SOFTWARE ENGINEERING

FASTER AND MORE FLEXIBLE TO AN EXECUTABLE SOFTWARE

00000



SOFTWARE ENGINEERING

SYSTEMS ENGINEERIN

MECHATRONIC CONSULTING

DIGITAL EDUCATION

info@itq.de

ITQ GmbH

Parkring 4, D-85748 Garching b. München

+49 89 321 981-70

www.itq.de

IQ

Cumilit

AI IN MECHATRONICS CONTINUING DIGITALIZATION

ARTIFICIAL INTELLIGENCE WITH STRATEGY

Digitalization and the use of Artificial Intelligence (AI) is penetrating ever more into mechanical and plant engineering. AI also promises your industry more efficient processes, increased employee productivity, and large productivity gains. Our consultants will advise you on which AI strategy is the right one for your company, how you can benefit from it and how to get your employees on board in good time.

Optimization of production processes through self-learning algorithms

Al is used in mechanical and plant engineering for a variety of purposes: object identification, pattern recognition for quality assurance, predictive maintenance and the optimization of production processes and traveling distances using self-learning algorithms.

The analysis of the data obtained offers huge opportunities, among other things, to integrate new, Al-based products and services into existing products at an ideal cost-benefit ratio.

In all of these areas, it is important to take up, understand, and apply the new opportunities at an early stage.





Which AI strategy is suitable for you?

First, we work with you to identify, which processes in your company are simplified and which products can be optimized using Artificial Intelligence. Our consultants acquire a deep understanding of your core business, the company philosophy, and the processes of your company in order to get the greatest possible benefit from AI.

Thus, the choice of the appropriate Artificial Intelligence processes is transparent and easy. Using suitable simulation models, AI training courses can be carried out that are used to generate data. This means that the team can develop first prototypes quickly. All methods are subject to strict controls with a focus on safety.

AI IN MECHATRONICS CONTINUING DIGITALIZATION

ITQ

APPROACH

What will make you successful?

To develop all the advantages of the new processes, machine builders need clear strategies and plans.

The focus is on the provision of the necessary technology, data collection, and use. The interaction between employees and AI is also extremely important. The question of which problem can be solved using Al and which of the various solution options is the most promising, is one of the critical points in order to quickly achieve project success.

With our many years of experience in the industry and our knowledge from implemented projects in the field of Al, we can give you professional support.



"Using Artificial Intelligence, we move your machines and systems into a new industry era."

Harald Weigold Member of Management & weigold@itq.de

SERVICES

We support you!

- In-house training on Artificial Intelligence with focus on application in the machine and plant engineering
- Benchmarking, comparison and selection of third party tools
- Development of customized solutions

BENEFITS Make use of our experience!

- Establishing experience in the field of AI in your company
- Identification of application areas for AI in mechanical and plant engineering
- Selection and generation of data sets for efficient training of AI algorithms
- Targeted design of solutions based on many years of experience in the industry
- Efficient support in the development of AI algorithms

- Support in the generation, conversion and storage of training data
- Conduct AI training on local computers or with the help of cloud computing capacity
- Adaptation and scaling of the results on hardware such as IPC, industrial control or microcontrollers

info@itq.de

SYSTEMS ENGINEERING

MECHATRONIC CONSULTING

DIGITAL EDUCATION

ITQ GmbH

Parkring 4, D-85748 Garching b. München

+49 89 321 981-70



CONTROL TECHNOLOGY AUTOMATED ENGINEERING

SAVE THE LEAD WITH AUTOMATION

Software-based automation is at the forefront of the fourth industrial revolution, the digitization of production. The goal: to be more efficient, to increase productivity and speed, and to ensure quality, while at the same time reducing engineering costs and time to market.

Complex controls required

The control software is becoming increasingly complex within machines. Today software is an essential core component of every machine or system. It is no longer just sensors that are read and actuators controlled. Due to these constantly increasing requirements and the ever shorter innovation cycles, a level of complexity is now often achieved that every high-level language application can keep up with.

Therefore, the implementation approach that can handle this complexity must be chosen. It is essential to live a process that takes into account the entire life cycle of the software. Here, for example, the agile development methods already established in high-level language development are suitable.



Automated solutions with suitable technology

Every automation solution consists of control and software components that are optimized for the respective application.

