weight data to a smartphone via the cloud. This enables the correct tyre pressure to be set conveniently. TECALEMIT Flow is a flow meter for tank systems that is also connected to a data cloud.

Irrigation tailored to requirements is becoming increasingly important. The prerequisite for this is knowledge of the water available to plants in the soil. To this end, Drought Analytics GmbH, a spin-off of the Jülich Research Centre, has developed Dürrepilot, which provides a powerful irrigation management system based on TDR sensors in the soil, plant models and daily weather forecasts. The irrigation specialist Bauer from Austria developed Cosmofield. This involves using the principle of cosmic neutron detection to measure soil moisture. One sensor covers 5 to 10 hectares of arable land, eliminating the need for a large number of individual soil sensors.

In the field of pest detection, EFOS d.o.o. presents AURA 2 SC, a solar-powered insect trap that uses UV light instead of pheromones and features AI-based evaluation. The same company also developed BARKB SC, a solar-powered bark beetle trap with automated evaluation.

Computer vision

The development of increasingly affordable camera systems and, above all, the possibilities of image analysis using machine learning have led to a number of new developments. In particular, the evaluation of drone images is becoming increasingly diverse. Proofminder Services uses high-resolution drone and camera images in AI Agronomist for weed detection, yield forecasting, crop counting, weather and wildlife damage assessment, as well as for creating precise spraying maps, supporting over 30 use cases. ZONEYE from Skymaps s.r.o. also uses a cloud-based AI algorithm to detect over 30 plant species from drone images. Kiel University of Applied Sciences has developed Dynamic Field Scout, which uses drone orthophotos to determine current, exact field contours and also detects obstacles in the process. Photoheyler GmbH offers the Custom AI training platform for training AI algorithms with the user's own images.

Brigade Electronics offers a new front-mounted camera monitor system with AI-based person and traffic detection, including warning messages. The front-mounted camera has already been

DLG-tested. EasyMatch from Amazonen Werke GmbH enables automated adjustment of the fertiliser spreader by identifying the commercial fertiliser to be applied using image analysis. Hagedorn Software Engineering GmbH is launching VISION, an AI-based 3D camera system that can be used to monitor the working quality of implements. For example, blockages in a cultivator can be detected automatically. Vision Pro from FieldBee, on the other hand, is a retrofit solution for a steering system, but also includes an RGB and NIR camera for calculating a vegetation index (EVI) in real time. With WIN – Weeder Intelligent Network, Rau Serta Hydraulik GmbH offers a camera-based row recognition system for hoe control and track guidance. Claas has developed AI-supported spare parts recognition using image analysis of a photograph to quickly find the right spare part.

Management systems

The more expensive and complex a system becomes, the more important machine management becomes. High machine utilisation, monitoring and optimised functionalities are prerequisites for efficient operation. Lemken has already presented innovative developments in the past with iQblue. The iQblue tool monitoring system for assessing the condition of cultivator shares, which was presented (and received an award) two years ago, has now been expanded to become iQblue Smart implement. In addition to the roller speed, the crop flow is also monitored to detect blockages. iQblue Machine connect allows device combinations with and without their own ISOBUS function to be networked into a single unit. Claas, on the other hand, has developed an AI-supported assistance system for the operation and maintenance of machines. A chatbot with an analysis module assists with specific questions and supports the planning of maintenance and repair measures in the authorised workshop. The Claas Green Yield Score enables the automated collection and allocation of emissions data along agricultural production chains. This involves allocating fuel consumption to the respective process steps. With Connected Operator Services, Case IH offers a total of four digital services to support drivers in making optimal use of their machines, avoiding errors and increasing productivity. Operator Insight analyses machine data in real time and provides immediate feedback to the driver. Operational Report analyses consumption, CO₂ emissions and performance, links the data to expert knowledge, identifies operating errors and shows consumption and emission trends – including specific suggestions for improvement. Operational Dashboard provides dealers with a powerful tool for proactively planning maintenance and improving service. Operator Advisor generates individual driving feedback based on machine data. FarmBlick GmbH has developed SRC Smart Relay Cropping, a tool for automatic track planning, field optimisation and data transfer directly to the steering system.

