Optimize automation with advanced design

HMI and visualization with zenon 6.50

zenon®

Content

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Modern production processes are, like the machines and systems used in them, characterized by considerably increased complexity. The interface between these complex systems and the people that monitor and control them plays a key role in the management of these processes. From HMIs to fully fledged control room applications, the operator has the same needs in terms of perception and visual guidance: complex control functions must be created in a clear and logical manner, so that the user can work as intuitively and safely as possible. Visualization is, and will, remain a key task of HMI/SCADA. And visualization is the key to optimizing processes.

Interface visualization

Visualization is the interface between the human as decision-maker and the machine/system as implementer. Visualization cannot, therefore, be reduced to the mere display of some colorful pictures. Being colorful alone is too little, since:

Preparation of information in a manner that is right for the user, and is an easily understandable representation, determine how statuses are perceived and subsequently interpreted. The user interface is, thus, not limited to one-way communication towards the user; for example, to communicate operating states. Instead, it is the hub for interaction and must also correctly communicate user actions to the system. Whether a user action is carried out punctually, correctly and without error often depends on the display and user elements available. The user interface thus becomes the decisive factor in how problem-free the equipment runs and what effects errors have. Cutting corners here can have potentially catastrophic outcomes and make the difference between “business as usual” and “worst case scenario”.

COPA-DATA has, in its capacity as technological leader in HMI/SCADA systems, a good reason for investing much time, manpower and means into comprehensive usability research and then implementing the results of it.

Targeted usability supports productivity and safety

The results of our usability research combined with perception psychology leads to clear rules on how systems should be designed so that humans can quickly and clearly understand the information displayed and carry out user actions spontaneously and without error.

COPA-DATA has, as a result of this, considerably enhanced the graphical capabilities of its automation suite, zenon. New features in zenon 6.50 include:

1. Freely designable screens
2. Enhanced design features
3. Complete WPF integration

Freely designable screens

The design of user interfaces is often orientated to website best practice and popular mass-market products. Tabs remain very popular for navigation. It is evident that the user interfaces of machine operating systems are also starting to follow this trend. The approach of not only adapting the design of the user interface to the Internet, but also the technology used, is not enough however. This is because in this period of web 2.0, dedicated automation technology still offers unbeatable advantages in relation to performance and safety in comparison to web technologies.

The advantages of the many design possibilities that have become familiar through the web can now be implemented with safe automation technology.

For example, zenon offers freely designable screens to achieve this. Not only can tab navigation be created as desired, but any other screen design can be implemented with a few mouse clicks. For example, simple pop-up dialogues for the log in or tool tips can be implemented. These are clearly recognized by the user as an input field; they attract attention and successfully prevent operating error. The object-orientated concept upon which it is based ensures an optimized engineering workflow.

When usability is improved in this way it is not only beneficial to the technicians who design the project, the operator also benefits from already-familiar navigation elements, a clear differentiation of screen background and operating areas and the quick comprehension of system reports.

In visualization, screens generally have a background or setting function. However, the elements displayed in the screens take on the role of the active bearers of information. These elements have been supported with enhanced design features in zenon 6.50.

Enhanced design features

In principle, there are two classes of screen elements: static vector elements and dynamic elements.

Dynamic elements are the most impressive way of demonstrating the advantages of dedicated automation solutions as opposed to web-based solutions or in-house developments: they already have a multitude of special automation functionality. This can range from simple variable linking through to highly developed calculations, trends or courses of movement.

Static vector elements are designed more simply. With these, usually the basic designs are developed and context graphics such as pipes, leads, equipment replication, etc. are created.

A combination of desired vector elements and dynamic elements can be combined to form a symbol. This serves as an object-orientated starting point for the symbol to be reused in development.

Such symbols bring maximum benefits if they at least:

- Allow parameters to be set ‘out-of-the-box’, without programming
- Are automatically fully networkable – including redundancy capability
- Support a comprehensive user safety concept.

The more possibilities the project engineer has when using elements and symbols, the closer he gets to meeting his requirements and creating ideal solutions.

New features of zenon 6.50 expand zenon’s repertoire here considerably:

- Shading: freely definable in lightness, distance and form
- Color gradients as desired
- Transparency
- Free rotation
- Free forms: rounded corners, asymmetrically formed elements (such as margin elements)
- Universal buttons: combinations of different button styles configured as desired (text, screen, visibility)

With these design possibilities, further laws of perception can be taken into account. For example: simple shading of operating elements distinguishes these from the background clearly. More examples?