This includes the decision as to which hardware is used, as well as the selection of software libraries, a suitable tool landscape, as well as the implementation and creation of a suitable test environment.

To ensure the longevity of the automation solution, it must be designed for expandability, testability, and maintainability right from the start. Good software quality can only be achieved with an architecture that is designed to meet these criteria.





CONTROL TECHNOLOGY AUTOMATED ENGINEERING

ITQ

APPROACH

The basis for successful control

First of all, the decision for a control manufacturer must be made. This can also be influenced by the decision for hardware components such as sensors, actuators, and communication channels, and technologies. Furthermore, it must be decided how the controller communicates with external systems and thus the communication technology for this application must be selected. An example of external systems are a HMI, an MES system, or other controls. Once the interfaces have been clarified, the machine itself can be modularized. Suitable software architecture can now be designed for this modularly structured machine that fits the respective application. Patterns from the high-level language are used here to illustrate the high level of complexity and to ensure testability. The control software is continuously tested while it is being implemented.



"The complexity of control software can keep up with any high-level language application today, and so it should be developed and tested."

Jörn Linke ITQ Branch Manager NRW 🖂 linke@itq.de

SERVICES

We offer you!

- Analysis of existing software
- Development of new systems
- Broad know-how
 - Siemens
 - B&R
 - Beckhoff
 - Rockwell
 - Codesys based systems
 - IEC 61131-3

BENEFITS Control technologies help you to

- Reduces development costs
- Function check with simulation and unit tests
- Shorten development times
- Earlier error detection
- Faster time to market
- Maintainability
- Flexibility

- C/C++
- Embedded real-time systems
- Selection of suitable communication technologies
 - OPC Classic
 - OPC UA
 - Customer-specific communication protocols
- IOT Connection
- Safety

SOFTWARE ENGINEERING							
		SYSTEMS ENGINEERING	MECHATRONIC CONSULTI	NG	DIG	ITAL EDUCATION	
ITQ GmbH	Parkring	, 4, D-85748 Garching b. München	+49 89 321 981-70	info@	Ditq.de	www.itg.de	ļ

WEB TECHNOLOGIES DEVELOPING SUITABLE APPLICATIONS

FROM THE WEB APP TO THE IOT PLATFORM

Web technologies are one of the most modern variants of HMI development and enable the production of executable applications in the browser. We are happy to support you with our wide-ranging expertise in control, HMI, and web in the selection and engineering for applications – from the web app to the complete IoT platform.

DEVELOPMENT

How do you live up to responsive design?

The complexity of projects and user interface requirements increases to the same extent as the number of interfaces.

Customers need a complex interface that cannot be covered by HMI technology that was previously common.

The requirements are changing. For example, today's users have to switch workspaces more often, which increases the demands on usability and responsive design.

Independent platforms are a big advantage. Web technologies are used here in the modular system to connect control code to the HMI, cloud, and database.



Individual solutions need experience

To use web technologies effectively, you need extensive experience in control, HMI, and basic technologies such as HTML, CSS, JavaScript, and AngularX.

Experience in the ecosystem of modern web frameworks such as Bootstrap or React, which significantly accelerate development, is also essential.

Our consultants offer you their expertise from numerous projects to jointly develop an individual solution based on open source that can be adapted to the existing hardware and software.



WEB TECHNOLOGIES DEVELOPING SUITABLE APPLICATIONS



APPROACH

Find out exactly what you need

A key success factor in the introduction of web technologies is a precise benchmarking of the available technologies.

Which technologies offer the greatest benefit for your company? Afterwards, it is an agile and cross-disciplinary development in close coordination with you and your team.

Our consulting includes:

- HMI for machine operation and configuration
- Dashboards for machine/production data
- Ordering systems
- Surveillance systems
- Resource management/planning



"Data is the currency of the future. Web technologies allow the evaluation and visualization of these data treasures, which opens up new business areas and strengthens customer loyalty."

Karl-Heinz Wind Member of Management 🖂 wind@itq.de

SERVICES

We offer you!