With TCU Traction Control Unit from AgXeed b.v., centrally planned tasks can be carried out with an existing multi-brand fleet (tractor, self-propelled machine, robot, etc.). Depending on the

level of technology, the scope of the order can range from track lines to complete routing, including implement settings. Maschinenfabrik Bernhard Krone has developed SPARTA², a system for the standardised description of the spatio-temporal behaviour (trajectories) of machine movements. The goal is interoperability between machine combinations from different manufacturers. Syngenta Agro GmbH is launching two new systems: Cropwise Operations AI Machine Pool is a machine rental platform that suggests optimal equipment combinations between farmers through real-time analysis of planned field work and machine utilisation. Machine Manager enables work orders to be created while taking into account field relief, soil type and composition, weather conditions and crop growth stages. An integrated telematics module enables machine allocation, quality control and real-time monitoring. AGMO Inc. offers SeamOS, an "ecosystem-as-a-service" platform. The open operating system enables the development of applications and plug-ins, e.g. for ISOBUS applications.

With Panorama Passmaster, PTx offers a live view of machine data, including data exchange between machines in the tractor cab, thereby facilitating the coordination of work between multiple machines and operators by combining application maps.

Hardware and software components

New hardware and software components form the basis for more complex systems and a higher degree of automation. Centro Motion has developed a new display and controller called CrossCore A100. WEED-IT DASH from Rometron B.B., on the other hand, is part of a spot spray system consisting of a touchscreen, controller and communication module. Neousys Technology GmbH offers Fanless Flattop, a dust-protected control unit with six camera inputs for AI applications. Marinelli's STEERMASTER is a system for integrating sensors, remote control and data acquisition for autonomous driving.

NX Next Motion from Arnold NextG GmbH is extremely interesting. This is a complete drive-by-wire system that replaces the mechanical connections of the steering, brakes and drive with electronics and is approved for road use. The DUXALPHA retrofit solution from the same company is a 3D guidance system for off-road terrain. The driving lanes are planned depending on the slope of the terrain and the working width. The logiBUS2026 from HR Agrartechnik GmbH is a prime example. This is the next version of an intuitive graphical development environment for ISOBUS applications. Zunhammer's ISO Cloud Control is also interesting: Here, the ISOBUS Task Controller is directly connected to the cloud. A new application card is therefore synchronised immediately with the vehicle. The Smartstick from Hagedorn Software GmbH replaces the USB stick for transferring orders, driving routes and application maps with an app on the user's smartphone. The terminal recognises it like a USB stick. AgGateway presents a new version of ADAPT, a data model for a common, portable and interoperable file

layout. With Mela, IAV GmbH offers a system that can be used to analyse large videos, measurement data or texts. VLLM – a tool that is already widely used in the automotive sector – then enables critical driving scenarios to be generated.

Conclusion and outlook

This year's Agritechnica will also showcase a wide range of new developments in the field of digital systems and IT. The possibilities offered by artificial intelligence, and machine learning in particular, are being exploited in many applications. In image processing in particular, this can be used to generate information that was previously only available to human beings.

Sophisticated components as part of complex systems require the development of new management systems in order to be able to use the machines efficiently. Decisions are increasingly being transferred to the system. It can therefore be expected that more and more autonomous systems will be presented in the future, but their beneficial application must also be proven.

Media Contact

Media contact:

Malene Conlong

Tel: +49 6924788237

Email: M.conlong@dlg.org

About DLG

With more than 31,000 members, DLG is a politically independent and non-profit organisation. DLG draws on an international network of some 3,000 food and agricultural experts. DLG operates with subsidiaries in 10 countries and also organizes over 30 regional agricultural and livestock exhibitions worldwide. DLG's leading international exhibitions, EuroTier for livestock farming and Agritechnica for agricultural machinery, which are held every two years in Hanover, Germany, provide international impetus for the local trade fairs. Headquartered in Frankfurt, Germany, DLG conducts practical trials and tests to keep its members informed of the latest developments. DLG's sites include DLG's International Crop Production Centre, a 600-hectare test site in Bernburg-Strenzfeld, Germany and the DLG Test Centre, Europe's largest agricultural machinery test centre for Technology and Farm Inputs, located in Gross-Umstadt,

Germany. DLG bridges the gap between theory and practice, as evidenced by more than 40 working groups of farmers, academics, agricultural equipment companies and organisations that continually compare advances in knowledge in specific areas such as irrigation and precision farming.

www.dlg.org