- Diversity of forms such as different button forms for the law of uniformity
- Transparency, to receive graded information levels

- Content can quickly be grouped and each item’s designation can be displayed by means of uniform color gradients
- Affordance (functional coloring) of buttons can be very quickly increased by means of shading and rounded edges
- Uniform button styles can be developed for each different function group; differentiation of functions reduces the function complexity

Usability naturally also plays a major role as a design factor in engineering too. These selected examples of how zenon delivers usability are just three of many:

- Live preview of the configuration:
  Live preview of, for example, colors, transparencies and shadings makes intuitive engineering possible.
- Central color palettes:
  Simple replacement of colors using palettes guarantees, for example, the implementation of central corporate design requirements for uniform designs with distributed engineering. Central color palettes also make it possible to have uniform, integrated color-coding. Subsequent fine adjustments can be carried out centrally without effort at any time.
- Copy properties:
  Simply transfer properties of elements instead of creating them from scratch each time; increasing speed and reducing design errors.

Shared responsibilities

In the field of “Power HMIs” for high-value machines and equipment, user interfaces are often designed by a designer and presented to the technicians for implementation. This “definition” is usually carried out in external graphics programs and the result is generally saved in a picture format. The technician then has the challenge of implementing the actual application logic and also implementing the design according to the design requirements. To achieve this, it is generally aimed to replicate the user interface as far as possible using the automation software, even though it is not a dedicated graphics application. Difficulties in setting it up and the technical limitations of the tools used mean that an exact Implementation is rarely possible.

Specialists in design and usability are not only used for “Power HMIs” but also in the control system environment, to give advice on how projects can be improved and optimized.

Against the backdrop of this challenge, we looked for a new solution at COPA-DATA. We asked ourselves the question “How can a modern software tool help

users master this situation and optimize the interdisciplinary teamwork of specialists?”.

We found an answer in a new technology, which was previously mainly used in web applications: Windows Presentation Foundation (WPF) and XAML (Extensible Application Markup Language) format.

WPF in process visualization

WPF stands for Windows Presentation Foundation and describes a graphics framework that is part of the Windows .NET frameworks. WPF displays the programming environment. XAML is a markup language based on XML and describes the user interface hierarchy. The framework unites the different areas of a presentation such as user interface, illustrations, graphics, audio, video, documents and typography. Depending on the structure of the XAML file, there is the possibility of linking properties, events and transformations of WPF elements to variables and functions in zenon.

COPA-DATA is a pioneer in this. We’re making new workflows possible by means of the comprehensive implementation of WPF/XAML technology. The clear separation of design and program code make it possible for the programmer and designer to work closely together, as well as make possible the simple fulfillment of design requirements - such as the use of pre-existing designs that no longer need to be modified by the developer.

For zenon users, this new technology offers enormous possibilities in graphic design. Through the targeted separation of the display and function of an element in XAML files, a new generation of display elements is introduced. Display elements and dynamic elements can be graphically adapted, independently of their program code. In this way, elaborate illustrations from designers can be created and then imported into zenon as an XAML file and then linked to the corresponding parameters.

Dynamic elements in analog look

Graphics now no longer need to be drawn in zenon, but instead can be imported directly as an XAML file. Therefore, elaborately illustrated elements in process visualization can now be used; there are no limits to the graphical possibilities. Reflections, shading, 3D effects etc. are supported as graphics. The elements, adapted to the appropriate industry environment, and designed to reflect operators‘ real workstations, enable intuitive operation.

Meaningful illustrations for intuitive operation

The inclusion of XAML based display elements graphically enhances projects and enables a clearer display of the process. Usability-optimized elements simplify operation. Clear presentation of data makes it easier to receive complex content. Operation is also simplified thanks to possibilities for adapting the individual elements. It is therefore possible for the project engineer to determine display values, scales and units individually.

Clear presentation of data and summaries

Grouped display elements make it possible to display the most important process data informatively. Thus, the equipment operator is always informed of current process flows. Graphical evaluations, display values, and sliders can be grouped into one element and allow quick and uncomplicated control.

Industry-specific displays

Elements such as thermometers, scales or bar graphs are some of the basic elements of process visualization. With XAML, it is possible to adapt these graphically to the requirements of the appropriate industry. The equipment operators work with established and familiar elements that they already know from their workstations and which they find in the digital process visualization at the terminal. Reactions to critical situations are learnt and backed up by previous experience. Recognition of known shapes and design characteristics invokes trusted associations: the equipment operator can react intuitively.

Adapting to the Corporate Design

The user interface design can be adapted to the respective style requirements of the company using WPF and XAML to create a consistent visual appearance through to the individual process screen. As a template, the standard operating elements from zenon can be used which can then, for example, be adapted to the color palettes, house fonts and illustration styles of the corporate design.

Advanced design with zenon 6.50

COPA-DATA has equipped zenon 6.50 with those graphic properties that are required for modern process visualizations and for the design of effective interfaces between operators and machines. The basis for this is the results of the usability research, which show that projects optimized for usability also exhibit higher productivity figures. There are two reasons for this: firstly, operator errors are minimized by means of clear interface designs. Secondly, systems that have been designed in a user-friendly manner make it easier to learn complex controls and to master them. The new features of 6.50 are highly suited to creating user interfaces that correspond precisely to usability requirements and that fully support the user.