- Conceptual design with support during implementation
- Engineering to the implementation of an executable tool including ongoing support
- Support regarding the licensing of open source libraries
- State-of-the-art quality assurance right from the start: Continuous integration, unit tests, automated UI tests

- BENEFITS What exactly do web technologies offer?
- Rapid market maturity thanks to extensive libraries
- Modularity and expandability
- Platform independence
- Mostly open-source, with easy-to-fulfill license terms
- Easy to update
- Often executable directly in the browser or PWA
- Very large community and many existing frameworks
- Wide range of applications: from simple static websites via, for example, dynamic dashboards to mobile apps

- Cross-platform development (Desktop, mobile/app, cloud services)
- Responsive web design (The same layout on all platforms)
- Reliable connection of the frontend to your database and your machine controls
- Modernize your current user interface

SOFT\	NARE	ENGIN	EERING
-------	------	-------	--------

SYSTEMS ENGINEERING

Parkring 4, D-85748 Garching b. München

NG MECHATR

MECHATRONIC CONSULTING

info@itq.de

DIGITAL EDUCATION

ITQ GmbH

+49 89 321 981-70



CONTROL PANEL EXPECTATIONS INCREASE

The Human Machine Interface (HMI), as the central operating interface between machine and user, is responsible for essential functions during commissioning, operation and maintenance. Future machine operators belong to the smartphone generation and have correspondingly high expectations of the operating devices and their ergonomics.

Do you want to increase overall productivity?

Based on the consumer industry, operating philosophies and demands have changed drastically in recent years. This has a major influence on the design and development of the HMI, which, as the central operator interface, makes a decisive contribution to the ergonomics of the overall machine.

In addition, the integration of other mobile devices such as smartphones or barcode scanners offers the opportunity to support activities that do not take place directly on the machine. The classic HMI can thus be expanded and other processes can be automated and digitized. This leads to a lower error rate and increases the overall productivity of the machine.



Tunin



Established tools and motivated developers

Thanks to a modular software architecture, HMI applications are created from individual components with clearly separated responsibilities and few interdependencies.

When developing HMI projects, we use established procedure models such as SCRUM, Extreme Programming (XP) and Software Kanban, as well as techniques such as pair programming and code reviews.

Regular releases allow reliable statements to be made about the status of the project. The developers are more motivated thanks to their responsibility.

HMI DEVELOPMENT OPERATE THE MACHINE LIKE A SMARTPHONE



APPROACH Structuring sustainably and flexibly

We support you in the implementation of your HMI projects in all phases, from brainstorming to the finished product. The central starting point is the collaboration of various disciplines from the areas of usability and software engineering in modern, agile development teams. Based on your product vision and company situation, we support you in the selection of suitable technologies, tools and procedures. When implementing your product, we always pursue modular approaches to ensure longterm flexibility despite the usual requirement for a short time to market. Your HMI can be implemented remotely or at your location with the support of our experienced HMI developers.



"An easy-to-use HMI increases customer acceptance of the machine enormously."

Inge Jaßniger Senior Consultant jassniger@itq.de

BENEFITS

The advantages of modern HMI development

- Modular approach in all areas enables easy exchange of components or technologies
- Modern appearance and modern devices through the use of the latest technologies
- High maintainability through the support of experienced project team developer
- Short time to market and short release cycles through the use of the latest quality assurance tools
- Regular usability checks increase acceptance of the end customer

SERVICES

We support you in all phases

Before the start of the project

- Analysis of existing HMI solutions
- Development of requirements and boundary conditions for a new user interface
- Comparison of the hardware, technologies and possible modern alternatives used

In early project phases

 Support in joint development teams with experienced software/UI experts

- Development of subcomponents through ITQ training courses on usability, implementation, procedures, technologies, quality assurance
- Automated toolbased testing of quality standards
- In late project phases
 - Support with subsequent code reviews or restructuring measures
 - Development of automated deployment strategies

SOFTWARE ENGINEERING						
		SYSTEMS ENGINEERING	MECHATRONIC CONSULTING		DIGITAL EDUCATION	
ITQ GmbH	Parkring	g 4, D-85748 Garching b. München	+49 89 321 981-70	info@itq.de	www.itq.de	9

DEVOPS ESTABLISH NEW IT CULTURE

DEVELOPMENT AND IT OPERATIONS ARE MOVING CLOSER TOGETHER

IT cultures have to evolve continuously to provide the customer with individual high-quality solutions with the greatest possible transparency. This can only be achieved with good and strong communication within the interdisciplinary teams and effective cooperation. The goal of everyone involved should be to take responsibility for the entire process (end-to-end) and to be able to react quickly to changes at any time.

