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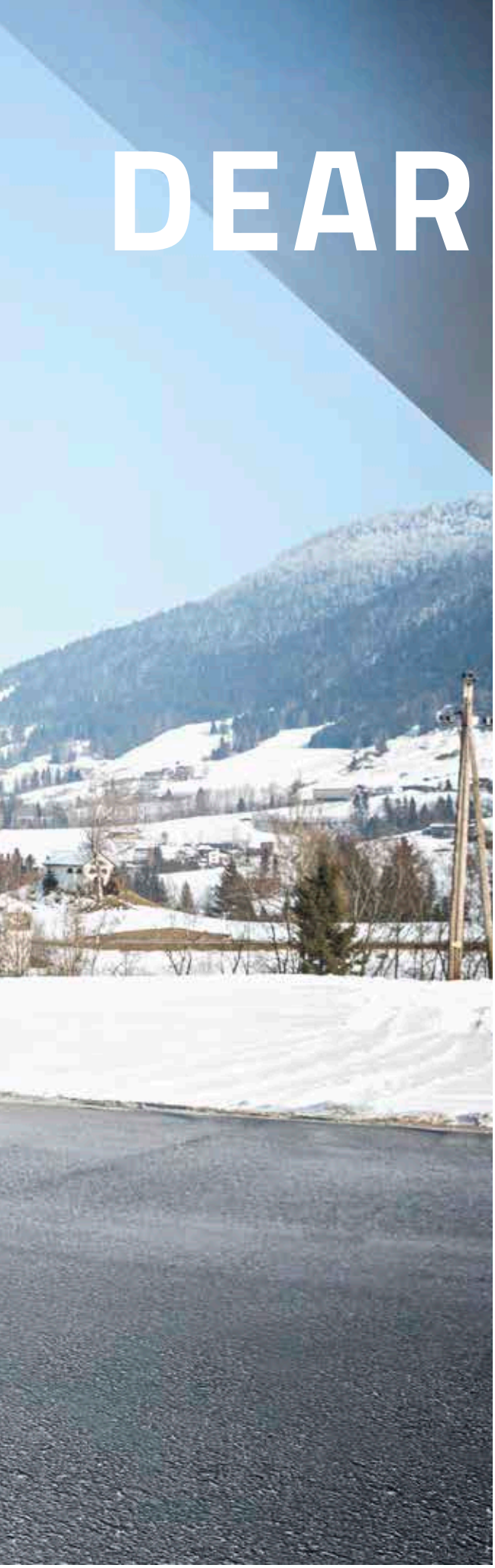
The Bachmann Customer Magazine 08 | 2018

MISSION

INTERVIEW: HAMSTER WHEEL 4.0 | AI: MAGIC OR TRADE?
INDUSTRY: TSN OPC UA | SOFTWARE: WHAT IS AGILE?
NEWS: PRODUCTS AND MARKETS

»We need to have some new thinking and develop a new roadmap.«

Werner Elender
COO Bachmann electronic



Werner Elender at the bus stop in Krumbach, Austria

DEAR READER,

We humans love plans. They give us security, provide us with binding frameworks in which we can move, as well as incentives, goals and direction. We have plans for our society, for the economy, for projects, and even for public transport. A plan is binding, but also often implies time frames in order to cushion any uncertainties. And today this presents many people and companies with a challenge. When the plans we rely on are restrictive, we very often experience a considerable deviation from reality. We consequently live between extremes.

Constant flexibility is what we often and gladly demand of ourselves, and you do as well. However, we still need orientation and a solid foundation. Too much flexibility means uncertainty, which is unhealthy for us humans and can cause a company like ours to overlook what's important – our customers and our business. Every day, we receive an enormous amount of new information or technologies which enable us to alter our plans swiftly and spontaneously. Whilst this is a tremendous benefit, it does cause us to worry sometimes.

Do we now have to change our roadmap due to the new technologies present in industry? Many new competitors from other sectors are penetrating our market. These have a serious disadvantage: They do not have a decisive plan.

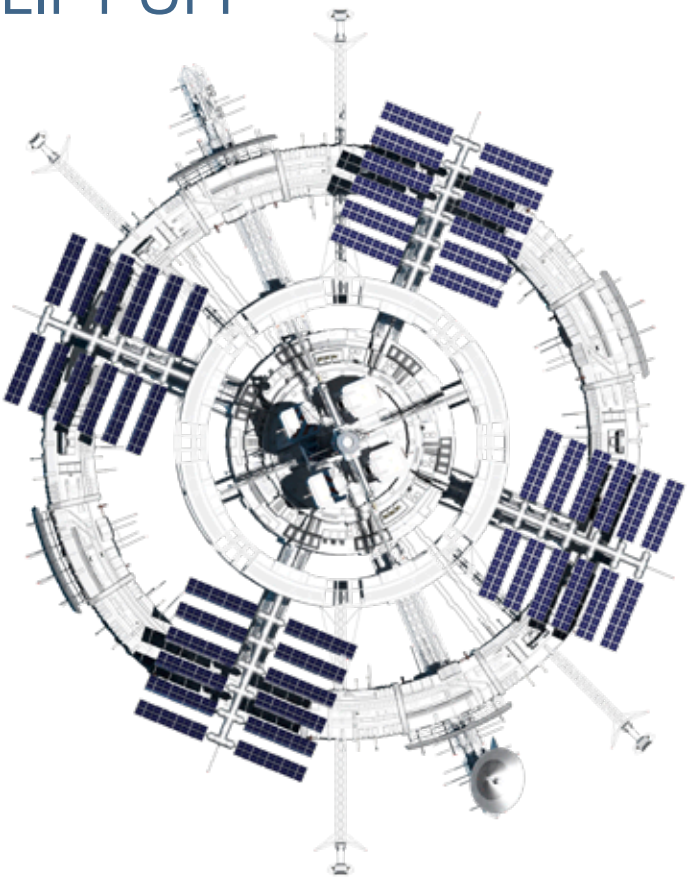
The future requires us to have two plans which have to be coordinated with each other. A long-term plan, which has already been with us for decades, continues to guide us, and which we always have to prioritize: Who we are. Where we come from. What we have achieved. What our strengths are. What our customers and partners can rely on.

The second plan must show a way forward – where we want to go, what we can achieve and what is required of us? This is what we all, both you and I in the company, have to work on. Yes, we have to develop and use new technologies, but not everything that is vigorously marketed is useful for us and for you as a customer. The benefits for customers should also be the focus of our plans for the future. That is why in this edition we are presenting you with different roadmaps – some more futuristic, some more for discussion and some more down-to-earth. These are issues about which we also have views.

Yours sincerely,

Werner Elender
COO Bachmann electronic

RESEARCH, TEST AND LIFT OFF



No, you haven't missed anything – the space station on the cover is not yet in operation. It is a vision. The fascination for space travel seemed lost until some private investors rediscovered it. They are looking into the future, researching and trying things out. Not every start is successful.

Even industry has to experiment, test and develop new ideas. New vendors are penetrating the market. Get inspired and set off into the future with Bachmann electronic.

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Interview

IN HAMSTER WHEEL 4.0?

We discuss Industry 4.0 and/or the digitalization of factories together with naysayer Prof. Andreas Syska and a dedicated pragmatist, Matthias Schagginger, from Bachmann electronic in Feldkirch. These two are joined by Werner Elender, another realist and COO of the company, and Robert Weber, who is asking the questions.

Why are you the naysayer of Industry 4.0, Prof. Syska?

Prof. Dr. Ing. Andreas Syska: (laughing) The person who gave that title is not listening properly to what I have to say. After all, the possibilities of digitalization and networking go far beyond what is currently being discussed. They will offer us a unique opportunity in history to shape how we live, work and do business in the future.

And you, Mr. Schagginger – why are you the pragmatist when it comes to factory digitalization?

Matthias Schagginger: I have lived through the era of CIM and am seeing again today trends and technologies popping up that will have little point in the end. Added to this is the fact that Industry 4.0 is also still a politically charged issue. I wonder who will benefit from it.

Your customers...

Werner Elender: Some of our customers are unsure. For fear of falling behind, they are rushing to information events held by different associations. Our advice is to take a deep breath and do nothing for the time being. There is no common understanding on this subject at present. We are a very technology-oriented company, and so the benefits and advantages must be recognizable for the customer. What is the point of collecting data without knowing what to do with it? A lot of what we are seeing today is the revamped marketing of old technologies without any innovation.

Prof. Dr. Ing. Andreas Syska: Basically, the Emperor's new clothes. Apart from web-based networking, there's not much involved that is new. The technologies used would also have been on the agenda without the Industry 4.0 label. People are getting lost in details and technology is being imposed on factories that may perhaps not even exist in the future.

There is nothing bad about marketing in itself. Why doesn't Bachmann electronic jump on the bandwagon and sell a few more controllers with the Industry 4.0-ready logo?

Matthias Schagginger: We like to call a spade a spade, but this isn't happening with Industry 4.0. Connectors that have been available since the nineties all of a sudden are Industry 4.0 ready – nobody's going to believe you.

Okay, I understand. The technologies are already known – no big deal then. A lot of things would also have been available without the Industry 4.0 label. But new business models are nevertheless important or are they now two a penny!?

Werner Elender: Two a penny certainly not, but also not the result of trade conferences, or government ministries, which are boosting the hype with taxpayers' money. With Industry 4.0, we are often still not thinking from the point of view of the end customers. That's why the subject is not moving forward. That's why it's the equipment suppliers who are forcing the issue in the media, not the users.

Prof. Dr. Ing. Andreas Syska: Factory equipment suppliers and researchers are driving the politics and are dictating the agenda. They are implementing projects and telling politicians at the same time that these are successful and that the funding is money well spent. Trade associations are supporting this

Prof. Dr. Ing. Andreas Syska

1978 – 1985 Studied mechanical engineering, RWTH Aachen

1985 – 1990 Research institute for rationalization at the RWTH, Aachen, research associate, became a Dr. Ing.

1990 – 1994 Robert Bosch GmbH, Stuttgart, production manager

1994 – 1995 Arthur D. Little, Wiesbaden, consultant

1995 Founding of Syska consultancy

Since 1997 Professor for production management at the Niederrhein University of Applied Science in Mönchengladbach

because they sense that this will mean good business for their member companies. This has therefore produced a closed circuit in which everyone involved is mutually reinforcing their views and patting each other vigorously on the back. Let's be honest for once. Is monitoring the performance of a machine really a new idea?

That's all very well and good, but if you were the CEO of a medium-sized automation company, what would you do? Destroy everything and start again from scratch?

Prof. Dr. Ing. Andreas Syska: I would destroy my existing business model before someone else does it for me. I would sacrifice my own products to build a platform. Products are only a means to an end in order to operate the platforms. In Germany and Austria you will often hear the view that technological miracles are achieved already once the data formats have been defined. While this speeds things up, it doesn't actually invent anything new. This is different in the USA. I would position myself as a contender between Bachmann electronic and the customer, running the platform on which I would get involved in all business sectors. The machine builder then becomes a replaceable supplier of components.

Thinking further ahead... Will Bachmann electronic give away its M1 controller for free in future?

Matthias Schagginger: Give away, probably not (he laughs) – thanks to their openness, our controllers have allowed programming with third party software for many years. The software infrastructure offered by us will naturally continue to further expand and save users time for development and costs. Besides the usual purchase model we see today, there will be asset-light models, such as leasing, perhaps even one or two operator models. Nobody in the industrial sector believes any more in the fairy tale of the crowd that hands out software free of charge as open source. What counts much more is whether something is really long lasting.

Werner Elender: We already know the phenomenon you describe from the consumer world. The difference to our business is that we as manufacturers have created many differentiation features on individual products, and our customers expect reliability, spare parts and service – even over decades. However, one thing is certain. As long as I still depend on the product, focusing on platforms is virtually impossible. It prevents the manufacturer from letting go.

Prof. Dr. Ing. Andreas Syska: I agree with you. It's easier for newcomers from a different sector. The greatest danger to producers with a factory are producers without a factory. Imagine this scenario. A manufacturer releases patents, makes them available on a platform and benefits from the individual interactions. That's where I see the future. Our prosperity, however, depends on production and product know-how. To give this up would affect us substantially in all areas.