More code quality through mindset change

All phases of DevOps are run through permanently in a software development process – consciously or unconsciously. In some cases, the existing processes are intended for this – but often not yet. In the area of code and build, CI mechanisms have already found their way into the world of machine and plant construction. Code reviews, the execution of automated tests as well as efficient and comprehensible release and deployment management are rarely found.

Besides, the engineering and the operation of mechatronic products are traditionally separated, between the developer and the commissioning engineer. By changing the mindset and philosophy to DevOps, the goal "You build it, you run it, you love it" can be brought closer and the code quality, customer orientation, and motivation of the development team can be increased.





New way of working together

First of all, you need a consistent concept that includes all phases of development, commissioning, and operation in the field. The development team and the operators have to develop a new common mindset aimed at continuous improvement.

Extensions should take place iteratively and gaps closed. Suitable tools must be used for this and procedures and automatic processes must be established.

So everyone gets an expanded view beyond the release of the mechatronic product. This automatically increases the team's commitment and identification with their own product.

DEVOPS ESTABLISH NEW IT CULTURE

ITQ

APPROACH

Together we will close the gaps

First, our consultants analyze the existing development process. Then we build a capable and interdisciplinary team that works according to the motto: "We build it, we ship it, we run it".

All team members receive the required DevOps mindset through training courses and workshops.

Then the team goes to work:

- Strategy and tools must be defined in order to gradually close DevOps gaps in coordination with all stakeholders
- New processes and tools (CI/CD) must to be rolled out
- Common KPIs and evaluation of measures will be agreed



"DevOps brings the development team faster and closer to the machine, in virtual or real form."

Kilian Meßmer Consultant ⊠ messmer@itq.de

BENEFITS DevOps produces high quality products!

- Targeted reaction to customer requests and integration into the development process
- Shorter release cycles
- Development of automation processes and tools
- Save time and increase efficiency
- High informative value about the code quality through automatic mated and intensive testing of the products
- "You know what you ship": through efficient, consistent and secure release and deployment management
- Increased motivation of the team and look ove outside of the box

SERVICES

We show you new options!

- Implementation of training courses and workshops to introduce the team to the DevOps mindsets
- Analysis of the existing development processes
- Benchmark, select, and build a suitable toolchain
- Joint elaboration of a suitable concept with all company departments involved

info@itq.de

 Build efficient, and consistent approval process for your product

SOFTWARE ENGINEERING

SYSTEMS ENGINEERING

MECHATRONIC CONSULTING

DIGITAL EDUCATION

ITQ GmbH

+49 89 321 981-70

TEST AUTOMATION REPRODUCIBLE SOFTWARE QUALITY

THE CHALLENGE IN MECHANICAL ENGINEERING

Reliably working software is the desire of every project manager. However, this goal will only be achieved if you set the right course in terms of quality assurance and automation in development projects right from the start.

Early testing saves time and money

The steadily increasing complexity and variability of modern systems and development processes often lead to increased and mostly manual expenditure for quality assurance. In modern, agile development processes, intensive testing in the different development phases is essential.

In practice, unsystematic or incomplete testing often leads to errors being found only on the real machine. This costs a lot of time and money. In mechanical engineering, the close link between software and hardware is an additional challenge.

For this reason, only the protection of individual software components of the machine via unit tests has been established. Structured, extensive, and (partially) automated tests at integration and system level, however, are very rarely found.





With end-to-end tests to success

In practice, a structured test methodology that is adapted to the development process has the best cost-benefit factor. For this, customized tools, processes, simulations, and test setups are needed.

That way, comprehensive quality assurance from individual software modules to (virtual) commissioning can be guaranteed. The automation of the test execution via Continuous Integration and Continuous Deployment (CI/CD) as well as systematic reporting accelerate the agile development process with consistent and verified product quality.

TEST AUTOMATION REPRODUCIBLE SOFTWARE QUALITY



APPROACH

Improve quality step by step

- Analysis of existing test activities
- User stories and acceptance criteria for coverage of the required functionality
- Definition of test environments and tools
- Classification of test cases in different test levels and systems

- Demand-oriented structure of test systems and simulations
- Agile development of unit, integration and system/acceptance tests
- Gradual expansion of test automation
- Connection of the CI/CD systems



" The automation of repetitive test tasks is a central element of agile procedures. The supreme discipline is certainly the automation of a system and end-to-end tests."

Tobias Herkert Senior Consultant M herkert@itq.de

SERVICES

We support you in all phases and at all levels!