Matthias Schagginger: This reminds me of a discussion from the nineties. At that time, we discussed whether to offer a pure operator model for SCADA instead of a software license!? I am still thinking about this today. However, I still haven't found the right application field.

So now we're talking about platforms. That's all well and good, but why are mediumsized automation companies not represented in the IIoT platforms?

Matthias Schagginger: They are being

Realist Werner Elender lets himself be guided by customer requirements, not by economic policy.

Prof. Dr. Ing. Andreas Syska: The naysayer would sacrifice the factory, in order to run a platform before another person does it.

led by competitors (laughing). But even Google could have a platform like this. We are working on our own solutions for customers. These are also cheaper than in the Google Cloud, which is definitely not cheap, even if it is presented as such. For years we have been offering two cloud solutions. Some have become very popular on the market, while others are only implemented by three or four users. Our customers come to us for advice.

One question – the term 'platform' also means: developing apps and making the platform available. Would that not be a new business model for Bachmann electronic?

Pragmatist Matthias Schagginger advises against the impulse to take action.

Werner Elender: Careful. I'd make one reservation here. This is not primarily an issue for us as manufacturers of generic controller solutions, but for the machine builders with system specific functions and information.

Matthias Schagginger: I haven't understood this yet. We normally hope for all the biotopes we have cultivated to take off one day like the Playstore in the B2C sector. But let's be realistic. Controllers in machine tools are and will remain initially closed. The little information that is shared is certainly not enough for an application at present.

How will Bachmann electronic earn its money in ten years?

Werner Elender: Through services and through more condition monitoring. We are developing ourselves as suppliers of complete solutions. That's where we see our potential.

Matthias Schagginger: And with robust and industrial controllers with long-term availability. Unlike in the mobile phone industry, even the most radical transformation will not cause the need to upgrade the electrical equipment of industrial plants every 1 to 2 years. Anyone who has ever implemented an ERP system knows that it's not just about ready-to-use algorithms from the App store, and that's even before we start talking about hard real-time functionality. And we will have to wait more than ten years until the entire technology has moved to the cloud, if at all. This needs more than a little bit of infrastructure and 5G.

Prof. Dr. Ing. Andreas Syska: I'm now going to change the subject. What makes you so certain that future production will be carried out in factories?

You mean stop investing in factories?

Prof. Dr. Ing. Andreas Syska: It is vital that this subject is taken out of the restricted context of the factory and not just viewed solely from the standpoint of technology and the factory. This would only cause old mistakes to be repeated by introducing solutions without understanding the relevant problem and without the vision of tomorrow's world. Producers with their factories like to think that they have the sovereign right to value creation. Anyone looking closely can already detect the signs of value creation becoming more decentralized in future.

Can you give an example?

Prof. Dr. Ing. Andreas Syska: Sure, look at 3D printers. Obviously, the first devices will also appear in the factories in the future, but you will also find them in trade workshops, supermarkets or at home. Take the example of makerspaces. These enable anyone to access NC supported machine tools. While they all still have many technical limitations, the progress they have made has been tremendous. Once these decentralized value creation sites are networked, a considerable amount of production will move there.

Matthias Schagginger: But these too will need control technology.

Prof. Dr. Ing. Andreas Syska: Yes, but not yours. Wind turbine manufacturers will build this on site, wherever possible by themselves. You will supply the knowhow and will lose the non-digital part of value creation such as electronics production, mechanical processing, assembly, etc.

We are back talking about the customer who has changed ... or the new customer.

Werner Elender: Customers are changing continually and new ones come. That's why we have to continually focus on our direct customers as well as their end customers and their needs. We can't afford to be complacent today but must respond cautiously to the changed requirements. However, I don't see that primarily as a risk but rather as an exciting task.

Industry 4.0 is also a social issue.

Prof. Dr. Ing. Andreas Syska: Yes, and that is too often overlooked. As already mentioned, digitalization and networking will enable us to shape how we aim to live, work and earn our living in future. However, the value of work must also be worked out here, as well as the fair distribution of wealth and access to resources, information and knowledge. This subject needs a vision – a guiding star. But this will only be found outside of factories and industry. The currently often highlighted issues of increased efficiency and market growth – the call for everything to be faster, greater and further – do not add up to a vision but rather "Hamster Wheel 4.0".

Matthias Schagginger: That's all well and good but global competition is driving us to offer greater, faster and better solutions.

The ultimate question is how will we earn our money in 2040?

Prof. Dr. Ing. Andreas Syska: A considerable part of value creation in 2040 will be in flexible networks. In other words: The value flows will bypass conventional factories. Industry as we know it has started its final chapter. This is the actual consequence of the networking of digital processes.

Werner Elender: I'd make one reservation here. This scenario only applies to products that do not require long-term availability. And only products for which individualization is a relevant aim. Mass-produced goods still need factories. Factories where people work will still continue to exist. They will work differently but they will still work. The factories of the future will be powered by renewable energy, and automation will simplify work and increase productivity.

»We must focus our attention on new customer requirements.«

Werner Elender
COO, Bachmann electronic

Opinion

DIGITALIZATION – KILLER OR MOTOR?

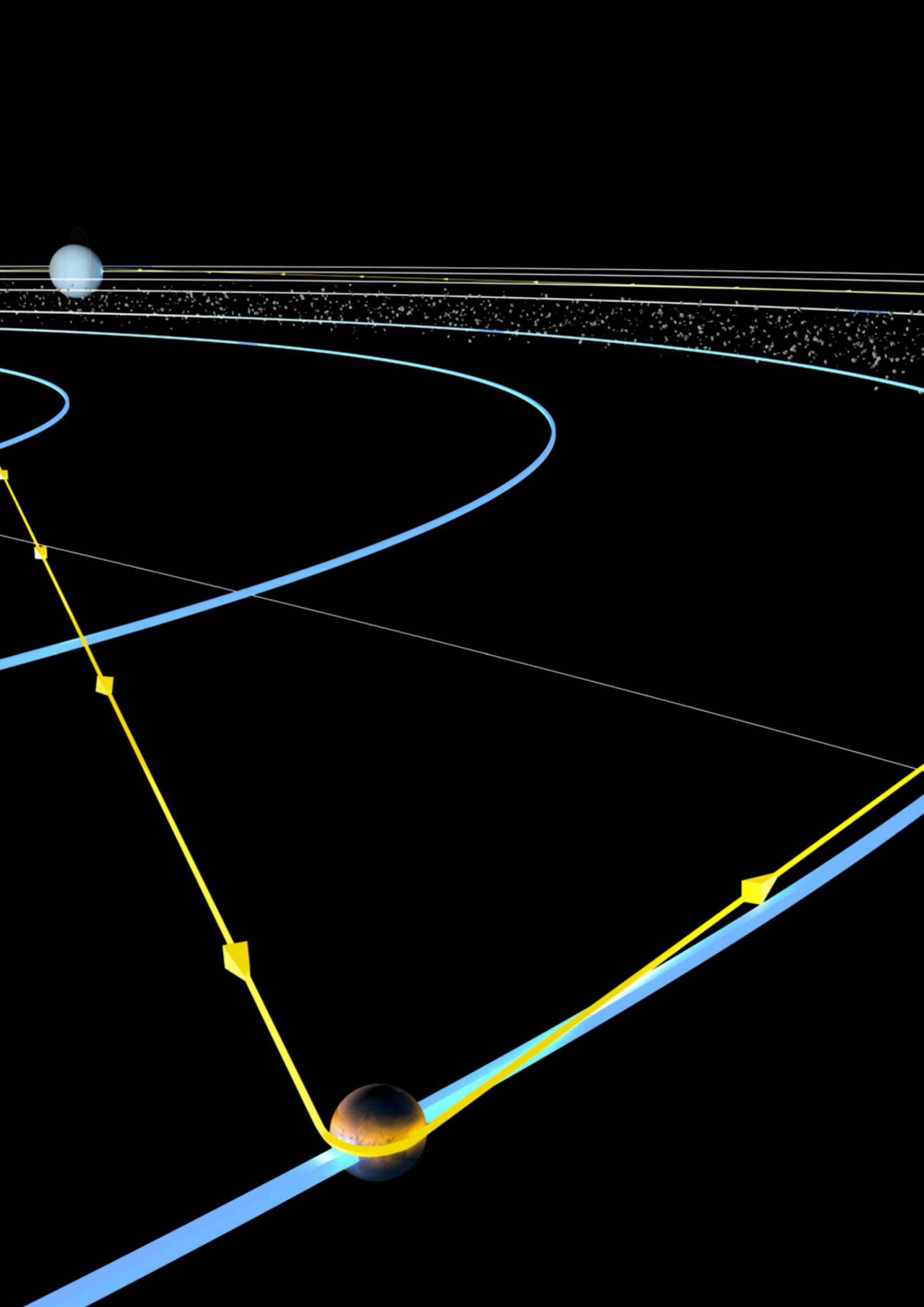
Prof. Volker Markus Banholzer
Chair for technical communication at
Nuremberg College of Applied Sciences

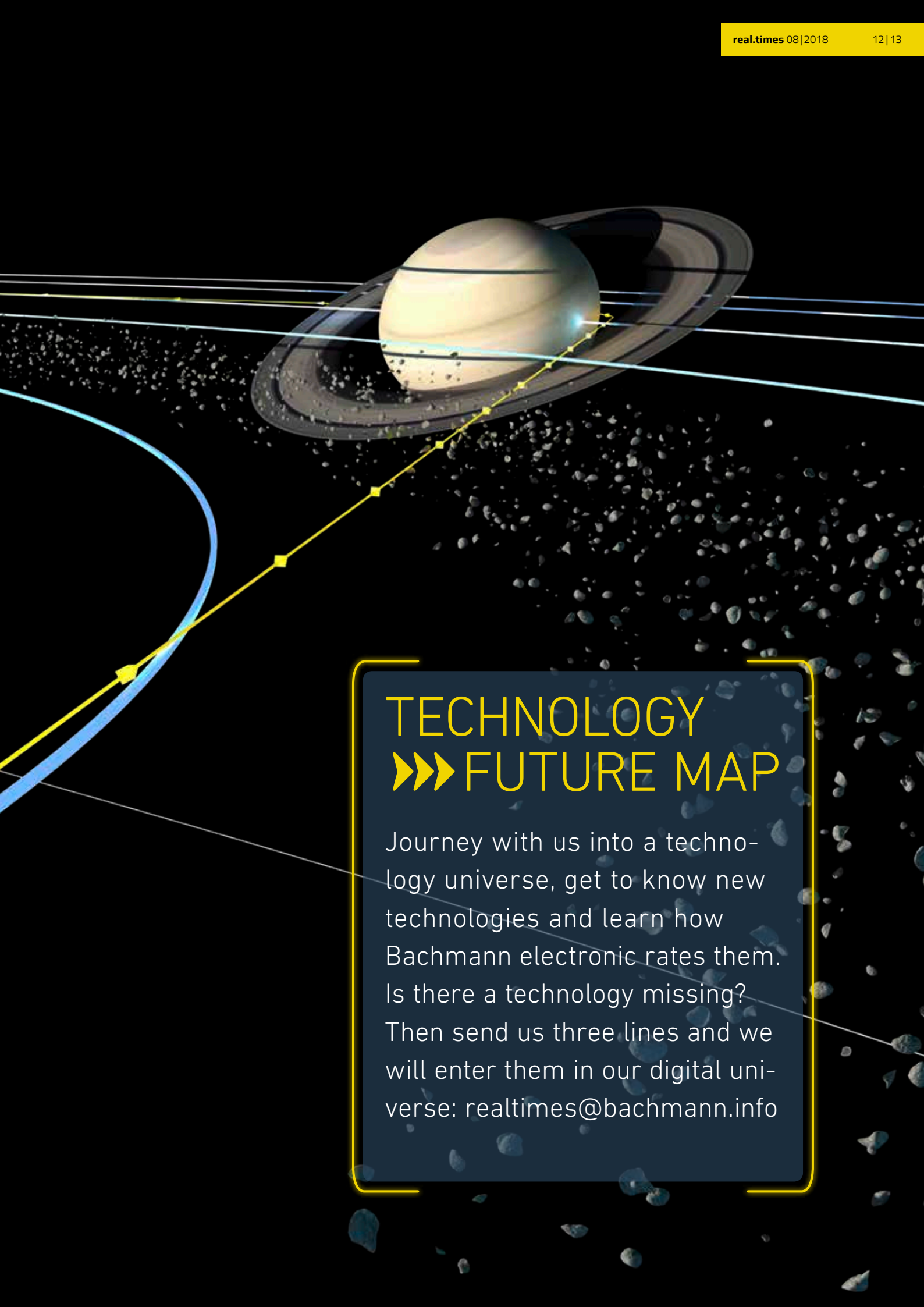
This question is not only raised in specialist circles but also discussed in the public domain. The fact that the Bitkom association for the IT sector has taken up the role of Cassandra has got peoples' attention. This arose from a survey indicating that 3.4 million jobs could be lost in five years because robots and automation technology will take over the work. And according to Bitkom president Achim Berg, banks and insurance companies are threatened with job losses. Was there good reason to panic then?

We are reminded of Frey/Osborne's first study from 2013 when they forecast the loss of 50 million jobs worldwide due to the onset of digitalization, robotics and automation. There is no doubt that automation and robotics also led to considerable changes in the work landscape in the past. The digitalization and globalization of business activities are currently expediting the change faster than in previous transformation phases. Banks and insurance companies are also facing radical cutbacks and the automation of routine operations. The problem is that forecasts are always about the future and are mostly formulated on the basis of extrapolations. The suggested certainty, however, also does not exclude the imminent uncertainty of occurrence probabilities, course deviations and unforeseeable events. It is true to say that digitalization changes or replaces working relationships, profiles and areas. The questions about the exact time scale, the exact number or the exact type or method cannot be answered.

Bitkom was the first industry association, with member companies actually benefiting from digitalization to warn of impending job losses in significant numbers. The VDMA and ZVEI responded accordingly with some irritation. The VDMA considers digitalization to be a "Jobs Motor for Germany". Digitalization would generate new job profiles, and skilled workers would become a rare commodity through the demographic transition. Those industrial nations with the highest density of robots would be those with the highest economic growth. What is true? On the one hand Bitkom has not addressed the mechanical engineering sector or the electrical engineering sector, but banks, insurance companies and the pharmaceutical industry. The consensus of all forecasts on digitalization is that those sectors with a large proportion of routine processes or operating on the basis of standardized data will have to expect the first effects of automation. On the other hand, the reactions of the VDMA and ZVEI show that digitalization will also create new jobs and new work profiles in particular. However, this will certainly not be synchronized with the processes of decline.

As a result, this will have an effect on business models, job profiles, legal and financial models and thus all areas of society. Due to the unpredictability of the related developments and results, there are no exclusively correct solutions. Western industrial nations will definitely be facing some uncomfortable discussions for a long time. They will therefore have to respect the demand for transparency in decision making processes. However it's a demand placed on politics as much as on society. The future is unknown but it can be discussed and shaped from the present.

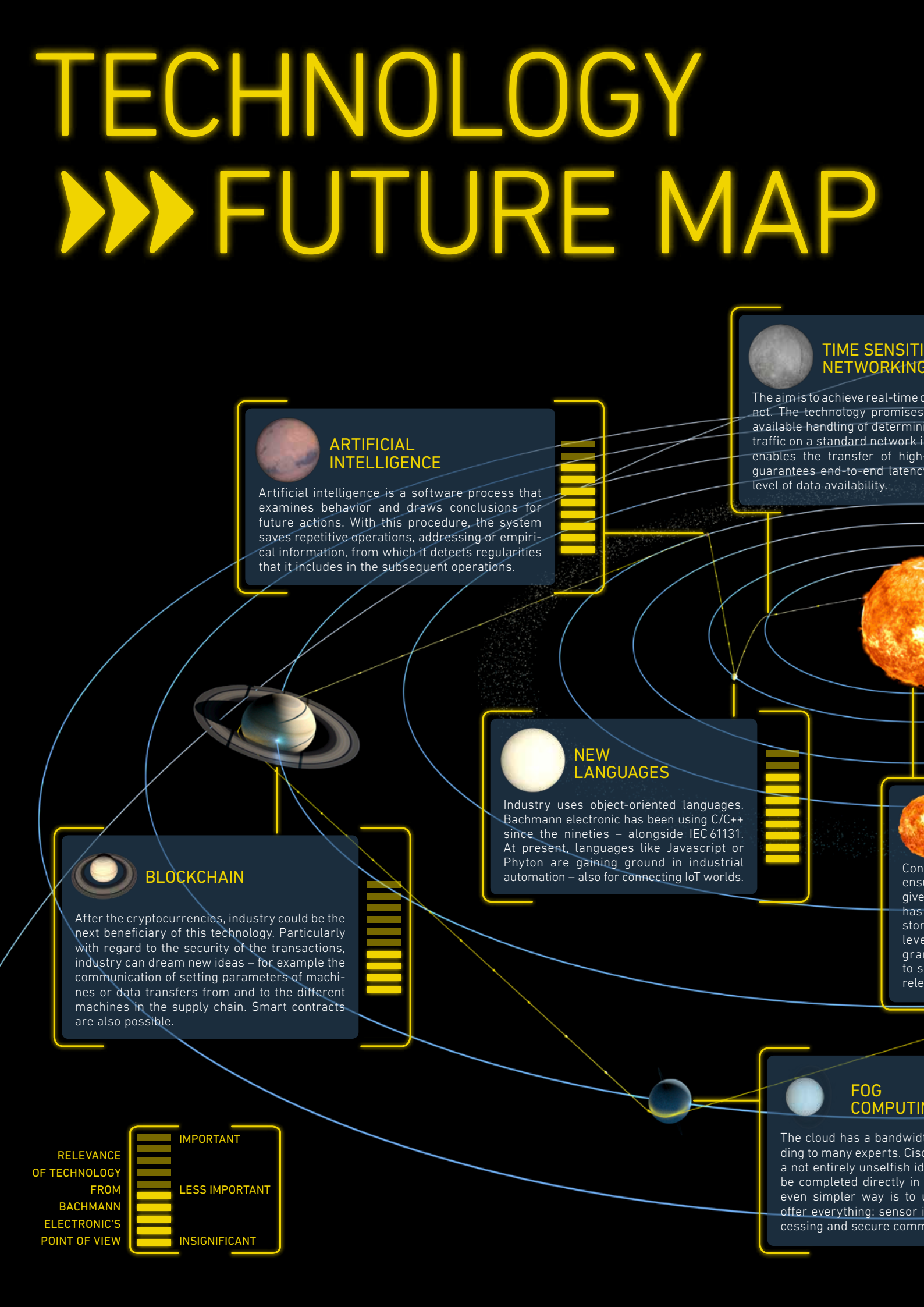




TECHNOLOGY »» FUTURE MAP

Journey with us into a technology universe, get to know new technologies and learn how Bachmann electronic rates them. Is there a technology missing? Then send us three lines and we will enter them in our digital universe: realtimes@bachmann.info

TECHNOLOGY FUTURE MAP



ARTIFICIAL INTELLIGENCE

Artificial intelligence is a software process that examines behavior and draws conclusions for future actions. With this procedure, the system saves repetitive operations, addressing or empirical information, from which it detects regularities that it includes in the subsequent operations.

TIME SENSITI NETWORKING

The aim is to achieve real-time c net. The technology promises available handling of determini traffic on a standard network i enables the transfer of high guarantees end-to-end latenc level of data availability.

NEW LANGUAGES

Industry uses object-oriented languages. Bachmann electronic has been using C/C++ since the nineties – alongside IEC 61131. At present, languages like Javascript or Phyton are gaining ground in industrial automation – also for connecting IoT worlds.

BLOCKCHAIN

After the cryptocurrencies, industry could be the next beneficiary of this technology. Particularly with regard to the security of the transactions, industry can dream new ideas – for example the communication of setting parameters of machines or data transfers from and to the different machines in the supply chain. Smart contracts are also possible.

Con ensu give has stor leve gra to s rele

FOG COMPUTI

The cloud has a bandwid ding to many experts. Cisc a not entirely unselfish id be completed directly in even simpler way is to offer everything: sensor i cessing and secure comm

RELEVANCE OF TECHNOLOGY FROM BACHMANN ELECTRONIC'S POINT OF VIEW

IMPORTANT

LESS IMPORTANT

INSIGNIFICANT

NARROWBAND

Narrowband IoT is a new wireless technology specially developed for the Internet of Things. Low band width, low energy consumption, latency of up to 20 seconds, average monthly data volume per device max. 500 KB.

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capability for Ether-
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nfrastructure. This
-priority data and
y to ensure a high

DIGITAL TWIN

The digital twin is primarily used in trials, such as for model-based development. Modifications and adjustments are first simulated on the digital twin and then later implemented in the field. The benefit of the software is that enables very realistic simulation and programming.

USABILITY/UX

Good operator interfaces are the foundation for safety and productivity. This has now been a clear requirement of users. Through the complexity brought on by Industry 4.0, usability is becoming the critical success factor in engineering.

SECURITY

fidentiality, availability and integrity have to be
ured. At present, too few companies are willing to
up patching and default passwords. Data security
primarily been used for process parameters, key
es and user management. This requires a high
el of flexibility for role-based access, a highly
nular access control and user-oriented access
pecific data items and variables. IEC 62443 is the
vant security standard.

PLATFORM ECONOMY

Trumpf, Kuka, Siemens, DMG Mori – all have a platform or even several platforms. The platform becomes an operating system and Prof. Thomas Bauernhansl from the Fraunhofer IPA can even imagine a controller arising from it.

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th and latency problem, accor-
co and other IT companies have
ea: Enable processing tasks to
the field by smart routers. An
use modern PLCs, which now
nterfaces, local real-time pro-
nunication to the cloud.

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Report

IS TSN PLUS OPC UA WINNING THE RACE?

All signs are pointing to it: Ethernet TSN could be introduced in factories on a broad scale and even replace established fieldbuses as “the” communication standard right down to the sensors.

Time Sensitive Networking (TSN) stands for a number of real- time extensions of the established Ethernet standard which are specified by an IEEE working group (within IEEE 802.1). The extensions here represent less of a revolution and more of a standard toolbox for different problems in real-time communication. Looked at objectively, these mechanisms are nothing new for fieldbus specialists. Guaranteed real time and the synchronization of controllers, drives or IOs with an accuracy of less than one microsecond have been common features for a long time.

Then why does this need TSN at all? Why should the fieldbuses give up their place?

Heinrich Munz, responsible at Kuka for Industry 4.0 Visions, considers the requirements of future industrial communication. “Deterministic real-time computing is very important for machine builders. We sometimes

»We need to implement deterministic open and closed-loop control.«

Heinrich Munz
Lead architect for Industry 4.0, Kuka. Roboter GmbH

have to deterministically control and regulate our machines from the controlling software in synchronization with their movements in the sub-millisecond range." In his opinion, Industry 4.0 is presenting machine builders with two new requirements which cannot be solved with traditional methods.

Protecting existing assets

Firstly, due to the processes described in Moore's and Nielsen's laws, by which the computer performance or network bandwidth doubles every 18 to 24 months, it will no longer make sense in future to accumulate individual tasks in complex central controllers with several operating systems and hypervisors. The tasks must rather be distributed among small and easy to control networked nodes to thus form so-called holonic production systems. Decentralization "at the bottom" on the plant floor and centralization "at the top" in the cloud through web services is the current trend in these times of Industry 4.0.

Question two: some of these nodes will no longer be permanently installed in future, but will be mobile and will communicate on the handheld devices in real-time with the fixed stations. Example: A mobile robot carries the semi-finished product to a machining station, where a permanently installed robot carries a polishing machine. They polish the product together through synchronized movements. The real-time communication needed for these requirements has previously only been possible via fieldbuses. As the name already says, these were developed for I/O communication in the field, and, with their primitive bit and byte data, are no match for the current requirements of service-oriented peer-to-peer communication between controllers.