- Collection and structuring of test cases
- Creation of test plans & test specifications
- Selection of a suitable toolchain
- Development of testable software architectures with suitable interfaces
- Selection of suitable hardware and software components
- Mechanical/electrical structure of test systems

BENEFITS

We help you increase product quality!

- Transparent status of software quality
- Ensuring a consistently high software quality
- Reduction of test time on the machine
- Systematic structuring/documentation of test cases
- Effortless execution of all function tests after bug fixes and further developments
- Automatic tests independent of working hours and quick feedback
- Testing hardware and software without complex mechanical construction
- Safeguarding of software optimization and reengineering

- Implementation
 - of test cases
 - of test sequence control
 - of necessary simulations (mechanical components, controlled systems)
 - of the interface to test management systems
- Automation of test procedures and reporting the results

SOFTWARE ENGINEERING						
		SYSTEMS ENGINEERING	MECHATRONIC CONSULTING		DIGITAL EDUCATION	
ITQ GmbH	Parkring	g 4, D-85748 Garching b. München	+49 89 321 981-70	info@itq.c	le www.itq.de	13

APP DEVELOPMENT MOBILE SOLUTIONS ALWAYS AT HAND

THE APP REPLACES THE DESKTOP SYSTEM

Apps have been adopting classic programs and functions on PCs for years. And for good reasons: A system that we always have at hand, that can notify us of important things at any time and that is easily accessible for everyone, solves many disadvantages of programs on desktop systems. Also, new technologies such as augmented reality or localization can be easily integrated.

Many functions bundled?

The growing networking of systems enables a few employees to monitor and control many machines. A high level of mobility and knowledge of many machines are often required.

Employees have a wide range of tasks, from observing and monitoring machine complexes to configuring and setting up machines and troubleshooting in the event of malfunctions.

Technologies are often not uniform but depend on the manufacturer. As a result, the functions for all of these activities are usually distributed across many devices and locations. A smartphone app can help in many ways.





The operator becomes remote

Permanent monitoring is no longer necessary by introducing a mobile app. If an operator's attention is required, he can be notified everywhere by a push notification. Actions can also be controlled directly in an app.

The integration of chat tools makes it possible to coordinate, plan, or get help with unknown problems. Video tutorials can also be integrated, which shorten the process of familiarization and enable new features to be conveyed easily and intuitively.

Interfaces such as NFC or QR codes make it easy to identify machines and immediately evaluate its status. Workpieces and tools can also be identified and the correct parameters set automatically.

WEB TECHNOLOGIES DEVELOPING SUITABLE APPLICATIONS



APPROACH

Find out exactly what you need

A key success factor in the introduction of web technologies is a precise benchmarking of the available technologies.

Which technologies offer the greatest benefit for your company? Afterwards, it is an agile and cross-disciplinary development in close coordination with you and your team.

Our consulting includes:

- HMI for machine operation and configuration
- Dashboards for machine/production data
- Ordering systems
- Surveillance systems
- Resource management/planning



"Data is the currency of the future. Web technologies allow the evaluation and visualization of these data treasures, which opens up new business areas and strengthens customer loyalty."

Karl-Heinz Wind Member of Management 🖂 wind@itq.de

SERVICES

We offer you!

- Conceptual design with support during implementation
- Engineering to the implementation of an executable tool including ongoing support
- Support regarding the licensing of open source libraries
- State-of-the-art quality assurance right from the start: Continuous integration, unit tests, automated UI tests

- BENEFITS What exactly do web technologies offer?
- Rapid market maturity thanks to extensive libraries
- Modularity and expandability
- Platform independence
- Mostly open-source, with easy-to-fulfill license terms
- Easy to update
- Often executable directly in the browser or PWA
- Very large community and many existing frameworks
- Wide range of applications: from simple static websites via, for example, dynamic dashboards to mobile apps

- Cross-platform development (Desktop, mobile/app, cloud services)
- Responsive web design (The same layout on all platforms)
- Reliable connection of the frontend to your database and your machine controls
- Modernize your current user interface

SOFTWARE ENGINEERING

SYSTEMS ENGINEERING

MECHATRONIC CONSULTING

info@itq.de

DIGITAL EDUCATION

ITQ GmbH

Parkring 4, D-85748 Garching b. München +4

+49 89 321 981-70