It has thus become a strong belief in the industry over the last two years that TSN as the lower layer and OPC UA on top will very soon play a major role in industrial automation. But where will the limits of its use be? There is currently no consensus in the sector about this point. Players such as the Profibus Users Organization believe that the communication combination of OPC UA plus TSN belongs to the future, although restricted to the use from the cloud down to the controller level. In their view, the conventional field level of the automation pyramid will also be covered in future by solutions such as Profinet IRT, Ethercat and Sercos. Not so the representatives of the so-called Shaper Group, a loose corporate association of currently 17 manufacturers in IT and industrial automation. "We anticipate that OPC UA TSN will quickly reveal itself as a game changer in the field of industrial automation, being the first and only candidate for establishing a holistic communication infrastructure from the sensor to the cloud," states an extract from the group's latest white paper "OPC UA TSN – A New Solution for Industrial Communication".

The Pub/sub extension

OPC UA still lacks the Pub/Sub extension, which is currently still urgently needed. Admittedly, the Pub/Sub specification of the OPC Foundation was released in February 2018. However, the work on this has progressed so much that the Open Source Automation Development Lab (OSADL) already presented an open source implementation of the Pub/Sub extension at the embedded world in February. "We experienced such a tremendous demand for this kind of implementation at the SPS IPC Drives fair in November that it became very clear to us that we had to initiate this kind of project," explains OSADL CEO Carsten Emde. OSADL used a demonstrator at the fair to show that the open source implementation actually worked. It showed several TSN-capable embedded systems that transfer both real-time and non-realtime data. Different measurement methods confirm that the OPC UA Pub/Sub implementation currently available makes it possible to transfer real-time data via TSN without a broker to several recipients, without any loss in determinism due to the non-realtime data.

The companion standards

So-called companion standards have to be defined in order to ensure, as Heinrich Munz is requesting, that a wide range of different machines can communicate in a network as smoothly as possible.

The VDMA in Germany with its 38 trade associations in particular is promoting the idea of the OPC UA companion standards. While the injection molding industry were the trailblazers here, followed by "Machine Vision" and robotics, there are now already eleven trade associations in the VDMA actively working on OPC UA. "The real challenge for the future is how to coordinate these different companion specs together so that a robot and an injection molding machine, for example, do not have completely different MES or energy interfaces – this will be synchronized by the VDMA," Stefan Hoppe, vice president of the OPC Foundation, praises these activities.

However, defining the standards is not enough on its own. An institution is required which ideally offers the certification of OPC UA over TSN devices as a one-stop shop service. As Stefan Hoppe notes, "In January 2017, we opened the OPC Laboratory Europe in Stuttgart. In future this will also certify companion standards, such as the OPC UA OPEN-SCS standard for serialization in the pharmaceutical industry, which was published at the end of 2017. The OPC Laboratory is also preparing to offer itself in future as a one-stop shop service for the certification of OPC UA over TSN devices." This is certainly a start. However, if TSN plus OPC UA is to become as popular as the OSADL is already registering, a certification body will definitely not be enough.

And Siemens has also recognized the trend. At a press conference, the Munich-based company announced that Profinet network infrastructures will gradually integrate the basic TSN technology. This is in line with the view of Karsten Schneider from Profibus and Profinet International. "At Profibus and Profinet International we also consider TSN as 'only' one more mechanism that we will be using in future for Profinet." In his view, established protocols like Profinet will therefore continue to play a key role. They are specialized in collecting data in the field and transferring it to a controller such as a PLC or fetching it from them. According to the presentation, Siemens will implement TSN right down to the field level, and OPC UA down to the control level, which is bad news for some people.

The Bachmann Contribution

All CPUs of the M1 automation system can already be run today as an OPC UA server or client. Communication with the atvise® SCADA system or our proprietary cloud solution use OPC UA as standard.

TSN is being followed closely and supported by Bachmann. The IEEE standardization group has drawn up TSN as a sector-independent solution for further improving Ethernet. It is therefore foreseeable that automation specialists will not have to develop and use any special components.

In collaboration with the Swabian switch manufacturer Hirschmann, Bachmann has carried out research projects in automation and control to examine the suitability of the new technology in conjunction with control technology.

Hirschmann provided prototypes of new TSN-capable switches for this, Bachmann provided the real-time controllers for the automation systems. Hirschmann is using this jointly created test rig to present the new technology at various technical congresses.

Interview

NEW STANDARD REPERTOIRE

Model-based development, digital twin, batch size 1 – all buzzwords that are also currently circulating in the machine building sector. Are these fantasies, visions or are we talking about technological implementations that will already be standard features in the future? Philipp Wallner, industry manager at MathWorks responsible for the automation and machine building sector, gives a picture of the status quo in this interview.

Mr Wallner, model-based development, digital twin – how big is the fear in the sector of having to deal with these subjects?

Philipp Wallner: I have already been dealing with model-based development in the machine building sector for ten years now, and I can recall here some very difficult beginnings. I often had to answer the question: What is the added value from simulation if I can just verify the functionality of the machine by simply switching it on and testing it?

However, in these times of overall digitalization, these discussions about value addition are largely passé. There is hardly a technical decision maker today who still doubts that model creation, simulation and automated verification of machine functionality early on is a necessary element in any future-proof development workflow.

How did you manage to persuade the machine builders?

Philipp Wallner: It was primarily the close collaboration with the controller manufacturers and shared arguments that persuaded many machine builders that model-based simulation, combined with code generation, was a suitable way of tackling the challenges of increasingly more complex mechatronic systems.

What success parameters can you generally use for the projects?

Philipp Wallner: The most important success parameter in projects is almost always the shortening of the development and commissioning of the machines and the resulting significant time and cost savings.

And how do you achieve this?

Philipp Wallner: The first step in model-based development is normally the simulation of a system model, i.e. a model of the machine or plant combined with the required functionality, such as a sequence control or closed-loop controller. A desktop simulation can already verify early on here whether the requirements of the customer or one's own product management have been met.

At this stage the developer does not have to decide which automation components are to be used later at the machine, and can test the functionality independently of the actual implementation on a PLC.

However, simulation models not only bring added value through the shortening the development time. What can you also offer?

Philipp Wallner: Models that provide a virtual representation of the plant, the machine or individual mechatronic components also provide added value after commissioning – in the form of a digital twin. This runs for the entire lifetime of the machine parallel to the physical system and ensures that faults during operation are detected early on, isolated and rectified.

In this way, the digital twin for example can be fed continuously with operating data in the form of a real-time simulation model and the simulation results compared with the data measured on the physical system. If the two measurement series drift apart, the operator knows that something is not right on the plant and can search for the cause using the simulation model.

What does a machine builder have to do in order to create and maintain a twin?

Philipp Wallner: The great thing about our approach is the fact that the digital twin does not have to be created from scratch. The Simulink® model created for the model-based development is used as a basis for the digital twin so that the effort required is not only

kept within reasonable limits, but also ensures that the behavior of the digital twin actually corresponds to the physical system.

We also offer in MATLAB® several algorithms for signal processing, machine learning and deep learning, which can be configured with apps and then linked to the digital twin.

Let's get back to the basics. How do you recommend machine builders should approach "model-based development" in order to work with a digital twin in the end?

Philipp Wallner: The important thing is not to overdo things already in the first step. The introduction of model-based development is a decisive step that can lead to significant savings in time and costs when used properly. However, it does involve work and requires the necessary knowledge of the domain. As the name already suggests, models provide the basis for model-based development. Their development is therefore the first and most important step in the entire process.

After all, the simulation model must act as a digital twin during development, virtual commissioning and then over the entire life cycle of the machine. A few basic questions should therefore be asked at the beginning.

What would those be?

Philipp Wallner: Question one: Which component of my machine or plant shall I model in the first step? Or shall I model the entire machine straightaway? Our experience has shown that the most successful customer projects with the greatest returns on investment (ROI) are those that single out a key component from the overall system. For example, in wind power this can be the pitch system for adjusting and controlling the rotor blades. Question two: What are the effects that I want to be able to observe in the simulation? Depending on what is to be observed in the simulation model, the appropriate degree of detail must be selected for the model. This can range

»Modeling and the digital twin will very soon become the standard repertoire in machine building!«

Philipp Wallner
Industry manager for automation and machine building at MathWorks

from logical behavior models to physical multibody models, right through to the detailed modeling of special effects. Bear in mind here, before starting modeling, the user needs a clear idea of the degree of detail required for the simulation. Our technical experts will be pleased to help with their experience if in doubt.

Question three: What components can I reuse in my model? Many of our long standing customers, particularly from the automotive or aerospace industry, have built up extensive component libraries so that new models normally no longer have to be developed from scratch. In machine building, we are noticing that more and more manufacturers of automation components, i.e. servo drives, motors or sensors are sending Simulink® models of their components to their customers in the machine and plant building sector.

What is your future vision for machine and plant building?

Philipp Wallner: The trend towards digitalization is advancing at a tremendous rate. Improved environments for modeling and data evaluation, combined with rapidly increasing CPU performance in automation hardware, are providing the conditions for modeling, simulation, advance verification and automatic code generation to become very soon the standard repertoire in the development of innovative machines and plants. In other words, this not only allows the creation of digital twins, which reduce maintenance costs and increase reliability in the field; the vision of efficient and highly flexible production and manufacturing plants with “batch size 1 production” capability is also now within reach.

The Bachmann Contribution

Getting to market faster with better solutions is the challenge for the machine and plant builders. With plants becoming constantly larger and more extensive, maintaining an overview and checking the usefulness of innovations before implementation are essential. The discipline of plant simulation makes this possible.

Bachmann has been bridging the gap between this virtual world and the requirements of industrial real-time control since 2005 with its M-Target for Simulink®. This software offers engineers a critical advantage in model- based development: a unique engineering tool for all tasks – from the first simulation design, to real-time code generation, right through to the online debugging of a developed application in customer operation.

The starting point is a simulation model that mirrors the behavior of the plant. Simulink® provides a host of toolboxes which allow the system for this virtual simulation to be described on a physical level. The necessary sequence and control simulation algorithms are then added to the simulation. Accurate plant models for the most demanding requirements also, however, take into account the signal response of the control components over time. M-Target for Simulink® includes the necessary reproduction of the M1 input and output modules in the simulation. The target also enables networking with other PLC applications running in parallel as well as the direct linking to the M1 CPU.

After the simulation is successfully completed, the question is: How can the code be implemented directly on the target controller? M-Target for Simulink® enabled Bachmann to be the first to offer real-time code generation for an industrial controller directly from the simulation model. The automatically generated code does not have to be edited again and so error sources are excluded from the start. A real-time application, which can even be run 24/7 at cycle times from 200µs on the M1 CPU, can be produced directly from the model at a single click of the mouse.

Extending the simulation model into a hardware-inthe- loop test rig makes it possible to already test in advance future application expansions in combination with their environment. It also enables new personnel to be trained in a safe environment. Bachmann's M-Target for Simulink® thus provides a solution for model-based development that offers benefits far beyond the initial delivery of the plant.

The office environment broadens the mental horizons of employees.

Insight

INDIA OR INNSBRUCK?

Opening of the IT development center in Innsbruck in the Austrian Tirol offers the industrial company benefits for the startup.

"India or Innsbruck? This question about the location of our development center never really arose. We wanted to keep such an important area close to the headquarters in Feldkirch at all cost," says Werner Elender, chief operating officer at Bachmann electronic. The new development center in Innsbruck provides the company with more new specialist potential in Austria.

"Specialists in the fields of hardware and system testing, particularly those with experience, don't grow on trees in the Austrian Tirol either. We can nevertheless be successful in exciting areas," says Bernd Süßmilch, head of the development center, "The response fills me with confidence. For us the startup in Innsbruck is taking off. Outstanding educational establishments with interesting specializations make the Innsbruck site very attractive for us. Employee retention goes well with our Bachmann culture."

The team moved into the offices in the modern SOHO 2.0 business center in April. Four new employees have already completed an intensive initial training course. A powerful team will look after customer tasks from the middle of 2018. It will take care of specific development topics from the beginning right through to the end.

Süßmilch can start with some experienced specialists. "I expected to find some young professionals. The fact that I can now build on the specialization of the team makes it easier for me to concentrate on the development of optimum processes.

The response from the first job interviews fills center manager Süßmilch (middle) with confidence.

A powerful team has been in place here since April.

Report

AN EAR ON THE DATA STREAM

Autonomous ships could soon become reality. The most innovative offshore supply ship of shipping company Royal Wagenborg is currently testing methods for data acquisition.

Remote monitoring: Predicting the availability of the diesel electric drive train system provides support for tactical decisions.

For generations of seafarers, the pounding noise of ships' engines has been enough to precisely assess their condition. However, one onshore technician will in future be able to keep an ear on the data flow of several ships and get just as accurate a picture of the situation on board. The trend toward digitalization on ships is advancing rapidly, and shipping companies will soon be building the first autonomous ships in the near future. Their crews will be based onshore – and that also goes for the technical personnel. Data for shipping will literally be the oil of the digital age. After all, autonomous ships cannot be kept in operation by responding to the activation of a warning message. Predictive remote monitoring and an integrated condition monitoring system will play an increasingly important role here. Dutch shipbuilders Royal Wagenborg are going one step further in this direction with their internationally acclaimed offshore supply ship Kroonborg.

Predicting availability

"We are currently testing a system for the acquisition, compression and visualization of data. Ultimately reactive measures will no longer be enough in the future. The onshore crew is required to interpret the data correc-

tly and thus predict situations that require intervention," says Maarten ten Wolde, technical manager responsible at Wagenborg Offshore. A Bachmann data collector was installed on board to transfer information to shore, and make it possible to assess the remaining availability of the diesel-electric drive train system and its subsystems on board. The data collector is organized in the same structure as the components of the drive train, from the power generation down to the thruster. The four diesel generators are interconnected via the J1939 protocol. Component values such as load, fuel consumption, temperatures or pressure are monitored and stored in a separate data cluster for each diesel generator. "We are experimenting with sample rates between 60 and 6,000 milliseconds for each cluster. Each individual probe is provided with a time registration accurate to 1 millisecond," explains Joeri ten Napel, expert for maritime automation at Bachmann Benelux. The electrical values of the busbars on board are monitored by the GMP232 grid measuring module.

Sending compact data packets

Thanks to the time stamps on all measured values, a direct association between increased fuel consumption and events at the end of the drive train system can be clearly identified. The Bachmann data collector saves all raw data at a maximum resolution to a mass storage device, which is connected via the USB interface. A selection of data points for the diesel generator and the three-phase busbar, with an individual sampling frequency, was sent to a third party system. "Thanks to the possibility to change all settings, we were able to compare the effect of different sample rates and data sets. We can assess the quality of the collected data based on a two-week measuring interval with the support of a data analyzer from QNH," Maarten ten Wolde reports. The employees onshore in the remote monitoring center process, filter and assess the compressed data. Configuration data sets provide them with the information they need. "We aim for the algorithm to be able to assess the remaining availability for a freely selectable time frame," says Joeri ten Napel. The prediction of the remaining availability according to a selectable time period supports ship owners in making tactical decisions. It helps to minimize the risk of a ship not being able to complete the agreed tasks. This can result in significant costs, such as contractual penalties.

The next step will be to provide the Bachmann data collector with additional functions. For example, Joeri ten Napel describes the implementation of counters for logging the number of peaks defined by threshold values. It will also be possible to compare the values of the subsystem in order to monitor the performance of the entire drive train system. "We use multitasking to create a digital twin. Several programs run simultaneously and process different tasks in parallel," says Joeri ten Napel.

The digital ship

The unique Kroonborg "walk-to-work" vessel is optimized to meet the requirements of buyers NAM/Shell. The company is looking for a ship that takes employees comfortably and safely to work on the offshore platforms as if they were walking. It is required to operate in the south North Sea more efficiently, effectively, productively and safely. "This completely newly developed service operating vessel is as versatile as a Swiss army knife. It is ideal for any kind of offshore support – not just for the oil and gas industry. The offshore wind energy sector will also benefit," writes Royal Wagenborg in its customer magazine.

»It's no longer enough in shipping to respond to alarm messages. The crew will be on land and will predict malfunctions through data monitoring.«

Maarten ten Wolde
Technical manager at Wagenborg Offshore

Background

AI: MAGIC OR A TRADE?

Artificial intelligence is a hype, a tool and not a universal cure-all. Machine builders, automation specialists and robot builders are working on the first projects. It not only needs Google in all cases, but also money, data and patience.

German machine builders met in Berlin in october 2017 at their annual machine building summit. It is the key event of the sector. Owners and CEOs discussed market developments, political decisions, new technologies and celebrated their sector in the evening – they do, after all, have a major anniversary behind them: 125 years of VDMA.

Prof. Torsten Kröger from KIT in Karlsruhe also traveled to the capital. He was meant to discuss artificial intelligence (AI) with the machine builders. However, only his panel had no machine builders represented on the podium. Kröger discussed the issue with software suppliers and research colleagues. Although the machine building sector is working on the first projects, it would seem that only a few people want to talk about it. Different interpretation: The idea of the technology is there but the business models are still not available. Kröger's self-defined mission: "We as researchers have to relativize expectations a bit."

Kröger talks about the hype around artificial intelligence and how business consultants are encouraging this. McKinsey* expects additional growth of billions of euros, and according to the analysts, the market for artificial intelligence will experience two-digit annual growth. However, it won't just be sales that benefit. New jobs will also be created according to IDC. Around 800,000 jobs are expected to be created directly from the technology. Added to this are an approximate two million indirect workplaces. Realistic figures?

Analysts write that 2018 will be a critical year for artificial intelligence. The sector is waiting. Vendors showed their first solutions to machine builders at the Hannover Fair. Around 40 percent of the companies and organizations surveyed are planning to start AI projects from next year. "Yes, there's a lot of hype around AI, but a lot of money is already being earned with it worldwide," warns Hermann Hauser, an Austrian AI expert. "The use cases of industry are rather in the background," he adds. "Self-driving cars or voice control are now already in the spotlight." Also in industry, such as the example of Intralogistik. The Prostore warehouse management system is voice controlled via Alexa. Employees in the warehouse query order commissioning tasks by voice commands in the control center. "This is added value," says Michael Baranowski from the team from Paderborn at a trade event. And despite this, "I want there to be more realism in the debate – much of what we are experiencing and getting presented with today are the initial approaches of machine learning," explains Kröger, who has lived for several years in Silicon Valley and currently does research in AI projects with robots.

Google and machine building

Major machine building companies are already working in initial projects with the data from real machines and are achieving short-term results. The problem is that people often expect a return on investment within two to three years. This is still viewed amongst researchers as an illusion for many applications. "Predictive maintenance, for example, is a small area of research. The long-term potential is many times greater," Kröger assures.

The tremendous power of AI systems is at the same time the thing that makes people rely on the rapid exchange of sensor data between each other. "This is not available to humans, they cannot see with the eyes of others," explains Prof. Dr. Sabina Jeschke from RWTH Aachen at a conference in Hamburg. And that causes fear because this power of AI cannot be estimated, the scientist further explains. However, it is precisely this exchange of sensor data that makes AI safe. The systems

»Robots are not optimally programmed.«

Prof. Torsten Kröger
KIT Karlsruhe

can no longer be programmed because safe systems are only created if they can act autonomously and respond automatically to events. For the IT expert, this is the reason for the slow adaption of AI systems in machine building. "Engineers have to give up a bit of their previous top-down control."

Collecting everything?

Meanwhile, engineers in Buschhütten in the Siegerland region are already working on learning machines. Machine builder Achenbach, a Bachmann customer, is using the Google cloud to collect machine data. The next objective: applications that use unsupervised learning for improving machine output. (read the entire story of Roger Feist and his team in the 11/17 issue of realtimes).

Is that artificial intelligence already? Achenbach is using 'unsupervised machine learning'. The idea: For this, the rolling mill tries to detect patterns in the data that deviate from unstructured noise. Ideally, this will provide the operator with an action recommendation, such as the ordering of a spare part from Achenbach. "We are currently working on this and similar applications," reports Roger Feist, who is responsible for automation at Achenbach. "Neither we nor our customers can say today what questions we will have to answer with the data in future. Only if actual problems with a particular material occur, or if a customer is struggling with malfunctions in a particular subsystem, will we know which data is relevant for solving the problem. Problem solving would often be much more difficult if this data was not saved or deleted too early due to a lack of memory." Around three gigabytes of data can be produced for each machine in one day, mostly stored in the database via OPC UA and SQL. As the storage capacity of the cloud is virtually unlimited, data never has to be deleted to save space.

Feist's data collection is the right approach, if you agree with IT professor Jeschke's view. Faulty or inaccurate results are mostly due to the data selected or actions based on insufficient data, explains the scientist. The focus should not be on obvious problems or faults, she explains. Island thinking has to be overcome. Her example: The weather-sensitive injection molding machine. The simulation of production had continued to produce inaccurate data until the current weather data had been integrated as suggested by a machine operator.

Consequently more focus should be placed on the data lake within the company instead of just concentrating on a little data. It was at this point when a heated discussion broke out. At the Rethink SPMS conference in Hamburg, there were voices that stressed that data should only be gathered if you knew why. The opposing view was to include everything possible. Companies are not in agreement here.

Prof. Kröger sums up the tasks for the entire machine building sector: "Achenbach is a trailblazer in its sector. Instead of implementing new functions with software, data is used for the targeted "training" of software systems; if they are trained correctly they can be used to perform new functions. This means that data is just as important as the software itself."

What questions can we ask the data?

No wonder that cloud data giants like Amazon, Google, IBM or Microsoft are today dominating the AI market. According to market observers, US companies in particular are benefiting from the technology (sales growth of 596bn US dollars). Thanks to AI, Japanese companies were able to increase their sales by 91bn US dollars. Germany, with 62bn US dollars came third, followed by the United Kingdom and France. "The USA is ahead of us. I myself have lived for seven years in Silicon Valley and have held several discussions with Mark Zuckerberg and Larry Page on this subject. Many developments from the B2C world or the social networks or the Internet companies like Amazon or Google can also be used for industry – the trick here is to ask the data the right questions,"

says Kröger, but also concedes in an interview that "safety and real time capability in industry are also underestimated in Silicon Valley." He recommends that industry should also look at China, since it is there that AI research also has a strong focus on industrial scenarios.

The researchers at the KIT in Karlsruhe have also completely set their own industrial AI objective: The digital shadow of the production line. "We are simulating production, optimizing it in the digital shadow, and can thus reduce the cycle times or even make savings on robots," Kröger hopes.

Industry knows that robots and their movement sequences are often not optimally programmed because developers do not have the time or the optimization tools. This is also admitted by automobile builders. "If we could now view entire production lines through a digital shadow and change processes quickly, we could achieve an optimum result." Reinforcement learning is the keyword here. This task could only be solved by a production planner with great difficulty. The idea: for researchers to therefore reduce cycle times and save on robots or energy costs in the applications. However: That's what research is like and currently means a great deal of investment. Companies, however, are willing to pay. For example, many robotics companies are buying up startups or investing in research. Kuka is doing this, but Fanuc as well. Together with Japanese company Preferred Networks, the robot builder developed an AI application, in which the robots optimize each other in order to prevent defects in production – also without a cloud.

Google's 800,000 gripper attempts

Google is also researching this area. The engineers installed 14 robot arms next to each other in order to pick objects out of box. The robots were fitted with a camera and a gripper and were interconnected. They started to work and shared experience with their robot colleagues in sequence. The robots completed error rate sank from 70 percent to 10 and 20 percent – thanks to the deep learning network. And one more analysis from actual case studies: "If it is possible to reduce electricity costs by just 1 percent with AI – and in our experience this is possible even with simpler AI algorithms – then this will already pay off the investment costs for the operator of a wind farm within a year," reports Prof. Dr. Michael Schulz from Indalyz Monitoring & Prognostics.

The figures are impressive. McKinsey expects a 20 percent improvement in plant use if, for example, predictive maintenance can be implemented through AI. A 20 percent increase in productivity for individual working steps is also possible through the targeted coordination of robots and employees.

However, what will happen if robots work together with humans? One possible aim: The modeling of user profiles that are made available to the robot so that it can make decisions on the interaction with the employee. Dr. Gerhard Rinkenauer from the Leibniz Institute for Work Research describes

"We as researchers have to relativize expectations a bit."
Prof. Torsten Kröger from KIT in Karlsruhe

Google uses robots to research AI – the systems are networked and learn from each other.

one scenario in an interview with a German trade magazine: The system stores the performance data, the age, the physical constitution and other characteristics of the worker. The robot is required from this to detect the well-being of its work partner.

Supposing the co-worker takes several breaks during the early shift – something that the profile defines as unusual. The robot will then know that its partner is tired or is suffering from a drop in performance for other reasons, and responds for example by slowing down its interaction with the co-worker. And the researcher explains further: Other possibilities would also be to adapt the environment by increasing the blue component in light in order to drive away tiredness. The robot can even draw conclusions if a person has made more order commissioning errors than is typical for that person. The user profiles must be developed in advance with the people involved. This feature is based on machine learning. This registers user behavior continuously, for example by means of visual sensors, and interprets and learns through the use of intelligent algorithms.

No magic

The example of the interaction between human and robot is definitely a challenge for data protection, which also the researchers concede. "User modeling runs the risk that the system knows people better than the people themselves," Rinkenauer warns.

What could somehow perhaps work all right in the USA becomes very problematic in Europe, even if AI could prevent the occurrence of serious accidents. Many employees are afraid. KI is a buzzword. Machine learning is a tool. It is not magic or a universal cure-all. "The aim is to monitor and optimally control machines and plants," says Prof. Dr. Michael Schulz. "The fear that machines will take over thinking is unfounded. We are generations away from that," says researcher Kröger and AI expert Hauser adds: "The problem is also that the issue of AI is not fully understood, so that it is often difficult for individuals to ap-

AI: THE FUTURE INFORMATION TECHNOLOGY

The first scientific conference at which the term "artificial intelligence" was mentioned for the first time took place in the USA 61 years ago. Several decades later, mankind is experiencing the first applications. It requires the use of powerful processors and sophisticated algorithms.

"The first requirement was historically secured through the advancements in microelectronics, by which electronic components were miniaturized down to microscopic scales. It is now being secured by an increasing trend toward parallel processing in the computer architecture, and it will probably be protected in future in the development of quantum computers suitable for applications. As far as algorithms are concerned, they are also rapidly growing in number. However, real applications will always ultimately be expected where they take over the work that humans actually want to get rid of," says Prof. Dr. Michael Schulz from Indalyz Monitoring & Prognostics.

AI is served by two sciences: engineering with mechatronics and information technology, and the cognitive sciences with linguistics, psychology, neurosciences and life sciences. Prof. Dr. Antonio Krüger from the German Research Institute for Artificial Intelligence (DFKI) sums up as follows: AI is the implementation of intelligent behavior and the underlying cognitive capabilities on computers or AI is the future information technology. According to Krüger: Difficult problems are easy in AI research, easy problems are difficult. In other words, AI can find an error in the computer chip but finds it difficult to understand a joke.

Prof. Dr. Schulz adds: "Strictly speaking, AI and machine learning are related. However, both terms are not unambiguous since there is no binding definition for intelligence and learning. It is better to distinguish between strong and weak artificial intelligence. While strong artificial intelligence is understood as the attempt to emulate human intelligence, weak artificial intelligence is more associated with concepts like pattern recognition, machine learning or data mining."

»AI is in its starting blocks in machine building, and companies do not want to reveal everything yet.«

Prof. Claus Oetter
VDMA

praise realistic future scenarios and assess reports from the media – a broad ranging and balanced discussion in society is needed at all cost. I see our future developing in positive coexistence with intelligent machines."

Scientist Kröger sees rather a much more important challenge: "Data from the robot controller is difficult to view. If we have it, the question arises: Who owns it?" A legal issue that has not been clarified so far. For SAP boss Bill McDermott, it is clear: "Data belongs to the customer – even in China."

Many machine builders are therefore setting up cooperation projects with their customers in order to generate added value for themselves and for the customer. "Companies need to show customers the benefit so that they are willing to give away the data. This requires a rethink, new business or remuneration models," Kröger states.

Is AI magic or a trade? It depends on your point of view. For the developer, AI is first and foremost a respectable trade with very ordinary tools. However, it is occasionally being perceived by users as magic. "Not least because science fiction suggests something precisely like this," says Prof. Dr. Schulz.

** McKinsey (2017): " Smartening up with Artificial Intelligence (AI) – What's in It for Germany and Its Industrial Sector?"*

The Bachmann Contribution

AI or machine learning is also an exciting and challenging research field for Bachmann electronic, which we are watching closely. In our view, however, the technologies and aims are often being thematically mixed together in public discussion or are simply being labeled as AI for marketing purposes. Example: Predictive maintenance. We have been implementing this very successfully for several years – even without the use of AI methods.

Our CMS goes one step further than just making use of machine information of the same type: We record the process data of around 6000 wind turbines from a wide range of manufacturers and types at different locations. The experience gained with this data is incorporated into our algorithms which can detect complex fault patterns. The customer uses this to develop predictive maintenance measures in order to gain financial benefit from it. Plants can thus already today decide automatically when to call a service technician and with which problems.

Predictive maintenance will provide benefits in completely different industrial areas, many solutions will be implemented in conventional ways, and we will also use AI methods for some in the next step.

Infographic

SOFTWARE DEVELOPMENT

PREVIOUSLY

slow waterfall models with strong regulation were standard practice.

TODAY

agile development has taken over. SCRUM sounds new – but isn't. Bachmann has been using this method since 2007.

AGILE DEVELOPMENT

characterizes the process – what does it mean?

Start **DEVELOPMENT** early on in extensive requirements workshops to discover the shared view through iteration.

CHANGE REQUESTS are possible during the project – close customer contact.

The team has all **COMPETENCIES** (product management, development, tests, documentation, project management) combined into one, that are required for the development.

CREATIVITY
through cooperation that encourages innovation, efficient administration and simple documentation

Everyone involved is in constant **CONTACT** – new requirements for developers.

QUALITY
ensured today by methods such as test-driven development, daily build, unit tests, code coverage, code generation, static code analysis, metrics, code review and other elements.



bachmann.

The **PROGRESS** of the project is visible at any time to any team member, customer or neighboring department.


Complexity and quantity of **CODE LINES** are increasing rapidly every year.

INFORMAL COMMUNICATION
and joint decisions by the team promote team work and motivation.

RESULTS are visible after a short time, can be tested and shown to the stakeholders, customers. Focus on customer benefit. "You'll know it, when you see it!"

Outlook

WHAT WILL BECOME OF IEC 61131-3?

The much much talked about trend of “digitalization”has been going on for more than 40 years. However, this general transformation seems to have speeded up exponentially in the last decade. At least in the consumer sector this is definitely the case – everything is becoming more digital... and therefore has to be programmed by someone. What has changed here and what is having an influence in automation technology?

Every year, new applications and business models are generating hundreds of new digital products. Many of these are still being ridiculed as gadgets, but will potentially have a disruptive effect in a few years. And all of them are programmed – without exception. In view of this incredible transformation in the market, it's worthwhile taking a look at the (software) trade behind this.

Everything flows! Everything?

"There isn't a year that passes without new programming languages coming onto the scene," explains Gerold Kerbleder, product manager of programming systems at Bachmann electronic. "And at least every second or third year some appear which claim to be the 'ultimate in future relevance'. Even the names suggest tremendous potential: Go, Ruby, Elixir, Kotlin, …." You would think that the technology used was going to regenerate digitalization with every new wave? "Far from it! What lasts is always what is good for solving a particular task," Kerbleder continues, "and naturally what people have already mastered."

Good things last

In the index of the most important programming languages that Tiobe updates every month, the classic languages like C, C++ and Java have been at the top for years (with Java experiencing a resurgence due to the many Android apps). This is followed by C# and JavaScript (everything that goes on in the web/browser). Good old "C" was even nominated the "Fastest Growing Language in 2018" next to Kotlin. These are the proven technologies that are behind the new lifestyle gadgets, the disruptive business models and IoT. And what is the situation with industrial automation? "Not much different: With a market penetration of around 80 %, the classic IEC 61131-3 is always the leader in the sector. Then comes C in second place, followed by C++ and model-based development with MATLAB®/Simulink® in 3rd and 4th place in our application statistics," says Kerbleder. No less than 83 % of all those surveyed in the latest Rothhöft market study PLC Systems 2018 also consider the IEC 61131 languages to be the central implementation technology in the future.

Why IEC 61131-3?

The clear benefits that helped IEC 61131-3 to break through to the top and stay there are easy to list: "Right on top is safety – any potential errors must be prevented from the start. Statically allocated memory, extensive avoidance of pointer arithmetic and very strict cyclical processing ensure robust programming from the very first line," says Kerbleder, "and the effectiveness of the 61131 languages is the second benefit: They were specifically designed so that even engineers could implement solutions for the tasks required quickly, reliably and above all understandably, without having to complete a course in IT." Thirdly, a language for PLC and embedded automation must naturally be able to offer hard real-time functionality. Interpreter languages with garbage collection, such as C# or Java, should be treated with particular caution here.

By far the largest amount of source code for automation is produced in structured text (ST), a high-level procedural language that has some resemblance to PASCAL. There are also the graphical languages FBD, CFC and SFC: They are used in cases where groups of people other than professional software programmers are required to read or write source code, such as commissioning technicians, service technicians, process specialists or safety auditors. Compared to ST, these are used less often but their share of use over the years is very constant. What is important here? The factor that today is more important for efficiency and success than the pure language syntax is the professionalism of the surrounding software infrastructure. "A great deal has happened here," says Kerbleder: "The efficiency of a modern editor alone, which provides all the symbols, structures, available functions and options according to context, virtually on the serving tray, gives the developer tremendous support. Instead of tedious debugging, the 'quick fixes' proposed by the 'Validator' offer ready-to-use solutions for all typing and programming errors – with just a simple click of the mouse."

It is only important that the engineering chain supports the real achievements of general IT and information technology: "We are offering today for all languages a high-end connection to repository systems such as SVN or GIT. This is not needed for version management. Without this technology, cooperation between large teams of developers would generally be unthinkable," explains Kerbleder and continues "'continuous delivery' with 'daily builds' and 'test driven development', will also be necessary for the PLC world in future! These technologies have also reached us in the software, also for IEC 61131-3. This includes multi-threading and MultiCore."

Plain text!

Looking at languages from the point of view of benefits, some trends are obvious: It's what suits the task that functions well. The software spectrum from IEC 61131-3 to C/C++ to Simulink®, provides the toolbox for every task relevant for industrial automation – together with Industry 4.0, IoT and Cloud. Things get difficult if a different technology is needed in every project. What is even more important besides the language, is the efficiency of the toolchain and the infrastructure on the target system.

Report

WOL!

Working out loud: Employees make the difference. Many companies would like to have an open and innovative corporate culture but this cannot be achieved by rules. However, a simple idea is increasingly gaining more followers – also in industry.

The man stands on a stool. The participants of the coaching seminar, all employees at an industrial company in Friedrichshafen, stand around him in groups and do WOL. John Stepper, the man on the stool, laughs. He just explained to them the meaning of: WOL (working out loud). Stepper is the inventor of WOL.

The idea: "It's a simple way of developing work relations, achieving a goal or discovering new issues," Stepper explains in YouTube videos or lectures around the world – WOL is in demand. But this way of creating relationships does not work via traditional networks but by people giving something from themselves over time. Employees let colleagues share their work.

Harald Schirmer also does WOL. He works at Continental in the field of digital transformation and change – auto parts suppliers also use WOL. What is WOL for him? "You go on a journey of learning with three or four people and try to reach a personal goal in the process. The whole thing takes twelve weeks (to cause a real change in behavior) for each hour of a curriculum (called circles) devised by John Stepper. The whole thing is based on Dale Carnegie and was enhanced with the possibilities of the Internet and adapted," explains Schirmer.

Circles? Stepper describes five columns:

BUILD SOCIAL NETWORKS	MAKE YOU AND YOUR WORK VISIBLE	GET BETTER	GROWTH MINDSET	BE PURPOSEFUL
You are not alone – link up with like minded people and experience the positive effect and possibilities of diversity	Share your issues, raise questions, let others see your solution approach – this will generate trust, participation and generate (often unexpectedly) new possibilities	Get fit for the digital age (media expertise, create and use networks effectively, online reputation)	Learn to change perspectives, and to be attentive without any ulterior motives – very helpful for self control and management tasks	Make it personal and relevant and experience the difference in passion and efficiency with a focus on durability

What do companies hope to get from WOL?

"Anyone can do WOL (also many times) – it is a fantastic experience, in which excellent relations are normally produced in addition to the objective. It is a continuous learning process and involves very intensive exchange. The greater the diversity of the group, the more surprising the results. In the corporate context, joining circles with direct line managers is not necessarily recommended," explains Schirmer.

Many employees realize that we sit all together in the same boat and that help is often only a click away," says Schirmer. "It therefore gives anyone wishing to make themselves or the world a little better a structured opportunity free of charge."

Opinion

LET US AFFIRM MATHEMATICS

»While Industry 4.0 is a hot topic at the moment, few people really have a precise definition of what it is.«

Prof. Dr. Marco Lübbecke
RWTH Aachen

Let me run some selected vocabulary past you: Digitalization; complete cross-linking; linking all data; revolution; "Processes and decisions will be made at unprecedented speeds"; Systems "control themselves autonomously"; "analyze everything"; self-organized production; highly individualized products; comprehensive flexibilization; digital transformation; new level of organization and control of the value creation chain over the entire product life cycle; a concept, not just a technology; unstoppable.

Digitalization still does not generate intelligence

We think of Industry 4.0 as extensive data collection, total analysis and total communication. The hope for "previously unforeseeable possibilities" is great and in my view justified. However, I am also reading something from this that I'd like to call "repression". What is the "autonomous control of systems" actually meant to look like? Where will the ideas come from for making decisions at an unprecedented speed? What will we do with the analyses that will be available in large quantities and sizes?

I think that, in the euphoria, it is often overlooked that neither data nor networking represent value addition in themselves. Data is not knowledge. Even knowledge does not represent decisions. It is worth noting that even autonomously operating machines must make decisions for themselves! If the number of possible alternatives grows rapidly, who will be able to keep an overview in order to make a rational choice from these alternatives? Who can assess if the machine did some good planning?

This is where mathematics comes into play, or mathematical optimization to be precise. It can and must bridge the technological options with the actual recommended action. The same questions arise again and again in the area of Production 4.0: In what order, at what times, in

what quantities, for which customers and in what quality, at what price, with what resources, at what capacities etc. are we meant to produce, when, where, how many and from what? For me, Industry 4.0 primarily means: creating possibilities, being able to move away from decisions, which are (at best) based on a few scenarios. For example, if we are able to free up technological potential through data collection and networking to implement customized production, we should also make use of mathematical possibilities to optimize this potential. Otherwise it will be lost.

Nowadays, data is already being collected in dashboards and table calculations in order to provide an overview of the status quo. This enables people to make decisions on the basis of comprehensive empirical knowledge. This process is called descriptive analytics and has been adopted in all companies. Perhaps you are using data scientists, who condition, evaluate your diverse data, make forecasts from it and prepare the basis for decision making. This is called "predictive analytics". The large growth area in machine learning also comes under this. Some companies are already active here. However, this in effect only assesses a few decision alternatives to be of high technical quality. Does this lead to good decisions being made?

Only "prescriptive analytics" can answer this question for you. Mathematical models and methods are used here to propose a suggestion that takes the chaotic and large number of alternatives and selects the best one from them. The mathematical subarea used here is called mathematical optimization. Some people may be familiar here with the somewhat outdated term 'operations research'.

The central element

Whatever term we use, Industry 4.0 will present us (or machines) with planning challenges of unknown complexity. These have to be made with resources that can match the complexity. This also means that we will accept mathematics and information technology not only as a "service" and "additional work" but as a central element, as part of the Manager 4.0 toolbox.

By calling for this now, I clearly hold the view that it is happening too little today. I believe that this "denial" is also due to the fear that awaits us that mathematics and information technology will be "too difficult" for us. That it is not only the processes and systems that are ridiculously complex, but also the models and methods used to control them. The fact that we all no longer understand all that and may even be regarded by others as stupid. Then is it not best to not deal with it at all?

What is true is that modern mathematical algorithms can suggest good or even the best decisions for people or machines. Just think simply about the algorithms in a navigation device that shows you the shortest route.

Today, there are several examples like this in production, logistics, traffic, energy, health etc. What is true is the fact that this process is not easy to understand even for experts. It is also true that the operation and use of these algorithms have become much easier because the standard software* available is excellent, even for depicting complex design making and planning tasks. If you actually want to get intelligence, you need mathematics.

The one piece of advice I would give someone today is

that before you start "blindly" collecting data and networking (or make networkable) "everything", you obtain some advice about the mathematical possibilities of what can be achieved with what data. Collect wisely and correctly with an aim in mind.

Don't buy any software that doesn't have the label "mathematics inside" on it. Don't be satisfied with less than mathematical optimization. Your competitors won't do it either. Perhaps we will soon be talking about the mathematized factory.

Who knows? Perhaps the mathematical revolution will only come with Industry 5.0. But it will definitely come. I am looking forward to it.

** You can always come to us for requirements that cannot be met with standard software.*

SPS OR PI?

MODERN PLC

(programmable automation controller at the M1 level)

APPLICATION AREA

- Production and working machines (series/special machines)
- Industrial plants, robotics
- Energy technology and power stations
- Distributed infrastructures (traffic, supply systems)
- Industrial building automation

DESIGN

- Modular system with local I/Os (signal interfaces) assembled to individual requirements by user
- I/Os spatially distributed in the network, both for standard applications and also for functional safety
- Hot standby redundancy possible
- Coordinated sensors, displays and communication modules as accessories

MODULARITY

- Integrated modularity together with housing technology and mounting systems
- Can be divided up into several dozens of stations, up to many thousands of I/O signals
- Scalable through different performance classes for CPUs, function classes for signal and function modules

INTERFACES

- Real-time Ethernet, classical fieldbuses (RS485/422)
- Safety communication to I/O, drives or sensors
- Telecontrol protocols/WAN via Ethernet and serial communication
- Control system protocols such as OPC UA, cloud communication
- All industrial unit signals (24VDC, ±10V, 4..20mA, PT100/1000, encoder, SSI, ...)

ROBUST DESIGN

- Extended temperature range -30...+60°C / -40...+70°
- Non condensing, degree of pollution 2
- Shock and vibration protection
- Certified, high EMC performance, robustness

PROGRAMMING

- IEC 61131-3 IL, FBD, LL, ST, SFC, CFC
- C/C++
- MATLAB®/Simulink®
- Libraries for industrial communication, signal processing, filters, closed-loop control, MotionControl, alarming, and much more
- Toolchains and libraries directly from device manufacturer

REAL-TIME

- Real-time operating system with coordinated hardware (I/O and network) – the manufacturer takes care of it!
- Cycle times from 100µs and reaction times within fractions of this possible -> enabling high quality control systems and MotionControl

FUNCTIONAL SAFETY

- Fully integrated according to ISO 13849 to PL e and IEC 61508 SIL3: Digital and analog IO, position encoders, DMS, temperatures
- Thanks to extensive type certifications no import or implementation problems

LONG-TERM AVAILABILITY

- Designed for >20 year service life (industrial environment)
- Market phase from 20-30 years with additional reparability for 10 years
- Scalable performance: Continuously new, compatible CPUs
- Long-term compatibility for hardware and software

COSTS

- 500 – 15,000 € depending on application, robust design requirements and number of IOs

STRENGTHS

- 24/7 operation over >20 years
- Compatibility of hardware and software
- Environmental robustness
- Support from manufacturers with large application know-how

Customers are frequently asking for alternatives to the PLC. Is the Raspberry Pi one? No but it has other strengths. We have presented a summary of the differences.

RASPBERRY PI

(or similar SBCs)

APPLICATION AREA

- Training: Trainees, school and university (98% software development, 2% electronics)
- Individual projects of private persons or communities ("maker spaces"), particularly in the field of multimedia, home automation, surveillance
- Prototyping and auxiliary equipment in research and development
- Publishing and distribution of technology via the above channels (driven by companies)

DESIGN

- Open single-board computer with alternative plug-in boards for sensors, communication or displays
- Variants with housing of different manufacturers

MODULARITY

- Pluggable expansion boards directly on the main board (SBC)
- In the custom system up to a few dozen I/O signals, fieldbuses via additional boards possible

INTERFACES

- Ethernet (protocols via software examples from the Internet)
- Wifi, Bluetooth
- Expansion board interface, USB, GPIO

ROBUST DESIGN

- Open single-board computer (optional variants with additional modules and housings)
- There is no official specification ("...designed primarily for classroom educational purposes, not a military grade product...")

PROGRAMMING

- C/C++
- Java
- Python,... and dozens of other languages incl. IEC 61131-3, all toolchains of different sources
- Libraries for offered sensor boards, multimedia, web services, image processing and much more
- Toolchains and libraries from many different sources, partly individuals, different licenses via the Internet

REAL-TIME

- No real-time operating system! (users must adapt/implement real-time systems themselves; there are 40(!) different portings of operating systems

FUNCTIONAL SAFETY

- Not possible

LONG-TERM AVAILABILITY

- Neither designed service life nor market phase are specified
- During its short existence so far, already 4 generations (incompatible)

COSTS

- 30 € for the basic system without housing, without additional boards (also from 30 €), rounded off housing variants from 210 €

STRENGTHS

- Costs
- Community and their program examples

USERS

CMS RESEARCH FOR REDUCING COSTS AT SEA

European community research aims to make the operation and maintenance of offshore wind turbines more affordable

ROMEO, a research project within the Horizon 2020 program of the EU, aims to reduce the costs of offshore operation and maintenance through comprehensive condition monitoring systems. The project that was started in the middle of last year brought Bachmann Monitoring and other leading companies in the offshore wind sector together in the same boat.

"The sector needs to move away from the corrective approach to maintenance. It is more economical to operate plants according to their actual condition and keep them operational until the next scheduled service date," says Ulrich Oertel, the designated project manager for Bachmann Monitoring.

pester
pac automation

PACKAGING MACHINES WITH DATA ADDED VALUE

Advanced process data logging and display of productivity data implemented

Machines from pester pac automation use atvise® scada to provide information in pure web technology directly in the browser. This makes it possible to also log, visualize and analyze the data of older machines.

As the functionality must be available, not only for new machines, but also for retrofitting legacy machines, the flexibility, the simple expandability and the effective engineering tool and the pure web technology were the key factors in choosing SCADA software.

SCHOTTEL

PLUG & PLAY

A real multi-talent is required for the control of ship propulsion systems

A wide range of different makes of proportional valves are used in the shipping industry. The display of all process data and associated diagnostics, right through to remote maintenance and configuration simplify practical onboard operations for crew and technician. The integration of function modules meets the objectives of digitalization.

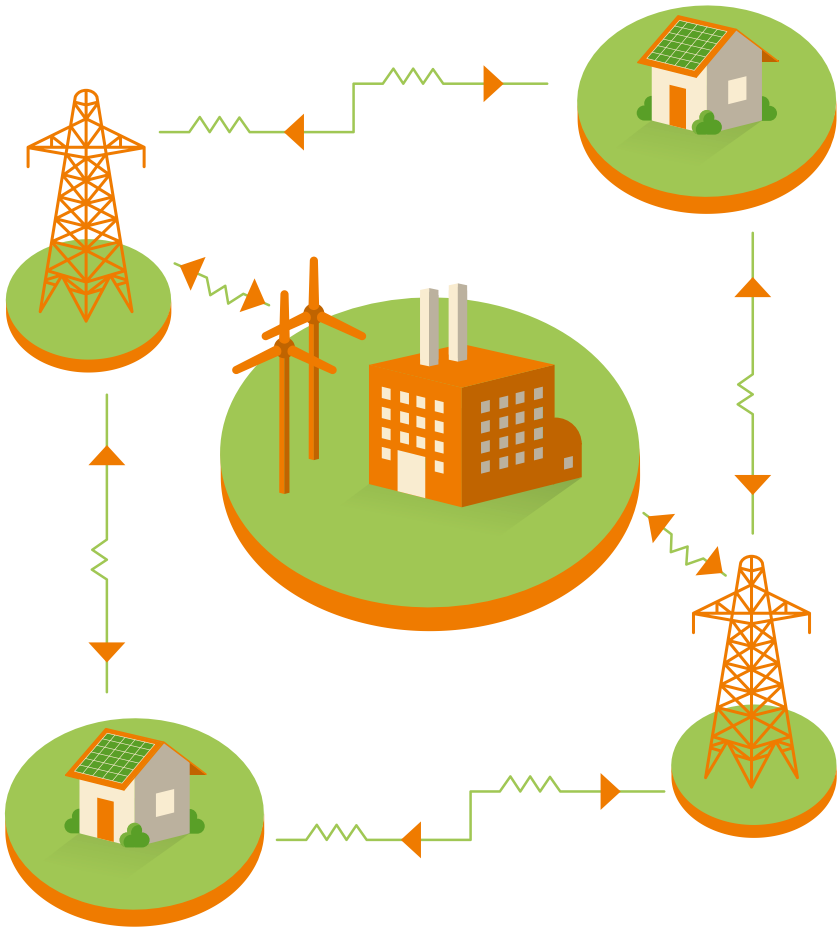
SCHOTTEL's maneuvering systems use the PVA200 modules for adjusting the blades of the conventional pitch propeller systems. The falling and rising ramps can be set with the controller as mechanical overload protection. Other applications are rotary movement and blade adjustment for azimuth drives.

VIRTUAL POWER STATIONS

Customers bringing control technology to joint research

Bachmann customers 2G Energy and Stornetic are researching in the Quirinus project together with six other companies, network operators, energy suppliers and research institutes. The aim is to show the effectiveness of virtual power stations.

These consist of interconnected plants, which can exchange data so that the electricity supply and demand can be matched to each other via so-called system services in order to ensure stability.



2G STORNETIC The Energy Storage Company

SMART ELECTRICITY MADE IN SWITZERLAND

Condition monitoring for the largest wind farm in Switzerland

The JUVENT wind farm and its main shareholders, the BKW Group, are implementing smart condition monitoring with "Omega Guard".

The data of all rotating components responsible for transferring power – main bearings, generator and gears – is continuously diagnosed. This enables repairs to be planned at the right time for each installation. This saves money for service team logistics and prevents long downtimes or minor faults turning into very expensive consequential damage.

BKW

SELECTIVE SOLDERING IN RECORD TIME

Revolutionary motion controller masters completely independently operating solder pots

Together with Bachmann, soldering system manufacturer Kurtz Ersa has developed a revolutionary idea into series production in the field of selective soldering. Two objectives had to be reached: a record cycle time and the soldering of several variants without the need for setup operations. The complexity of the task was in the layout of the boards to be soldered – three PCB panels, with different sizes and terminal densities, which were difficult to access by conventional means.

The solution: The Versaflex 4 selective soldering module uses two solder pots, which are each installed on a separate axis system. They operate completely independently of each other in the same work area on the same panel. For this Bachmann electronic enhanced the M-CNC runtime component to ensure collision-free operation of the two systems. In order to be able to use different nozzle systems (tool tips) flexibly, the protection areas can be set individually for the X, Y and Z coordinates. The software for operation also calculates the optimum paths for the solder nozzle.

kurtz ersa

COMBINED KNOW-HOW FOR THE MARINE SECTOR

The strategic partnership is strengthening Hyundai Electric as a system supplier

HYUNDAI ELECTRIC

Hyundai Electric & Energy Systems is combining its knowledge in the shipping industry with Bachmann's integrated M1 controller technology to thus offer more modern solutions. The collaboration consists of a hardware platform specially approved for maritime use and an optimized user interface. Hyundai Electric as a system supplier can thus offer its customers the best possible platform at a very competitive price.

News

PRODUCTS

MULTICORE POWER

MH230: New CPU flag ship with triple the performance

Bachmann's new series of Multi-Core processor modules will be launched from autumn this year. Depending on the application, up to 3.5 times the processing performance is available compared to its predecessor. The industrial ultra-low voltage processor design processes up to 4 parallel threads at 2.3 GHz. Depending on the application, SingleCore performance also offers an impressive performance increase of 60-80%. Enough power for complex multi-axis motion, extensive signal processing, image processing or online optimizations. To simplify the transition, the entire CPU can be run in SingleCore mode or an older SingleCore application can be run on the first core in Legacy mode. The MH230, like all Bachmann CPUs, naturally operates fan-free, even in the extended temperature range.

Bachmann has announced the next step for the end of the year: Multicore for the MC family.

VIBRATION MONITORING OF LARGE WIND TURBINE FLEETS

VGB White Paper confirms the benefits of condition monitoring systems

An examination by Bachmann Monitoring in the application of VDI 3834-1 and DIN ISO 10816-21 standards in the monitoring of large wind turbine fleets shows: Vibration evaluation based on these standards, combined with the condition monitoring systems, offers the greatest benefits. This is particularly due to the ability to prevent the early onset of wear through innovative turbine comparison information.

This provides easy to handle variables for the plant controller software and for integration in web-based SCADA systems, which can be combined particularly with other process variables.

THE TROJAN OF NUREMBERG

Ignorance is one of the greatest gateways for hackers

The Shodan.io search engine enables any open and unprotected controller to be found worldwide. Many industrial companies were surprised when we presented them with the search engine results. Viewing the HMI of a brewery in Italy? Not a problem to find everything quickly. The message of the Trojan at the SID in Nuremberg was – whatever is in the network must be protected, otherwise Industry 4.0 will not happen. That goes also for remote maintenance.

For us this means we must make customers more aware about security in automation. A first important step would be the end of default passwords or default operator settings and consistent use of new versions. Our SolutionCenter therefore offers users regular updates for their systems.

FAST AND COST EFFECTIVE ROTOR UNBALANCE MONITORING

Blade Unbalance Calculator – a new plug-in for condition monitoring systems

With prototype testing successfully completed, a new plug-in for the condition monitoring system of Bachmann Monitoring GmbH can now supply plant operators with regular information on the condition of wind turbine rotor blades. The German CMS specialist is thus the first supplier with a balance calculator that does not require any lengthy unbalance calculation and expensive process. The mass unbalance of the rotor blades was calculated in field trials with development partner BKW Wind Service GmbH. The calculated unbalance has an outstanding correlation with the actual mass unbalance of the rotor.

The product called Blade Unbalance Calculator will initially be presented at the Wind Energy Hamburg fair.

FASTER CERTIFICATION OF GENERATING PLANTS

TÜV Nord Cert GmbH is issuing component certificates for the GMP232/x grid measuring module

Bachmann solutions come already with all the relevant component certificates in order to make it easier for plant manufacturers to ensure conformity with national grid codes.

The updated certificates for the latest enhanced functionality (FW1.03) have been available since March this year: The models of the GMP232/x series have certified compliance with the BDEW guidelines (06/2008) including the 2013 amendments and FGW TR 3 (Rev. 24), FGW TR 8 (Rev. 8), ENA ER G59/3 amendment 2: 2015, IEEE C37.90:2005.

ADAPTIVE TEMPERATURE CONTROL

ATeC: intelligent, convenient, cost efficient

Sophisticated algorithms automatically determine the characteristics of temperature systems. The necessary control parameters for connected heating and cooling systems can also be directly derived from this learning process. Any tedious manual searching for the optimum control parameters thus becomes unnecessary.

The new software controller can be fully parameterized and diagnosed in the SolutionCenter. Besides providing the temperature inputs and actuator outputs, no additional hardware is required as it is run directly on the M1 controller. The optimized heating pulse distribution makes it possible to achieve the constant recording of electrical output values. The power management also helps to reduce the upper power consumption limits. This save energy costs, and the machine is adjusted optimally to the conditions at the installation site.

Report

A FEW SENSORS AREN'T ENOUGH

Wind turbines are data screens – at least compared to machine tools. Data experts at Bachmann Monitoring collect over 50,000 measured values alone on one vibration channel for a wind turbine. Only a few companies, however, know what to do with all this data.

It sounds so simple. Controller, sensor, communication, a small FFT and that's all that is needed for condition monitoring. What looks so simple on the fair stands of many automation suppliers is in reality, up in the nacelle of a wind turbine, far more difficult, and is the cause of considerable potential conflict between operator and automation engineer. While many suppliers have the required technology, they don't have the know-how.

Wind platform as a sales model?

"Our competitors sell a controller and a vibration sensor, connect them up and already think they can implement condition monitoring," explains Holger Fritsch from Bachmann Monitoring in Rudolstadt, Thuringia, a company of Bachmann electronic. This is not enough. Although it is scalable for the competition, customers are disappointed since many small operators do not have the knowledge to the depth required to analyze the measuring data at the machine components. According to the sector, industrial applications cannot be compared to wind turbines. Many companies collect data but develop neither information nor derive valuable knowledge from it for operating their plants.

A wind turbine produces over 50,000 measured values a second – just on one vibration measuring channel. This therefore needs experts in condition monitoring. Demirel Arik, head of the Remote Monitoring Center at Bachmann Monitoring has these. Over 20 employees analyze the data for their customers on a daily basis and output a qualified fault message in the event of a serious issue. WebLog, the front end of the Bachmann Condition Monitoring System, serves as the interface to the operator. It functions as the communication interface to the diagnostics system and enables via IP the secure and worldwide access to raw data and spectral data as well as the trend curves of the monitored plants. The IT application prepares all CMS data using different visualization options and thus considerably supports the diagnostics and the derivation of recommended actions.

What is behind the upgrade? Cinematic models, a wide range of filters, transformations, correlation with other data and statistical evaluations.

As the developers promise, the reporting function enables here the rapid creation of specific reports for different issues – also beyond the limits of the machine park and server. The final evaluation of these reports is then carried out, however, by the employees of the certified Remote Monitoring department – Arik's team. This relatively high degree of effort is still necessary, since "we must not make a mistake and lose the trust of the customers after fault alarms have occurred," Arik explains.

The key aim – the reduction of downtimes through condition-oriented maintenance by scheduling service operations, inspections and particularly repairs. Early detection of impending damage and efficiency-oriented procedures mean optimized yield and savings in service costs. Furthermore: Gathering knowledge, as Arik appreciates the value of the treasure that he is guardian of. His colleagues know the plants, know the critical states.

Knowledge in condition monitoring becomes the business model, but this knowledge can also already be used in the construction of new plants. No wonder that plant builders are also setting up departments themselves to collect and evaluate data. "However, we have an enormous advantage: Thanks to our colleagues in Austria, we know the control technology of different plant types and can therefore link the data from the plant controller with the vibration data. What we have learned here and continue to learn is helping us to also understand other plant types," reports Arik, who has been analyzing wind turbines worldwide with his colleagues for over 20 years. Would that not be a business model for a digital wind platform? Bachmann Monitoring offers analysis software based on its experience with different wind turbines, and utility companies can buy this software on a platform as a service (SaaS), for example, for use, adaption and further development!? "The sector is currently working on these kinds of platforms and we are also have an interest here," Holger Fritsch promises.

Man, mathematics and statistics

But what have his colleagues been doing so far and where is the journey taking them? At present, most employees are still working on the basic measuring points: rotor bearings, gears, generator bearings and tower with nacelle. Rotor blade monitoring is also in operation. The following are planned and partly already implemented: Linking of the analyses of process parameters, imbalance monitoring, alignment (gears/generator), particle measured variables (gear oil monitoring with detection of the operating state: oil temperature, output etc.), temperatures (outdoor air, nacelle, oil, bearing points: in the gear systems and in the generator), pressure (e.g. hydraulic oil, gear oil), status messages (e.g. from filters and lubrication systems), structure monitoring (e.g. foundation), load measurements for lifespan models, motion values (e.g. structure), electrical measured values (e.g. for monitoring the generator and the inverter).

And some time also AI for the "wind turbine"? "Not at some unplanned time in the future either. We are already researching and have already started to understand the plants. Mathematics and statistics are helping us a lot and customers prefer to come to us in order to set up a knowledge base, rather than engaging one of the many big data companies who know nothing about the sector and the technology on site. This is confirming us."

»We have a mission for our customers' challenges – knowing their requirements and innovations are what makes our mission outstanding.«

Werner Elender
COO Bachmann electronic

bachmann.

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